REGIONS AND MARGINAL LOSS FACTORS: FY 2016–17

NATIONAL ELECTRICITY MARKET

Published: **8 July 2016**

IMPORTANT NOTICE

Purpose

This document has been prepared by AEMO under clauses 2A.1.3 and 3.6 of the National Electricity Rules (Rules), and 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

This document might also contain explanatory information. Explanatory information does not constitute legal or business advice, and should not be relied on as a substitute for obtaining detailed advice about the Law, the Rules, or any other applicable laws, procedures or policies. AEMO has made every effort to ensure the quality of the information but cannot guarantee its accuracy or completeness.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of this document:

- make no representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of the information in this document; and
- are not liable (whether by reason of negligence or otherwise) for any statements or representations in this document, or any omissions from it, or for any use or reliance on the information in it.

VERSION RELEASE HISTORY

Version No.	Release date	Description
4.0	08 July 2016	Updates to the following: • Correction of typographical error for Taralga WF TNI (NMR2) – (Table 6) • Removed load Canterbury 132 kV (NCB1) – (Table 4) • Removed load Peakhurst 132 kV (NPH1) – (Table 4) • Removed embedded generator Highbury LFG PS (Table 14) • Removed embedded generator Tea Tree Gully LFG PS (Table 14) • Removed embedded generator Angaston PS ANGAS2 (Table 14) • Updated embedded generator DUID Angaston PS ANGAST1 (Table 14) • Updated generator DUID and connection point ID for Ararat WF (Table 10) • Updated generator DUID and connection point ID for Hornsdale WF (Table 13)
3.0	27 June 2016	Correction of MLF for Carlingford TNI (NCAR).
2.0	26 May 2016	Updates to the following: • Correction of TNI allocation for embedded generators Tower Power Plant and Tahmoor Power Station, NLP1 instead of NSW1 (Table 6) • Correction of MLF embedded generator for Woodlawn Bioreactor (Table 6) • Added embedded generator Oaky Creek 2 (Table 3) • Added embedded generator Chepstowe Wind Farm (Table 11) • Added embedded generator Eildon Hydro Power Station (Table 11) • Added embedded generator Broadmeadows Power Plant (Table 11) • Correction of typographical error for Kangaroo Valley TNI (Table 5) • Correction of typographical error for Yarrawonga Hydro Power Station (Table 11) • Correction of typographical error for Oaky Creek Generator (Table 3) • Correction of typographical error for heading in South Australia Embedded Generation table (Table 14)
1.0	01 April 2016	Final document includes the addition of recently registered TNIs: • Coonooer Bridge WF • Hornsdale WF • Ararat WF
0.1	17 March 2016	Draft version published

EXECUTIVE SUMMARY

This document details the 2016–17 Marginal Loss Factors (MLF) that represent electrical transmission losses across the five regions in the National Electricity Market (NEM) – Queensland, New South Wales (NSW), Victoria, South Australia, and Tasmania. This is as required by clause 3.6 of the National Electricity Rules (Rules). This document also serves as the Regions Publication under clause 2A.1.3 of the Rules.

Major changes in load and generation patterns have characterised the 2016–17 MLF calculation compared to the 2015–16 MLF study. They are:

- Forecasted regional demand has increased in all regions.
- Reduced thermal generation in South Australia has increased modelled power imports to South Australia.
- Reduced generation forecast in Tasmania has increased modelled power imports from Victoria.
- Reduced generation in South Australia and Tasmania has increased power exports from Queensland to NSW and reduced power flow from Victoria to NSW.

These flow changes have an impact on electrical losses, and drive significant changes in MLFs in 2016–17 compared to 2015–16. They are:

- An increase in MLFs at connection points in central and southern Tasmania.
- A reduction in MLFs at connection points in the Riverland in South Australia, and a reduction in MLFs at connection points in south-east South Australia.
- A reduction in MLFs at connection points in northern Victoria.
- An increase in MLFs at connection points in southern NSW, and a reduction in MLFs at connection points in northern NSW.
- A reduction in MLFs at connection points in northern and central Queensland.

AEMO applies a number of quality assurance steps when calculating MLFs. This includes engaging Ernst and Young to perform a two-step parallel MLF calculation to identify and resolve outcomes inconsistent with the Forward Looking Loss Factors (FLLF) methodology.

Supply and demand patterns in the NEM are changing at a growing rate, influenced by a combination of drivers, leading to potentially greater uncertainty and volatility of power system flows. AEMO is scheduled to review the FLLF methodology before publication of the 2017-18 MLFs, and will be seeking to address these changes where appropriate.

Other information in this document related to marginal losses for 2016–17 include:

- Inter-regional loss factor and loss equations.
- Virtual Transmission Nodes (VTNs).
- Connection point Transmission Node Identifiers (TNIs).
- Regions, Regional Reference Nodes (RRNs), and region boundaries.
- Brief overview of the FLLF methodology used by AEMO to calculate MLFs and inter-regional loss factor equations.

CONTENTS

TABLES

FIGURES

1. MARGINAL LOSS FACTORS BY REGION

This section shows the 2016–17 MLFs values for every load or generation TNI in each region.

1.1 Queensland Marginal Loss Factors

Table 1 Queensland Loads

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Abermain	33	QABM	0.9990	0.9965
Abermain	110	QABR	0.9951	0.9945
Alan Sherriff	132	QASF	1.0781	1.0855
Algester	33	QALG	1.0138	1.0112
Alligator Creek	132	QALH	1.0383	1.0627
Alligator Creek	33	QALC	1.0452	1.0627
Ashgrove West	33	QAGW	1.0152	1.0152
Ashgrove West	110	QCBW	1.0125	1.0141
Belmont	110	QBMH	1.0091	1.0067
Belmont Wecker Road	33	QBBS	0.9993	1.0012
Belmont Wecker Road	11	QMOB	1.0308	1.0313
Biloela	66/11	QBIL	0.9456	0.9625
Blackstone	110	QBKS	0.9968	0.9953
Blackwater	66/11	QBWL	1.0265	1.0575
Blackwater	132	QBWH	1.0262	1.0565
Bluff	132	QBLF	1.0252	1.0594
Bolingbroke	132	QBNB	1.0240	1.0447
Bowen North	66	QBNN	1.0337	1.0586
Boyne Island	275	QBOH	0.9868	1.0050
Boyne Island	132	QBOL	0.9824	1.0054
Braemar - Kumbarilla Park	275	QBRE	0.9573	0.9593
Bulli Creek (Essential Energy)	132	QBK2	0.9638	0.9608
Bulli Creek (Waggamba)	132	QBLK	0.9638	0.9608
Bundamba	110	QBDA	0.9983	0.9961
Burton Downs	132	QBUR	1.0425	1.0679
Cairns	22	QCRN	1.0904	1.0928
Cairns City	132	QCNS	1.0895	1.0914
Callemondah (Rail)	132	QCMD	0.9750	0.9930
Calliope River	132	QCAR	0.9747	0.9906
Cardwell	22	QCDW	1.0856	1.0893
Chinchilla	132	QCHA	0.9705	0.9722
Clare	66	QCLR	1.0910	1.0990
Collinsville Load	33	QCOL	1.0444	1.0637
Columboola	132	QCBL	0.9692	0.9651
Coppabella (Rail)	132	QCOP	1.0610	1.0767
Dan Gleeson	66	QDGL	1.0786	1.0869
Dingo (Rail)	132	QDNG	1.0059	1.0481
Duaringa	132	QDRG	0.9955	1.0381
Dysart	66/22	QDYS	1.0494	1.0696

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Eagle Downs Mine	132	QEGD	1.0617	1.0798
Edmonton	22	QEMT	1.0946	1.0934
Egans Hill	66	QEGN	0.9686	0.9880
El Arish	22	QELA	1.0883	1.0922
Garbutt	66	QGAR	1.0816	1.0887
Gin Gin	132	QGNG	0.9883	1.0024
Gladstone South	66/11	QGST	0.9784	0.9961
Goodna	33	QGDA	1.0027	1.0013
Goonyella Riverside Mine	132	QGYR	1.0813	1.0973
Grantleigh (Rail)	132	QGRN	0.9672	1.0116
Gregory (Rail)	132	QGRE	1.0091	1.0288
Ingham	66	QING	1.1260	1.0936
Innisfail	22	QINF	1.1001	1.0960
Invicta Load	132	QINV	1.0327	1.1033
Kamerunga	22	QKAM	1.0945	1.0949
Kemmis	132	QEMS	1.0370	1.0581
King Creek	132	QKCK	1.0475	1.0700
Lilyvale	66	QLIL	1.0122	1.0373
Lilyvale (Barcaldine)	132	QLCM	1.0061	1.0328
Loganlea	33	QLGL	1.0117	1.0118
Loganlea	110	QLGH	1.0080	1.0078
Mackay	33	QMKA	1.0392	1.0602
Middle Ridge (Energex)	110	QMRX	0.9746	0.9729
Middle Ridge (Ergon)	110	QMRG	0.9746	0.9729
Mindi (Rail)	132	QMND	1.0177	1.0365
Molendinar	110	QMAR	1.0106	1.0042
Molendinar	33	QMAL	1.0102	1.0039
Moranbah (Mine)	66	QMRN	1.0721	1.0890
Moranbah (Town)	11	QMRL	1.0526	1.0824
Moranbah South (Rail)	132	QMBS	1.0730	1.0871
Moranbah Substation	132	QMRH	1.0719	1.0839
Moura	66/11	QMRA	0.9779	1.0056
Mt McLaren (Rail)	132	QMTM	1.0783	1.0875
Mudgeeraba	33	QMGL	1.0121	1.0041
Mudgeeraba	110	QMGB	1.0113	1.0036
Murarrie (Belmont)	110	QMRE	1.0100	1.0069
Nebo	11	QNEB	1.0116	1.0343
Newlands	66	QNLD	1.0809	1.0977
North Goonyella	132	QNGY	1.0820	1.0981
Norwich Park (Rail)	132	QNOR	1.0362	1.0559
Oakey	110	QOKT	0.9684	0.9725
Oonooie (Rail)	132	QOON	1.0399	1.0703
Orana LNG	275	QORH	0.9633	0.9625
Palmwoods	132	QPWD	1.0120	1.0124
Pandoin	132	QPAN	0.9699	0.9914
Pandoin	66	QPAL	0.9700	0.9909
Peak Downs (Rail)	132	QPKD	1.0672	1.0832

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Pioneer Valley	66	QPIV	1.0487	1.0568
Proserpine	66	QPRO	1.0770	1.0937
Queensland Alumina Ltd (Gladstone South)	132	QQAH	0.9829	0.9974
Queensland Nickel (Yabulu)	132	QQNH	1.0735	1.0779
Raglan	275	QRGL	0.9686	0.9886
Redbank Plains	11	QRPN	1.0007	0.9996
Richlands	33	QRLD	1.0129	1.0099
Rockhampton	66	QROC	0.9726	0.9949
Rocklands (Rail)	132	QRCK	0.9657	0.9858
Rocklea (Archerfield)	110	QRLE	1.0052	1.0039
Ross	132	QROS	1.0667	1.0764
Runcorn	33	QRBS	1.0150	1.0123
South Pine	110	QSPN	1.0049	1.0057
Stony Creek	132	QSYC	1.0449	1.0805
Sumner	110	QSUM	1.0057	1.0044
Tangkam (Dalby)	110	QTKM	0.9717	0.9747
Tarong	66	QTRL	0.9691	0.9711
Teebar Creek	132	QTBC	1.0033	1.0107
Tennyson	33	QTNS	1.0100	1.0076
Tennyson (Rail)	110	QTNN	1.0082	1.0056
Townsville East	66	QTVE	1.0763	1.0886
Townsville South	66	QTVS	1.0774	1.0872
Townsville South (KZ)	132	QTZS	1.0765	1.0916
Tully	22	QTLL	1.1188	1.1003
Turkinje	66	QTUL	1.1103	1.1137
Turkinje (Craiglee)	132	QTUH	1.1077	1.1127
Wandoan South	132	QWSH	0.9810	0.9744
Wandoan South (NW Surat)	275	QWST	0.9800	0.9737
Wandoo (Rail)	132	QWAN	1.0236	1.0387
Wivenhoe Pump	275	QWIP	0.9940	0.9941
Woolooga (Energex)	132	QWLG	0.9984	1.0062
Woolooga (Ergon)	132	QWLN	0.9984	1.0062
Woree	132	QWRE	1.0887	1.0902
Wotonga (Rail)	132	QWOT	1.0616	1.0769
Wycarbah	132	QWCB	0.9585	0.9901
Yarwun – Boat Creek (Ergon)	132	QYAE	0.9717	0.9901
Yarwun – Rio Tinto	132	QYAR	0.9716	0.9889

Table 2 Queensland Generation

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Barron Gorge PS Unit 1	132	BARRON-1	QBGH1	QBGH	1.0530	1.0677
Barron Gorge PS Unit 2	132	BARRON-2	QBGH2	QBGH	1.0530	1.0677
Braemar PS Unit 1	275	BRAEMAR1	QBRA1	QBRA	0.9549	0.9567
Braemar PS Unit 2	275	BRAEMAR2	QBRA2	QBRA	0.9549	0.9567
Braemar PS Unit 3	275	BRAEMAR3	QBRA3	QBRA	0.9549	0.9567
Braemar Stage 2 PS Unit 5	275	BRAEMAR5	QBRA5B	QBRA	0.9549	0.9567
Braemar Stage 2 PS Unit 6	275	BRAEMAR6	QBRA6B	QBRA	0.9549	0.9567
Braemar Stage 2 PS Unit 7	275	BRAEMAR7	QBRA7B	QBRA	0.9549	0.9567
Callide PS Load	132	CALLNL1	QCAX	QCAX	0.9344	0.9590
Callide A PS Unit 4	132	CALL_A_4	QCAA4	QCAA	0.9268	0.9563
Callide A PS Unit 4 Load	132	CALLNL4	QCAA2	QCAA	0.9268	0.9563
Callide B PS Unit 1	275	CALL_B_1	QCAB1	QCAB	0.9456	0.9671
Callide B PS Unit 2	275	CALL_B_2	QCAB2	QCAB	0.9456	0.9671
Callide C PS Unit 3	275	CPP_3	QCAC3	QCAC	0.9410	0.9648
Callide C PS Unit 4	275	CPP_4	QCAC4	QCAC	0.9410	0.9648
Columboola - Condamine PS	132	CPSA	QCND1C	QCND	0.9685	0.9642
Darling Downs PS	275	DDPS1	QBRA8D	QBRA	0.9549	0.9567
Gladstone PS (132 kV) Unit 3	132	GSTONE3	QGLD3	QGLL	0.9603	0.9855
Gladstone PS (132 kV) Unit 4	132	GSTONE4	QGLD4	QGLL	0.9603	0.9855
Gladstone PS (132kV) Load	132	GLADNL1	QGLL	QGLL	0.9603	0.9855
Gladstone PS (275 kV) Unit 1	275	GSTONE1	QGLD1	QGLH	0.9662	0.9868
Gladstone PS (275 kV) Unit 2	275	GSTONE2	QGLD2	QGLH	0.9662	0.9868
Gladstone PS (275 kV) Unit 5	275	GSTONE5	QGLD5	QGLH	0.9662	0.9868
Gladstone PS (275 kV) Unit 6	275	GSTONE6	QGLD6	QGLH	0.9662	0.9868
Kareeya PS Unit 1	132	KAREEYA1	QKAH1	QKYH	1.0495	1.0690
Kareeya PS Unit 2	132	KAREEYA2	QKAH2	QKYH	1.0495	1.0690
Kareeya PS Unit 3	132	KAREEYA3	QKAH3	QKYH	1.0495	1.0690
Kareeya PS Unit 4	132	KAREEYA4	QKAH4	QKYH	1.0495	1.0690
Kogan Creek PS	275	KPP_1	QBRA4K	QWDN	0.9588	0.9582
Koombooloomba	132	KAREEYA5	QKYH5	QKYH	1.0495	1.0690
Millmerran PS Unit 1 (Millmerran)	330	MPP_1	QBCK1	QMLN	0.9642	0.9612
Millmerran PS Unit 2 (Millmerran)	330	MPP_2	QBCK2	QMLN	0.9642	0.9612
Mt Stuart PS Unit 1	132	MSTUART1	QMSP1	QMSP	0.9834	1.0156
Mt Stuart PS Unit 2	132	MSTUART2	QMSP2	QMSP	0.9834	1.0156
Mt Stuart PS Unit 3	132	MSTUART3	QMSP3M	QMSP	0.9834	1.0156
Oakey PS Unit 1	110	OAKEY1	QOKY1	QOKY	0.9420	0.9498
Oakey PS Unit 2	110	OAKEY2	QOKY2	QOKY	0.9420	0.9498
Stanwell PS Load	132	STANNL1	QSTX	QSTX	0.9618	0.9897
Stanwell PS Unit 1	275	STAN-1	QSTN1	QSTN	0.9561	0.9784
Stanwell PS Unit 2	275	STAN-2	QSTN2	QSTN	0.9561	0.9784
Stanwell PS Unit 3	275	STAN-3	QSTN3	QSTN	0.9561	0.9784
Stanwell PS Unit 4	275	STAN-4	QSTN4	QSTN	0.9561	0.9784
Swanbank E GT	275	SWAN_E	QSWE	QSWE	0.9984	0.9972
Tarong North PS	275	TNPS1	QTNT	QTNT	0.9678	0.9707

