Marginal Loss Factors: Financial Year 2022-23

April 2022

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 2022-23 inter-regional loss equations under clause 3.6.1 of the Rules and 2022-23 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.

Disclaimer

The calculation of the loss factors presented in this document incorporates information and forecasts from third parties. AEMO has made every reasonable effort to ensure the quality of the information in this publication but cannot guarantee that any information, forecasts and assumptions are accurate, complete or appropriate for your circumstances.

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Version control

Version	Release date	Changes
1	1/4/2022	Final 2022-23 MLFs published
2	6/4/2022	Removed incorrect statement from Appendix A2.4 relating to limits under review
3	13/07/2022	• July 2022 including the following new and revised connection points: • QLD Generation: Columboola Solar Farm, Woolooga Solar Farm • SA Generation: Happy Valley BESS, Happy Valley Solar Farm , Christies Beach BESS, Christies Beach Biogas, Christies Beach Diesel 1, Christies Beach Diesel 2, Christies Beach Solar 1, Christies Beach Solar 2, Mannum-Adelaide Pipeline Pumping Station No 3 Solar Farm • NSW Generation: Queanbeyan BESS

Version	Release date	Changes
		• ACT Generation: Mugga Lane Landfill • VIC Generation: Mortlake South Wind Farm • TAS Load: Fisher 220 DNSP

Introduction

This document sets out the 2022-23 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 2022-23 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 2022-23 financial year:

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

Loss factors apply for 2022-23 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 of both generation and transmission 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 to, the power system.

Improving transparency

In December 2021, AEMO published a preliminary report on MLFs for 2022-23[2], intended to provide an early indication to stakeholders of both the potential direction and extent of movement in MLFs across the NEM between 2021-22 and 2022-23. The preliminary report was based on a limited study using some inputs from the 2021-22 study with generation profiles updated to reflect committed generation as of August 2021.

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

[2] At https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/market-operations/loss-factors-and-regional-boundaries.

Structure of the report

This document has been structured as follows:

- Section 1 outlines the MLFs for loads and generators in 2022-23.
- Section 2 summarises the key changes that have been observed in MLFs between 2021-22 and 2022-23.
- Section 3 outlines the inter-regional loss factor equations for 2022-23.
- Section 4 outlines the inter-regional loss equations for 2022-23.
- Section 5 outlines the Basslink, Murraylink and Terranora loss equations for 2022-23.
- Section 6 outlines the proportioning of inter-regional losses to regions for 2022-23.
- Section 7 defines the regions and regional reference nodes for 2022-23.
- Section 8 outlines the virtual transmission nodes for 2022-23.
- Appendix A1 provides a background to MLFs.
- Appendix A2 outlines the methodology, inputs, and assumptions that have been used to determine the MLFs for 2022-23.

Quality control

AEMO applied a number of quality assurance steps when calculating the 2022-23 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 2022-23 MLFs on 1 March 2022, and sought feedback from stakeholders.

AEMO made a number of minor improvements to modelling compared to the study used for the draft report, as part of the quality assurance steps undertaken. This has resulted in a small number of connection points having a minor change in the final MLF value when compared to the draft report.

Observations and trends

For the 2022-23 MLF study, the primary observation is that new committed generation expected to become operational over the 2022-23 financial year is predominantly located within Queensland and New South Wales.

Within New South Wales, the new generation capacity has been largely spread across central and northern areas, whereas over the last several years a large portion of the new generation capacity has been located within the south-west and south New South Wales. This has resulted in a slight increase of MLFs for certain generators in south-west New South Wales which have been trending downward for the last several years as the capacity of generation within this sub-region grew.

The output of thermal generation continues to decrease, offset by low marginal cost renewable generation. Additionally, the Liddell closure is forecast to occur within 2022-23 resulting in a reduction of the capacity of thermal generation within New South Wales.

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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 2022-23, for every existing load or generation transmission connection point (identified by transmission node identifier [TNI] or dispatchable unit identifier [DUID]) in each 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. On registration, AEMO will publish MLFs for those connection points. MLF updates and additions that are developed throughout the year will be included in the "2022-23 MLF Applicable from 1 July 2022" spreadsheet, which is also published on AEMO's website[3].

1.1 Queensland marginal loss factors

Table 1 Queensland loads

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Abermain	33	QABM	0.9992	1.0001
Abermain - Dual MLF (Generation)	110	QABR	0.9995	1.0010
Abermain - Dual MLF (Load)	110	QABR	0.9980	1.0010
Alan Sherriff	132	QASF	1.0027	1.0039
Algester	33	QALG	1.0142	1.0134
Alligator Creek	132	QALH	0.9885	0.9883
Alligator Creek	33	QALC	0.9972	0.9961
Ashgrove West	33	QAGW	1.0137	1.0154
Ashgrove West	110	QCBW	1.0113	1.0135
Belmont	110	QBMH	1.0108	1.0083
Belmont Wecker Road	33	QBBS	1.0119	1.0097
Biloela	66/11	QBIL	0.9473	0.9348
Blackstone	110	QBKS	0.9973	0.9975
Blackwater	66/11	QBWL	0.9890	0.9791
Blackwater	132	QBWH	0.9844	0.9745
Bluff	132	QBLF	0.9859	0.9759
Bolingbroke	132	QBNB	0.9775	0.9751
Bowen North	66	QBNN	0.9807	0.9776
Boyne Island	275	QBOH	0.9794	0.9696
Boyne Island	132	QBOL	0.9756	0.9663
Braemar – Kumbarilla Park	275	QBRE	0.9753	0.9739
Bulli Creek (Essential Energy)	132	QBK2	0.9748	0.9731

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

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Bulli Creek (Waggamba)	132	QBLK	0.9748	0.9731
Bundamba	110	QBDA	0.9992	0.9997
Burton Downs	132	QBUR	0.9851	0.9812
Cairns	22	QCRN	0.9954	1.0090
Cairns City	132	QCNS	0.9860	0.9995
Callemondah (Rail)	132	QCMD	0.9676	0.9580
Calliope River	132	QCAR	0.9672	0.9558
Cardwell	22	QCDW	1.0017	1.0052
Chinchilla	132	QCHA	0.9781	0.9863
Clare	66	QCLR	1.0003	1.0101
Collinsville Load	33	QCOL	0.9719	0.9706
Columboola	132	QCBL	0.9828	0.9849
Columboola 132 (Bellevue LNG load)	132	QCBB	0.9841	0.9857
Coppabella (Rail)	132	QCOP	0.9917	0.9865
Dan Gleeson	66	QDGL	1.0031	1.0031
Duaringa	132	QDRG	0.9660	0.9567
Dysart	66/22	QDYS	0.9939	0.9849
Eagle Downs Mine	132	QEGD	0.9898	0.9816
Edmonton	22	QEMT	1.0039	1.0189
Egans Hill	66	QEGN	0.9524	0.9453
El Arish	22	QELA	1.0085	1.0146
Garbutt	66	QGAR	1.0064	1.0090
Gin Gin	132	QGNG	0.9855	0.9792
Gladstone South	66/11	QGST	0.9713	0.9602
Goodna	33	QGDA	1.0031	1.0030
Goonyella Riverside Mine	132	QGYR	1.0015	0.9979
Grantleigh (Rail)	132	QGRN	0.9574	0.9572
Gregory (Rail)	132	QGRE	0.9677	0.9591
Ingham	66	QING	1.0113	1.0664
Innisfail	22	QINF	1.0053	1.0199
Invicta Load	132	QINV	0.9501	0.9272
Kamerunga	22	QKAM	1.0065	1.0208
Kemmis	66	QEMS	0.9826	0.9820
King Creek	132	QKCK	0.9806	0.9781
Lilyvale	66	QLIL	0.9716	0.9585
Lilyvale (Barcaldine)	132	QLCM	0.9786	0.9515
Loganlea	33	QLGL	1.0120	1.0117
Loganlea	110	QLGH	1.0087	1.0083
Mackay	33	QMKA	0.9896	0.9866
Middle Ridge (Energex)	110	QMRX	0.9823	0.9796

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Middle Ridge (Ergon)	110	QMRG	0.9823	0.9796
Mindi (Rail)	132	QMND	0.9726	0.9680
Molendinar	110	QMAR	1.0086	1.0087
Molendinar	33	QMAL	1.0084	1.0082
Moranbah (Mine)	66	QMRN	1.0014	0.9949
Moranbah (Town) - Dual MLF (Generation)	11	QMRL	1.0026	0.9877
Moranbah (Town) - Dual MLF (Load)	11	QMRL	1.0026	0.9852
Moranbah Substation	132	QMRH	0.9926	0.9870
Moura	66/11	QMRA	0.9537	0.9527
Mt McLaren (Rail)	132	QMTM	0.9785	0.9773
Mudgeeraba	33	QMGL	1.0083	1.0088
Mudgeeraba	110	QMGB	1.0078	1.0079
Murarrie (Belmont)	110	QMRE	1.0101	1.0090
Nebo	11	QNEB	0.9718	0.9675
Newlands	66	QNLD	1.0056	1.0042
North Goonyella	132	QNGY	1.0030	0.9937
Norwich Park (Rail)	132	QNOR	0.9856	0.9754
Oakey	110	QOKT	0.9804	0.9765
Oonooie (Rail)	132	QOON	0.9891	0.9902
Orana LNG	275	QORH	0.9764	0.9767
Palmwoods	132	QPWD	1.0095	1.0091
Pandoin	132	QPAN	0.9539	0.9479
Pandoin	66	QPAL	0.9639	0.9484
Peak Downs (Rail)	132	QPKD	0.9996	0.9925
Pioneer Valley	66	QPIV	1.0008	0.9953
Proserpine	66	QPRO	1.0112	1.0061
Queensland Alumina Ltd (Gladstone South)	132	QQAH	0.9754	0.9652
Queensland Nickel (Yabulu)	132	QQNH	0.9899	0.9887
Raglan	275	QRGL	0.9571	0.9492
Redbank Plains	11	QRPN	1.0034	1.0035
Richlands	33	QRLD	1.0130	1.0127
Rockhampton	66	QROC	0.9575	0.9506
Rocklea (Archerfield)	110	QRLE	1.0040	1.0044
Ross	132	QROS	0.9906	0.9929
Runcorn	33	QRBS	1.0151	1.0142
South Pine	110	QSPN	1.0046	1.0052
Stony Creek	132	QSYC	0.9859	0.9830
Sumner	110	QSUM	1.0050	1.0052
Tangkem (Dalby) - Dual MLF (Generation)	110	QTKM	0.9792	0.9774
Tangkem (Dalby) - Dual MLF (Load)	110	QTKM	0.9827	0.9774

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Tarong	66	QTRL	0.9734	0.9725
Teebar Creek	132	QTBC	0.9956	0.9918
Tennyson	33	QTNS	1.0077	1.0083
Tennyson (Rail)	110	QTNN	1.0062	1.0065
Townsville East	66	QTVE	0.9975	1.0026
Townsville South	66	QTVS	1.0025	1.0043
Townsville South (KZ)	132	QTZS	1.0029	1.0019
Tully	22	QTLL	1.0223	1.0521
Turkinje	66	QTUL	1.0201	1.0291
Turkinje (Craiglie)	132	QTUH	1.0235	1.0376
Wandoan South	132	QWSH	0.9953	0.9982
Wandoan South (NW Surat)	275	QWST	0.9946	0.9970
Wandoo (Rail)	132	QWAN	0.9760	0.9730
Wivenhoe Pump	275	QWIP	0.9994	0.9974
Woolooga (Energex)	132	QWLG	0.9942	0.9928
Woolooga (Ergon)	132	QWLN	0.9942	0.9928
Woree	132	QWRE	0.9938	1.0075
Wotonga (Rail)	132	QWOT	0.9938	0.9864
Wycarbah	132	QWCB	0.9525	0.9480
Yarwun – Boat Creek (Ergon)	132	QYAE	0.9659	0.9579
Yarwun – Rio Tinto	132	QYAR	0.9632	0.9545

Table 2 Queensland generation

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Baking Board Solar Farm (Chinchilla Solar Farm)	132	BAKING1	QCHS1C	QCHS	0.9664	0.9886
Barcaldine PS – Lilyvale	132	BARCALDN	QBCG	QBCG	0.9350	0.9064
Barcaldine Solar at Lilyvale (132)	132	BARCSF1	QLLV1B	QLLV	0.9334	0.9267
Barron Gorge Power Station (PS) Unit 1	132	BARRON-1	QBGH1	QBGH	0.9623	0.9832
Barron Gorge PS Unit 2	132	BARRON-2	QBGH2	QBGH	0.9623	0.9832
Bluegrass Solar Farm	132	BLUEGSF1	QCBS1B	QCBS	0.9600	0.9549
Braemar PS Unit 1	275	BRAEMAR1	QBRA1	QBRA	0.9630	0.9629
Braemar PS Unit 2	275	BRAEMAR2	QBRA2	QBRA	0.9630	0.9629
Braemar PS Unit 3	275	BRAEMAR3	QBRA3	QBRA	0.9630	0.9629
Braemar Stage 2 PS Unit 5	275	BRAEMAR5	QBRA5B	QBRA	0.9630	0.9629
Braemar Stage 2 PS Unit 6	275	BRAEMAR6	QBRA6B	QBRA	0.9630	0.9629
Braemar Stage 2 PS Unit 7	275	BRAEMAR7	QBRA7B	QBRA	0.9630	0.9629
Browns Plains Landfill Gas PS	110	BPLANDF1	QLGH3B	QLGH	1.0087	1.0083
Callide A PS Unit 4	132	CALL_A_4	QCAA4	QCAA	0.9392	0.9266

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Callide A PS Unit 4 Load	132	CALLNL4	QCAA2	QCAA	0.9392	0.9266
Callide B PS Unit 1	275	CALL_B_1	QCAB1	QCAB	0.9404	0.9251
Callide B PS Unit 2	275	CALL_B_2	QCAB2	QCAB	0.9404	0.9251
Callide C PS Unit 3	275	CPP_3	QCAC3	QCAC	0.9361	0.9274
Callide C PS Unit 4	275	CPP_4	QCAC4	QCAC	0.9361	0.9274
Callide PS Load	132	CALLNL1	QCAX	QCAX	0.9351	0.9257
Childers Solar Farm	132	CHILDSF1	QTBS1C	QTBS	0.9823	0.9797
Clare Solar Farm	132	CLARESF1	QCLA1C	QCLA	0.9177	0.9197
Clermont Solar Farm	132	CLERMSF1	QLLV3C	QLLV	0.9334	0.9267
Collinsville Solar Farm	33	CSPVPS1	QCOS1C	QCOS	0.9268	0.9247
Columboola – Condamine PS	132	CPSA	QCND1C	QCND	0.9744	0.9825
Columboola Solar Farm	132	COLUMSF1	QCBR1C	QCBR	0.9812	0.9846
Coopers Gap Wind Farm	275	COOPGWF1	QCPG1C	QCPG	0.9685	0.9683
Daandine PS - Dual MLF (Generation)	110	DAANDINE	QTKM1	QTKM	0.9792	0.9774
Daandine PS - Dual MLF (Load)	110	DAANDINE	QTKM1	QTKM	0.9827	0.9774
Darling Downs PS	275	DDPS1	QBRA8D	QBRA	0.9630	0.9629
Darling Downs Solar Farm	275	DDSF1	QBRS1D	QBRS	0.9796	0.9762
Daydream Solar Farm	33	DAYDSF1	QCCK1D	QCCK	0.9296	0.9268
Emerald Solar Farm	66	EMERASF1	QLIS1E	QLIS	0.9333	0.9237
Gangarri Solar Farm	132	GANGARR1	QWSS1G	QWSS	0.9921	0.9959
German Creek Generator	66	GERMCRK	QLIL2	QLIL	0.9716	0.9585
Gladstone PS (132 kV) Unit 3	132	GSTONE3	QGLD3	QGLL	0.9581	0.9470
Gladstone PS (132 kV) Unit 4	132	GSTONE4	QGLD4	QGLL	0.9581	0.9470
Gladstone PS (132kV) Load	132	GLADNL1	QGLL	QGLL	0.9581	0.9470
Gladstone PS (275 kV) Unit 1	275	GSTONE1	QGLD1	QGLH	0.9623	0.9519
Gladstone PS (275 kV) Unit 2	275	GSTONE2	QGLD2	QGLH	0.9623	0.9519
Gladstone PS (275 kV) Unit 5	275	GSTONE5	QGLD5	QGLH	0.9623	0.9519
Gladstone PS (275 kV) Unit 6	275	GSTONE6	QGLD6	QGLH	0.9623	0.9519
Grosvenor PS At Moranbah 66 No 1	66	GROSV1	QMRN2G	QMRV	0.9923	0.9844
Grosvenor PS At Moranbah 66 No 2	66	GROSV2	QMRV1G	QMRV	0.9923	0.9844
Hamilton Solar Farm	33	HAMISF1	QSLD1H	QSLD	0.9238	0.9239
Haughton Solar Farm	275	HAUGHT11	QHAR1H	QHAR	0.9300	0.9356
Hayman Solar Farm	33	HAYMSF1	QCCK2H	QCCK	0.9296	0.9268
Hughenden Solar Farm	132	HUGSF1	QROG2H	QROG	0.9369	0.9395
Invicta Sugar Mill	132	INVICTA	QINV1I	QINV	0.9501	0.9272
Isis CSM	132	ICSM	QGNG1I	QTBC	0.9956	0.9918
Kareeya PS Unit 1	132	KAREEYA1	QKAH1	QKYH	0.9702	0.9656
Kareeya PS Unit 2	132	KAREEYA2	QKAH2	QKYH	0.9702	0.9656

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Kareeya PS Unit 3	132	KAREEYA3	QKAH3	QKYH	0.9702	0.9656
Kareeya PS Unit 4	132	KAREEYA4	QKAH4	QKYH	0.9702	0.9656
Kennedy Energy Park Battery (Generation)	132	KEPBG1	QROW3K	QROW	0.9808	0.9912
Kennedy Energy Park Battery (Load)	132	KEPBL1	QROW4K	QROW	0.9808	0.9912
Kennedy Energy Park Solar Farm	132	KEPSF1	QROW2K	QROW	0.9808	0.9912
Kennedy Energy Park Wind Farm	132	KEPWF1	QROW1K	QROW	0.9808	0.9912
Kidston Solar Farm	132	KSP1	QROG1K	QROG	0.9369	0.9395
Kogan Creek PS	275	KPP_1	QBRA4K	QWDN	0.9698	0.9694
Koombooloomba	132	KAREEYA5	QKYH5	QKYH	0.9702	0.9656
Lilyvale Solar Farm	33	LILYSF1	QBDR1L	QBDR	0.9323	0.9276
Longreach Solar Farm	132	LRSF1	QLLV2L	QLLV	0.9334	0.9267
Mackay GT	33	MACKAYGT	QMKG	QMKG	0.9871	0.9549
Maryorough Solar Farm (Brigalow Solar Farm)	110	MARYRSF1	QMRY2M	QMRY	0.9861	0.9789
Middlemount Sun Farm	66	MIDDLSF1	QLIS2M	QLIS	0.9333	0.9237
Millmerran PS Unit 1	330	MPP_1	QBCK1	QMLN	0.9762	0.9733
Millmerran PS Unit 2	330	MPP_2	QBCK2	QMLN	0.9762	0.9733
Moranbah Generation - Dual MLF (Generation)	11	MORANBAH	QMRL1M	QMRL	1.0026	0.9877
Moranbah Generation - Dual MLF (Load)	11	MORANBAH	QMRL1M	QMRL	1.0026	0.9852
Moranbah North PS	66	MBAHNTH	QMRN1P	QMRN	1.0014	0.9949
Mount Emerald Wind farm	275	MEWF1	QWKM1M	QWKM	0.9575	0.9835
Mt Stuart PS Unit 1	132	MSTUART1	QMSP1	QMSP	0.9160	0.9286
Mt Stuart PS Unit 2	132	MSTUART2	QMSP2	QMSP	0.9160	0.9286
Mt Stuart PS Unit 3	132	MSTUART3	QMSP3M	QMSP	0.9160	0.9286
Oakey 1 Solar Farm	110	OAKEY1SF	QTKS1O	QTKS	0.9800	0.9711
Oakey 2 Solar Farm	110	OAKEY2SF	QTKS2O	QTKS	0.9800	0.9711
Oakey PS Unit 1	110	OAKEY1	QOKY1	QOKY	0.9530	0.9536
Oakey PS Unit 2	110	OAKEY2	QOKY2	QOKY	0.9530	0.9536
Oaky Creek 2	66	OAKY2	QLIL3O	QLIL	0.9716	0.9585
Oaky Creek Generator	66	OAKYCREK	QLIL1	QLIL	0.9716	0.9585
Rocky Point Gen (Loganlea 110kV)	110	RPCG	QLGH2	QLGH	1.0087	1.0083
Roma PS Unit 7 – Columboola	132	ROMA_7	QRMA7	QRMA	0.9761	0.9679
Roma PS Unit 8 – Columboola	132	ROMA_8	QRMA8	QRMA	0.9761	0.9679
Ross River Solar Farm	132	RRSF1	QROG3R	QROG	0.9369	0.9395
Rugby Run Solar Farm	132	RUGBYR1	QMPL1R	QMPL	0.9224	0.9156
Stanwell PS Load	132	STANNL1	QSTX	QSTX	0.9527	0.9463
Stanwell PS Unit 1	275	STAN-1	QSTN1	QSTN	0.9409	0.9338
Stanwell PS Unit 2	275	STAN-2	QSTN2	QSTN	0.9409	0.9338
Stanwell PS Unit 3	275	STAN-3	QSTN3	QSTN	0.9409	0.9338

