



Otago Network

Supplementary Information - Substation Load Characteristics

EECA

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CONSULTING

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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	Updated for client/Transpower/EDB comments

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1. Introduction

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

For each GXP, the January 2022 through December 2022 apparent (MVA) and reactive loadings (MVAr) are presented. For each Zone Substation, the apparent (MVA) or real (MW) 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:

- **Clyde GXP**
 - Figure 1 Clyde: Apparent power (MVA) load characteristics
 - Figure 2 Clyde: Reactive power (MVAr) load characteristics
- **Cromwell GXP**
 - Figure 3 Cromwell: Apparent power (MVA) load characteristics
 - Figure 4 Cromwell: Reactive power (MVAr) load characteristics
- **Frankton GXP**
 - Figure 5 Frankton: Apparent power (MVA) load characteristics
 - Figure 6 Frankton: Reactive power (MVAr) load characteristics
- **Halfway Bush GXP**
 - Figure 7 Halfway Bush: Apparent power (MVA) load characteristics
 - Figure 8 Halfway Bush: Reactive power (MVAr) load characteristics
- **Naseby GXP**
 - Figure 9 Naseby: Apparent power (MVA) load characteristics
 - Figure 10 Naseby: Reactive power (MVAr) load characteristics
- **South Dunedin GXP**
 - Figure 11 South Dunedin: Apparent power (MVA) load characteristics
 - Figure 12 South Dunedin: Reactive power (MVAr) load characteristics