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Tarong PS Unit 1	275	TARONG#1	QTRN1	QTRN	0.9686	0.9708
Tarong PS Unit 2	275	TARONG#2	QTRN2	QTRN	0.9686	0.9708
Tarong PS Unit 3	275	TARONG#3	QTRN3	QTRN	0.9686	0.9708
Tarong PS Unit 4	275	TARONG#4	QTRN4	QTRN	0.9686	0.9708
Wivenhoe Generation Unit 1	275	W/HOE#1	QWIV1	QWIV	0.9902	0.9895
Wivenhoe Generation Unit 2	275	W/HOE#2	QWIV2	QWIV	0.9902	0.9895
Wivenhoe Pump 1	275	PUMP1	QWIP1	QWIP	0.9940	0.9941
Wivenhoe Pump 2	275	PUMP2	QWIP2	QWIP	0.9940	0.9941
Yabulu PS	132	YABULU	QTYP	QTYP	1.0073	1.0337
Yarwun PS	132	YARWUN_1	QYAG1R	QYAG	0.9693	0.9879

Table 3 Queensland Embedded Generation

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Barcaldine PS - Lilyvale	132	BARCALDN	QBCG	QBCG	0.9777	0.9935
Browns Plains Landfill Gas PS	110	BPLANDF1	QLGH3B	QLGH	1.0080	1.0078
Daandine PS	110	DAANDINE	QTKM1	QTKM	0.9717	0.9747
German Creek Generator	66	GERMCRK	QLIL2	QLIL	1.0122	1.0373
Isis CSM	132	ICSM	QGNG1I	QTBC	1.0033	1.0107
Mackay GT	33	MACKAYGT	QMKG	QMKG	0.9737	1.0550
Moranbah Gen	11	MORANBAH	QMRL1M	QMRL	1.0526	1.0824
Moranbah North PS	66	MBAHNTH	QMRN1P	QMRN	1.0721	1.0890
Oaky Creek Generator	66	OAKYCREK	QLIL1	QLIL	1.0122	1.0373
Oaky Creek 2	66	OAKY2	QLIL3O	QLIL	1.0122	1.0373
Rochedale Renewable Energy Plant	110	ROCHEDAL	QBMH2	QBMH	1.0091	1.0067
Rocky Point Gen (Loganlea 110kV)	110	RPCG	QLGH2	QLGH	1.0080	1.0078
Roghan Road Generator	110	EDLRGNRD	QSPN2	QSPN	1.0049	1.0057
Roma PS Unit 7 - Columboola	132	ROMA_7	QRMA7	QRMA	0.9629	0.9591
Roma PS Unit 8 - Columboola	132	ROMA_8	QRMA8	QRMA	0.9629	0.9591
Southbank Institute Of Technology	110	STHBKTEC	QCBD1S	QCBW	1.0125	1.0141
Ti Tree BioReactor	33	TITREE	QABM1T	QABM	0.9990	0.9965
Whitwood Rd Renewable Energy Plant	110	WHIT1	QSBK1	QBKS	0.9968	0.9953
Windy Hill WF	66	WHILL1	QTUL	QTUL	1.1103	1.1137
Wivenhoe Small Hydro	110	WIVENSH	QABR1	QABR	0.9951	0.9945
Yabulu Steam Turbine (Garbutt 66kV)	66	YABULU2	QGAR1	QYST	0.9992	1.0428

1.2 NSW Marginal Loss Factors[1]

Table 4 NSW Loads

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Albury	132	NALB	1.0305	0.9779
Alcan	132	NALC	0.9933	0.9943
Armidale	66	NAR1	0.9435	0.9905
Australian Newsprint Mill	132	NANM	1.0294	0.9824
Balranald	22	NBAL	1.1166	1.0259
Beaconsfield North	132	NBFN	1.0078	1.0065
Beaconsfield South	132	NBFS	1.0078	1.0065
Beaconsfield West	132	NBFW	1.0078	1.0065
Belmore Park	132	NBM1	1.0079	1.0061
Beresfield	33	NBRF	0.9965	0.9973
Beryl	66	NBER	1.0145	1.0077
BHP (Waratah)	132	NWR1	0.9898	0.9923
Boambee South	132	NWST	0.9680	1.0157
Boggabri East	132	NBGE	1.0022	1.0578
Boggabri North	132	NBGN	1.0056	1.0609
Brandy Hill	11	NBHL	0.9941	0.9958
Broken Hill	22	NBKG	1.1714	1.0480
Broken Hill	220	NBKH	1.1632	1.0427
Bunnerong	132	NBG1	1.0076	1.0054
Bunnerong	33	NBG3	1.0097	1.0090
Burrinjuck	132	NBU2	1.0045	0.9764
Canterbury	33	NCTB	1.0134	1.0114
Carlingford	132	NCAR	1.0035	1.0018
Casino	132	NCSN	0.9648	1.0213
Charmhaven	11	NCHM	0.9935	0.9944
Chullora	132	NCHU	1.0077	1.0072
Coffs Harbour	66	NCH1	0.9634	1.0124
Coleambally	132	NCLY	1.0477	1.0004
Cooma	66	NCMA	1.0106	0.9763
Cooma (AusNet Services)	66	NCM2	1.0106	0.9763
Cowra	66	NCW8	1.0355	1.0099
Dapto (Endeavour Energy)	132	NDT1	0.9986	0.9916
Dapto (Essential Energy)	132	NDT2	0.9986	0.9916
Darlington Point	132	NDNT	1.0470	0.9961
Deniliquin	66	NDN7	1.0715	1.0154
Dorrigo	132	NDOR	0.9568	1.0044
Drummoyne	11	NDRM	1.0090	1.0122
Dunoon	132	NDUN	0.9553	1.0251
Far North VTN		NEV1	0.9745	0.9819
Finley[2] – Dual MLF - Load	66	NFNY	1.0825	1.0235
Finley[2] – Dual MLF - Generation	66	NFNY	1.0157	0.9670
Forbes	66	NFB2	1.0535	1.0411

[1] The NSW region includes the ACT. ACT generation and load are detailed separately for ease of reference.
[2] The dual MLF for Finley TNI (NFNY), is due to the impact of in-feed at Finley.

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Gadara	132	NGAD	1.0328	0.9934
Glen Innes	66	NGLN	0.9696	1.0217
Gosford	66	NGF3	1.0015	1.0017
Gosford	33	NGSF	1.0021	1.0019
Green Square	11	NGSQ	1.0081	1.0069
Griffith	33	NGRF	1.0665	1.0146
Gunnedah	66	NGN2	0.9879	1.0360
Haymarket	132	NHYM	1.0079	1.0068
Heron's Creek	132	NHNC	1.0226	1.0462
Holroyd	132	NHLD	1.0001	1.0029
Hurstville North	11	NHVN	1.0063	1.0078
Homebush Bay	11	NHBB	1.0112	1.0108
Ilford	132	NLFD	0.9928	0.9895
Ingleburn	66	NING	1.0005	0.9991
Inverell	66	NNVL	0.9823	1.0377
Kemps Creek	330	NKCK	0.9957	0.9954
Kempsey	66	NKS2	0.9976	1.0360
Kempsey	33	NKS3	1.0006	1.0391
Koolkhan	66	NKL6	0.9776	1.0250
Kurnell	132	NKN1	1.0052	1.0039
Kogarah	11	NKOG	1.0086	1.0098
Kurri	33	NKU3	0.9967	0.9969
Kurri	11	NKU1	0.9932	0.9942
Kurri[3] - Dual MLF - Generation	132	NKUR	0.9905	0.9944
Kurri[3] - Dual MLF - Load	132	NKUR	0.9941	0.9944
Lake Munmorah	132	NMUN	0.9791	0.9885
Lane Cove	132	NLCV	1.0086	1.0082
Liddell	33	NLD3	0.9679	0.9740
Lismore	132	NLS2	0.9661	1.0268
Liverpool	132	NLP1	1.0019	1.0010
Macarthur	132	NMC1	0.9953	0.9913
Macarthur	66	NMC2	0.9986	0.9959
Macksville	132	NMCV	0.9824	1.0272
Macquarie Park	11	NMQP	1.0116	1.0109
Manildra	132	NMLD	1.0410	1.0342
Marrickville	11	NMKV	1.0132	1.0117
Marulan (Endeavour Energy)	132	NMR1	0.9922	0.9844
Marulan (Essential Energy)	132	NMR2	0.9922	0.9844
Mason Park	132	NMPK	1.0087	1.0086
Meadowbank	11	NMBK	1.0117	1.0112
Molong	132	NMOL	1.0359	1.0302
Moree	66	NMRE	1.0039	1.0847
Morven	132	NMVN	1.0316	0.9844
Mt Piper	66	NMP6	0.9765	0.9754
Mudgee	132	NMDG	1.0095	1.0042
Mullumbimby	11	NML1	0.9494	1.0346

3 The dual MLF for Kurri TNI (NKUR), is due to the impact of in-feed at Kurri.

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Mullumbimby	132	NMLB	0.9403	1.0336
Munmorah[4]	330	NMN1	0.9882	0.9899
Munyang	11	NMY1	1.0148	0.9549
Munyang	33	NMYG	1.0148	0.9549
Murrumbateman	132	NMBM	1.0009	0.9800
Murrumburrah	66	NMRU	1.0245	0.9950
Muswellbrook	132	NMRK	0.9754	0.9828
Nambucca Heads	132	NNAM	0.9773	1.0237
Narrabri	66	NNB2	1.0154	1.0699
Newcastle	132	NNEW	0.9907	0.9926
North of Broken Bay VTN		NEV2	0.9937	0.9949
Orange	66	NRGE	1.0450	1.0398
Orange	132	NRG1	1.0453	1.0387
Orange North	132	NONO	1.0437	1.0367
Ourimbah	33	NORB	0.9987	0.9994
Ourimbah	132	NOR1	0.9976	0.9981
Ourimbah	66	NOR6	0.9975	0.9981
Panorama	66	NPMA	1.0292	1.0246
Parkes	66	NPK6	1.0527	1.0432
Parkes	132	NPKS	1.0506	1.0413
Peakhurst	33	NPHT	1.0071	1.0059
Pt Macquarie	33	NPMQ	1.0187	1.0518
Pyrmont	33	NPT3	1.0085	1.0073
Pyrmont	132	NPT1	1.0080	1.0069
Raleigh	132	NRAL	0.9691	1.0166
Regentville	132	NRGV	0.9991	0.9984
Rookwood Road	132	NRWR	1.0013	1.0013
Rozelle	132	NRZH	1.0101	1.0085
Rozelle	33	NRZL	1.0098	1.0097
Queanbeyan 132	132	NQBY	1.0250	0.9924
Snowy Adit	132	NSAD	0.9741	0.9763
Somersby	11	NSMB	1.0024	1.0027
South of Broken Bay VTN		NEV3	1.0060	1.0050
St Peters	11	NSPT	1.0109	1.0096
Stroud	132	NSRD	1.0057	1.0096
Sydney East	132	NSE2	1.0050	1.0051
Sydney North (Ausgrid)	132	NSN1	1.0016	1.0013
Sydney North (Endeavour Energy)	132	NSN2	1.0016	1.0013
Sydney South	132	NSYS	1.0029	1.0016
Sydney West (Ausgrid)	132	NSW1	1.0035	1.0018
Sydney West (Endeavour Energy)	132	NSW2	1.0035	1.0018
Tamworth	66	NTA2	0.9638	0.9830
Taree (Essential Energy)	132	NTR2	1.0295	1.0462
Tenterfield	132	NTTF	0.9705	1.0259
Terranora	110	NTNR	0.9986	1.0347
Tomago	330	NTMG	0.9905	0.9931

4 TNI NMNP (33 kV) has been changed to NMN1 (330 kV).

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Tomago (Ausgrid)	132	NTME	0.9923	0.9928
Tomago (Essential Energy)	132	NTMC	0.9923	0.9928
Top Ryde	11	NTPR	1.0094	1.0091
Tuggerah	132	NTG3	0.9938	0.9946
Tumut	66	NTU2	1.0314	0.9910
Vales Pt.	132	NVP1	0.9883	0.9898
Vineyard	132	NVYD	0.9991	0.9996
Wagga	66	NWG2	1.0313	0.9889
Wagga North	132	NWGN	1.0292	0.9910
Wagga North	66	NWG6	1.0319	0.9923
Wallerawang (Endeavour Energy)	132	NWW6	0.9766	0.9741
Wallerawang (Essential Energy)	132	NWW5	0.9766	0.9741
Wallerawang 66 (Essential Energy)	66	NWW4	0.9771	0.9748
Wallerawang 66	66	NWW7	0.9771	0.9748
Wallerawang 330 PS Load	330	NWWP	0.9798	0.9760
Wellington	132	NWL8	0.9909	0.9903
West Gosford	11	NGWF	1.0031	1.0033
Williamsdale	132	NWDL	1.0090	0.9830
Wyong	11	NWYG	0.9963	0.9966
Yanco	33	NYA3	1.0546	1.0049
Yass	66	NYS6	1.0016	0.9806
Yass	132	NYS1	0.9914	0.9742

Table 5 NSW Generation

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Bayswater PS Unit 1	330	BW01	NBAY1	NBAY	0.9590	0.9668
Bayswater PS Unit 2	330	BW02	NBAY2	NBAY	0.9590	0.9668
Bayswater PS Unit 3	500	BW03	NBAY3	NBYW	0.9603	0.9668
Bayswater PS Unit 4	500	BW04	NBAY4	NBYW	0.9603	0.9668
Blowering	132	BLOWERNG	NBLW8	NBLW	0.9815	0.9431
Broken Hill GT 1	22	GB01	NBKG1	NBKG	1.1714	1.0480
Burrinjuck	132	BURRIN	NBUK	NBUK	0.9915	0.9589
Capital Wind Farm	330	CAPTL_WF	NCWF1R	NCWF	0.9931	0.9748
Colongra PS Unit 1	330	CG1	NCLG1D	NCLG	0.9872	0.9793
Colongra PS Unit 2	330	CG2	NCLG2D	NCLG	0.9872	0.9793
Colongra PS Unit 3	330	CG3	NCLG3D	NCLG	0.9872	0.9793
Colongra PS Unit 4	330	CG4	NCLG4D	NCLG	0.9872	0.9793
Eraring 330 PS Unit 1	330	ER01	NEPS1	NEP3	0.9829	0.9856
Eraring 330 PS Unit 2	330	ER02	NEPS2	NEP3	0.9829	0.9856
Eraring 500 PS Unit 3	500	ER03	NEPS3	NEPS	0.9846	0.9867
Eraring 500 PS Unit 4	500	ER04	NEPS4	NEPS	0.9846	0.9867
Eraring PS Load	500	ERNL1	NEPSL	NEPS	0.9846	0.9867
Gullen Range Wind Farm	330	GULLRWF1	NGUR1G	NGUR	0.9909	0.9770
Guthega	132	GUTHEGA	NGUT8	NGUT	0.9371	0.8882
Guthega Auxiliary Supply	11	GUTHNL1	NMY11	NMY1	1.0148	0.9549
Hume (NSW Share)	132	HUMENSW	NHUM	NHUM	1.0020	0.9483

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Kangaroo Valley – Bendeela (Shoalhaven) Generation - dual MLF	330	SHGEN	NSHL	NSHN	0.9904	0.9838
Kangaroo Valley (Shoalhaven) Pumps - dual MLF	330	SHPUMP	NSHP1	NSHN	1.0010	0.9941
Liddell 330 PS Load	330	LIDDNL1	NLDPL	NLDP	0.9593	0.9676
Liddell 330 PS Unit 1	330	LD01	NLDP1	NLDP	0.9593	0.9676
Liddell 330 PS Unit 2	330	LD02	NLDP2	NLDP	0.9593	0.9676
Liddell 330 PS Unit 3	330	LD03	NLDP3	NLDP	0.9593	0.9676
Liddell 330 PS Unit 4	330	LD04	NLDP4	NLDP	0.9593	0.9676
Lower Tumut Generation - dual MLF	330	TUMUT3	NLTS8	NLTS	0.9897	0.9465
Lower Tumut Pipeline Auxiliary	66	TUMT3NL3	NTU2L3	NTU2	1.0314	0.9910
Lower Tumut Pumps - dual MLF	330	SNOWYP	NLTS3	NLTS	1.0142	0.9773
Lower Tumut T2 Auxiliary	66	TUMT3NL1	NTU2L1	NTU2	1.0314	0.9910
Lower Tumut T4 Auxiliary	66	TUMT3NL2	NTU2L2	NTU2	1.0314	0.9910
Mt Piper PS Load	330	MPNL1	NMPPL	NMTP	0.9753	0.9744
Mt Piper PS Unit 1	330	MP1	NMTP1	NMTP	0.9753	0.9744
Mt Piper PS Unit 2	330	MP2	NMTP2	NMTP	0.9753	0.9744
Upper Tumut	330	UPPTUMUT	NUTS8	NUTS	0.9943	0.9538
Uranquinty PS Unit 11	132	URANQ11	NURQ1U	NURQ	0.9291	0.8970
Uranquinty PS Unit 12	132	URANQ12	NURQ2U	NURQ	0.9291	0.8970
Uranquinty PS Unit 13	132	URANQ13	NURQ3U	NURQ	0.9291	0.8970
Uranquinty PS Unit 14	132	URANQ14	NURQ4U	NURQ	0.9291	0.8970
Vales Point 330 PS Load	330	VPNL1	NVPPL	NVPP	0.9853	0.9877
Vales Point 330 PS Unit 5	330	VP5	NVPP5	NVPP	0.9853	0.9877
Vales Point 330 PS Unit 6	330	VP6	NVPP6	NVPP	0.9853	0.9877
Woodlawn Wind Farm	330	WOODLWN1	NCWF2W	NCWF	0.9931	0.9748

