Southland Electrical Network

Supplementary Information - Substation Load Characteristics

EECA

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ERGO CONSULTING

Document history and status

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Revision details

Revision	Details
A	Supplementary document created to reduce size of overall “spare capacity and load conversion opportunity report”
B	Issued in Final

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1. Introduction

The following figures illustrate the characteristics of the major electrical substations (both GXPs and Zone Substations) in the Southland Region. This document supplements the main report titled "Southland Electrical Network – Spare Capacity and Load Conversion Opportunity Report".

For each GXP, the 2020 apparent (MVA) and reactive loadings (MVAr) are presented. For each Zone Substation, the apparent (MVA) loadings only are presented. The data is presented in graphs of:

- The load profile for the entire year.
- The maximum and minimum loads for each of the 365 days.
- Load profiles for two weeks in summer and two weeks in winter.
- Typical daily summer and winter load profiles.
- A load duration curve for the entire year.

2. Transmission/GXP Substations

The characteristics of the transmission substation **apparent and reactive power loadings** are shown in the following:

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BALCLUTHA MVA

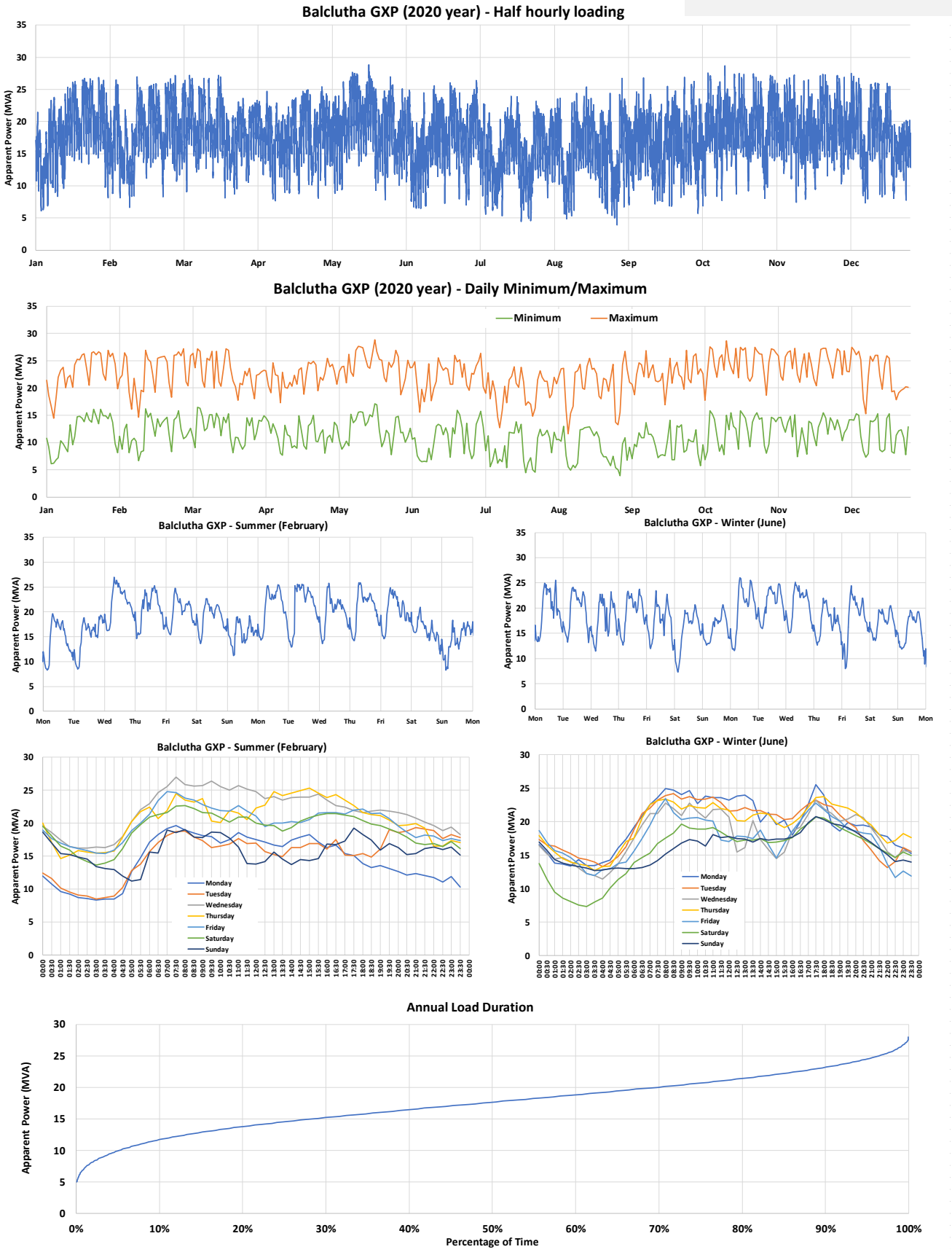


Figure 1 Balclutha: Apparent power (MVA) load characteristics

BALCLUTHA MVAr

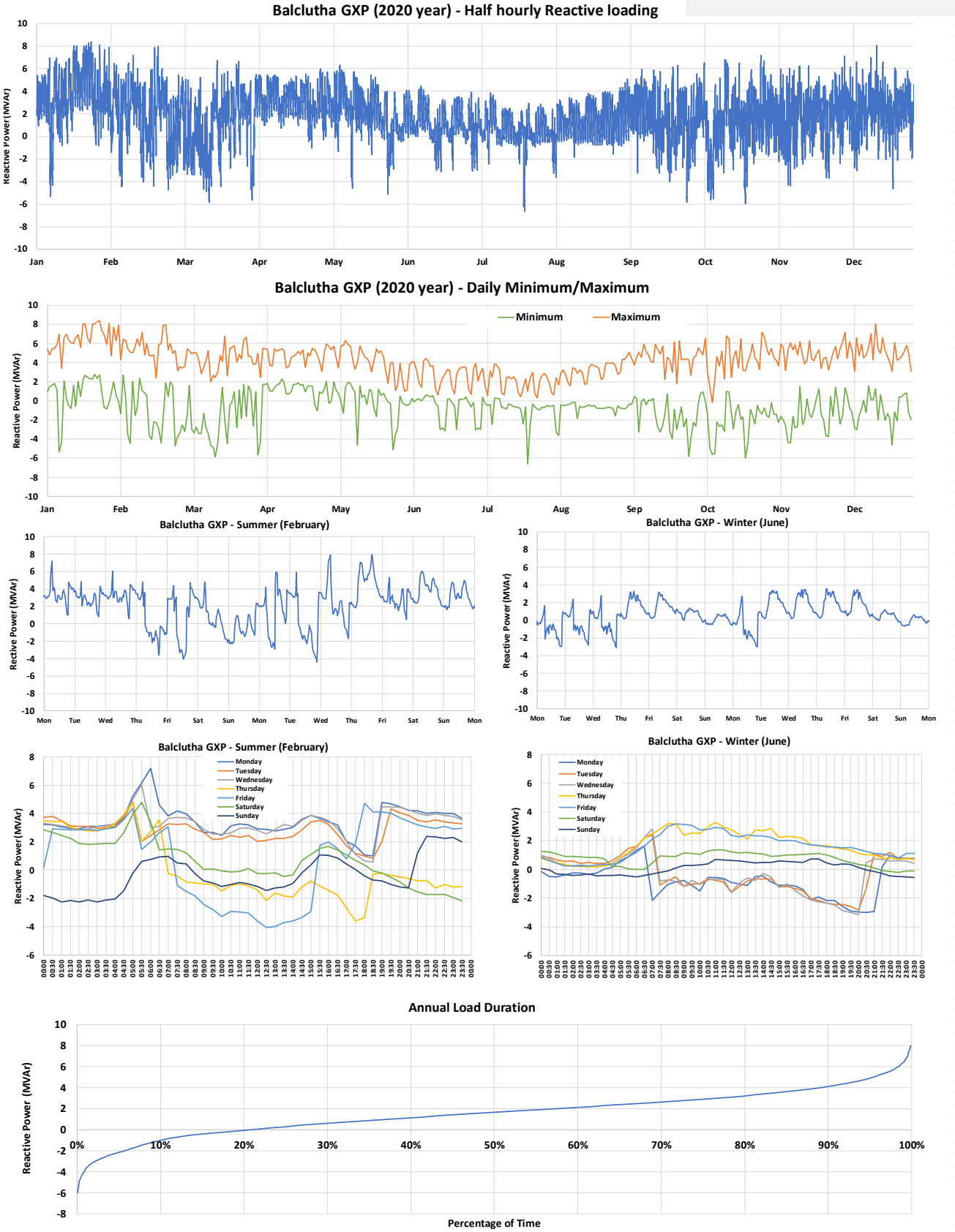


Figure 2 Balclutha: Reactive power (MVAr) load characteristics

BRYDONE MVA

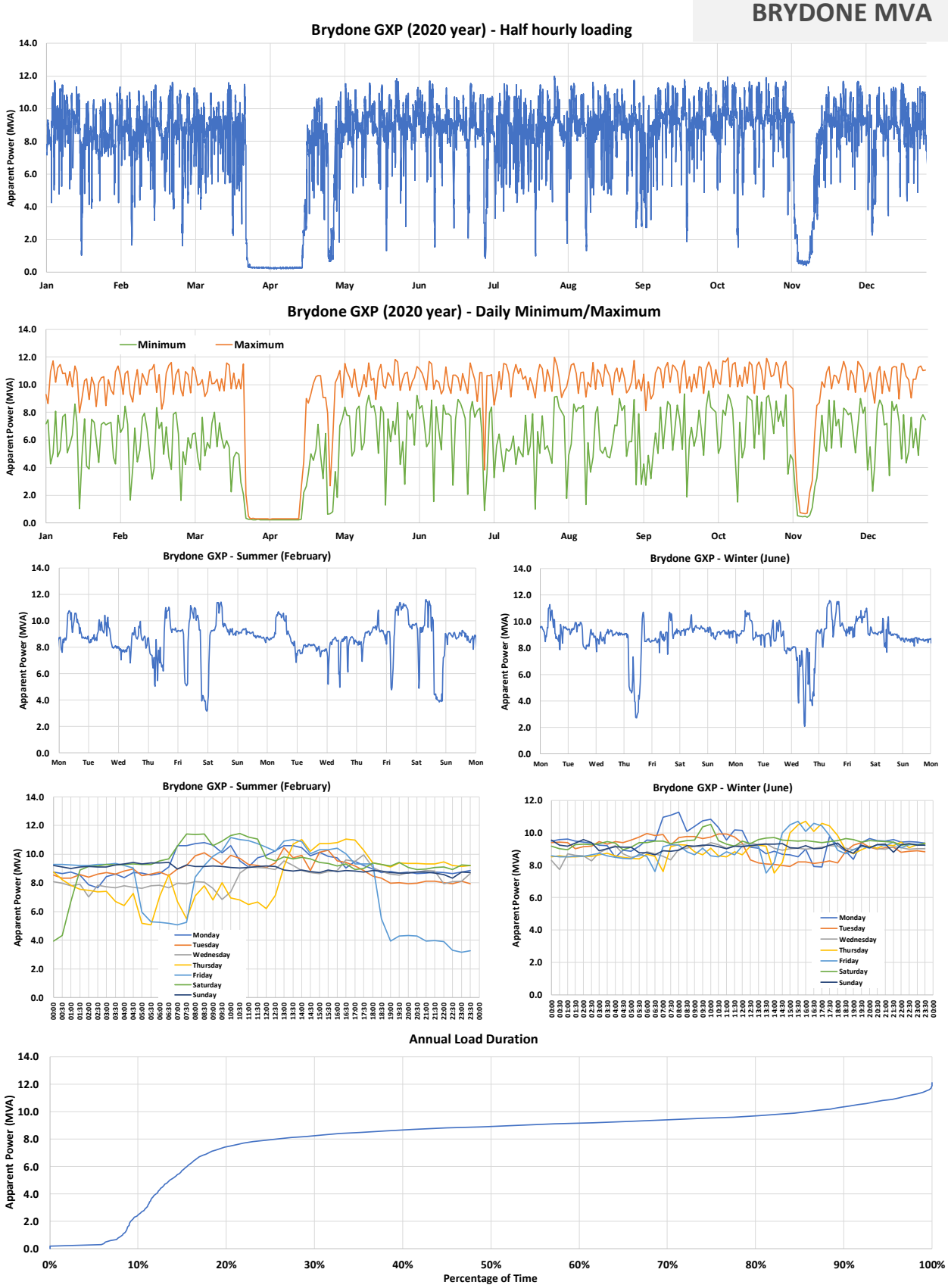


Figure 3 Brydone: Apparent power (MVA) load characteristics

BRYDONE MVAr

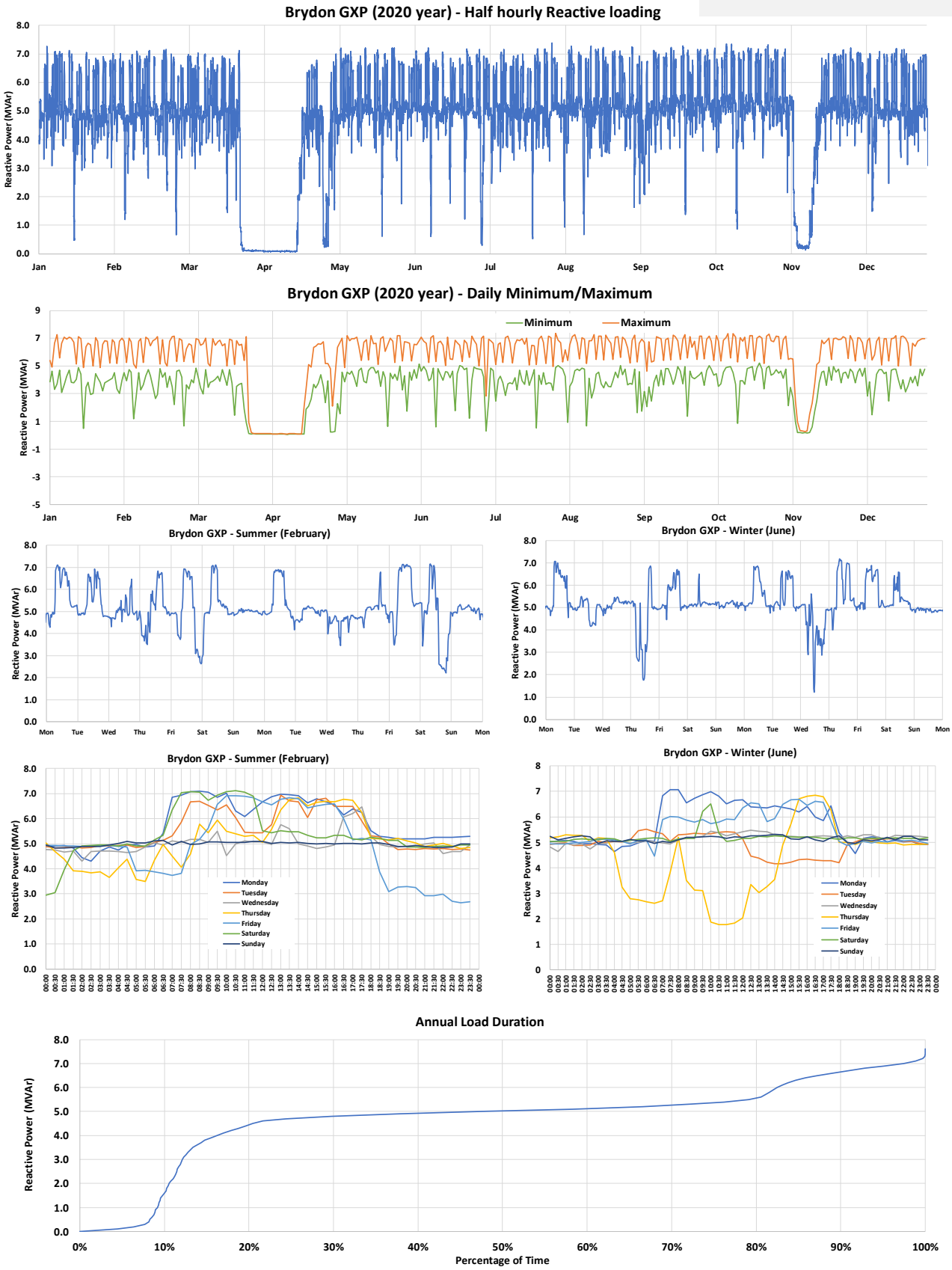


Figure 4 Brydone: Reactive power (MVAr) load characteristics

EDENDALE MVA

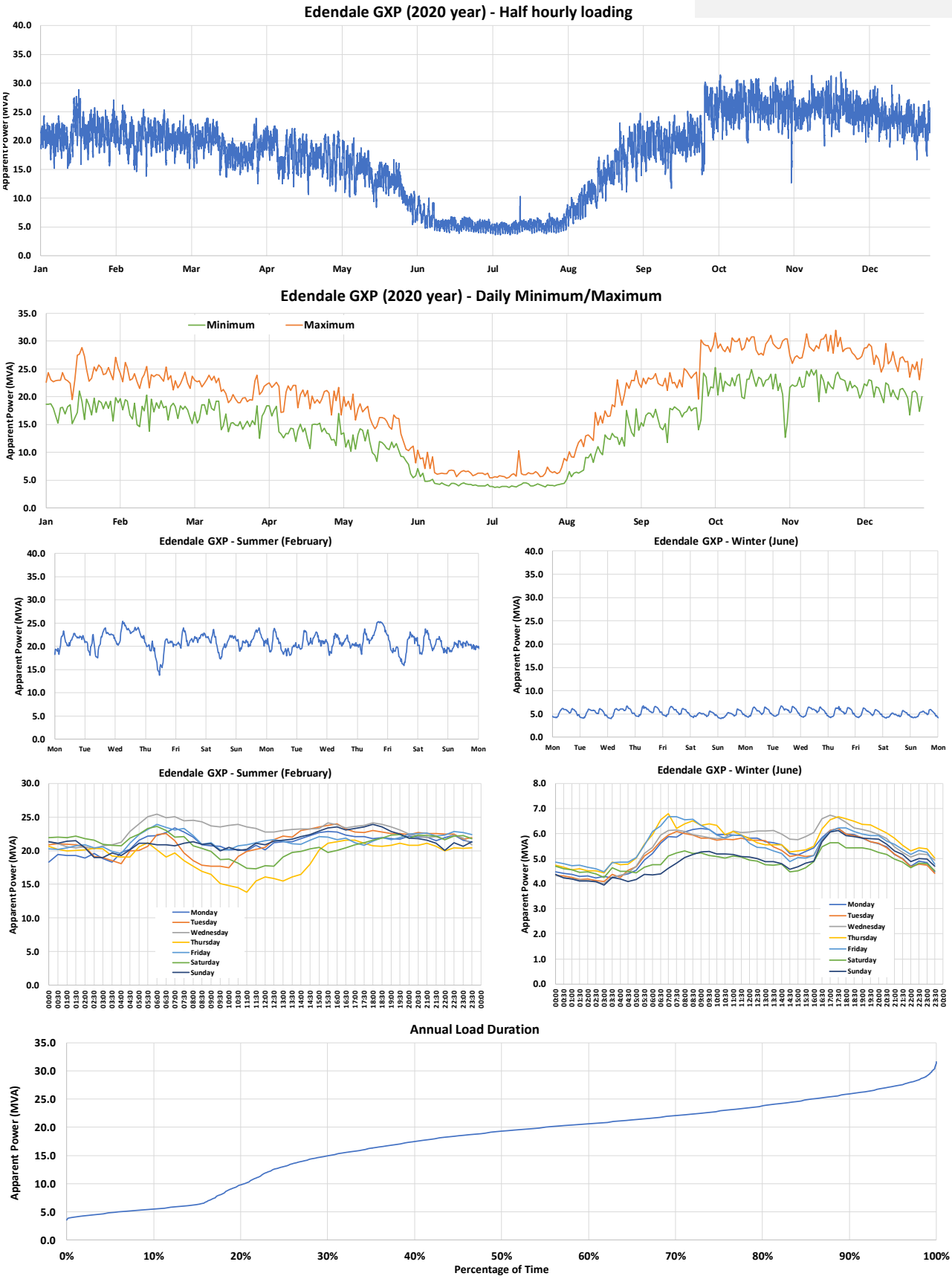


Figure 5 Edendale: Apparent power (MVA) load characteristics

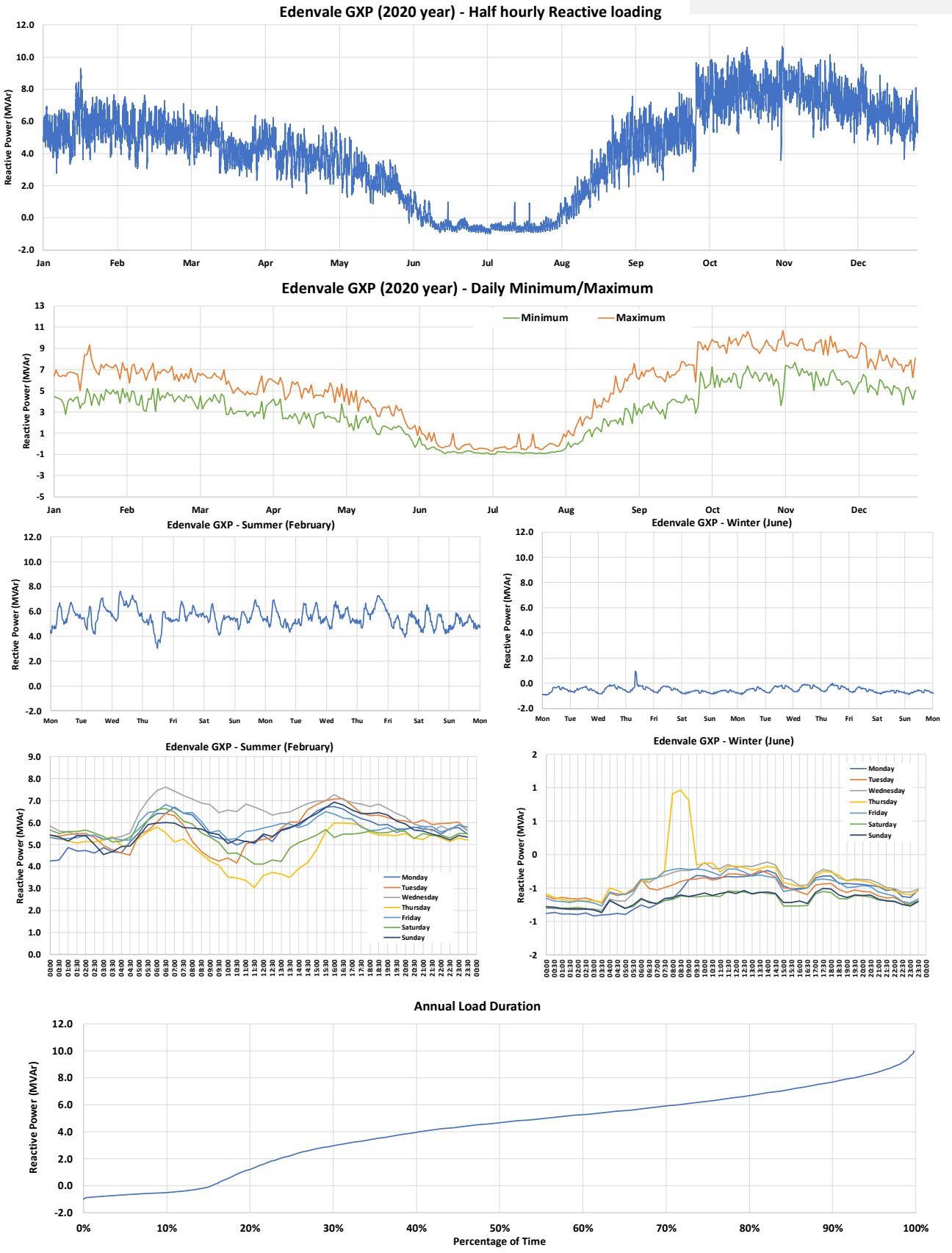


Figure 6 Edendale: Reactive power (MVAr) load characteristics

GORE MVA

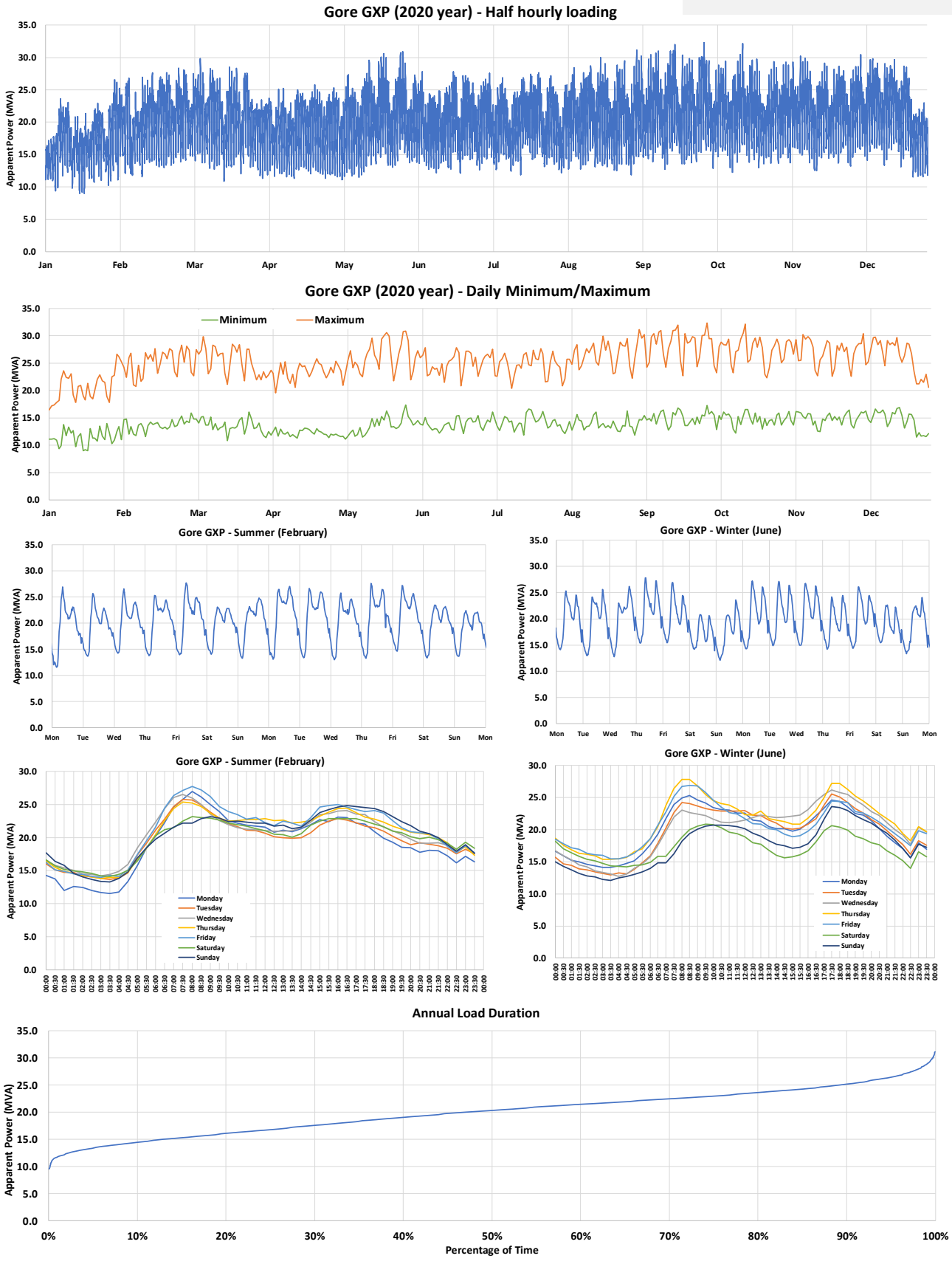


Figure 7 Gore: Apparent power (MVA) load characteristics

GORE MVAr

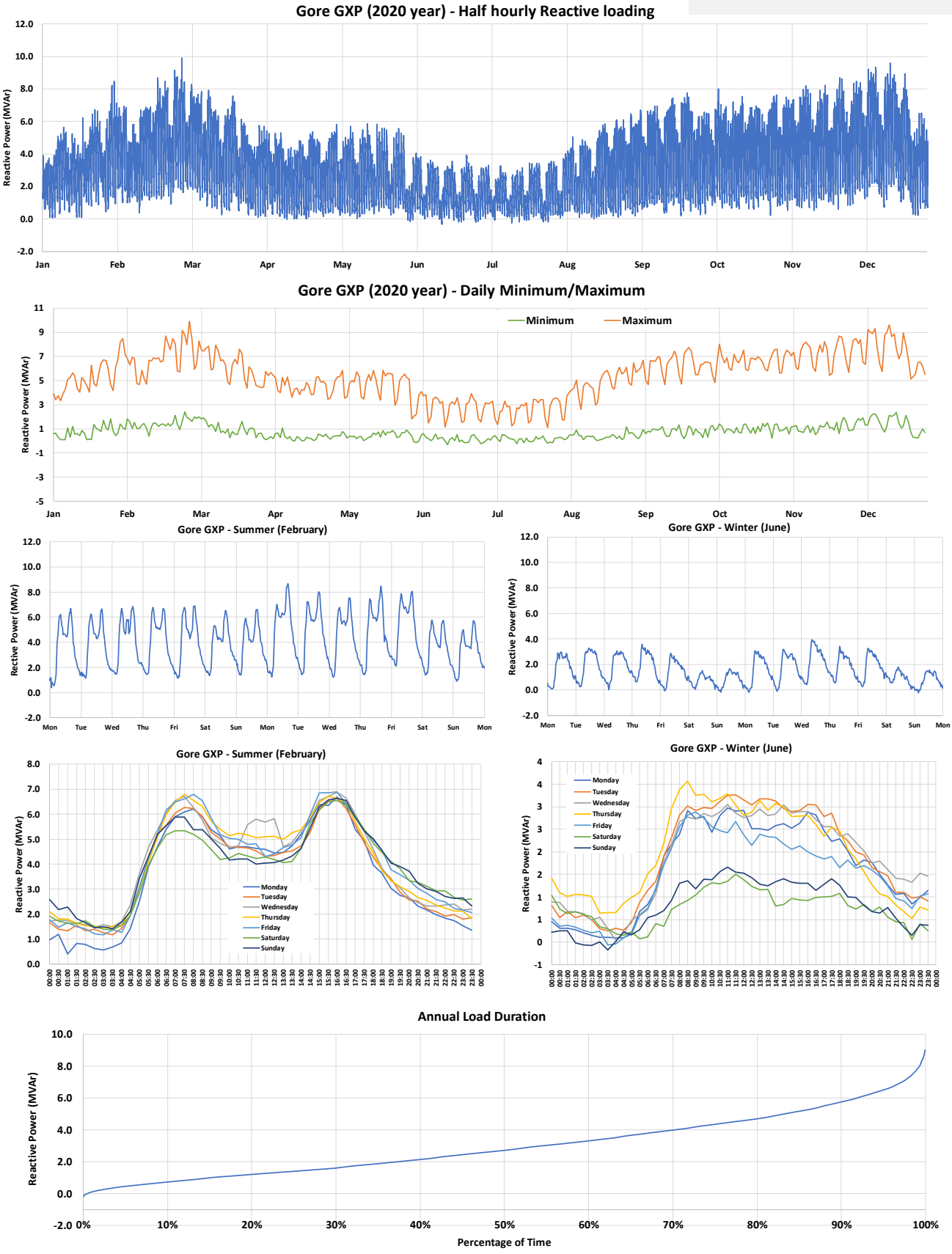


Figure 8 Gore: Reactive power (MVAr) load characteristics

HALFWAY BUSH MVA

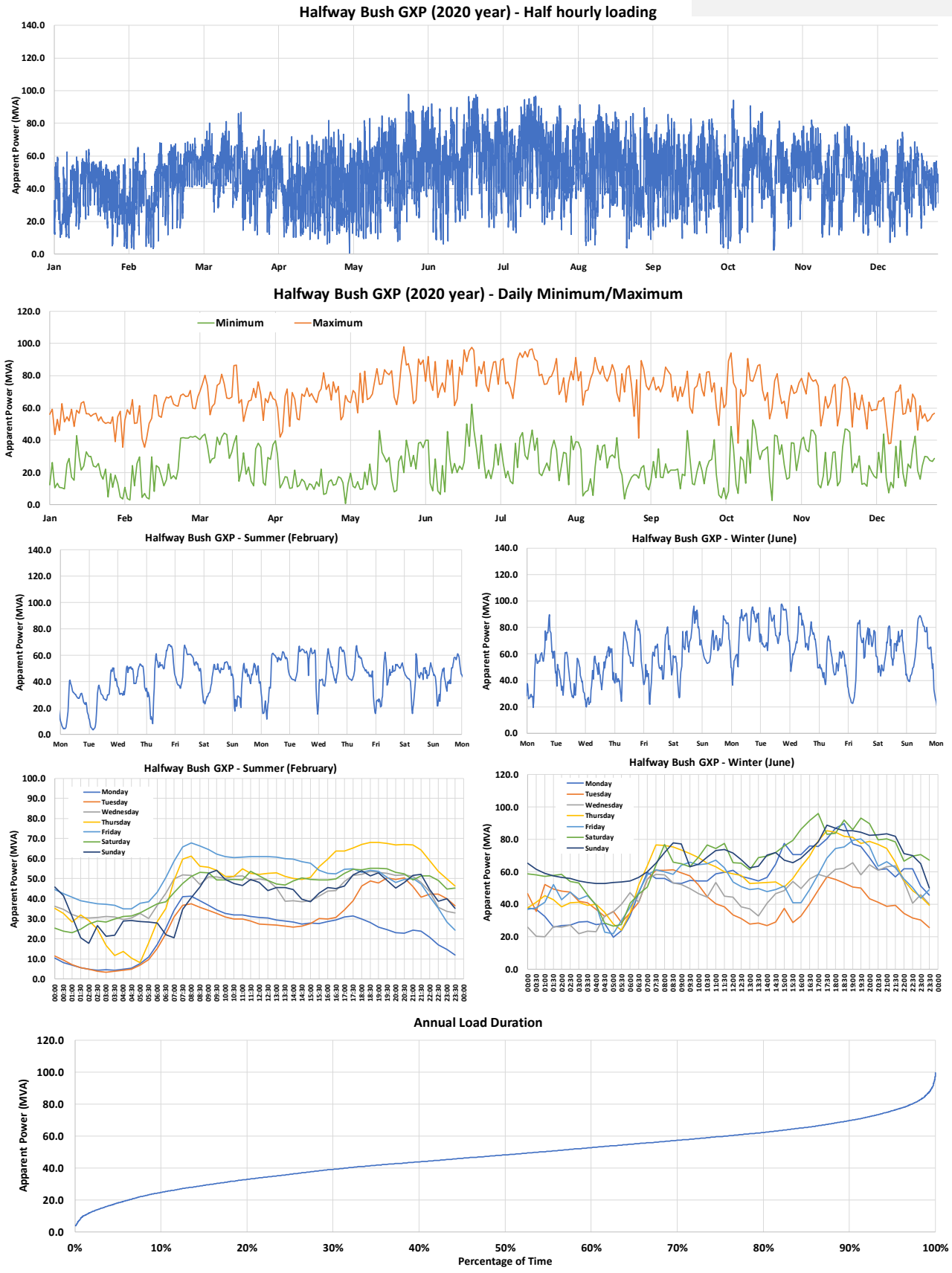


Figure 9 Halfway Bush: Apparent power (MVA) load characteristics

HALFWAY BUSH MVAr

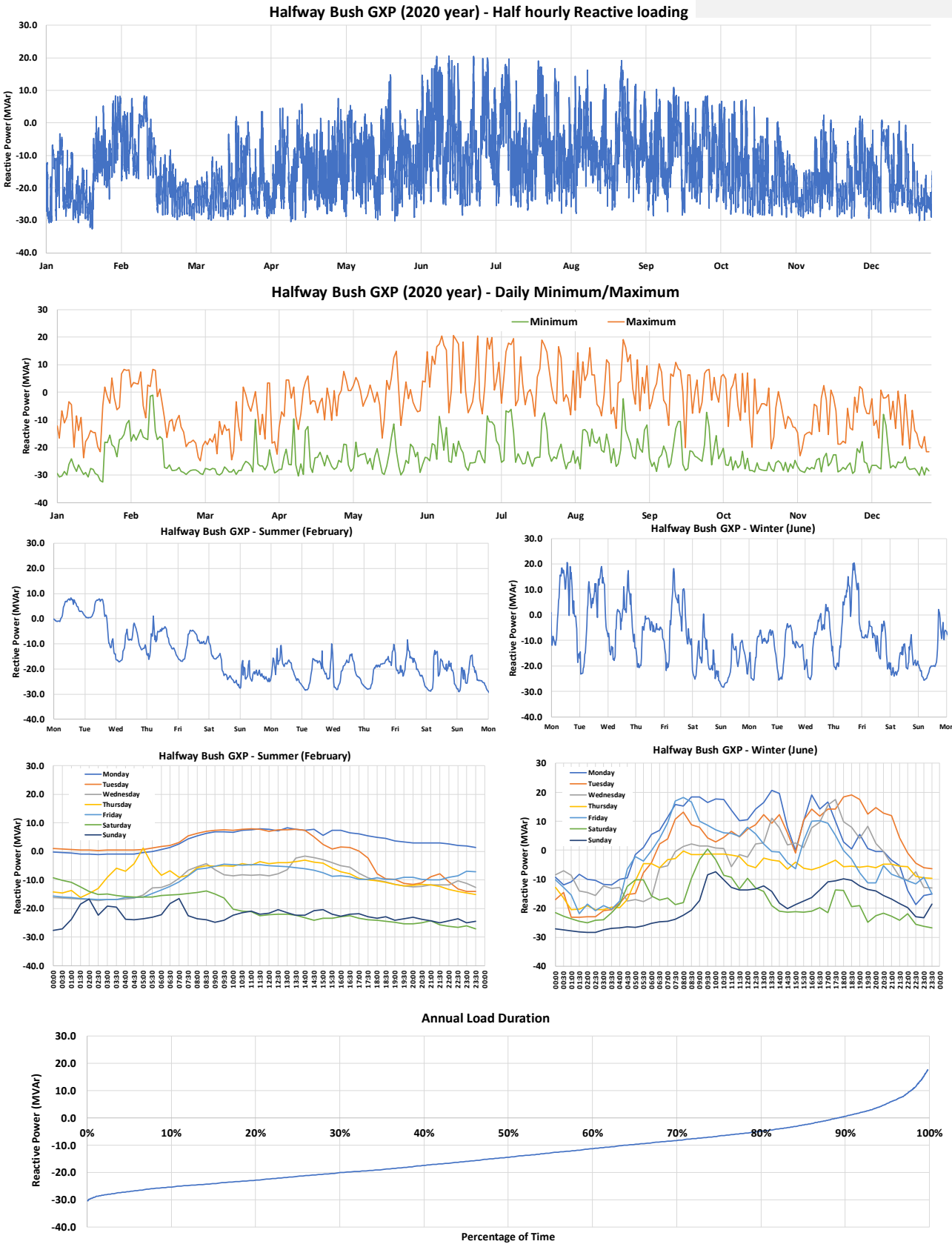
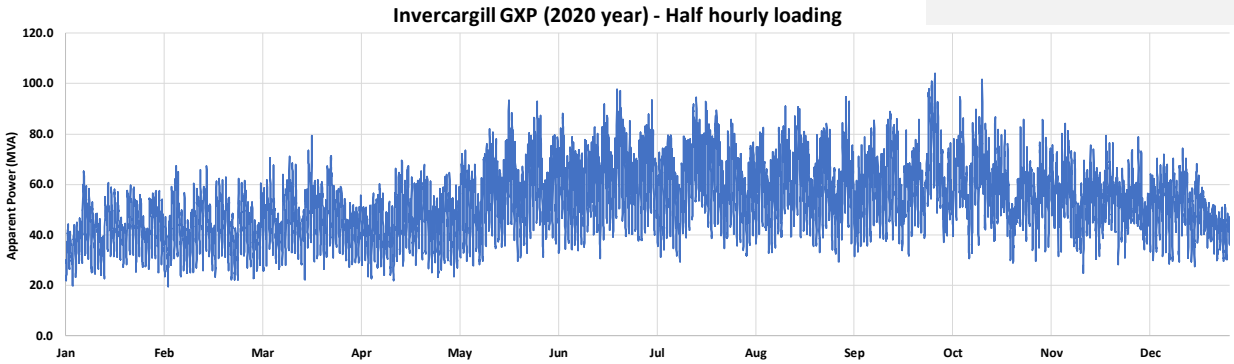
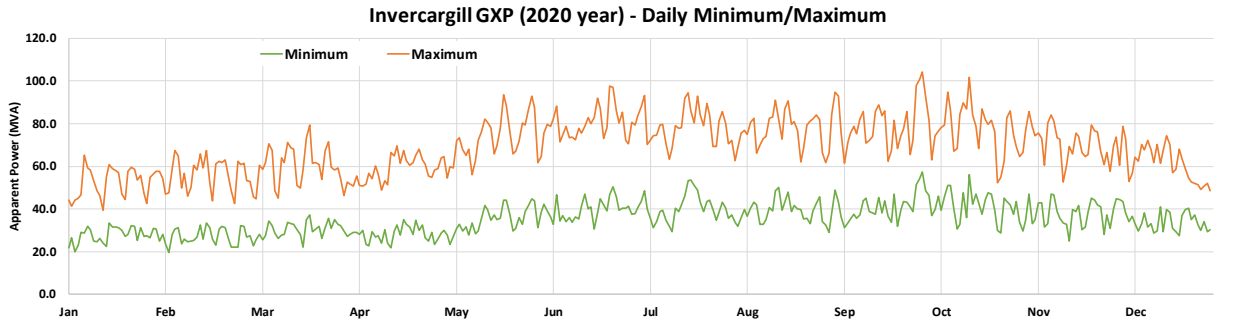
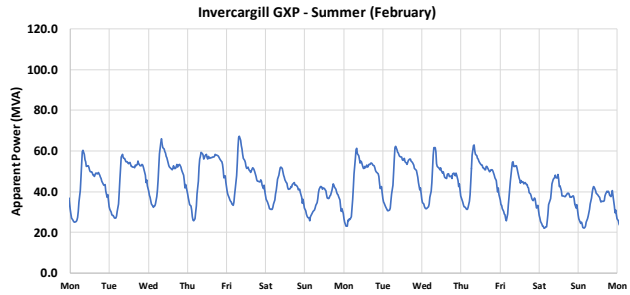


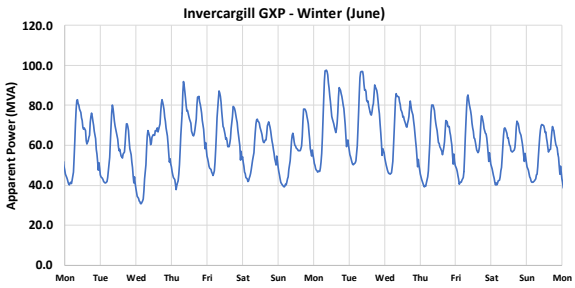
Figure 10 Halfway Bush: Reactive power (MVAr) load characteristics