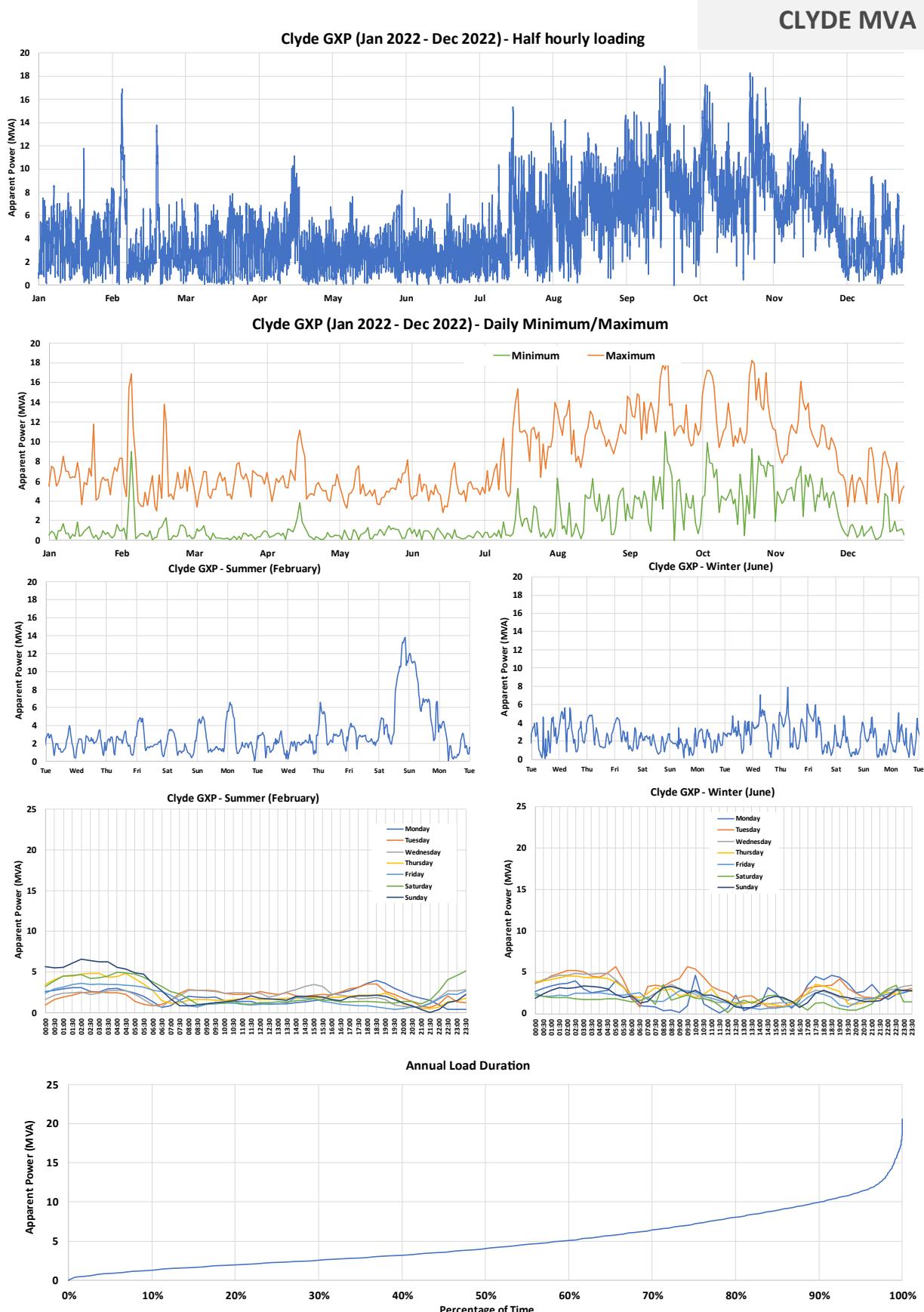


Figure 1 Clyde: Apparent power (MVA) load characteristics

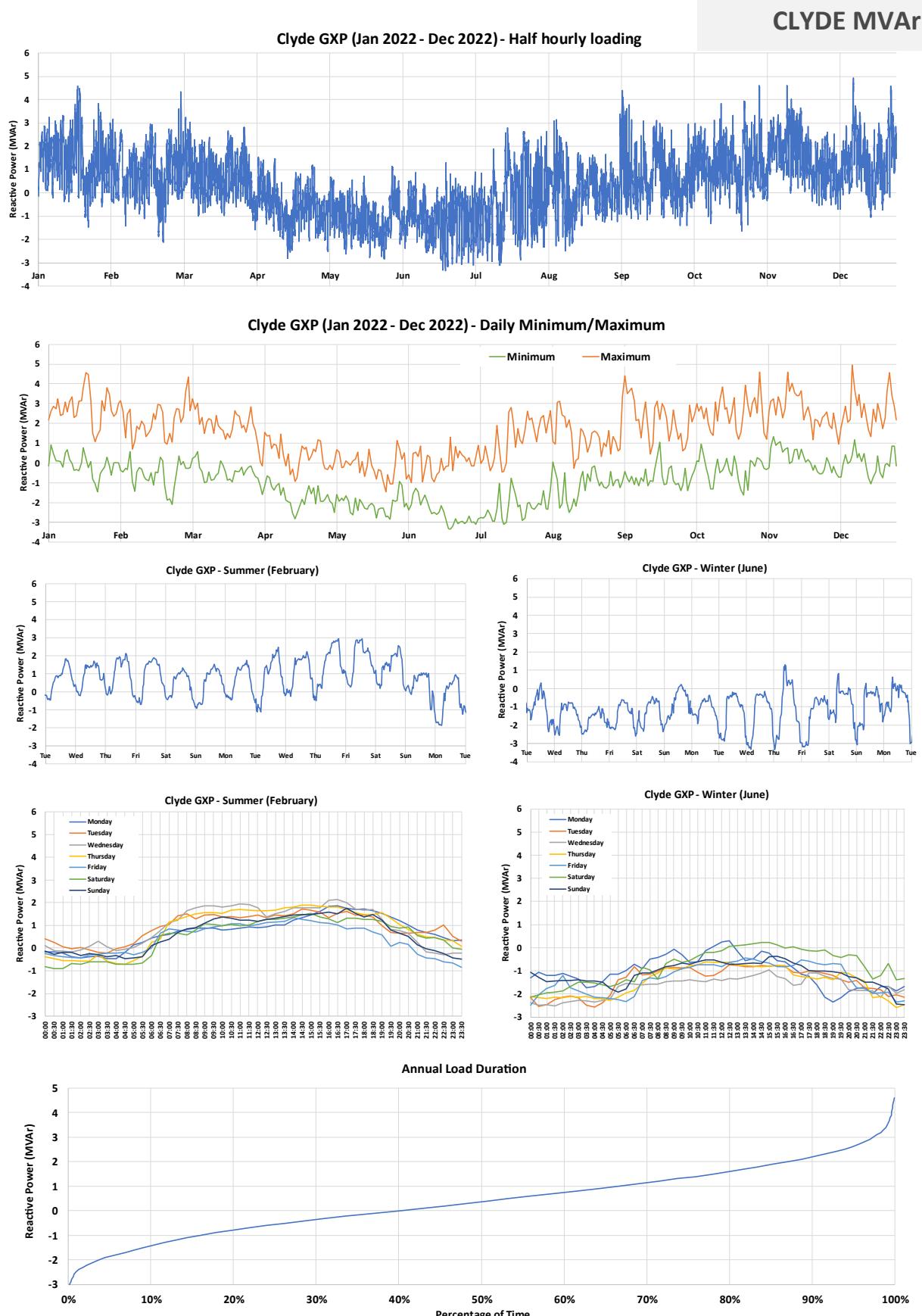