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Stanwell PS Unit 4	275	STAN-4	QSTN4	QSTN	0.9409	0.9338
Stapylton	110	STAPYLTON1	QLGH4S	QLGH	1.0087	1.0083
Sun Metals Solar Farm	132	SMCSF1	QTZS1S	QTZS	1.0029	1.0019
Sunshine Coast Solar Farm	132	VALDORA1	QPWD1S	QPWD	1.0095	1.0091
Susan River Solar Farm	132	SRSF1	QTBS2S	QTBS	0.9823	0.9797
Swanbank E GT	275	SWAN_E	QSWE	QSWE	0.9976	0.9971
Tarong North PS	275	TNPS1	QTNT	QTNT	0.9737	0.9723
Tarong PS Unit 1	275	TARONG#1	QTRN1	QTRN	0.9729	0.9719
Tarong PS Unit 2	275	TARONG#2	QTRN2	QTRN	0.9729	0.9719
Tarong PS Unit 3	275	TARONG#3	QTRN3	QTRN	0.9729	0.9719
Tarong PS Unit 4	275	TARONG#4	QTRN4	QTRN	0.9729	0.9719
Ti Tree BioReactor	33	TITREE	QABM1T	QABM	0.9992	1.0001
Wandoan BESS (Generation)	132	WANDBG1	QWSB1W	QWSB	0.9767	0.9764
Wandoan BESS (Load)	132	WANDBL1	QWSB2W	QWSB	1.0007	1.0054
Warwick Solar Farm 1	110	WARWSF1	QMRY3W	QMRY	0.9861	0.9789
Warwick Solar Farm 2	110	WARWSF2	QMRY4W	QMRY	0.9861	0.9789
Western Downs Green Power Hub	275	WDGPH1	QWDR1W	QWDR	0.9757	0.9704
Whitsunday Solar Farm	33	WHITSF1	QSLS1W	QSLS	0.9218	0.9231
Windy Hill Wind Farm	66	WHILL1	QTUL	QTUL	1.0201	1.0291
Wivenhoe Generation Unit 1	275	W/HOE#1	QWIV1	QWIV	0.9913	0.9903
Wivenhoe Generation Unit 2	275	W/HOE#2	QWIV2	QWIV	0.9913	0.9903
Wivenhoe Pump 1	275	PUMP1	QWIP1	QWIP	0.9994	0.9974
Wivenhoe Pump 2	275	PUMP2	QWIP2	QWIP	0.9994	0.9974
Wivenhoe Small Hydro - Dual MLF (Generation)	110	WIVENSH	QABR1	QABR	0.9995	1.0010
Wivenhoe Small Hydro - Dual MLF (Load)	110	WIVENSH	QABR1	QABR	0.9980	1.0010
Woolooga Solar Farm	132	WOOLGSF1	QWLS1W	QWLS	0.9832	0.9951
Yabulu PS	132	YABULU	QTYP	QTYP	0.9572	0.9661
Yabulu Steam Turbine (Garbutt 66kV)	66	YABULU2	QGAR1	QYST	0.9237	0.9755
Yarranlea Solar Farm	110	YARANSF1	QMRY1Y	QMRY	0.9861	0.9789
Yarwun PS	132	YARWUN_1	QYAG1R	QYAG	0.9627	0.9544

1.2 New South Wales marginal loss factors[4]

Table 3 New South Wales loads

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Alexandria	33	NALX	1.0039	1.0048
Albury	132	NALB	0.9551	0.9591
Armidale	66	NAR1	0.9429	0.9474
Australian Newsprint Mill	132	NANM	0.9426	0.9456
Balranald	22	NBAL	0.8998	0.8921
Beaconsfield North	132	NBFN	1.0036	1.0044
Beaconsfield South	132	NBFS	1.0036	1.0044
Belmore Park	132	NBM1	1.0039	1.0045
Beryl	66	NBER	0.9813	0.9723
BHP (Waratah)	132	NWR1	0.9949	0.9921
Boambee South	132	NWST	0.9830	0.9833
Boggabri East	132	NBGE	0.9611	0.9956
Boggabri North	132	NBGN	0.9630	0.9990
Brandy Hill	11	NBHL	0.9988	0.9963
Brandy Hill (Essential Energy)	11	NBHX	0.9988	0.9963
Broken Hill	22	NBKG	0.8685	0.8580
Broken Hill	220	NBKH	0.8600	0.8423
Bunnerong - Dual MLF (Generation)	132	NBG1	1.0039	1.0040
Bunnerong - Dual MLF (Load)	132	NBG1	1.0039	1.0045
Bunnerong	33	NBG3	1.0055	1.0066
Buronga	220	NBRG	0.8866	0.7477
Burrinjuck	132	NBU2	0.9601	0.9698
Campbell Street	11	NCBS	1.0060	1.0057
Campbell Street	132	NCS1	1.0038	1.0047
Canterbury	33	NCTB	1.0175	1.0168
Carlingford	132	NCAR	1.0010	1.0010
Casino	132	NCSN	0.9864	0.9912
Charmhaven	11	NCHM	0.9967	0.9952
Coffs Harbour	66	NCH1	0.9747	0.9789
Coleambally	132	NCLY	0.9268	0.9258
Cooma	66	NCMA	0.9625	0.9673
Cooma (AusNet Services)	66	NCM2	0.9625	0.9673
Croydon	11	NCRD	1.0131	1.0135

[4] 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	2022-23 MLF	2021-22 MLF
Cowra	66	NCW8	0.9746	0.9721
Dapto (Endeavour Energy)	132	NDT1	0.9934	0.9929
Dapto (Essential Energy)	132	NDT2	0.9934	0.9929
Darlington Point	132	NDNT	0.9397	0.9397
Deniliquin	66	NDN7	0.9733	0.9704
Dorrigo	132	NDOR	0.9692	0.9684
Drummoyne	11	NDRM	1.0131	1.0136
Dunoon	132	NDUN	0.9991	0.9883
Far North VTN		NEV1	0.9781	0.9755
Finley - Dual MLF (Generation)	132	NFN2	0.9815	0.9904
Finley - Dual MLF (Load)	132	NFN2	0.9070	0.8465
Finley	66	NFNY	0.9708	0.9686
Forbes	66	NFB2	1.0018	0.9986
Gadara	132	NGAD	0.9693	0.9795
Glen Innes	66	NGLN	0.9346	0.9365
Gosford	66	NGF3	1.0048	1.0037
Gosford	33	NGSF	1.0053	1.0043
Grafton East 132	132	NGFT	0.9709	0.9832
Green Square	11	NGSQ	1.0063	1.0073
Griffith	33	NGRF	0.9473	0.9688
Gunnedah	66	NGN2	0.9833	0.9972
Haymarket	132	NHYM	1.0038	1.0046
Heron's Creek	132	NHNC	1.0350	1.0396
Holroyd	132	NHLD	1.0020	1.0022
Holroyd (Ausgrid)	132	NHLX	1.0020	1.0022
Hurstville North	11	NHVN	1.0048	1.0057
Homebush Bay	11	NHBB	1.0161	1.0166
Ilford	132	NLFD	0.9639	0.9610
Ingleburn	66	NING	0.9976	0.9987
Inverell	66	NNVL	0.9461	0.9482
Kemps Creek	330	NKCK	0.9959	0.9955
Kempsey	66	NKS2	1.0008	1.0101
Kempsey	33	NKS3	1.0107	1.0158
Koolkhan	66	NKL6	1.0008	0.9969
Kurnell	132	NKN1	1.0023	1.0030
Kogarah	11	NKOG	1.0066	1.0077
Lake Munmorah	132	NMUN	0.9890	0.9821
Lane Cove	132	NLCV	1.0130	1.0136
Leichhardt	11	NLDT	1.0130	1.0135

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Liddell	33	NLD3	0.9678	0.9652
Lismore	132	NLS2	1.0079	1.0080
Liverpool	132	NLP1	1.0011	1.0015
Macarthur	132	NMC1	0.9954	0.9951
Macarthur	66	NMC2	0.9972	0.9973
Macksville	132	NMCV	0.9966	0.9981
Macquarie Park	11	NMQP	1.0188	1.0183
Macquarie Park	33	NMQS	1.0128	1.0122
Manildra	132	NMLD	1.0025	1.0083
Marrickville	11	NMKV	1.0089	1.0097
Marulan (Endeavour Energy)	132	NMR1	1.0118	1.0122
Marulan (Essential Energy)	132	NMR2	1.0118	1.0122
Mason Park	132	NMPK	1.0135	1.0140
Meadowbank	11	NMBK	1.0167	1.0173
Molong	132	NMOL	1.0258	1.0292
Moree	66	NMRE	0.9761	0.9847
Morven	132	NMVN	0.9431	0.9514
Mt Piper	66	NMP6	0.9744	0.9757
Mudgee	132	NMDG	0.9797	0.9699
Mullumbimby	11	NML1	0.9987	0.9898
Mullumbimby	132	NMLB	0.9899	0.9805
Munmorah STS 33	33	NMU3	0.9937	0.9917
Munyang	11	NMY1	0.9633	0.9762
Munyang	33	NMYG	0.9633	0.9762
Murrumbateman	132	NMBM	0.9645	0.9681
Murrumburrah	66	NMRU	0.9719	0.9723
Muswellbrook	132	NMRK	0.9788	0.9764
Nambucca Heads	132	NNAM	0.9905	0.9923
Narrabri	66	NNB2	0.9926	1.0050
Newcastle	132	NNEW	0.9942	0.9917
Newcastle (Essential Energy)	132	NNEX	0.9942	0.9917
North of Broken Bay VTN		NEV2	0.9970	0.9949
Orange	66	NRGE	1.0427	1.0478
Orange North	132	NONO	1.0348	1.0454
Ourimbah	33	NORB	1.0017	1.0010
Ourimbah	132	NOR1	1.0007	0.9994
Ourimbah	66	NOR6	1.0013	1.0000
Panorama	66	NPMA	1.0252	1.0291
Parkes	66	NPK6	1.0026	1.0007

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Parkes	132	NPKS	0.9865	0.9909
Peakhurst	33	NPHT	1.0037	1.0045
Potts Hill 11	11	NPHL	1.0072	1.0081
Potts Hill 132	132	NPO1	1.0044	1.0049
Pt Macquarie	33	NPMQ	1.0312	1.0344
Pyrmont	33	NPT3	1.0056	1.0065
Pyrmont	132	NPT1	1.0037	1.0045
Queanbeyan 132	132	NQBY	0.9941	0.9953
Raleigh	132	NRAL	0.9847	0.9857
Ravine	330	NRVN	0.9495	0.9483
Regentville	132	NRGV	0.9984	0.9983
Rockdale (Ausgrid)	11	NRKD	1.0060	1.0069
Rookwood Road	132	NRWR	1.0043	1.0049
Rose Bay	11	NRSB	1.0069	1.0061
Rozelle	132	NRZH	1.0130	1.0135
Rozelle	33	NRZL	1.0130	1.0135
Snowy Adit	132	NSAD	0.9550	0.9623
Somersby	11	NSMB	1.0057	1.0049
South of Broken Bay VTN		NEV3	1.0057	1.0056
St Peters	11	NSPT	1.0069	1.0081
Strathfield South	11	NSFS	1.0091	1.0106
Stroud	132	NSRD	1.0119	1.0109
Sydney East	132	NSE2	1.0061	1.0068
Sydney North (Ausgrid)	132	NSN1	1.0042	1.0042
Sydney North (Endeavour Energy)	132	NSN2	1.0042	1.0042
Sydney South	132	NSYS	1.0009	1.0015
Sydney West (Ausgrid)	132	NSW1	1.0010	1.0010
Sydney West (Endeavour Energy)	132	NSW2	1.0010	1.0010
Tamworth	66	NTA2	0.9660	0.9703
Taree (Essential Energy)	132	NTR2	1.0411	1.0453
Tenterfield	132	NTTF	0.9600	0.9603
Terranora	110	NTNR	0.9771	0.9947
Tomago	330	NTMG	0.9953	0.9926
Tomago (Ausgrid)	132	NTME	0.9980	0.9952
Tomago (Essential Energy)	132	NTMC	0.9980	0.9952
Top Ryde	11	NTPR	1.0157	1.0163
Tuggerah	132	NTG3	0.9974	0.9956
Tumut	66	NTU2	0.9735	0.9838
Tumut 66 (AusNet DNSP)	66	NTUX	0.9735	0.9838

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Vales Pt.	132	NVP1	0.9924	0.9893
Vineyard	132	NVYD	1.0001	1.0000
Wagga	66	NWG2	0.9529	0.9492
Wagga North	132	NWGN	0.9487	0.9491
Wagga North	66	NWG6	0.9500	0.9485
Wallerawang (Endeavour Energy)	132	NWW6	0.9747	0.9765
Wallerawang (Essential Energy)	132	NWW5	0.9747	0.9765
Wallerawang 66 (Essential Energy)	66	NWW4	0.9752	0.9772
Wallerawang 66	66	NWW7	0.9752	0.9772
Wallerawang 330 PS Load	330	NWWP	0.9737	0.9759
Waverley	11	NWAV	1.0066	1.0058
Wellington	132	NWL8	0.9862	0.9903
West Gosford	11	NGWF	1.0063	1.0054
Williamsdale (Essential Energy) (Bogong)	132	NWD1	0.9682	0.9379
Wyong	11	NWYG	0.9992	0.9979
Yanco	33	NYA3	0.9502	0.9473
Yass	66	NYS6	0.9643	0.9677
Yass	132	NYS1	0.9485	0.9082

Table 4 New South Wales generation

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
AGL Sita Landfill 1	132	AGLSITA1	NLP13K	NLP1	1.0011	1.0015
Appin Power Station	66	APPIN	NAPP1A	NAPP	0.9973	0.9975
Bango 973 Wind Farm	132	BANGOWF1	NBA21B	NBA2	0.9107	0.9134
Bango 999 Wind Farm	132	BANGOWF2	NBB21B	NBB2	0.9283	0.9294
Bayswater PS Unit 1	330	BW01	NBAY1	NBAY	0.9653	0.9622
Bayswater PS Unit 2	330	BW02	NBAY2	NBAY	0.9653	0.9622
Bayswater PS Unit 3	500	BW03	NBAY3	NBYW	0.9653	0.9620
Bayswater PS Unit 4	500	BW04	NBAY4	NBYW	0.9653	0.9620
Beryl Solar Farm	66	BERYLSF1	NBES1B	NBES	0.9289	0.9184
Blowering	132	BLOWERNG	NBLW8	NBLW	0.9064	0.9444
Boco Rock Wind Farm	132	BOCORWF1	NCMA3B	NBCO	0.9355	0.9359
Bodangora Wind Farm	132	BODWF1	NBOD1B	NBOD	0.9595	0.9581
Bomen Solar Farm	132	BOMENSF1	NWGS1B	NWGS	0.9089	0.8875
Broadwater PS	132	BWTR1	NLS21B	NLS2	1.0079	1.0080
Broken Hill GT 1	22	GB01	NBKG1	NBKG	0.8685	0.8580
Broken Hill Solar Farm	22	BROKENH1	NBK11B	NBK1	0.8381	0.7953

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Brown Mountain	66	BROWNMT	NCMA1	NCMA	0.9625	0.9673
Burrendong Hydro PS	132	BDONGHYD	NWL81B	NWL8	0.9862	0.9903
Burrinjuck PS	132	BURRIN	NBUK	NBUK	0.9459	0.9653
Campbelltown WSLC	66	WESTCBT1	NING1C	NING	0.9976	0.9987
Capital Wind Farm	330	CAPTL_WF	NCWF1R	NCWF	0.9558	0.9563
Coleambally Solar Farm	132	COLEASF1	NCLS1C	NCLS	0.8770	0.8478
Collector Wind Farm	330	COLWF01	NCLW1C	NCLW	0.9581	0.9588
Colongra PS Unit 1	330	CG1	NCLG1D	NCLG	0.9864	0.9851
Colongra PS Unit 2	330	CG2	NCLG2D	NCLG	0.9864	0.9851
Colongra PS Unit 3	330	CG3	NCLG3D	NCLG	0.9864	0.9851
Colongra PS Unit 4	330	CG4	NCLG4D	NCLG	0.9864	0.9851
Condong PS	110	CONDONG1	NTNR1C	NTNR	0.9771	0.9947
Copeton Hydro PS	66	COPTNHYD	NNVL1C	NNVL	0.9461	0.9482
Corowa Solar Farm	132	CRWASF1	NAL11C	NAL1	0.9242	0.8813
Crookwell 2 Wind Farm	330	CROOKWF2	NCKW1C	NCKW	0.9611	0.9616
Crudine Ridge Wind Farm	132	CRURWF1	NCDS1C	NCDS	0.9381	0.9246
Cullerin Range Wind Farm	132	CULLRGWF	NYS11C	NYS1	0.9485	0.9082
Darlington Point Solar Farm	132	DARLSF1	NDNS1D	NDNS	0.8880	0.8587
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	0.9865	0.9849
Eraring 330 PS Unit 1	330	ER01	NEPS1	NEP3	0.9865	0.9849
Eraring 330 PS Unit 2	330	ER02	NEPS2	NEP3	0.9865	0.9849
Eraring 500 PS Unit 3	500	ER03	NEPS3	NEPS	0.9877	0.9858
Eraring 500 PS Unit 4	500	ER04	NEPS4	NEPS	0.9877	0.9858
Eraring PS Load	500	ERNL1	NEPSL	NNEW	0.9942	0.9917
Finley Solar Farm	132	FINLYSF1	NFNS1F	NFNS	0.9036	0.8432
Glenbawn Hydro PS	132	GLBWNHYD	NMRK2G	NMRK	0.9788	0.9764
Glenn Innes (Pindari PS)	66	PINDARI	NGLN1	NGLN	0.9346	0.9365
Glennies Creek PS	132	GLENNCRK	NMRK3T	NMRK	0.9788	0.9764
Goonumbla Solar Farm	66	GOONSF1	NPG12G	NPG1	0.8818	0.8918
Grange Avenue	132	GRANGEAV	NVYD1	NVYD	1.0001	1.0000
Griffith Solar Farm	33	GRIFSF1	NGG11G	NGG1	0.8862	0.8547
Gullen Range Solar Farm	330	GULLRSF1	NGUR2G	NGUR	0.9592	0.9595
Gullen Range 1 Wind Farm	330	GULLRWF1	NGUR1G	NGUR	0.9592	0.9595
Gullen Range 2 Wind Farm	330	GULLRWF2	NGUR3G	NGUR	0.9592	0.9595
Gunnedah Solar Farm	132	GNNDHSF1	NGNE1G	NGNE	0.8353	0.8960
Gunning Wind Farm	132	GUNNING1	NYS12A	NYS1	0.9485	0.9082

