APPENDIX J – PRICE LIMITS AND CONSTRAINT VIOLATION PENALTIES

J.1 MAXIMUM AND MINIMUM PRICES

J.1.1 The lower limit on *energy* prices in *standing offers*, *offer variations* or *settlements* shall be:

EnergyPriceMin

J.1.2 The upper limit on *energy* prices in *standing offers*, *offer variations* or *settlements* shall be:

EnergyPriceMax

J.1.3 The upper limit on *regulation* prices in *standing offers*, *offer variations* or *settlements* shall be:

RegPriceMax

J.1.4 The upper limit on *reserve* prices for primary *reserve* in *standing offers*, *offer variations* or *settlements* shall be:

Res1PriceMax

J.1.5 The upper limit on *reserve* prices for secondary *reserve* in *standing offers*, *offer variations* or *settlements* shall be:

Res2PriceMax

J.1.6 The upper limit on *reserve* prices for contingency *reserve* in *standing offers*, *offer variations* or *settlements* shall be:

Res3PriceMax

Explanatory Note: The lower limit on prices for regulation and all classes of reserve is zero.

J.1.7 Price bound values:

Parameter	Value
EnergyPriceMin	0.9 * CDC
EnergyPriceMax	0.9 * VoLL
RegPriceMax	0.55 * VoLL
Res1PriceMax	0.85 * VoLL
Res2PriceMax	0.75 * VoLL
Res3PriceMax	0.65 * VoLL

Explanatory Note:

"Value of Lost Load" (VoLL) is specified in Appendix 6J.2.

"Cost of Decommitment" (CDC) is specified in Appendix 6J.2.

Price bounds are applied at Market Network Nodes.

Energy price bounds should be less than the first block of the violation penalties for deficit energy, by at least the maximum expected marginal loss between any two points in the system. Otherwise load shedding could be recommended by the market clearing engine at some nodes because of the losses between those nodes and the generation facility nodes, even though not all generation capacity has been utilised.

J.2 VoLL AND CDC

The following information will form part of the input data for the *market clearing engine* in accordance with section B.8 of Appendix 6B:

Value of Lost Load (VoLL)	=	$5,000/MWh
Cost of Decommitment (CDC)	=	-$5,000/MWh

J.3 MAPPING OF VIOLATION PENALTIES TO VARIABLES USED IN THE MARKET CLEARING ENGINE FORMULATION

Variable used in MCE formulation	**Violation Penalty Block Prices**	**Violation Penalty Block Quantities**
$DeficitGenerationBlock_{n,j}$ where *n* is a dispatch network node other than those dispatch network nodes added to the dispatch network pursuant to section D.6.5 or section D.8.2 of Appendix 6D.	$DeficitGenerationPenalty_{n,j}$ VoLL	$DeficitGenerationBlockMax_{n,j}$ 10,000 MW
Explanatory Note: **These violation variables do not have the same penalty logic as other violations – any violation blocks are penalised directly in the objective function.** **The purchase bid price is set to a very high level, so that any energy deficit violation will appear in the deficit generation variables, rather than the purchase bid variables.** **Market Max Energy Price/Max Energy Offer Price should be less than the first block of violation penalties for deficit energy, by at least the maximum expected marginal loss between any two points in the system. Otherwise load shedding could be recommended by the market clearing engine at some nodes because of the losses between those nodes and the generation facility nodes, even though not all generation capacity has been utilised.**		
DeficitRegulation	0.6 * VoLL	2,000 MW
$DeficitReserve_c$	**8 Second Class:** 0.9 * VoLL **30 Second Class:** 0.8 * VoLL **10 Minute Class:** 0.7 * VoLL	 2,000 MW 2,000 MW 2,000 MW

Explanatory Note:

Shorter term reserve classes are more critical than longer term classes, and should have higher penalties. Regulation is less critical than reserve, hence is given a lower penalty.

Variable used in MCE formulation	Violation Penalty Block Prices	Violation Penalty Block Quantities
$ExcessGenerationBlock_{n,j}$ where *n* is a dispatch network node other than those dispatch network nodes added to the dispatch network pursuant to section D.6.5 or section D.8.2 of Appendix 6D.	$ExcessGenerationPenalty_{n,j}$ -CDC	$ExcessGenerationBlockMax_{n,j}$ 10,000 MW
$ExcessLineFlowForward_k$ $ExcessLineFlowReverse_k$ $DeficitWLineFlow_k$ $ExcessWLineFlow_k$ where $\{k \in$ LINES, $k \notin$ ARTIFICIALLINES$\}$	2.2 * VoLL	10,000 MW

Explanatory Note:

The recommended violation penalty for line flow is derived from the violation penalties for energy, since line flow or node violations trade-off against each other. Generally the deficiency leading to a line flow violation could alternatively result in a nodal violation – load could be shed at the receiving node rather than violating the flow limits. Assuming the flow limits are hard, then the solution that best matches what will happen in reality is for load to be shed at the receiving end of the line. Hence the price for the line flow violation is the maximum difference between energy prices at each end of the line, VoLL and -VoLL, plus an adder.

Variable used in MCE formulation	**Violation Penalty Block Prices**	**Violation Penalty Block Quantities**
$ExcessRawReserve_r$ $ExcessResGen_r$ $ExcessResGenSegment1_r$ $ExcessResGenSegment2_r$ $ExcessResGenSegment3_r$ $ExcessResRamp_r$ $ExcessResPropRamp_r$ $ExcessRegGen_l$ $DeficitRegGen_l$ $ExcessRegRamp_l$ $ExcessUpRampRate_g$ $ExcessDownRampRate_g$ $DeficitMulti_s$ $ExcessMulti_s$ $ExcessLineFlowForward_k$ $ExcessLineFlowReverse_k$ $DeficitWLineFlow_k$ $ExcessWLineFlow_k$ where $\{k \in$ ARTIFICIALLINES1$\cup$ ARTIFICIALLINES2$\}$	20 * VoLL	10,000 MW

Explanatory Note: **Facility constraints should be the most expensive to violate. They comprise constraints on ramping, reserve capability at low loading, total generation plus reserve plus regulation capacity, combined ramping and reserve capability and regulation capability loading levels. These penalty violations should have large values because they relate to the plant capability specified by market participants, who have the best knowledge of the capability of their plant.** **All facility groups should have the same violation penalties unless there is some valid reason to discriminate between facilities.**		
$DeficitGenerationBlock_{n,j}$ and $ExcessGenerationBlock_{n,j}$ where *n* is a dispatch network node added to the dispatch network pursuant to section D.6.5 or section D.8.2 of Appendix 6D.	20 * VoLL	10,000 MW
Explanatory Note: **These artificial nodes are a modelling construct created to support the modelling of an individual facility. It is therefore most appropriate to use the penalty scheme applicable to other facility violation variables, and not the scheme applicable to conventional nodes.**		
Variable used in MCE formulation	**Violation Penalty Block Prices**	**Violation Penalty Block Quantities**
$DeficitSecurity_s$	6 * VoLL	10,000 MW