Figure 2 Clyde: Reactive power (MVAr) load characteristics

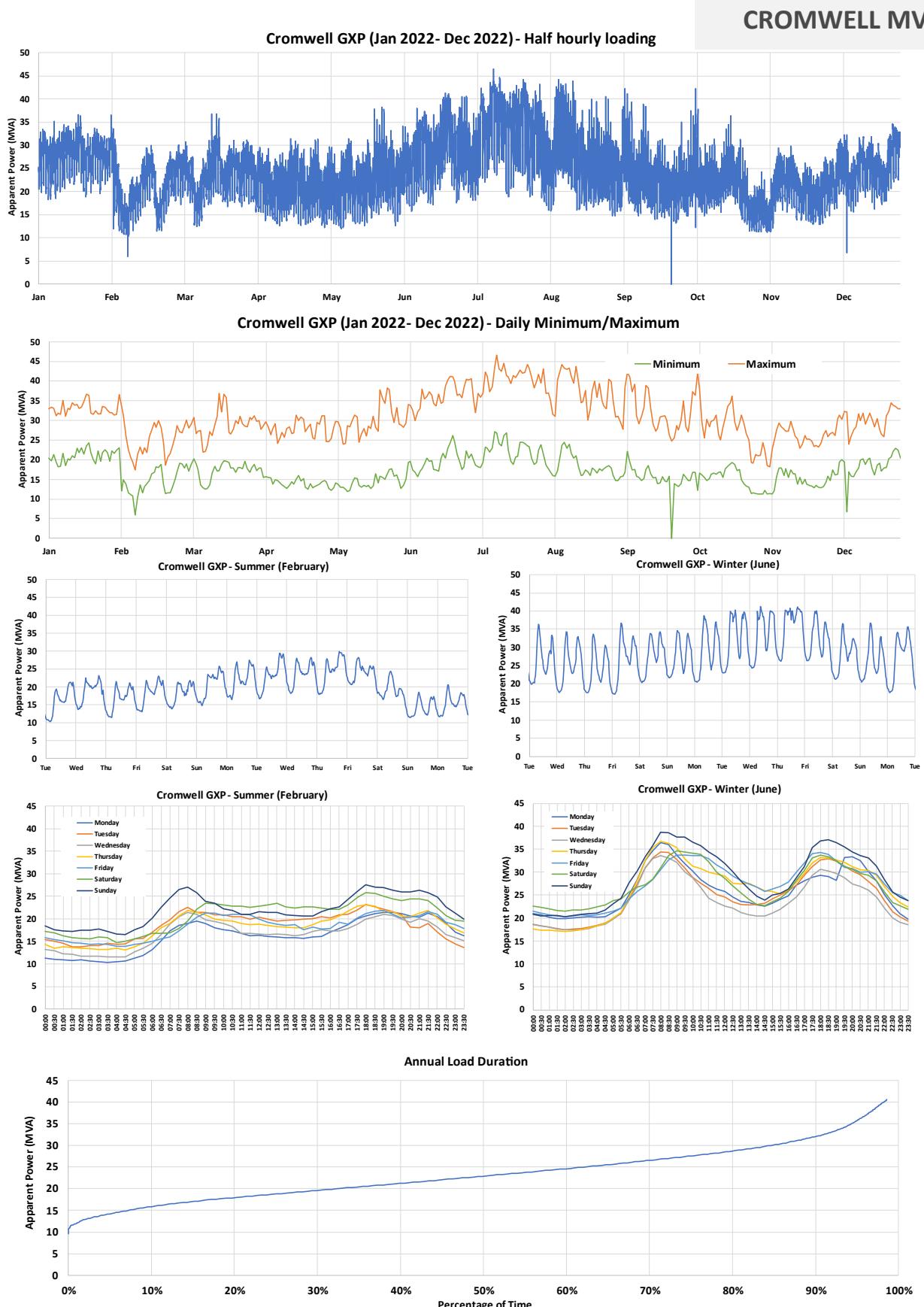


Figure 3 Cromwell: Apparent