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Guthega	132	GUTHEGA	NGUT8	NGUT	0.8870	0.9006
Guthega Auxiliary Supply	11	GUTHNL1	NMY11	NMY1	0.9633	0.9762
Hillston Solar Farm	132	HILLSTN1	NDNH1H	NDNH	0.8906	0.8593
Hume (New South Wales Share)	132	HUMENSW	NHUM	NHUM	0.9118	0.8989
Hunter Economic Zone	132	HEZ1	NNEE1H	NNEE	0.9920	0.9897
Jemalong Solar Farm	66	JEMALNG1	NFBS1J	NFBS	0.8833	0.8956
Jindabyne Generator	66	JNDABNE1	NCMA2	NCMA	0.9625	0.9673
Jounama PS	66	JOUNAMA1	NTU21J	NTU2	0.9735	0.9838
Junee Solar Farm	132	JUNEESF1	NWGJ1J	NWGJ	0.9129	0.8799
Kangaroo Valley – Bendeela (Shoalhaven) Generation – Dual MLF	330	SHGEN	NSHL	NSHN	0.9733	0.9763
Kangaroo Valley (Shoalhaven) Pumps – Dual MLF	330	SHPUMP	NSHP1	NSHN	0.9896	0.9919
Keepit	66	KEEPIT	NKPT	NKPT	0.9833	0.9972
Liddell 330 PS Unit 1	330	LD01	NLDP1	NLDP	0.9659	0.9628
Liddell 330 PS Unit 2	330	LD02	NLDP2	NLDP	0.9659	0.9628
Liddell 330 PS Unit 3	330	LD03	NLDP3	NLDP	0.9659	0.9628
Liddell 330 PS Unit 4	330	LD04	NLDP4	NLDP	0.9659	0.9628
Limondale Solar Farm 1	220	LIMOSF11	NBSF1L	NBSF	0.8314	0.8070
Limondale Solar Farm 2	22	LIMOSF21	NBL21L	NBL2	0.8309	0.7985
Liverpool 132 (Jacks Gully)	132	JACKSGUL	NLP11	NSW2	1.0010	1.0010
Lower Tumut Generation – dual MLF	330	TUMUT3	NLTS8	NLTS	0.9092	0.9195
Lower Tumut Pumps – dual MLF	330	SNOWYP	NLTS3	NLTS	0.9895	0.9525
Lower Tumut Pipeline Auxiliary	66	TUMT3NL3	NTU2L3	NTU2	0.9735	0.9838
Lower Tumut T2 Auxiliary	66	TUMT3NL1	NTU2L1	NTU2	0.9735	0.9838
Lower Tumut T4 Auxiliary	66	TUMT3NL2	NTU2L2	NTU2	0.9735	0.9838
Lucas Heights II Power Plant	132	LUCASHGT	NSYS2G	NSYS	1.0009	1.0015
Lucas Heights Stage 2 Power Station	132	LUCAS2S2	NSYS1	NSYS	1.0009	1.0015
Manildra Solar Farm	132	MANSLR1	NMLS1M	NMLS	0.9287	0.9333
Metz Solar Farm	132	METZSF1	NMTZ1M	NMTZ	0.8831	0.9208
Molong Solar Farm	66	MOLNGSF1	NMOS1M	NMOS	0.9433	0.9541
Moree Solar Farm	66	MOREESF1	NMR41M	NMR4	0.8275	0.8931
Mt Piper PS Load	330	MPNL1	NMPPL	NMTP	0.9720	0.9726
Mt Piper PS Unit 1	330	MP1	NMTP1	NMTP	0.9720	0.9726
Mt Piper PS Unit 2	330	MP2	NMTP2	NMTP	0.9720	0.9726
Narromine Solar Farm	132	NASF1	NWLS1N	NWLS	0.9352	0.9444
Nevertire Solar Farm	132	NEVERSF1	NWLS3N	NWLS	0.9352	0.9444
Nine Willoughby	132	NINEWIL1	NSE21R	NSE2	1.0061	1.0068
Nyngan Solar Farm	132	NYNGAN1	NWL82N	NWL8	0.9862	0.9903
Parkes Solar Farm	66	PARSF1	NPG11P	NPG1	0.8818	0.8918

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Queanbeyan BESS (Generation)	66	QBYNBG1	NQBB1Q	NQBB	0.9752	
Queanbeyan BESS (Load)	66	QBYNBL1	NQBB2Q	NQBB	0.9917	
Sapphire Wind Farm	330	SAPHWF1	NSAP1S	NSAP	0.9470	0.9426
Sebastopol Solar Farm	132	SEBSF1	NWGJ2S	NWGJ	0.9129	0.8799
Silverton Wind Farm	220	STWF1	NBKW1S	NBKW	0.7973	0.8456
Sithe (Holroyd Generation)	132	SITHE01	NSYW1	NHD2	1.0018	1.0017
South Keswick Solar Farm	132	SKSF1	NWLS2S	NWLS	0.9352	0.9444
St George Leagues Club	33	STGEORG1	NPHT1E	NPHT	1.0037	1.0045
Sunraysia Solar Farm	220	SUNRSF1	NBSF2S	NBSF	0.8314	0.8070
Suntop Solar Farm	132	SUNTPSF1	NWLW1S	NWLW	0.9128	0.9159
Tahmoor PS	132	TAHMOOR1	NLP12T	NLP1	1.0011	1.0015
Tallawarra PS	132	TALWA1	NDT13T	NTWA	0.9901	0.9912
Taralga Wind Farm	132	TARALGA1	NMR22T	NMR2	1.0118	1.0122
The Drop Power Station	66	THEDROP1	NFNY1D	NFNY	0.9708	0.9686
Tower Power Plant	132	TOWER	NLP11T	NLP1	1.0011	1.0015
Upper Tumut	330	UPPTUMUT	NUTS8	NUTS	0.9347	0.9335
Uranquinty PS Unit 11	132	URANQ11	NURQ1U	NURQ	0.8673	0.8625
Uranquinty PS Unit 12	132	URANQ12	NURQ2U	NURQ	0.8673	0.8625
Uranquinty PS Unit 13	132	URANQ13	NURQ3U	NURQ	0.8673	0.8625
Uranquinty PS Unit 14	132	URANQ14	NURQ4U	NURQ	0.8673	0.8625
Vales Point 330 PS Load	330	VPNL1	NVPPL	NVPP	0.9892	0.9872
Vales Point 330 PS Unit 5	330	VP5	NVPP5	NVPP	0.9892	0.9872
Vales Point 330 PS Unit 6	330	VP6	NVPP6	NVPP	0.9892	0.9872
Wagga North Solar Farm	66	WAGGNSF1	NWGG1W	NWGG	0.9064	0.8869
Wallgrove BESS (Generation)	132	WALGRVG1	NSWB1W	NSWG	1.0010	1.0011
Wallgrove BESS (Load)	132	WALGRVL1	NSWB2W	NSWB	1.0009	1.0010
Wellington Solar Farm	132	WELLSF1	NWLS4W	NWLS	0.9352	0.9444
Wests Illawara Leagues Club	132	WESTILL1	NDT14E	NDT1	0.9934	0.9929
White Rock Solar Farm	132	WRSF1	NWRK2W	NWRK	0.8697	0.8708
White Rock Wind Farm	132	WRWF1	NWRK1W	NWRK	0.8697	0.8708
Wilga Park A	66	WILGAPK	NNB21W	NNB2	0.9926	1.0050
Wilga Park B	66	WILGB01	NNB22W	NNB2	0.9926	1.0050
Woodlawn Bioreactor	132	WDLNGN01	NMR21W	NMR2	1.0118	1.0122
Woodlawn Wind Farm	330	WOODLWN1	NCWF2W	NCWF	0.9558	0.9563
Wyangala A PS	66	WYANGALA	NCW81A	NCW8	0.9746	0.9721
Wyangala B PS	66	WYANGALB	NCW82B	NCW8	0.9746	0.9721

Table 5 ACT loads

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Angle Crossing	132	AAXG	0.9549	0.9397
Belconnen	132	ABCN	0.9675	0.9673
City East	132	ACTE	0.9695	0.9684
Civic	132	ACVC	0.9672	0.9663
East lake	132	AELK	0.9681	0.9669
Gilmore	132	AGLM	0.9678	0.9682
Gold Creek	132	AGCK	0.9693	0.9708
Latham	132	ALTM	0.9688	0.9696
Telopea Park	132	ATLP	0.9687	0.9681
Theodore	132	ATDR	0.9691	0.9716
Wanniassa	132	AWSA	0.9693	0.9695
Woden	132	AWDN	0.9685	0.9680
ACT VTN	132	AAVT	0.9687	0.9683
Queanbeyan (ACTEW)	66	AQB1	0.9866	0.9882
Queanbeyan (Essential Energy)	66	AQB2	0.9866	0.9882

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	2022-23 MLF	2021-22 MLF
Capital East Solar Farm	66	CESF1	AQB21C	AQB2	0.9866	0.9882
Mugga Lane Solar Farm	132	MLSP1	ACA12M	AMS1	0.9606	0.9440
Mugga Lane landfill	132	MLLFGEF1	AGLM1M	AAVT	0.9687	0.9683
Royalla Solar Farm	132	ROYALLA1	ACA11R	ARS1	0.9596	0.9436

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	2022-23 MLF	2021-22 MLF
Altona	66	VATS	1.0108	1.0086
Altona	220	VAT2	0.9949	0.9936
Ballarat	66	VBAT	0.9699	0.9699
Bendigo	66	VBE6	1.0084	1.0101
Bendigo	22	VBE2	1.0072	1.0101
BHP Western Port	220	VJLA	0.9926	0.9915
Brooklyn (Jemena)	22	VBL2	1.0014	1.0005
Brooklyn (Jemena)	66	VBL6	1.0066	1.0062
Brooklyn (POWERCOR)	22	VBL3	1.0014	1.0005

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Brooklyn (POWERCOR)	66	VBL7	1.0066	1.0062
Brunswick (CitiPower)	22	VBT2	0.9980	0.9977
Brunswick (Jemena)	22	VBTS	0.9980	0.9977
Brunswick 66 (CitiPower)	66	VBT6	0.9971	0.9971
Cranbourne	220	VCB2	0.9916	0.9905
Cranbourne (AusNet Services)	66	VCBT	0.9935	0.9921
Cranbourne (United Energy)	66	VCB5	0.9935	0.9921
Deer Park	66	VDPT	0.9994	0.9992
East Rowville (AusNet Services)	66	VER2	0.9962	0.9944
East Rowville (United Energy)	66	VERT	0.9962	0.9944
Fishermans Bend (CITIPOWER)	66	VFBT	0.9997	0.9995
Fishermans Bend (POWERCOR)	66	VFB2	0.9997	0.9995
Fosterville	220	VFVT	1.0034	1.0057
Geelong	66	VGT6	0.9933	0.9918
Glenrowan	66	VGNT	1.0182	1.0299
Heatherton	66	VHTS	0.9981	0.9965
Heywood	22	VHY2	0.9923	0.9862
Horsham	66	VHOT	0.9092	0.9328
Keilor (Jemena)	66	VKT2	0.9991	0.9977
Keilor (POWERCOR)	66	VKTS	0.9991	0.9977
Kerang	22	VKG2	1.0092	1.0156
Kerang	66	VKG6	1.0136	1.0234
Khancoban	330	NKHN	1.0239	1.0422
Loy Yang Substation	66	VLY6	0.9791	0.9764
Malvern	22	VMT2	0.9960	0.9947
Malvern	66	VMT6	0.9950	0.9938
Malvern (CitiPower)	66	VMT7	0.9950	0.9938
Morwell Power Station Units 1 to 3	66	VMWG	0.9756	0.9736
Morwell PS (G4&5)	11	VMWP	0.9801	0.9777
Morwell TS	66	VMWT	0.9977	0.9936
Mt Beauty	66	VMBT	1.0190	1.0292
Portland	500	VAPD	0.9945	0.9908
Red Cliffs	22	VRC2	0.9732	0.9721
Red Cliffs	66	VRC6	0.9744	0.9730
Red Cliffs (Essential Energy)	66	VRCA	0.9744	0.9730
Richmond	22	VRT2	0.9970	0.9978
Richmond (CITIPOWER)	66	VRT7	0.9973	0.9978
Richmond (United Energy)	66	VRT6	0.9973	0.9978
Ringwood (AusNet Services)	22	VRW3	0.9978	0.9968

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Ringwood (AusNet Services)	66	VRW7	1.0002	0.9988
Ringwood (United Energy)	22	VRW2	0.9978	0.9968
Ringwood (United Energy)	66	VRW6	1.0002	0.9988
Shepparton	66	VSHT	1.0313	1.0346
South Morang (Jemena)	66	VSM6	0.9951	0.9956
South Morang (AusNet Services)	66	VSMT	0.9951	0.9956
Springvale (CITIPOWER)	66	VSVT	0.9972	0.9957
Springvale (United Energy)	66	VSV2	0.9972	0.9957
Templestowe (CITIPOWER)	66	VTS2	0.9996	0.9987
Templestowe (Jemena)	66	VTST	0.9996	0.9987
Templestowe (AusNet Services)	66	VTS3	0.9996	0.9987
Templestowe (United Energy)	66	VTS4	0.9996	0.9987
Terang	66	VTGT	0.9972	1.0035
Thomastown (Jemena)	66	VTTS	1.0000	1.0000
Thomastown (AusNet Services)	66	VTT2	1.0000	1.0000
Tyabb	66	VTBT	0.9938	0.9930
Wemen 66 (Essential Energy)	66	VWEA	0.9622	0.9472
Wemen TS	66	VWET	0.9622	0.9472
West Melbourne	22	VWM2	0.9995	0.9984
West Melbourne (CITIPOWER)	66	VWM7	0.9985	0.9982
West Melbourne (Jemena)	66	VWM6	0.9985	0.9982
Wodonga	22	VWO2	1.0260	1.0411
Wodonga	66	VWO6	1.0198	1.0393
Yallourn	11	VYP1	0.9638	0.9639

Table 8 Victoria generation

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Ararat Wind Farm	220	ARWF1	VART1A	VART	0.8894	0.8987
Bairnsdale Power Station	66	BDL01	VMWT2	VBDL	0.9913	0.9874
Bairnsdale Power Station Generator Unit 2	66	BDL02	VMWT3	VBDL	0.9913	0.9874
Bald Hills Wind Farm	66	BALDHWF1	VMWT9B	VMWT	0.9977	0.9936
Ballarat BESS (Generation)	22	BALBG1	VBA21B	VBA2	0.9663	0.9573
Ballarat BESS (Load)	22	BALBL1	VBA22B	VBA2	0.9629	0.9573
Ballarat Health Services	66	BBASEHOS	VBAT1H	VBAT	0.9699	0.9699
Banimboola	220	BAPS	VDPS2	VDPS	0.9542	0.9861
Bannerton Solar Farm	66	BANN1	VWES1B	VWES	0.8928	0.8633
Basslink (Loy Yang Power Station Switchyard) Tasmania to Victoria	500	BLNKVIC	VLYP13	VTBL	0.9749	0.9735

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Basslink (Loy Yang Power Station Switchyard) Victoria to Tasmania	500	BLNKVIC	VLYP13	VTBL	0.9821	0.9803
Berrybank Wind Farm	220	BRYB1WF1	VBBT1B	VBBT	0.9496	0.9431
Broadmeadows Power Plant	66	BROADMDW	VTTS2B	VTTS	1.0000	1.0000
Brooklyn Landfill & Recycling Facility	66	BROOKLYN	VBL61	VBL6	1.0066	1.0062
Bulgana BESS (Generation)	220	BULBESG1	VBGT2B	VBGT	0.8839	0.8949
Bulgana BESS (Load)	220	BULBESL1	VBGT3B	VBGT	0.8839	0.8949
Bulgana Green Power Hub	220	BULGANA1	VBGT1B	VBGT	0.8839	0.8949
Challicum Hills Wind Farm	66	CHALLHWF	VHOT1	VBAT	0.9699	0.9699
Chepstowe Wind Farm	66	CHPSTWF1	VBAT3C	VBAT	0.9699	0.9699
Cherry Tree Wind Farm	66	CHYTWF1	VSM71C	VSM7	0.9955	0.9959
Clayton Landfill Gas Power Station	66	CLAYTON	VSV21B	VSV2	0.9972	0.9957
Clover PS	66	CLOVER	VMBT1	VMBT	1.0190	1.0292
Codrington Wind Farm	66	CODRNGTON	VTGT2C	VTGT	0.9972	1.0035
Cohuna Solar Farm	66	COHUNSF1	VKGS2C	VKGS	0.9336	0.9127
Coonooer Bridge Wind Farm	66	CBWF1	VBE61C	VBE6	1.0084	1.0101
Corio LFG PS	66	CORIO1	VGT61C	VGT6	0.9933	0.9918
Crowlands Wind Farm	220	CROWLWF1	VCWL1C	VCWL	0.8877	0.8985
Dartmouth PS	220	DARTM1	VDPS	VDPS	0.9542	0.9861
Diapur Wind Farm	66	DIAPURWF1	VHOG2D	VHOG	0.8788	0.9005
Dundonnell Wind Farm 1	500	DUNDWF1	VM051D	VM05	0.9824	0.9789
Dundonnell Wind Farm 2	500	DUNDWF2	VM052D	VM05	0.9824	0.9789
Dundonnell Wind Farm 3	500	DUNDWF3	VM053D	VM05	0.9824	0.9789
Eildon Hydro PS	66	EILDON3	VTT22E	VSMT	0.9951	0.9956
Eildon PS Unit 1	220	EILDON1	VEPS1	VEPS	0.9887	0.9995
Eildon PS Unit 2	220	EILDON2	VEPS2	VEPS	0.9887	0.9995
Elaine Wind Farm	220	ELAINWF1	VELT3E	VELT	0.9480	0.9459
Ferguson North Wind Farm	66	FNWF1	VTGT6F	VTGT	0.9972	1.0035
Ferguson South Wind Farm	66	FSWF1	VTGT7F	VTGT	0.9972	1.0035
Gannawarra BESS (Generation)	66	GANNBG1	VKGB1G	VKGB	1.0026	0.9773
Gannawarra BESS (Load)	66	GANNBL1	VKGB2G	VKGL	0.9846	0.9933
Gannawarra Solar Farm	66	GANNSF1	VKGS1G	VKGS	0.9336	0.9127
Glenmaggie Hydro PS	66	GLENMAG1	VMWT8G	VMWT	0.9977	0.9936
Glenrowan West Sun Farm	66	GLRWNSF1	VGNS1G	VGNS	0.9671	0.9976
Hallam Mini Hydro	66	HLMSEW01	VER21H	VCBT	0.9935	0.9921
Hallam Road Renewable Energy Facility	66	HALAMRD1	VER22L	VER2	0.9962	0.9944
Hepburn Community Wind Farm	66	HEPWIND1	VBAT2L	VBAT	0.9699	0.9699
Hume (Victorian Share)	66	HUMEV	VHUM	VHUM	0.9535	0.9933
Jeeralang A PS Unit 1	220	JLA01	VJLGA1	VJLG	0.9727	0.9755

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Jeeralang A PS Unit 2	220	JLA02	VJLGA2	VJLG	0.9727	0.9755
Jeeralang A PS Unit 3	220	JLA03	VJLGA3	VJLG	0.9727	0.9755
Jeeralang A PS Unit 4	220	JLA04	VJLGA4	VJLG	0.9727	0.9755
Jeeralang B PS Unit 1	220	JLB01	VJLGB1	VJLG	0.9727	0.9755
Jeeralang B PS Unit 2	220	JLB02	VJLGB2	VJLG	0.9727	0.9755
Jeeralang B PS Unit 3	220	JLB03	VJLGB3	VJLG	0.9727	0.9755
Jindabyne pump at Guthega	132	SNOWYGJP	NGJP	NGJP	1.0914	1.1350
Karadoc Solar Farm	66	KARSF1	VRCS1K	VRCS	0.8886	0.8673
Kiamal Solar Farm	220	KIAMSF1	VKMT1K	VKMT	0.8775	0.8504
Kiata Wind Farm	66	KIATAWF1	VHOG1K	VHOG	0.8788	0.9005
Laverton PS (LNGS1)	220	LNGS1	VAT21L	VAT2	0.9949	0.9936
Laverton PS (LNGS2)	220	LNGS2	VAT22L	VAT2	0.9949	0.9936
Longford	66	LONGFORD	VMWT6	VMWT	0.9977	0.9936
Loy Yang A PS Load	500	LYNL1	VLYPL	VLYP	0.9783	0.9759
Loy Yang A PS Unit 1	500	LYA1	VLYP1	VLYP	0.9783	0.9759
Loy Yang A PS Unit 2	500	LYA2	VLYP2	VLYP	0.9783	0.9759
Loy Yang A PS Unit 3	500	LYA3	VLYP3	VLYP	0.9783	0.9759
Loy Yang A PS Unit 4	500	LYA4	VLYP4	VLYP	0.9783	0.9759
Loy Yang B PS Unit 1	500	LOYYB1	VLYP5	VLYP	0.9783	0.9759
Loy Yang B PS Unit 2	500	LOYYB2	VLYP6	VLYP	0.9783	0.9759
MacArthur Wind Farm	500	MACARTH1	VTRT1M	VTRT	0.9807	0.9753
Maroona Wind Farm	66	MAROOWF1	VBAT5M	VBAT	0.9699	0.9699
McKay Creek / Bogong PS	220	MCKAY1	VMKP1	VT14	0.9665	0.9726
Moorabool Wind Farm	220	MOORAWF1	VELT2M	VELT	0.9480	0.9459
Mortlake Unit 1	500	MORTLK11	VM0P1O	VM0P	0.9901	0.9865
Mortlake Unit 2	500	MORTLK12	VM0P2O	VM0P	0.9901	0.9865
Mortlake South Wind Farm	220	MRTLSWF1	VTG21M	VTG2	0.9573	0.9768
Mortons Lane Wind Farm	66	MLWF1	VTGT4M	VTGT	0.9972	1.0035
Mt Gellibrand Windfarm	66	MTGELWF1	VGTW1M	VGTW	0.9879	0.9862
Mt Mercer Windfarm	220	MERCER01	VELT1M	VELT	0.9480	0.9459
Murra Warra Wind Farm	220	MUWAWF1	VMRT1M	VMRT	0.8661	0.8883
Murra Warra Wind Farm - stage 2	220	MUWAWF2	VMRT2M	VMRT	0.8661	0.8883
Murray	330	MURRAY	NMUR8	NMUR	0.9719	0.9966
Murray (Geehi Tee off Auxiliary)	330	MURAYNL3	NMURL3	NMUR	0.9719	0.9966
Murray Power Station M1 Auxiliary	330	MURAYNL1	NMURL1	NMUR	0.9719	0.9966
Murray Power Station M2 Auxiliary	330	MURAYNL2	NMURL2	NMUR	0.9719	0.9966
Newport PS	220	NPS	VNPS	VNPS	0.9919	0.9926
Numurkah Solar Farm	66	NUMURSF1	VSHS1N	VSHS	0.9715	0.9963
Oaklands Hill Wind Farm	66	OAKLAND1	VTGT3A	VTGT	0.9972	1.0035