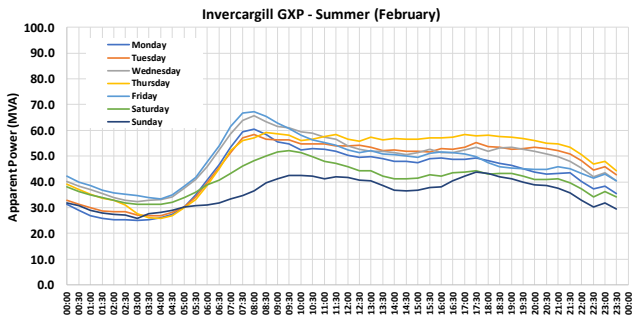
INVERCARGILL MVA

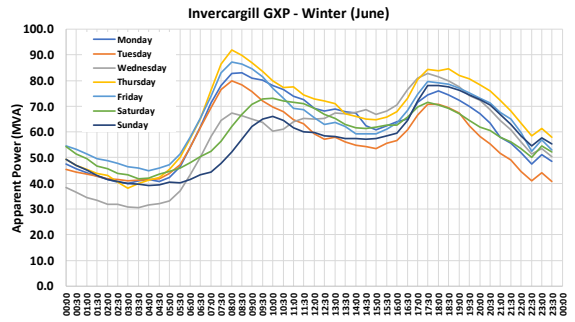












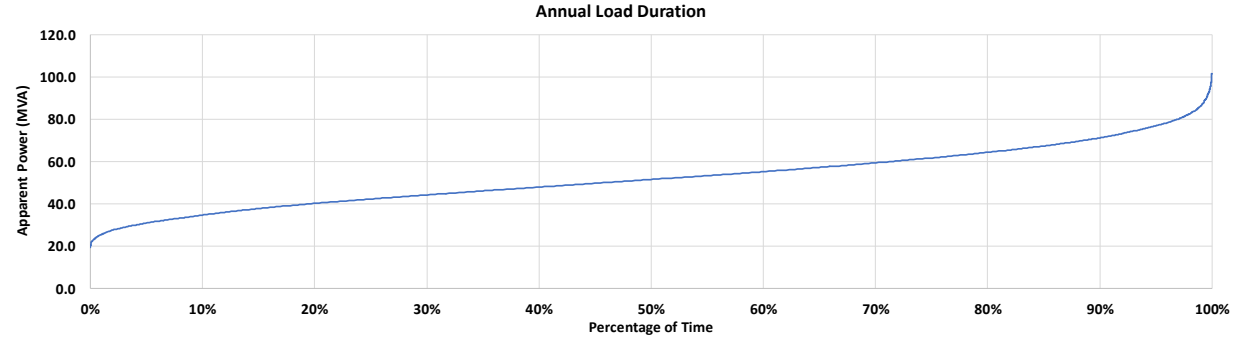


Figure 11 Invercargill: Apparent power (MVA) load characteristics

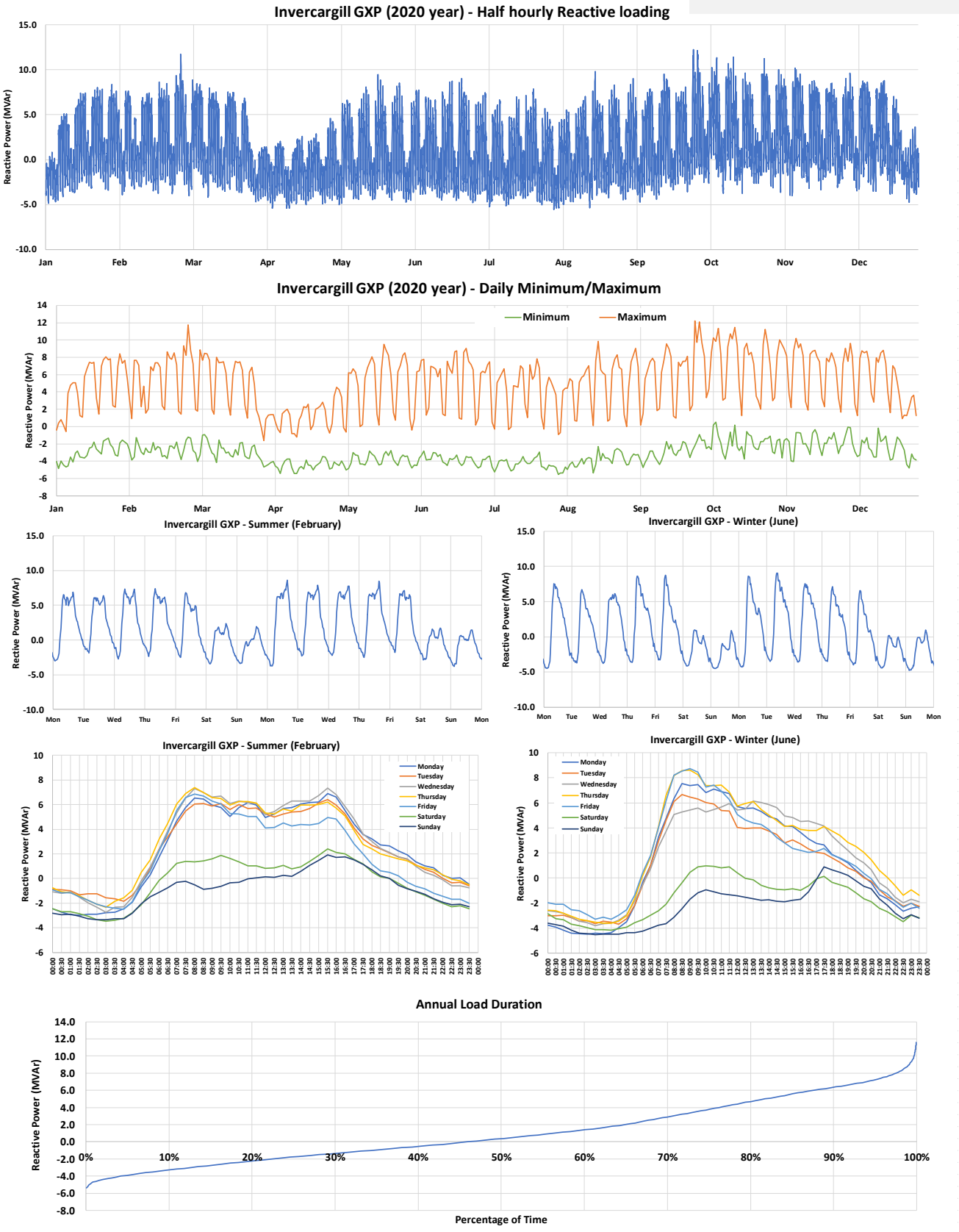


Figure 12 Invercargill: Reactive power (MVAr) load characteristics

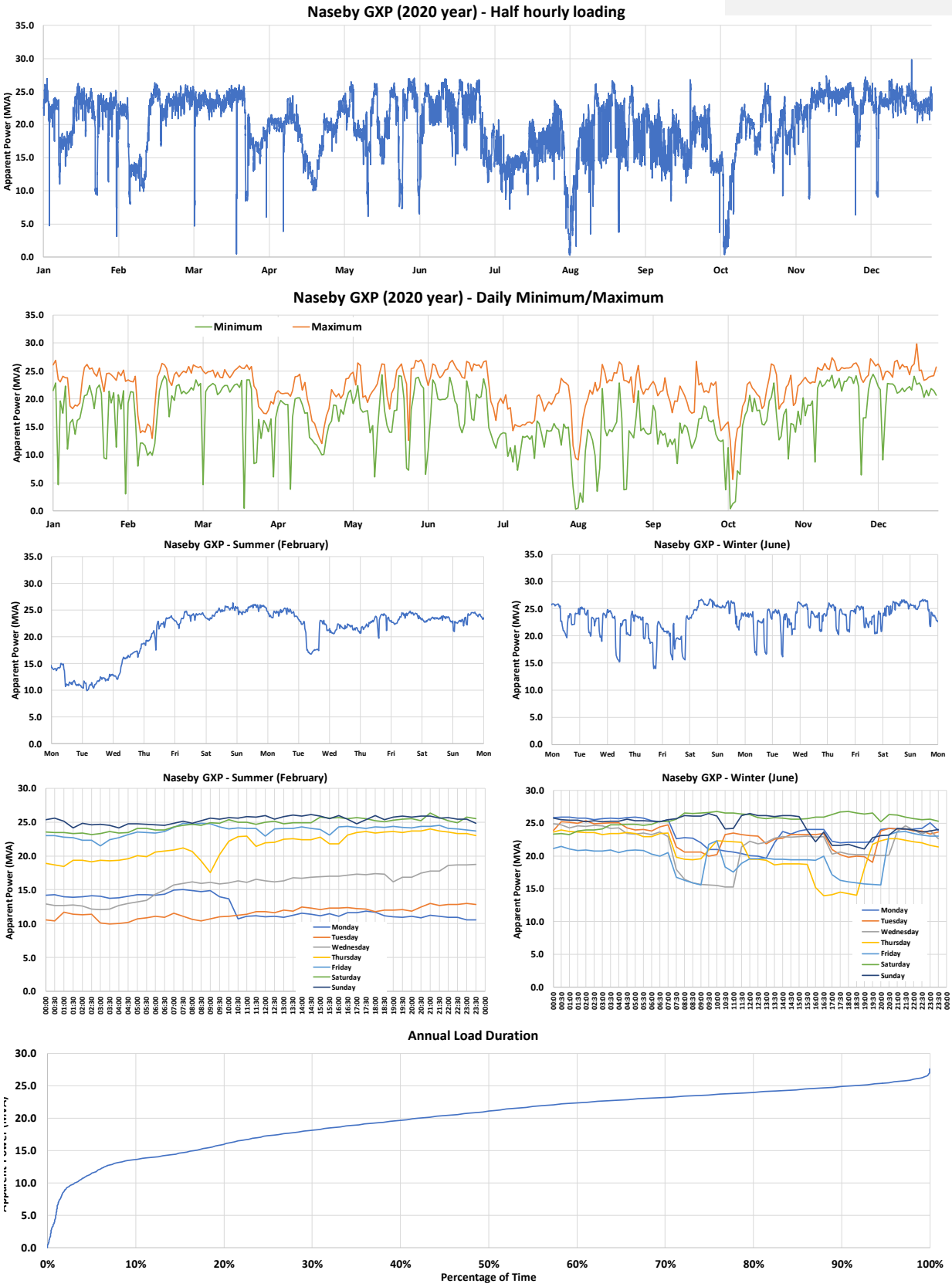


Figure 13 Naseby: Apparent power (MVA) load characteristics

NASEBY MVAr

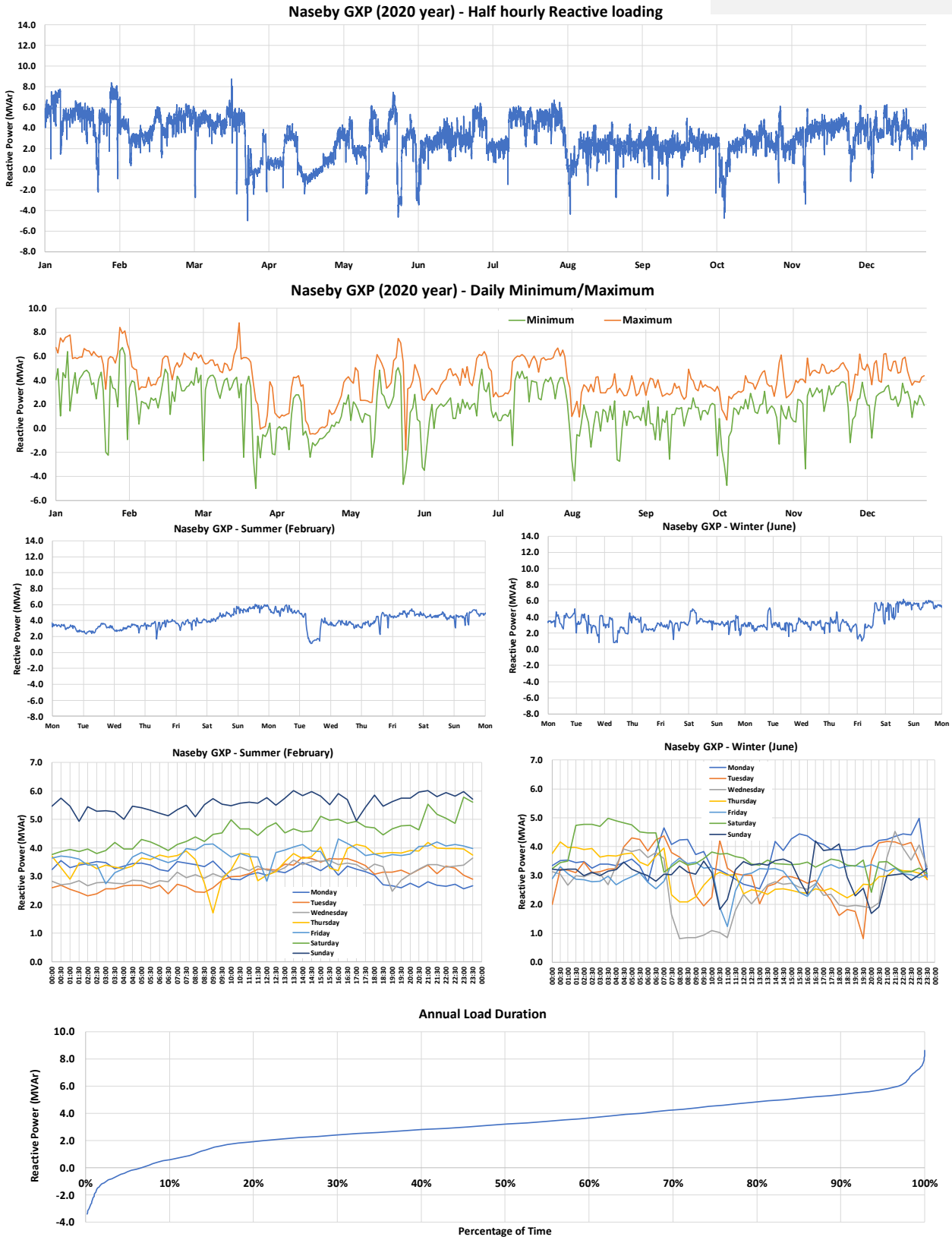


Figure 14 Naseby: Reactive power (MVAr) load characteristics

NORTH MAKAREWA MVA

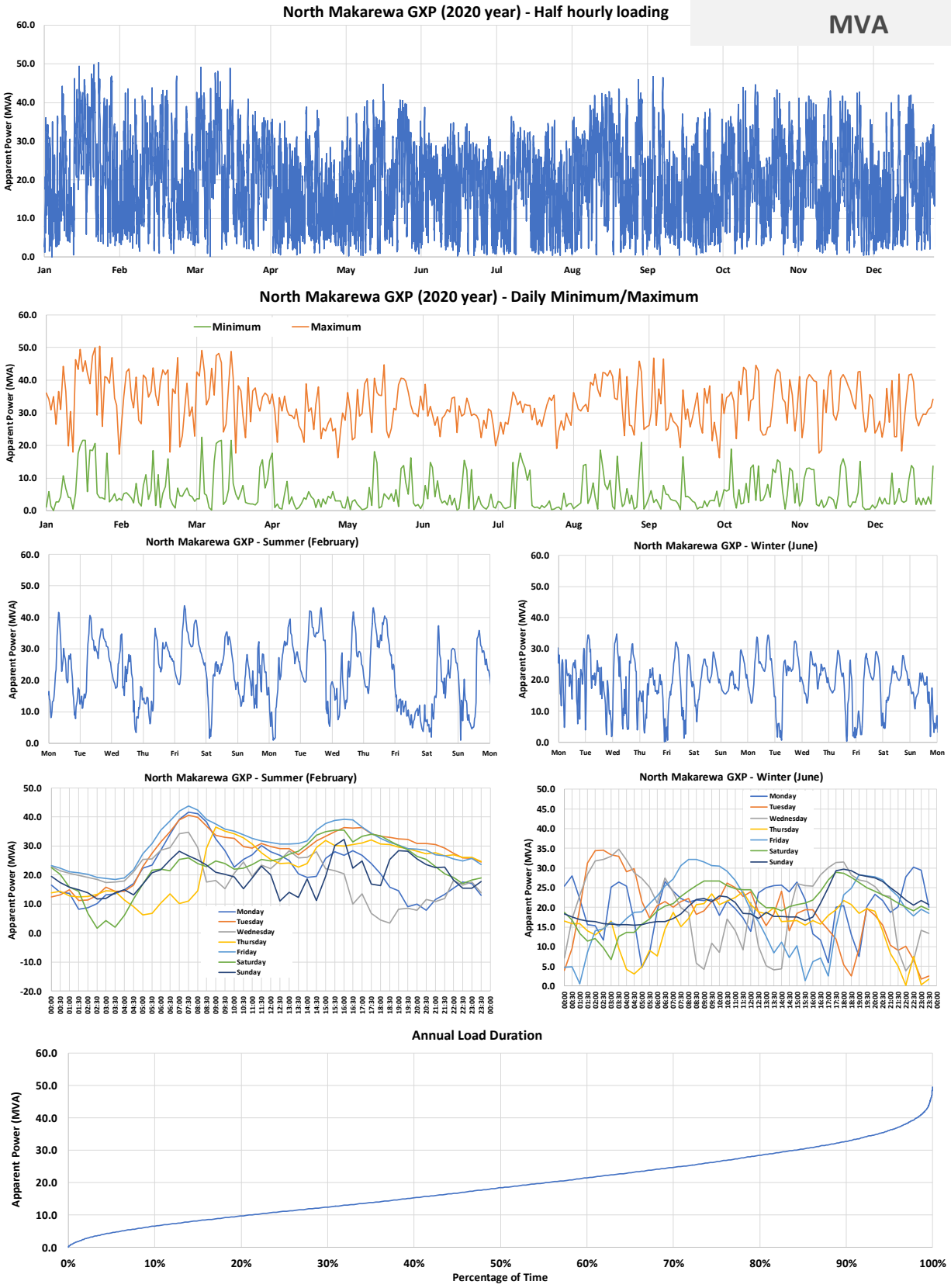


Figure 15 North Makarewa: Apparent power (MVA) load characteristics

NORTH MAKAREWA
MVAr

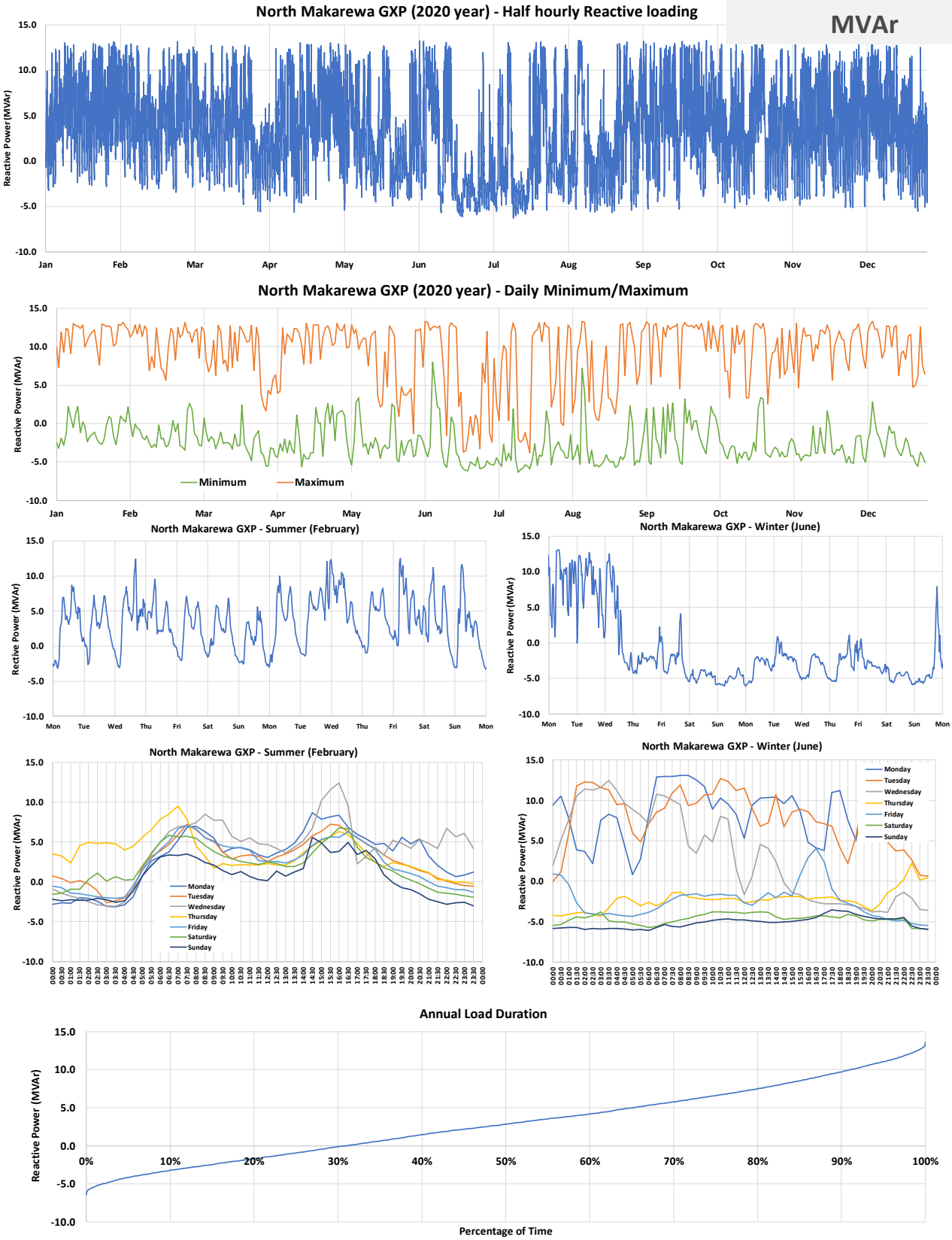


Figure 16 North Makarewa: Reactive power (MVAr) load characteristics

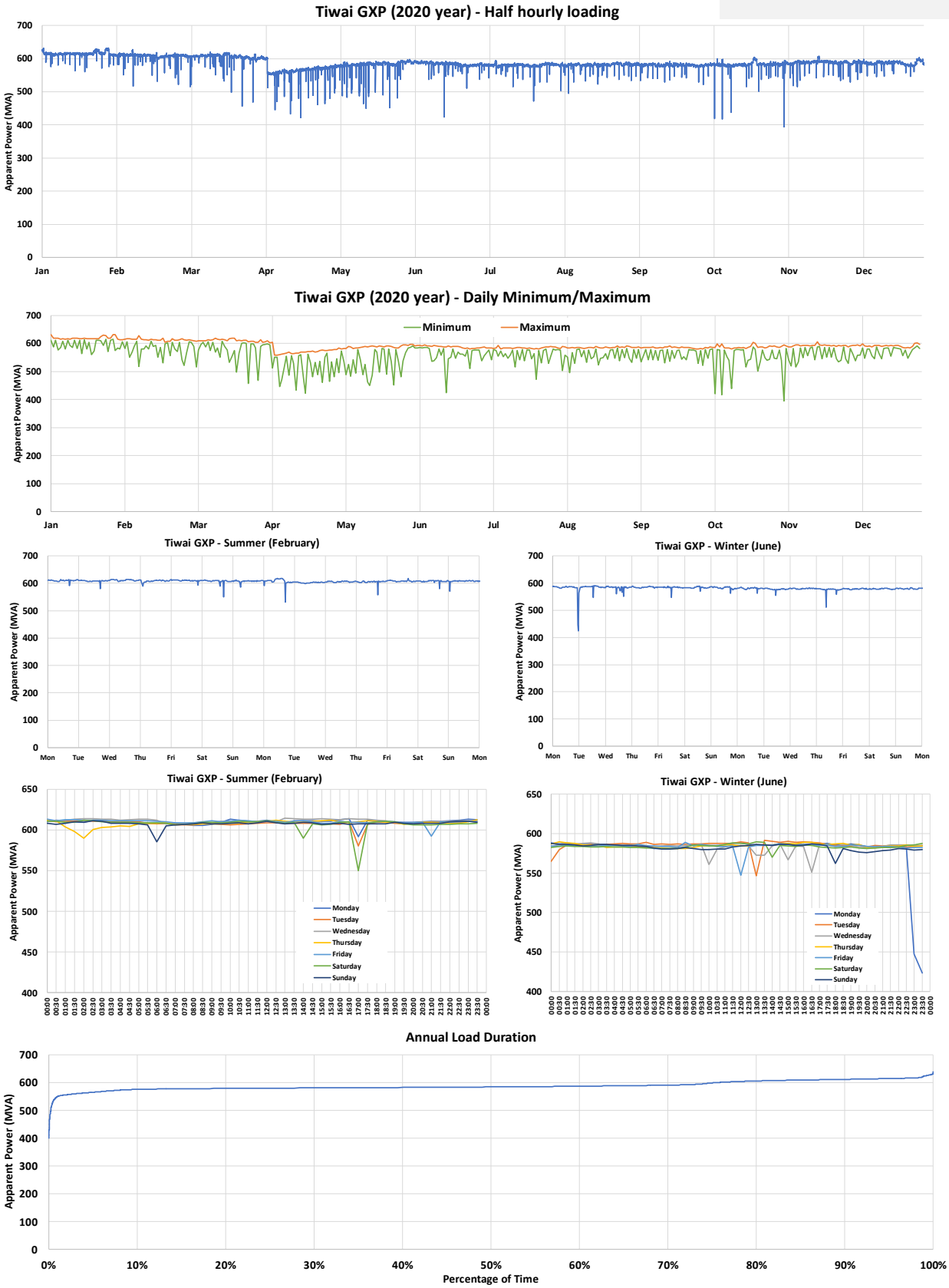


Figure 17 Tiwai: Apparent power (MVA) load characteristics

TIWAI MVAr

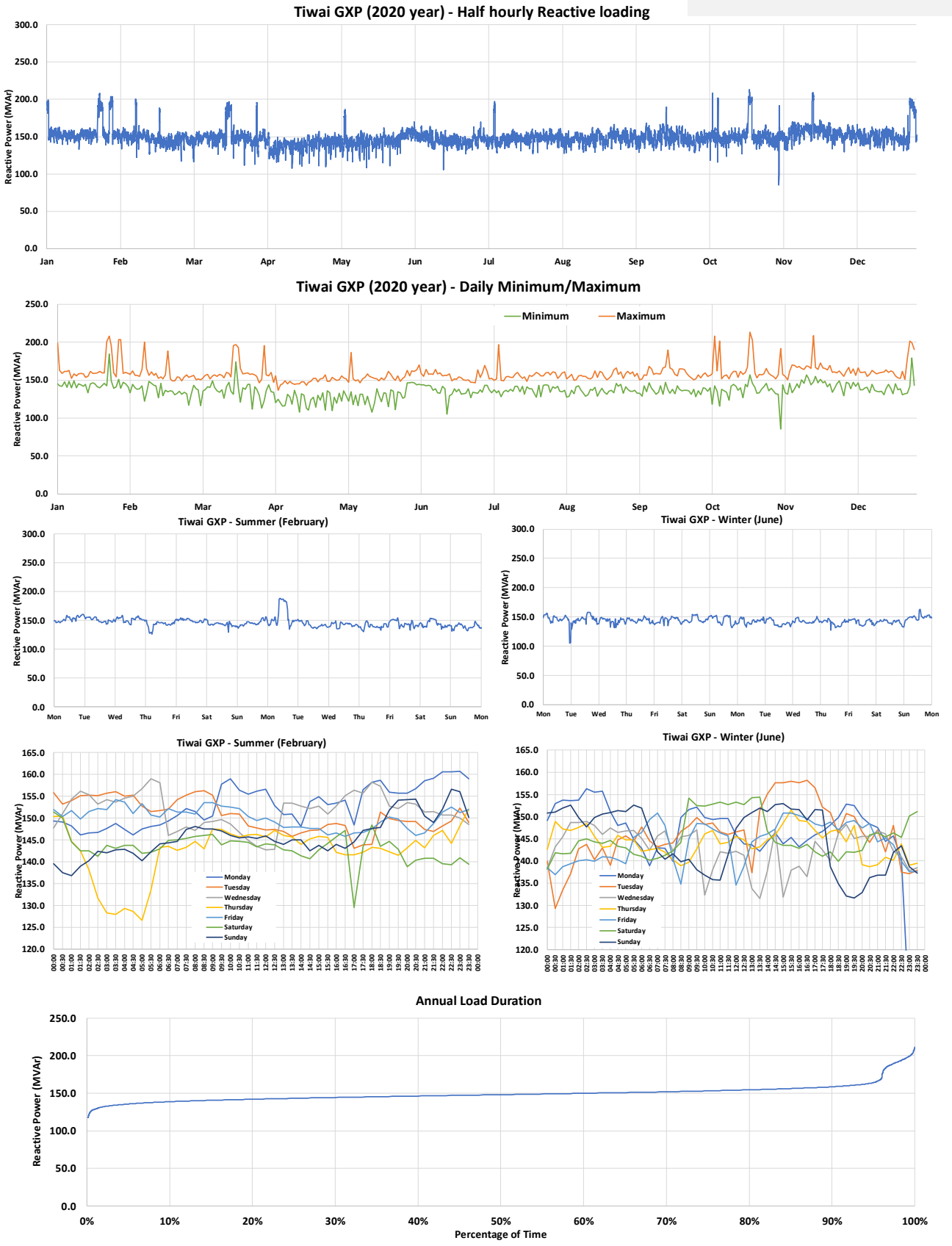


Figure 18 Tiwai: Reactive power (MVAr) load characteristics

3. Zone Substations

3.1 The Power Company

The characteristics of the zone substation **apparent power loadings** within The Power Company's network are shown in the following:

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- **Figure 21** Bluff 33/11kV zone substation: Apparent power (MVA) load characteristics
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- **Figure 39** Mossburn 66/33/11kV zone substation: Apparent power (MVA) load characteristics
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- **Figure 41** North Makarewa 66/33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 42** Ohai 66/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 43** Orawia 66/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 44** Otatara 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 45** Otautau 66/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 46** Riversdale 33/11kV zone substation: Apparent power (MVA) load characteristics
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- **Figure 48** Seaward Bush 33/11kV zone substation: Apparent power (MVA) load characteristics
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- **Figure 51** Tokanui 33/11kV zone substation: Apparent power (MVA) load characteristics
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ATHOL MVA

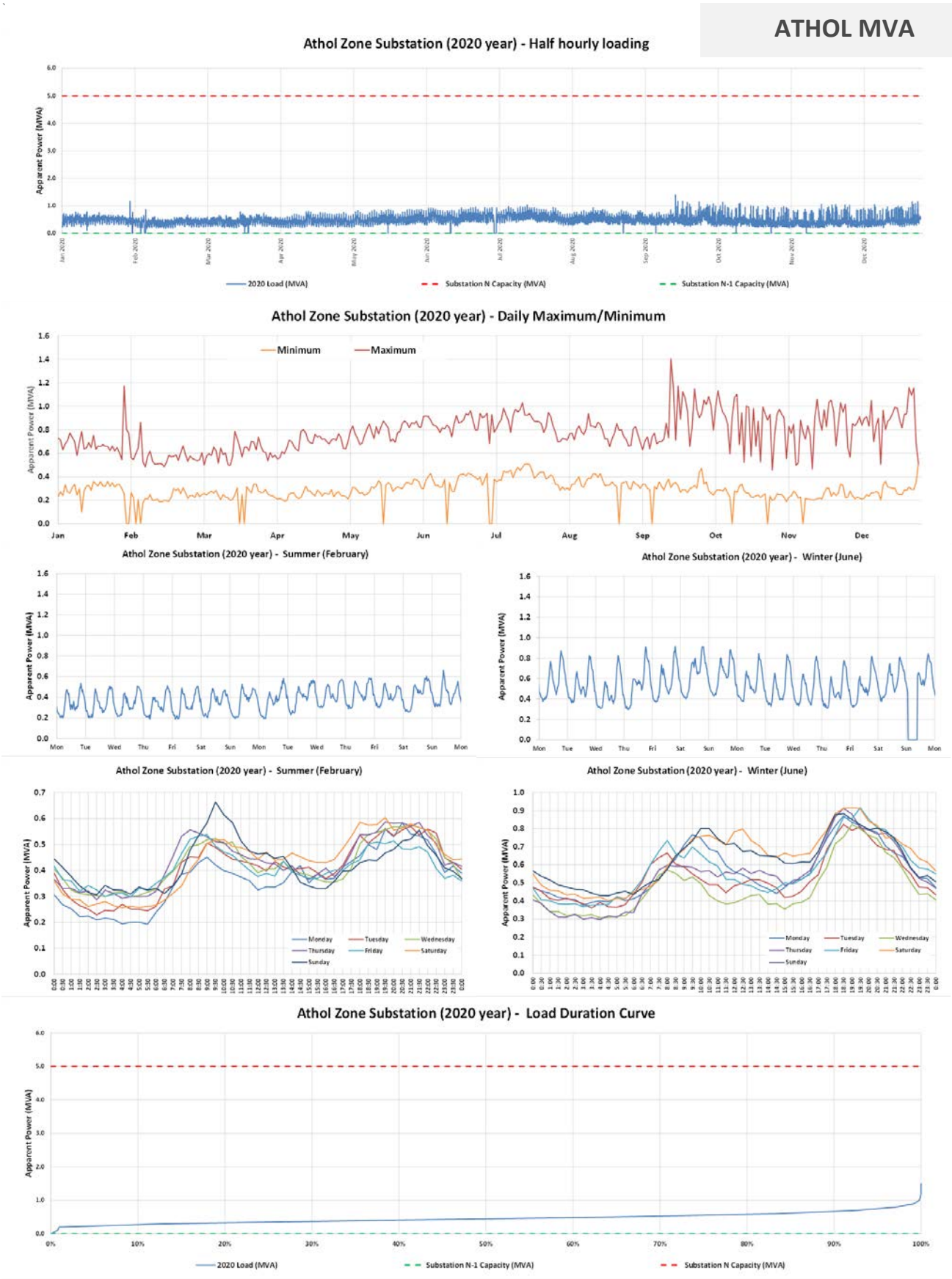


Figure 19 Athol 66/11kV zone substation: Apparent power (MVA) load characteristics

AWARUA CHIP MILL MVA

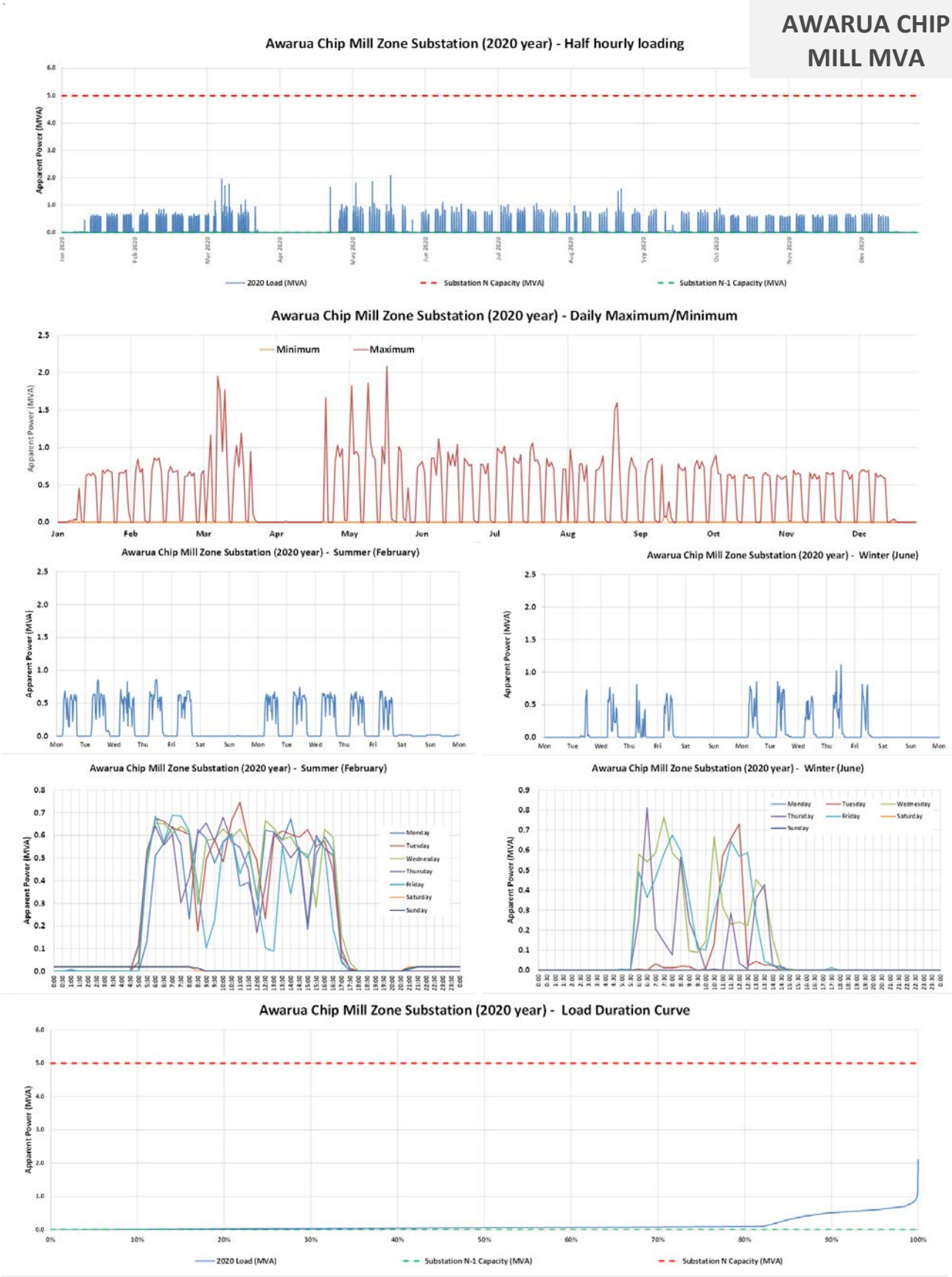


Figure 20 Awarua Chip Mill 33/11kV zone substation: Apparent power (MVA) load characteristics

BLUFF MVA

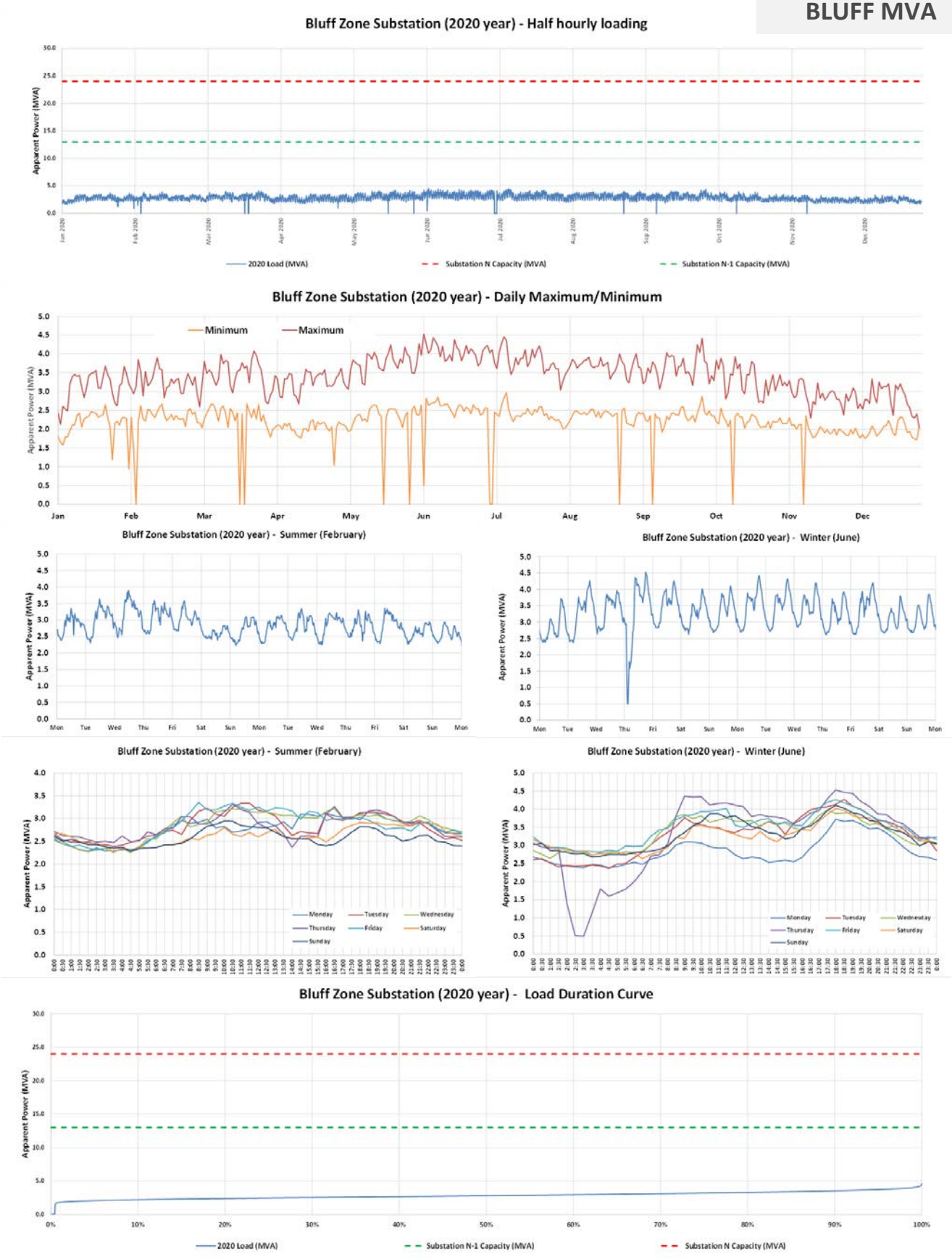


Figure 21 Bluff 33/11kV zone substation: Apparent power (MVA) load characteristics

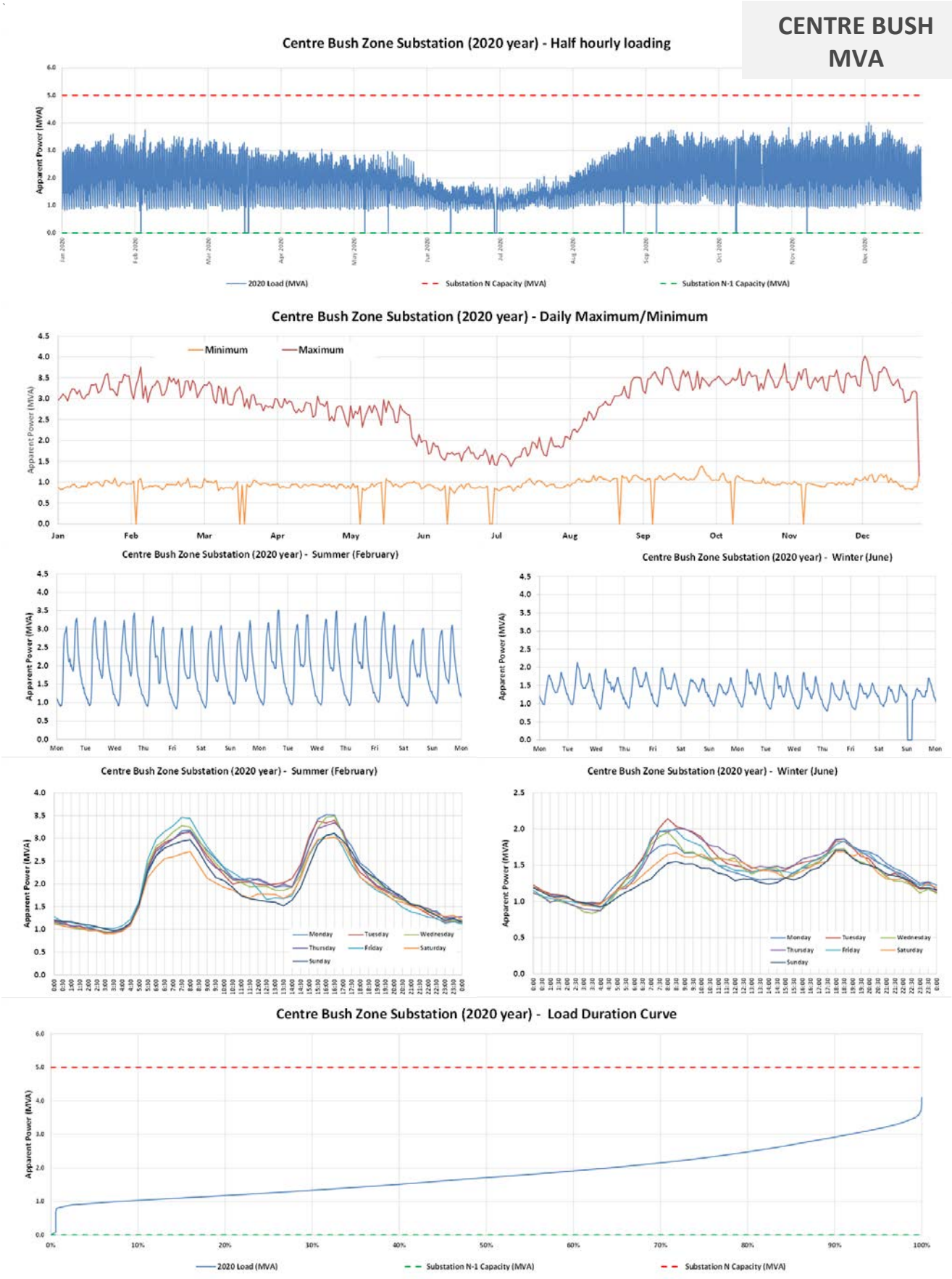


Figure 22 Centre Bush 33/11kV zone substation: Apparent power (MVA) load characteristics