Table 6 NSW Embedded Generation

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Appin PS	66	APPIN	NAPP1A	NAPP	0.9986	0.9961
Awaba Renewable Energy Facility	132	AWABAREF	NNEW2	NNEW	0.9907	0.9926
Bankstown Sport Club	132	BANKSPT1	NSYS3R	NSYS	1.0029	1.0016
Boco Rock Wind Farm	132	BOCORWF1	NCMA3B	NBCO	0.9882	0.9602
Broadwater PS	132	BWTR1	NLS21B	NLS2	0.9661	1.0268
Broken Hill Solar Farm	22	BROKENH1	NBK11B	NBK1	1.1220	1.0150
Brown Mountain	66	BROWNMT	NCMA1	NCMA	1.0106	0.9763
Burrendong Hydro PS	132	BDONGHYD	NWL81B	NWL8	0.9909	0.9903
Campbelltown WSLC	66	WESTCBT1	NING1C	NING	1.0005	0.9991
Condong PS	110	CONDONG1	NTNR1C	NTNR	0.9986	1.0347
Copeton Hydro PS	66	COPTNHYD	NNVL1C	NNVL	0.9823	1.0377
Cullerin Range Wind Farm	132	CULLRGWF	NYS11C	NYS1	0.9914	0.9742
Eastern Creek	132	EASTCRK	NSW21	NSW2	1.0035	1.0018
Eraring 330 BS UN (GT)	330	ERGT01	NEP35B	NEP3	0.9829	0.9856
Glenbawn Hydro PS	132	GLBWNHYD	NMRK2G	NMRK	0.9754	0.9828

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Glenn Innes (Pindari PS)	66	PINDARI	NGLN1	NGLN	0.9696	1.0217
Grange Avenue	132	GRANGEAV	NVYD1	NVYD	0.9991	0.9996
Gunning Wind Farm	132	GUNNING1	NYS12A	NYS1	0.9914	0.9742
HEZ PS	33	HEZ	NKU31H	NKU3	0.9967	0.9969
Jindabyne Generator	66	JNDABNE1	NCMA2	NCMA	1.0106	0.9763
Jounama PS	66	JOUNAMA1	NTU21J	NTU2	1.0314	0.9910
Keepit	66	KEEPIT	NKPT	NKPT	0.9879	1.0360
Kincumber Landfill	66	KINCUM1	NGF31K	NGF3	1.0015	1.0017
Liddell 33 – Hunter Valley GTs	33	HVGTS	NLD31	NLD3	0.9679	0.9740
Liverpool 132 (Jacks Gully)	132	JACKSGUL	NLP11	NSW2	1.0035	1.0018
Lucas Heights II Power Plant	132	LUCASHGT	NSYS2G	NSYS	1.0029	1.0016
Lucas Heights Stage 2 Power Station	132	LUCAS2S2	NSYS1	NSYS	1.0029	1.0016
Moree Solar Farm	66	MOREESF1	NMR41M	NMR4	0.9433	1.0479
Nine Willoughby	132	NINEWIL1	NSE21R	NSE2	1.0050	1.0051
Nyngan Solar Farm	132	NYNGAN1	NWL82N	NWL8	0.9909	0.9903
Sithe	132	SITHE01	NSYW1	NSW2	1.0035	1.0018
St George Leagues Club	33	STGEORG1	NPHT1E	NPHT	1.0071	1.0059
Tahmoor PS	132	TAHMOOR1	NLP12T	NLP1	1.0019	1.0010
Tallawarra PS	132	TALWA1	NDT13T	NTWA	0.9967	0.9912
Taralga Wind Farm	132	TARALGA1	NMR22T	NMR2	0.9922	0.9844
Teralba Power Station	132	TERALBA	NNEW1	NNEW	0.9907	0.9926
The Drop PS – Dual MLF associated to Finley (NFNY) - Load	66	THEDROP1	NFNY1D	NFNY	1.0825	1.0235
The Drop PS – Dual MLF associated to Finley (NFNY) - Generation	66	THEDROP1	NFNY1D	NFNY	1.0157	0.9670
Tower Power Plant	132	TOWER	NLP11T	NLP1	1.0019	1.0010
West Nowra	132	AGLNOW1	NDT12	NDT1	0.9986	0.9916
Wests Illawara Leagues Club	132	WESTILL1	NDT14E	NDT1	0.9986	0.9916
Wilga Park A	66	WILGAPK	NNB21W	NNB2	1.0154	1.0699
Wilga Park B	66	WILGB01	NNB22W	NNB2	1.0154	1.0699
Woodlawn Bioreactor	132	WDLNGN01	NMR21W	NMR2	0.9922	0.9844
Woy Woy Landfill	66	WOYWOY1	NGF32W	NGF3	1.0015	1.0017
Wyangala A PS	66	WYANGALA	NCW81A	NCW8	1.0355	1.0099
Wyangala B PS	66	WYANGALB	NCW82B	NCW8	1.0355	1.0099

Table 7 ACT Loads

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Canberra	132	ACA1	1.0095	0.9828
Queanbeyan (ACTEW)	66	AQB1	1.0257	0.9924
Queanbeyan (Essential Energy)	66	AQB2	1.0257	0.9924

Table 8 ACT Embedded Generation

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Capital East Solar Farm	66	CESF1	AQB21C	AQB2	1.0257	0.9924
Royalla Solar Farm	132	ROYALLA1	ACA11R	ACA1	1.0095	0.9828

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

1.3 Victoria Marginal Loss Factors

Table 9 Victorian Loads

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Altona	66	VATS	1.0068	1.0032
Altona	220	VAT2	1.0010	0.9985
Ballarat	66	VBAT	1.0209	1.0207
Bendigo	66	VBE6	1.0664	1.0672
Bendigo	22	VBE2	1.0658	1.0684
BHP Western Port	220	VJLA	0.9909	0.9910
Brooklyn (Jemena)	22	VBL2	1.0064	1.0039
Brooklyn (Jemena)	66	VBL6	1.0054	1.0053
Brooklyn (Powercor)	22	VBL3	1.0064	1.0039
Brooklyn (Powercor)	66	VBL7	1.0054	1.0053
Brunswick (CitiPower)	22	VBT2	1.0003	0.9995
Brunswick (Jemena)	22	VBTS	1.0003	0.9995
Cranbourne	220	VCB2	0.9897	0.9901
Cranbourne (AusNet Services)	66	VCBT	0.9919	0.9919
Cranbourne (United Energy)	66	VCB5	0.9919	0.9919
East Rowville (AusNet Services)	66	VER2	0.9932	0.9931
East Rowville (United Energy)	66	VERT	0.9932	0.9931
Fishermens Bend (CitiPower)	66	VFBT	1.0036	1.0043
Fishermens Bend (Powercor)	66	VFB2	1.0036	1.0043
Fosterville	220	VFVT	1.0619	1.0649
Geelong	66	VGT6	1.0048	0.9987
Glenrowan	66	VGNT	1.0368	1.0532
Heatherton	66	VHTS	0.9986	0.9985
Heywood	22	VHY2	1.0111	1.0007
Horsham	66	VHOT	1.0803	1.0680
Keilor (Jemena)	66	VKT2	1.0037	1.0014
Keilor (Powercor)	66	VKTS	1.0037	1.0014
Kerang	22	VKG2	1.1124	1.0988
Kerang	66	VKG6	1.1118	1.0986
Khancoban	330	NKHN	1.0123	1.0468
Loy Yang Substation	66	VLY6	0.9709	0.9765
Malvern	22	VMT2	0.9962	0.9964
Malvern	66	VMT6	0.9950	0.9953
Morwell Power Station Units 1 to 3	66	VMWG	0.9707	0.9704
Morwell PS (G4&5)	11	VMWP	0.9708	0.9732
Morwell TS	66	VMWT	0.9759	0.9799
Mt Beauty	66	VMBT	1.0189	1.0368
Portland	500	VAPD	1.0135	1.0033
Pt Henry	220	VPTH	1.0023	0.9915
Red Cliffs	22	VRC2	1.1621	1.1205
Red Cliffs	66	VRC6	1.1602	1.1212
Red Cliffs (Essential Energy)	66	VRCA	1.1602	1.1212
Richmond	22	VRT2	0.9979	0.9977
Richmond (CitiPower)	66	VRT7	1.0000	1.0023

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Richmond (United Energy)	66	VRT6	1.0000	1.0023
Ringwood (AusNet Services)	22	VRW3	0.9989	0.9998
Ringwood (AusNet Services)	66	VRW7	0.9990	0.9993
Ringwood (United Energy)	22	VRW2	0.9989	0.9998
Ringwood (United Energy)	66	VRW6	0.9990	0.9993
Shepparton	66	VSHT	1.0502	1.0639
South Morang (Jemena)	66	VSM6	0.9985	0.9987
South Morang (AusNet Services)	66	VSMT	0.9985	0.9987
Springvale (CitiPower)	66	VSVT	0.9972	0.9970
Springvale (United Energy)	66	VSV2	0.9972	0.9970
Templestowe (CitiPower)	66	VTS2	0.9995	0.9993
Templestowe (Jemena)	66	VTST	0.9995	0.9993
Templestowe (AusNet Services)	66	VTS3	0.9995	0.9993
Templestowe (United Energy)	66	VTS4	0.9995	0.9993
Terang	66	VTGT	1.0339	1.0300
Thomastown (Jemena)	66	VTTS	1.0000	1.0000
Thomastown (AusNet Services)	66	VTT2	1.0000	1.0000
Tyabb	66	VTBT	0.9925	0.9924
Wemen TS	66	VWET	1.1513	1.1206
West Melbourne	22	VWM2	1.0021	1.0023
West Melbourne (CitiPower)	66	VWM7	1.0031	1.0039
West Melbourne (Jemena)	66	VWM6	1.0031	1.0039
Wodonga	22	VWO2	1.0252	1.0495
Wodonga	66	VWO6	1.0235	1.0480
Yallourn	11	VYP1	0.9528	0.9597

Table 10 Victoria Generation

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Ararat WF	220	ARWF1	VART1A	VART	1.0299	1.0344
Banimboola	220	BAPS	VDPS2	VDPS	0.9812	1.0004
Basslink (Loy Yang PS Switchyard) Tasmania to Victoria	500	BLNKVIC	VLYP13	VTBL	0.9765	0.9828
Dartmouth PS	220	DARTM1	VDPS	VDPS	0.9812	1.0004
Eildon PS Unit 1	220	EILDON1	VEPS1	VEPS	0.9945	1.0026
Eildon PS Unit 2	220	EILDON2	VEPS2	VEPS	0.9945	1.0026
Hazelwood PS Load	220	HWPNL1	VHWPL	VHWP	0.9701	0.9723
Hazelwood PS Unit 1	220	HWPS1	VHWP1	VHWP	0.9701	0.9723
Hazelwood PS Unit 2	220	HWPS2	VHWP2	VHWP	0.9701	0.9723
Hazelwood PS Unit 3	220	HWPS3	VHWP3	VHWP	0.9701	0.9723
Hazelwood PS Unit 4	220	HWPS4	VHWP4	VHWP	0.9701	0.9723
Hazelwood PS Unit 5	220	HWPS5	VHWP5	VHWP	0.9701	0.9723
Hazelwood PS Unit 6	220	HWPS6	VHWP6	VHWP	0.9701	0.9723
Hazelwood PS Unit 7	220	HWPS7	VHWP7	VHWP	0.9701	0.9723
Hazelwood PS Unit 8	220	HWPS8	VHWP8	VHWP	0.9701	0.9723
Jeeralang A PS Unit 1	220	JLA01	VJLGA1	VJLG	0.9641	0.9667

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Jeeralang A PS Unit 2	220	JLA02	VJLGA2	VJLG	0.9641	0.9667
Jeeralang A PS Unit 3	220	JLA03	VJLGA3	VJLG	0.9641	0.9667
Jeeralang A PS Unit 4	220	JLA04	VJLGA4	VJLG	0.9641	0.9667
Jeeralang B PS Unit 1	220	JLB01	VJLGB1	VJLG	0.9641	0.9667
Jeeralang B PS Unit 2	220	JLB02	VJLGB2	VJLG	0.9641	0.9667
Jeeralang B PS Unit 3	220	JLB03	VJLGB3	VJLG	0.9641	0.9667
Jindabyne pump at Guthega	132	SNOWYGJP	NGJP	NGJP	1.1115	1.1380
Laverton PS (LNGS1)	220	LNGS1	VAT21L	VAT2	1.0010	0.9985
Laverton PS (LNGS2)	220	LNGS2	VAT22L	VAT2	1.0010	0.9985
Loy Yang A PS Load	500	LYNL1	VLYPL	VLYP	0.9723	0.9742
Loy Yang A PS Unit 1	500	LYA1	VLYP1	VLYP	0.9723	0.9742
Loy Yang A PS Unit 2	500	LYA2	VLYP2	VLYP	0.9723	0.9742
Loy Yang A PS Unit 3	500	LYA3	VLYP3	VLYP	0.9723	0.9742
Loy Yang A PS Unit 4	500	LYA4	VLYP4	VLYP	0.9723	0.9742
Loy Yang B PS Unit 1	500	LOYYB1	VLYP5	VLYP	0.9723	0.9742
Loy Yang B PS Unit 2	500	LOYYB2	VLYP6	VLYP	0.9723	0.9742
MacArthur Wind Farm	500	MACARTH1	VTRT1M	VTRT	1.0022	0.9940
McKay Creek / Bogong PS	220	MCKAY1	VMKP1	VT14	0.9543	0.9883
Mortlake Unit 1	500	MORTLK11	VM0P1O	VM0P	1.0015	0.9942
Mortlake Unit 2	500	MORTLK12	VM0P2O	VM0P	1.0015	0.9942
Mt Mercer Windfarm	220	MERCER01	VELT1M	VELT	1.0048	1.0033
Murray	330	MURRAY	NMUR8	NMUR	0.9590	0.9885
Newport PS	220	NPS	VNPS	VNPS	0.9939	0.9952
Valley Power Unit 1	500	VPGS1	VLYP07	VLYP	0.9723	0.9742
Valley Power Unit 2	500	VPGS2	VLYP08	VLYP	0.9723	0.9742
Valley Power Unit 3	500	VPGS3	VLYP09	VLYP	0.9723	0.9742
Valley Power Unit 4	500	VPGS4	VLYP010	VLYP	0.9723	0.9742
Valley Power Unit 5	500	VPGS5	VLYP011	VLYP	0.9723	0.9742
Valley Power Unit 6	500	VPGS6	VLYP012	VLYP	0.9723	0.9742
Waubra Wind Farm	220	WAUBRAWF	VWBT1A	VWBT	1.0111	1.0122
West Kiewa PS Unit 1	220	WKIEWA1	VWKP1	VWKP	1.0026	1.0247
West Kiewa PS Unit 2	220	WKIEWA2	VWKP2	VWKP	1.0026	1.0247
Yallourn W PS 220 Load	220	YWNL1	VYP2L	VYP2	0.9509	0.9563
Yallourn W PS 220 Unit 1	220	YWPS1	VYP21	VYP3	0.9541	0.9589
Yallourn W PS 220 Unit 2	220	YWPS2	VYP22	VYP2	0.9509	0.9563
Yallourn W PS 220 Unit 3	220	YWPS3	VYP23	VYP2	0.9509	0.9563
Yallourn W PS 220 Unit 4	220	YWPS4	VYP24	VYP2	0.9509	0.9563

Table 11 Victoria Embedded Generation

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Bairnsdale Power Station	66	BDL01	VMWT2	VBDL	0.9745	0.9771

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Bairnsdale PS Generator Unit 2	66	BDL02	VMWT3	VBDL	0.9745	0.9771
Bald Hills WF	66	BALDHWF1	VMWT9B	VMWT	0.9759	0.9799
Ballarat Health Services	66	BBASEHOS	VBAT1H	VBAT	1.0209	1.0207
Broadmeadows Power Plant	66	BROADMDW	VTTS2B	VTTS	1.0000	1.0000
Brooklyn Landfill & Recycling Facility	66	BROOKLYN	VBL61	VBL6	1.0054	1.0053
Chepstowe Wind Farm	66	CHPSTWF	VBAT3C	VBAT	1.0209	1.0207
Clayton Landfill Gas Power Station	66	CLAYTON	VSV21B	VSV2	0.9972	0.9970
Codrington Wind Farm	66	CODRNGTON	VTGT2C	VTGT	1.0339	1.0300
Coonooer Bridge WF	66	CBWF1	VBE61C	VBE6	1.0664	1.0672
Corio LFG PS	66	CORIO1	VGT61C	VGT6	1.0048	0.9987
Eildon Hydro PS	66	EILDON3	VTT22E	VSMT	0.9985	0.9987
Glenmaggie Hydro PS	66	GLENMAG1	VMWT8G	VMWT	0.9759	0.9799
Hallam Mini Hydro	66	HLMSEW01	VER21H	VER2	0.9932	0.9931
Hallam Road Renewable Energy Facility	66	HALLAMRD1	VER22L	VER2	0.9932	0.9931
Hepburn Community WF	66	HEPWIND1	VBAT2L	VBAT	1.0209	1.0207
Hume (Victorian Share)	66	HUMEV	VHUM	VHUM	0.9947	0.9768
Longford	66	LONGFORD	VMWT6	VMWT	0.9759	0.9799
Mornington Landfill Site Generator	66	MORNW	VTBT1	VTBT	0.9925	0.9924
Mortons Lane Wind Farm	66	MLWF1	VTGT4M	VTGT	1.0339	1.0300
Oaklands Hill Wind Farm	66	OAKLAND1	VTGT3A	VTGT	1.0339	1.0300
Shepparton Waste Gas	66	SHEP1	VSHT2S	VSHT	1.0502	1.0639
Somerton Power Station	66	AGLSOM	VTTS1	VSOM	0.9949	0.9946
Springvale Power Plant	66	SVALE1	VSV22S	VSV2	0.9972	0.9970
Tatura	66	TATURA01	VSHT1	VSHT	1.0502	1.0639
Toora Wind Farm	66	TOORAWF	VMWT5	VMWT	0.9759	0.9799
Traralgon NSS	66	TGNSS1	VMWT1T	VMWT	0.9759	0.9799
William Horvell Hydro PS	66	WILLHOV1	VW061W	VWO6	1.0235	1.0480
Wollert Renewable Energy Facility	66	WOLLERT1	VSMT1W	VSMT	0.9985	0.9987
Wonthaggi Wind Farm	66	WONWP	VMWT7	VMWT	0.9759	0.9799
Wyndham Landfill Site Generator	66	WYNDW	VATS1	VATS	1.0068	1.0032
Yambuk Wind Farm	66	YAMBUKWF	VTGT1	VTGT	1.0339	1.0300
Yarrawonga Hydro PS	66	YWNGAHYD	VSHT3Y	VSHT	1.0502	1.0639

