AusNet

Transmission Revenue Reset 2027 to 2032 (TRR 2027-32)

Network Modelling Report:	Moorabool 220 and 500 kV Shunt Reactor Replacement Project
Date:	September 2026

Schedule of revisions

ISSUE	DATE	AUTHOR	REVIEWER	DETAILS OF CHANGE
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1. Introduction

Moorabool Terminal Station (MLTS) is part of the main Victorian 500 kV transmission system with transformation from 500 kV to 220 kV located north of Geelong. It serves as a 500 kV switching station connecting the 500 kV backbone to the 220 kV transmission network. MLTS contains two 121 MVA 500 kV and three 121 MVA 220 kV shunt reactors.

The results in this document refer to the network studies carried out for the potential replacement of the 220 kV and 500 kV shunt reactors at MLTS.

2. Study Methodology

2.1. Network Operation Scenarios

AusNet obtained the PSSE minimum demand cases produced by AEMO for their 2025 Victorian Annual Planning Report (VAPR). This study has been conducted using these PSSE models to quantify the Minimum Supportable Demand (MSD), and hence voltage management support from a representative gas-fired generator to maintain transmission system voltages due to the failure (outage) of the MLTS No.1 220kV Bus Shunt Reactor and CRTS No.2 500kV Line Shunt Reactor at MLTS. The specific operating scenarios are shown in Table 1 below.

Case	Asset Failure Contingency N-1	Asset Failure Contingency N-2	Secure Operating State Contingency
1	None	None	Trip of every element in the MLTS subsystem (one at a time)
2	MLTS No.1 220kV Bus Shunt Reactor	None	
3	CRTS No.2 500kV Line Shunt Reactor	None	
4	MLTS No.1 220kV Bus Shunt Reactor	CRTS No.2 500kV Line Shunt Reactor	

Table 1: Operating Scenarios

2.2. General Approach for Contingency Analysis

2.2.1. Asset Failure Contingency N-1

PSSE Contingency Analysis (ACCC) Simulation

1) Switch-out element and ensure that no other element (transformer/lines) overloads its continuous rating and all transmission bus voltages are below 1.05 pu. If a bus voltage exceeds 1.05 pu, system demand (MW & MVAr) is increased with a fixed P/Q ratio.
2) Run N-1-1 contingency analysis by ensuring that no other element (transformer/lines) overloads its continuous rating and all transmission bus voltages are below 1.05 pu. If a bus voltage exceeds 1.05 pu, system demand (MW & MVAr) is increased with a fixed P/Q ratio.

Minimum Supportable Demand (MW) = System Demand (MW) + Load Adjustment (Step 1) (MW) + Load Adjustment (Step 2) (MW)

Equivalent Generation Support for Voltage Management (from a representative gas-fired generator in MW) = Load Adjustment (Step 1) (MW) + Load Adjustment (Step 2) (MW)

2.2.2. Asset Failure Contingency N-2

PSSE Contingency Analysis (ACCC) Simulation

1) Switch-out two elements and ensure that no other element (transformer/lines) overloads its continuous rating and all transmission bus voltages are below 1.05 pu. If a bus voltage exceeds 1.05 pu, system (MW & MVAr) is increased with a fixed P/Q ratio.
2) Run N-1-1 contingency analysis by ensuring that no other element (transformer/lines) overloads its continuous rating and all transmission bus voltages are below 1.05 pu. If a bus voltage exceeds 1.05 pu, system demand (MW & MVAr) is increased with a fixed P/Q ratio.

Minimum Supportable Demand (MW) = System Demand (MW) + Load Adjustment (Step 1) (MW) + Load Adjustment (Step 2) (MW)

Equivalent Generation Support for Voltage Management (from a representative gas-fired generator in MW) = Load Adjustment (Step 1) (MW) + Load Adjustment (Step 2) (MW)

2.3. PSSE Base Case & Load (Bus Numbers)

The 2025 VAPR minimum demand (night) of year five PSSE case has been used for the base case for this study as the MLTS 220kV bus shunt reactors are predominantly switched on at night, and this case depicts the most onerous voltage conditions in the MLTS subsystem. The MLTS subsystem consists of the 220/66kV terminal stations shown in Table 2 below and Section 2.5. Loads at these stations were scaled up/down until a network constraint/bus overvoltage is identified to determine the Minimum Supportable Demand. The PSSE bus numbers used for load scaling at these stations are also shown in Table 2.