COLYER ROAD MVA

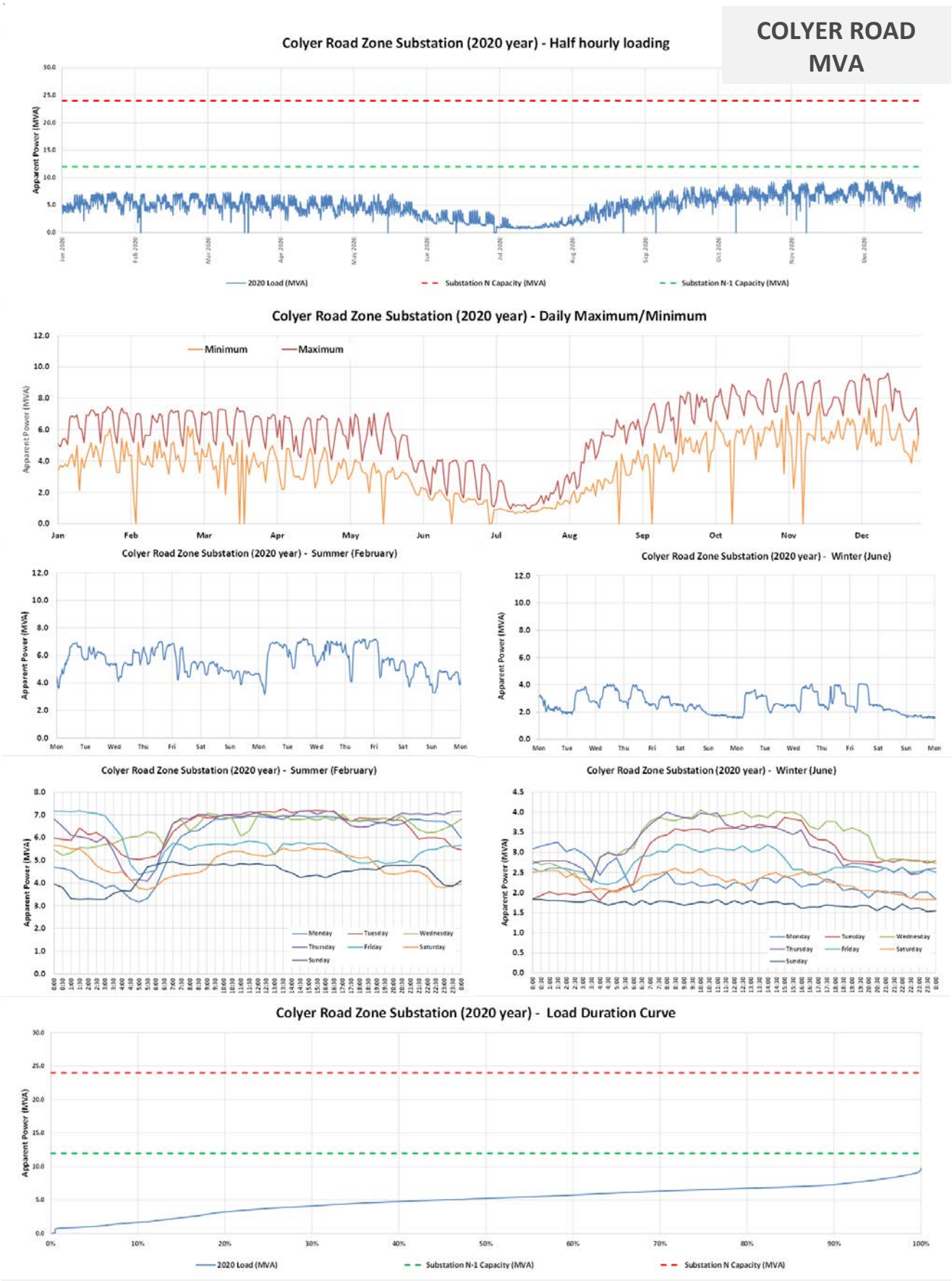


Figure 23 Colyer Road 33/11kV zone substation: Apparent power (MVA) load characteristics

CONICAL HILL MVA

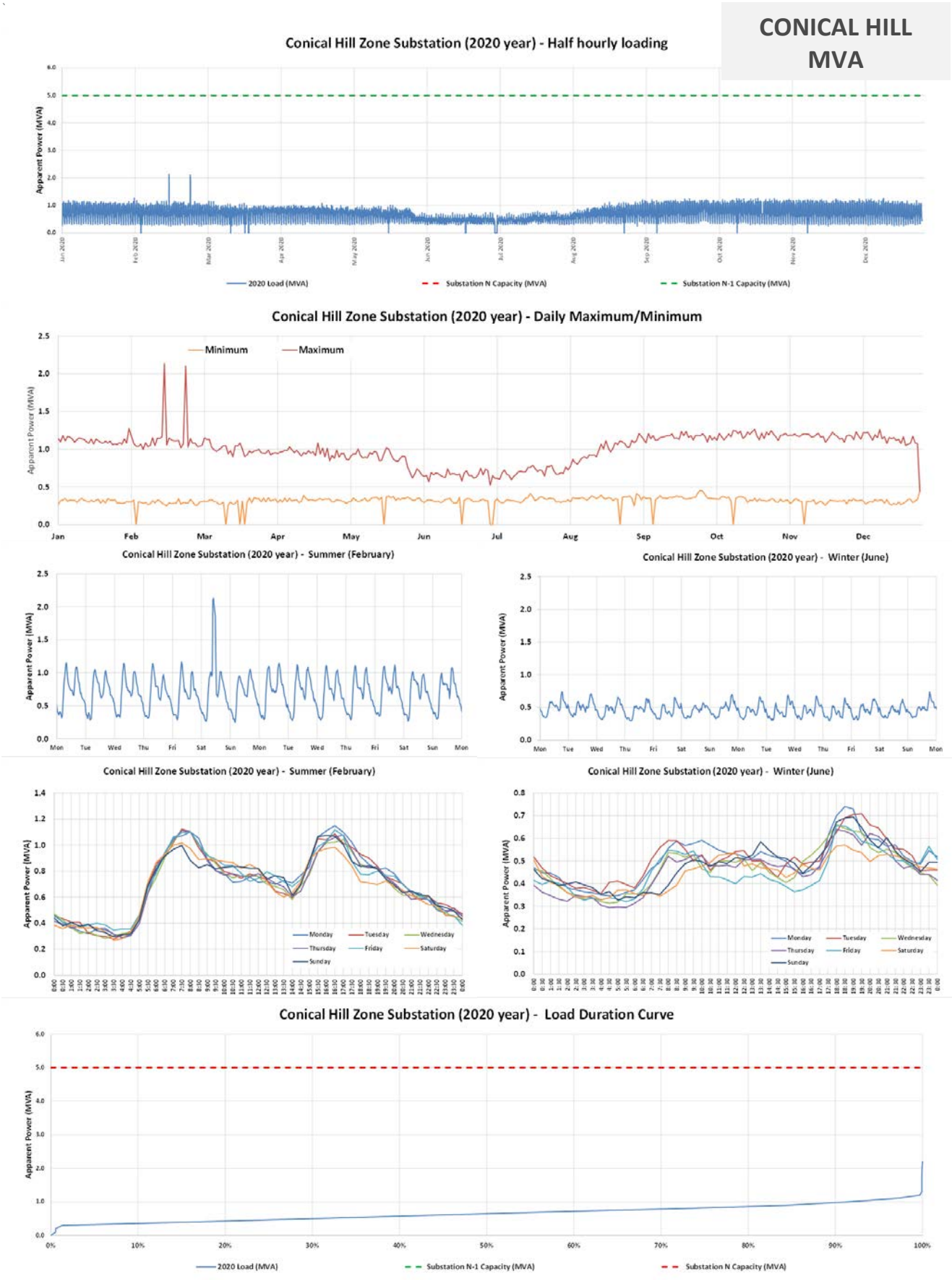


Figure 24 Conical Hill 33/11kV zone substation: Apparent power (MVA) load characteristics

DIPTON MVA

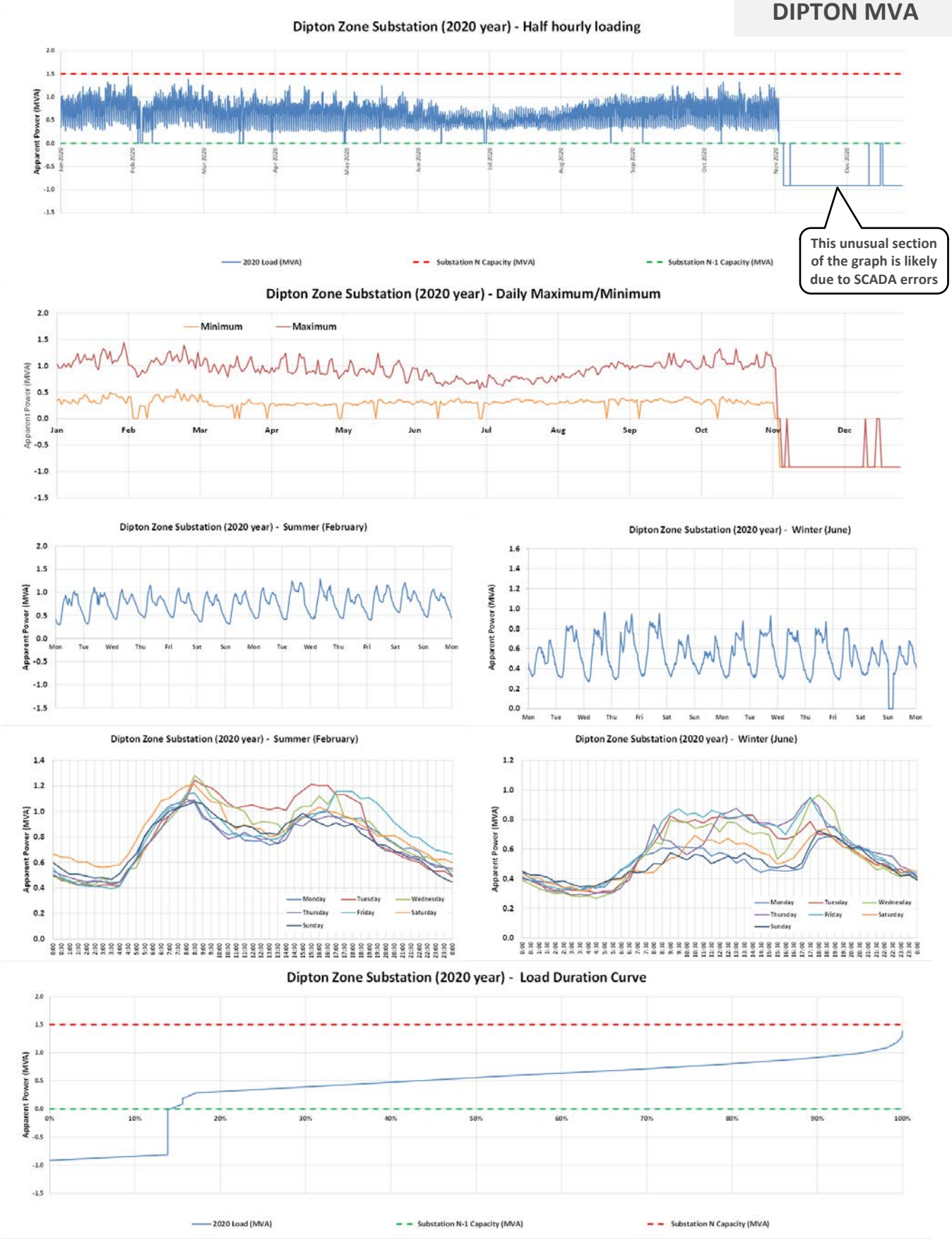


Figure 25 Dipton 33/11kV zone substation: Apparent power (MVA) load characteristics

INFORMATION NOT SUPPLIED

Figure 26 Edendale Fonterra 33/11kV zone substation: Apparent power (MVA) load characteristics

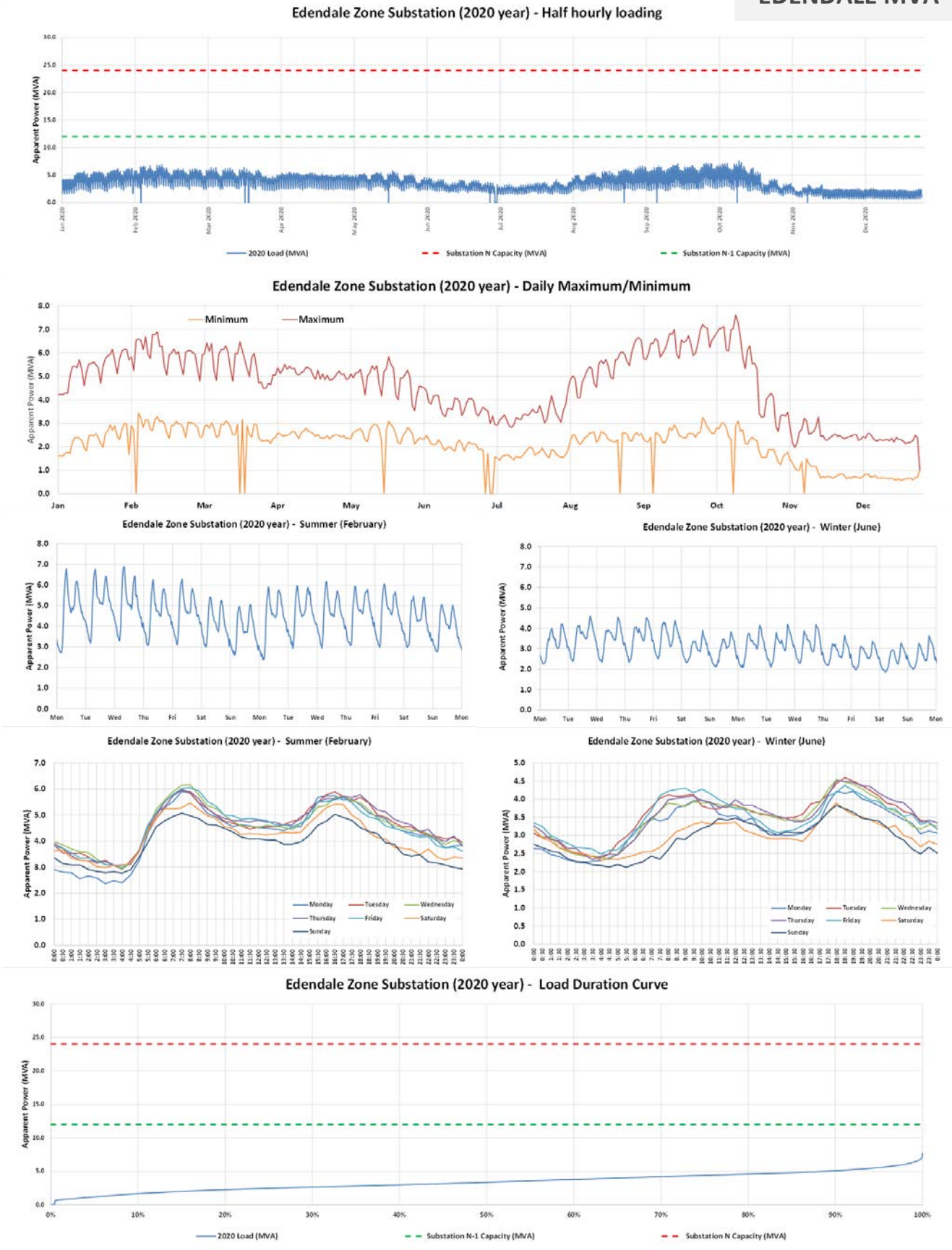


Figure 27 Edendale 33/11kV zone substation: Apparent power (MVA) load characteristics

GLENHAM MVA

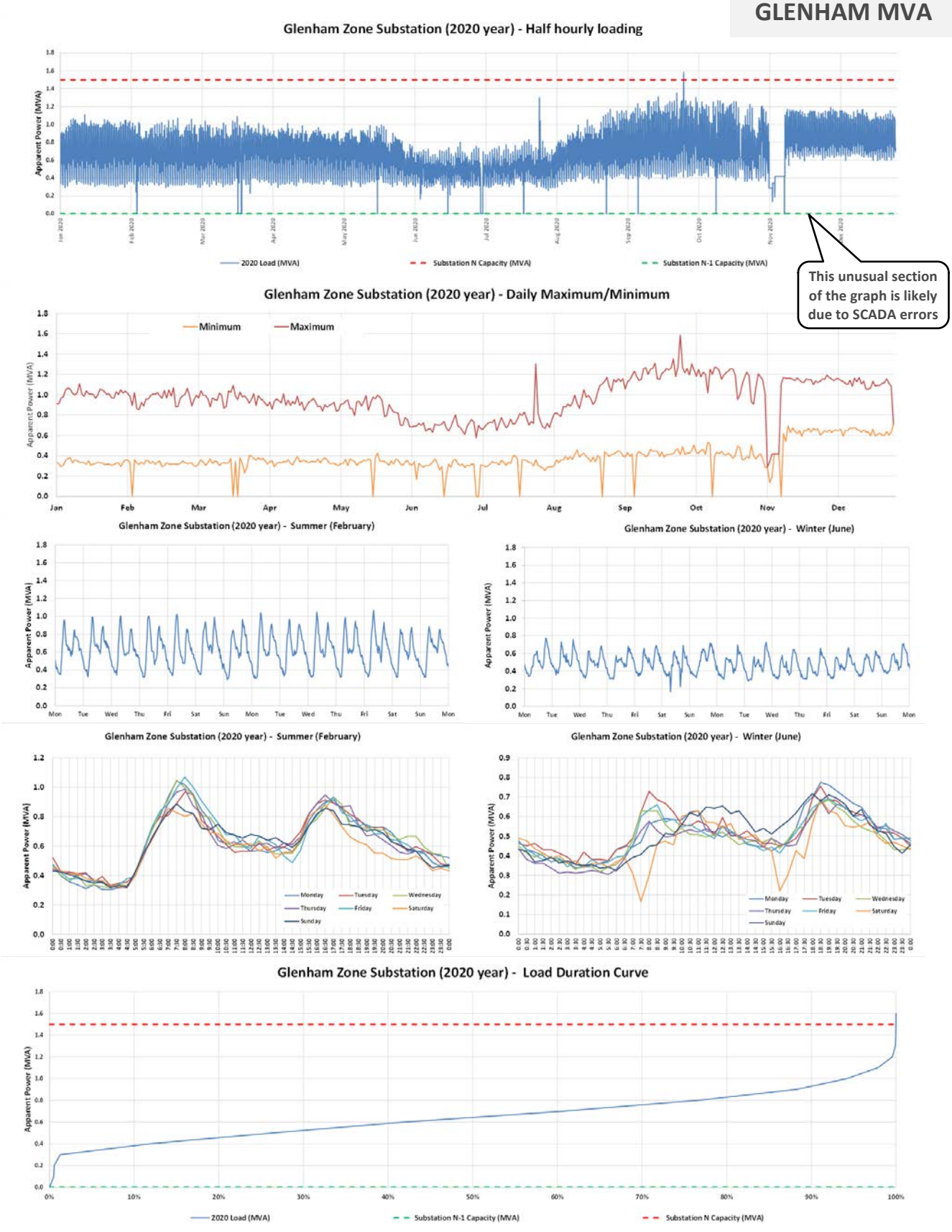


Figure 28 Glenham 33/11kV zone substation: Apparent power (MVA) load characteristics

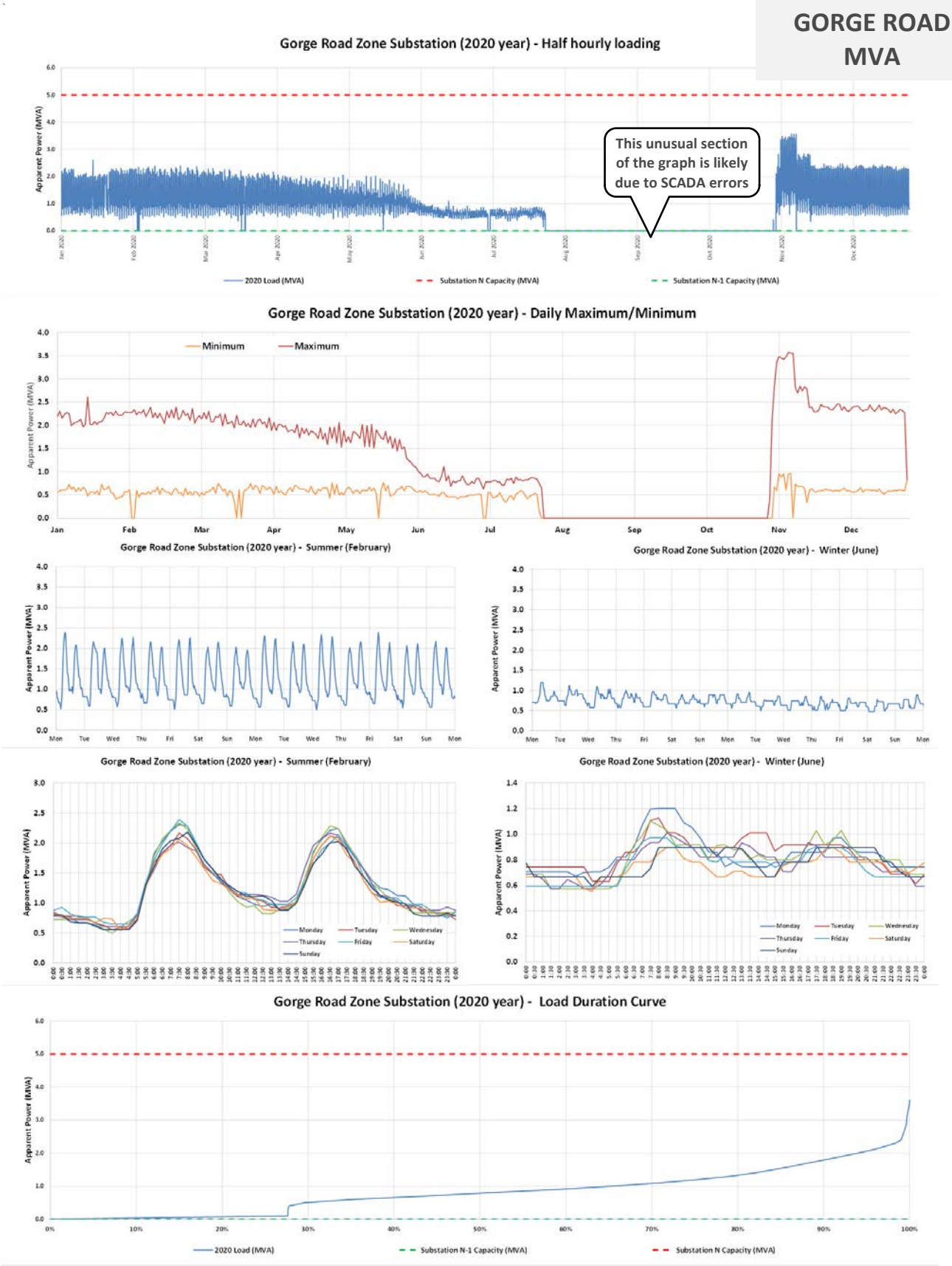


Figure 29 Gorge Road 33/11kV zone substation: Apparent power (MVA) load characteristics

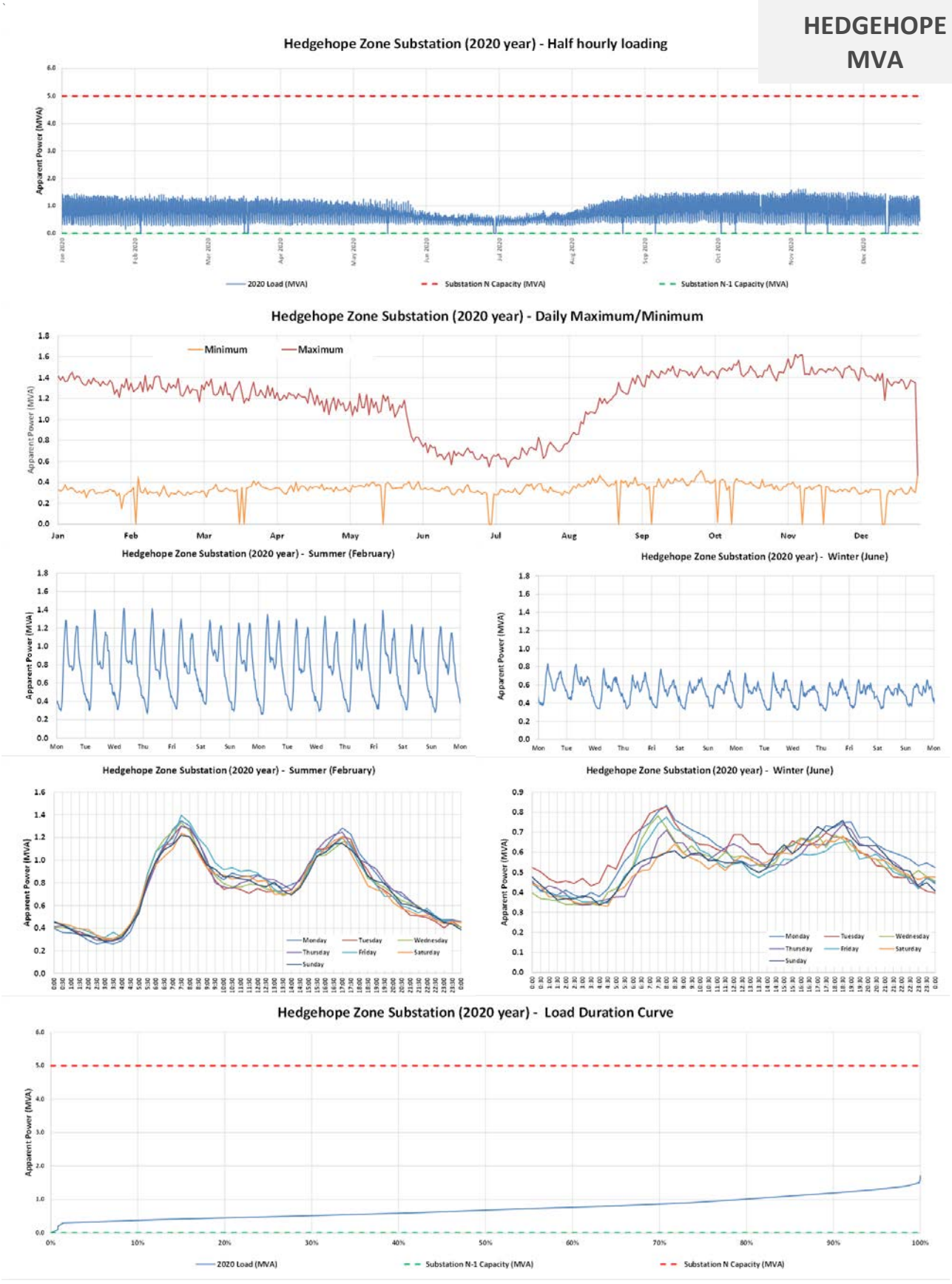


Figure 30 Hedgehope 33/11kV zone substation: Apparent power (MVA) load characteristics

HILLSIDE MVA

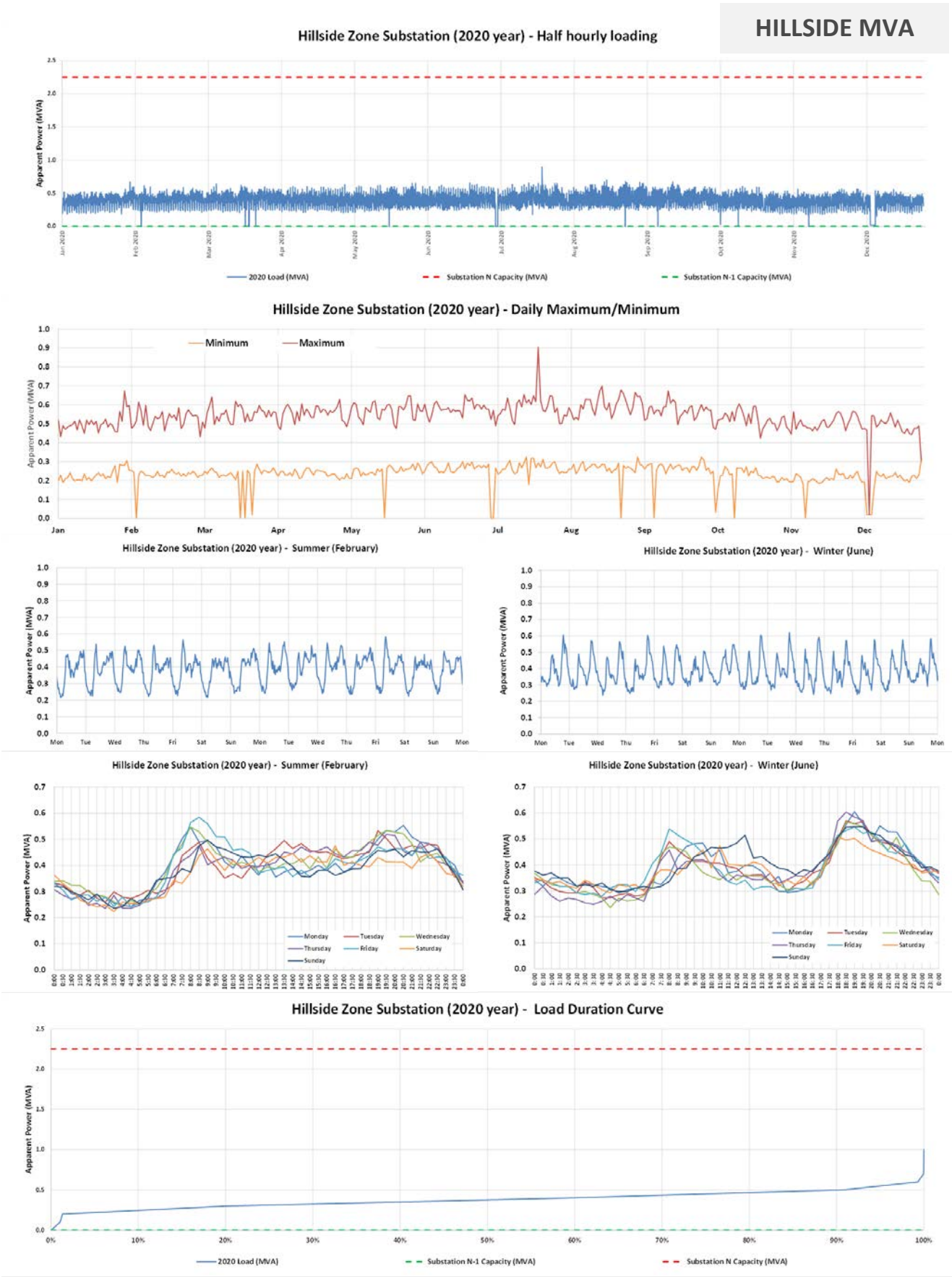


Figure 31 Hillside 33/11kV zone substation: Apparent power (MVA) load characteristics

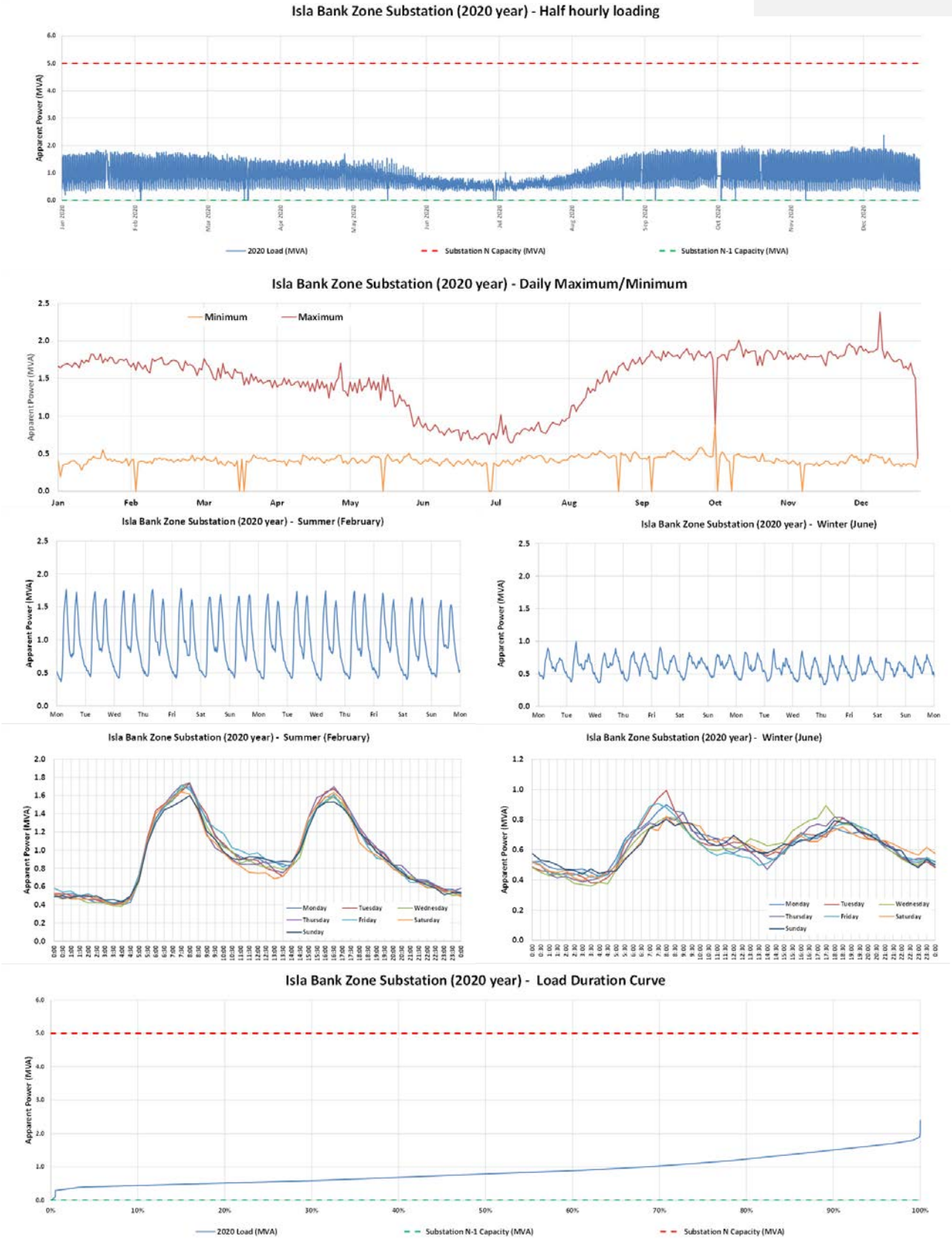


Figure 32 Isla Bank 33/11kV zone substation: Apparent power (MVA) load characteristics

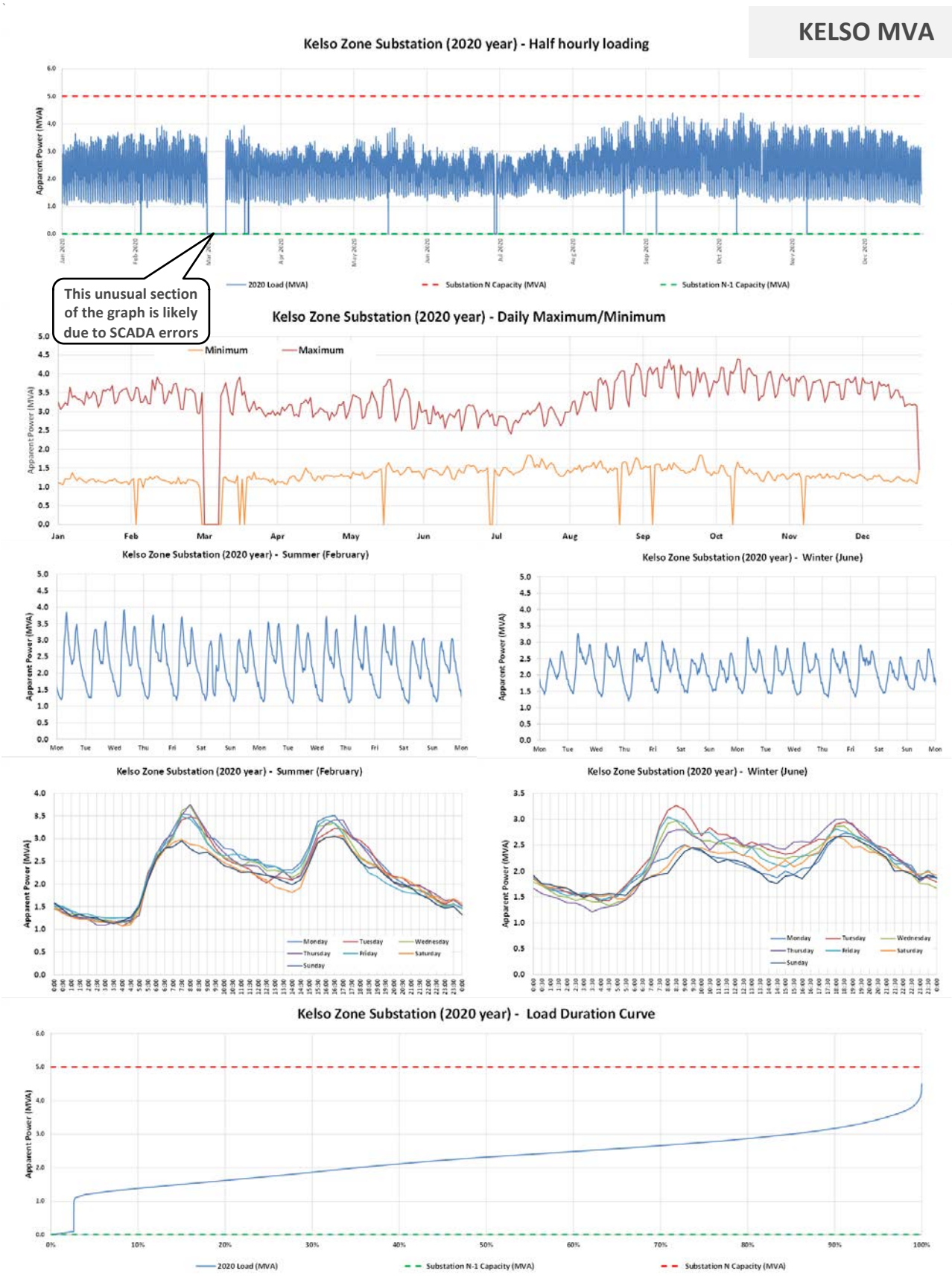


Figure 33 Kelso 33/11kV zone substation: Apparent power (MVA) load characteristics

KENNINGTON MVA

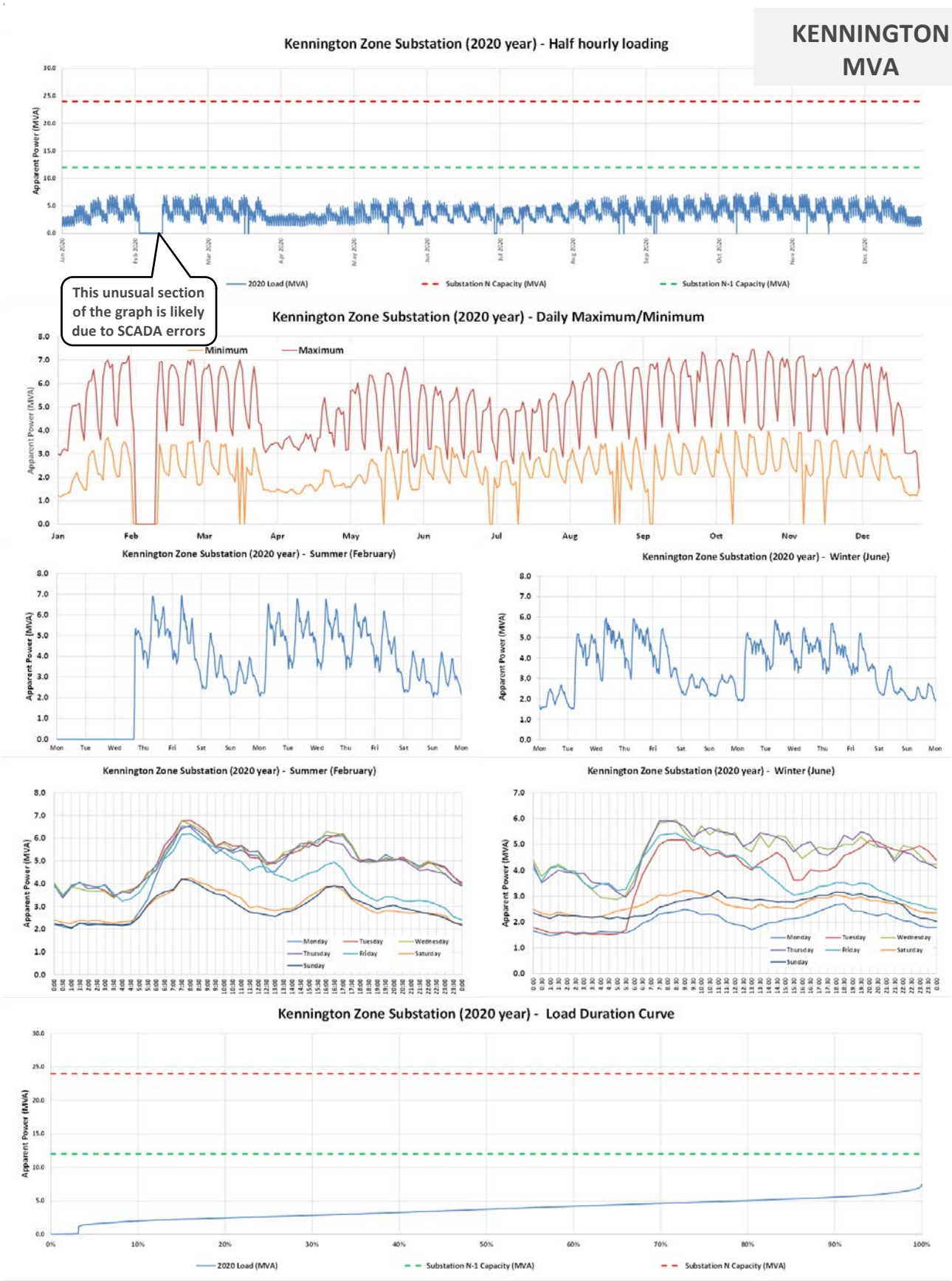


Figure 34 Kennington 33/11kV zone substation: Apparent power (MVA) load characteristics

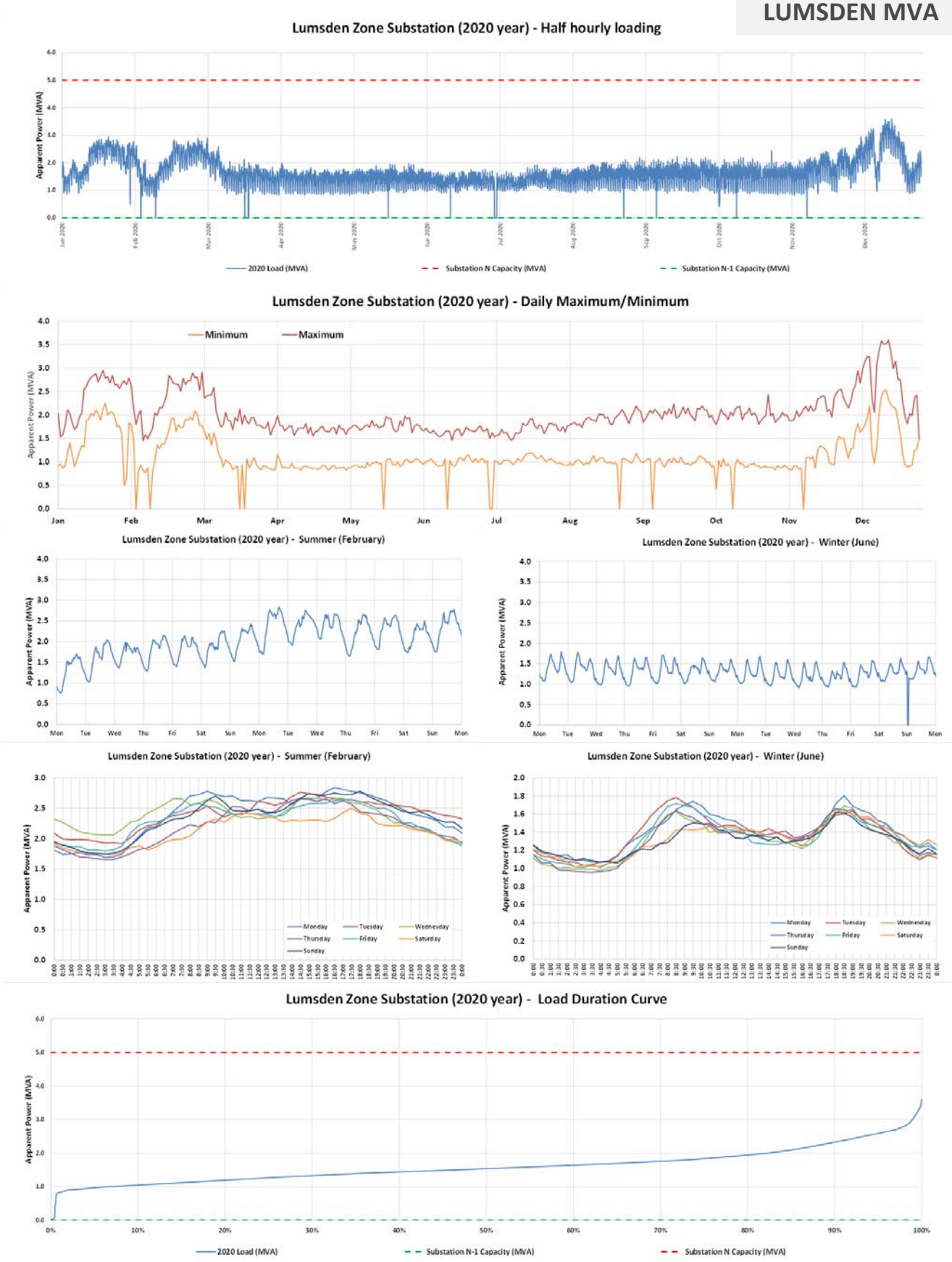


Figure 35 Lumsden 33/11kV zone substation: Apparent power (MVA) load characteristics