1.4 South Australia Marginal Loss Factors

Table 12 South Australia Loads

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Angas Creek	33	SANC	1.0093	1.0115
Ardrossan West	33	SARW	0.9544	0.9382
Back Callington	11	SBAC	1.0071	1.0133
Baroota	33	SBAR	1.0125	0.9918
Berri	66	SBER	0.9379	1.0536
Berri (Powercor)	66	SBE1	0.9379	1.0536
Blanche	33	SBLA	0.9218	0.9903
Blanche (Powercor)	33	SBL1	0.9218	0.9903
Brinkworth	33	SBRK	1.0061	0.9928
Bungama Industrial	33	SBUN	1.0078	0.9874
Bungama Rural	33	SBUR	1.0194	0.9984
City West	66	SACR	1.0047	1.0054
Clare North	33	SCLN	1.0012	0.9906
Dalrymple	33	SDAL	0.9153	0.8995
Davenport	275	SDAV	1.0114	0.9886
Davenport	33	SDAW	1.0129	0.9891
Dorrien	33	SDRN	1.0114	1.0082
East Terrace	66	SETC	1.0048	1.0055
Happy Valley	66	SHVA	1.0050	1.0068
Hummocks	33	SHUM	0.9758	0.9599
Kadina East	33	SKAD	0.9815	0.9648
Kanmantoo	11	SKAN	1.0070	1.0133
Keith	33	SKET	0.9703	1.0062
Kilburn	66	SKLB	1.0017	1.0029
Kincraig	33	SKNC	0.9452	0.9975
Lefevre	66	SLFE	0.9997	1.0002
Leigh Creek	33	SLCC	1.0791	1.0482
Leigh Creek South	33	SLCS	1.0719	1.0477
Magill	66	SMAG	1.0044	1.0053
Mannum	33	SMAN	1.0071	1.0140
Mannum – Adelaide Pipeline 1	3.3	SMA1	1.0137	1.0199
Mannum – Adelaide Pipeline 2	3.3	SMA2	1.0132	1.0191
Mannum – Adelaide Pipeline 3	3.3	SMA3	1.0135	1.0177
Middleback	33	SMDL	1.0170	0.9880
Middleback	132	SMBK	1.0202	0.9893
Millbrook	132	SMLB	1.0046	1.0061
Mobilong	33	SMBL	1.0032	1.0126
Morgan – Whyalla Pipeline 1	3.3	SMW1	0.9810	1.0292
Morgan – Whyalla Pipeline 2	3.3	SMW2	0.9908	1.0163
Morgan – Whyalla Pipeline 3	3.3	SMW3	0.9972	1.0028
Morgan – Whyalla Pipeline 4	3.3	SMW4	0.9978	0.9957
Morphett Vale East	66	SMVE	1.0051	1.0075
Mount Barker South	66	SMBS	1.0037	1.0073

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Mt Barker	66	SMBA	1.0029	1.0072
Mt Gambier	33	SMGA	0.9231	0.9908
Mt Gunson	33	SMGU	1.0445	0.9969
Munno Para	66	SMUP	1.0044	1.0022
Murray Bridge - Hahndorf Pipeline 1	11	SMH1	1.0096	1.0173
Murray Bridge - Hahndorf Pipeline 2	11	SMH2	1.0120	1.0193
Murray Bridge - Hahndorf Pipeline 3	11	SMH3	1.0119	1.0166
Neuroodla	33	SNEU	1.0392	1.0164
New Osborne	66	SNBN	0.9995	0.9998
North West Bend	66	SNWB	0.9754	1.0261
Northfield	66	SNFD	1.0037	1.0042
Para	66	SPAR	1.0042	1.0059
Parafield Gardens West	66	SPGW	1.0054	1.0045
Penola West 33	33	SPEN	0.9241	0.9861
Pimba	132	SPMB	1.0493	0.9991
Playford	132	SPAA	1.0132	0.9929
Port Lincoln	33	SPLN	1.0021	0.9645
Port Pirie	33	SPPR	1.0150	0.9957
Roseworthy	11	SRSW	1.0134	1.0111
Snuggery Industrial	33	SSNN	0.9176	0.9704
Snuggery Rural	33	SSNR	0.9016	0.9701
South Australian VTN		SJP1	1.0001	1.0012
Stony Point	11	SSPN	1.0189	0.9947
Tailem Bend	33	STAL	0.9896	1.0096
Templers	33	STEM	1.0086	1.0062
Torrens Island	66	STSY	1.0000	1.0000
Waterloo	33	SWAT	0.9931	0.9881
Whyalla Central Substation	33	SWYC	1.0196	0.9930
Whyalla Terminal BHP	33	SBHP	1.0181	0.9943
Woomera	132	SWMA	1.0510	0.9984
Wudina	66	SWUD	1.0229	0.9855
Yadnarie	66	SYAD	1.0080	0.9731

Table 13 South Australia Generation

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Cathedral Rocks Wind Farm	132	CATHROCK	SCRK	SCRK	0.8896	0.8775
Clements Gap Wind Farm	132	CLEMGPWF	SCGW1P	SCGW	0.9822	0.9701
Dry Creek PS Unit 1	66	DRYCGT1	SDCA1	SDPS	1.0011	1.0018
Dry Creek PS Unit 2	66	DRYCGT2	SDCA2	SDPS	1.0011	1.0018
Dry Creek PS Unit 3	66	DRYCGT3	SDCA3	SDPS	1.0011	1.0018
Hallett 2 WF	275	HALLWF2	SMOK1H	SMOK	0.9871	0.9811
Hallett PS	275	AGLHAL	SHPS1	SHPS	0.9900	0.9835
Hallett WF	275	HALLWF1	SHPS2W	SHPS	0.9900	0.9835
Hornsdale WF	275	HDWF1	SHDW1H	SHDW	0.9965	0.9793
Ladbroke Grove PS Unit 1	132	LADBROK1	SPEW1	SPEW	0.8872	0.9563

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Ladbroke Grove PS Unit 2	132	LADBROK2	SPEW2	SPEW	0.8872	0.9563
Lake Bonney Wind Farm	33	LKBONNY1	SMAY1	SMAY	0.8768	0.9352
Lake Bonney Wind Farm Stage 2	33	LKBONNY2	SMAY2	SMAY	0.8768	0.9352
Lake Bonney Wind Farm Stage 3	33	LKBONNY3	SMAY3W	SMAY	0.8768	0.9352
Leigh Creek Northern PS Load 2	33	NPSNL2	SLCCL	SLCC	1.0791	1.0482
Mintaro PS	132	MINTARO	SMPS	SMPS	0.9889	0.9736
Mt Millar Wind Farm	33	MTMILLAR	SMTM1	SMTM	0.9120	0.9016
North Brown Hill Wind Farm	275	NBHWF1	SBEL1A	SBEL	0.9863	0.9767
Northern PS Unit 1	275	NPS1	SNPA1	SNPS	1.0098	0.9826
Northern PS Unit 2	275	NPS2	SNPA2	SNPS	1.0098	0.9826
O.C.P.L. Unit 1	66	OSB-AG	SNBN1	SOCP	0.9994	0.9995
Pelican Point PS	275	PPCCGT	SPPT	SPPT	1.0009	1.0010
Playford Northern PS Load 1	132	NPSNL1	SPAAL	SPAA	1.0132	0.9929
Playford PS	275	PLAYB-AG	SPSD1	SPPS	1.0098	0.9881
Port Lincoln 3	33	POR03	SPL31P	SPL3	1.0064	0.8976
Port Lincoln PS	132	POR01	SPLN1	SPTL	1.0011	0.9520
Quarantine PS Unit 1	66	QPS1	SQPS1	SQPS	0.9864	0.9932
Quarantine PS Unit 2	66	QPS2	SQPS2	SQPS	0.9864	0.9932
Quarantine PS Unit 3	66	QPS3	SQPS3	SQPS	0.9864	0.9932
Quarantine PS Unit 4	66	QPS4	SQPS4	SQPS	0.9864	0.9932
Quarantine PS Unit 5	66	QPS5	SQPS5Q	SQPS	0.9864	0.9932
Snowtown WF Stage 2 - North	275	SNOWNTH1	SBLWS1	SBLW	0.9888	0.9782
Snowtown WF Stage 2 - South	275	SNOWSTH1	SBLWS2	SBLW	0.9888	0.9782
Snowtown Wind Farm	33	SNOWTWN1	SNWF1T	SNWF	0.9289	0.9198
Snuggery PS Units 1 to 3	132	SNUG1	SSGA1	SSPS	0.8417	0.9829
The Bluff wind Farm	275	BLUFF1	SBEL2P	SBEL	0.9863	0.9767
Torrens Island PS A Unit 1	275	TORRA1	STSA1	STPS	1.0014	1.0019
Torrens Island PS A Unit 2	275	TORRA2	STSA2	STPS	1.0014	1.0019
Torrens Island PS A Unit 3	275	TORRA3	STSA3	STPS	1.0014	1.0019
Torrens Island PS A Unit 4	275	TORRA4	STSA4	STPS	1.0014	1.0019
Torrens Island PS B Unit 1	275	TORRB1	STSB1	STPS	1.0014	1.0019
Torrens Island PS B Unit 2	275	TORRB2	STSB2	STPS	1.0014	1.0019
Torrens Island PS B Unit 3	275	TORRB3	STSB3	STPS	1.0014	1.0019
Torrens Island PS B Unit 4	275	TORRB4	STSB4	STPS	1.0014	1.0019
Torrens Island PS Load	66	TORNL1	STSYL	STSY	1.0000	1.0000
Waterloo Wind Farm	132	WATERLWF	SWLE1R	SWLE	0.9784	0.9764
Wattle Point Wind Farm	132	WPWF	SSYP1	SSYP	0.8185	0.8195

Table 14 South Australia Embedded Generation

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Amcor Glass UN 1	11	AMCORGR	SRSW1E	SRSW	1.0134	1.0111
Angaston Power Station	33	ANGAST1	SDRN1	SANG	1.0042	1.0061
Blue Lake Milling	33	BLULAKE1	SKET2B	SKET	0.9703	1.0062
Bolivar WWT Plant (NEW)	66	BOLIVAR1	SPGW1B	SPGW	1.0054	1.0045
Canunda Wind Farm	33	CNUNDAWF	SSNN1	SCND	0.8850	0.9432

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Cummins Lonsdale PS	66	LONSDALE	SMVE1	SMVE	1.0051	1.0075
Pedler Creek Landfill Gas PS	66	PEDLER1	SMVE5C	SMVE	1.0051	1.0075
Pt Stanvac Power Station	66	PTSTAN1	SMVE3P	SMVE	1.0051	1.0075
Starfish Hill Wind Farm	66	STARHLWF	SMVE2	SMVE	1.0051	1.0075
Tatiara Meat Co	33	TATIARA1	SKET1E	SKET	0.9703	1.0062
Terminal Storage Mini-Hydro	66	TERMSTOR	SNFD1	SNFD	1.0037	1.0042
Wingfield 1 LFG PS	66	WINGF1_1	SKLB1W	SKLB	1.0017	1.0029
Wingfield 2 LFG PS	66	WINGF2_1	SNBN2W	SNBN	0.9995	0.9998

1.5 Tasmania Marginal Loss Factors

Table 15 Tasmania Loads

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
Arthurs Lake	6.6	TAL2	1.0012	0.9911
Avoca	22	TAV2	1.0301	1.0167
Boyer SWA	6.6	TBYA	1.0322	1.0141
Boyer SWB	6.6	TBYB	1.0325	1.0223
Bridgewater	11	TBW2	1.0278	1.0143
Burnie	22	TBU3	0.9905	0.9835
Chapel St.	11	TCS3	1.0264	1.0132
Comalco	220	TCO1	1.0006	1.0006
Creek Road	33	TCR2	1.0276	1.0127
Derby	22	TDE2	0.9695	0.9566
Derwent Bridge	22	TDB2	0.9390	0.9438
Devonport	22	TDP2	0.9895	0.9874
Electrona	11	TEL2	1.0381	1.0235
Emu Bay	11	TEB2	0.9877	0.9811
Fisher (Rowallan)	220	TFI1	0.9755	0.9701
George Town	22	TGT3	1.0021	1.0025
George Town (Basslink)	220	TGT1	1.0000	1.0000
Gordon	22	TGO2	1.0155	0.9903
Greater Hobart Area VTN		TVN1	1.0287	1.0137
Hadspen	22	THA3	0.9988	0.9904
Hampshire	110	THM2	0.9865	0.9796
Huon River	11	THR2	1.0409	1.0179
Kermandie	11	TKE2	1.0435	1.0256
Kingston	33	TK13	1.0323	1.0179
Kingston	11	TKI2	1.0329	1.0200
Knights Road	11	TKR2	1.0455	1.0284
Lindisfarne	33	TLF2	1.0301	1.0164
Meadowbank	22	TMB2	0.9933	0.9828
Mornington	33	TMT2	1.0283	1.0145
Mowbray	22	TMY2	0.9971	0.9881
New Norfolk	22	TNN2	1.0244	1.0068
Newton	22	TNT2	0.9809	0.9603
Newton	11	TNT3	0.9710	0.9642

Location	Voltage (kV)	TNI	2016-17 MLF	2015-16 MLF
North Hobart	11	TNH2	1.0276	1.0119
Norwood	22	TNW2	0.9974	0.9884
Palmerston	22	TPM3	0.9951	0.9844
Port Latta	22	TPL2	0.9722	0.9589
Que	22	TQU2	0.9759	0.9731
Queenstown	11	TQT3	0.9730	0.9668
Queenstown	22	TQT2	0.9687	0.9633
Railton	22	TRA2	0.9895	0.9878
Risdon	33	TRI4	1.0305	1.0131
Risdon	11	TRI3	1.0351	1.0152
Rokeby	11	TRK2	1.0296	1.0175
Rosebery	44	TRB2	0.9753	0.9707
Savage River	22	TSR2	1.0049	1.0003
Scottsdale	22	TSD2	0.9791	0.9661
Smithton	22	TST2	0.9574	0.9414
Sorell	22	TSO2	1.0365	1.0207
St Leonard	22	TSL2	0.9964	0.9880
St. Marys	22	TSM2	1.0435	1.0324
Starwood	110	TSW1	1.0008	1.0010
Tamar Region VTN		TVN2	0.9982	0.9904
Temco	110	TTE1	1.0037	1.0041
Trevallyn	22	TTR2	0.9980	0.9886
Triabunna	22	TTB2	1.0533	1.0332
Tungatinah	22	TTU2	0.9417	0.9483
Ulverstone	22	TUL2	0.9888	0.9854
Waddamana	22	TWA2	0.9667	0.9644
Wayatinah	11	TWY2	1.0079	0.9927
Wesley Vale	22	TWV2	0.9810	0.9845

Table 16 Tasmania Generation

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Basslink (George Town)	220	BLNKTAS	TGT11	TGT1	1.0000	1.0000
Bastyan	220	BASTYAN	TFA11	TFA1	0.9496	0.9466
Bell Bay No.3	110	BBTHREE1	TBB11	TBB1	1.0001	0.9995
Bell Bay No.3	110	BBTHREE2	TBB12	TBB1	1.0001	0.9995
Bell Bay No.3	110	BBTHREE3	TBB13	TBB1	1.0001	0.9995
Bluff Point and Studland Bay Wind Farms	110	WOOLNTH1	TST11	TST1	0.9120	0.8944
Butlers Gorge	110	BUTLERSG	TBG11	TBG1	0.9399	0.9418
Catagunya	220	LI_WY_CA	TLI11	TLI1	1.0028	0.9915
Cethana	220	CETHANA	TCE11	TCE1	0.9723	0.9671
Cluny	220	CLUNY	TCL11	TCL1	1.0055	0.9933
Devils gate	110	DEVILS_G	TDG11	TDG1	0.9700	0.9719
Fisher	220	FISHER	TFI11	TFI1	0.9755	0.9701
Gordon	220	GORDON	TGO11	TGO1	0.9676	0.9400

Location	Voltage (kV)	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
John Butters	220	JBUTTERS	TJB11	TJB1	0.9456	0.9384
Lake Echo	110	LK_ECHO	TLE11	TLE1	0.9360	0.9338
Lemonthyme	220	LEM_WIL	TSH11	TSH1	0.9749	0.9746
Liapootah	220	LI_WY_CA	TLI11	TLI1	1.0028	0.9915
Mackintosh	110	MACKNTSH	TMA11	TMA1	0.9367	0.9381
Meadowbank	110	MEADOWBK	TMB11	TMB1	0.9756	0.9737
Musselroe	110	MUSSELR1	TDE11M	TDE1	0.9193	0.9039
Paloona	110	PALOONA	TPA11	TPA1	0.9754	0.9830
Poatina	220	POAT220	TPM11	TPM1	0.9929	0.9725
Poatina	110	POAT110	TPM21	TPM2	0.9824	0.9630
Reece No.1	220	REECE1	TRCA1	TRCA	0.9413	0.9425
Reece No.2	220	REECE2	TRCB1	TRCB	0.9390	0.9426
Repulse	220	REPULSE	TCL12	TCL1	1.0055	0.9933
Rowallan	220	ROWALLAN	TFI12	TFI1	0.9755	0.9701
Tamar Valley CCGT	220	TVCC201	TTV11A	TTV1	1.0000	0.9996
Tamar Valley OCGT	110	TVPP104	TBB14A	TBB1	1.0001	0.9995
Tarraleah	110	TARRALEA	TTA11	TTA1	0.9453	0.9432
Trevallyn	110	TREVALLN	TTR11	TTR1	0.9927	0.9857
Tribute	220	TRIBUTE	TTI11	TTI1	0.9437	0.9421
Tungatinah	110	TUNGATIN	TTU11	TTU1	0.9091	0.9404
Wayatinah	220	LI_WY_CA	TLI11	TLI1	1.0028	0.9915
Wilmot	220	LEM_WIL	TSH11	TSH1	0.9749	0.9746

Table 17 Tasmania Embedded Generation

Location	Voltage [kV]	DUID	Connection Point ID	TNI	2016-17 MLF	2015-16 MLF
Midlands PS	22	MIDLDPS1	TAV21M	TAV2	1.0301	1.0167
Remount	22	REMOUNT	TMY21	TVN2	0.9982	0.9904

2. CHANGES IN MARGINAL LOSS FACTORS

This section summarises changes in MLFs in 2016–17 from 2015–16 and the trends driving them.