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Rubicon Mountain Streams Station	66	RUBICON	VTT21R	VSMT	0.9951	0.9956
Salt Creek Wind Farm	66	SALTCRK1	VTG61S	VTG6	0.9584	0.9515
Shepparton Waste Gas	66	SHEP1	VSHT2S	VSHT	1.0313	1.0346
Somerton Power Station	66	AGLSOM	VTTS1	VSOM	0.9924	0.9932
Springvale Power Plant	66	SVALE1	VSV22S	VSV2	0.9972	0.9957
Stockyard Hill Wind Farm	500	STOCKYD1	VHGT1S	VHGT	0.9799	0.9782
Tatura	66	TATURA01	VSHT1	VSHT	1.0313	1.0346
Timboon West Wind Farm	66	TIMWEST	VTGT5T	VTGT	0.9972	1.0035
Toora Wind Farm	66	TOORAWF	VMWT5	VMWT	0.9977	0.9936
Traralgon NSS	66	TGNSS1	VMWT1T	VMWT	0.9977	0.9936
Valley Power Unit 1	500	VPGS1	VLYP07	VLYP	0.9783	0.9759
Valley Power Unit 2	500	VPGS2	VLYP08	VLYP	0.9783	0.9759
Valley Power Unit 3	500	VPGS3	VLYP09	VLYP	0.9783	0.9759
Valley Power Unit 4	500	VPGS4	VLYP010	VLYP	0.9783	0.9759
Valley Power Unit 5	500	VPGS5	VLYP011	VLYP	0.9783	0.9759
Valley Power Unit 6	500	VPGS6	VLYP012	VLYP	0.9783	0.9759
Victorian Big Battery (Generation)	220	VBBG1	VMLB1V	VMLB	0.9848	0.9820
Victorian Big Battery (Load)	220	VBBL1	VMLB2V	VMLB	0.9870	0.9864
Waubra Wind Farm	220	WAUBRAWF	VWBT1A	VWBT	0.9233	0.9221
Wemen Solar Farm	66	WEMENSF1	VWES2W	VWES	0.8928	0.8633
West Kiewa PS Unit 1	220	WKIEWA1	VWKP1	VWKP	1.0049	1.0096
West Kiewa PS Unit 2	220	WKIEWA2	VWKP2	VWKP	1.0049	1.0096
William Hovell Hydro PS	66	WILLHOV1	VW061W	VGNT	1.0182	1.0299
Winton Solar Farm	66	WINTSF1	VGNS2W	VGNS	0.9671	0.9976
Wollert Renewable Energy Facility	66	WOLLERT1	VSMT1W	VSMT	0.9951	0.9956
Wonthaggi Wind Farm	66	WONWP	VMWT7	VMWT	0.9977	0.9936
Yallourn W PS 220 Load	220	YWNL1	VYP2L	VYP2	0.9602	0.9596
Yallourn W PS 220 Unit 1	220	YWPS1	VYP21	VYP3	0.9690	0.9663
Yallourn W PS 220 Unit 2	220	YWPS2	VYP22	VYP2	0.9602	0.9596
Yallourn W PS 220 Unit 3	220	YWPS3	VYP23	VYP2	0.9602	0.9596
Yallourn W PS 220 Unit 4	220	YWPS4	VYP24	VYP2	0.9602	0.9596
Yaloak South Wind Farm	66	YSWF1	VBAT4Y	VBAT	0.9699	0.9699
Yambuk Wind Farm	66	YAMBUKWF	VTGT1	VTGT	0.9972	1.0035
Yarrawonga Hydro PS	66	YWNGAHYD	VSHT3Y	VSHT	1.0313	1.0346
Yatpool Solar Farm	66	YATSF1	VRCS2Y	VRCS	0.8886	0.8673
Yawong Wind Farm	66	YAWWF1	VBE62Y	VBE6	1.0084	1.0101
Yendon Wind Farm	66	YENDWF1	VBAW1Y	VBAW	0.9497	0.9422

1.4 South Australia marginal loss factors

Table 9 South Australia loads

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Angas Creek	33	SANC	1.0096	1.0113
Ardrossan West	33	SARW	0.9472	0.9485
Back Callington	11	SBAC	1.0063	1.0099
Baroota - Dual MLF (Generation)	33	SBAR	0.9680	0.9670
Baroota - Dual MLF (Load)	33	SBAR	0.9893	0.9946
Berri	66	SBER	0.9875	1.0072
Berri (POWERCOR)	66	SBE1	0.9875	1.0072
Blanche	33	SBLA	1.0038	1.0333
Blanche (POWERCOR)	33	SBL1	1.0038	1.0333
Brinkworth	33	SBRK	0.9876	0.9918
Bungama Industrial	33	SBUN	0.9817	0.9868
Bungama Rural	33	SBUR	0.9905	0.9958
City West	66	SACR	1.0068	1.0067
Clare North	33	SCLN	0.9846	0.9884
Dalrymple	33	SDAL	0.9127	0.9128
Davenport	275	SDAV	0.9788	0.9841
Davenport	33	SDAW	0.9812	0.9874
Dorrien	33	SDRN	1.0036	1.0051
East Terrace	66	SETC	1.0009	1.0021
Happy Valley	66	SHVA	1.0030	1.0052
Hummocks	33	SHUM	0.9587	0.9640
Kadina East	33	SKAD	0.9864	0.9745
Kanmantoo	11	SKAN	1.0108	1.0128
Keith	33	SKET	1.0119	1.0263
Kilburn	66	SKLB	1.0010	1.0008
Kincraig	33	SKNC	1.0053	1.0258
Lefevre	66	SLFE	1.0003	1.0003
Leigh Creek South	33	SLCS	1.0033	1.0579
Magill	66	SMAG	1.0026	1.0041
Mannum	33	SMAN	1.0185	1.0169
Mannum – Adelaide Pipeline 1	3.3	SMA1	1.0141	1.0206
Mannum – Adelaide Pipeline 2 - Dual MLF (Generation)	3.3	SMA2	0.9944	1.0016
Mannum – Adelaide Pipeline 2 - Dual MLF (Load)	3.3	SMA2	1.0143	1.0182
Mannum – Adelaide Pipeline 3 - Dual MLF (Generation)	3.3	SMA3	0.9934	1.0012
Mannum – Adelaide Pipeline 3 - Dual MLF (Load)	3.3	SMA3	1.0141	1.0178

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Middleback	33	SMDL	0.9923	0.9997
Middleback	132	SMBK	0.9955	1.0003
Millbrook	132	SMLB	1.0019	1.0041
Mobilong	33	SMBL	1.0091	1.0140
Morgan Whyalla Pump Station 1 PV	3.3	SMW1	1.0018	1.0271
Morgan Whyalla Pump Station 2 PV - Dual MLF (Generation)	3.3	SMW2	0.9999	0.9664
Morgan Whyalla Pump Station 2 PV - Dual MLF (Load)	3.3	SMW2	0.9999	0.9994
Morgan Whyalla Pump Station 3 PV - Dual MLF (Generation)	3.3	SMW3	0.9717	0.9719
Morgan Whyalla Pump Station 3 PV - Dual MLF (Load)	3.3	SMW3	0.9864	0.9927
Morgan Whyalla Pump Station 4 PV - Dual MLF (Generation)	3.3	SMW4	0.9889	0.9751
Morgan Whyalla Pump Station 4 PV - Dual MLF (Load)	3.3	SMW4	0.9889	0.9874
Morphett Vale East	66	SMVE	1.0036	1.0055
Mount Barker South	66	SMBS	1.0038	1.0063
Mt Barker	66	SMBA	1.0024	1.0049
Mt Gambier	33	SMGA	1.0060	1.0356
Mt Gunson South	132	SMGS	0.9895	0.9947
Mt Gunson	33	SMGU	0.9883	0.9939
Munno Para	66	SMUP	0.9980	0.9992
Murray Bridge – Hahndorf Pipeline 1	11	SMH1	1.0115	1.0198
Murray Bridge - Hahndorf Pipeline 2 – Dual MLF (Generation)	11	SMH2	1.0190	1.0058
Murray Bridge - Hahndorf Pipeline 2 – Dual MLF (Load)	11	SMH2	1.0190	1.0205
Murray Bridge – Hahndorf Pipeline 3	11	SMH3	1.0104	1.0169
Neuroodla	33	SNEU	0.9952	1.0190
New Osborne	66	SNBN	1.0008	1.0005
North West Bend	66	SNWB	0.9892	0.9982
Northfield	66	SNFD	1.0023	1.0027
Para	66	SPAR	1.0000	1.0012
Parafield Gardens West	66	SPGW	1.0002	1.0011
Penola West 33	33	SPEN	1.0009	1.0236
Pimba	132	SPMB	0.9952	1.0015
Playford	132	SPAA	0.9773	0.9828
Port Lincoln	33	SPLN	0.9786	0.9813
Port Pirie	33	SPPR	0.9867	0.9912
Roseworthy	11	SRSW	1.0067	1.0082
Snuggery Industrial	33	SSNN	1.0029	1.0358

Location	Voltage [kV]	TNI code	2022-23 MLF	2021-22 MLF
Snuggery Rural	33	SSNR	0.9797	1.0030
South Australian VTN		SJP1	0.9962	1.0003
Stony Point	11	SSPN	0.9843	0.9904
Tailem Bend	33	STAL	1.0110	1.0173
Templers	33	STEM	1.0011	1.0029
Torrens Island	66	STSY	1.0000	1.0000
Waterloo	33	SWAT	0.9786	0.9821
Whyalla Central Substation	33	SWYC	0.9845	0.9909
Whyalla Terminal BHP	33	SBHP	0.9847	0.9902
Woomera	132	SWMA	0.9902	0.9956
Wudina	66	SWUD	0.9945	1.0001
Yadnarie	66	SYAD	0.9792	0.9864

Table 10 South Australia generation

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Adelaide Desalination Plant Battery (Generation)	66	ADPBA1G	SMVE4D	SMVE	1.0036	1.0055
Adelaide Desalination Plant Battery (Load)	66	ADPBA1L	SMVE5D	SMVE	1.0036	1.0055
Adelaide Desalination Plant Hydro	66	ADPMH1	SMVE9D	SMVE	1.0036	1.0055
Adelaide Desalination Plant PV1	66	ADPPV1	SMVE6D	SMVE	1.0036	1.0055
Adelaide Desalination Plant PV2	66	ADPPV2	SMVE7D	SMVE	1.0036	1.0055
Adelaide Desalination Plant PV3	66	ADPPV3	SMVE8D	SMVE	1.0036	1.0055
Angaston Power Station	33	ANGAST1	SDRN1	SANG	1.0027	1.0020
Barker Inlet PS	275	BARKIPS1	SBPS1B	SBPS	0.9996	0.9997
Bolivar WWT Plant	66	BOLIVAR1	SPGW1B	SPGW	1.0002	1.0011
Bolivar Wastewater Treatment Plant PV	66	BOWWPV1	SPGW2B	SPGW	1.0002	1.0011
Bolivar Wastewater Treatment Plant Reserve Diesel	66	BOWWDG1	SPGW5B	SPGW	1.0002	1.0011
Bolivar Wastewater Treatment Plant Reserve BESS (Generation)	66	BOWWBA1G	SPGW3B	SPGW	1.0002	1.0011
Bolivar Wastewater Treatment Plant Reserve BESS (Load)	66	BOWWBA1L	SPGW4B	SPGW	1.0002	1.0011
Bungala One Solar Farm	132	BNGSF1	SBEM1B	SBEM	0.9567	0.9597
Bungala Two Solar Farm	132	BNGSF2	SBEM2B	SBEM	0.9567	0.9597
Canunda Wind Farm	33	CNUNDAWF	SSNN1	SCND	0.9742	0.9944
Cathedral Rocks Wind Farm	132	CATHROCK	SCRK	SCRK	0.9281	0.9166
Christies Beach BESS Gen	66	CBWWBA1G	SMVE7C	SMVE	1.0036	
Christies Beach BESS Load	66	CBWWBA1L	SMVE8C	SMVE	1.0036	
Christies Beach Biogas	66	CBWWBG1	SMVE11	SMVE	1.0036	
Christies Beach Diesel 1	66	CBWWDG1	SMVE12	SMVE	1.0036	

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Christies Beach Diesel 2	66	CBWWDG2	SMVE13	SMVE	1.0036	
Christies Beach Solar 1	66	CBWWPV1	SMVE9C	SMVE	1.0036	
Christies Beach Solar 2	66	CBWWPV2	SMVE10	SMVE	1.0036	
Clements Gap Wind Farm	132	CLEMGPWF	SCGW1P	SCGW	0.9530	0.9564
Cummins Lonsdale PS	66	LONSDALE	SMVE1	SMVE	1.0036	1.0055
Dalrymple North BESS (Generation)	33	DALNTH01	SDAN1D	SDAM	0.9432	0.9212
Dalrymple North BESS (Load)	33	DALNTHL1	SDAN2D	SDAN	0.9113	0.9073
Dry Creek PS Unit 1	66	DRYCGT1	SDCA1	SDPS	0.9991	1.0002
Dry Creek PS Unit 2	66	DRYCGT2	SDCA2	SDPS	0.9991	1.0002
Dry Creek PS Unit 3	66	DRYCGT3	SDCA3	SDPS	0.9991	1.0002
Hallet 2 Wind Farm	275	HALLWF2	SMOK1H	SMOK	0.9572	0.9606
Hallett 1 Wind Farm	275	HALLWF1	SHPS2W	SHPS	0.9599	0.9630
Hallett PS	275	AGLHAL	SHPS1	SHPS	0.9599	0.9630
Happy Valley BESS (Generation)	66	HVWWBA1G	SHVA1H	SHVA	1.0030	1.0052
Happy Valley BESS (Load)	66	HVWWBA1L	SHVA2H	SHVA	1.0030	1.0052
Happy Valley Solar	66	HVWWPV1	SHVA3H	SHVA	1.0030	1.0052
Hornsdale Battery (Generation)	275	HPRG1	SMTL1H	SMTL	0.9652	0.9772
Hornsdale Battery (Load)	275	HPRL1	SMTL2H	SMTL	0.9681	0.9693
Hornsdale Wind Farm Stage 1	275	HDWF1	SHDW1H	SHDW	0.9479	0.9518
Hornsdale Wind Farm Stage 2	275	HDWF2	SHDW2H	SHDW	0.9479	0.9518
Hornsdale Wind Farm Stage 3	275	HDWF3	SHDW3H	SHDW	0.9479	0.9518
Ladbroke Grove PS Unit 1	132	LADBROK1	SPEW1	SPEW	0.9553	0.9883
Ladbroke Grove PS Unit 2	132	LADBROK2	SPEW2	SPEW	0.9553	0.9883
Lake Bonney BESS (Generation)	33	LBBG1	SLBB1L	SLBB	0.9851	1.0022
Lake Bonney BESS (Load)	33	LBBL1	SLBB2L	SLBB	1.0230	1.0094
Lake Bonney Wind Farm	33	LKBONNY1	SMAY1	SMAY	0.9585	0.9803
Lake Bonney Wind Farm Stage 2	33	LKBONNY2	SMAY2	SMAY	0.9585	0.9803
Lake Bonney Wind Farm Stage 3	33	LKBONNY3	SMAY3W	SMAY	0.9585	0.9803
Lincoln Gap Wind Farm	275	LGAPWF1	SLGW1L	SLGW	0.9628	0.9644
Lincoln Gap Wind Farm (Stage 2)	275	LGAPWF2	SLGW4L	SLGW	0.9628	0.9644
Mannum-Adelaide Pipeline Pumping Station No 2 Solar Farm – dual MLF (Generation)	3.3	MAPS2PV1	SMA21M	SMA2	0.9944	1.0016
Mannum-Adelaide Pipeline Pumping Station No 2 Solar Farm – dual MLF (Load)	3.3	MAPS2PV1	SMA21M	SMA2	1.0143	1.0182
Mannum-Adelaide Pipeline Pumping Station No 3 Solar Farm – dual MLF (Generation)	3.3	MAPS3PV1	SMA31M	SMA3	0.9934	1.0012
Mannum-Adelaide Pipeline Pumping Station No 3 Solar Farm – dual MLF (Load)	3.3	MAPS3PV1	SMA31M	SMA3	1.0141	1.0178
Mintaro PS	132	MINTARO	SMPS	SMPS	0.9793	0.9865
Morgan Whyalla Pump Station 1 PV	3.3	MWPS1PV1	SMW11M	SMW1	1.0018	1.0271
Morgan Whyalla Pump Station 2 PV – Dual MLF (Generation)	3.3	MWPS2PV1	SMW21M	SMW2	0.9999	0.9664

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Morgan Whyalla Pump Station 2 PV – Dual MLF (Load)	3.3	MWPS2PV1	SMW21M	SMW2	0.9999	0.9994
Morgan Whyalla Pump Station 3 PV – Dual MLF (Generation)	3.3	MWPS3PV1	SMW31M	SMW3	0.9717	0.9719
Morgan Whyalla Pump Station 3 PV – Dual MLF (Load)	3.3	MWPS3PV1	SMW31M	SMW3	0.9864	0.9927
Morgan Whyalla Pump Station 4 PV – Dual MLF (Generation)	3.3	MWPS4PV1	SMW41M	SMW4	0.9889	0.9751
Morgan Whyalla Pump Station 4 PV – Dual MLF (Load)	3.3	MWPS4PV1	SMW41M	SMW4	0.9889	0.9874
Morphett Vale East 66	66	SATGS1	SMVG1L	SMVG	1.0015	1.0021
Mt Millar Wind Farm	33	MTMILLAR	SMTM1	SMTM	0.9245	0.9287
Murray Bridge - Hahndorf Pipeline 2 – Dual MLF (Generation)	11	MBPS2PV1	SMH21M	SMH2	1.0190	1.0058
Murray Bridge - Hahndorf Pipeline 2 – Dual MLF (Load)	11	MBPS2PV1	SMH21M	SMH2	1.0190	1.0205
North Brown Hill Wind Farm	275	NBHWF1	SBEL1A	SBEL	0.9539	0.9571
O.C.P.L. Unit 1	66	OSB-AG	SNBN1	SOCP	0.9999	0.9999
Pelican Point PS	275	PPCCGT	SPPT	SPPT	0.9983	0.9987
Port Augusta Renewable Energy Park - Wind	275	PAREPW1	SDAP1P	SDAP	0.9641	0.9728
Port Lincoln 3	33	POR03	SPL31P	SPL3	0.9945	0.9467
Port Lincoln PS	132	POR01	SPLN1	SPTL	0.9899	0.9505
Pt Stanvac PS	66	PTSTAN1	SMVE3P	SMVE	1.0036	1.0055
Quarantine PS Unit 1	66	QPS1	SQPS1	SQPS	0.9871	0.9858
Quarantine PS Unit 2	66	QPS2	SQPS2	SQPS	0.9871	0.9858
Quarantine PS Unit 3	66	QPS3	SQPS3	SQPS	0.9871	0.9858
Quarantine PS Unit 4	66	QPS4	SQPS4	SQPS	0.9871	0.9858
Quarantine PS Unit 5	66	QPS5	SQPS5Q	SQPS	0.9871	0.9858
Snapper Point PS	275	SNAPPER1	SNPT1S	SNPT	0.9990	0.9990
Snowtown Wind Farm	33	SNOWTWN1	SNWF1T	SNWF	0.9162	0.9134
Snowtown Wind Farm Stage 2 – North	275	SNOWNTH1	SBLWS1	SBLW	0.9666	0.9678
Snowtown Wind Farm Stage 2 – South	275	SNOWSTH1	SBLWS2	SBLW	0.9666	0.9678
Snuggery PS Units 1 to 3	132	SNUG1	SSGA1	SSPS	0.9388	0.9533
Starfish Hill Wind Farm	66	STARHLWF	SMVE2	SMVE	1.0036	1.0055
Tailem Bend Solar Farm	132	TBSF1	STBS1T	STBS	1.0029	1.0113
Tatiara Meat Co	33	TATIARA1	SKET1E	SKET	1.0119	1.0263
The Bluff wind Farm	275	BLUFF1	SBEL2P	SBEL	0.9539	0.9571
Torrens Island PS A Unit 3	275	TORRA3	STSA3	STPS	0.9994	0.9999
Torrens Island PS B Unit 1	275	TORRB1	STSB1	STPS	0.9994	0.9999
Torrens Island PS B Unit 2	275	TORRB2	STSB2	STPS	0.9994	0.9999
Torrens Island PS B Unit 3	275	TORRB3	STSB3	STPS	0.9994	0.9999
Torrens Island PS B Unit 4	275	TORRB4	STSB4	STPS	0.9994	0.9999
Torrens Island PS Load	66	TORNL1	STSYL	STSY	1.0000	1.0000