Station	PSSE Bus Numbers
Altona & Brooklyn Terminal Stations (ATS & BLTS)	344080, 344081, 302031, 302033, 314030, 344002, 344001, 302030, 314032, 314034, 314035, 343030, 380030, 300530, 303001, 314033, 304030, 320530, 314023, 314021, 314022,
Ballarat Terminal Station (BATS)	1005, 309020, 309030, 309031, 309032, 310001, 390530, 391530, 390534, 1038, 307530, 391537, 391538, 2006, 316030, 316031, 316032, 3900, 306030, 310220,
Deer Park Terminal Station (TGTS)	323530, 323531, 323532, 323533, 323534, 323535, 323536,
Fishermans Bend Terminal Station (FBTS)	326030, 326031, 326032, 326033,
Geelong Terminal Station (GTS)	328080, 362084, 362087, 328030, 328031, 328034, 328035, 388030, 355737, 355738, 355739, 3002, 320030, 328032, 328033,
Keilor Terminal Station (KTS)	341030, 341035, 341039, 341001, 341034, 341036,
Terang Terminal Station (TGTS)	378030, 378038, 378039, 391000, 1032, 317030, 319030, 334530, 360231, 368530, 361030, 352530, 368533, 361034, 352520, 352501,
West Melbourne Terminal Station (WMTS)	387022, 387029, 387028, 387030, 387037,

Table 2: MLTS Subsystem 220/66kV Stations & Corresponding PSSE Bus Numbers

2.4. Assumptions

The following assumptions were applied to the network studies:

- The MLTS bus system consists of 500 kV buses two levels away from the MLTS 500 kV bus, and the 220kV network as shown in Figure 1
- The pre- and post-contingent bus voltages of the 220kV and 500kV buses included in the MLTS subsystem cannot exceed 1.05pu.
- MLTS A1 & A2 Transformers: 1,000 MVA (Continuous) & 1,500 MVA (Short-Term)
- KTS A2, A3 & A4 Transformer: 750 MVA (Continuous) & 750 MVA (Short-Term)
- Newport Power Station (NPSD) is offline in all scenarios studied
- Voltage support is assumed to be provided by a representative gas-fired (synchronous) generator, reflecting the synchronous generation available in the MLTS and surrounding supply area

2.5. Network Configuration

Figure 1 shows the network configuration of the MLTS subsystem. In the system intact state, the minimum supportable demand to maintain subsystem bus voltages at 1.05pu is approximately 1625 MW.