The following major trends in the NEM dictated changes in MLFs in 2016–17 from 2015–16:

- Increased regional demand forecast in all regions.
- Increased demand forecast in southern Queensland, in particular driven by new Liquefied Natural Gas (LNG) load connections.
- Reduced thermal generation in South Australia due to the closure of Northern Power Station (PS) and mothballing of Torrens Island A PS, and reduction in capacity at Pelican Point.
- Reduced hydro generation forecast in Tasmania.
- Forecasted increased Basslink power transfers from Victoria to Tasmania.
- De-commissioning of Anglesea PS in Victoria.

These major trends dictated the following changes in modelled net power transfer on interconnectors:

- Increased power flow from Victoria to South Australia compared to the 2015-16 MLF study.
- Increased power flow from Victoria to Tasmania compared to the 2015-16 MLF study.
- Reduced power from Victoria to NSW compared to the 2015-16 MLF study.
- Increased power flow from Queensland to NSW compared to the 2015-16 MLF study.

These changes have a consequent effect on MLFs, in particular at locations geographically close to interconnectors.

2.1 Changes to Marginal Loss Factors in Queensland

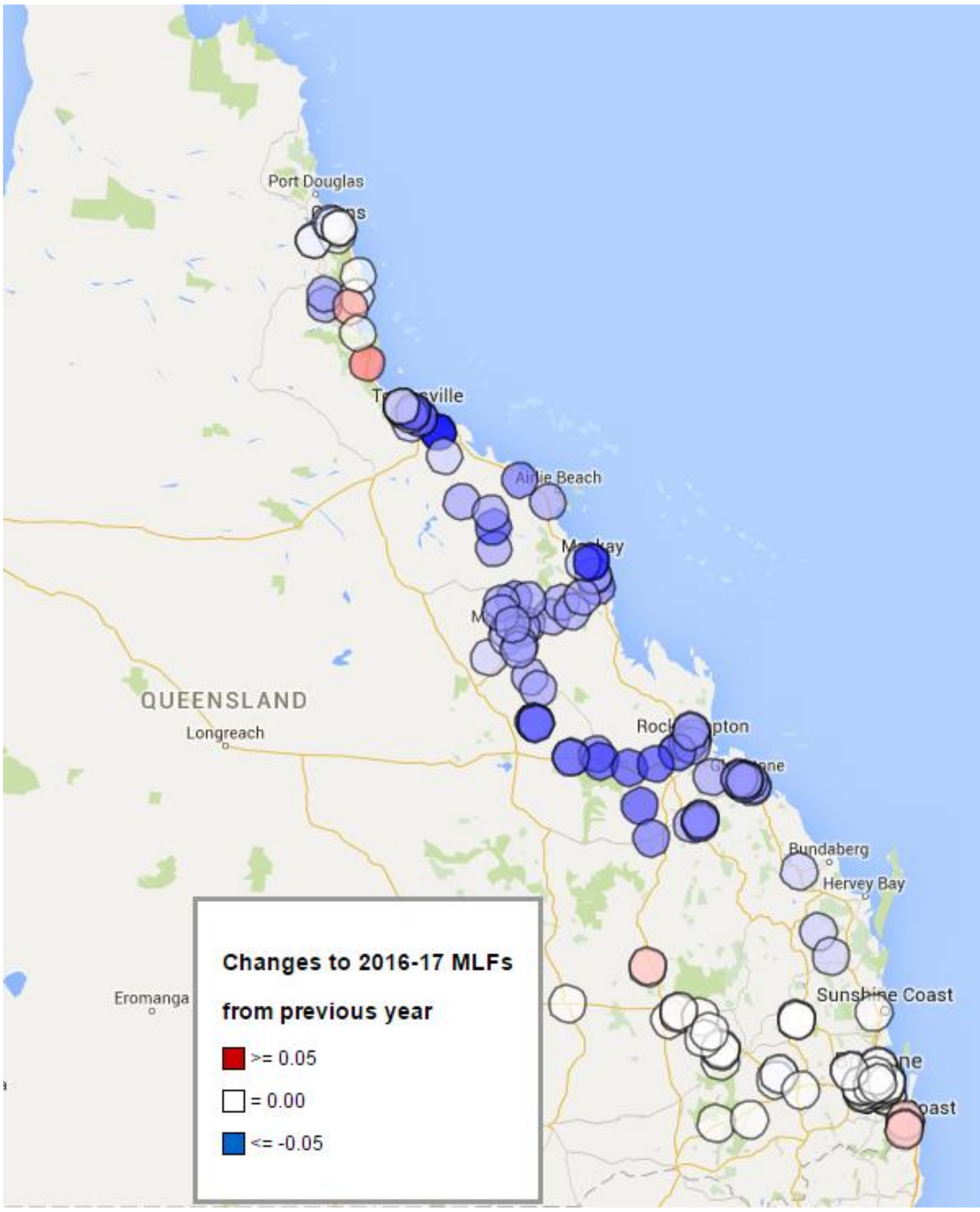
The 2016–17 forecast regional consumption in Queensland is 9.4% higher[5] than the forecast consumption modelled in the 2015–16 study, mostly due to the increase in LNG load connections in southern Queensland. The bulk of this forecast increased load is in southern Queensland.

Reduced generation in South Australia, due to the exit of Northern PS and reduced capacity at Pelican Point PS, has led to an increase in Queensland generation and exports compared to the 2015–16 MLF study.

The result of these two factors is an increase in power flow from northern and central Queensland toward the regional reference node; hence there is a general reduction in MLFs at connection points in central and northern Queensland.

Figure 1 shows the changes to MLFs at Queensland connection points in the 2016–17 study compared to the previous year.

Figure 1 Queensland changes to 2016–17 MLFs



[5] See Appendix B.2

2.2 Changes to Marginal Loss Factors in NSW

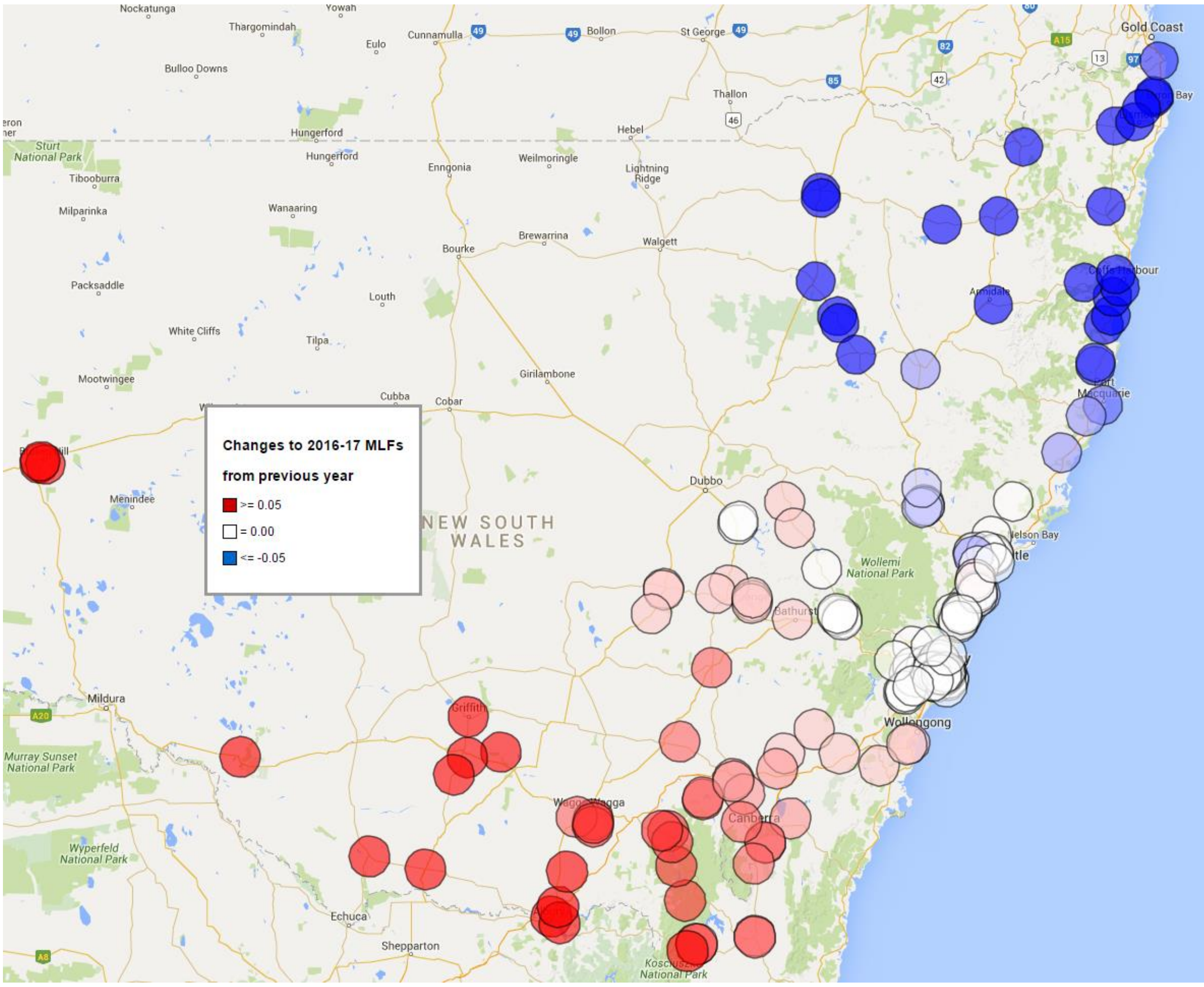
The NSW energy consumption forecast for 2016–17 has increased by 3.0% compared to the forecast consumption used in the 2015–16 MLF study. This increase in load, along with reduced generation in South Australia and Tasmania, has driven an increase in NSW generation.

Overall, NSW is importing more from Queensland and less from Victoria compared to the 2015–16 MLF study. As a result:

- MLFs at connection points in southern and western NSW have increased due to reduced power imports from Victoria.
- MLFs at connection points in northern NSW have reduced due to increased power imports from Queensland.

Figure 2 shows the changes to MLFs at NSW connection points in the 2016–17 study compared to the previous year.

Figure 2 NSW changes to 2016–17 MLFs



2.3 Changes to Marginal Loss Factors in Victoria

Forecast generation in Tasmania has reduced compared to the generation modelled in the 2015–16 MLF study (refer to section B.3.3). Modelled energy generation in South Australia is lower in the 2016–17 study than in the 2015-16 study due to retirement of thermal generation. This has resulted in increased transfers from Victoria to Tasmania and from Victoria to South Australia in the MLF model.

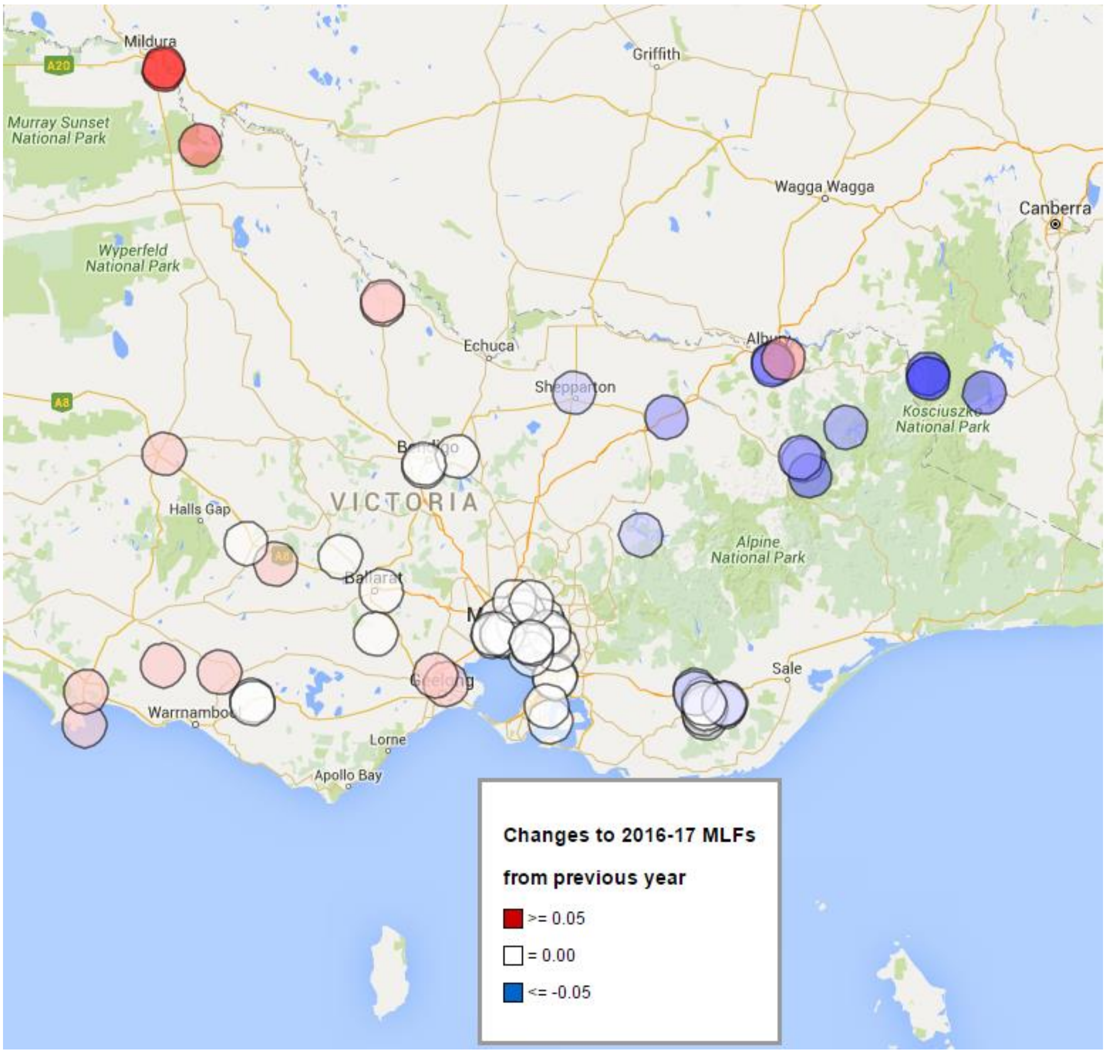
Victoria's energy consumption forecast for 2016–17 has increased compared to the 2015–16 MLF study, and Anglesea PS has been decommissioned. To balance supply and demand, an increase in generation in the Latrobe Valley was modelled.

In general, Victoria is exporting more energy to Tasmania and South Australia and exporting less energy to NSW compared to the 2015–16 MLF study. As a result:

- MLFs at connection points near the Victoria-NSW interconnector have reduced along with reduced power transfers from Victoria to NSW.
- MLFs at connection points near the Victoria-SA interconnector have increased due to increased power transfers from Victoria to South Australia.

Figure 3 shows the changes to MLFs at Victoria connection points in the 2016–17 study compared to the previous year.