Generator	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Waterloo Wind Farm	132	WATERLWF	SWLE1R	SWLE	0.9582	0.9594
Wattle Point Wind Farm	132	WPWF	SSYP1	SSYP	0.8174	0.8110
Willogoleche Wind Farm	275	WGWF1	SWGL1W	SWGL	0.9549	0.9583
Wingfield 1 LFG PS	66	WINGF1_1	SKLB1W	SKLB	1.0010	1.0008
Wingfield 2 LFG PS	66	WINGF2_1	SNBN2W	SNBN	1.0008	1.0005

1.5 Tasmania marginal loss factors

Table 11 Tasmania loads

Location	Voltage (kV)	TNI code	2022-23 MLF	2021-22 MLF
Arthurs Lake	6.6	TAL2	0.9774	0.9815
Avoca	22	TAV2	1.0104	1.0023
Boyer SWA	6.6	TBYA	1.0144	1.0003
Boyer SWB	6.6	TBYB	1.0248	1.0092
Bridgewater	11	TBW2	1.0206	1.0154
Burnie	22	TBU3	0.9872	0.9781
Chapel St.	11	TCS3	1.0051	1.0001
Comalco	220	TCO1	1.0006	1.0006
Creek Road	33	TCR2	1.0069	1.0009
Derby	22	TDE2	0.9614	0.9483
Derwent Bridge	22	TDB2	0.9177	0.9117
Devonport	22	TDP2	0.9880	0.9785
Electrona	11	TEL2	1.0218	1.0157
Emu Bay	11	TEB2	0.9850	0.9746
Fisher (Rowallan)	220	TFI1	0.9655	0.9561
Fisher 220 DNSP	220	TFI2	0.9655	0.9561
George Town	22	TGT3	1.0013	1.0020
George Town (Basslink)	220	TGT1	1.0000	1.0000
Gordon	22	TGO2	0.9879	0.9710
Greater Hobart Area VTN		TVN1	1.0092	1.0027
Hadspen	22	THA3	0.9931	0.9902
Hampshire	110	THM2	0.9834	0.9736
Huon River	11	THR2	1.0299	1.0189
Kermandie	11	TKE2	1.0288	1.0203
Kingston	33	TK13	1.0119	1.0067
Kingston	11	TKI2	1.0165	1.0114
Knights Road	11	TKR2	1.0267	1.0176
Lindisfarne	33	TLF2	1.0101	1.0039

Location	Voltage (kV)	TNI code	2022-23 MLF	2021-22 MLF
Meadowbank	22	TMB2	0.9972	0.9829
Mornington	33	TMT2	1.0104	1.0051
Mowbray	22	TMY2	0.9924	0.9896
New Norfolk	22	TNN2	1.0054	0.9954
Newton	22	TNT2	0.9709	0.9524
Newton	11	TNT3	0.9582	0.9369
North Hobart	11	TNH2	1.0066	0.9996
Norwood	22	TNW2	0.9921	0.9882
Palmerston	22	TPM3	0.9759	0.9728
Port Latta	22	TPL2	0.9644	0.9480
Que	22	TQU2	0.9805	0.9612
Queenstown	11	TQT3	0.9623	0.9437
Queenstown	22	TQT2	0.9617	0.9434
Railton	22	TRA2	0.9876	0.9783
Risdon	33	TRI4	1.0133	1.0042
Risdon	11	TRI3	1.0184	1.0046
Rokeby	11	TRK2	1.0138	1.0094
Rosebery	44	TRB2	0.9694	0.9505
Savage River	22	TSR2	1.0054	0.9876
Scottsdale	22	TSD2	0.9734	0.9639
Sheffield	22	TSH3	0.9813	0.9713
Smithton	22	TST2	0.9507	0.9330
Sorell	22	TSO2	1.0300	1.0264
St Leonard	22	TSL2	0.9935	0.9882
St. Marys	22	TSM2	1.0271	1.0153
Starwood	110	TSW1	1.0001	1.0006
Tamar Region VTN		TVN2	0.9937	0.9908
Temco	110	TTE1	1.0030	1.0032
Trevallyn	22	TTR2	0.9932	0.9901
Triabunna	22	TTB2	1.0395	1.0300
Tungatinah	22	TTU2	0.9176	0.9142
Ulverstone	22	TUL2	0.9864	0.9772
Waddamana	22	TWA2	0.9298	0.9395
Wayatinah	11	TWY2	0.9910	0.9802
Wesley Vale	22	TWV2	0.9847	0.9753

Table 12 Tasmania generation

Generator description	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Basslink (George Town)	220	BLNKTAS	TGT11	TGT1	1.0000	1.0000

Generator description	Voltage [kV]	DUID	Connection Point ID	TNI code	2022-23 MLF	2021-22 MLF
Bastyan	220	BASTYAN	TFA11	TFA1	0.9334	0.9286
Bell Bay No.3	110	BBTHREE1	TBB11	TBB1	0.9975	0.9982
Bell Bay No.3	110	BBTHREE2	TBB12	TBB1	0.9975	0.9982
Bell Bay No.3	110	BBTHREE3	TBB13	TBB1	0.9975	0.9982
Bluff Point and Studland Bay Wind Farms	110	WOOLNTH1	TST11	TST1	0.8951	0.8794
Butlers Gorge	110	BUTLERSG	TBG11	TBG1	0.9140	0.9049
Catagunya	220	LI_WY_CA	TLI11	TLI1	0.9845	0.9789
Cethana	220	CETHANA	TCE11	TCE1	0.9544	0.9512
Cluny	220	CLUNY	TCL11	TCL1	0.9850	0.9798
Devils gate	110	DEVILS_G	TDG11	TDG1	0.9594	0.9566
Fisher	220	FISHER	TFI11	TFI1	0.9655	0.9561
Gordon	220	GORDON	TGO11	TGO1	0.9400	0.9280
Granville Harbour Wind Farm	220	GRANWF1	TGH11G	TGH1	0.9543	0.9314
John Butters	220	JBUTTERS	TJB11	TJB1	0.9395	0.9258
Lake Echo	110	LK_ECHO	TLE11	TLE1	0.9142	0.9133
Lemonthyme	220	LEM_WIL	TSH11	TSH1	0.9672	0.9608
Liapootah	220	LI_WY_CA	TLI11	TLI1	0.9845	0.9789
Mackintosh	110	MACKNTSH	TMA11	TMA1	0.9186	0.9158
Meadowbank	110	MEADOWB K	TMB11	TMB1	0.9824	0.9830
Midlands PS	22	MIDLDPS1	TAV21M	TAV2	1.0104	1.0023
Musselroe	110	MUSSELR1	TDE11M	TDE1	0.9168	0.8999
Paloona	110	PALOONA	TPA11	TPA1	0.9642	0.9587
Poatina	220	POAT220	TPM11	TPM1	0.9771	0.9691
Poatina	110	POAT110	TPM21	TPM2	0.9625	0.9512
Reece No.1	220	REECE1	TRCA1	TRCA	0.9229	0.9193
Reece No.2	220	REECE2	TRCB1	TRCB	0.9195	0.9147
Repulse	220	REPULSE	TCL12	TCL1	0.9850	0.9798
Rowallan	220	ROWALLAN	TFI12	TFI1	0.9655	0.9561
St Leonards Scheduled Load	22	SLDCBLK1	TSL3SL1S	TSL3	0.9945	0.9888
Tamar Valley CCGT	220	TVCC201	TTV11A	TTV1	1.0000	1.0000
Tamar Valley OCGT	110	TVPP104	TBB14A	TBB1	0.9975	0.9982
Tarraleah	110	TARRALEA	TTA11	TTA1	0.9216	0.9106
Trevallyn	110	TREVALLN	TTR11	TTR1	0.9891	0.9848
Tribute	220	TRIBUTE	TTI11	TTI1	0.9263	0.9133
Tungatinah	110	TUNGATIN	TTU11	TTU1	0.8795	0.8859
Wayatinah	220	LI_WY_CA	TLI11	TLI1	0.9845	0.9789
Wild Cattle Hill Wind Farm	220	CTHLWF1	TWC11C	TWC1	0.9888	0.9809
Wilmot	220	LEM_WIL	TSH11	TSH1	0.9672	0.9608

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 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[5].

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.

[5] 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 2022-23 MLFs and the final 2022-23 MLFs

In December 2021, AEMO published a preliminary report containing indicative MLFs for 2022-23. 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 2021 Generation Information page [A]. Projects are included where the status is COM or COM* [B].	Inclusion based on generator project status in February 2022 Generation Information page. Projects are included where the status is COM or COM*.
Load profiles	Scaled historical load profiles from 2020-21.	Forecast load profiles for 2022-23.
Network model	2021-22 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 2021-22 MLF study.	Intra-regional limits reviewed for 2022-23, revised and incorporated into the 2022-23 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.

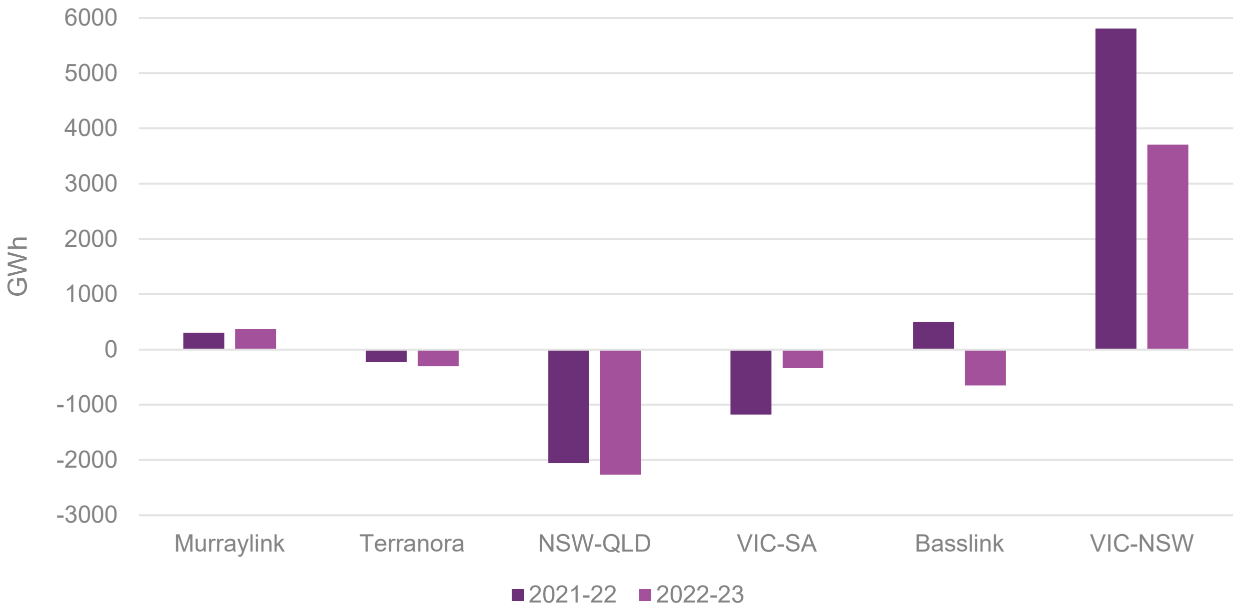
2.4 Changes between 2021-22 MLFs and 2022-23 MLFs

This section summarises the changes in MLFs for 2021-22 compared to the 2022-23 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 2022-23 calculations, and key changes from 2021-22.

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 2021-22 and 2022-23 MLF studies.

Figure 1 2021-22 vs 2022-23 MLF interconnector flow projections



2.4.1 Changes to marginal loss factors in Queensland

Figure 2 shows a geographical representation of MLF variations at Queensland connection points between 2021-22 and 2022-23. Table 14 shows the average sub-regional year-on-year MLF variations between 2021-22 and 2022-23.

The primary drivers of change in Queensland are variations in projected generation within Queensland between 2021-22 and 2022-23.

The north sub-region MLFs have decreased for both generation and load, by 2.32% and 0.17% respectively. This has primarily been driven by a forecast increase in generation within this sub-region due to committed projects.

The central sub-region MLFs have increased for both generation and load, by 1.13% and 0.93% respectively. This has primarily been driven by a forecast decrease in thermal generation within this sub-region, which has been offset by an increase in semi-scheduled generation capacity within Queensland.

Figure 2 Queensland changes compared to 2022-23 MLFs

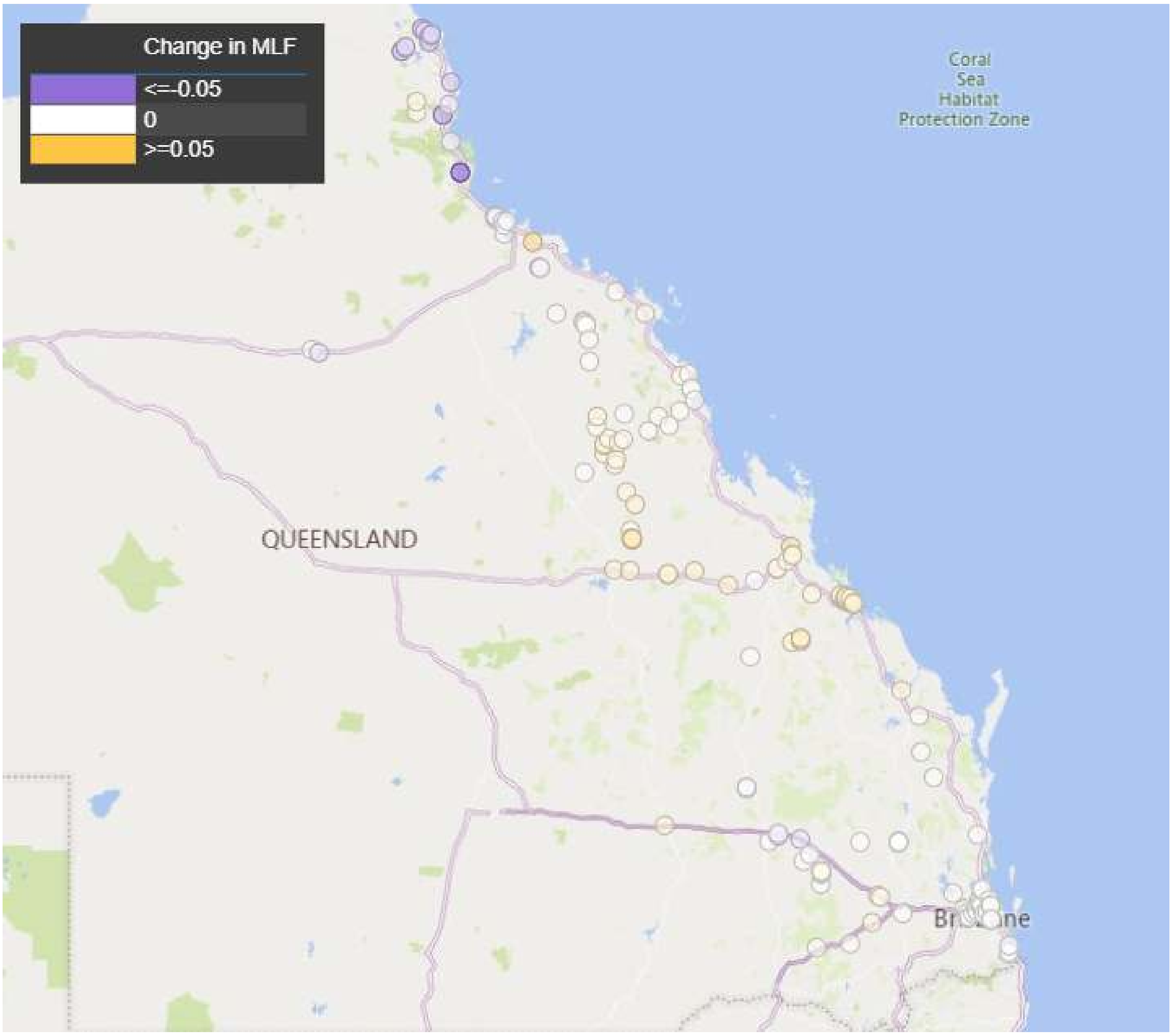


Table 14 Queensland sub-region year-on-year average MLF variation

Sub-region	Average MLF change 2021-22 to 2022-23	
	Gen	Load
Central	1.13%	0.93%
North	-2.32%	-0.17%
South-east	0.12%	0.02%
South-west	0.14%	-0.24%

2.4.2 Changes to marginal loss factors in New South Wales

Figure 3 shows a geographical representation of MLF variations at New South Wales connection points between 2021-22 and 2022-23. Table 15 shows the average sub-regional year on year MLF variations between 2021-22 and 2022-23.

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

Notably, in addition to the above the projected diurnal nature of flows between Victoria and New South Wales have changed. During hours of daylight, northerly flows have been materially supressed. This has partially been driven by a material increase in the capacity of grid scale solar generation within both New South Wales and Queensland.

The north New South Wales sub-region MLFs decreased for both generation and load, by 2.77% and 0.72% respectively. This has primarily been driven by a material increase in generation within this sub-region, especially generation connected to the 132 kV network where committed generation projects are also due to connect. Notably, the generation capacity within this region is almost entirely made up of solar. The resultant strong correlation of high output at times of low demand has increased the downward pressure on the underlying MLF outcomes for these generators.

The Hunter sub-region forecast MLFs have slightly increased for both generation and load, despite the increased generation capacity in north New South Wales the closure of Liddell has resulted in a material reduction in the forecast level of generation within the Hunter sub-region.

The south-west sub-region has seen a material increase to forecast MLF outcomes for generation with a 2.84% increase on average, the key driver of this change is a combination of much of this generation being solar and the diurnal variation in imports from Victoria which has resulted in a projected decrease in northerly flows during daylight hours. While the average generation MLF outcomes have increased, there is generation within this sub-region than has seen material declines. This is primarily due to the projected behaviour of these generators and the result impact on weighting.

While the Snowy and ACT sub-regions have on average seen reductions to forecast MLF outcomes, solar generation has seen increases driven by the diurnal variation in imports from Victoria.

Figure 3 New South Wales changes compared to 2022-23 MLFs

Table 15 New South Wales sub-region year-on-year average MLF variation

Sub-region	Average MLF change 2021-22 to 2022-23	
	Gen	Load
ACT	-0.30%	0.52%
Hunter	0.56%	0.29%
North	-2.77%	-0.72%
South-west	2.84%	0.58%
Snowy	-0.96%	-0.78%
Sydney	-0.89%	0.00%
West	-0.41%	0.04%

2.4.3 Changes to marginal loss factors in Victoria

Figure 4 shows a geographical representation of MLF variations at Victorian connection points between 2021-22 and 2022-23. Table 16 shows the average sub-regional year on year MLF variations between 2021-22 and 2022-23.

The primary drivers of change in Victoria are variations in projected exports to New South Wales, projected imports from Heywood, and projected exports from Murraylink between 2021-22 and 2022-23.

The north-west sub-region has seen slight increases of 0.96% to MLF outcomes for generation, primarily due to intra-regional limits. For north-west loads an average decrease of 1.67% has been observed, this is primarily the result of increased generation within this sub-region as well as decreased exports to New South Wales.

The north sub-region has seen material decreases of 2.39% for generation and 1.26% for load, this is primarily due to decreased exports to New South Wales.

The west sub-region has seen relatively small increases to both load and generation, this is primarily due to a material decrease in imports from South Australia.