MAKAREWA MVA

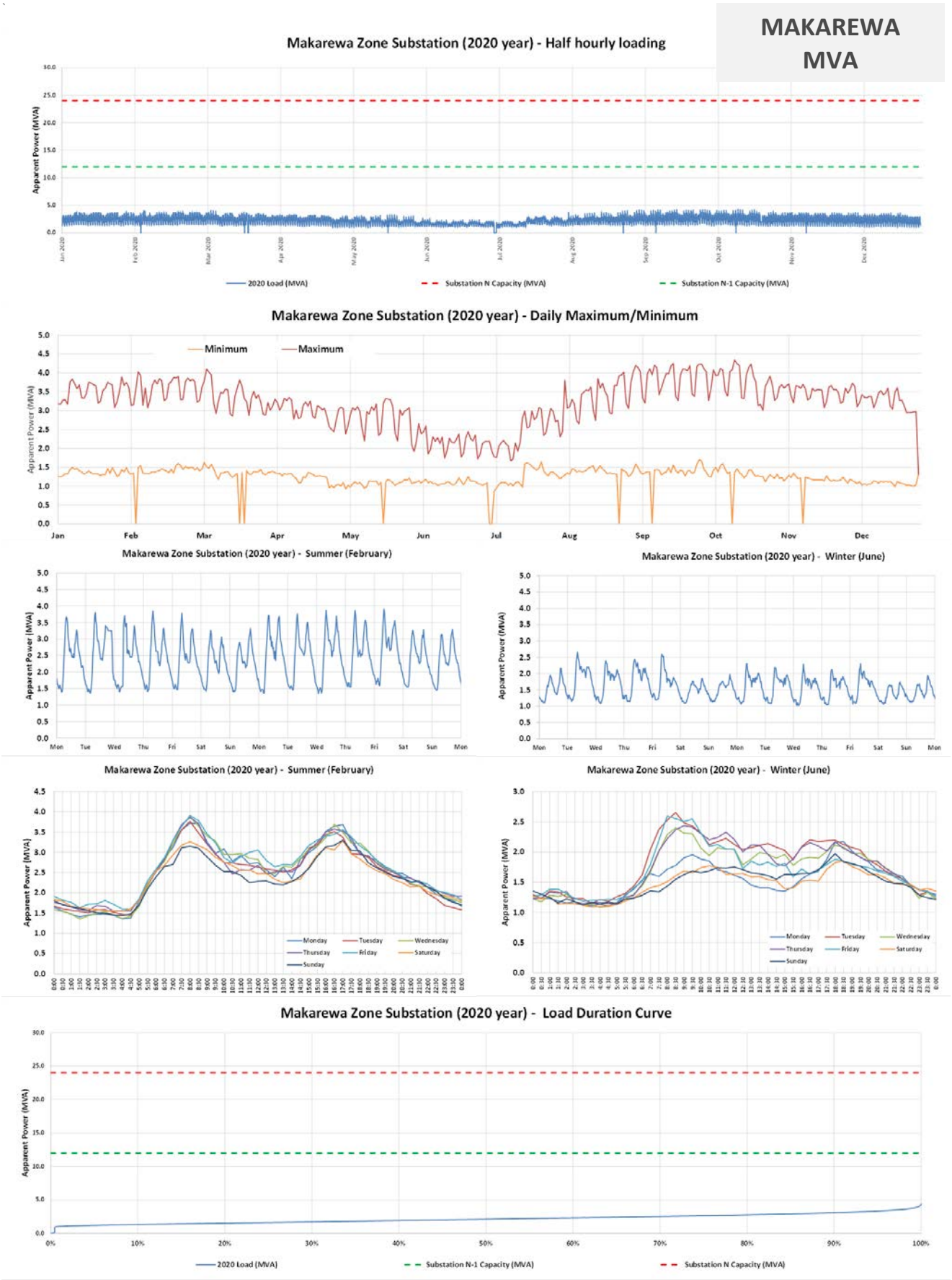


Figure 36 Makarewa 33/11kV zone substation: Apparent power (MVA) load characteristics

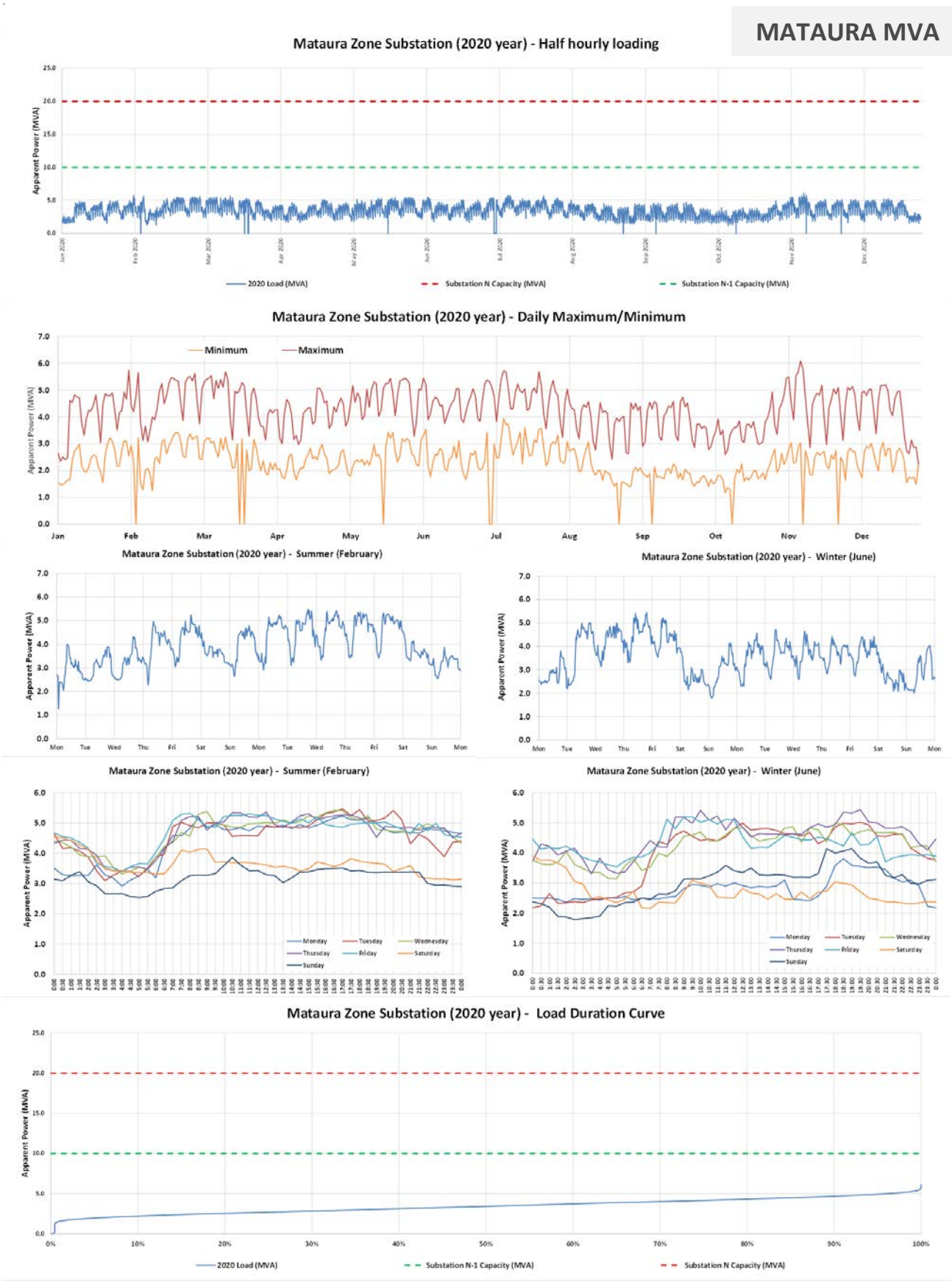


Figure 37 Mataura 33/11kV zone substation: Apparent power (MVA) load characteristics

MONOWAI MVA

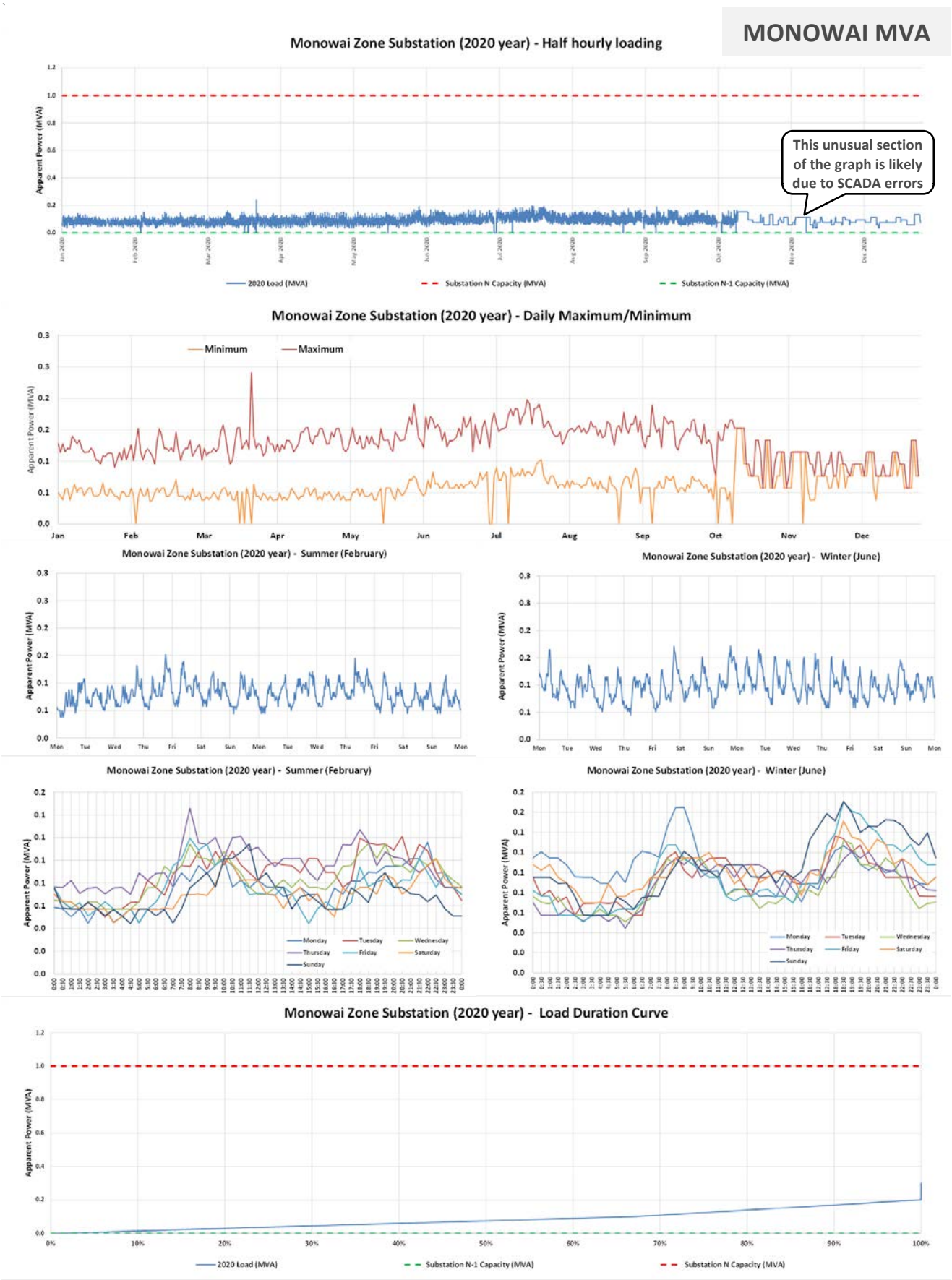


Figure 38 Monowai 66/11kV zone substation: Apparent power (MVA) load characteristics

MOSSBURN MVA

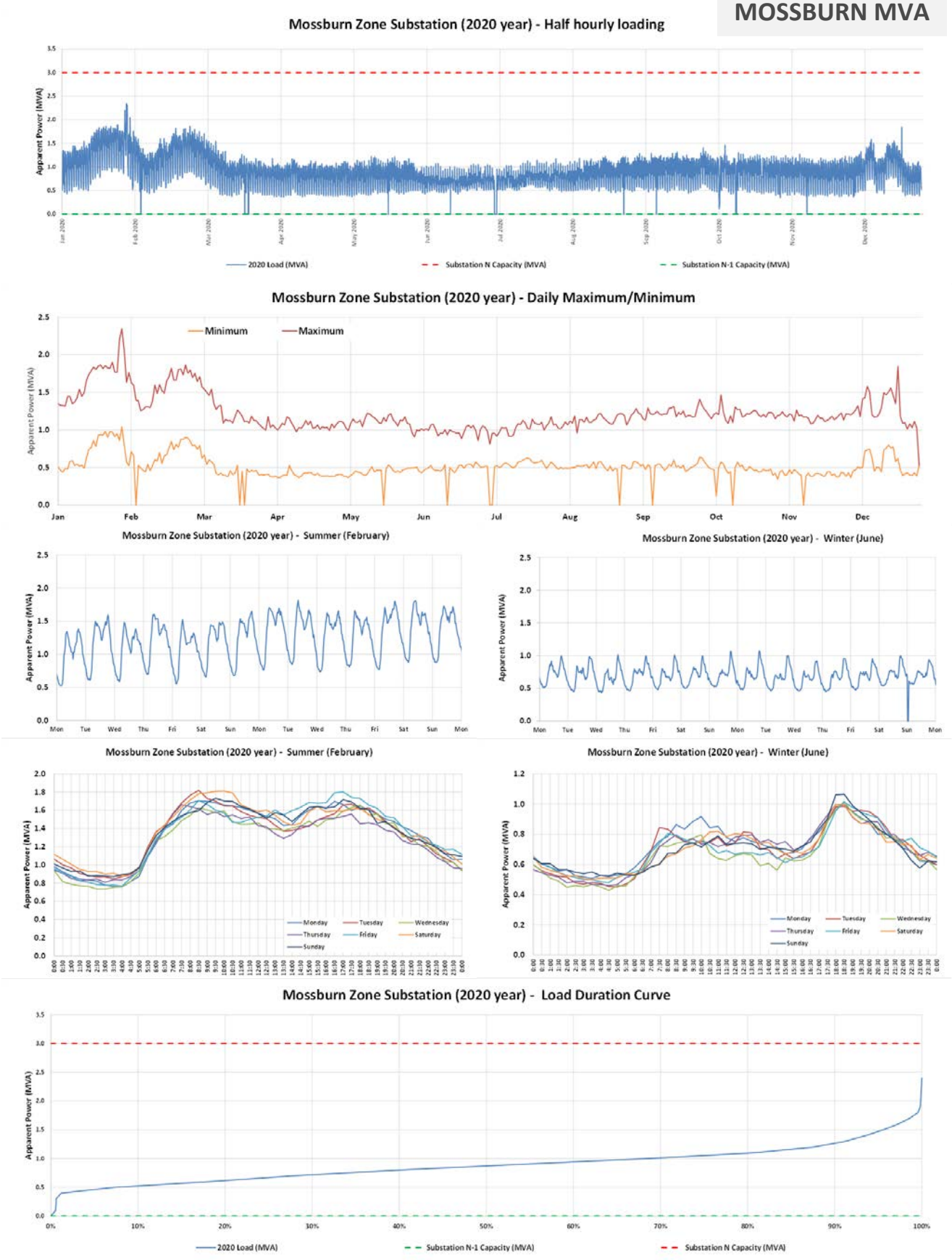


Figure 39 Mossburn 66/33/11kV zone substation: Apparent power (MVA) load characteristics

NORTH GORE MVA

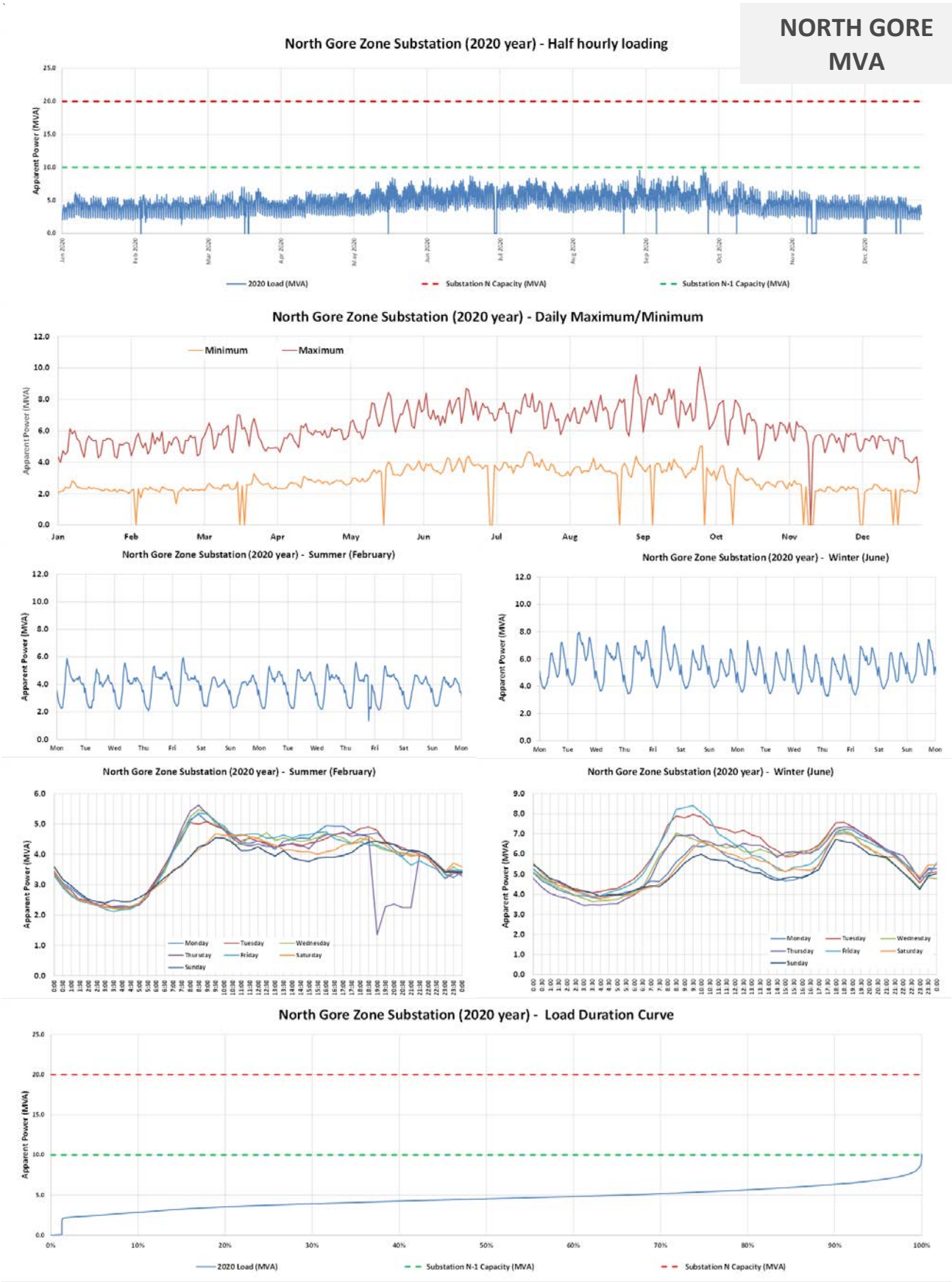


Figure 40 North Gore 33/11kV zone substation: Apparent power (MVA) load characteristics

INFORMATION NOT SUPPLIED

Figure 41 North Makarewa 66/33/11kV zone substation: Apparent power (MVA) load characteristics

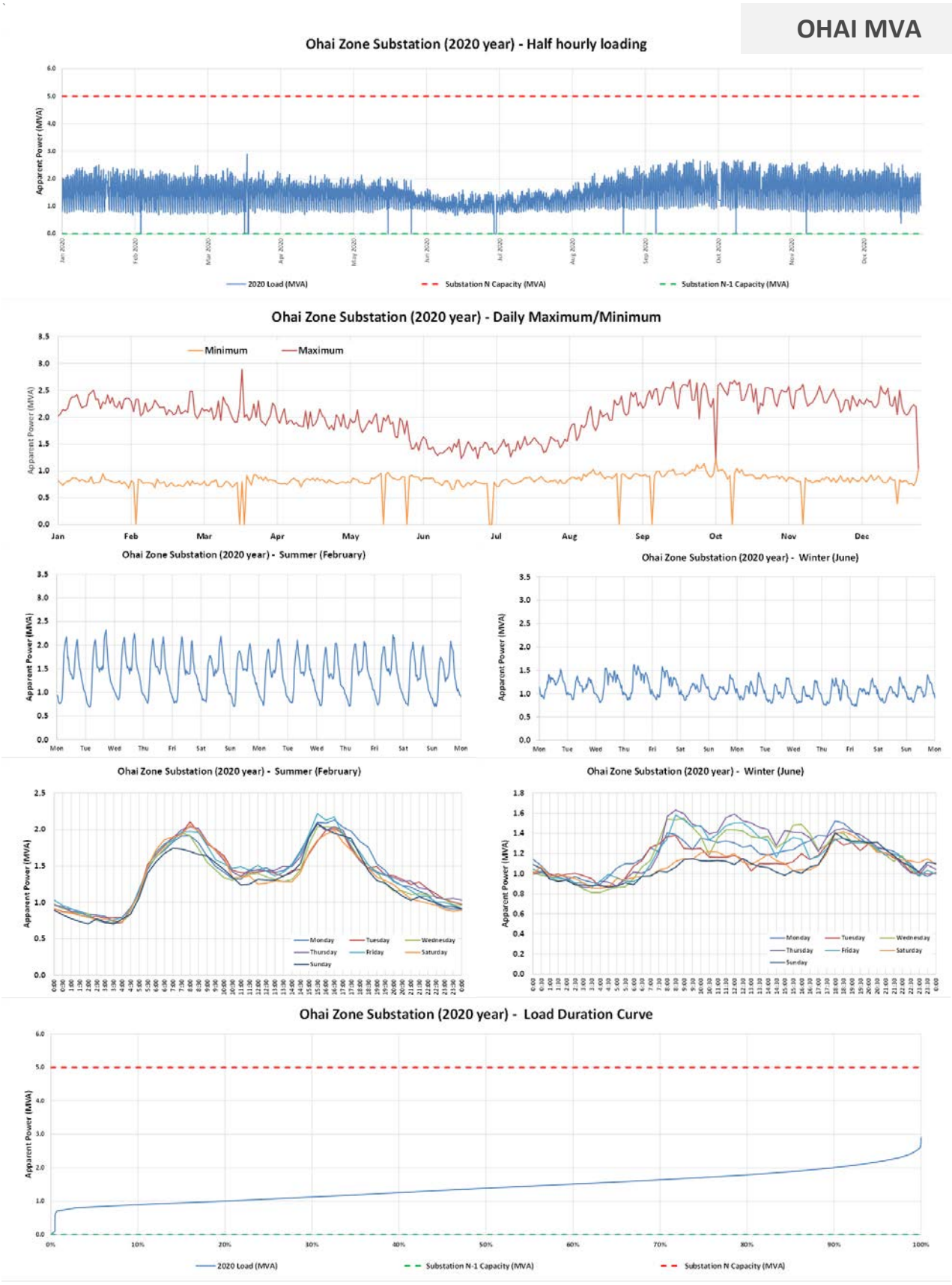


Figure 42 Ohai 66/11kV zone substation: Apparent power (MVA) load characteristics

ORAWIA MVA

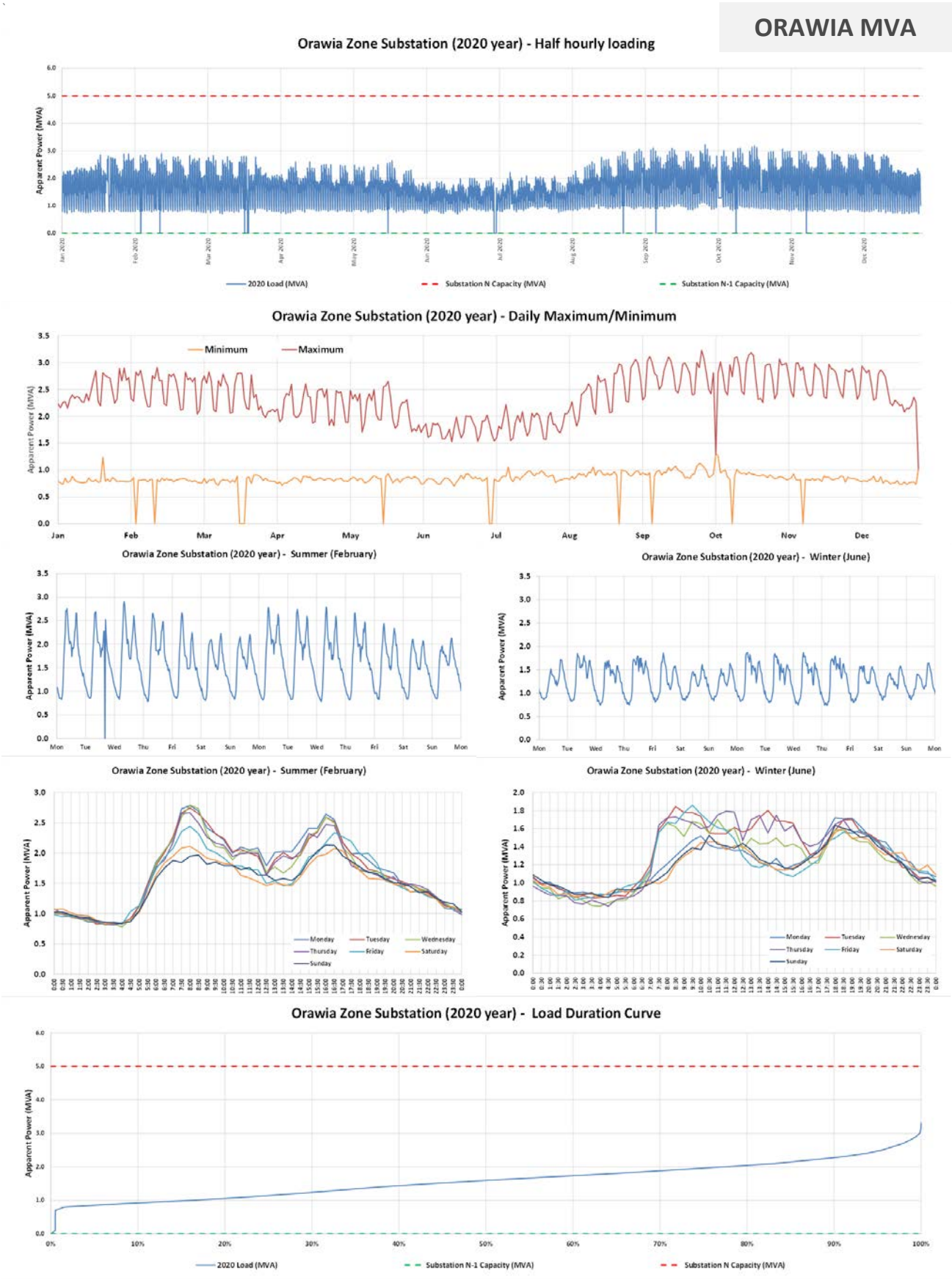


Figure 43 Orawia 66/11kV zone substation: Apparent power (MVA) load characteristics

OTATARA MVA

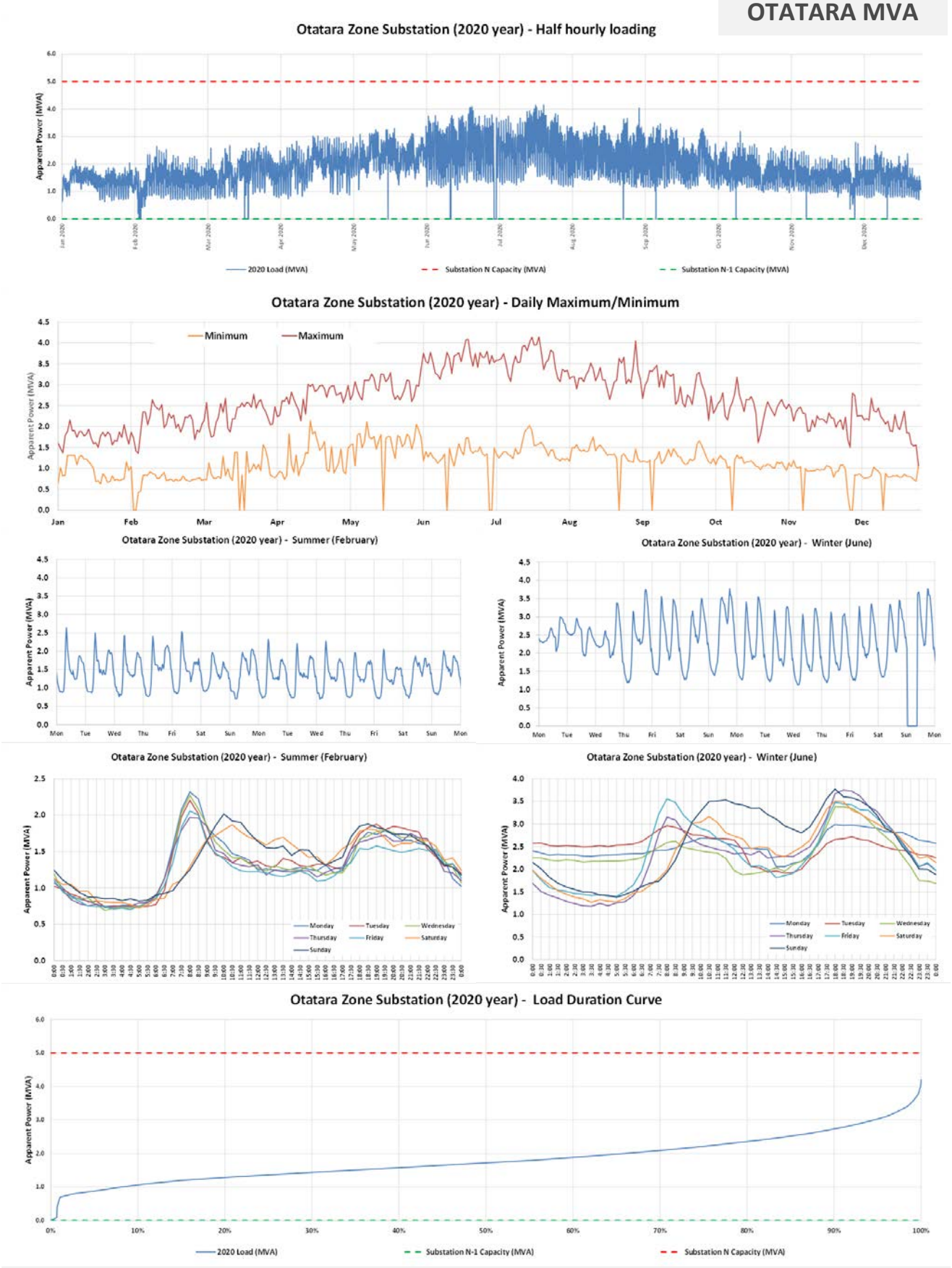


Figure 44 Otatara 33/11kV zone substation: Apparent power (MVA) load characteristics

OTAUTAU MVA

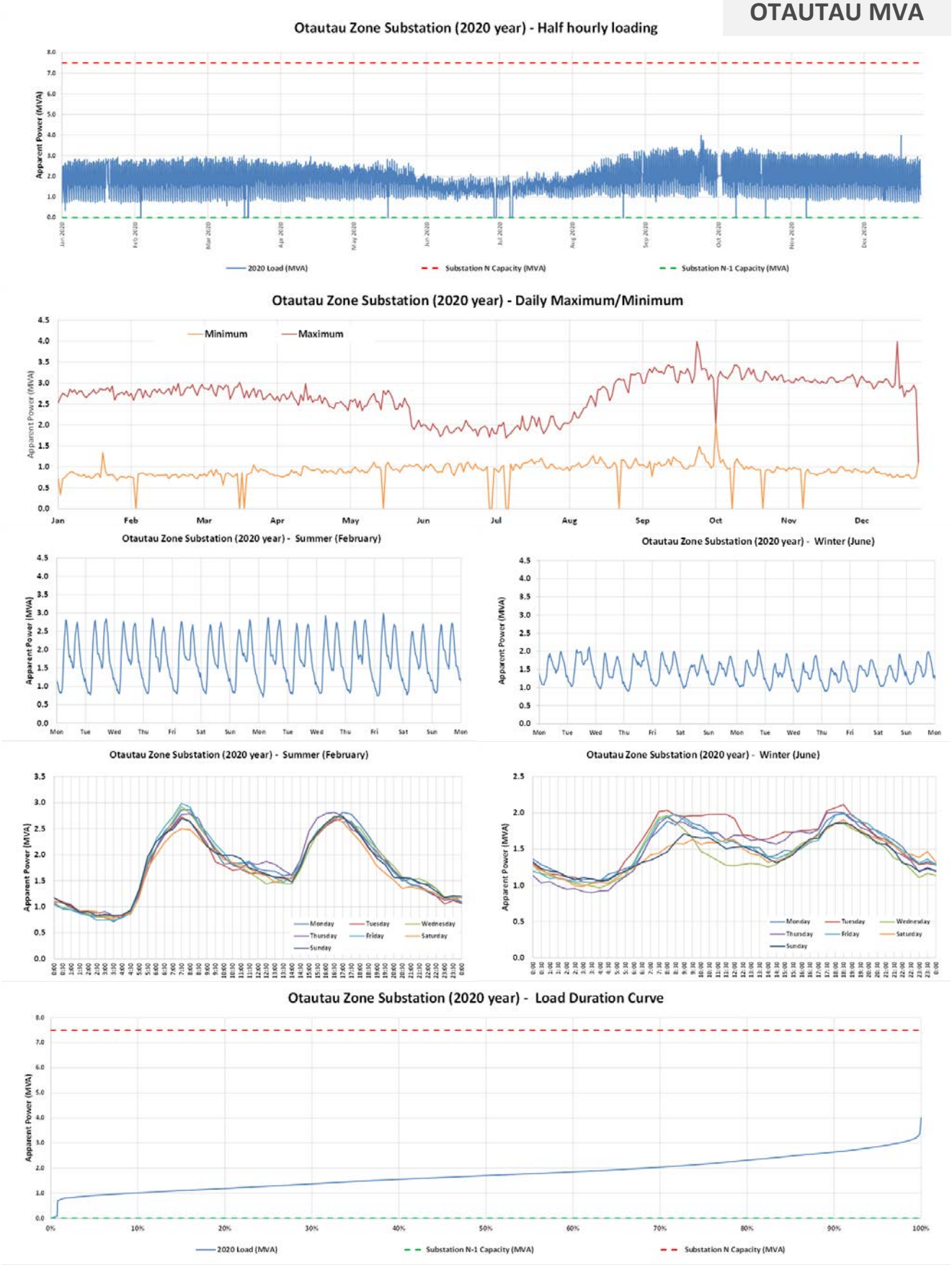


Figure 45 Otautau 66/11kV zone substation: Apparent power (MVA) load characteristics

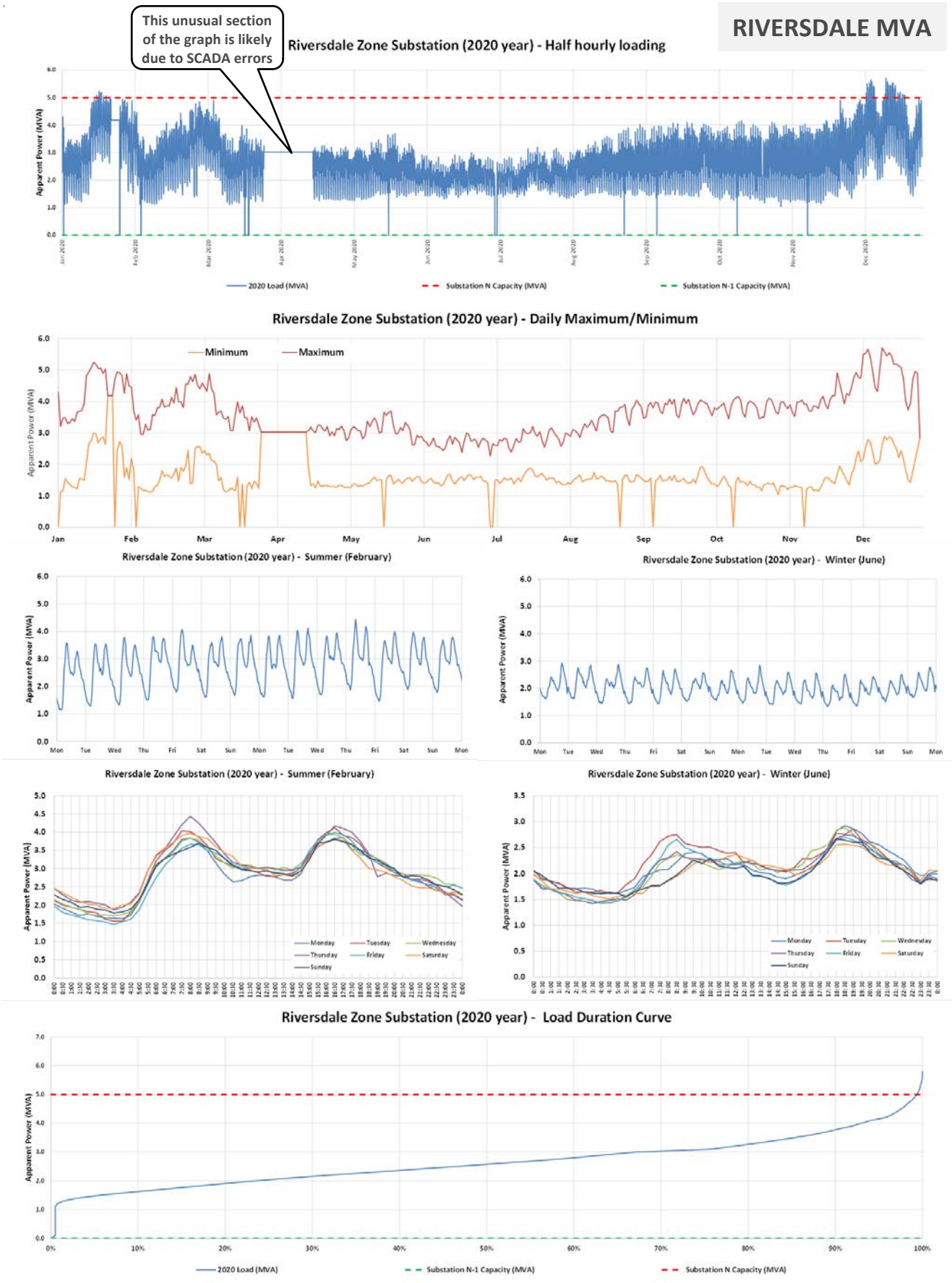


Figure 46 Riversdale 33/11kV zone substation: Apparent power (MVA) load characteristics

RIVERTON MVA

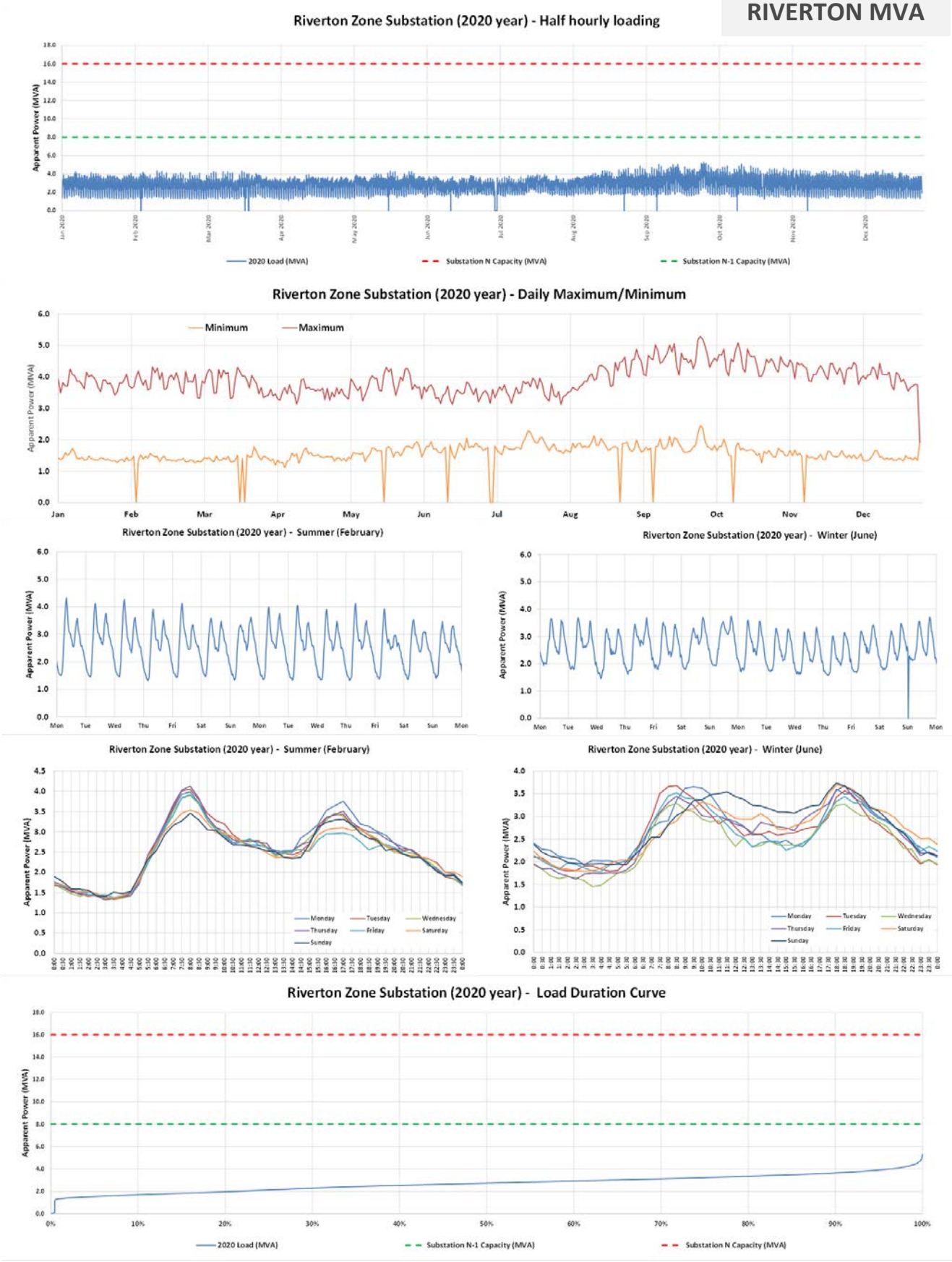


Figure 47 Riverton 33/11kV zone substation: Apparent power (MVA) load characteristics