Figure 3 Victoria changes to 2016–17 MLFs



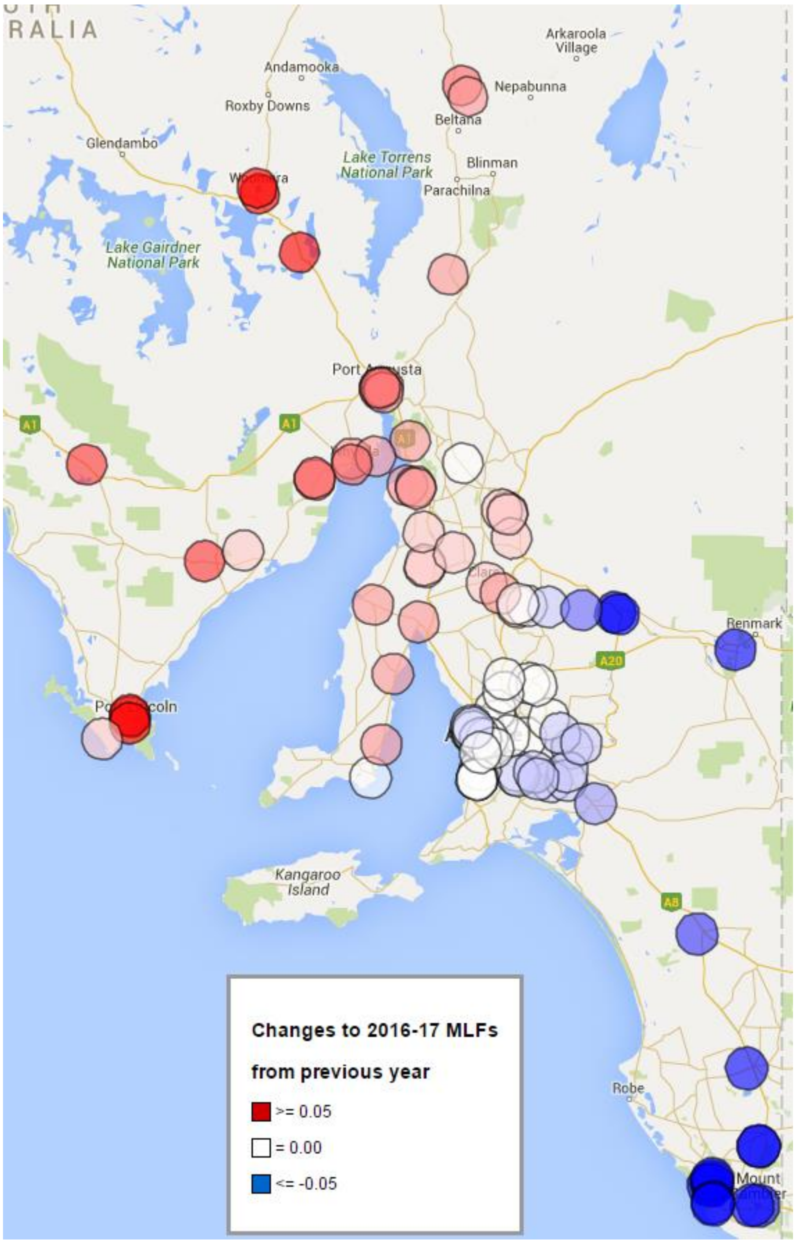
2.4 Changes to Marginal Loss Factors in South Australia

The South Australian energy consumption forecast for 2016–17 has increased by 3.7% compared to the 2015–16 MLF study. There has been a reduction in thermal generation due to the closure of Northern PS and Torrens Island A PS[6], and Pelican Point PS operating at half capacity. This has led to a large increase in South Australia import from Victoria in 2016–17. As a result:

- MLFs at connection points in south east SA and in the Riverland have reduced due to increased power transfers from Victoria to South Australia.
- MLFs at connection points in northern South Australia have increased due to the closure of Northern PS.

Figure 4 shows the changes to MLFs at South Australia connection points in the 2016–17 study compared to the previous year.

Figure 4 South Australia changes to 2016–17 MLFs



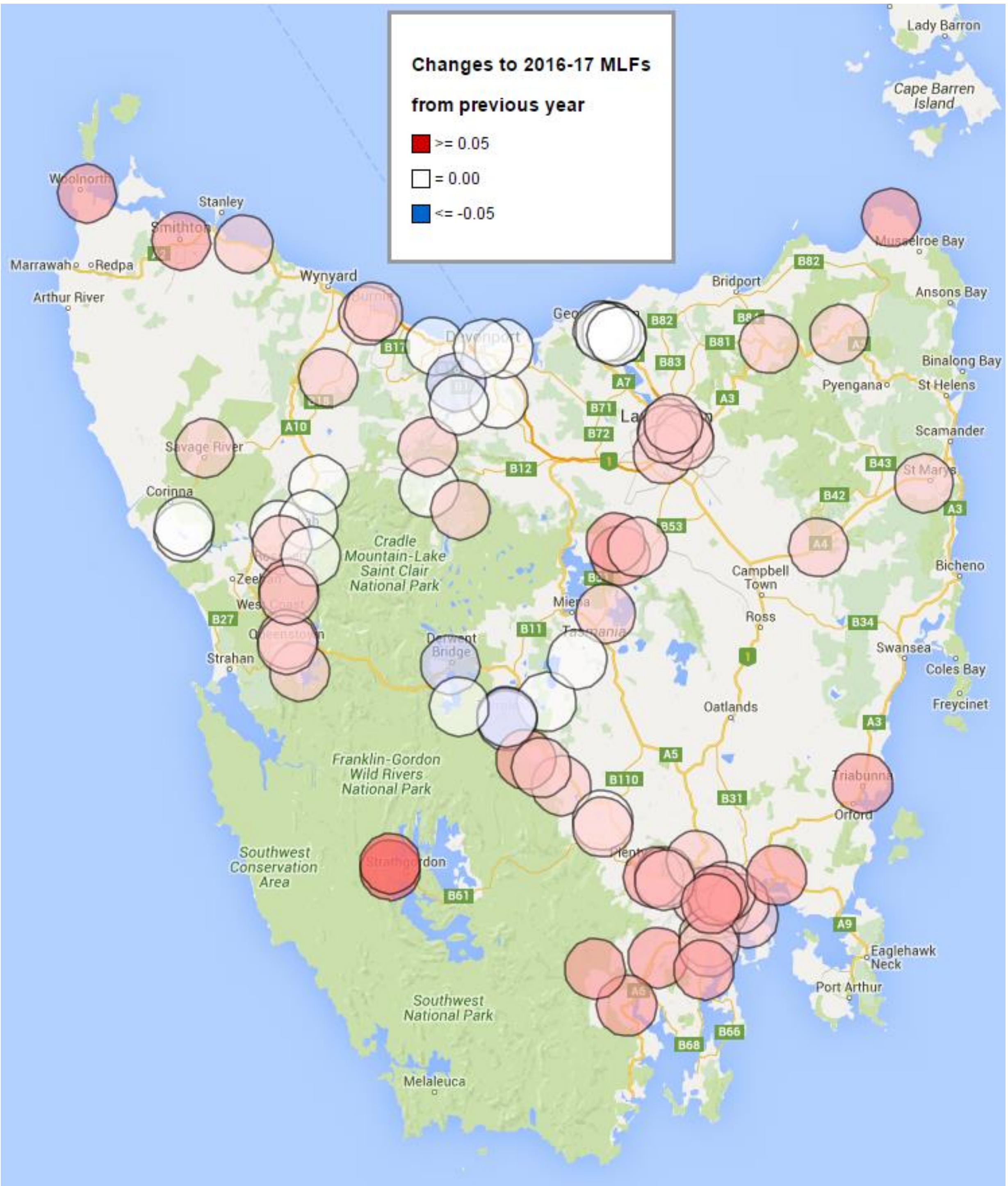
6 Torrens Island A PS is modelled in the 2016-17 MLF study until Winter 2017, http://www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information

2.5 Changes to Marginal Loss Factors in Tasmania

The Tasmanian energy consumption forecast for 2016–17 has increased compared to the 2015–16 MLF study. Forecast generation in Tasmania has reduced (refer to section B.3.3), resulting in increased imports from Victoria via Basslink. Consequently there has been a general increase in MLFs in Tasmania.

Figure 5 shows the changes to MLFs at Tasmania connection points in the 2016–17 study compared to the previous year.

Figure 5 Tasmania changes to 2016–17 MLFs



3. INTER-REGIONAL LOSS FACTOR EQUATIONS

This section describes inter-regional loss factor equations.

Inter-regional loss factor equations describe the variation in loss factor at one regional reference node (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)

= 0.9736 + 2.0138E-04*NQt - 3.2164E-06*Nd + 1.5402E-05*Qd

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

= 1.0498 + 1.7292E-04*VNt - 2.2596E-05*Vd + 6.7813E-06*Nd - 4.3624E-06*Sd

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

= 1.0201 + 4.0836E-04*VSAt + 2.1434E-06*Vd - 2.5713E-05*Sd

Where:

Qd = Queensland demand

Vd = Victorian demand

Nd = NSW demand

Sd = South Australian demand

NQt = transfer from NSW to Queensland

VNt = transfer from Victoria to NSW

VSAt = transfer from Victoria to South Australia

Figure 6 MLF (South Pine 275 referred to Sydney West 330)

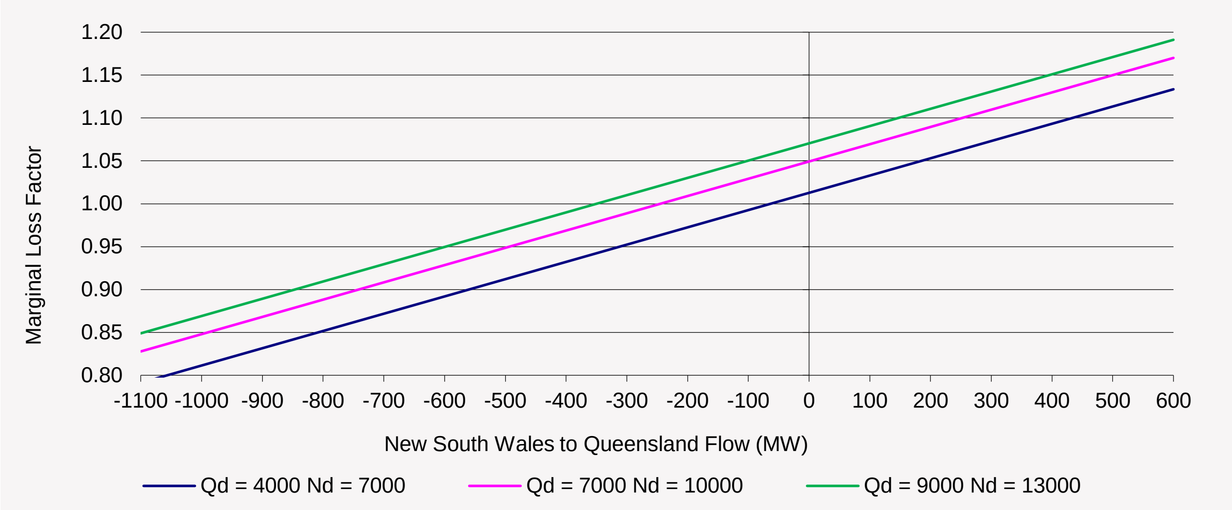


Table 18 South Pine 275 referred to Sydney West 330 MLF versus NSW to Queensland flow Coefficient statistics

Coefficient	Q_d	N_d	NQ_t	CONSTANT
Coefficient value	1.5402E-05	-3.2164E-06	2.0138E-04	0.9736
Standard error values for the coefficients	1.6508E-07	1.0996E-07	2.8653E-07	7.0481E-04
Coefficient of determination (R^2)	0.9784			
Standard error of the y estimate	0.0104			

Figure 7 MLF (Sydney West 330 referred to Thomastown 66)

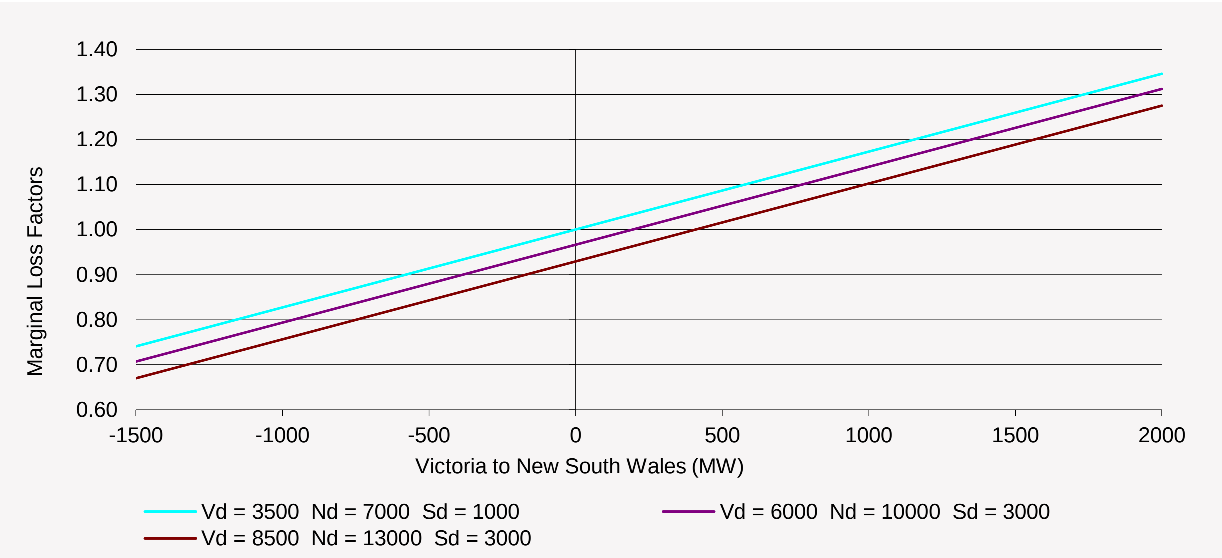


Table 19 Sydney West 330 referred to Thomastown 66 MLF versus Victoria to NSW flow Coefficient statistics

Coefficient	S_d	N_d	V_d	VN_t	CONSTANT
Coefficient value	-4.3624E-06	6.7813E-06	-2.2596E-05	1.7292E-04	1.0498
Standard error values for the coefficients	6.9235E-07	3.0840E-07	5.2291E-07	6.5127E-07	1.7953E-03
Coefficient of determination (R^2)	0.9242				
Standard error of the y estimate	0.0273				

Figure 8 MLF (Torrens Island 66 referred to Thomastown 66)

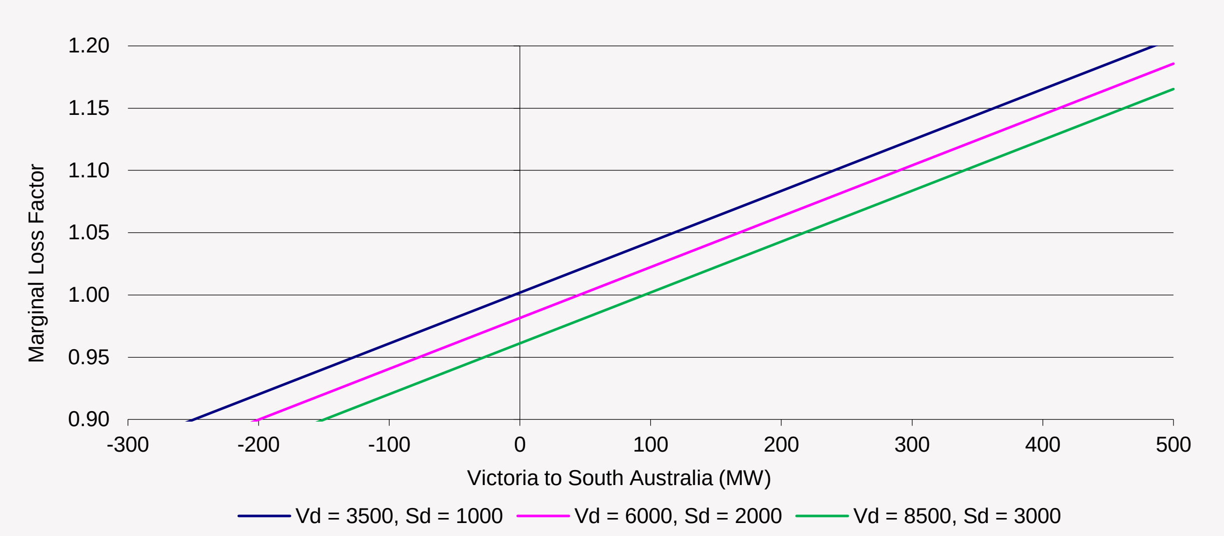


Table 20 Torrens Island 66 referred to Thomastown 66 MLF versus Victoria to South Australia flow Coefficient statistics

Coefficient	Sd	Vd	VSAt	CONSTANT
Coefficient value	-2.5713E-05	2.1434E-06	4.0836E-04	1.0201
Standard error values for the coefficients	8.2477E-07	2.9041E-07	1.3696E-06	1.0904E-03
Coefficient of determination (R2)	0.9387			
Standard error of the y estimate	0.0207			

4. INTER-REGIONAL LOSS EQUATIONS

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

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

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

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

$$= (-0.0264 - 3.2164E\text{-}06*Nd + 1.5402E\text{-}05*Qd)*NQt + 1.0069E\text{-}04*NQt^2$$

Sydney West 330 referred to Thomastown 66 notional link average losses

$$= (0.0498 - 2.2596E\text{-}05*Vd + 6.7813E\text{-}06*Nd - 4.3624E\text{-}06*Sd)*VNt + 8.6458E\text{-}05*VNt^2$$

Torrens Island 66 referred to Thomastown 66 notional link average losses

$$= (0.0201 + 2.1434E\text{-}06*Vd - 2.5713E\text{-}05*Sd)*VSAt + 2.0418E\text{-}04*VSAt^2$$

Where:

Qd = Queensland demand

Vd = Victorian demand

Nd = NSW demand

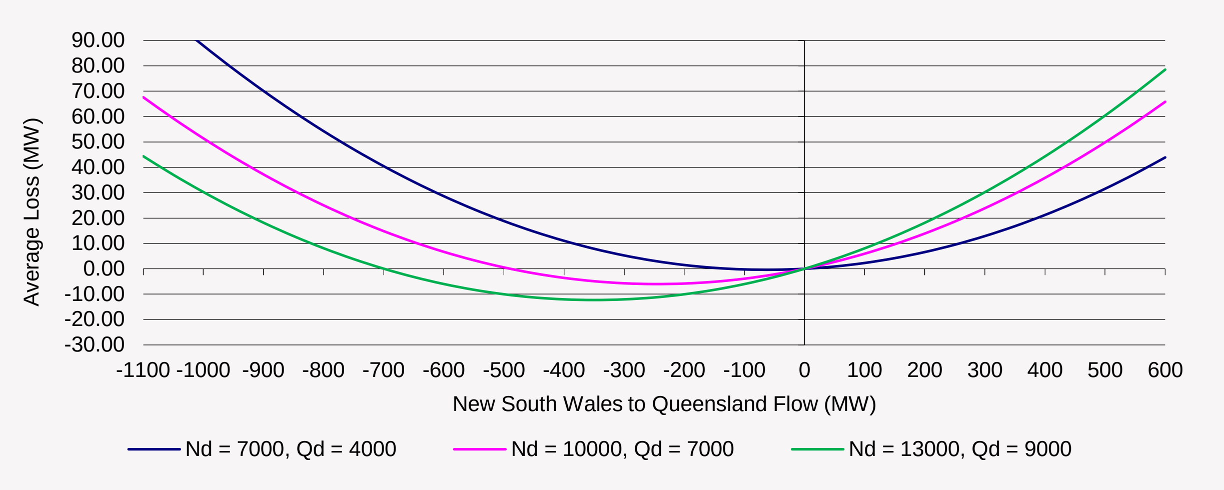
Sd = South Australia demand

NQt = transfer from NSW to Queensland

VNt = transfer from Victoria to NSW

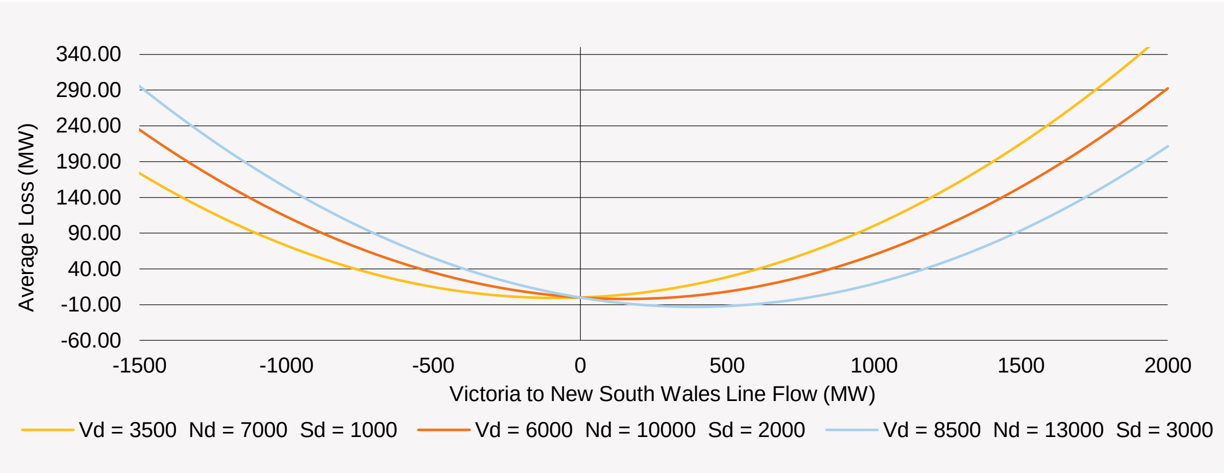
VSAt = transfer from Victoria to South Australia

Figure 9 Average Losses for New South Wales - Queensland Notional Link



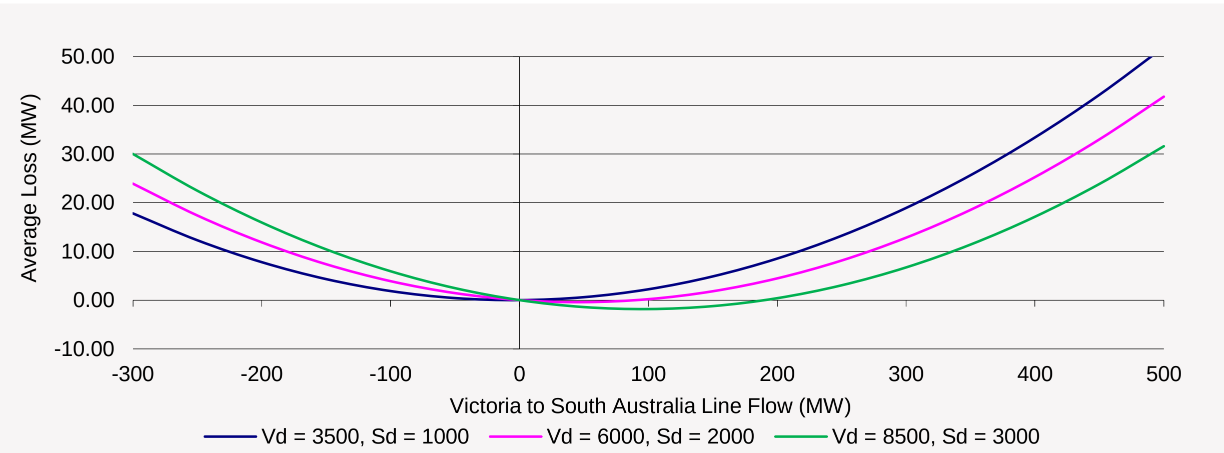
NSW to Queensland notional link losses versus NSW to Queensland notional link flow

Figure 10 Average Losses for Victoria - New South Wales Notional Link



Victoria to NSW notional link losses versus Victoria to NSW notional link flow

Figure 11 Average Losses for Victoria – SA National Link



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

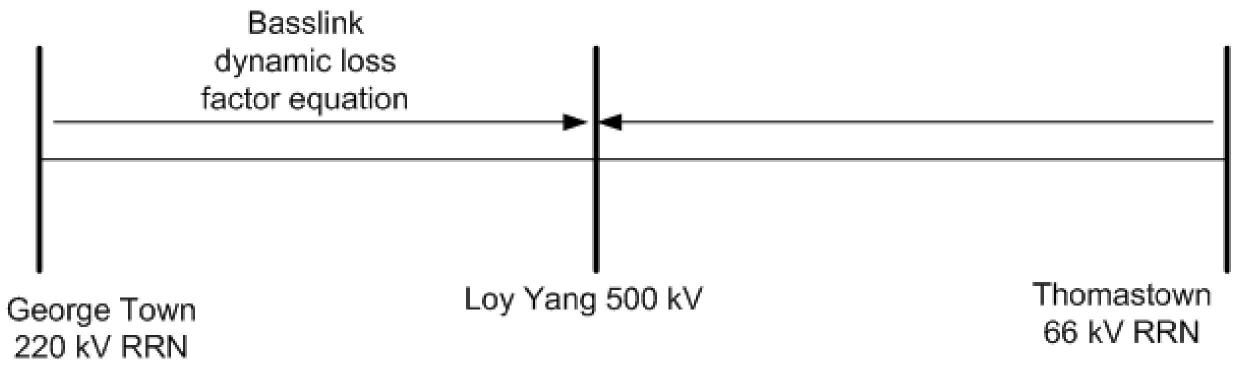
5. BASSLINK, TERRANORA, MURRAYLINK LOSS EQUATIONS

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 portions:

- George Town 220 kV MLF referred to Tasmania RRN = 1.0000
- Basslink (Loy Yang PS Switchyard) 500 kV MLF referred to Victorian RRN = 0.9765.
- 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.



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:

$$P_{(send)} = P_{(receive)} + [(-3.92x10^{-3}) * P_{(receive)} + (1.0393x10^{-4}) * P_{(receive)}^2 + 4]$$

Where:

$P_{(send)}$: Power in MW measured at the sending end,

$P_{(receive)}$: Power in MW measured at the receiving end.

The model is limited from 40MW to 630MW. When the model falls below 40MW, 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 Australia regions.

The losses between the Red Cliffs 220 kV and Monash 132 kV connection points is 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:

$$\text{Murraylink MLF (Torrens Island 66 referred to Thomastown 66)} = 1.0494 + 2.8180E\text{-}03*Flow_t$$

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:

Coefficient	$Flow_t$	CONSTANT
Coefficient Value	2.8180E-03	1.0494
Standard error values for the coefficient	3.6384E-06	4.5754E-04
Coefficient of determination (R2)	0.9716	
Standard error of the y estimate	0.0358	

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

$$\text{Murraylink loss} = 0.0494*Flow_t + 1.4090E\text{-}03*Flow_t^2$$

Figure 12 Murraylink MLF (Torrens Island 66 referred to Thomastown 66)

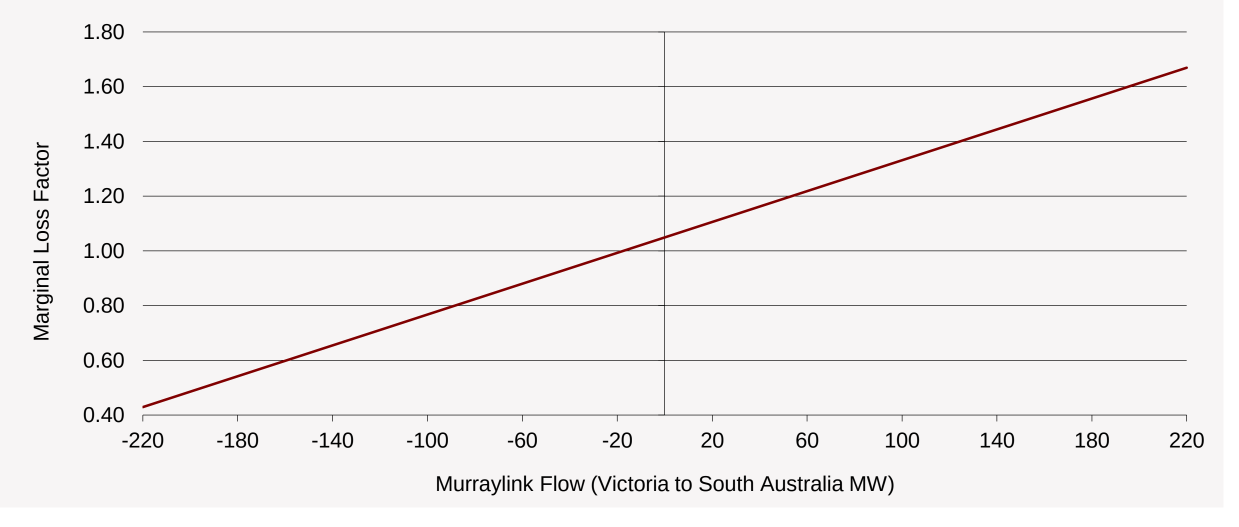
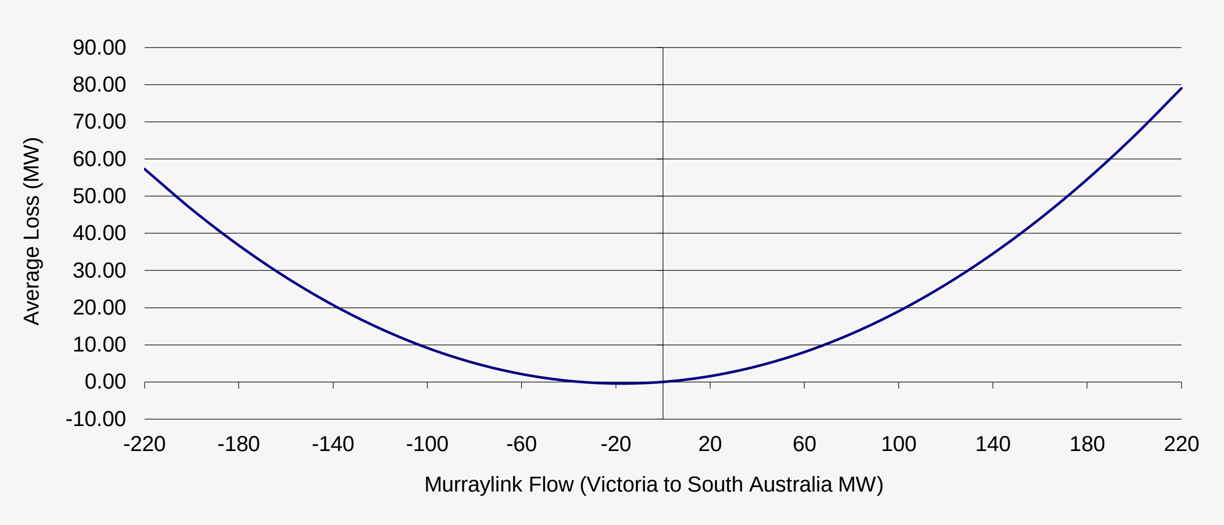


Figure 13 Average Losses for Murraylink Interconnector (Torrens Island 66 referred to Thomastown 66)



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 NSW 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 NSW and Queensland regions.

The losses between the Mullumbimby 132 kV and Terranora 110 kV connection points is 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) = 1.1021 + 2.1079E-03*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.

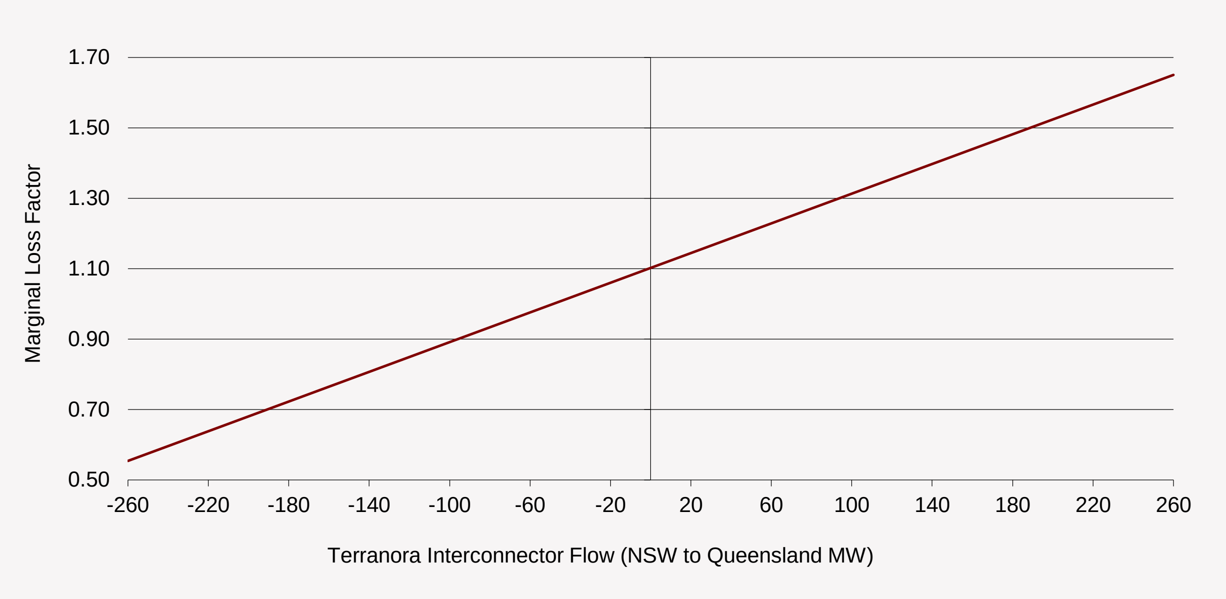
The regression statistics for this Terranora loss factor model are presented in the following table:

Coefficient	Flow_t	CONSTANT
Coefficient Value	2.1079E-03	1.1021
Standard error values for the coefficient	4.2758E-06	5.2598E-04
Coefficient of determination (R2)	0.9328	
Standard error of the y estimate	0.0350	

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

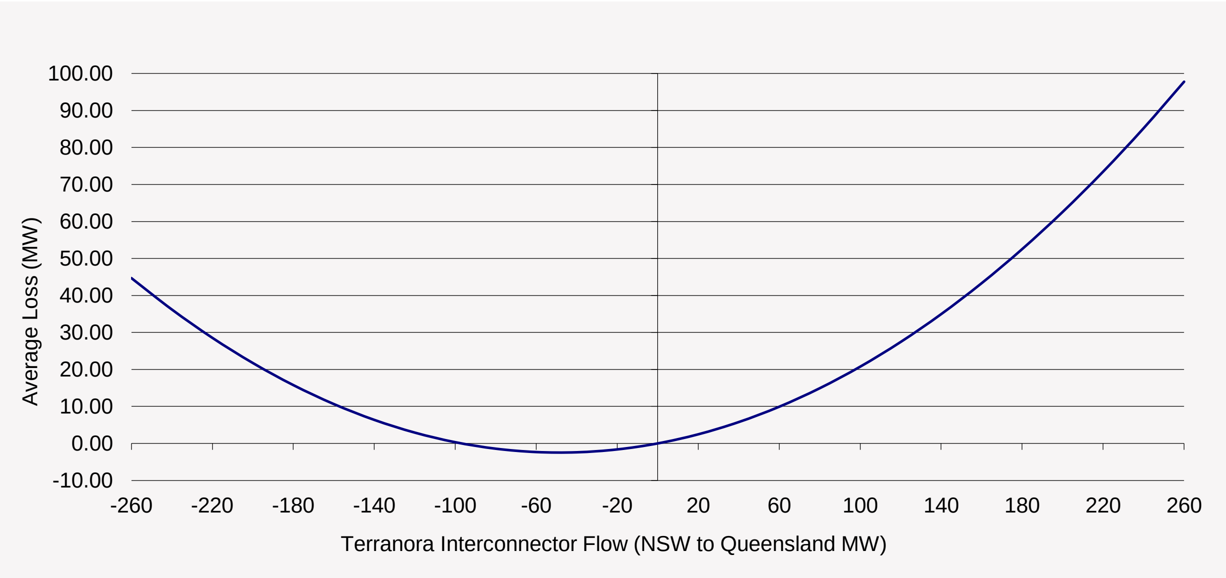
$$\text{Terranora loss} = 0.1021*\text{Flow}_t + 1.0540\text{E-}03*\text{Flow}_t^2$$

Figure 14 Terranora Interconnector MLF (South Pine 275 referred to Sydney West 330)



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

Figure 15 Average Losses for Terranora Interconnector (South Pine 275 referred to Sydney West 330)



Terranora interconnector notional link losses versus flow (NSW 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 portion 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 portion inter-regional losses to the associated regions for the 2016–17 financial year:

Notional interconnector	Proportioning factor	Applied to
Queensland – NSW (QNI)	0.50	NSW
Queensland – NSW (Terranora Interconnector)	0.52	NSW
Victoria – NSW	0.35	Victoria
Victoria – South Australia (Heywood)	0.73	Victoria
Victoria – South Australia (Murraylink)	0.79	Victoria

7. REGIONS AND REGIONAL REFERENCE NODES

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

7.1 Regions and Regional Reference Nodes

Region	Regional Reference Node
Queensland	South Pine 275kV node
NSW	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 NSW regions

- At Dumaresq Substation on the 8L and 8M Dumaresq to Bulli Creek 330kV lines;[7]
- 10.8km 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 NSW 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.