Figure 4 Victoria changes compared to 2022-23 MLFs

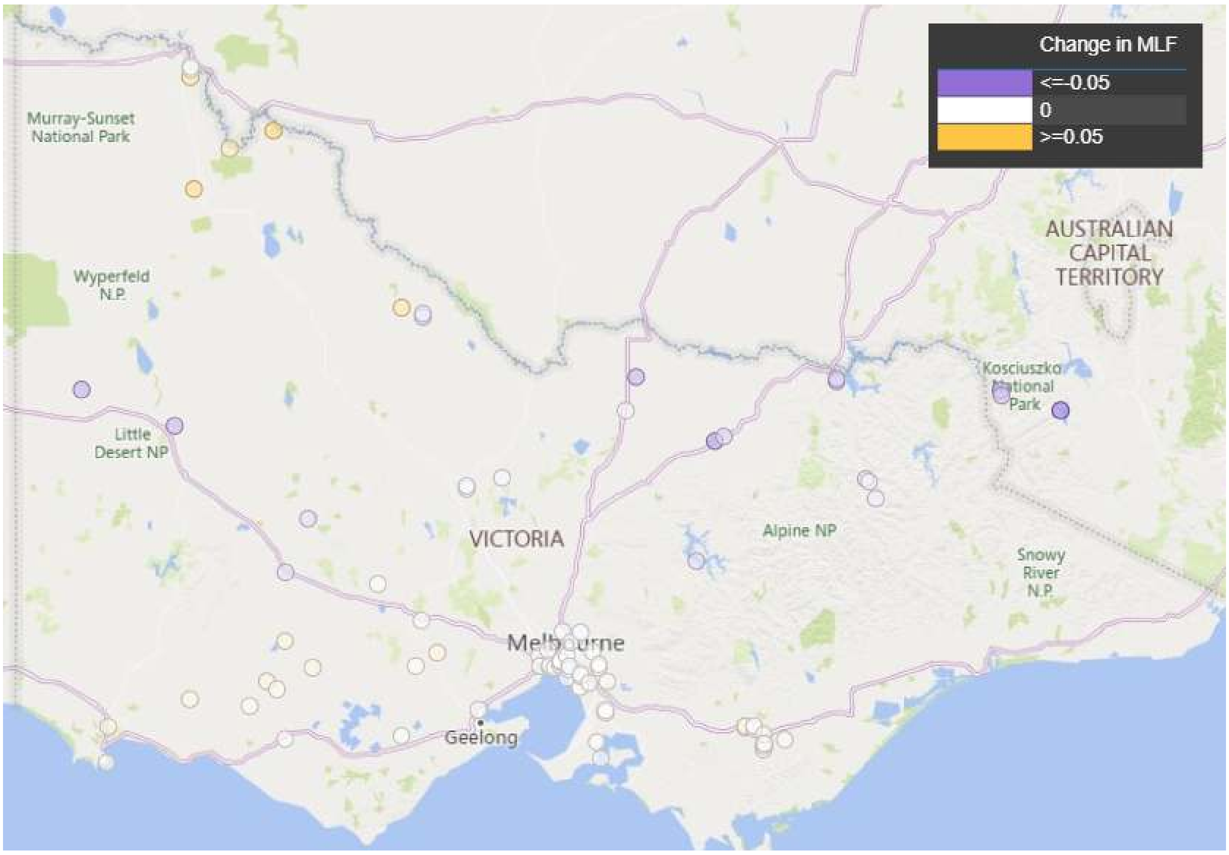


Table 16 Victoria sub-region year-on-year average MLF variation

Sub-region	Average MLF change 2021-22 to 2022-23	
	Gen	Load
Central	-0.35%	0.33%
Latrobe Valley	0.32%	1.00%
Melbourne	-0.02%	0.08%
North	-2.39%	-1.26%
North-west	0.96%	-1.67%
West	0.20%	0.46%

2.4.4 Changes to marginal loss factors in South Australia

Figure 5 shows a geographical representation of MLF variations at South Australian connection points between 2021-22 and 2022-23. Table 17 shows the average sub-regional year on year MLF variations between 2021-22 and 2022-23.

The primary drivers of change in South Australia are projected variations in exports to Victoria via Heywood which have been materially impacted by the restriction on easterly flows as a result of a Para static VAR compensator (SVC) outage. Additionally, easterly flows have been further reduced by the fact the vast majority of new generation capacity is outside of South Australia.

The Para SVC outage has resulted in easterly flows on Heywood being limited to 420MW until 4 January 2023, for further detail refer to Table 29 in section A2.6 of this report.

The Riverland sub-region MLFs decreased on average by 2.57%, primarily driven by increased generation (combined with load) within this sub-region.

The south-east sub-region MLFs decreased on average by 4.85% for generation and 1.57% for load, primarily driven by a projected decrease in exports to Victoria via Heywood as a result of the Para SVC outage.

Figure 5 South Australia changes to 2022-23 MLFs

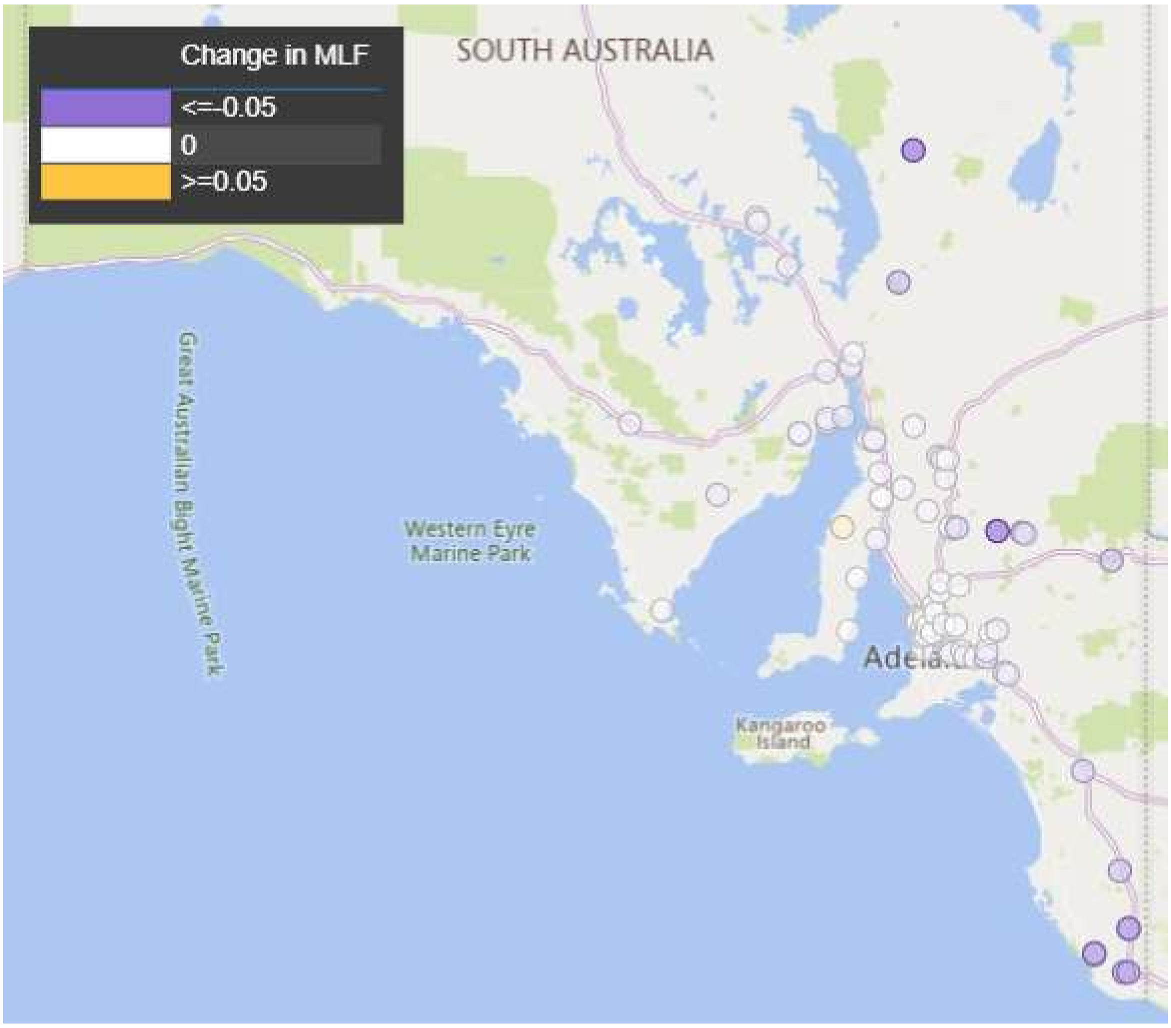


Table 17 South Australia sub-region year-on-year average MLF variation

Sub-region	Average MLF change 2021-22 to 2022-23	
	Gen	Load
Adelaide	-0.06%	-0.05%
North	-0.04%	0.41%
Riverland	NA	-2.57%
South-east	-4.85%	-1.57%

2.4.5 Changes to marginal loss factors in Tasmania

Figure 6 shows a geographical representation of MLF variations at Tasmanian connection points between 2021-22 and 2022-23. Table 18 shows the average sub-regional year on year MLF variations between 2021-22 and 2022-23.

The primary drivers of change in Tasmania are a projected reversal in the direction of net Basslink flows between 2021-22 and 2022-23.

All subregions except Georgetown have seen increases in average MLF outcomes. This is due to the increased flows from the RRN to these sub-regions which as mentioned is supported by the change in Basslink flows.

Figure 6 Tasmania changes to 2022-23 MLFs

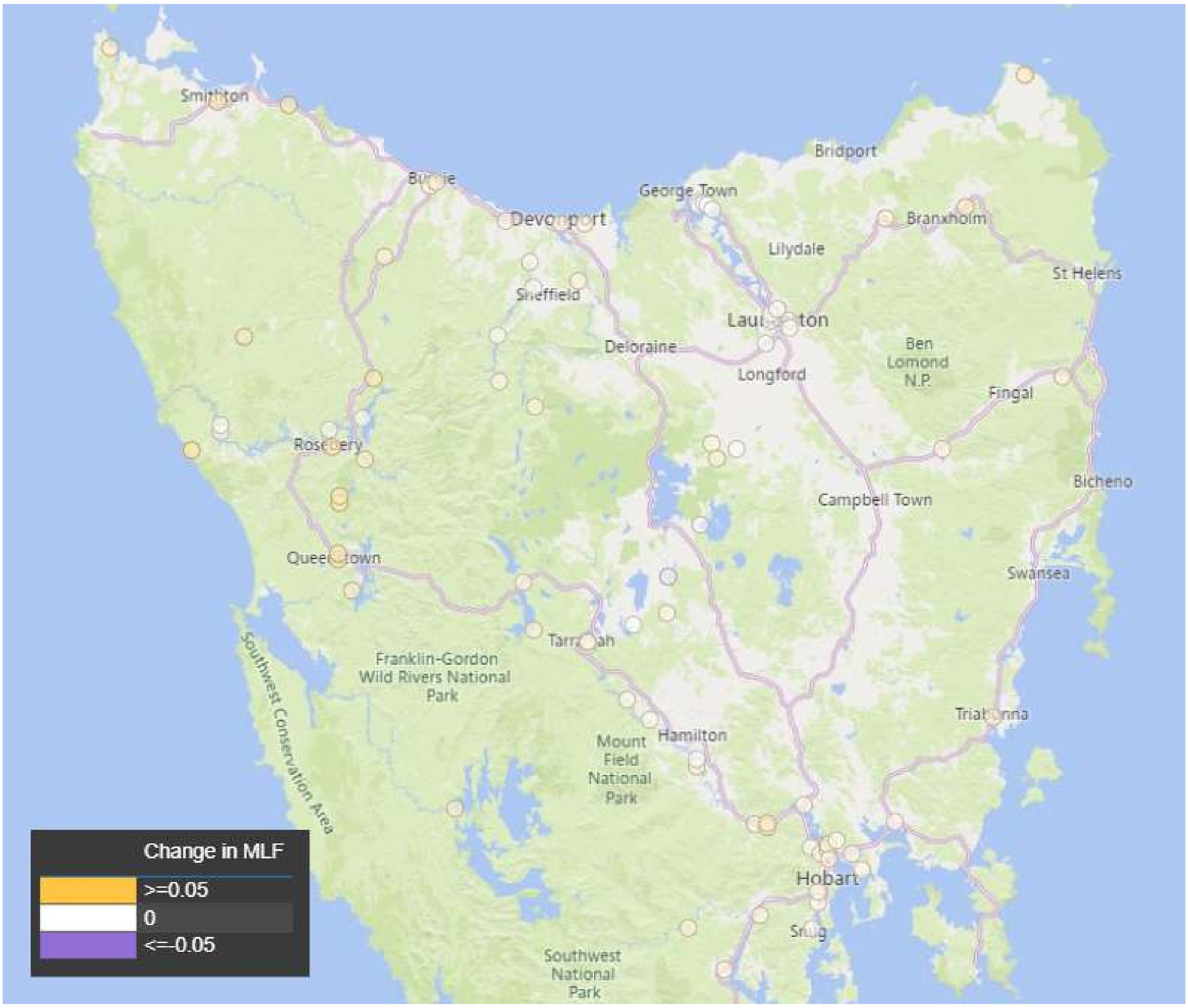


Table 18 Tasmania sub-region year-on-year average MLF variation

Sub-region	Average MLF change 2021-22 to 2022-23	
	Gen	Load
Georgetown	0.06%	-0.03%
North-west	0.44%	1.23%
North	1.28%	0.65%
South	0.40%	0.73%
West coast	0.78%	2.05%

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)

= 0.8870 + 2.0126E-04*NQt + 1.5623E-05*Qd + 5.6774E-06*Nd

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

= 1.0912 + 1.8863E-04*VNt + -8.2056E-06*Vd + 3.5899E-06*Nd + -5.7448E-05*Sd

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

= 1.0181 + 3.5925E-04*VSAt + -3.4191E-06*Vd + 1.8182E-08*Sd

Where:

Qd = Queensland demand

Vd = Victorian demand

Nd = New South Wales demand

Sd = South Australian demand

NQt = transfer from New South Wales to Queensland

VNt = transfer from Victoria to New South Wales

VSAt = transfer from Victoria to South Australia

Figure 7 MLF (South Pine 275 referred to Sydney West 330)

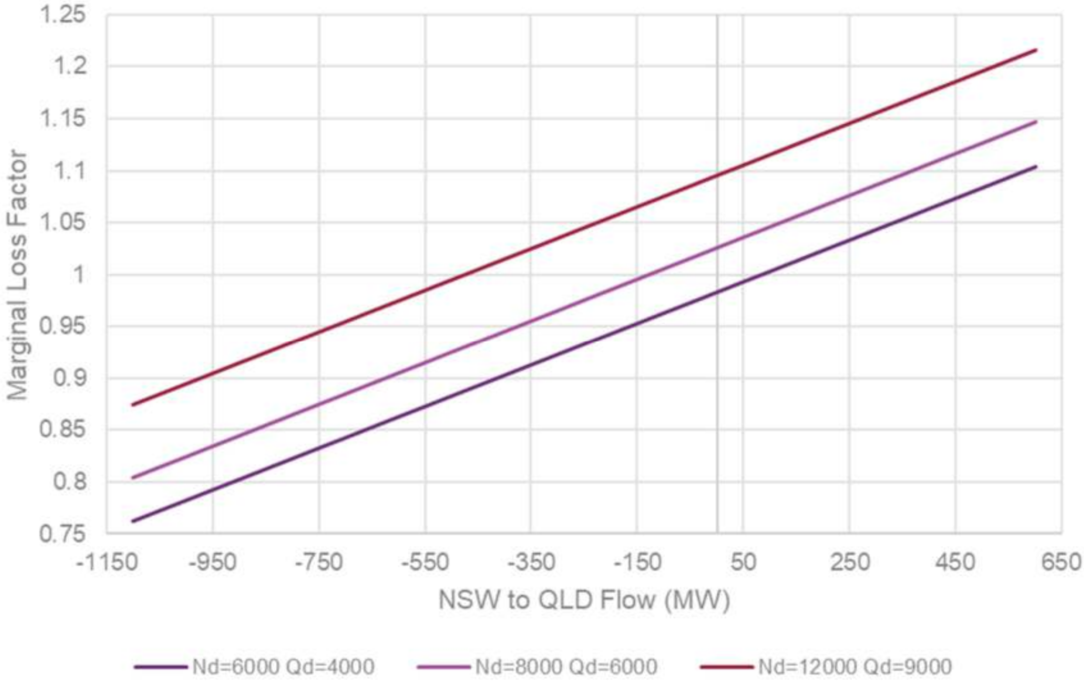


Table 19 South Pine 275 referred to Sydney West 330 MLF versus New South Wales to Queensland flow coefficient statistics

Coefficient	Qd	Nd	NQt	Constant
Coefficient value	1.5623E-05	5.6774E-06	2.0126E-04	0.887

Figure 8 MLF (Sydney West 330 referred to Thomastown 66)

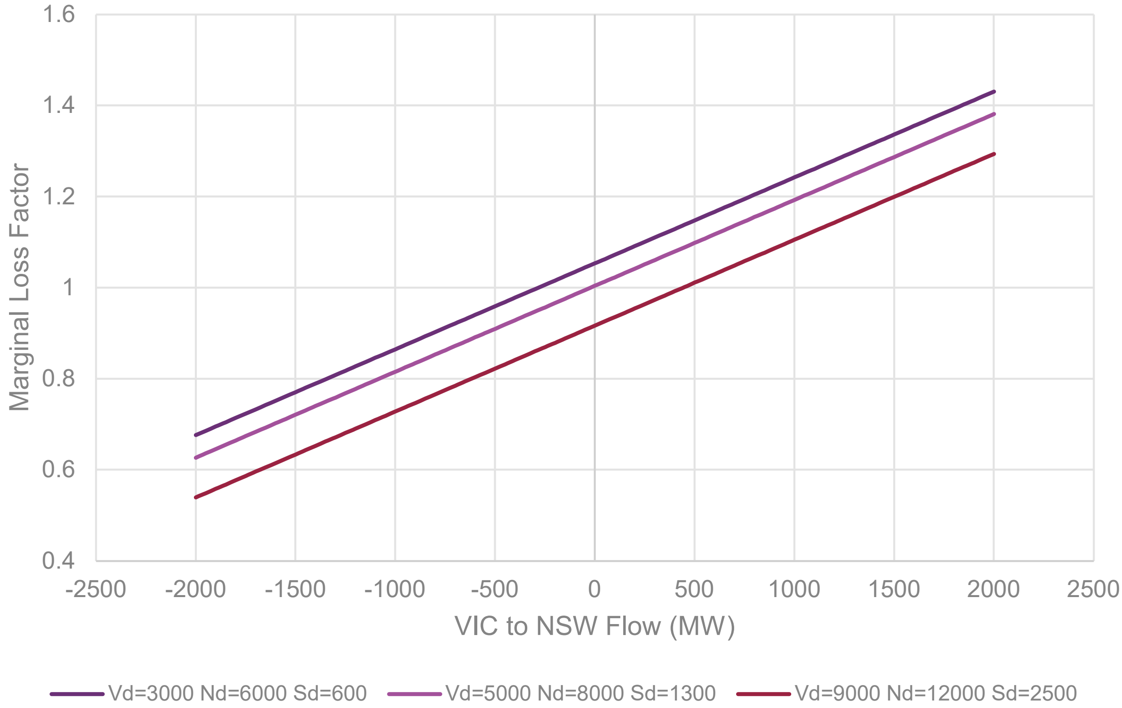


Table 20 Sydney West 330 referred to Thomastown 66 MLF versus Victoria to New South Wales flow coefficient statistics

Coefficient	Sd	Nd	Vd	VNt	Constant
Coefficient value	-5.7448E-05	3.5899E-06	-8.2056E-06	1.8863E-04	1.0912

Figure 9 MLF (Torrens Island 66 referred to Thomastown 66)

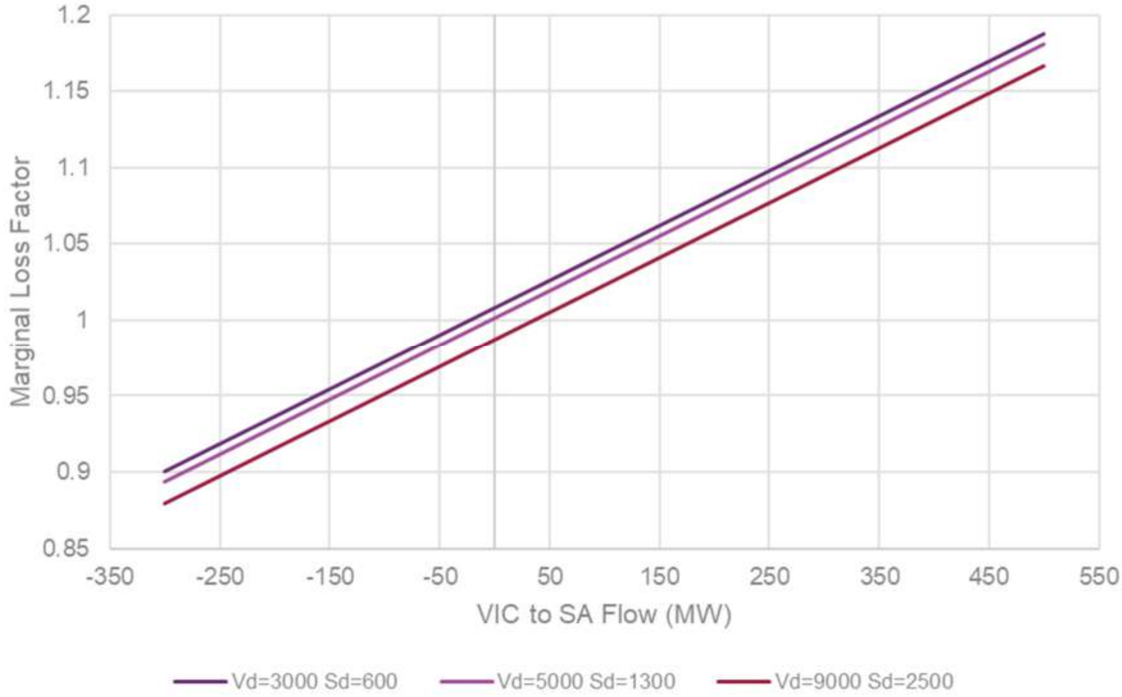


Table 21 Torrens Island 66 referred to Thomastown 66 MLF versus Victoria to South Australia flow coefficient statistics

Coefficient	Sd	Vd	VSAt	Constant
Coefficient value	1.8182E-08	-3.4191E-06	3.5925E-04	1.0181