SEAWARD BUSH MVA

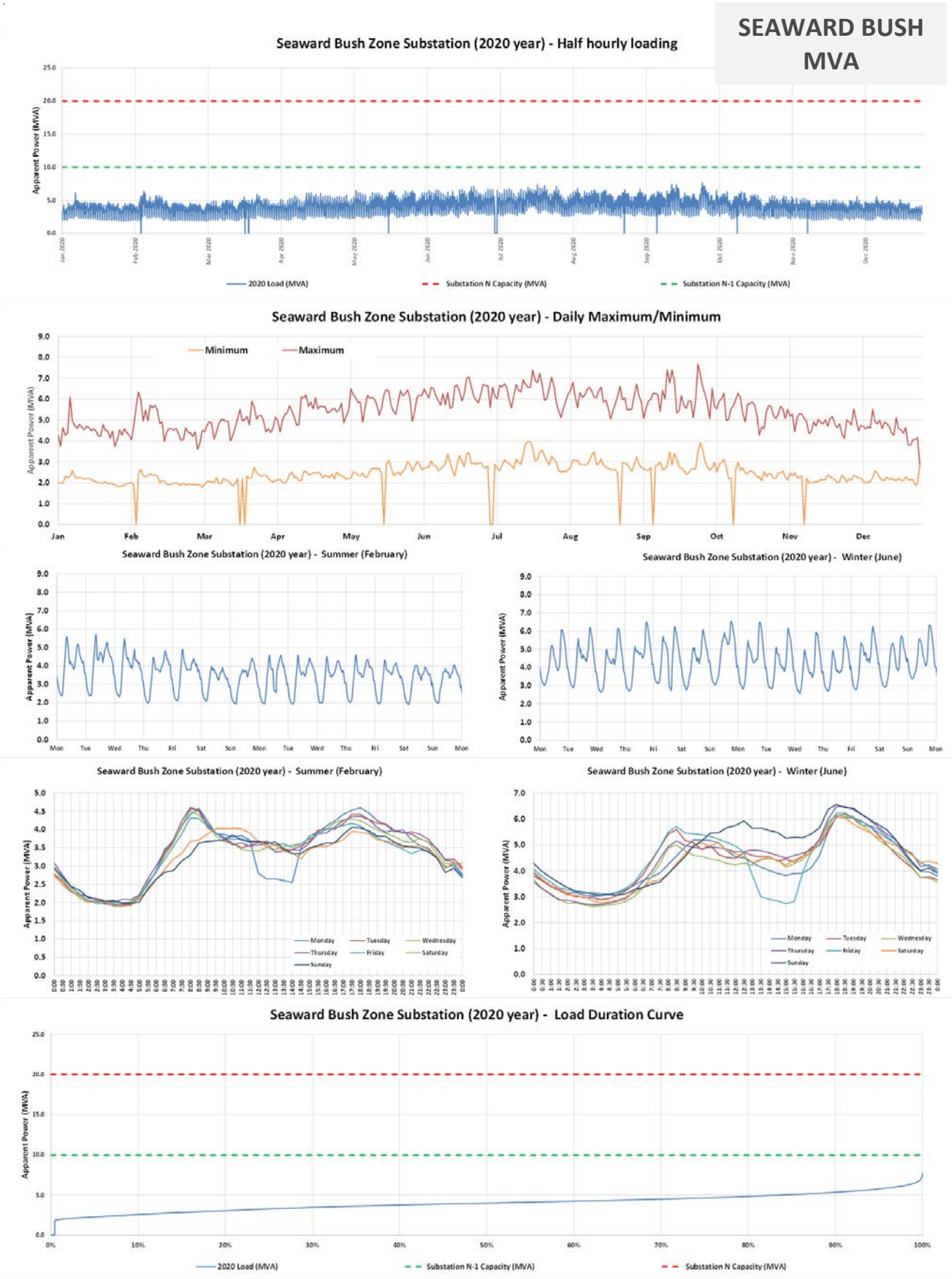


Figure 48 Seaward Bush 33/11kV zone substation: Apparent power (MVA) load characteristics

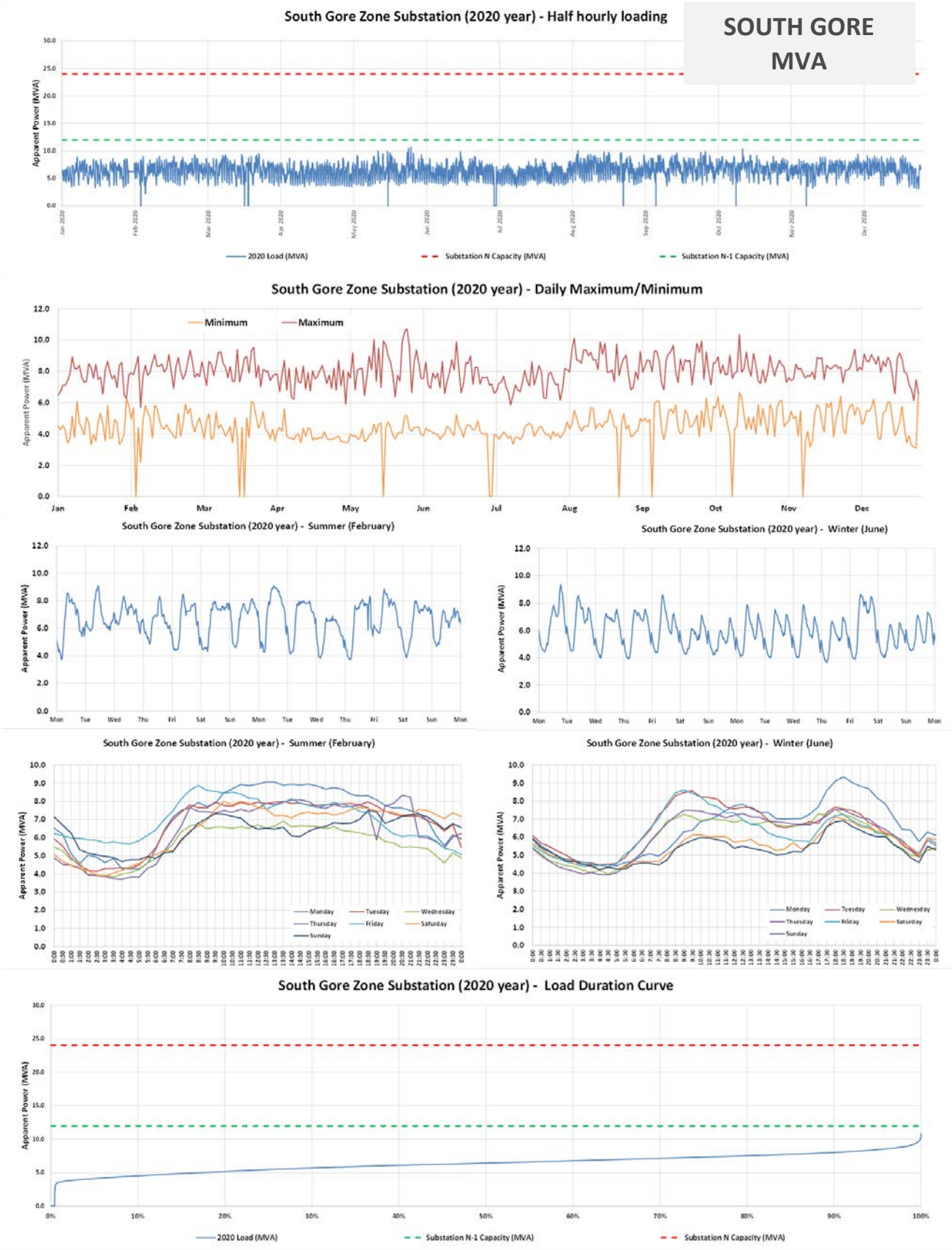


Figure 49 South Gore 33/11kV zone substation: Apparent power (MVA) load characteristics

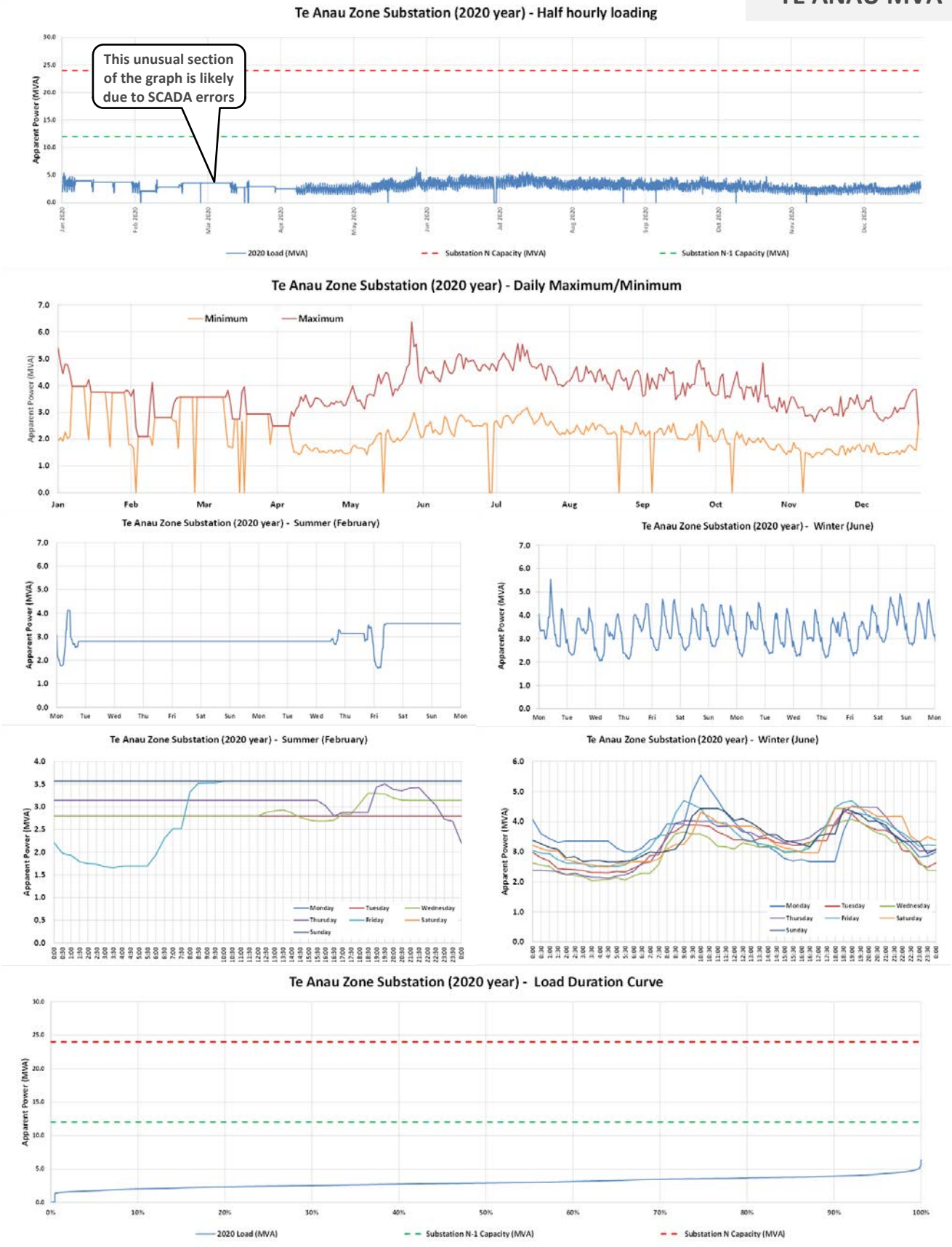


Figure 50 Te Anau 66/11kV zone substation: Apparent power (MVA) load characteristics

TOKANUI MVA

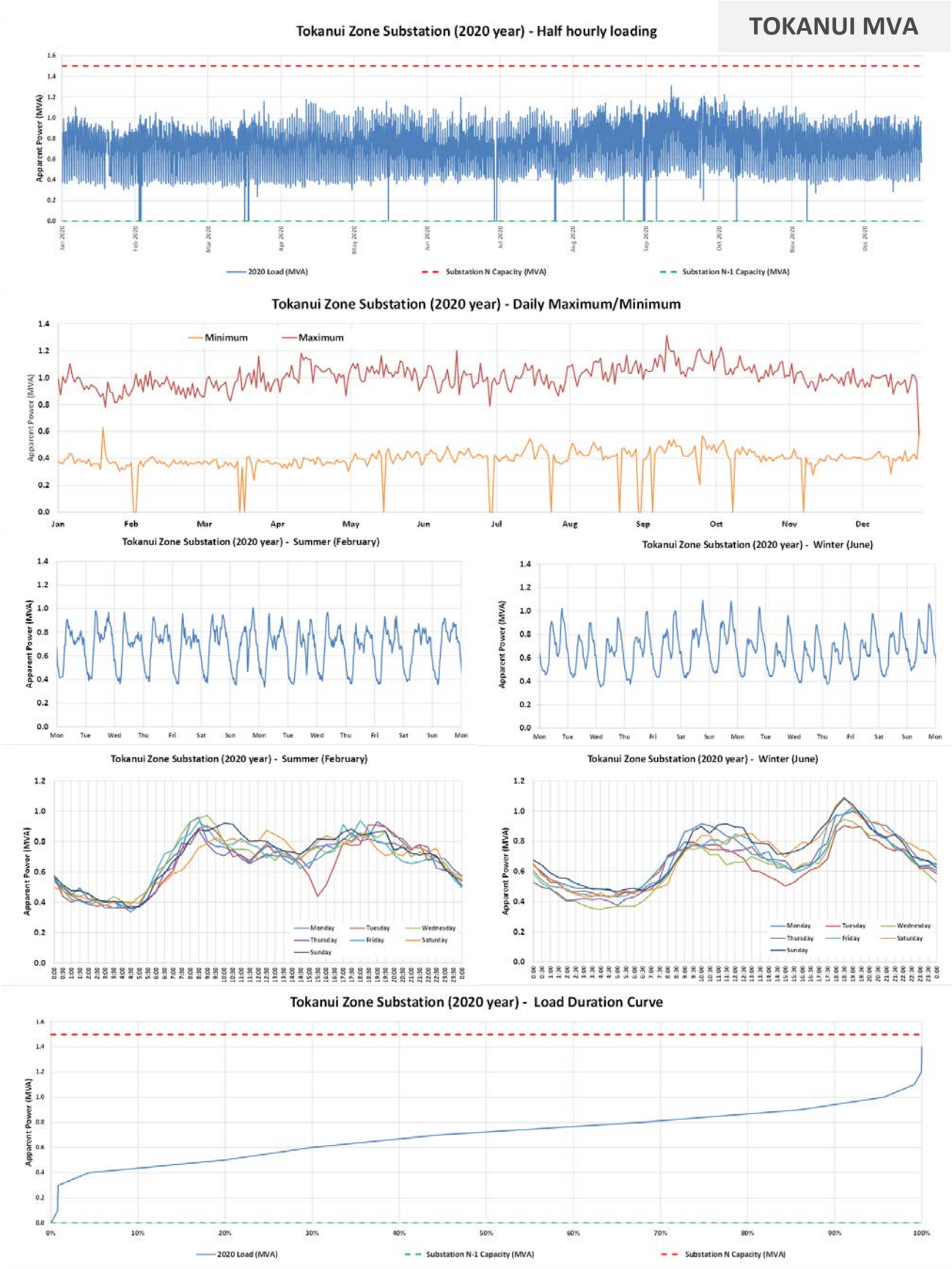


Figure 51 Tokanui 33/11kV zone substation: Apparent power (MVA) load characteristics

UNDERWOOD MVA

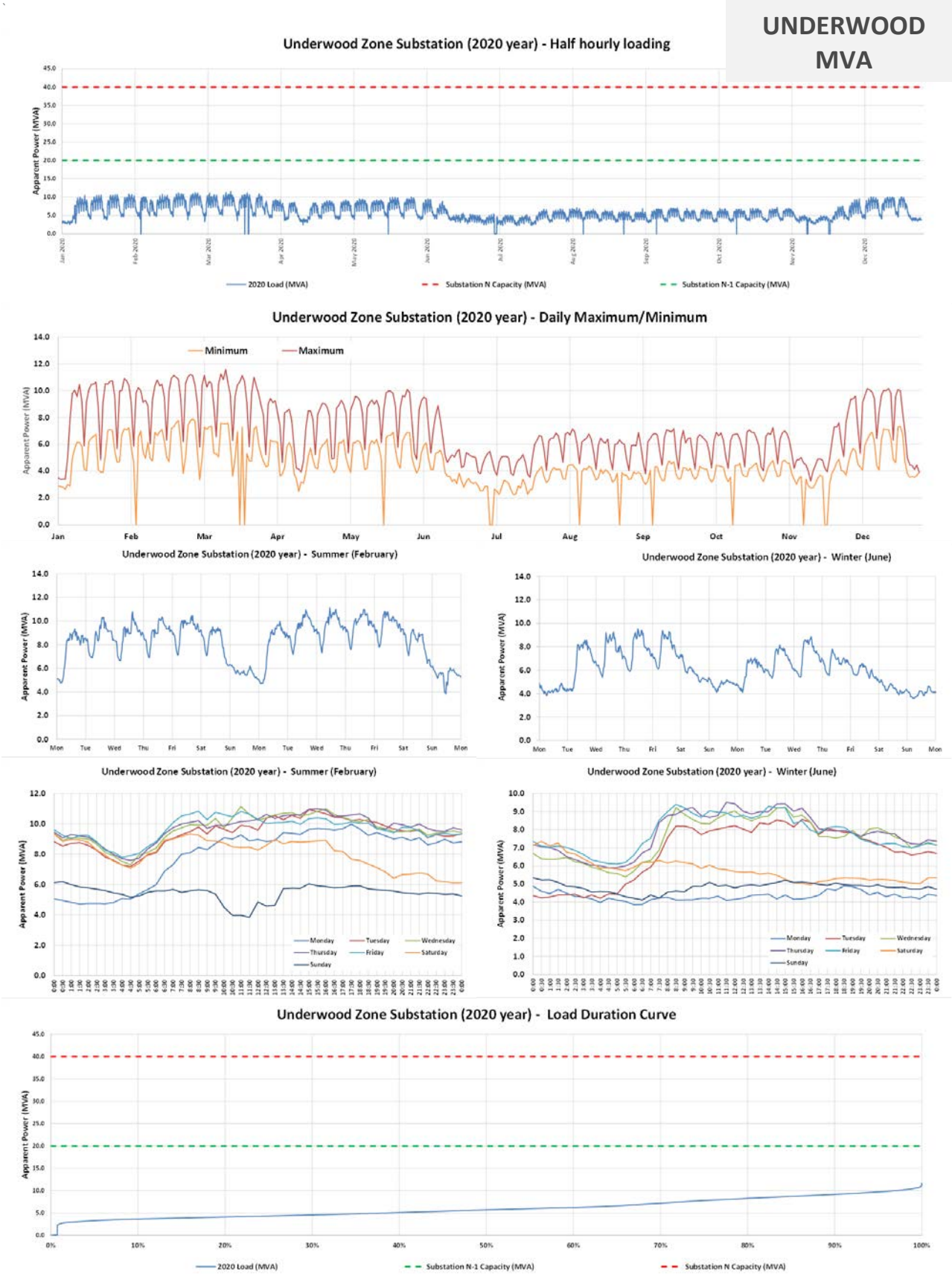


Figure 52 Underwood 33/11kV zone substation: Apparent power (MVA) load characteristics

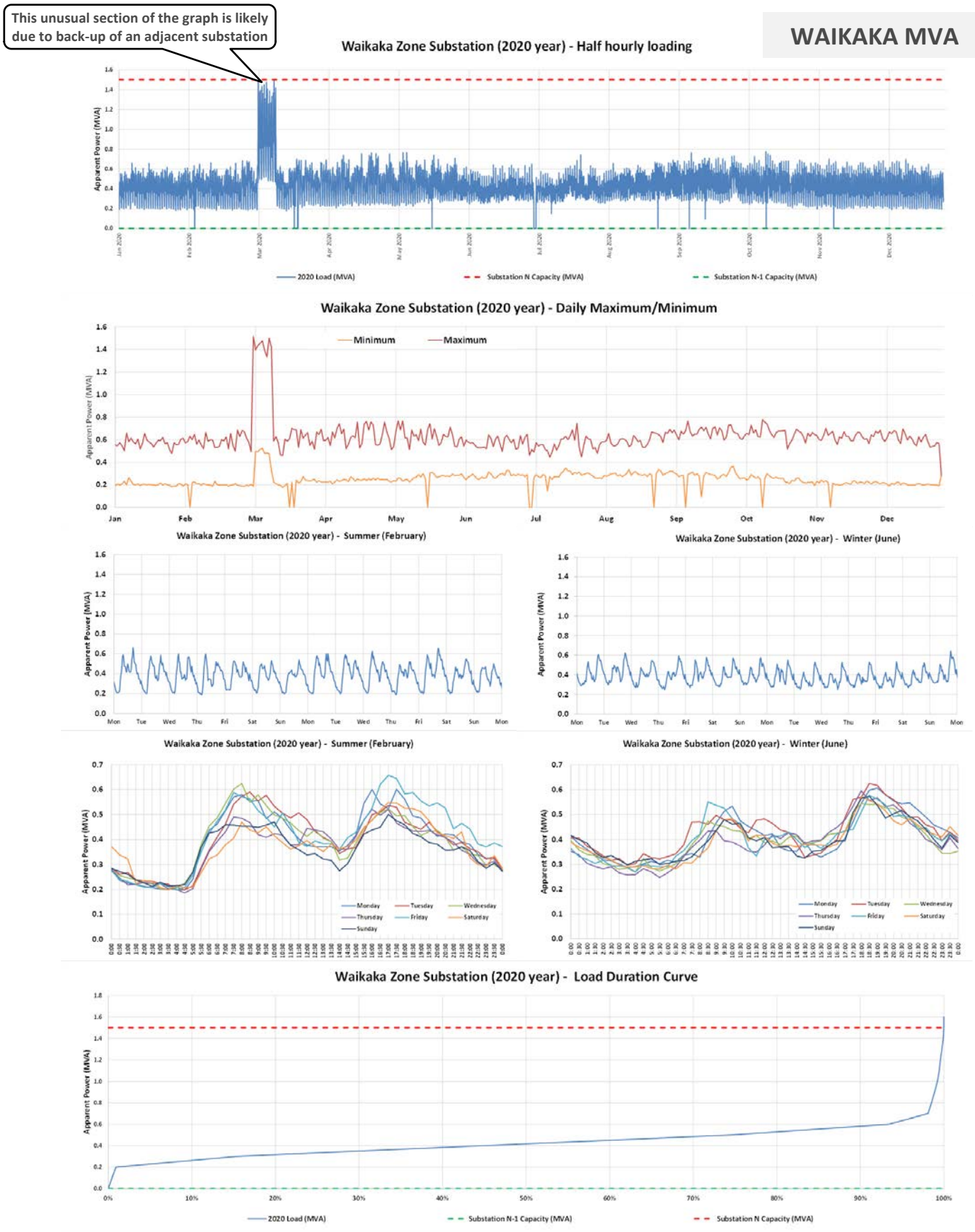


Figure 53 Waikaka 33/11kV zone substation: Apparent power (MVA) load characteristics

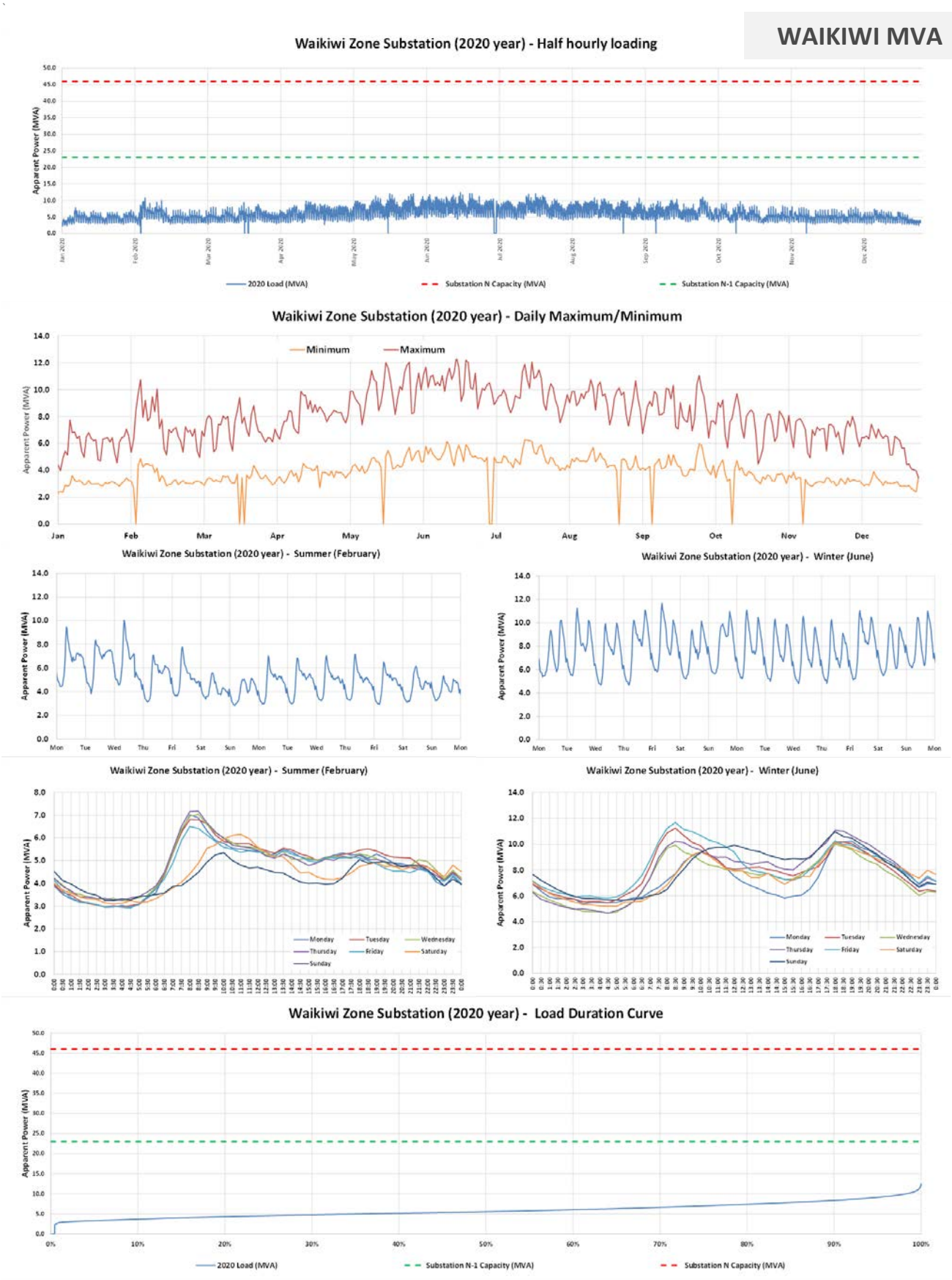


Figure 54 Waikiwi 33/11kV zone substation: Apparent power (MVA) load characteristics

WINTON MVA

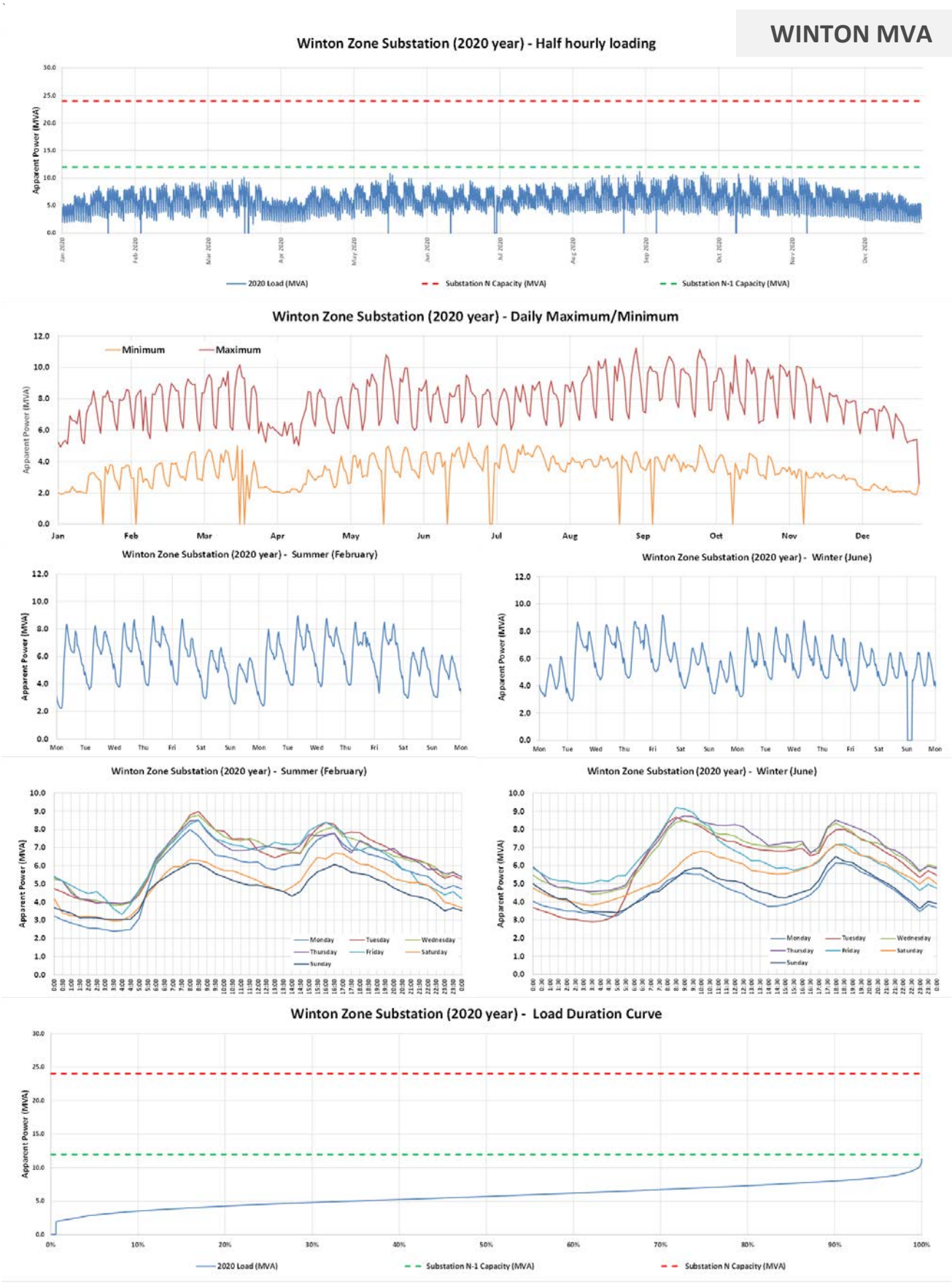


Figure 55 Winton 66/11kV zone substation: Apparent power (MVA) load characteristics

3.2 Electricity Invercargill

The characteristics of the zone substation **apparent power loadings** within Electricity Invercargill's network are shown in the following:

- **Figure 56** Spey Street 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 57** Leven Street 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 58** Racecourse Road 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 59** Southern 33/11kV zone substation: Apparent power (MVA) load characteristics

SPEY STREET MVA

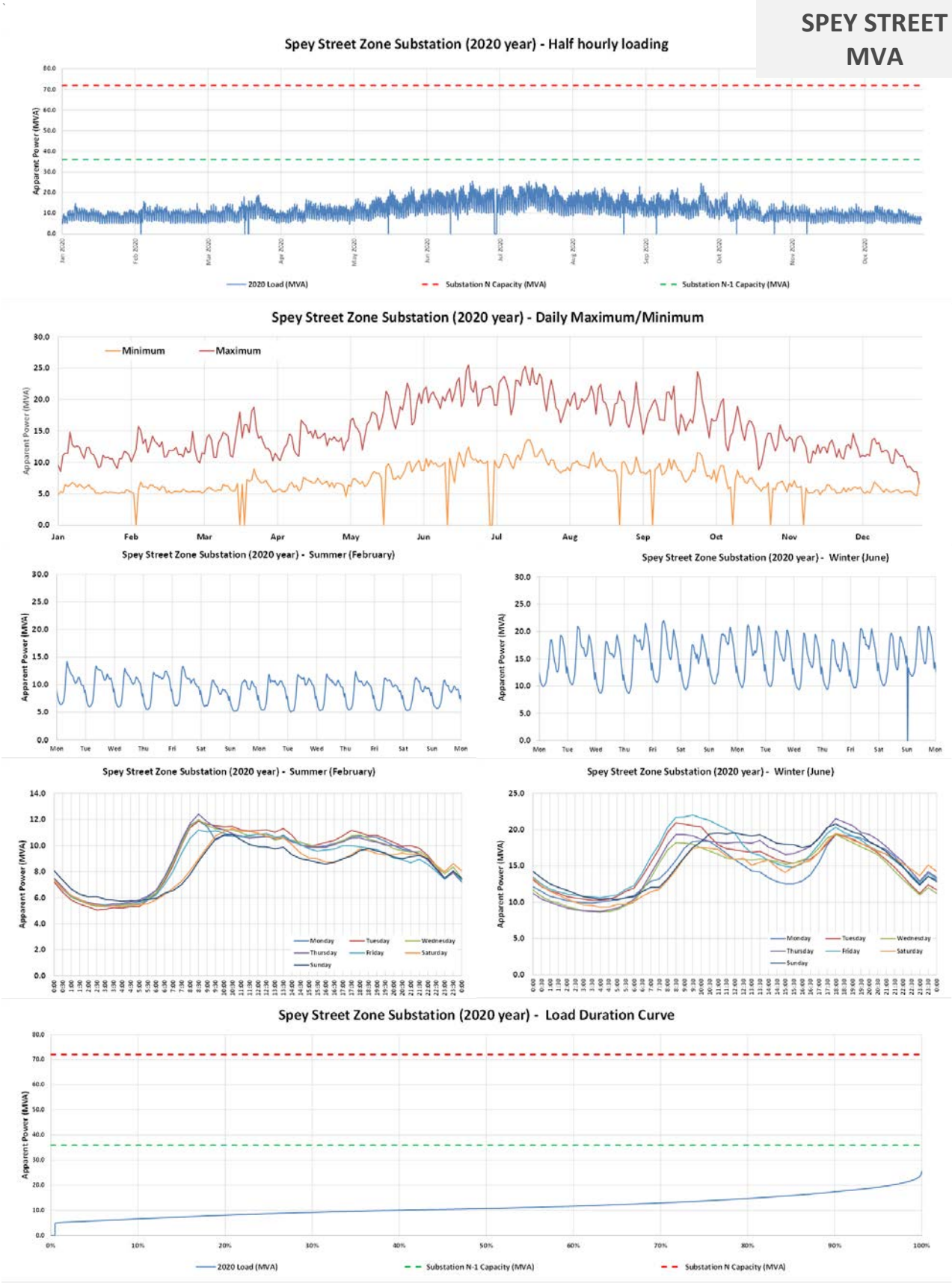


Figure 56 Spey Street 33/11kV zone substation: Apparent power (MVA) load characteristics

LEVEN STREET MVA

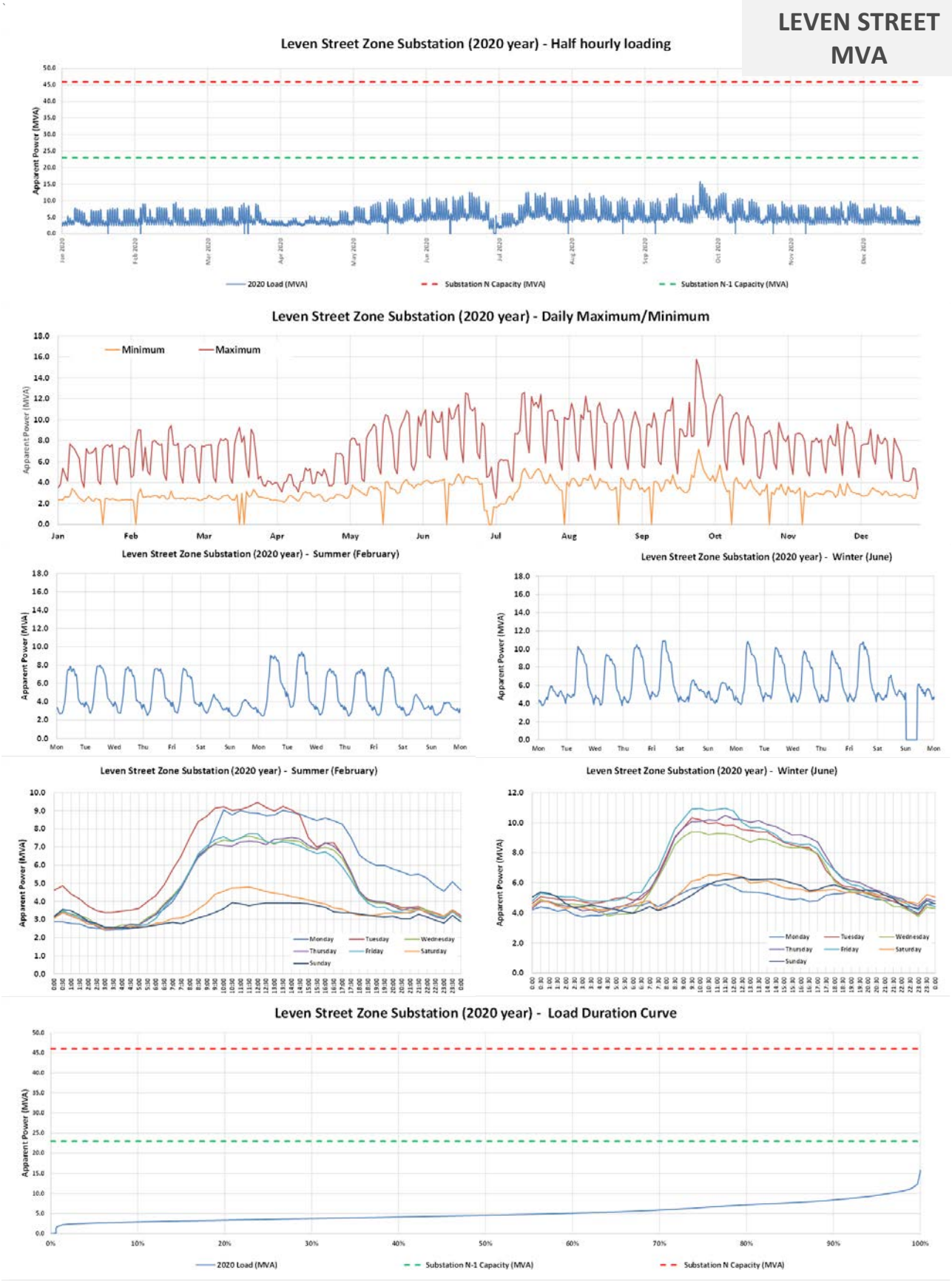


Figure 57 Leven Street 33/11kV zone substation: Apparent power (MVA) load characteristics

RACECOURSE ROAD MVA

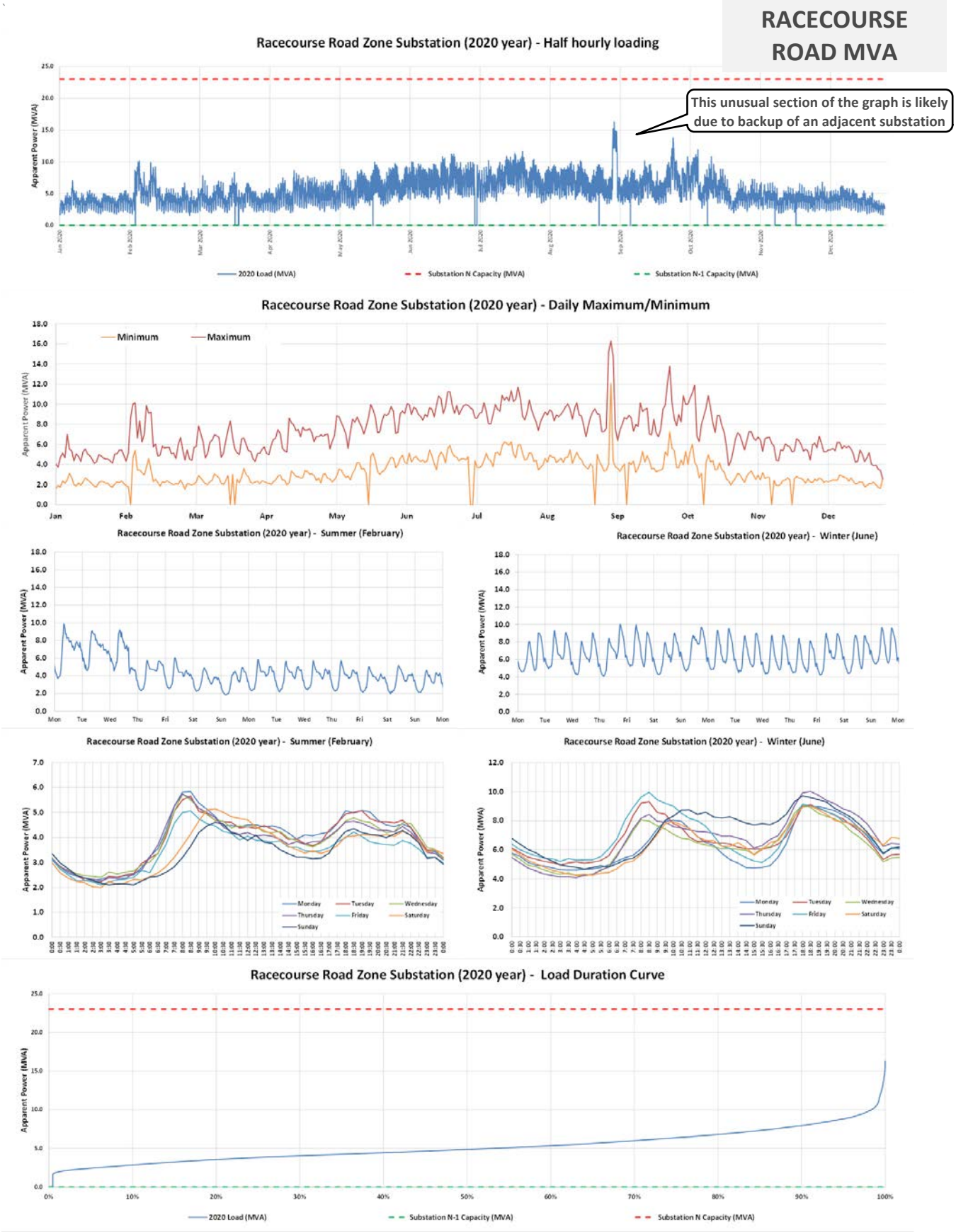


Figure 58 Racecourse Road 33/11kV zone substation: Apparent power (MVA) load characteristics

SOUTHERN MVA

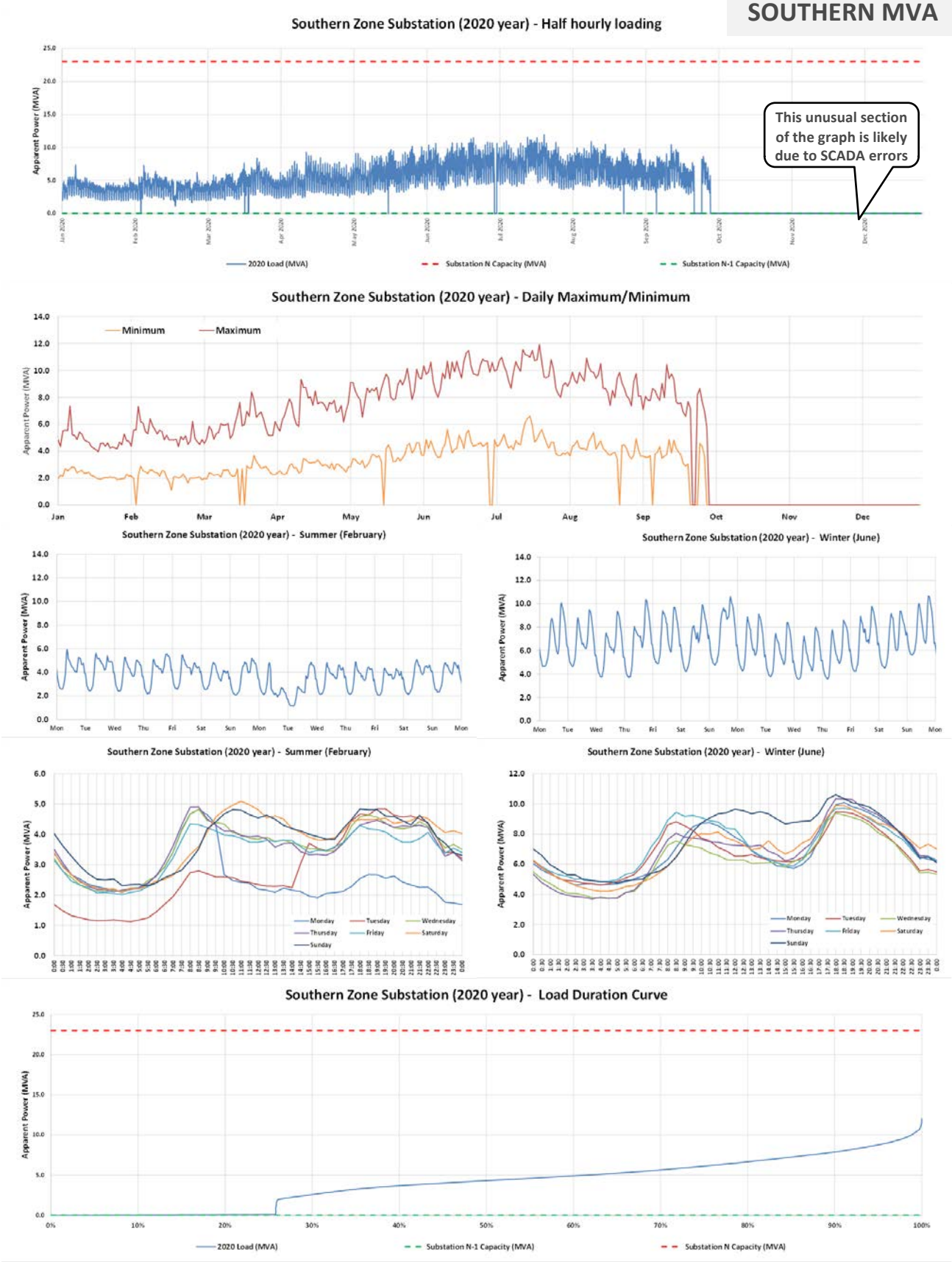


Figure 59 Southern 33/11kV zone substation: Apparent power (MVA) load characteristics