7.2.4 Between the Victoria and Tasmania regions

Basslink is not a regulated interconnector with the following metering points:

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

[7] The metering at Dumaresq is internally scaled to produce an equivalent flow at the NSW/Queensland State borders.

8. VIRTUAL TRANSMISSION NODES

This section shows the configuration of the different virtual transmission nodes (VTNs).

VTNs are aggregations of transmission nodes for which a single MLF is applied. AEMO has considered the following VTNs.

8.1 NSW 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, Kurri 11, Kurri 33, Kurri 132, Newcastle 132, Munmorah 330, Munmorah 33, Vales Pt. 132, Beresfield 33, Charmhaven 11, Gosford 33, Gosford 66, West Gosford 11, Ourimbah 33, Ourimbah 66, Ourimbah 132, Tomago 132, Tuggerah 132, Somersby 11, BHP Waratah 132 and Wyong 11
NEV3	South of Broken Bay	Sydney North 132 (Ausgrid), Lane Cove 132, Meadowbank 11, Mason Park 132, Homebush Bay 11, Chullora 132 kV, Chullora 11, Peakhurst 132, Peakhurst 33, Drummoyne 11, Rozelle 33, Pyrmont 132, Pyrmont 33, Marrickville 11, St Peters 11, Beaconsfield West 132, Canterbury 33, Bunnerong 33, Bunnerong 132, Sydney East 132, Sydney West 132 (Ausgrid) and Sydney South 132, Macquarie Park 11, Rozelle 132, Top Ryde 11, RookWood Road, Kurnell 132, Belmore Park 132, Green Square 11, and Haymarket 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

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

APPENDIX A. BACKGROUND TO MARGINAL LOSS FACTORS

This section summarises the method and interpretation AEMO uses to account for electrical 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 as the basis for setting electricity prices that also require 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 in order 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 the MLFs to determine dispatch of generation.

Dynamic inter-regional loss factor equations calculate the losses between regions. Depending on the flows between regions, the 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.

A.1 Rules requirements for the Marginal Loss Factor calculation

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.

Clause 3.6 of the Rules requires AEMO to calculate the MLFs and inter-regional loss factor equations by 1 April each year that will apply for the next financial year.

Clauses 3.6.1, 3.6.2 and 3.6.2(A) specify the requirements for calculating the MLFs and inter-regional loss factor equations, 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.

A.2 Interpretation 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.

A.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 them 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, this means that 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 this 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.

A.2.2 Marginal Loss Factors less than 1.0

Losses increase with distance, so the further 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 the existing net flow. At any instant, when the additional flow is against the net flow, total losses on the network 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 the local load.

Using the example above, if the 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.

A.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 customer at a connection point with an MLF of 1.05 purchases $1000 of electricity. The MLF of 1.05 multiplies the purchase value to 1.05 x 1000 = $1050. The higher purchase value covers the cost of the electrical losses in transporting electricity to the customer’s connection point from the RRN.

A Generator at a connection point with an MLF of 0.95 sells $1000 of electricity. The MLF of 0.95 multiplies the sales value to 0.95 x 1000 = $950. The lower sales value covers the cost of the electrical losses in transporting electricity from the 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.

APPENDIX B. 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.

AEMO uses a forward-looking loss factor (FLLF) methodology for calculating MLFs[8]. Appendix B provides a summary of this procedure along with key assumptions, required for the procedure, for the 2016–17 MLF calculation.

B.1 Marginal Loss Factors calculation methodology

The FLLF methodology uses the principle of "minimal extrapolation". An overview of the steps in this methodology is:

- 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 the FLLF Methodology.
- Calculate the MLFs using the resulting power flows in the transmission network.

B.2 Load data requirements for the Marginal Loss Factors calculation

The annual energy targets used in load forecasting for the 2016–17 MLF calculation are in the table below:

Region	2016–17 forecast sent-out energy[9] (GWh)	2015–16 forecast sent-out energy[10] (GWh)
NSW	67,755	65,780
Victoria	43,672	42,470
Queensland	54,194[11]	49,546
South Australia	12,922	12,466
Tasmania	10,344	9,903

B.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 exist in the data.

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

- The consumption forecast is consistent with the National Electricity Forecasting Report (NEFR) 2015.

8 http://aemo.com.au/Electricity/Market-Operations/Loss-Factors-and-Regional-Boundaries/Methodology-for-Calculating-ForwardLooking-Transmission-Loss-Factors

9 Forecast Operational consumption – as sent out used for the 2016-17 MLF calculation. It was sourced from the 2015 NEFR, and adjusted as required for the 2016-17 MLF study.

10 Forecast Operational consumption – as sent out used for the 2015-16 MLF calculation. It was sourced from the 2014 NEFR, and adjusted as required for the 2015-16 MLF study.

11 2016-17 forecast energy for Queensland is based on the 2015 NEFR update, published in December 2015.

- Load profiles are reasonable, and that the drivers for load profiles that have changed from the historical data are identifiable.
- The forecast for connection points includes any relevant embedded generation.
- Industrial and auxiliary type loads are scaled to meet industrial load forecasts for each individual load.

B.3 Generation data requirements for the Marginal Loss Factor calculation

AEMO obtains historical generation active power (MW) and reactive power (MVAr) data for each trading interval (half-hour) covering every generation connection point in the NEM from 1 July 2014 to 30 June 2015 from its settlements database.

AEMO also obtains the following data:

- Generation capacity data from AEMO's Generation Information page[12]; and
- Historical generation availability, as well as and on-line and off-line status data from AEMO's Market Management System (MMS).

B.3.1 New generating units

For new generating units, AEMO calculates the initial estimate of the output by identifying similar technology and fuel type in accordance with section 5.4.2 of the Methodology.

For generating units with an incomplete year of generation data from the previous financial year, AEMO uses a combination of existing and estimated data.

Queensland new generating units

There are no new committed generation projects in Queensland in 2016-17.

NSW new generating units

Tahmoor PS, Moree Solar Farm, Broken Hill Solar Farm and Nyngan Solar Farm are included.

Victoria new generating units

Ararat Wind Farm and Coonooer Bridge Wind Farm are included.

South Australia new generating units

Hornsdale Wind Farm Stage 1 is included.

Tasmania new generating units

There are no committed generation projects in Tasmania in 2016–17.

B.3.2 Removed generating units

Relevant NSPs advised of the following removed generating units in 2016–17:

- Collinsville and Swanbank E PS in Queensland.
- Redbank and Wallerawang C PS in NSW.
- Anglesea PS in Victoria.
- Northern, Playford B and Torrens Island A PS in South Australia.

[12] http://aemo.com.au/Electricity/Planning/Related-Information/Generation-Information, updated 10 March 2016

B.3.3 Abnormal generation patterns

Due to changes in physical circumstances (reduction in rainfall and storage levels), generation in Tasmania is expected to decrease in 2016–17 compared to 2014–15. Hydro Tasmania has provided expected generation profiles for the 2016–17 MLF calculation in accordance with section 5.5.6 of the Methodology.

Based on new developments following the fault on Basslink interconnector on 20 December 2015, AEMO requested a further update to forecast generation profiles from Hydro Tasmania in accordance with section 5.9 of the methodology.

AEMO has used the adjusted generation profiles to replace the historical profiles as an input to the 2016–17 MLF calculation process. AEMO used its best endeavours to ensure the 2016–17 MLF calculation was an accurate representation of the expected system conditions, and made corresponding adjustments to historical Basslink flows in accordance with section 5.3.1 of the Methodology.

The table below shows the historical and adjusted generation values aggregated quarterly and on a sub-regional level.

	Historical Generation (GWh)		**Adjusted Generation (GWh)**	
	Northern Tasmania	Southern Tasmania	Northern Tasmania	Southern Tasmania
Jul - Sep	1824	1097	1733	1008
Oct - Dec	1130	630	1036	629
Jan - Mar	989	657	1026	635
Apr - Jun	1801	946	1783	916
Total	**5744**	**3330**	**5578**	**3188**

B.4 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 accurately represent all normally connected equipment. AEMO also checks switching arrangements for the Victorian Latrobe Valley’s 220 kV and 500 kV networks to ensure they reflect normal operating conditions.

AEMO adds relevant network augmentations that will occur in the 2016–17 financial year. The snapshot is thus representative of the 2016–17 normally-operating power system.

B.4.1 Network augmentations for 2016–17

Relevant Transmission Network Service Providers (TNSPs) advised of the following network augmentations in 2016–17:

Queensland network augmentations

Powerlink provided the following list of network augmentations in 2016–17 in Queensland:

- Decommissioning of the two Mackay – Proserpine 132 kV lines.
- Closing of 132 kV bus coupler at Proserpine.
- Switching of the existing Nebo – Mackay 132 kV line at Pioneer Valley, to create Nebo – Pioneer Valley and Pioneer Valley – Mackay 132 kV lines.
- Mackay 132 kV bus split.
- Installation of a new capacitor bank at Moranbah 132 kV (50 MVAr).

- Replacement of one 132/66 kV transformer at Moranbah, and decommissioning of one 132/66 kV transformer.

NSW network augmentations

NSW NSPs provided the following list of network augmentations in 2016–17 in NSW:

- Establishment of new North Sydney 132/11 kV Substation and decommissioning of 33/11 kV Substation.
- Decommissioning of three 132/66/11 kV transformers at Cooma and installation of two new 132/66/11 kV transformers.
- Decommissioning of two SVCs at Kemps Creek and commissioning of a shunt reactor (100 MVAr).
- Establishment of new Engadine 132/33/11 kV Substation.
- Establishment of new Kurnell 132/11 kV Substation and decommissioning of 33/11 kV substation.
- Replacement of two 220 kV reactors at Broken Hill (25 MVAr each)
- Reconstructing a portion of line between Burrinjuck and Yass, and therefore changing the line impedance.
- Replacement of Tamworth 132/66 kV Substation, and replacement of three 132/66/11 kV transformers with two new 132/66/11 kV transformers.
- Decommissioning of two 330/132 kV transformers at Beaconsfield West and commissioning of a new 330/132 kV transformer.
- Replacement of a 132/66 kV transformer at Wagga.
- Establishment of Rookwood Tees between Chullora and Potts Hills, and disconnection of lines in Bankstown, Greenacre, Chullora and Mason Park.
- Installation of a 132 kV feeder between Beaconsfield and Belmore Park.

Victoria network augmentations

AEMO's Victorian Planning Group provided the following list of network augmentations in 2016–17 in Victoria.

- Establishment of a new 66 kV supply point with three 220/66 kV transformers at Brunswick.
- Installation of a new 220 kV line between Ballarat and Moorabool.
- Installation of a new capacitor bank at Keilor (50 MVAr).
- Installation of a third 500/275 kV transformer at Heywood.

South Australia network augmentations

ElectraNet provided the following list of network augmentations in 2016–17 in South Australia:

- Replacement of Neuroodla substation.
- Installation of second 132/33 kV transformer at Dalrymple.
- Uprating of thermal ratings between South East to Tailem Bend, and Tailem Bend to Tungkillo.
- Establishment of series compensation on South East to Tailem Bend lines, disconnection of Keith to Snuggery and Keith to Tailem Bend lines.

Tasmania network augmentations

TasNetworks provided the following list of network augmentations to in 2016–17 in Tasmania:

- Upgrading of Sheffield Substation, and increasing the thermal rating of Sheffield to George Town 220 kV lines.

B.4.2 Treatment of the 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. Section 5 outlines the loss model for Basslink.

B.4.3 Treatment of the Terranora interconnector

The Terranora interconnector is a regulated interconnector.

The boundary between Queensland and NSW 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.

Section 5 outlines the inter-regional loss factor equation for the Terranora interconnector.

B.4.4 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.

Section 5 outlines the inter-regional loss factor equation for Murraylink.

B.4.5 Treatment of Yallourn Unit 1

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

EnergyAustralia informed AEMO that the switching pattern for 2016–17 will differ significantly from the historical switching pattern for Yallourn Unit 1. AEMO, in consultation with AusNet Services, accepted the proposed switching profile provided by EnergyAustralia, and has used it as an input to the 2016–17 MLF calculation.

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.

B.5 Interconnector capability

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 on whether there were any additional factors that might influence these limits.

From region	To region	Summer peak (MW)	Summer off-peak (MW)	Winter peak (MW)	Winter off-peak (MW)
Queensland	NSW	1078	1078	1078	1078
NSW	Queensland	400	550	400	550
NSW	Victoria	1700 minus Murray Generation	1700 minus Murray Generation	1700 minus Murray Generation	1700 minus Murray Generation
Victoria	NSW	3200 minus Upper & Lower Tumut Generation	3000 minus Upper & Lower Tumut Generation	3200 minus Upper & Lower Tumut Generation	3000 minus Upper & Lower Tumut Generation
Victoria	South Australia[a]	650	650	650	650
South Australia	Victoria[a]	650	650	650	650
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)[b]	594	594	594	594
Victoria (Basslink)	Tasmania (Basslink)[b]	478	478	478	478

a Victoria to South Australia and South Australia to Victoria limits have changed due to the inclusion of the third transformer at Heywood.
b Limit referring to the receiving end.

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 the peak periods, which corresponds to 7 AM to 10 PM on weekdays.

B.6 Calculation of Marginal Loss Factors

AEMO uses the TPRICE[13] software to calculate MLFs. The TPRICE MLF calculation method is as follows:

- It converts 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.
- It adjusts the load flow case to ensure a reasonable voltage profile in each region at times of high demand.
- It converts the load flow case into a format suitable for use in TPRICE.
- The half-hourly generation and load data for each connection point, generating unit capacity and availability data, together with interconnector data feed into TPRICE one trading interval at a time. TPRICE allocates the load and generation values to the appropriate connection points in the load flow case.

[13] 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.

- It iteratively dispatches generation to meet forecast demand and solves each half-hourly load flow case and calculates the loss factors appropriate to the load flow conditions.
- The loss factors at each connection point in each region are referred to the RRN.
- It averages the loss factors for each trading interval and for each connection point using volume weighting.

Typically, the MLF calculation weights generation loss factors against generation output and load loss factors against load consumption. However, where load and generation are connected at the same connection point and individual metering is not available for the separate components, the same loss factor is calculated for both generation and load.

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.

AEMO will also make the MLFs available in an Excel spreadsheet.[14]

B.6.1 Inter-regional loss factor equations

The inter-regional loss factor equations applying for the 2016–17 financial year are provided in section 3. AEMO derives these equations by applying linear regression to the set of loss factor data for the RRNs. To meet the requirements of the AEMO dispatch algorithm, the choice of variables and equation formulation is restricted:

- Only linear terms are permitted in the equation.
- Only the notional link flow between the RRNs for which the loss factor difference is being determined is used.
- Region demands are allowed as equation variables.
- Other variables such as generation outputs are not used.

Graphs of variation in inter-regional loss factors with notional link flow are in section 3.

The inter-regional loss equations obtained by integrating the (inter-regional loss factor – 1) function are in section 4.

The inter-regional loss equations for Basslink, Terranora and Murraylink are in section 5.

The factors used to apportion the inter-regional losses to the associated regions for 2016–17 are in section 6.

B.6.2 Marginal Loss Factor calculation – quality control

AEMO engaged Ernst and Young (EY) to perform parallel calculations of MLFs using the FLLF methodology as published by AEMO. EY does not audit or review the AEMO MLF outcomes. Rather EY's parallel MLF calculations are used as an additional quality control measure to identify instances where there are differences between the results of the two parties.

The parallel calculation of MLFs undertaken by EY uses a two-step process:

- The **Benchmark study** – where MLFs are calculated for generators and major industrial loads using primarily publicly available sources of information. There are some inputs that rely on data provided by AEMO. EY has reviewed and provided comment on these data inputs.
- The **Verification study** – where MLFs are calculated for all generation and load connection points using the complete AEMO dataset. EY processes this information and calculate MLFs for all generation and load connection points using the PowerWorld software.

The objective of EY's analysis is to compare the outcomes of both the benchmark and verification studies with the MLFs calculated by AEMO.

[14] Available on the AEMO website

At no stage does EY provide any audit or review of the internal processes used by AEMO to calculate MLFs. In conducting the benchmark and verification studies, EY has not identified any outcomes from the final set of MLFs calculated by AEMO that would indicate that AEMO is not complying with the FLLF methodology. Where differences in MLF outcomes are found to exist, as described above, EY has commented on the outputs provided as part of the verification study and applied professional scepticism to the AEMO procedures.

EY has undertaken similar reviews to that described above for a number of years. At the cessation of each review period, EY has provided to AEMO recommendations in regard to the calculation process.

GLOSSARY

Term	Definition
ACT	Australian Capital Territory
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
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
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
RRP	Regional Reference Price
Rules	National Electricity Rules
TNI	Transmission Node Identity
TNSP	Transmission Network Service Provider
VTN	Virtual Transmission Node