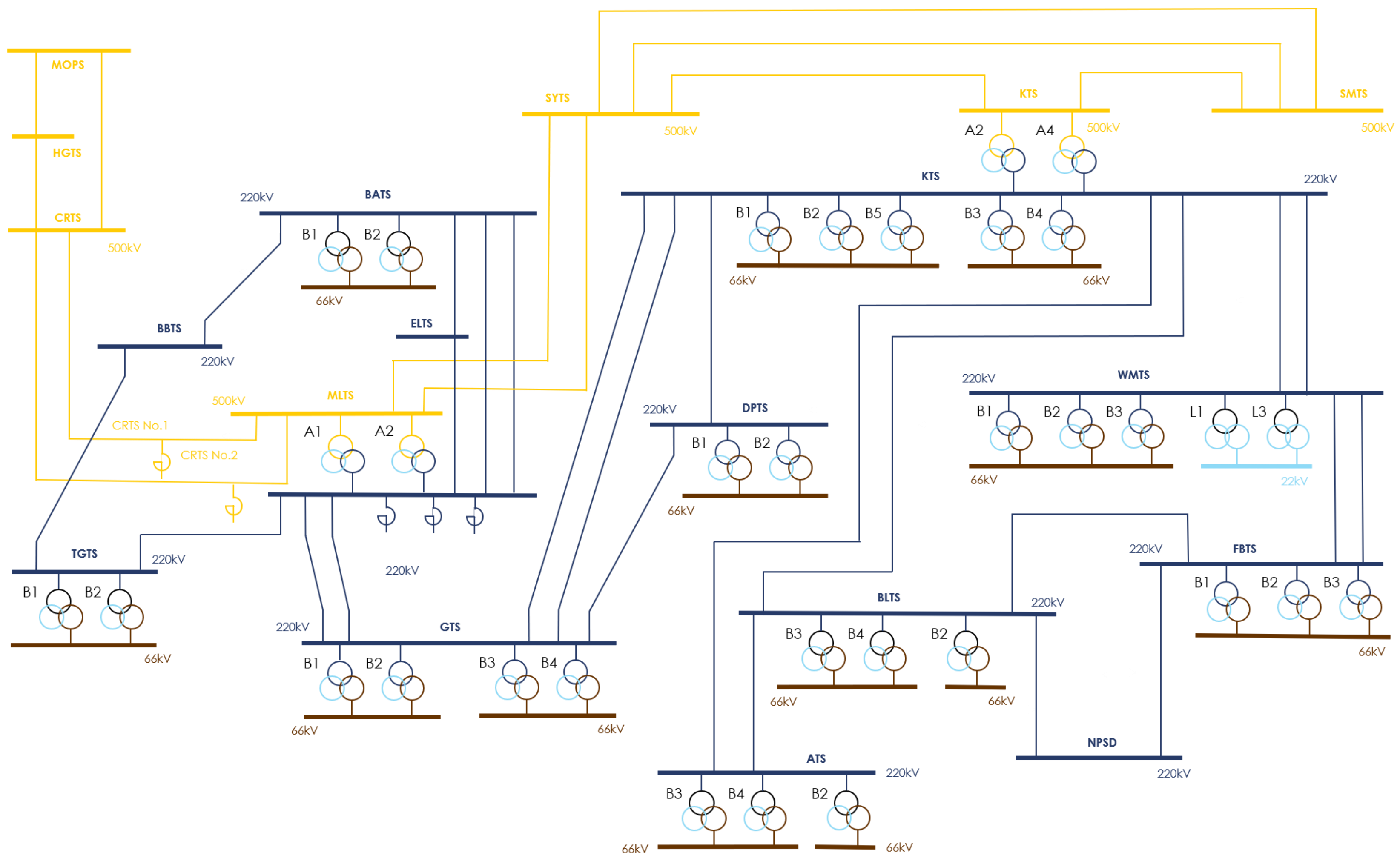

Figure 1: MLTS Subsystem

3. Results

The results of the study are shown in Table 3 and summarised below. Detailed results are presented in the Appendix section.

Case	Scenario	MLTS Subsystem Minimum Required Demand	Generation Support Required (MW)
1	System Intact	1625	
2	Prior Outage MLTS No.1 220kV Bus Shunt Reactor	1751	126
3	Prior Outage CRTS No.2 500kV Line Shunt Reactor	1841	216
4	Prior Outage MLTS No.1 220kV Bus Shunt Reactor and CRTS No.2 500kV Line Shunt Reactor	1969	344

Table 3: Study Results

3.1. Case 1: System Intact

There are existing network constraints in the system intact case, but they are not attributed to an outage of the MLTS No.1 220kV Bus Shunt Reactor or CRTS No.2 500kV Line Shunt Reactor. The MLTS subsystem minimum supportable demand to maintain subsystem bus voltages at 1.05pu is approximately **1625 MW**.

3.2. Case 2: Prior Outage MLTS No.1 220kV Bus Shunt Reactor

For a contingent trip of the MLTS-SYTS 500kV Line (most critical), the SYTS 500kV bus voltage increases to **1.0506pu**. The MLTS subsystem minimum required demand to maintain subsystem bus voltages at 1.05pu after this contingency is approximately **1751 MW**. As such, the equivalent generation support required is approximately **126 MW**.

3.3. Case 3: Prior Outage CRTS No.2 500kV Line Shunt Reactor

For a contingent trip of the MLTS-SYTS 500kV Line (most critical), the SYTS 500kV bus voltage increases to **1.0513pu**. The MLTS subsystem minimum required demand to maintain subsystem bus voltages at 1.05pu after this contingency is approximately **1841 MW**. As such, the equivalent generation support required is approximately **216 MW**.

3.4. Case 4: Prior Outage MLTS No.1 220kV Bus Shunt Reactor and CRTS No.2 500kV Line Shunt Reactor

For a contingent trip of the MLTS-SYTS 500kV Line (most critical), the SYTS 500kV bus voltage increases to **1.052pu**. The MLTS subsystem minimum required demand to maintain subsystem bus voltages at 1.05pu after this contingency is approximately **1969 MW**. As such, the equivalent generation support required is approximately **344 MW**.

4. Appendix

Detailed results are shown in the respective spreadsheets:

- MLTSReactorReplacement_NetworkModellingResults.xlsx

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