3.3 OtagoNet

The characteristics of the zone substation **apparent power loadings** within OtagoNet's network are shown in the following:

- **Figure 60** Charlotte Street (Balclutha) 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 61** Clarks 33/22kV zone substation: Apparent power (MVA) load characteristics
- **Figure 62** Clinton 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 63** Clydevale 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 64** Deepdell 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 65** Elderlee Street (Milton) 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 66** Finegand 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 67** Glenore 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 68** Golden Point 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 69** Greenfield 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 70** Hindon 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 71** Hyde 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 72** Kaitangata 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 73** Lawrence 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 74** Linnburn 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 75** Merton 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 76** Middlemarch 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 77** Milburn 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 78** North Balclutha 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 79** Oturehua 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 80** Owaka 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 81** Paerau 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 82** Paerau Hydro 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 83** Palmerston 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 84** Patearoa 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 85** Port Molyneux 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 86** Pukekawa 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 87** Ranfurly 33/11 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 88** Ranfurly 66/33 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 89** Remarkables 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 90** Stirling 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 91** Waihola 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 92** Waipiata 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 93** Waitati 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 94** Wedderburn 33/11kV zone substation: Apparent power (MVA) load characteristics

CHARLOTTE STREET MVA

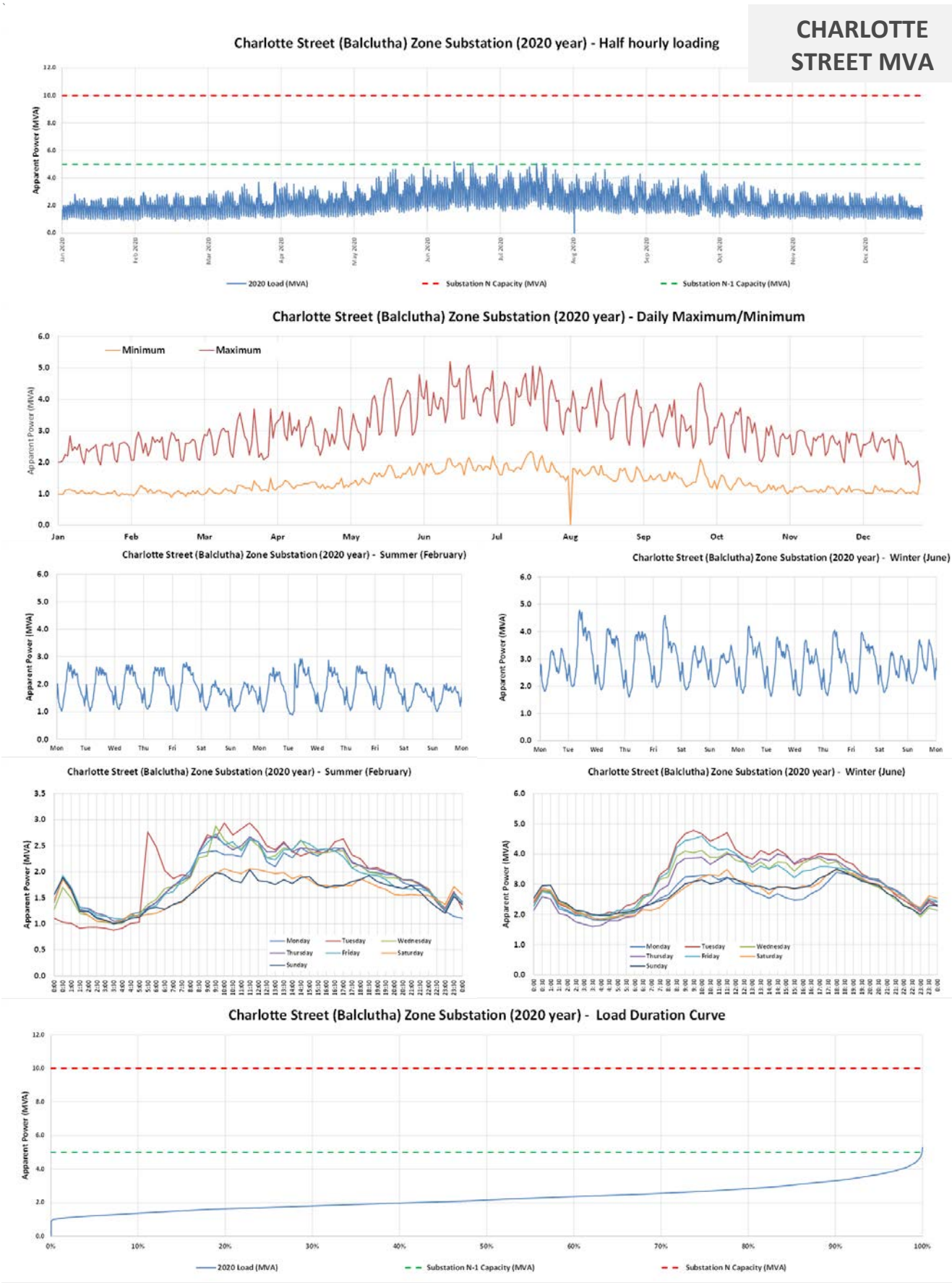


Figure 60 Charlotte Street (Balclutha) 33/11kV zone substation: Apparent power (MVA) load characteristics

CLARKS MVA

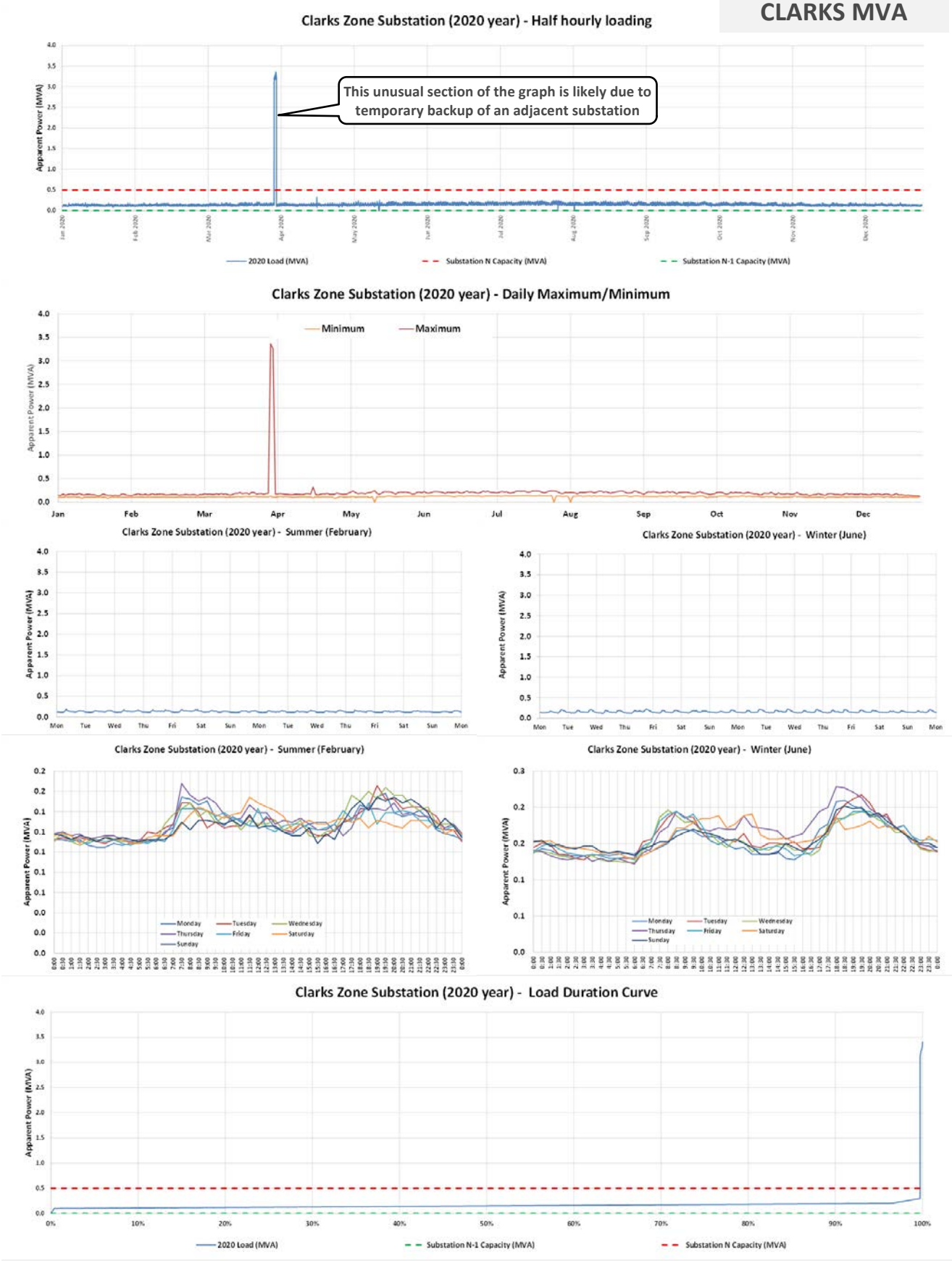


Figure 61 Clarks 33/22kV zone substation: Apparent power (MVA) load characteristics

CLINTON MVA

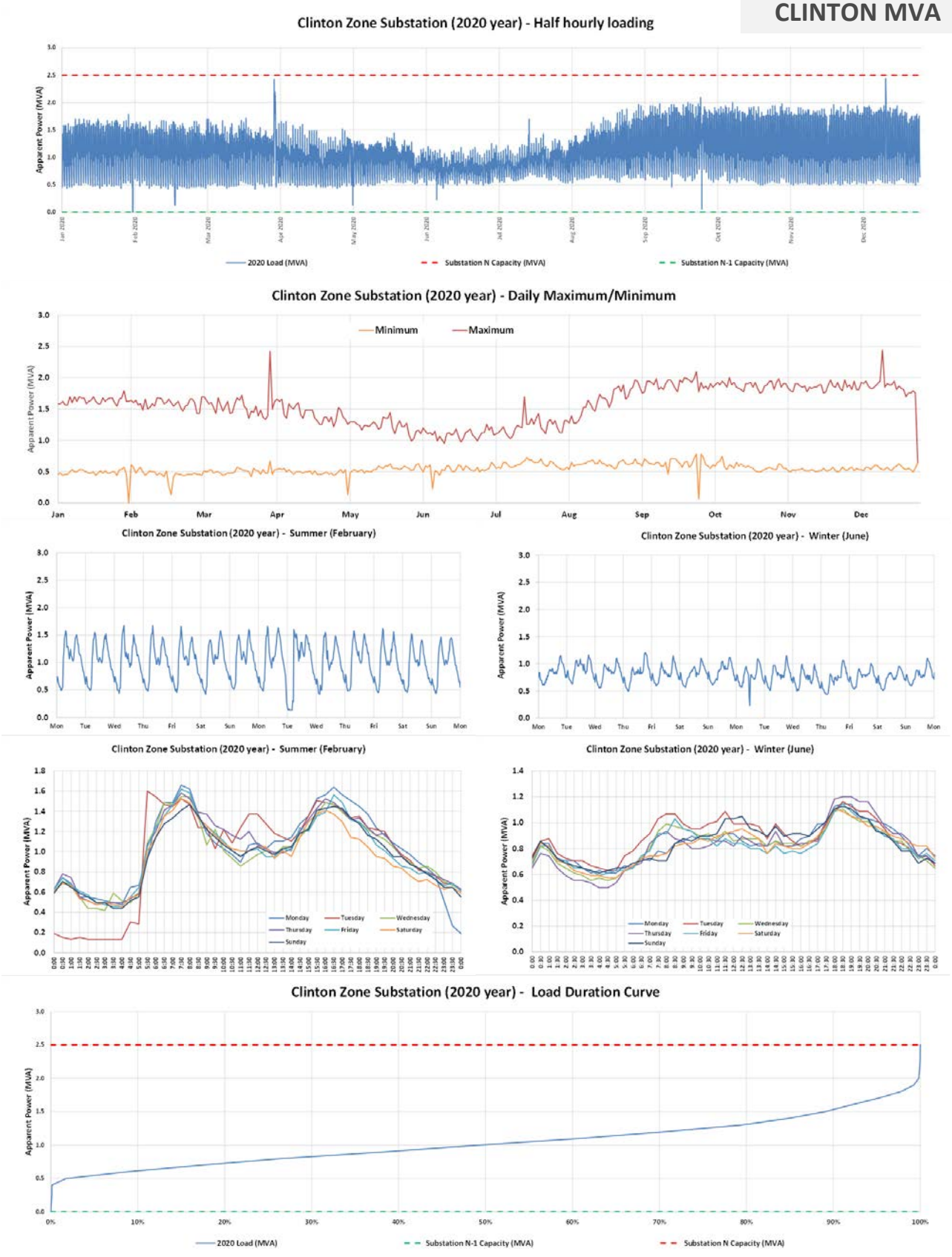


Figure 62 Clinton 33/11kV zone substation: Apparent power (MVA) load characteristics

CLYDEVALE MVA

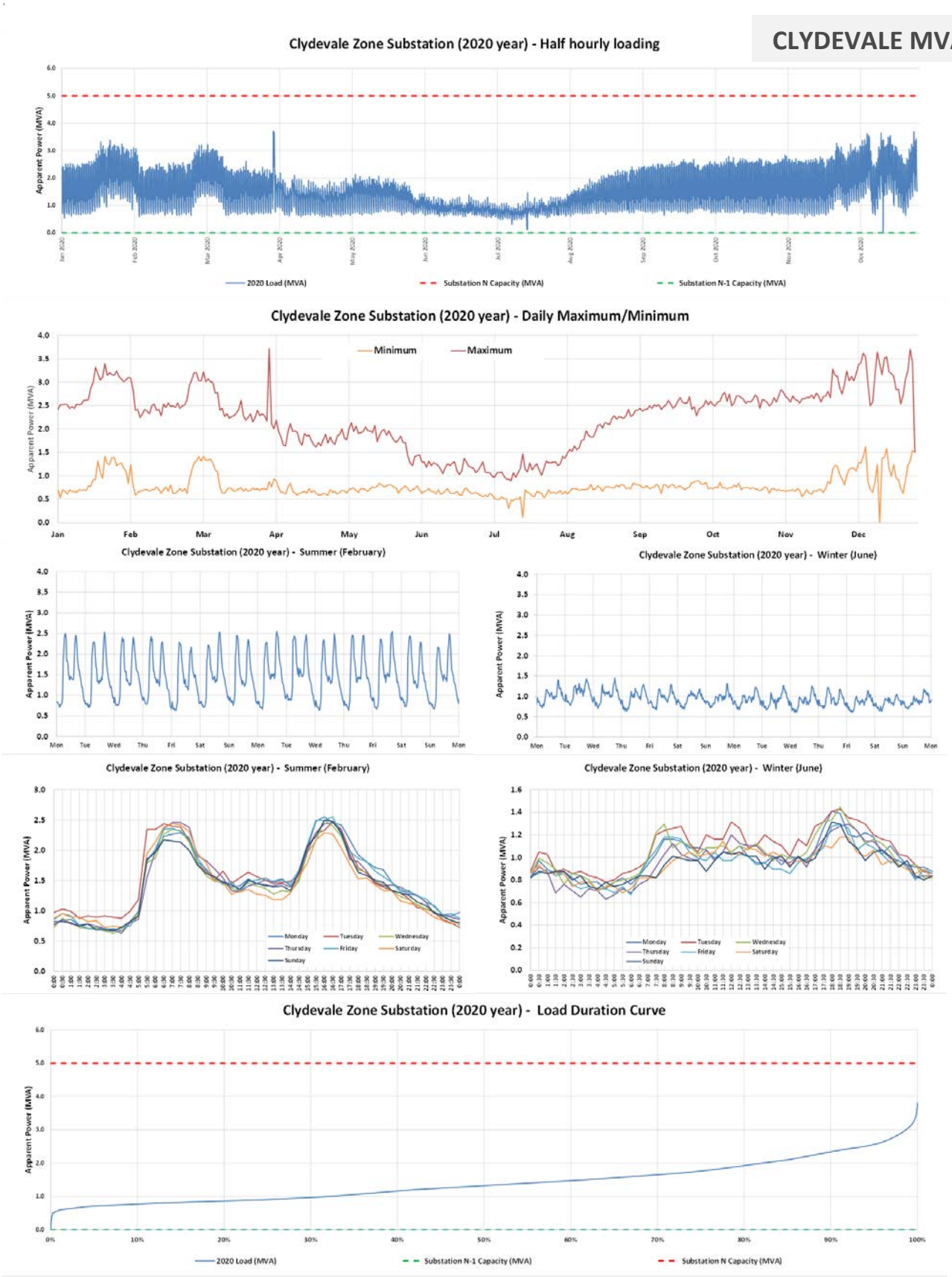


Figure 63 Clydevale 33/11kV zone substation: Apparent power (MVA) load characteristics

DEEPDELL MVA

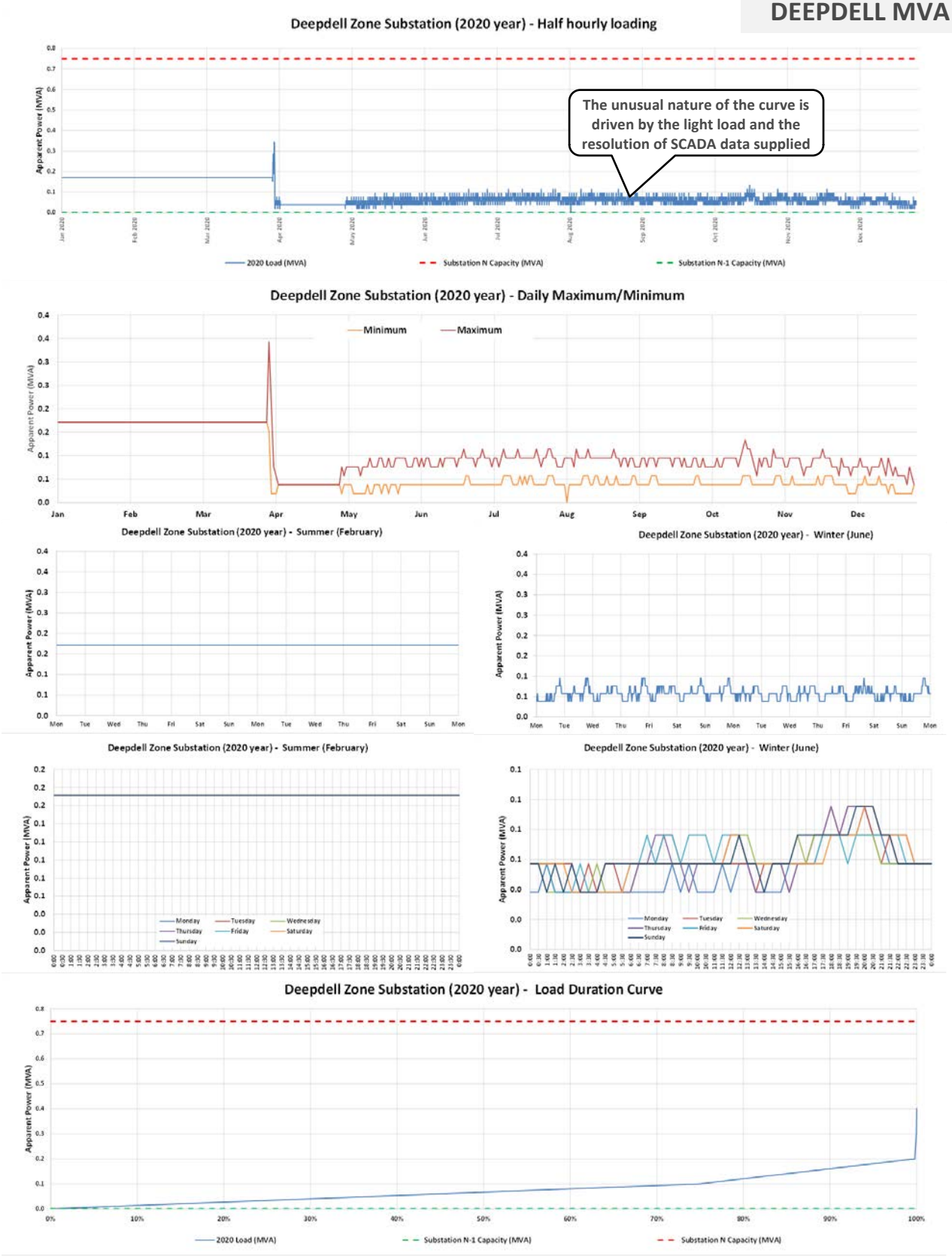


Figure 64 Deepdell 33/11kV zone substation: Apparent power (MVA) load characteristics

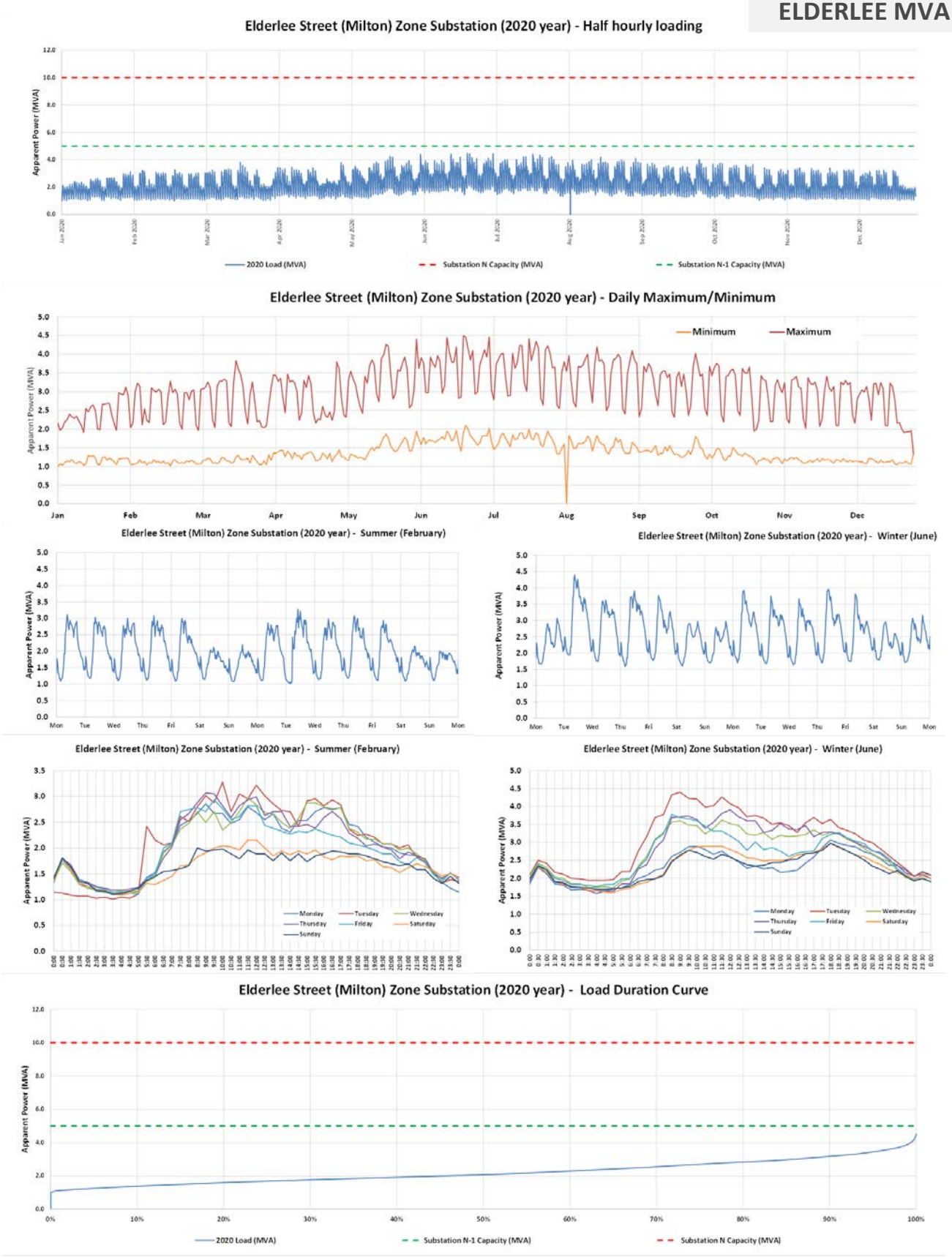


Figure 65 Elderlee Street (Milton) 33/11kV zone substation: Apparent power (MVA) load characteristics

FINEGAND MVA

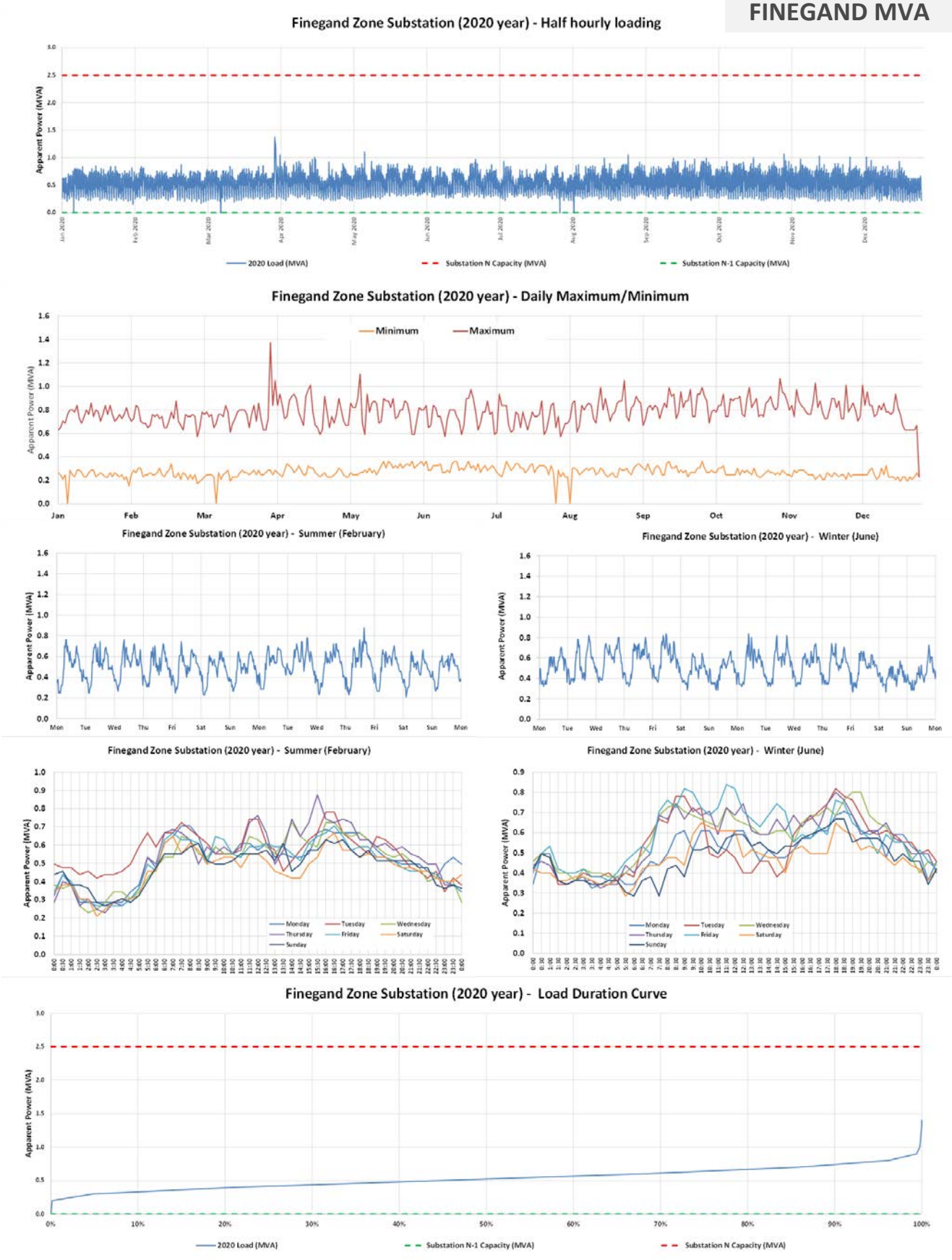


Figure 66 Finegand 33/11kV zone substation: Apparent power (MVA) load characteristics

GLENORE MVA

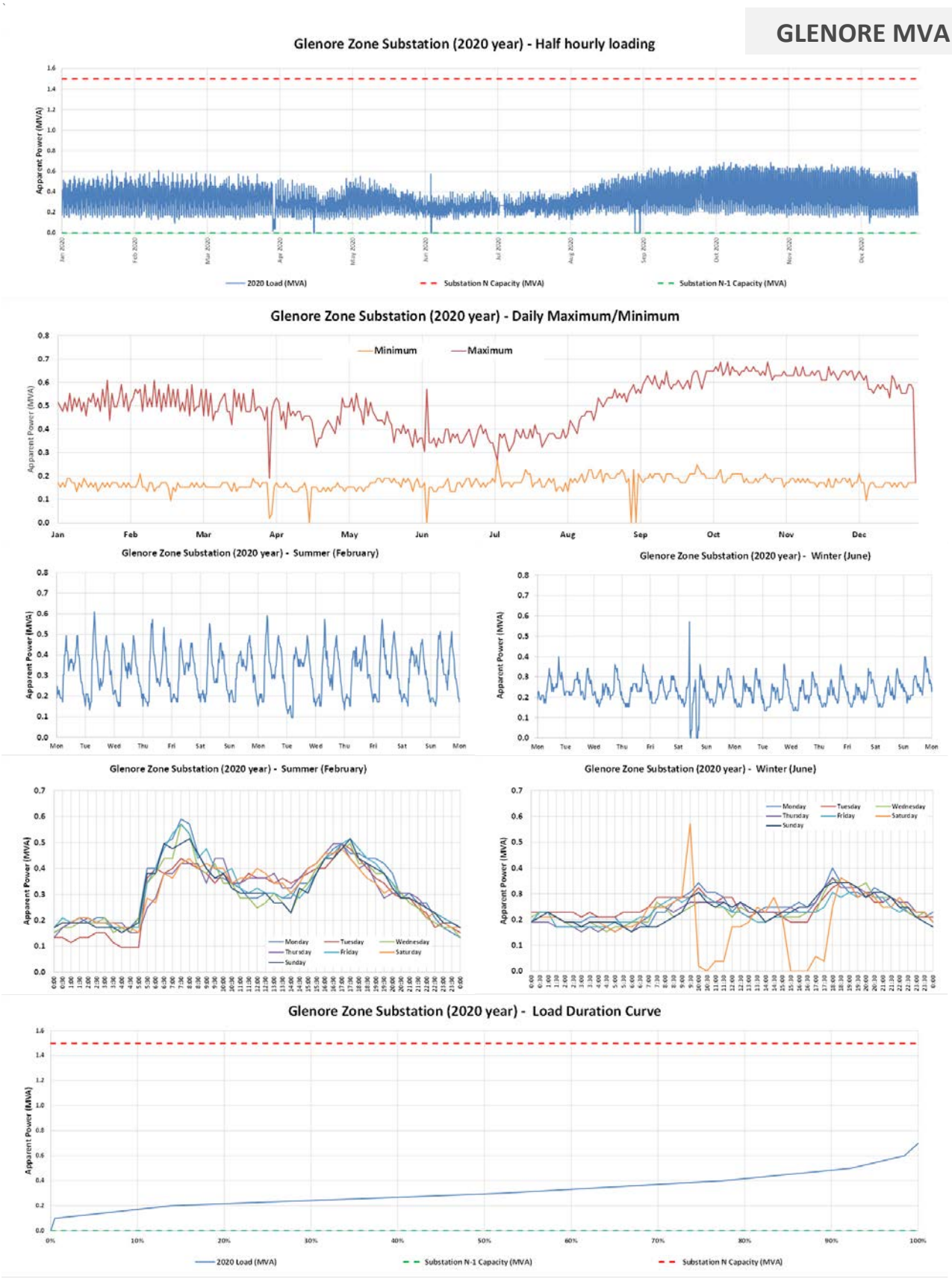


Figure 67 Glenore 33/11kV zone substation: Apparent power (MVA) load characteristics

GOLDEN POINT MVA

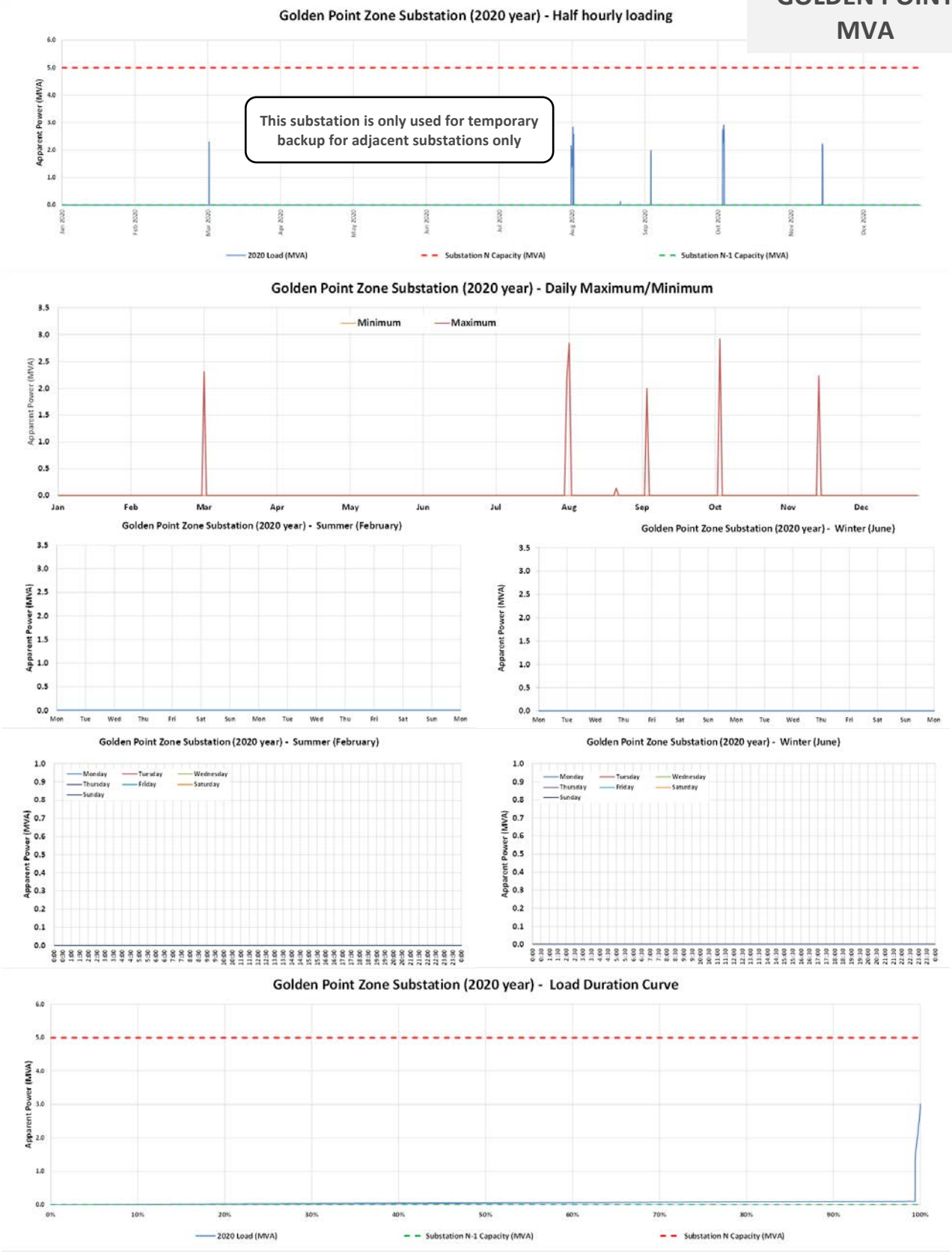


Figure 68 Golden Point 33/11kV zone substation: Apparent power (MVA) load characteristics

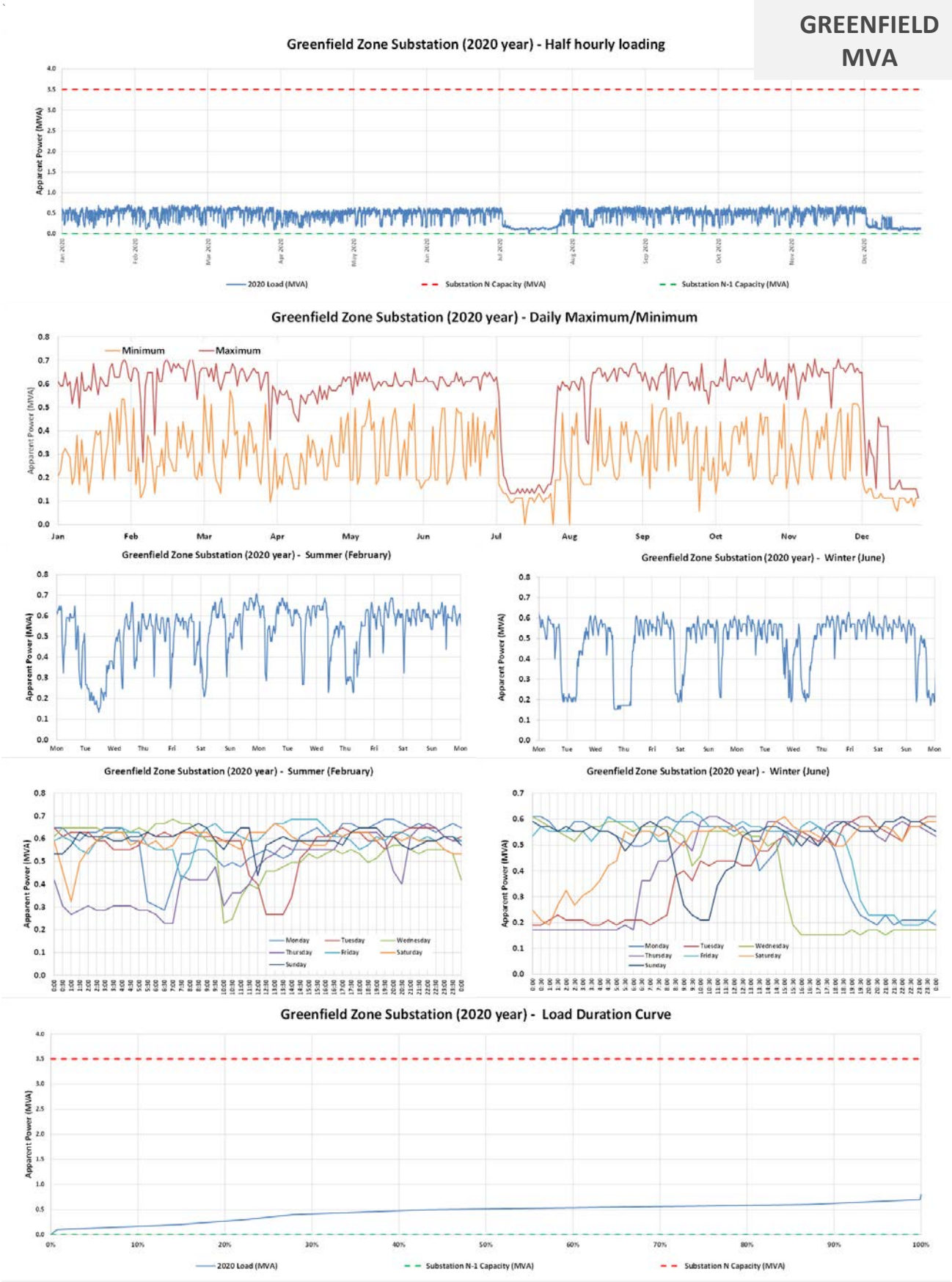


Figure 69 Greenfield 33/11kV zone substation: Apparent power (MVA) load characteristics

HINDON MVA

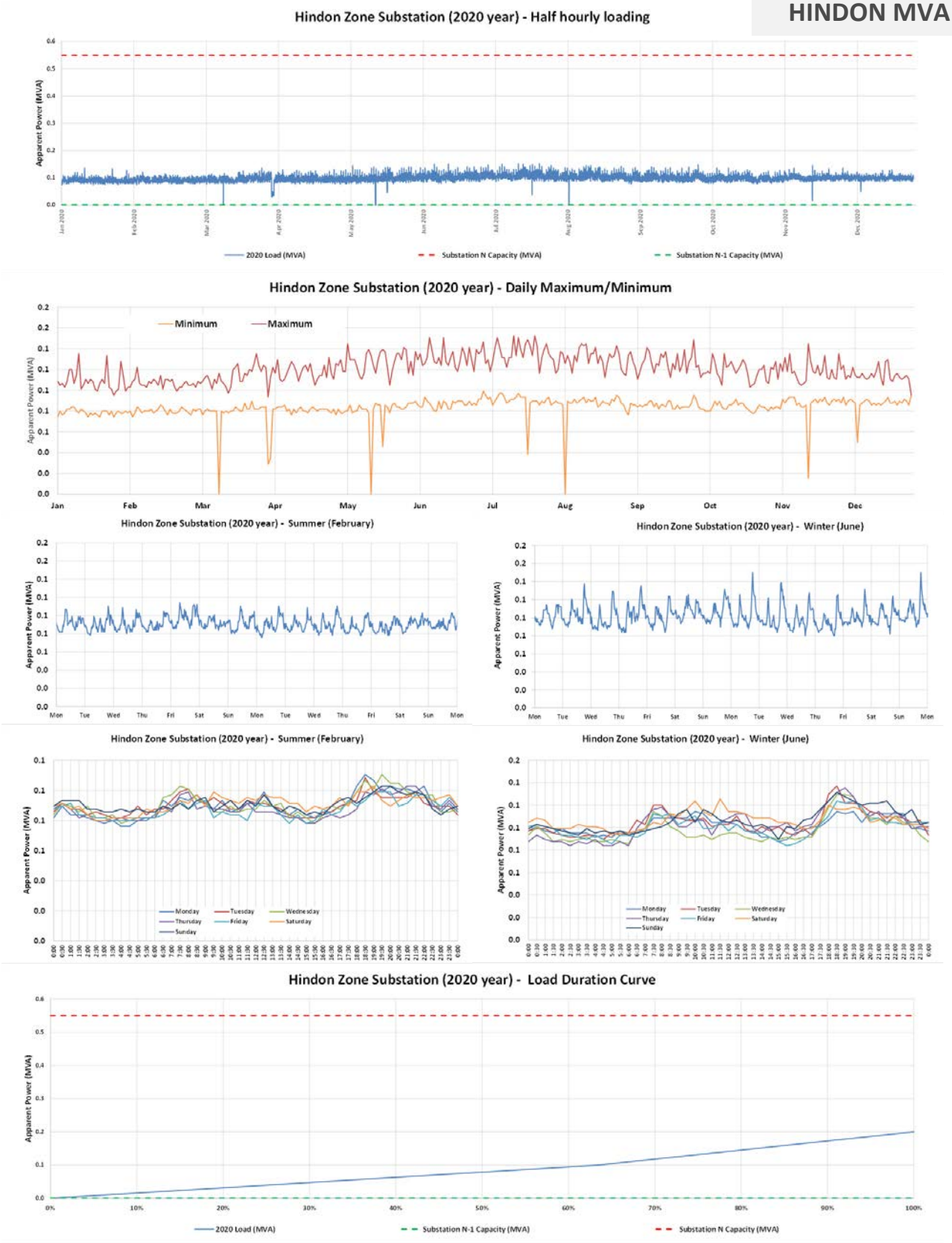


Figure 70 Hindon 33/11kV zone substation: Apparent power (MVA) load characteristics