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.:

Losses = ∫(Loss factor – 1) dFlow

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

= (-0.1130 + 1.5623E-05*Qd + 5.6774E-06*Nd)*NQt + 1.0063E-04*(NQt)^2

Sydney West 330 referred to Thomastown 66 notional link average losses

= (0.0912 + -8.2056E-06*Vd + 3.5899E-06*Nd + -5.7448E-05*Sd)*VNt + 9.4314E-05*(VNt)^2

Torrens Island 66 referred to Thomastown 66 notional link average losses

= (0.0181 + -3.4191E-06*Vd + 1.8182E-08*Sd)*VSAt + 1.7963E-04*(VSAt)^2

Where:

Qd = Queensland demand

Vd = Victorian demand

Nd = New South Wales demand

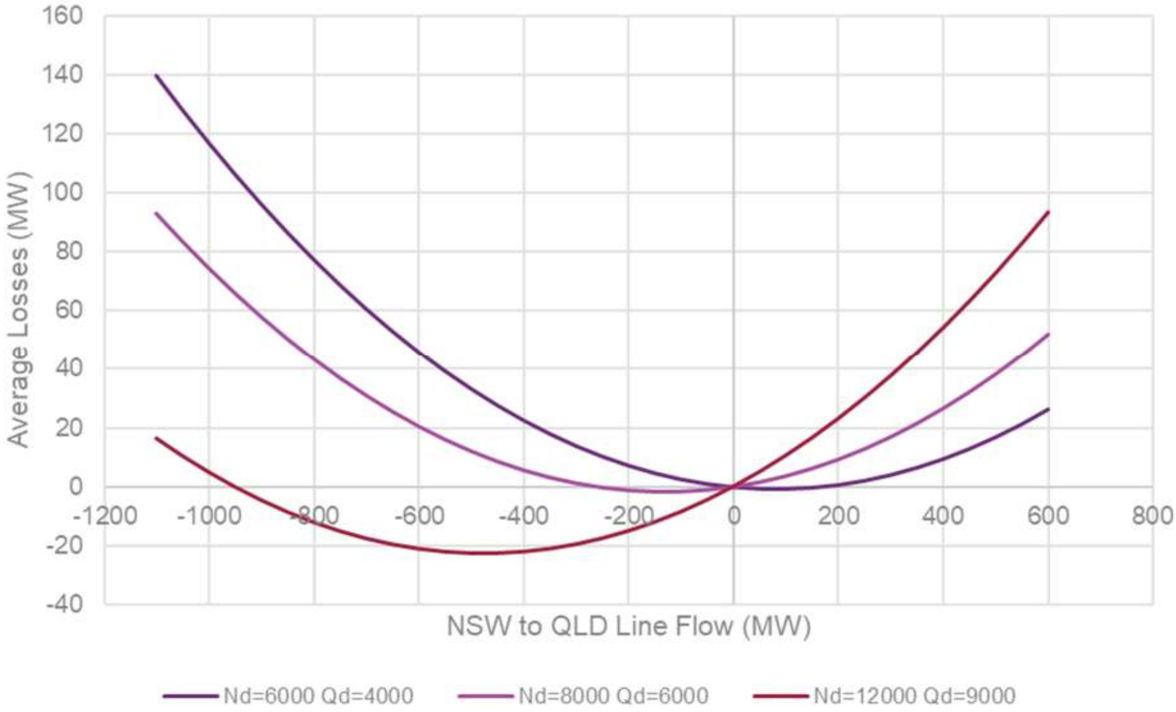
Sd = South Australia demand

NQt = transfer from New South Wales to Queensland

VNt = transfer from Victoria to New South Wales

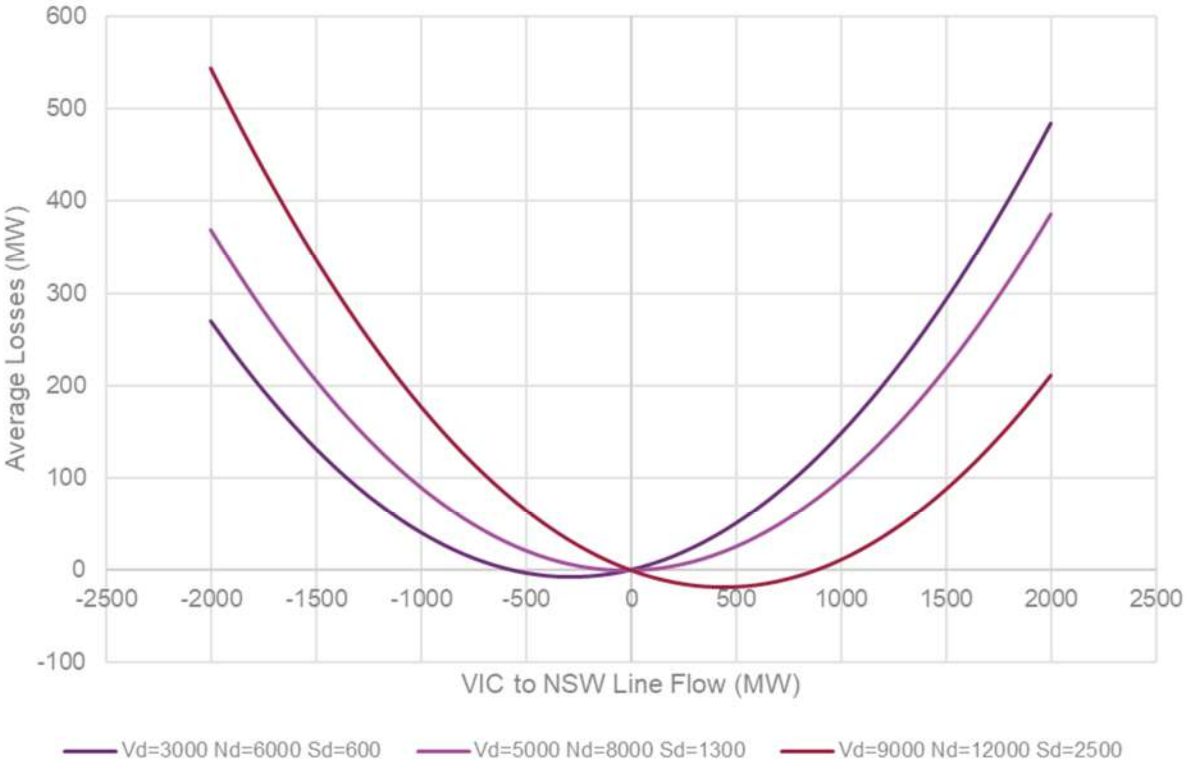
VSAt = transfer from Victoria to South Australia

Figure 10 Average losses for New South Wales – Queensland notional link



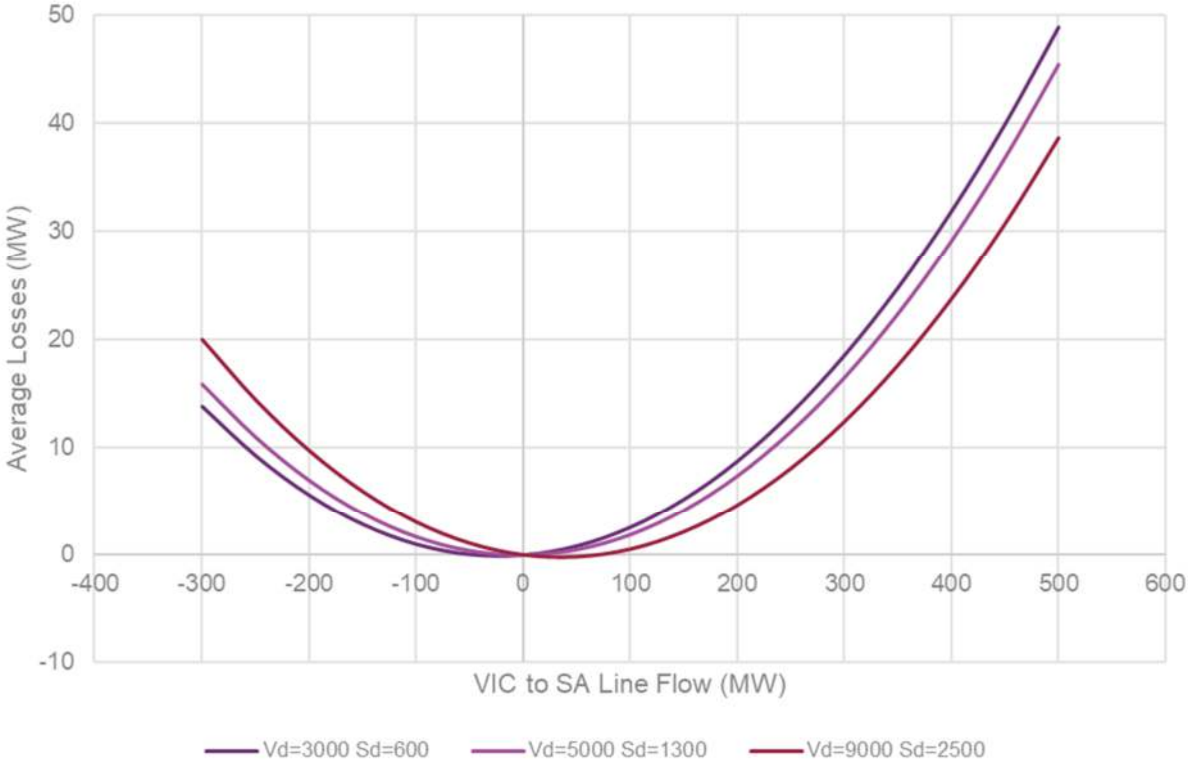
New South Wales to Queensland notional link losses versus New South Wales to Queensland notional link flow

Figure 11 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 12 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

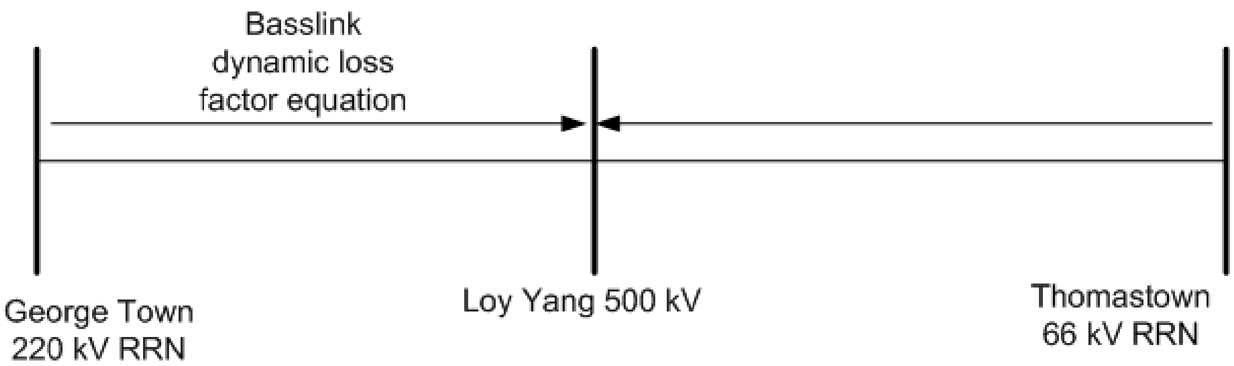
This section describes the loss equations for the DC interconnectors.

5.1 Basslink

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

- George Town 220 kV MLF referred to Tasmania RRN = 1.0000
- Basslink (Loy Yang PS Switchyard) 500 kV MLF referred to Victorian RRN is 0.9821 when exporting power to Tasmania and 0.9749 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 13 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:

$$Losses = (0.0039 * Flow_t + 2.8177 * 10^{-4} * Flow_t^2)$$

AEMO determined the following Murraylink MLF model using regression analysis:

$$\text{Murraylink MLF (Torrens Island 66 referred to Thomastown 66)} = 0.9376 + 1.8360E\text{-}03*Flow_t$$

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:

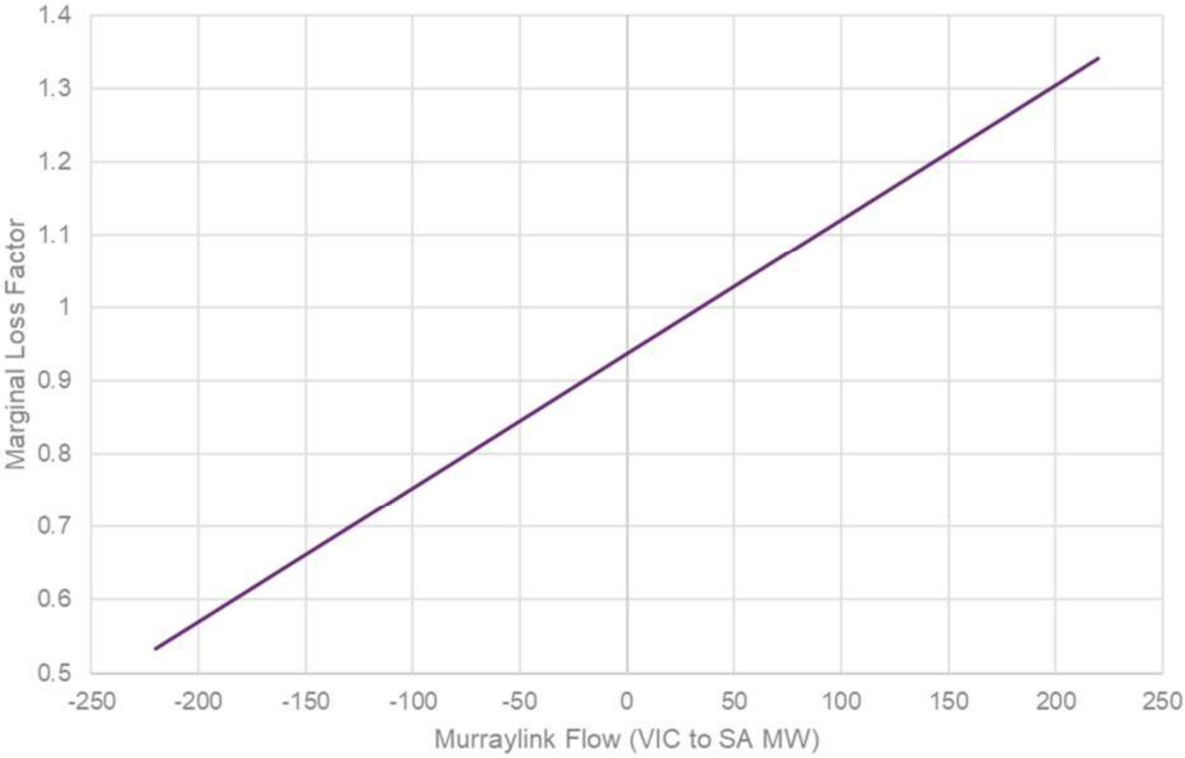
Table 22 Regression statistics for Murraylink

Coefficient	Murraylink flow	Constant
Coefficient Value	1.8360E-03	9.3761E-01

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

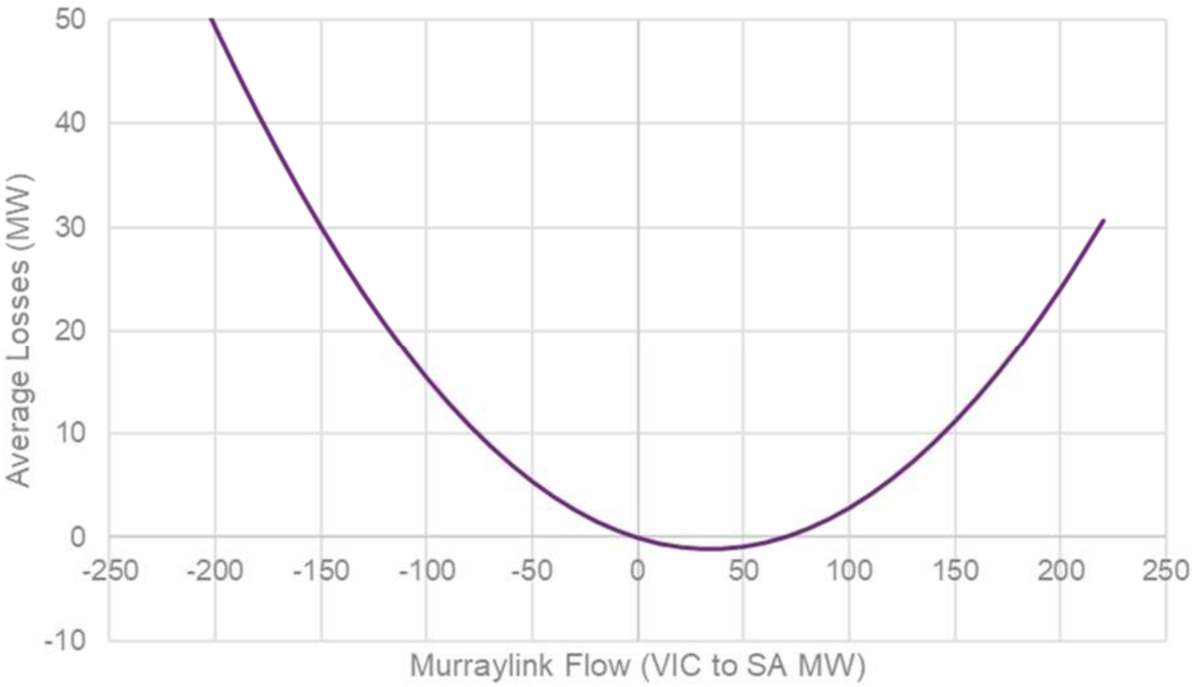
$$\text{Murraylink los} = -0.0624*Flow_t + 9.1798E\text{-}04*(Flow_t)^2$$

Figure 14 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 15 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)

$$= 1.0673 + 2.7640E\text{-}03 * \text{Flow}_t$$

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:

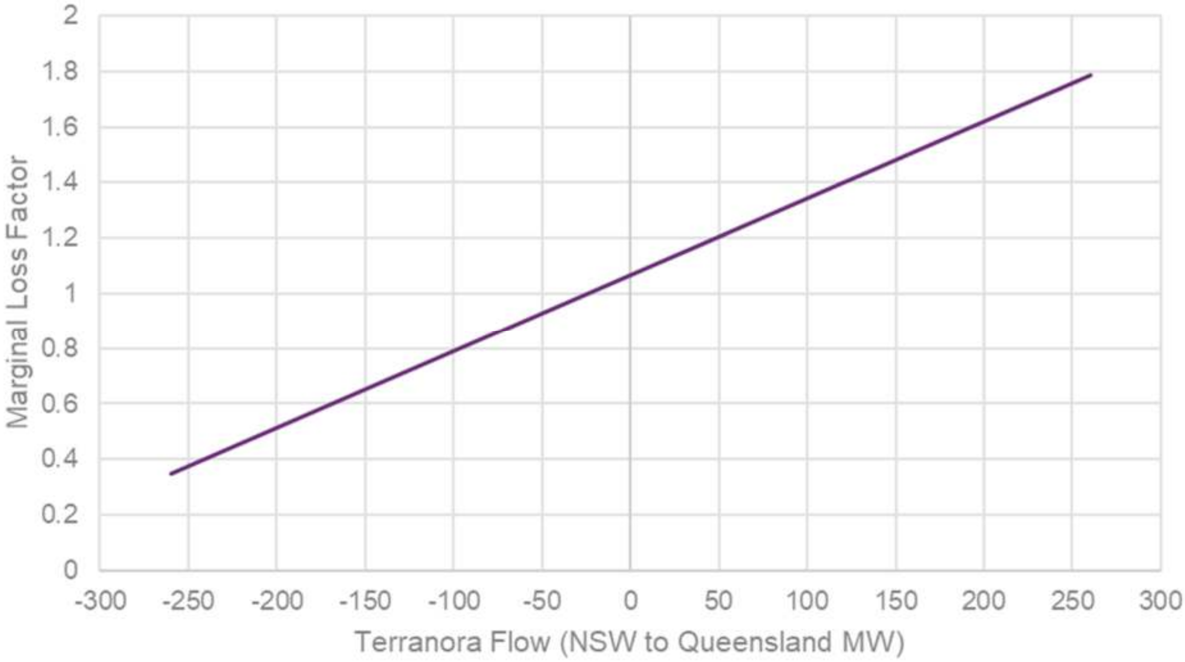
Table 23 Regression statistics for Terranora