HYDE MVA

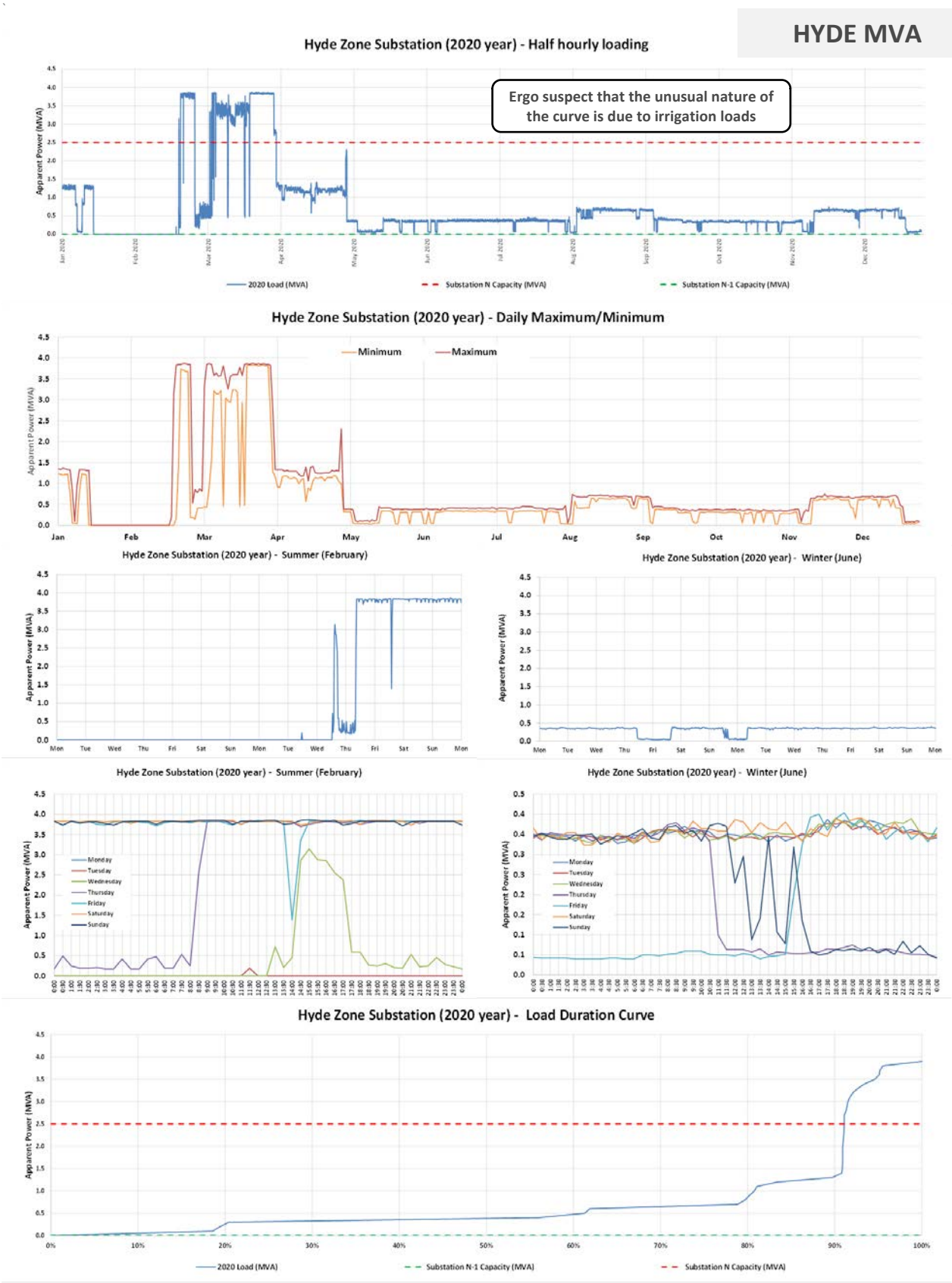


Figure 71 Hyde 33/11kV zone substation: Apparent power (MVA) load characteristics

KAITANGATA MVA

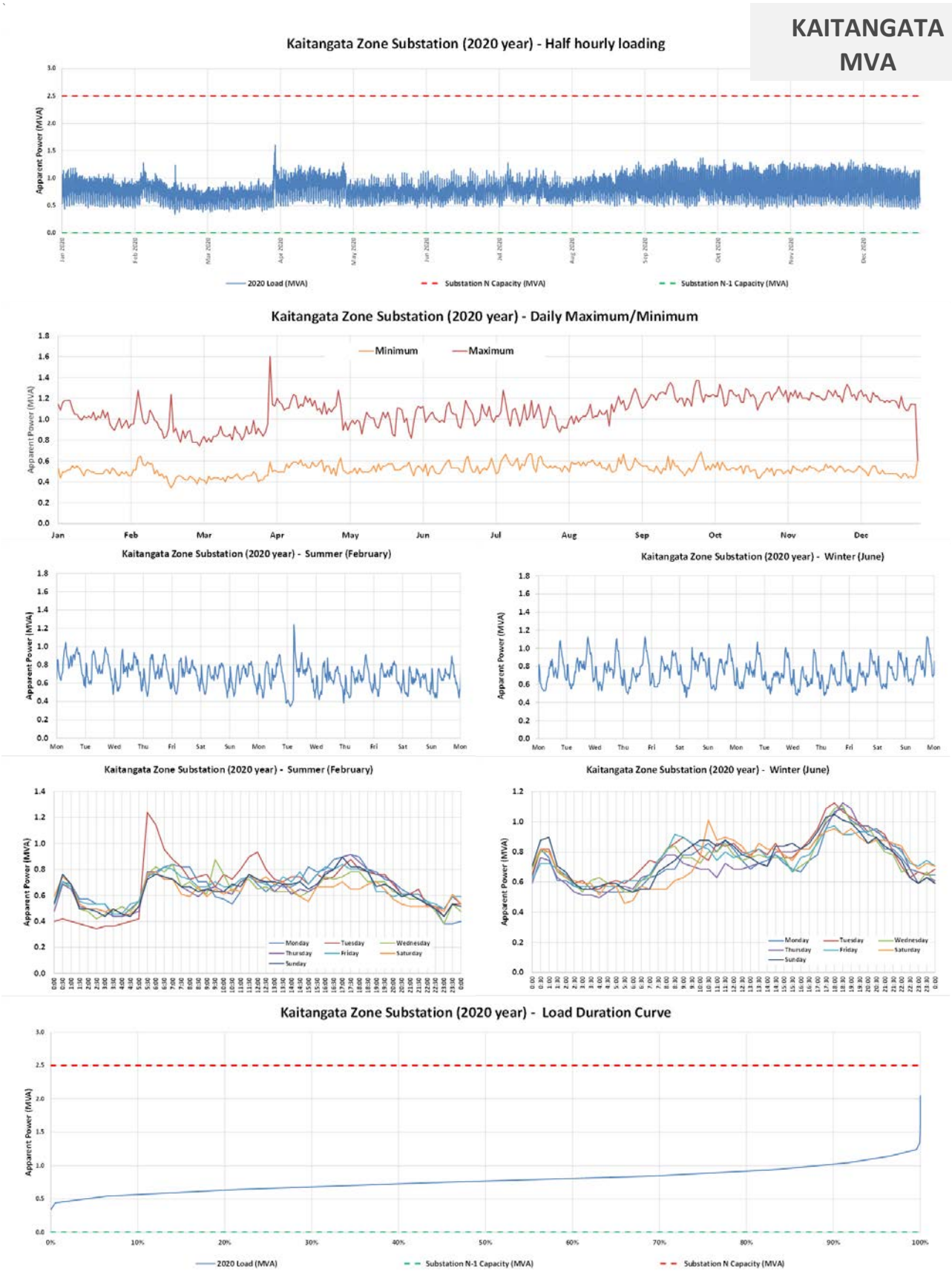


Figure 72 Kaitangata 33/11kV zone substation: Apparent power (MVA) load characteristics

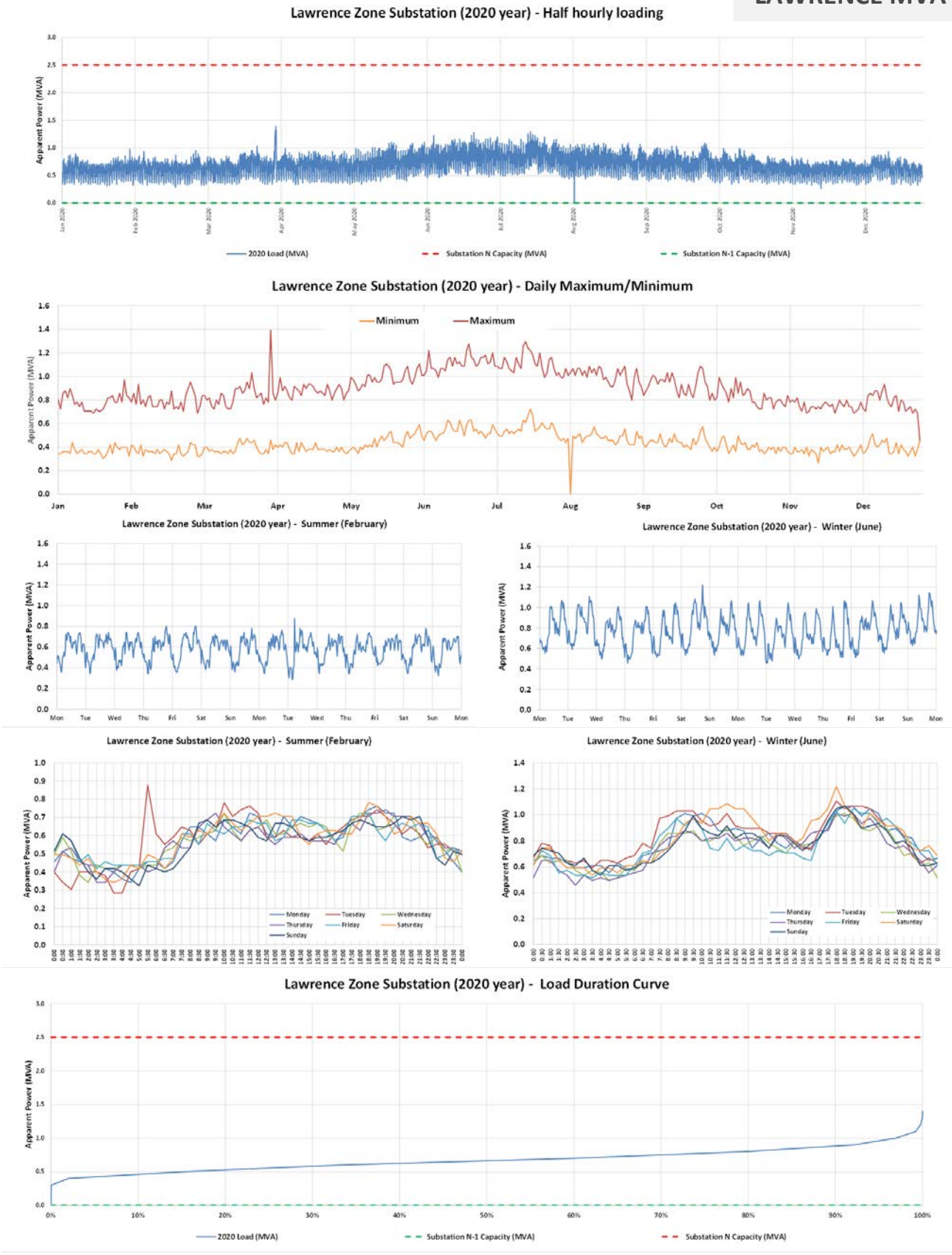


Figure 73 Lawrence 33/11kV zone substation: Apparent power (MVA) load characteristics

LINNBURN MVA

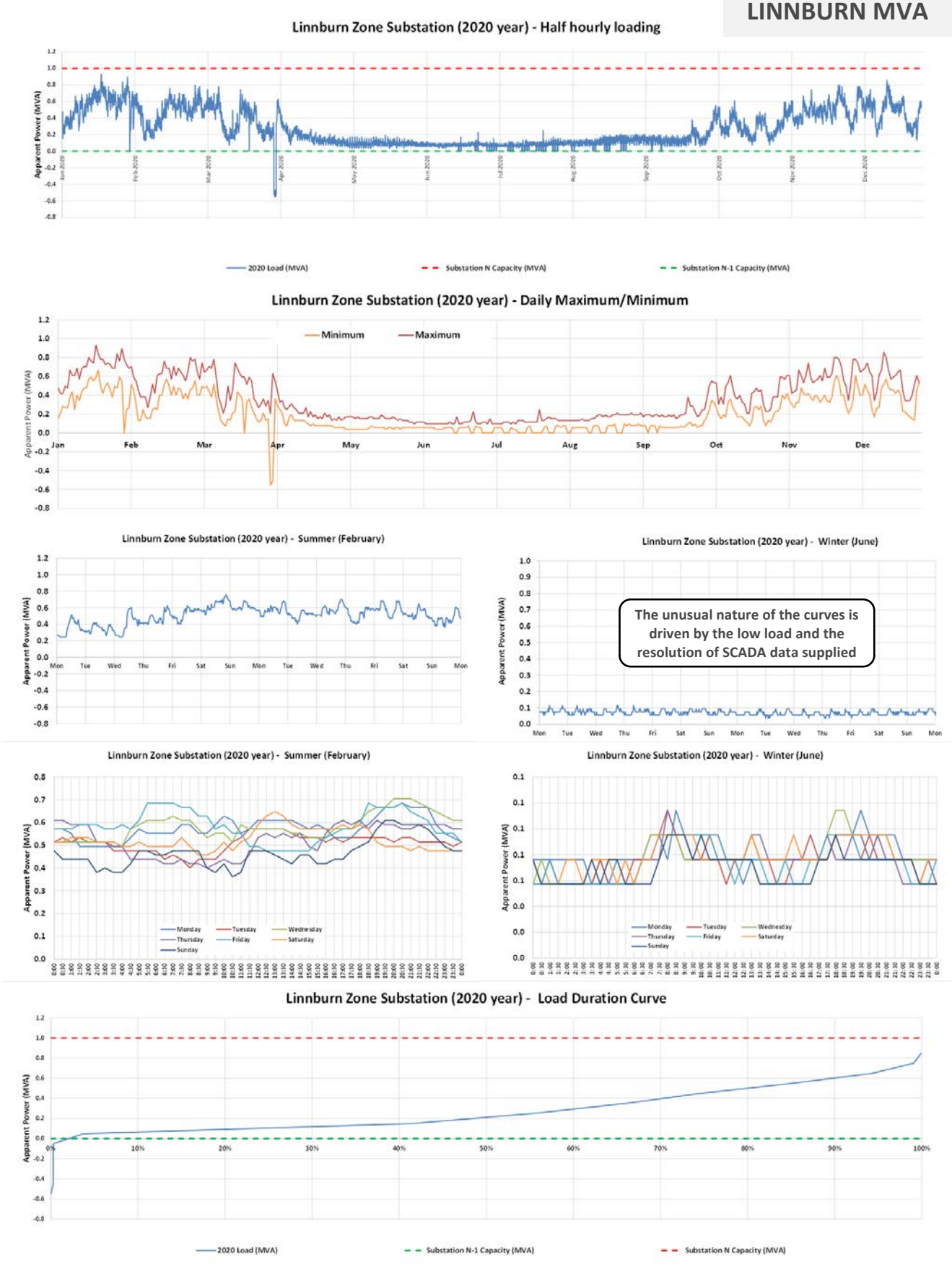


Figure 74 Linnburn 33/11kV zone substation: Apparent power (MVA) load characteristics

MERTON MVA

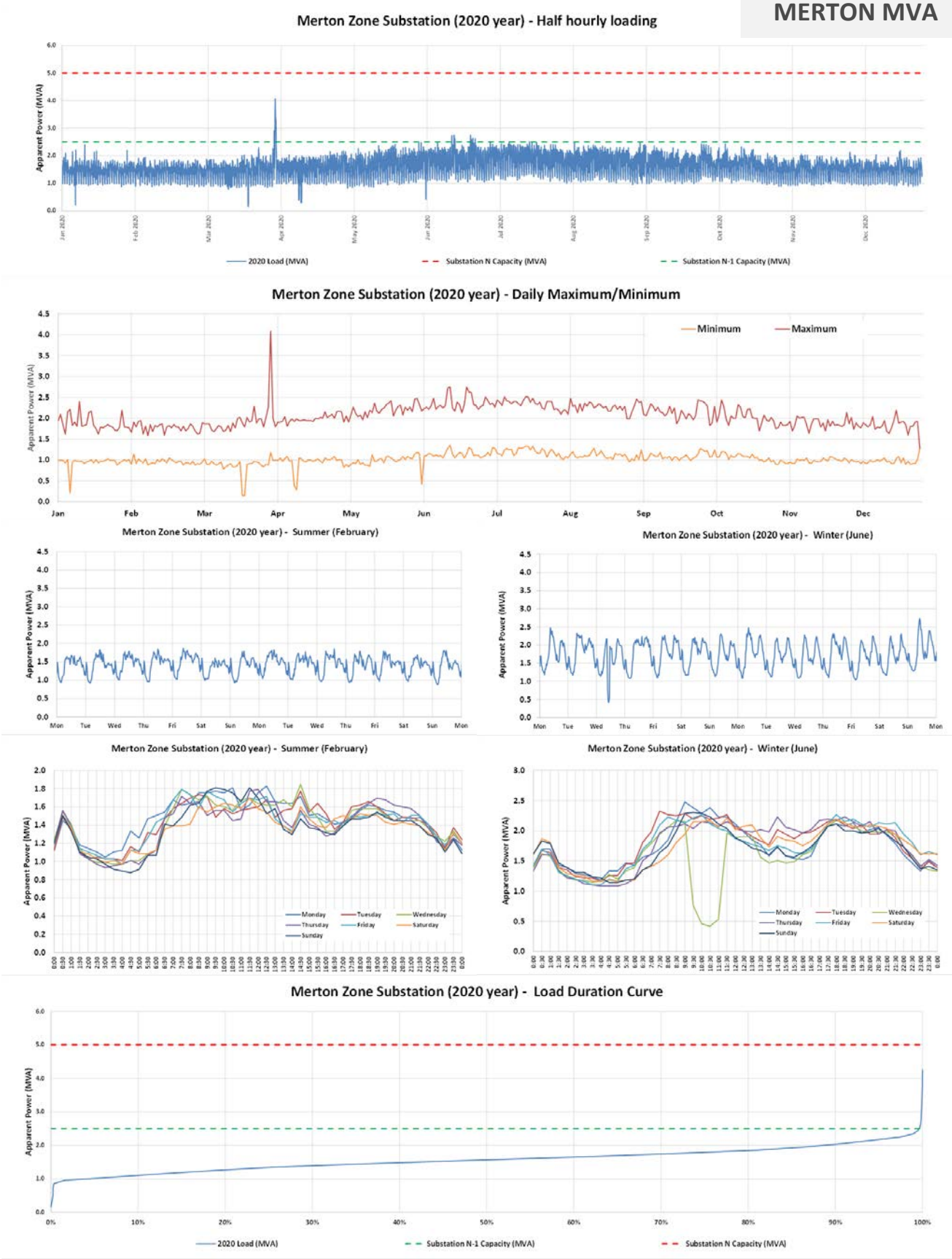


Figure 75 Merton 33/11kV zone substation: Apparent power (MVA) load characteristics

MIDDLEMARCH MVA

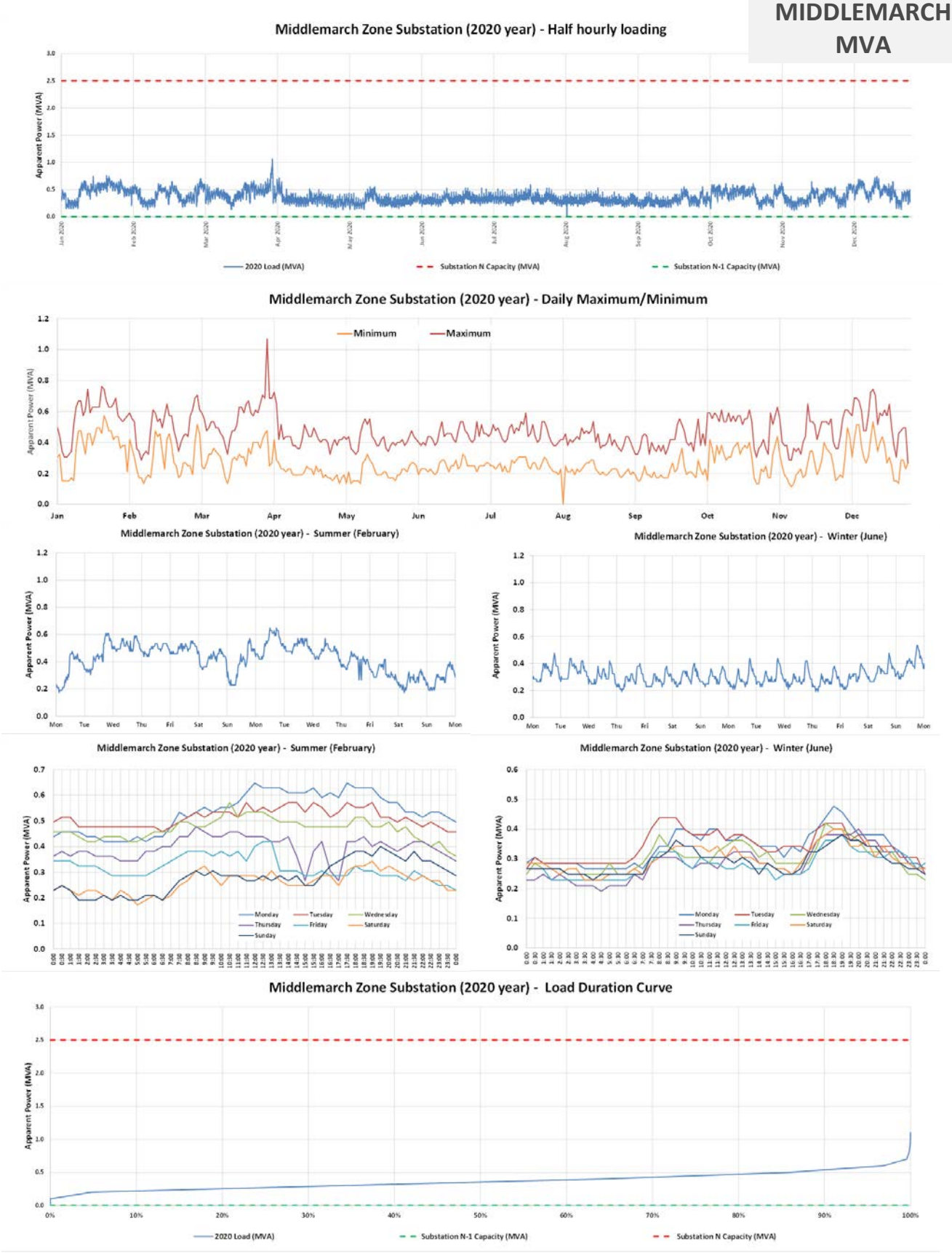


Figure 76 Middlemarch 33/11kV zone substation: Apparent power (MVA) load characteristics

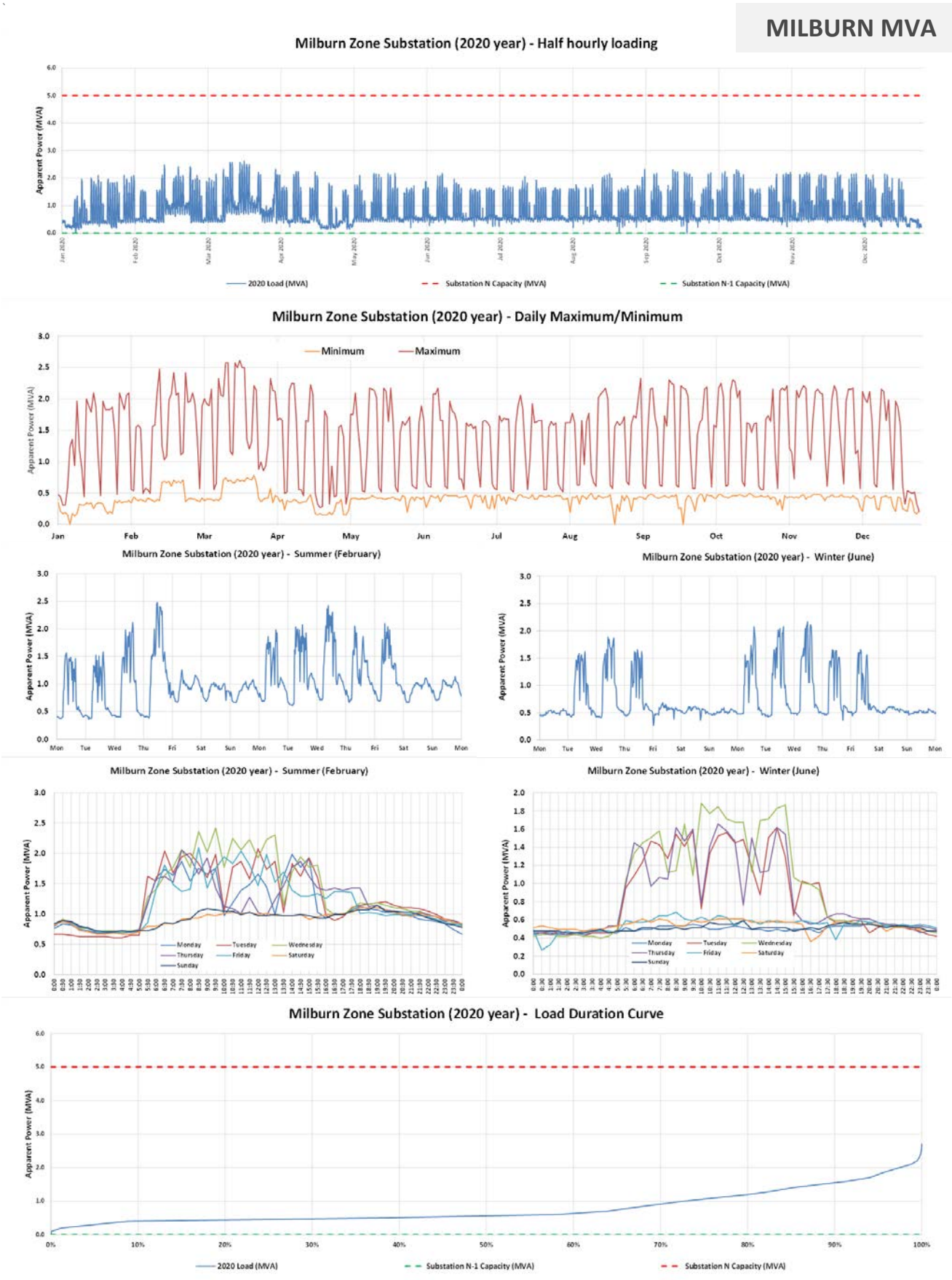


Figure 77 Milburn 33/11kV zone substation: Apparent power (MVA) load characteristics

NORTH BALCLUTHA MVA

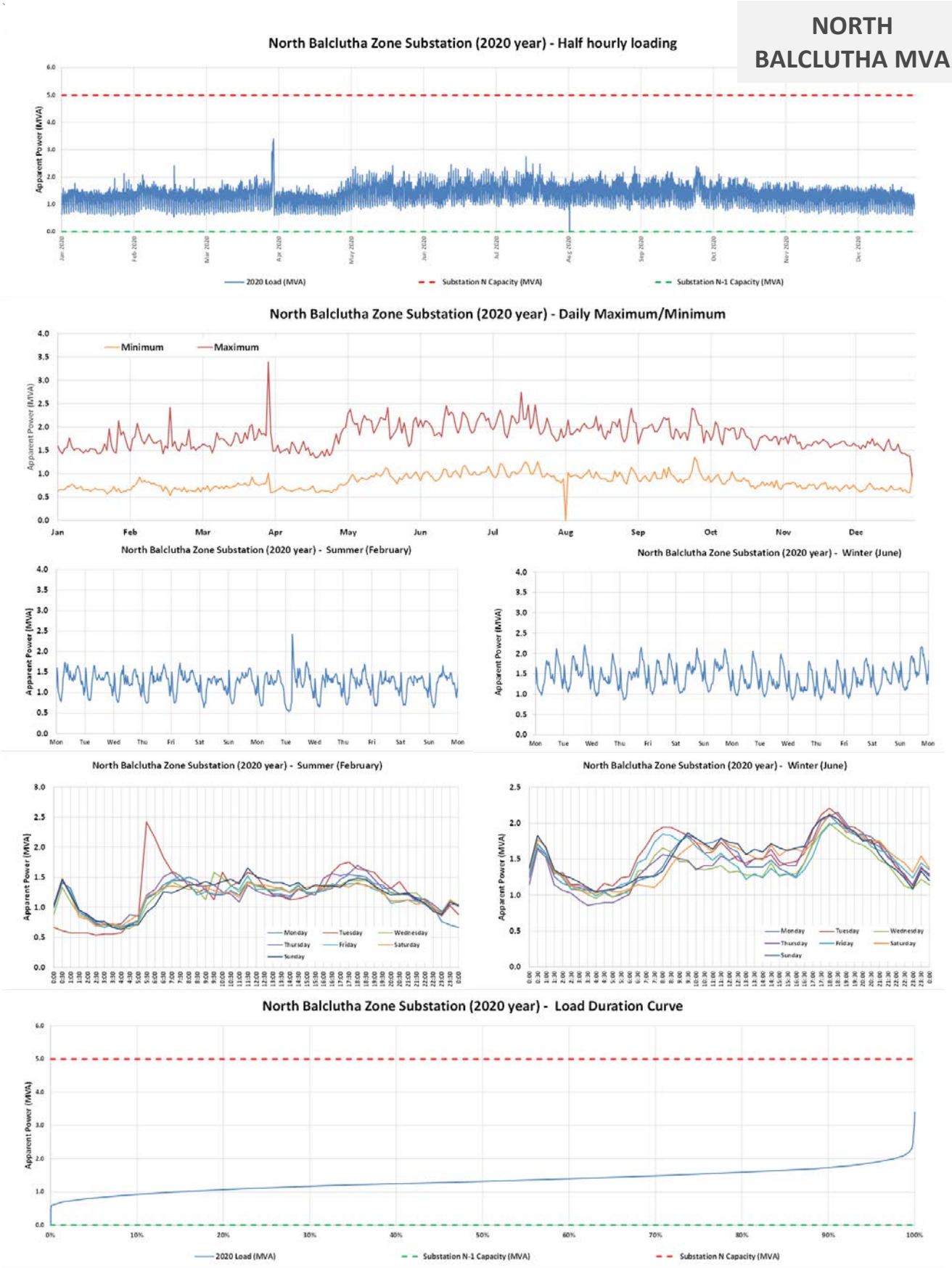


Figure 78 North Balclutha 33/11kV zone substation: Apparent power (MVA) load characteristics

OTUREHUA MVA

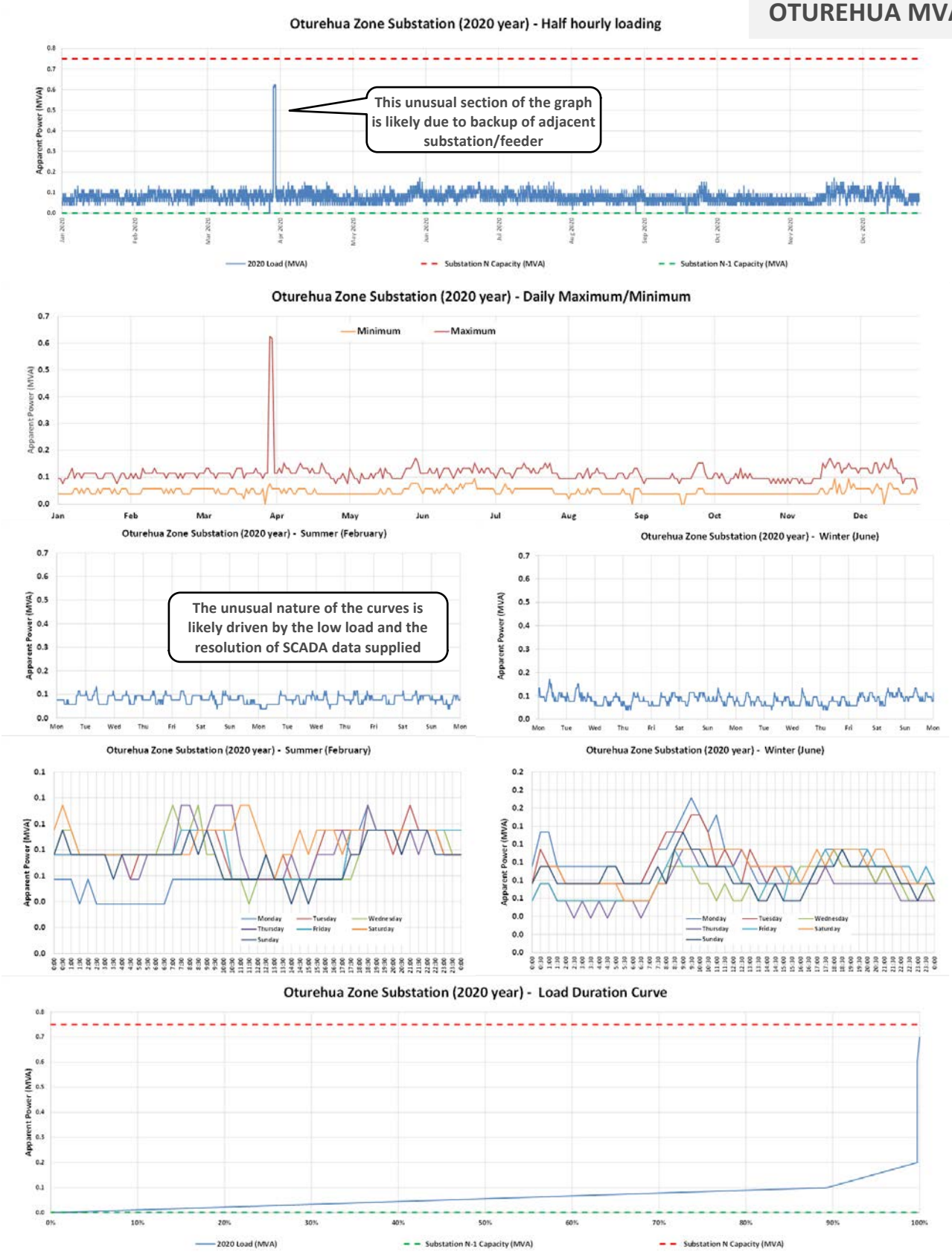


Figure 79 Oturehua 33/11kV zone substation: Apparent power (MVA) load characteristics

OWAKA MVA

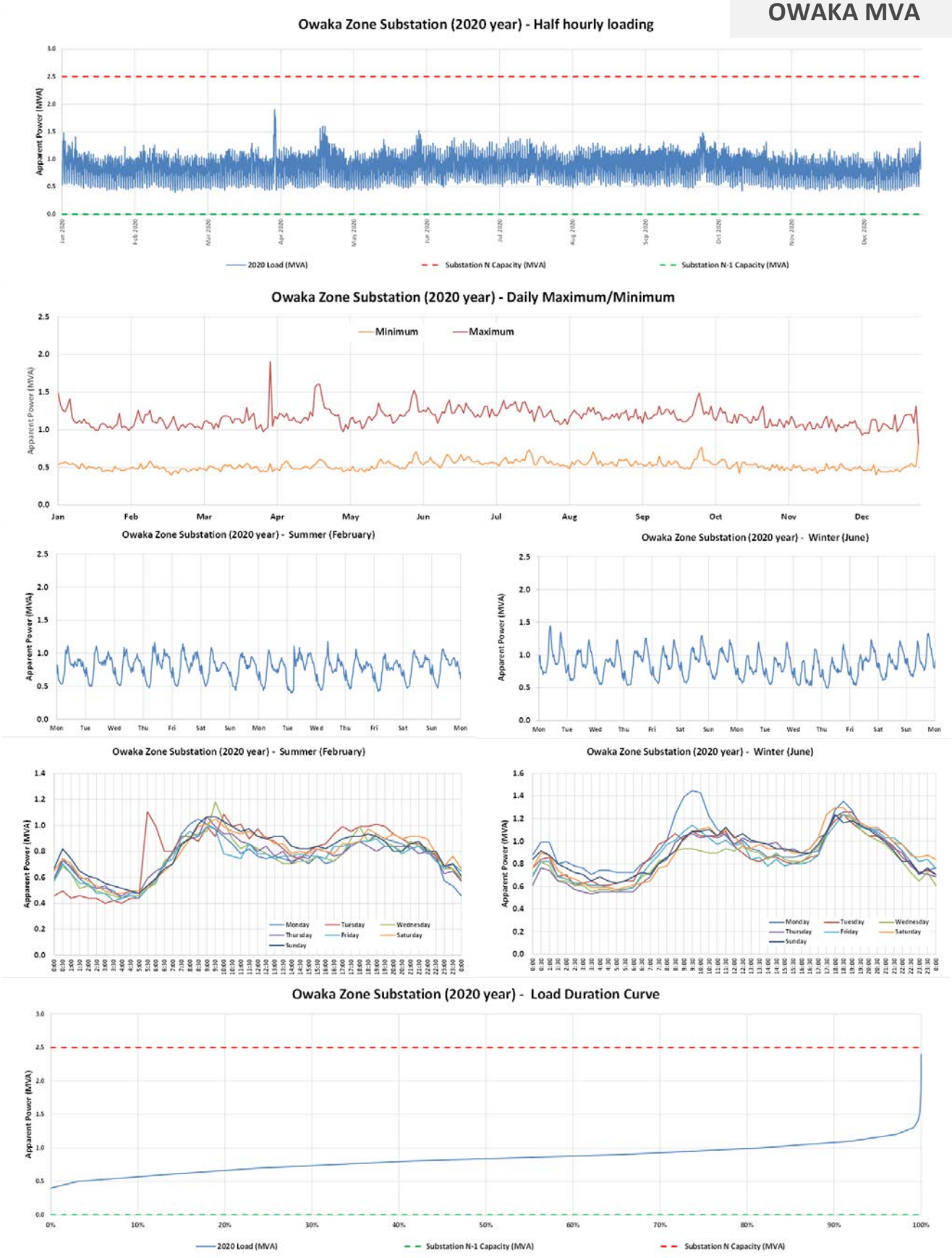


Figure 80 Owaka 33/11kV zone substation: Apparent power (MVA) load characteristics

PAERAU MVA

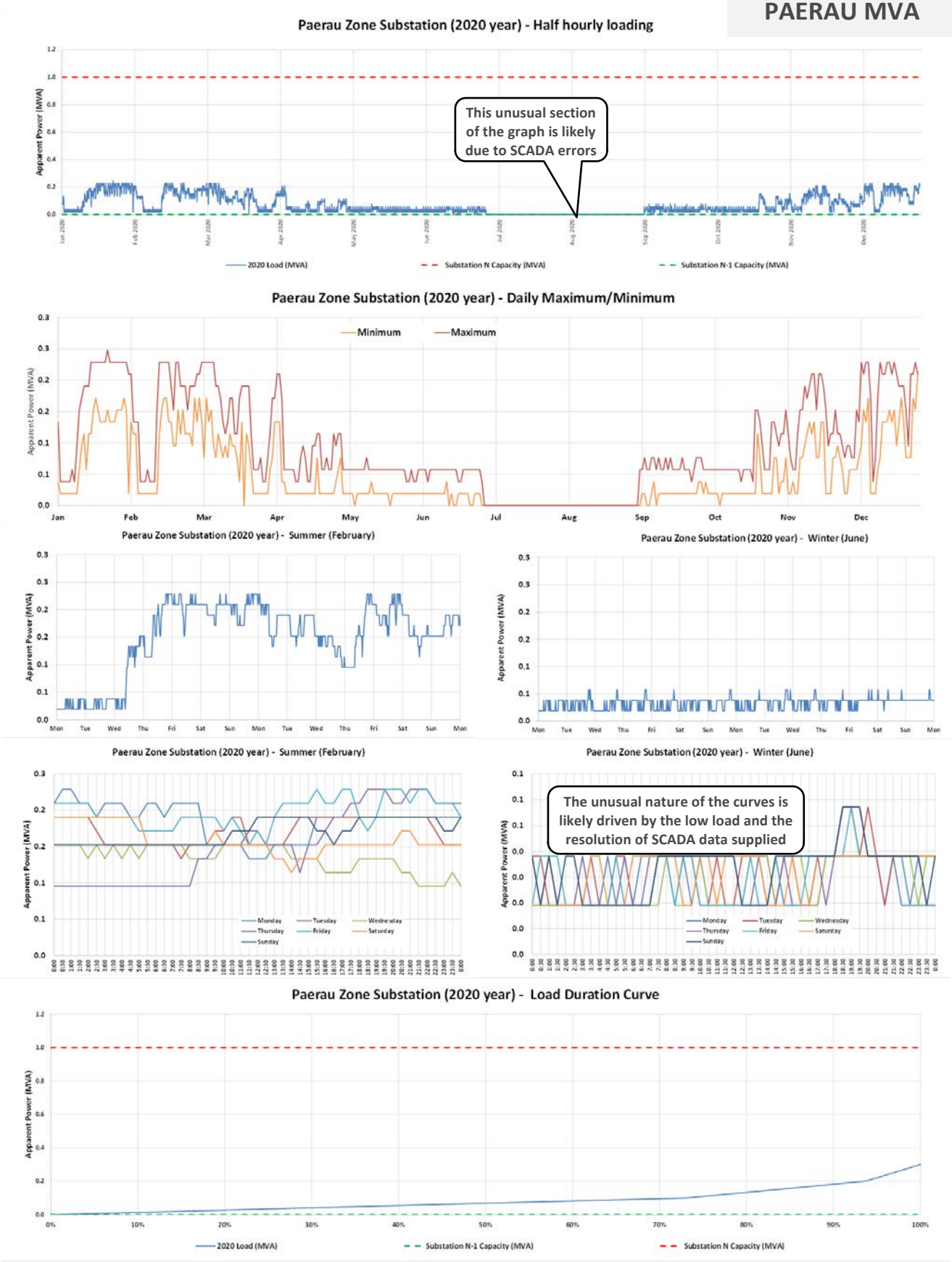


Figure 81 Paerau 33/11kV zone substation: Apparent power (MVA) load characteristics

INFORMATION NOT SUPPLIED

Figure 82 Paerau Hydro 33/11kV zone substation: Apparent power (MVA) load characteristics

PALMERSTON MVA

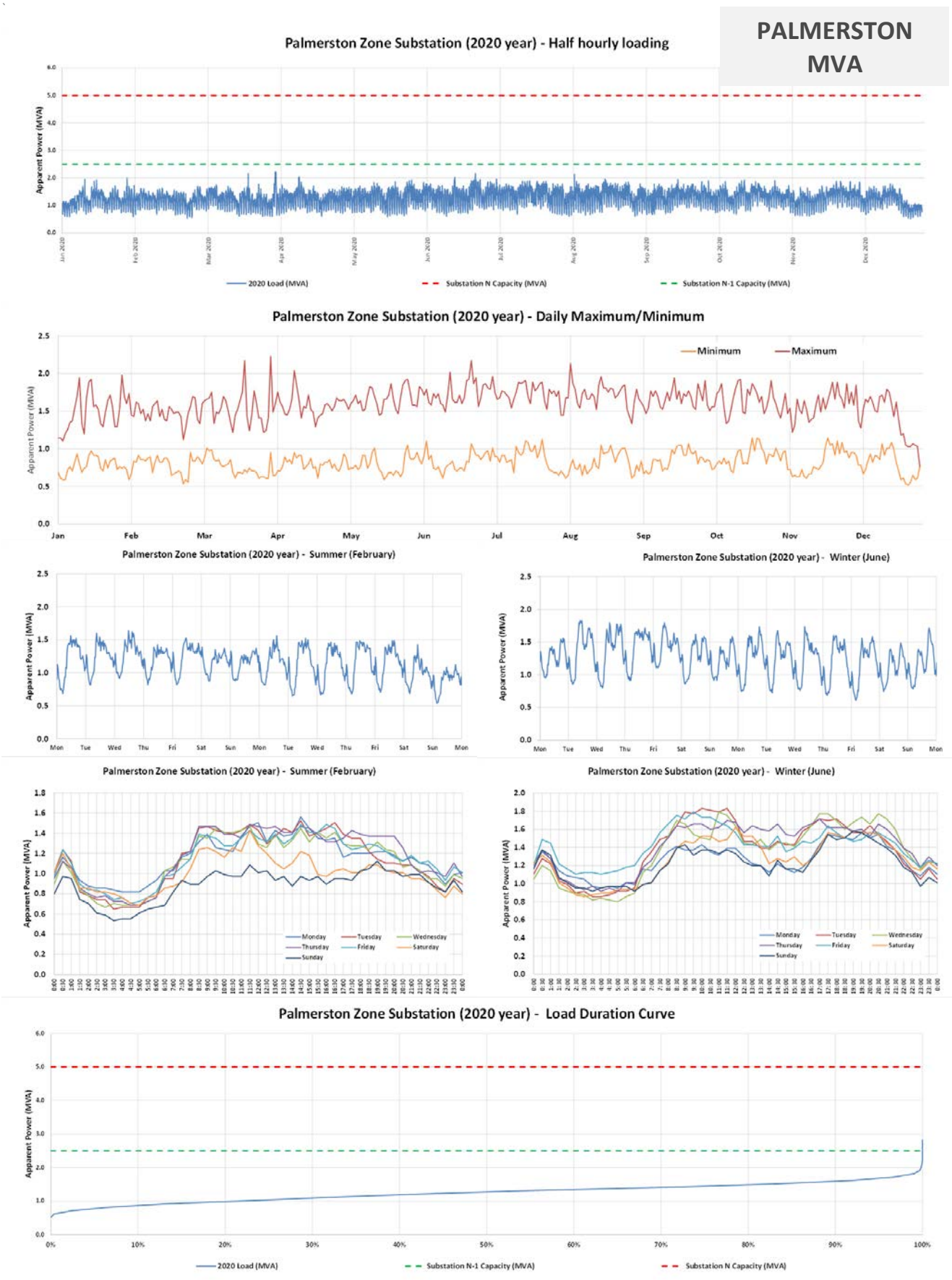


Figure 83 Palmerston 33/11kV zone substation: Apparent power (MVA) load characteristics

PATEAROA MVA

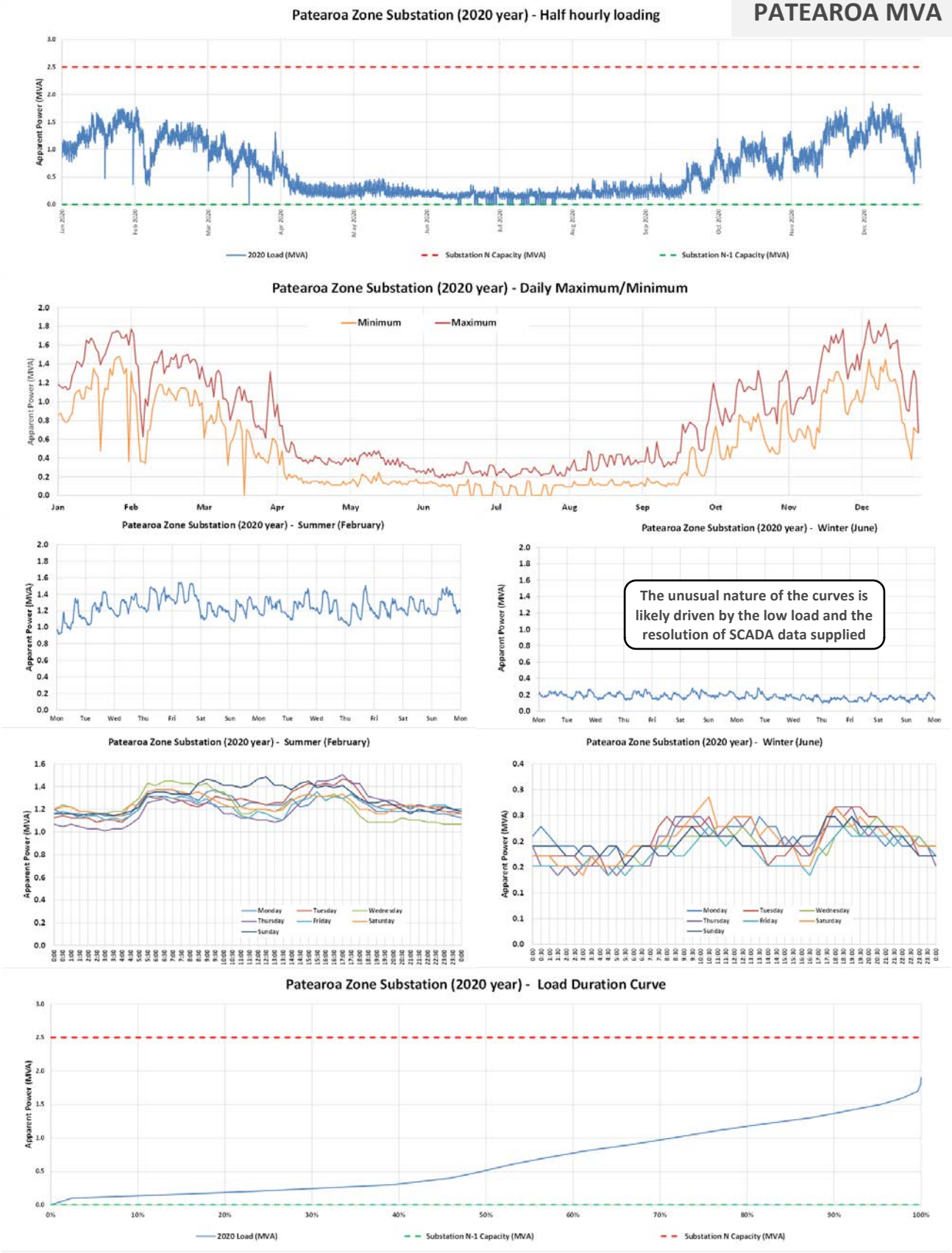


Figure 84 Patearoa 33/11kV zone substation: Apparent power (MVA) load characteristics

PORT MOLYNEUX MVA

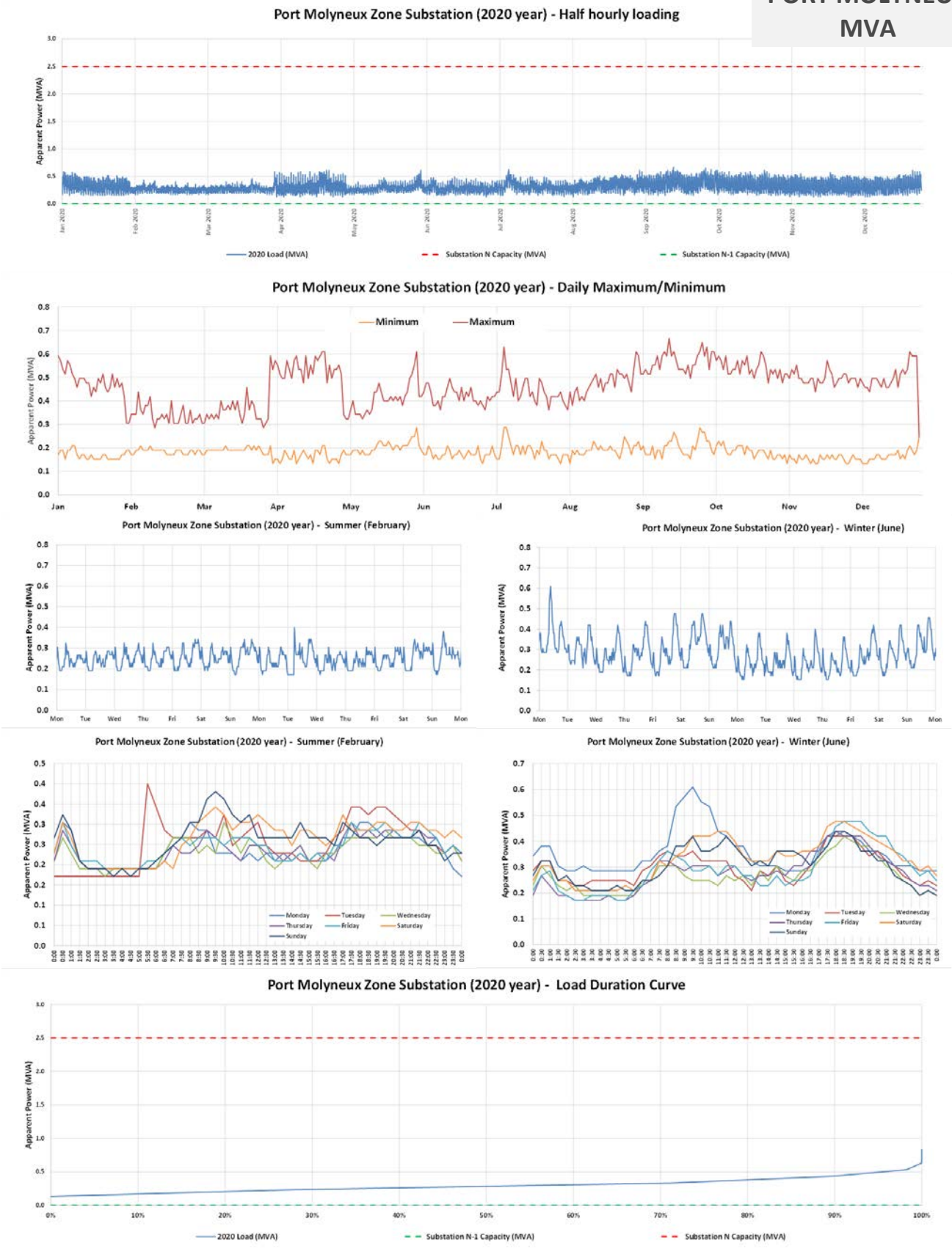


Figure 85 Port Molyneux 33/11kV zone substation: Apparent power (MVA) load characteristics

PUKEKAWA MVA

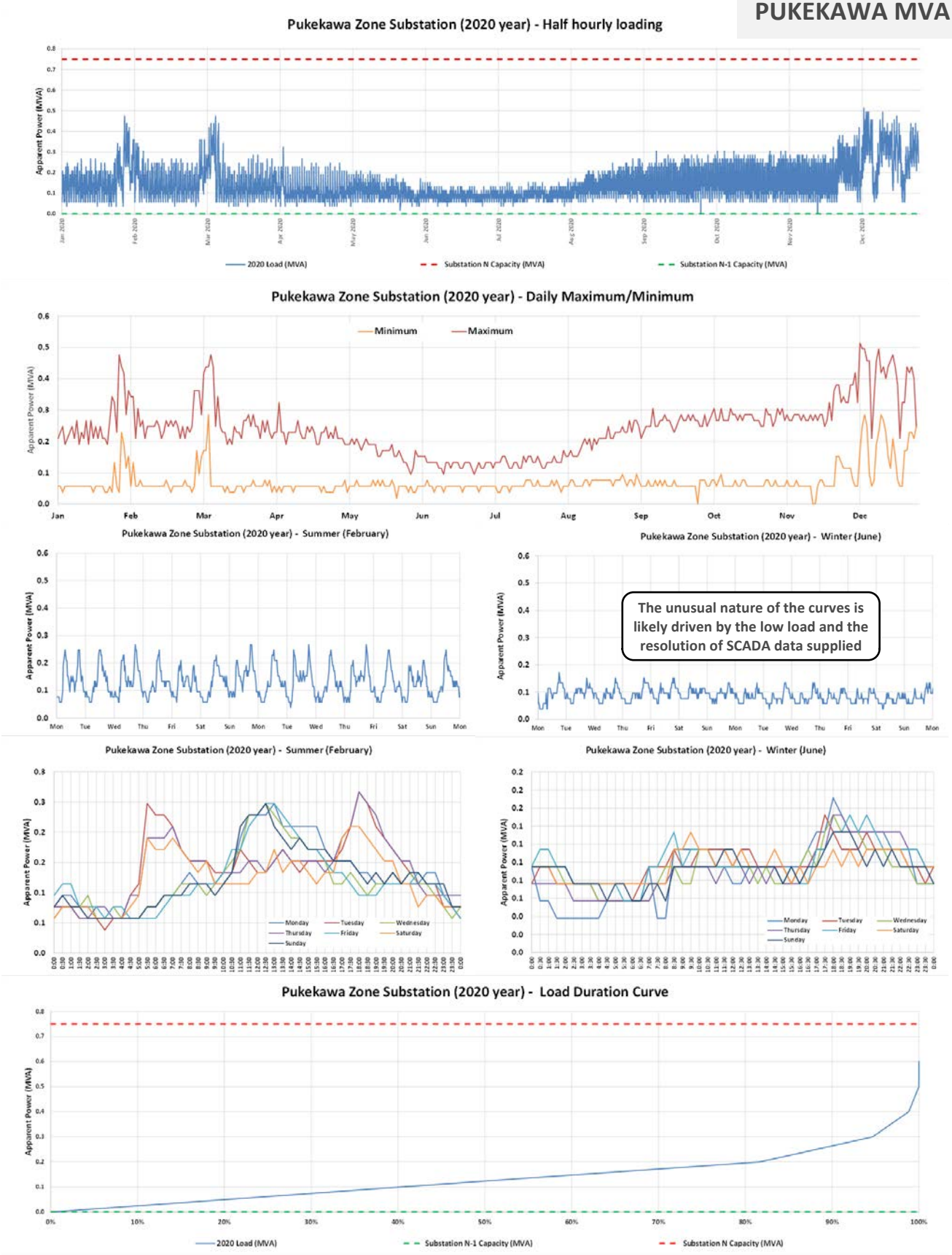


Figure 86 Pukekawa 33/11kV zone substation: Apparent power (MVA) load characteristics

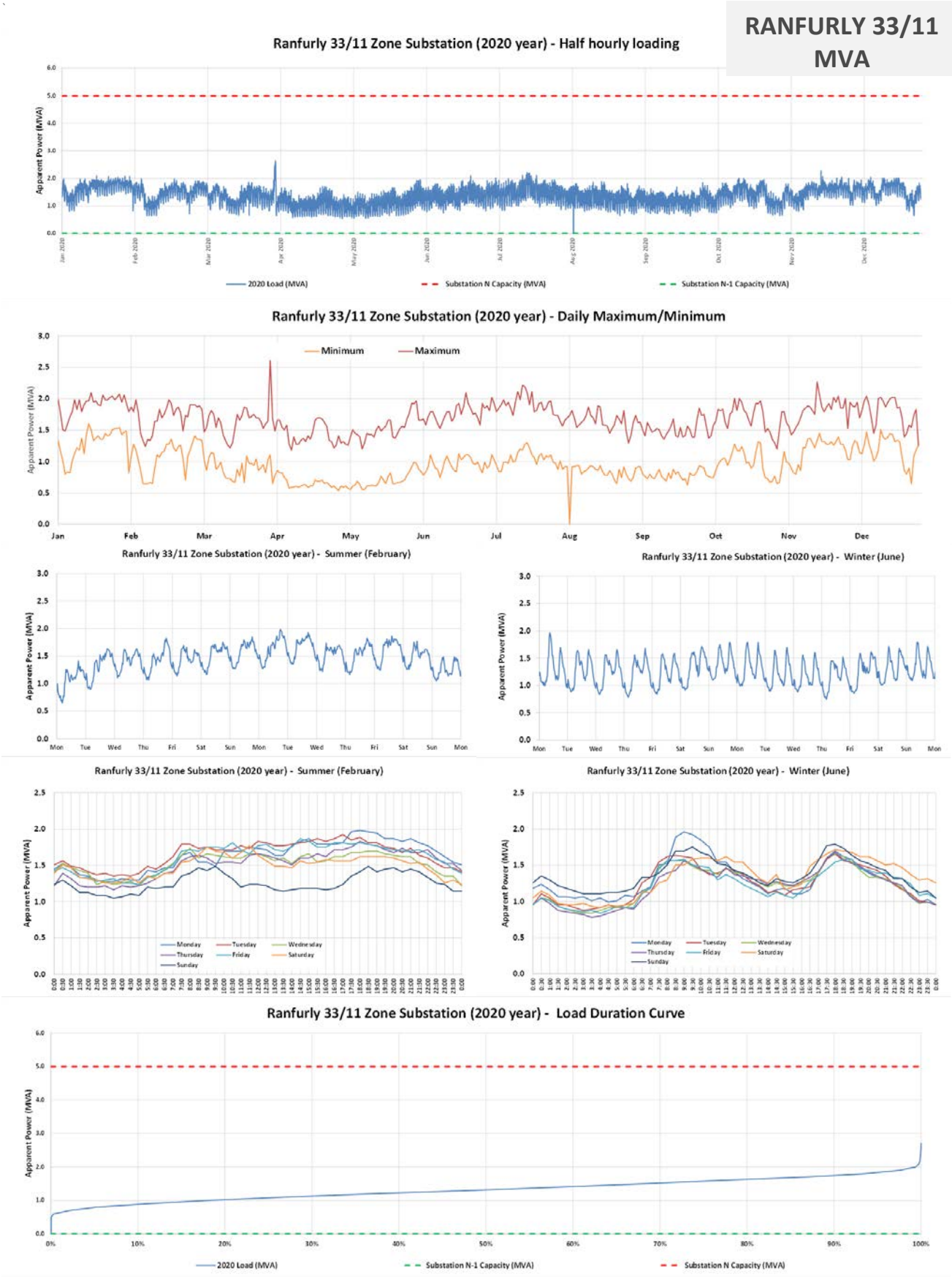


Figure 87 Ranfurly 33/11 33/11kV zone substation: Apparent power (MVA) load characteristics

INFORMATION NOT SUPPLIED

Figure 88 Ranfurly 66/33 33/11kV zone substation: Apparent power (MVA) load characteristics

REMARKABLES MVA

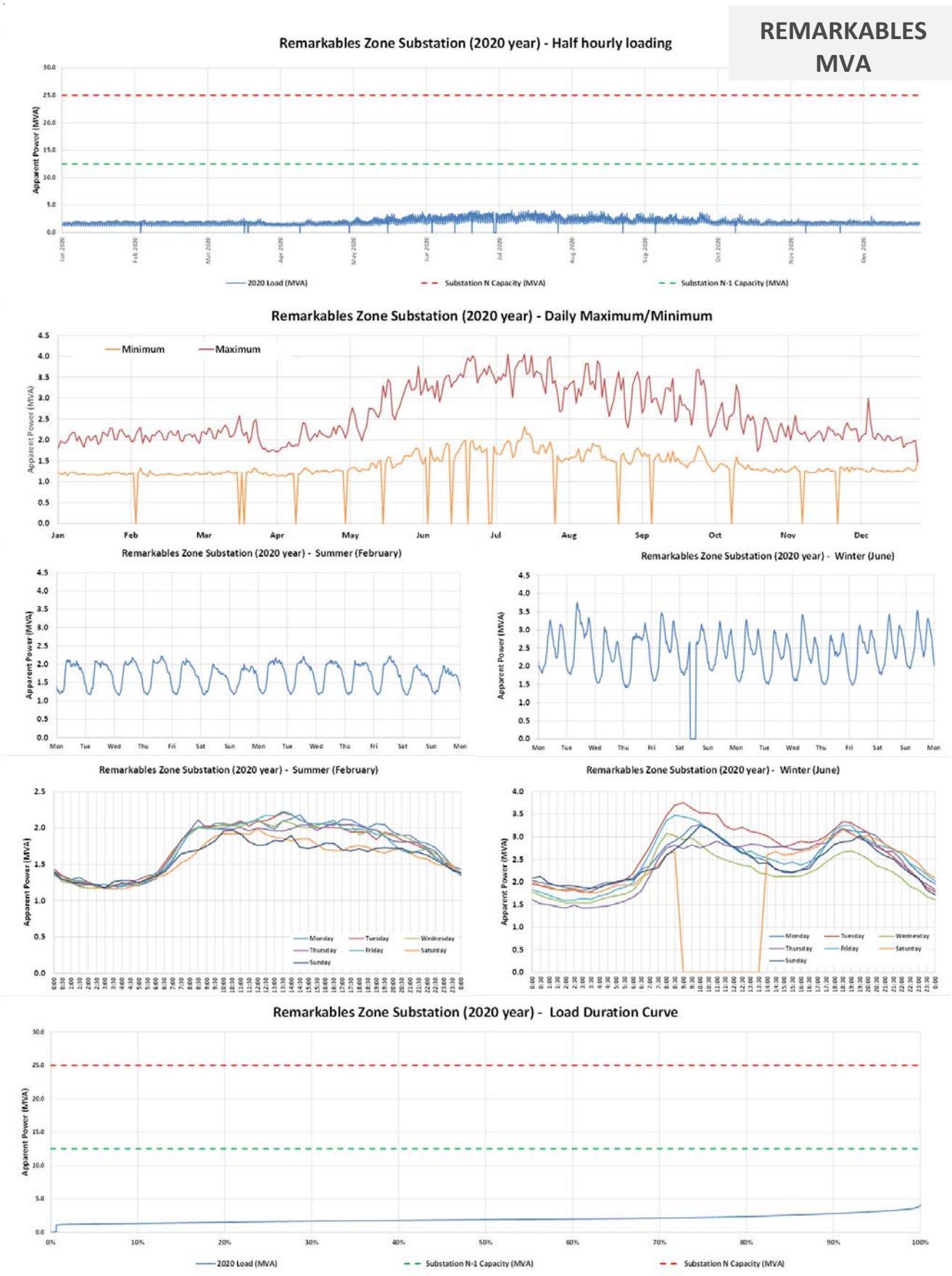


Figure 89 Remarkables 33/11kV zone substation: Apparent power (MVA) load characteristics

STIRLING MVA

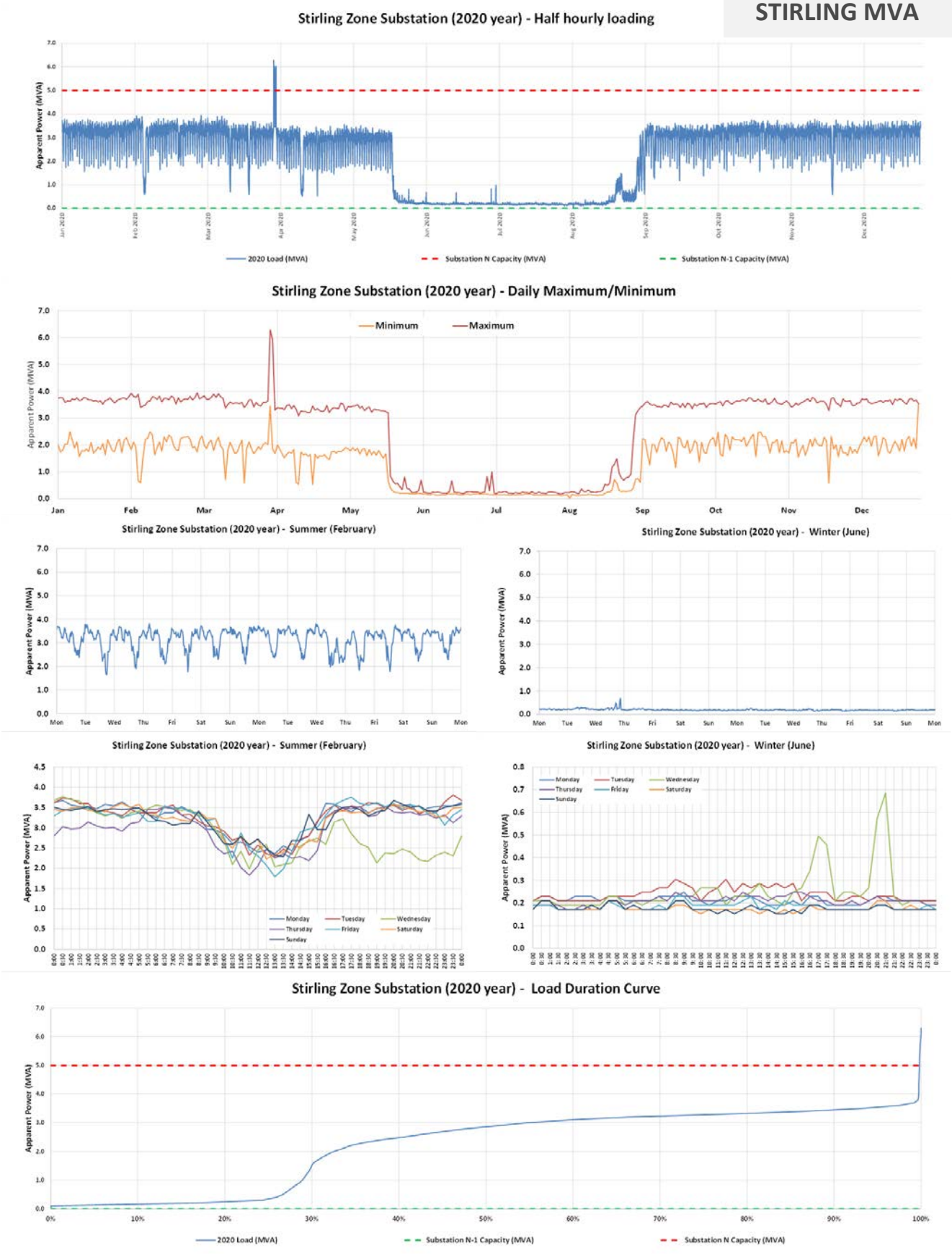
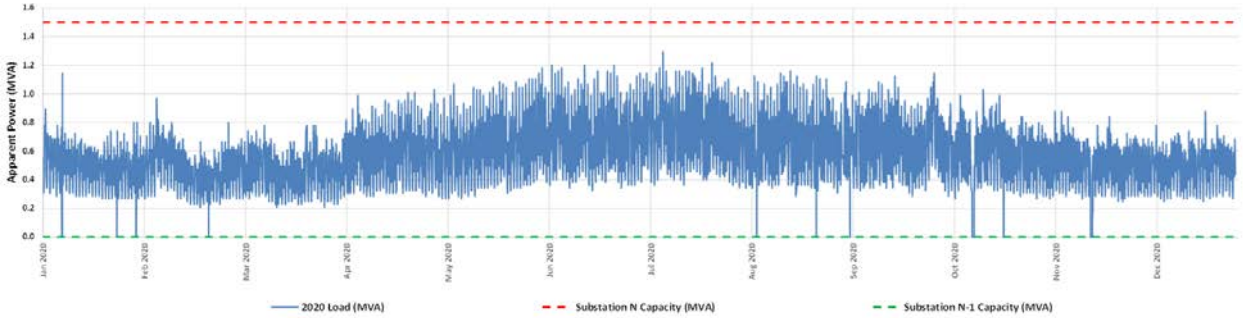


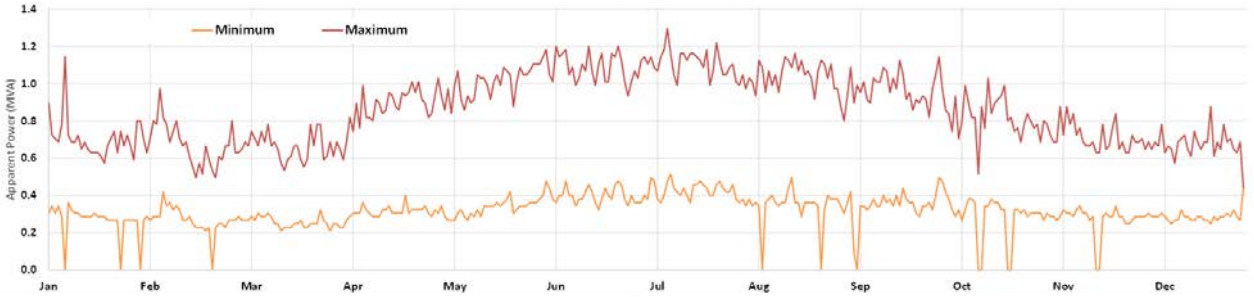
Figure 90 Stirling 33/11kV zone substation: Apparent power (MVA) load characteristics

WAIHOLA MVA

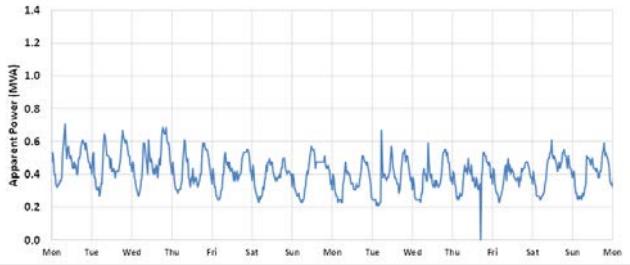
Waihola Zone Substation (2020 year) - Half hourly loading



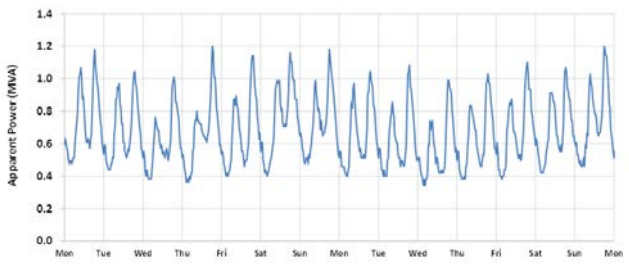
Waihola Zone Substation (2020 year) - Daily Maximum/Minimum



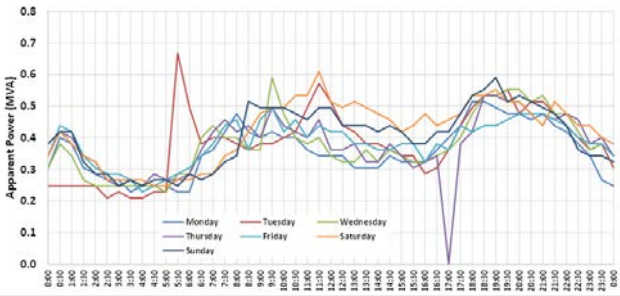
Waihola Zone Substation (2020 year) - Summer (February)



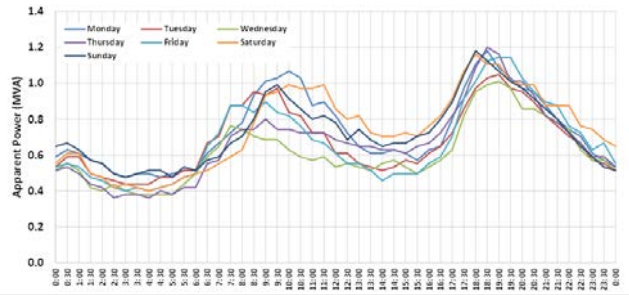
Waihola Zone Substation (2020 year) - Winter (June)



Waihola Zone Substation (2020 year) - Summer (February)



Waihola Zone Substation (2020 year) - Winter (June)



Waihola Zone Substation (2020 year) - Load Duration Curve

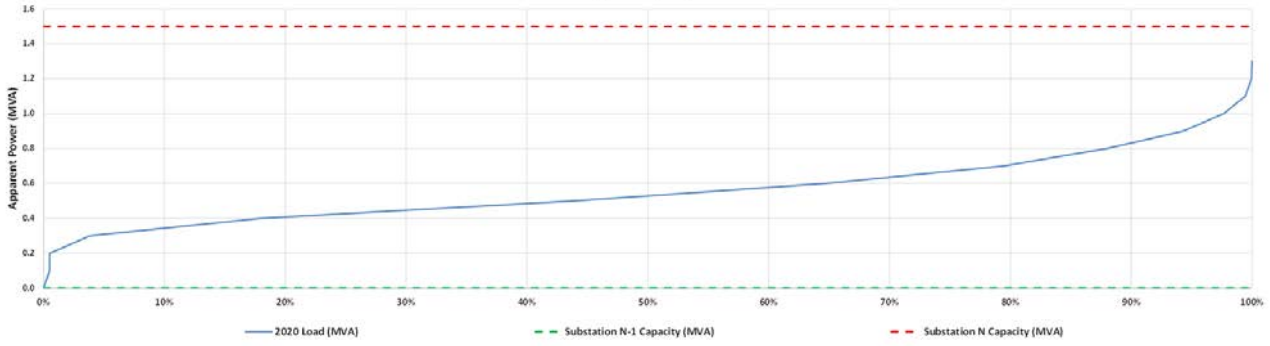
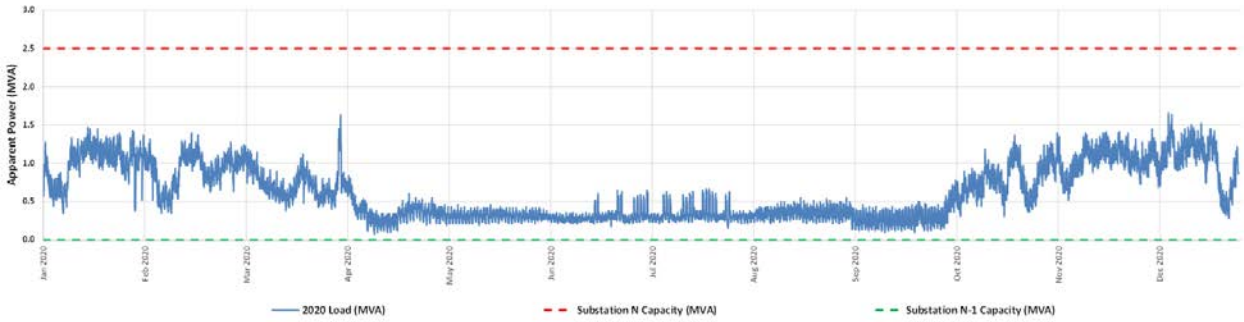


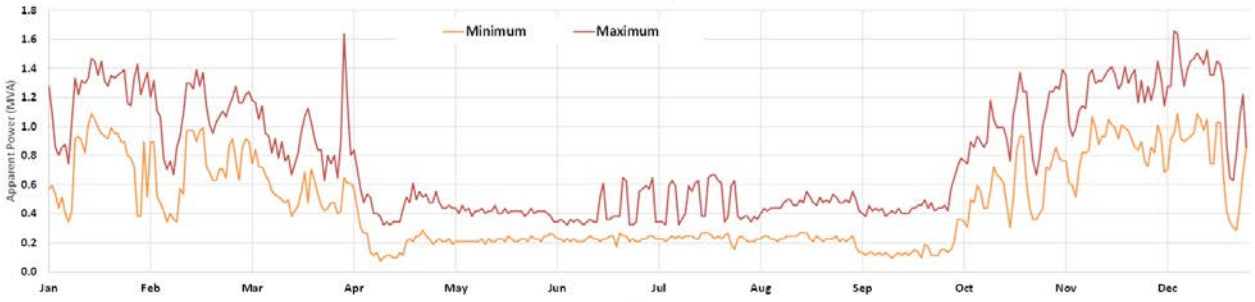
Figure 91 Waihola 33/11kV zone substation: Apparent power (MVA) load characteristics

WAIPIATA MVA

Waipiata Zone Substation (2020 year) - Half hourly loading

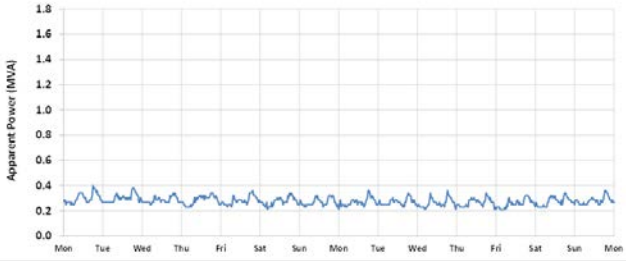


Waipiata Zone Substation (2020 year) - Daily Maximum/Minimum

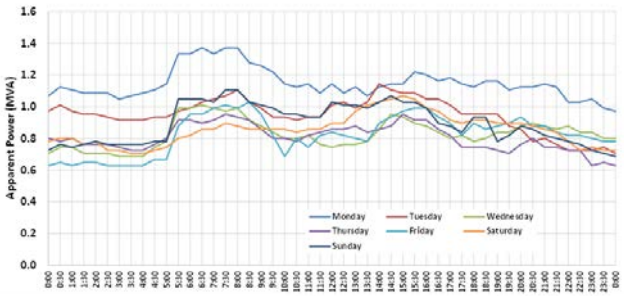


Waipiata Zone Substation (2020 year) - Summer (February)

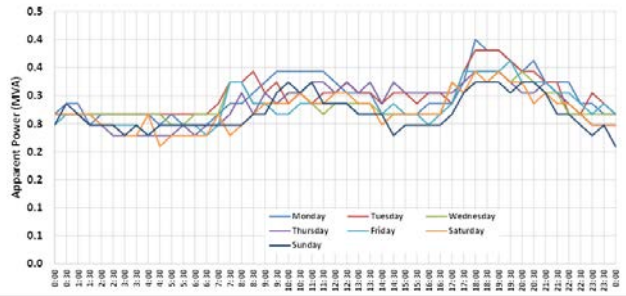
Waipiata Zone Substation (2020 year) - Winter (June)



Waipiata Zone Substation (2020 year) - Summer (February)



Waipiata Zone Substation (2020 year) - Winter (June)



Waipiata Zone Substation (2020 year) - Load Duration Curve

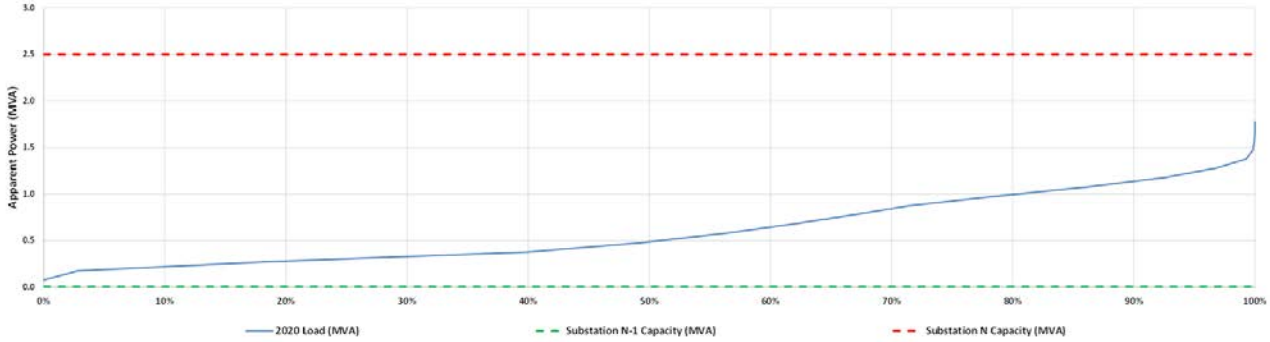


Figure 92 Waipiata 33/11kV zone substation: Apparent power (MVA) load characteristics

WAITATI MVA

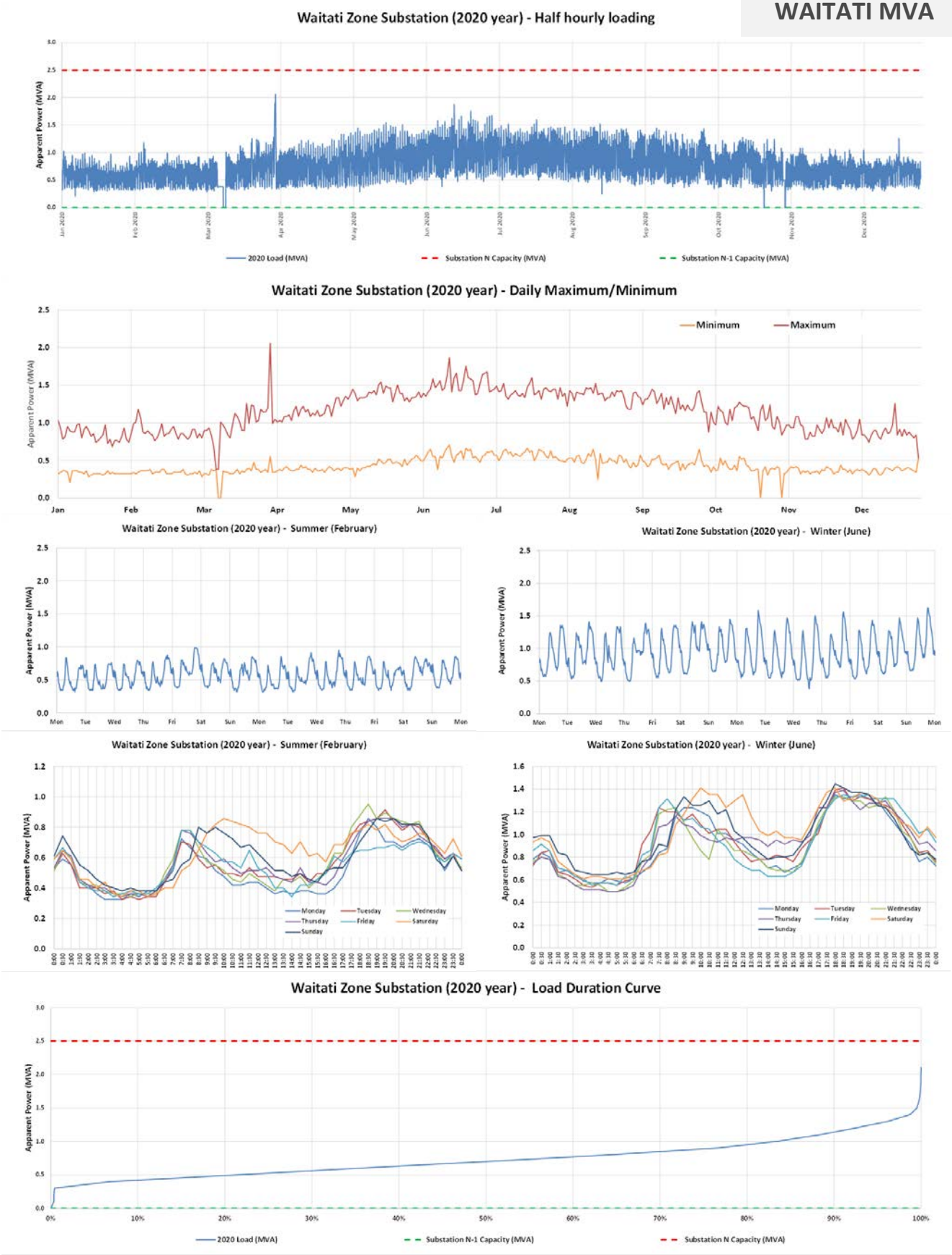


Figure 93 Waitati 33/11kV zone substation: Apparent power (MVA) load characteristics

WEDDERBURN MVA

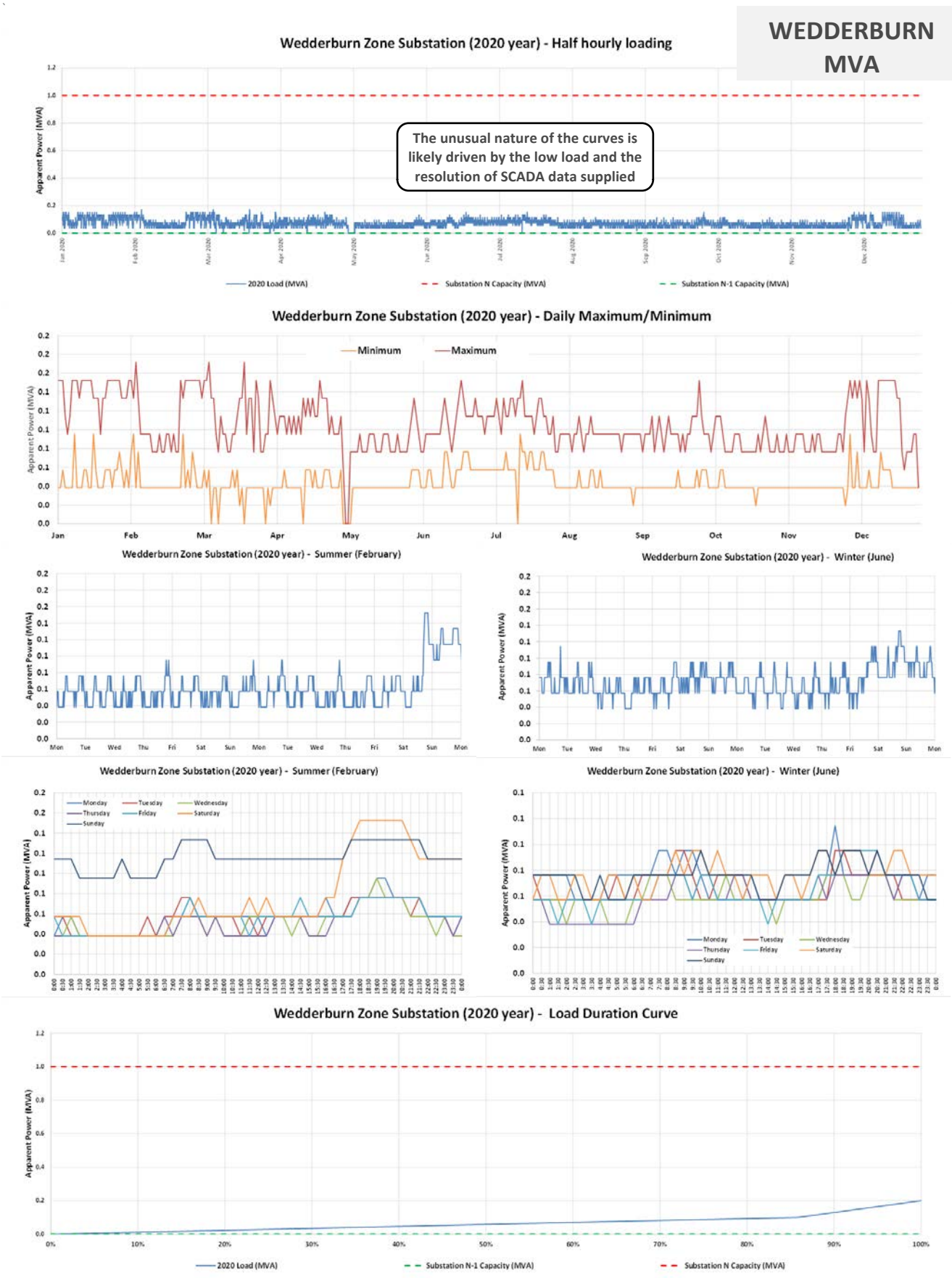


Figure 94 Wedderburn 33/11kV zone substation: Apparent power (MVA) load characteristics