Coefficient	Terranora Flow	Constant
Coefficient Value	2.7640E-03	1.0673

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

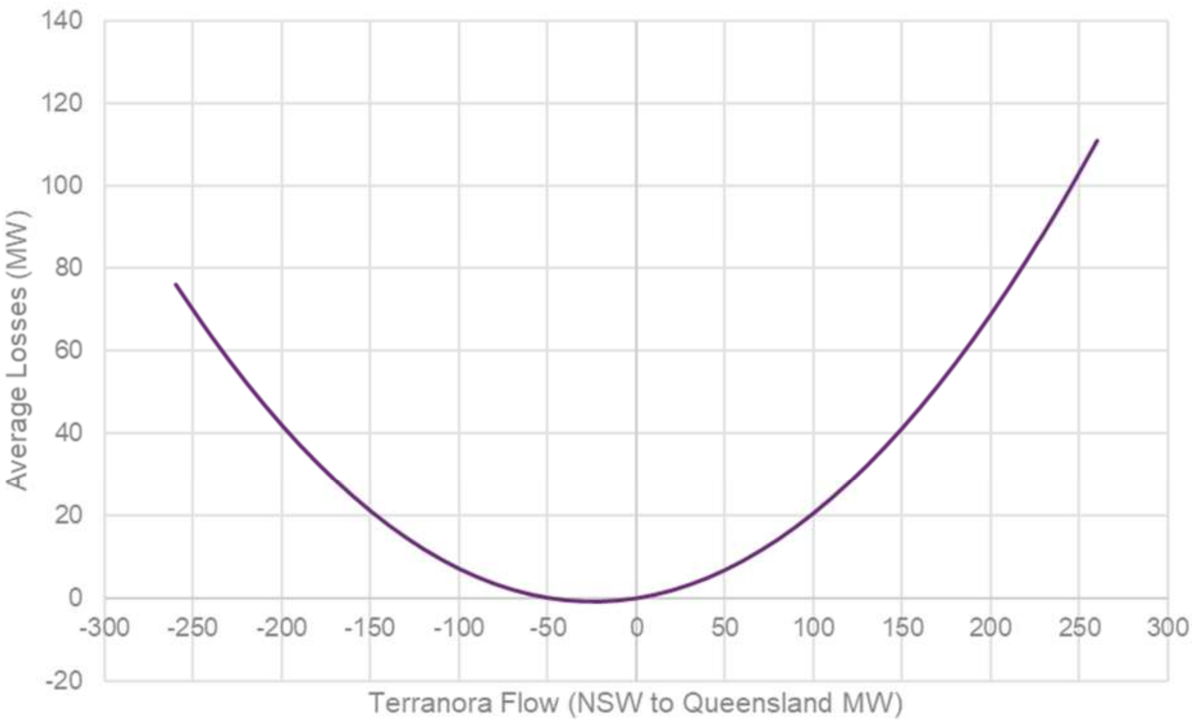
$$\text{Terranora loss} = 0.0673 * \text{Flow} + 1.3820E\text{-}03 * (\text{Flow}_t)^2$$

Figure 16 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 17 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 2022-23 financial year:

Table 24 Factors for inter-regional losses

Notional interconnector	Proportioning factor	Applied to
Queensland – New South Wales (QNI)	0.5383	New South Wales
Queensland – New South Wales (Terranora Interconnector)	0.5868	New South Wales
Victoria – New South Wales	0.2815	Victoria
Victoria – South Australia (Heywood)	0.7893	Victoria
Victoria – South Australia (Murraylink)	0.5651	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 25 Regions and Regional Reference Nodes

Region	Regional Reference Node
Queensland	South Pine 275kV node
New South Wales	Sydney West 330kV node
Victoria	Thomastown 66kV node
South Australia	Torrens Island PS 66kV 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 330kV lines[6].
- 10.8 km north of Terranora on the two 110kV 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 330kV line.
- At Red Cliffs Terminal Station (RCTS) on the Red Cliffs to Buronga 220kV line.
- At Murray Switching Station on the MSS to UTSS 330kV lines.
- At Murray Switching Station on the MSS to LTSS 330kV line.
- At Guthega Switching Station on the Guthega to Jindabyne PS 132kV line.
- At Guthega Switching Station on the Guthega to Geehi Dam Tee 132kV line.

7.2.3 Between the Victoria and South Australia regions

- At South East Switching Station (SESS) on the SESS to Heywood 275kV lines.
- At Monash Switching Station (MSS) on the Berri (Murraylink) converter 132kV 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 26 New South Wales virtual transmission nodes

VTN TNI code	Description	Associated transmission connection points (TCPs)
NEV1	Far North	Muswellbrook 132 and 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 and Wyong 11
NEV3	South of Broken Bay	Alexandria 33, Beaconsfield North 132, Beaconsfield South 132, 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 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 27 Tasmania virtual transmission nodes

VTN TNI code	Description	Associated transmission connection points (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.

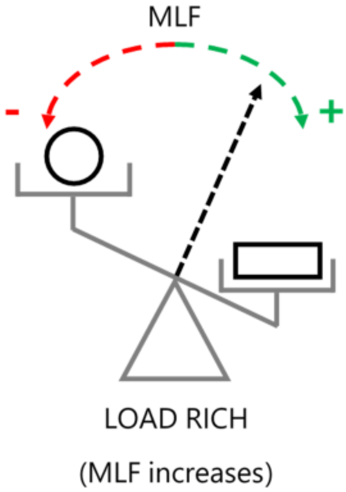
For example, a generating unit supplying an additional 1 MW at the RRN may find that a customer at a connection point can only receive an additional 0.95 MW. Marginal losses are 0.05 MW, or 5% of generation, resulting in an MLF of 1.05.

Marginal loss factors greater than 1.0 – simplified

Figure 18 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 18 MLFs greater than 1.0 simplified



A1.2.2 Marginal loss factors less than 1.0

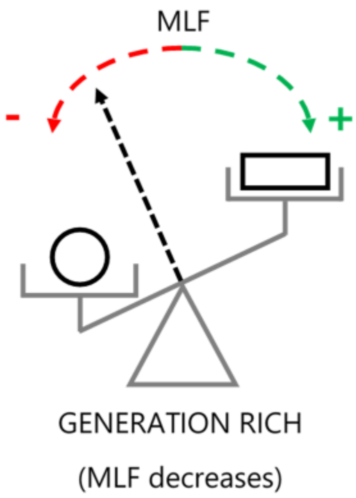
Losses increase with distance, so the greater the distance between the RRN and a connection point, the higher the MLF. However additional line flow only raises total losses if it moves in the same direction as existing net flow. At any instant, when additional flow is against net flow, total network 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 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 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 2022-23 MLF calculation are in the table below.

Table 28 Operational demand

Region	2021-22 forecast operational energy (GWh)[A]	2022-23 forecast operational energy (GWh)[A]
Queensland	50,078	47,380
New South Wales	65,667	60,671
Victoria	38,724	36,902
South Australia	11,264	10,964
Tasmania	10,333	10,520

A. Forecasting operational energy – as sent out energy was sourced from the most recent published Electricity Statement of Opportunities (for 2022-23), available 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.

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 Electricity Statement of Opportunities (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 obtains historical real power (MW) and reactive power (MVAr) data for each trading interval (half-hour) covering every generation connection point in the NEM from 1 July 2020 to 30 June 2021 from its settlements database.

AEMO also obtains the following data:

- Generation capacity data from AEMO's Generation Information Page published on its website as at 21 February 2022.
- 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 most recent medium term projected assessment of system adequacy (MT PASA) data, as of 1 January 2022, as a trigger for initiating discussions with participants with the potential to use an adjusted generation profile for the loss factor calculation.

A2.3.1 New generation

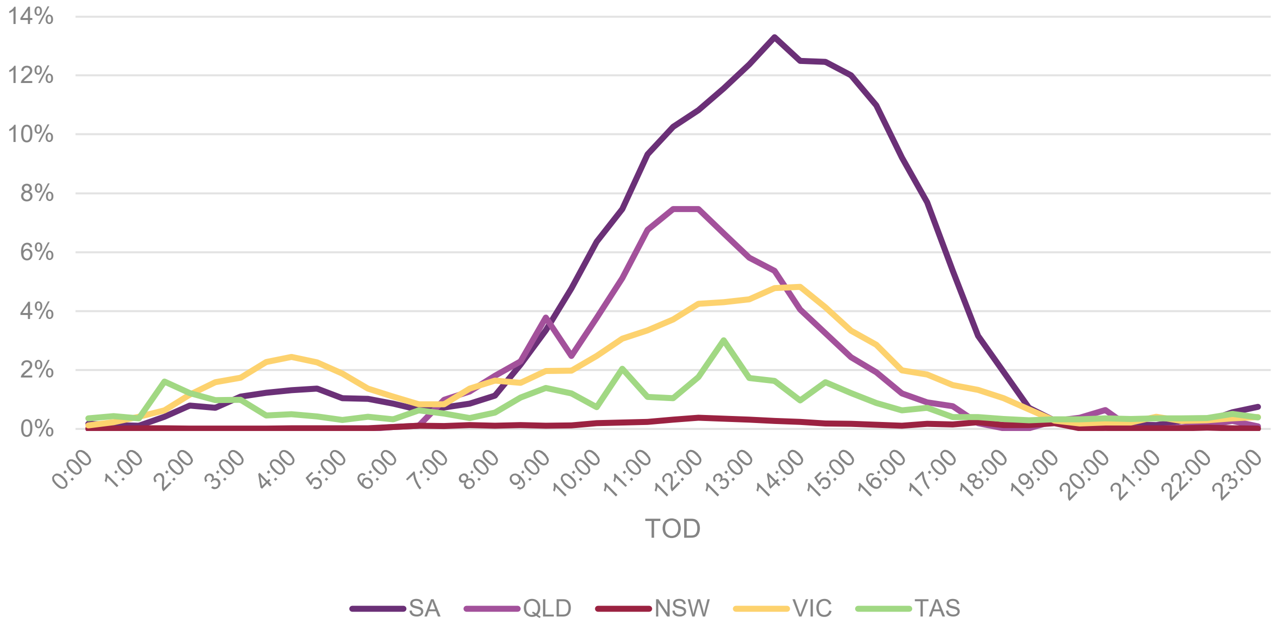
The new generation included is taken from the Generation Information Page as published on 21 February 2022. Projects listed as committed (Committed/Committed*) and with a target commercial operation date that implies generation in the target year are included. These generating systems are incorporated into the network model and forecast generation profiles are created.

For new solar and wind projects, AEMO created half-hourly profiles based on nameplate capacity and the Full Commercial Use Date indicated on the Generation Information Page, using the reference year 2020-21 weather data. Default hold point schedules were applied to these profiles prior to their full commercial operating date. Historical data from the previous financial year was incorporated into the profile if available. Relevant proponents for each project were consulted during the process.

[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.

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 2020-21. Forecast generation profiles were reduced by the time of day percentage of curtailment for the appropriate region.

Figure 20 Time of day average economic curtailment for 2022-23



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, but AEMO does not publish MLFs for connections that are not yet registered:

Queensland new generation

- Dulacca Wind Farm
- Columboola Solar Farm
- Kaban Green Power Hub Wind Farm
- Moura Solar Farm
- Woolooga Solar Farm

New South Wales and Australian Capital Territory new generation

- New England Solar Farm
- Riverina Solar Farm
- Rye Park Wind Farm
- Wyalong Solar Farm

Victoria new generation

- None

South Australia new generation

- Port Augusta Renewable Energy Park - Solar
- Mannum Adelaide Pumping Station 3 Solar Farm

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 (i.e. due to unit specific constraints). Forecast generation profiles for registered units are modelled using the reference year 2020-21 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 not operational 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 2022-23 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 2021-22. Historical generation patterns were adjusted to backfill historical outages and incorporate future outages identified through MT PASA data submitted as of 1 January 2022. 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.

A2.4 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 local generation levels to ensure the limits are not exceeded.

Constraints were incorporated into the 2022-23 MLF study using the approaches discussed below.

Limiting total output from relevant generators

When the total output of set of generators are defined as a limit, the input profiles are reduced on a pro-rata basis (in line with FLLF supply/demand balance theory) to adhere to the limit. The constrained generation profiles are then utilised in the initial FLLF study to obtain results reflective of these limits. The following limits were applied in this way:

- North-west Victoria voltage collapse limit (simplified to reflect previously invoked V^V_NIL_ARWBBA).

Thermal/transfer limit

When a thermal or transfer limit on a line or cutset is defined, this limit was first assessed using an unconstrained study with the relevant line flows being observed. The input profiles of renewable generators are then locationally grouped and reduced on a pro-rata basis (in line with FLLF supply/demand balance theory). The constrained generation profiles are then utilised in a second FLLF study to obtain results reflective of the impot of these limits. 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, previously N^^N_NIL_2).
- Waubra to Ballarat transfer limit (V>>V_NIL_9).
- Murray to Dederang transfer limit (V>>V_NIL_1A and V>>V_NIL_1B).

AEMO continuously monitors and assesses the impact of other system normal limits. The following lists the limits which have been considered but **not** modelled for the 2022-23 MLFs:

- Queensland Central to South transfer limit (Q^NIL_CS).
- Queensland North system strength limit[9].
- South Australia system strength limit[10].
- Victoria system strength limit.

A2.5 Network representation in the marginal loss factors calculation

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

AEMO adds relevant network augmentations that are scheduled to occur in 2022-23. The snapshot is thus representative of the anticipated normally operating power system in 2022-23.

[9] Based on limit advice available from https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/congestion-information/nqld-system-strength-constraints.pdf?la=en.

[10] The commissioning of 4 Synchronous Condensers in SA from April 2021 onwards will potentially increase the level of non-synchronous generation for 2021-22, however AEMO is unable to quantify the impact compared to historical generation using currently available information.

A2.5.1 Network augmentation for 2022-23

Relevant Transmission Network Service Providers (TNSPs) advised of the following network augmentations to be completed in 2022-23.

Queensland network augmentations

Powerlink provided the following list of planned network augmentations in 2022-23 in Queensland:

- Rebuilding CP.01710 Gin Gin substation:
  - Establish tee between 813/815 and T2
  - re-establish a bus at Gin Gin
- Replacement of CP.02339 Kemmis Transformer 2:
  - updated line parameters for transformer 2 based on Powerlink advice
- Decommissioning of OR.02253 Belmont 3T:
  - updated Belmont transformers based on Powerlink advice
- Replacement of CP.02371 H010 Bouldercombe - Transformer 1 and 2
  - updated two existing transformers data based on Powerlink advice
- Restore FNQ original configuration (Line impedance update)
- Replacement of H035 Strathmore/Kumbarilla Park (Transformer replacement)

New South Wales network augmentations

New South Wales NSPs provided the following list of planned network augmentations in 2022-23 in New South Wales:

- New Macquarie 132/33kV sub-transmission substation (connection to 92A and 92B)
- Replacement of 132kV feeder 265 between Bunnorong STS and Maroubra ZS with a spare duct
- Bango Wind Farm line parameters update - 132kV lines 973 and 999
- Collector Wind Farm line parameters update – 330kV Collector to Marulan
- Gunnedah East (for Gunnedah Solar Farm) Line parameters update – 132kV tee connected to 9U3 Gunnedah to Boggabri East
- Tallawarra "B" Open Cycle Gas Turbine (deletion of four 132kV Series Reactors at Dapto) (Endeavour Energy)
- Sydney East transformer changes –
  - Decommissioning of Sydney East transformer #1
  - Updated the parameters in Sydney East transformer #2

Victoria network augmentations

AEMO's Victorian Planning Group provided the following list of planned network augmentations in 2022-23 in Victoria:

- Fishermans Bend FBTS B2 transformer updates
- Minor VIC to NSW Upgrade:
  - Added SMTS second transformer
  - Updated SMTS-DDTS 330kV lines ratings

South Australia network augmentations

ElectraNet provided the following list of planned network augmentations in 2022-23 in South Australia:

- Replacement of Leigh Creek South transformer
- Eyre Peninsula Transmission Supply
  - Updated line configuration and impedances

Tasmania network augmentations

TasNetworks provided the following list of planned network augmentations in 2022-23 in Tasmania:

- De Port Latta Substation
  - 110/22 kV Supply transformer replacement

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 calculates 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 2022-23 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 the 2020-21.

As Directlink resides entirely within NSW, 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 2022-23 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 the 2020-21.

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 estimates 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 29 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]**	1,278	1,278	1,278	1,278
NSW	**Queensland[B]**	600	750	600	750
NSW	**Victoria**	1,700	1,700	1,700	1,700
Victoria	**NSW[C]**	1,670	1,670	1,670	1,670
Victoria	**South Australia**	650	650	650	650
South Australia	**Victoria**	420[D]/550	420[D]/550	420/[D]550	420[D]/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 is modelled with an additional headroom of 200MW in both directions.
C. The "VNI minor" upgrade is modelled with an additional headroom of 170MW in the Victoria to New South Wales direction.
D. Para 275kV substation SVC outage limiting flows on Heywood from SA to VIC, reduced capacity applies until 04/01/2023 as per Network Outage Schedule at https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/data-nem/network-data/network-outage-schedule.
E. Limit referring to the receiving end.

A2.7 Calculation of MLFs

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

[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.

- 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 utilise the verification study to ensure that AEMO's MLF calculation methods and results are accurate.

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 drastically vary. In remote locations with material levels of grid connected PV capacity an increasingly stronger diurnal pattern in half-hourly MLFs is observed due to increased supply and low demand (driven by rooftop 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 PV, it can present potential opportunities for storage technologies which may be able to achieve a delta between load and generation MLFs that will compliment arbitrage behaviour.

As a hypothetical example, Figure 21 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 30 shows the MLF outcomes for the different technologies shown in Figure 21. As can be seen, 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 is reflective of 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 is reflective of 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 reflective of 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 is reflective of 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 21 Time-of-day impact of technology on MLF outcomes

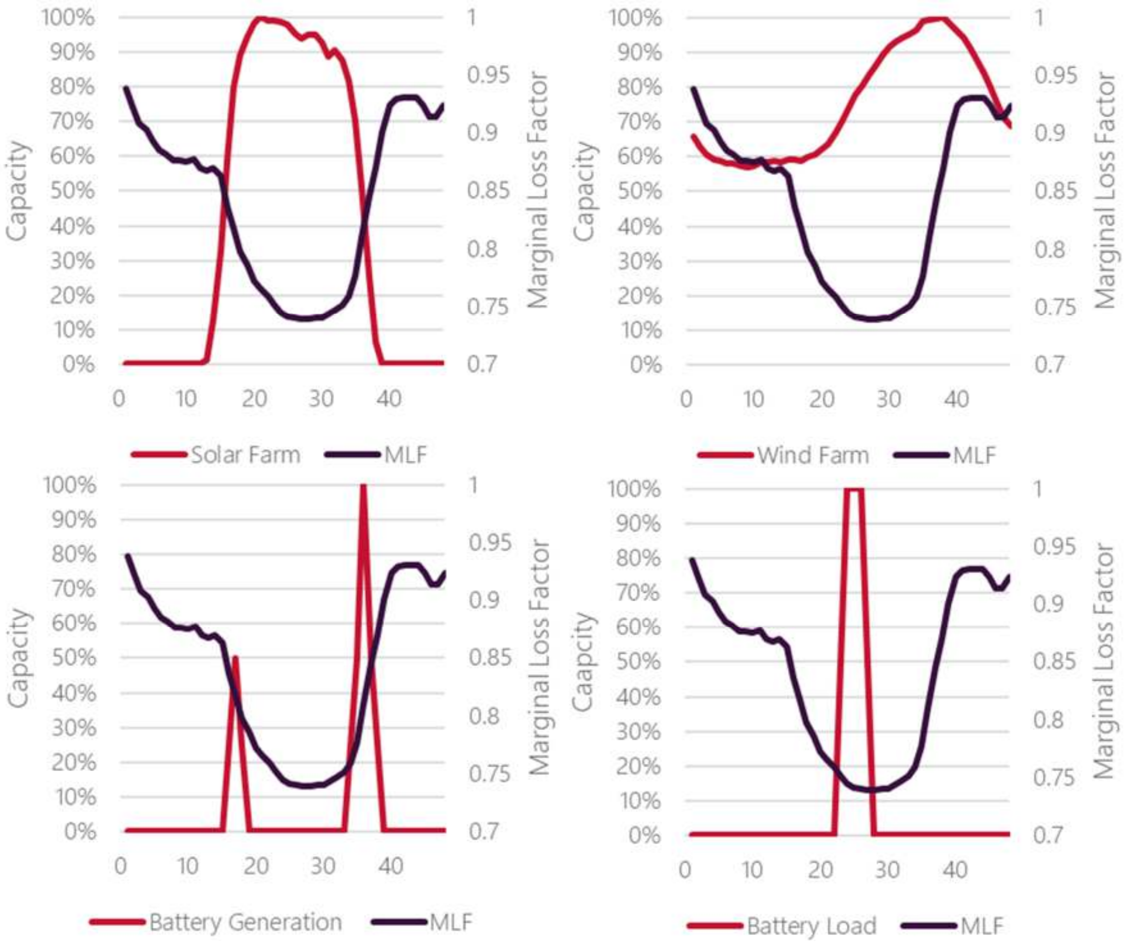


Table 30 Impact of technology on MLF outcomes

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

Glossary

Term	Definition
AC	Alternating current
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
MNSP	Market Network Service Provider
MVAr	Megavolt-ampere-reactive
MW	Megawatt
NEFR	National Energy Forecasting Report
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
NSP	Network Service Provider
NSW	New South Wales
PS	Power station
RRN	Regional Reference Node
Rules	National Electricity Rules
TNI	Transmission Node Identity
TNSP	Transmission Network Service Provider
VTN	Virtual Transmission Node