power (MVA) load characteristics

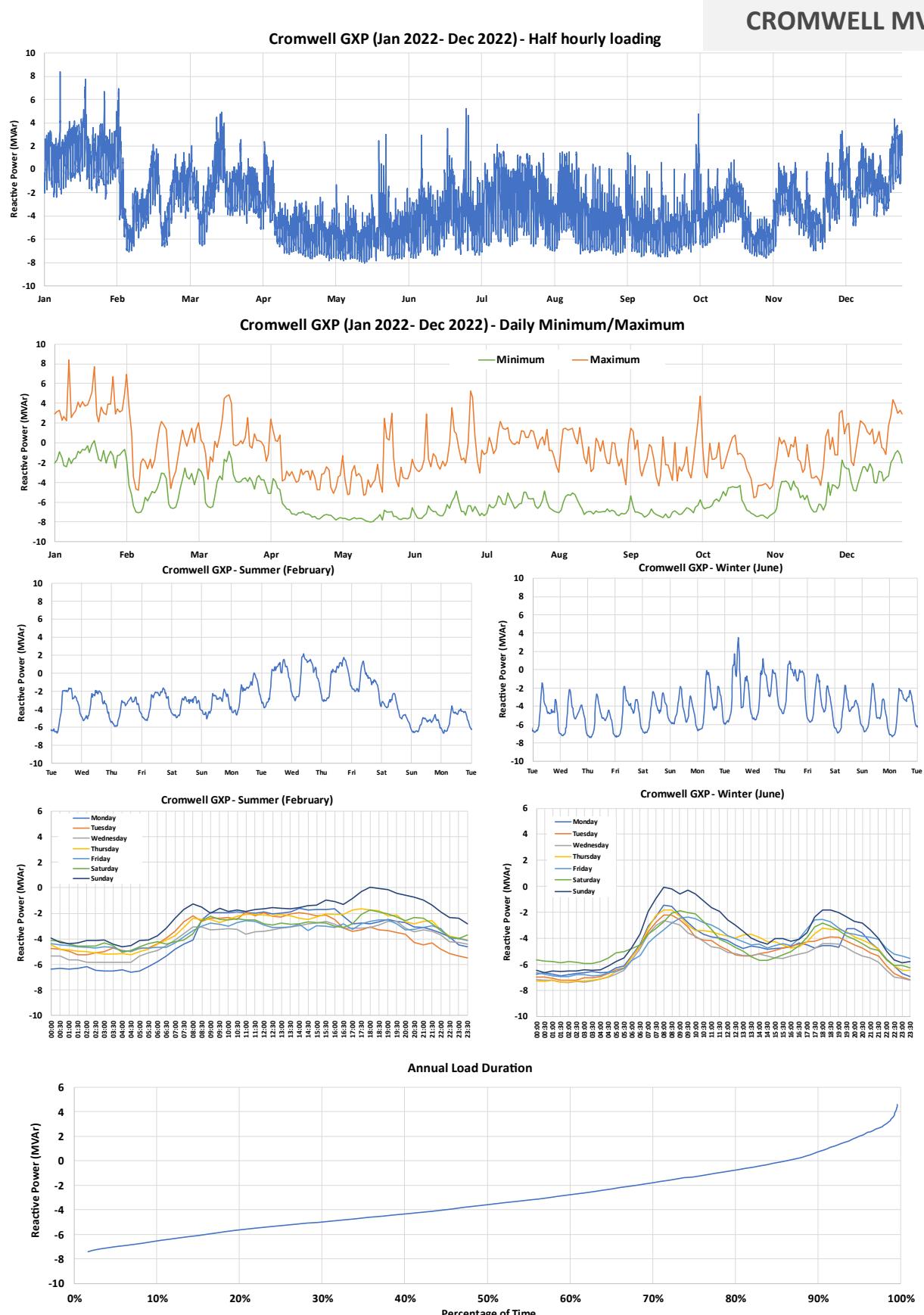


Figure 4 Cromwell: Reactive power (MVAr) load characteristics

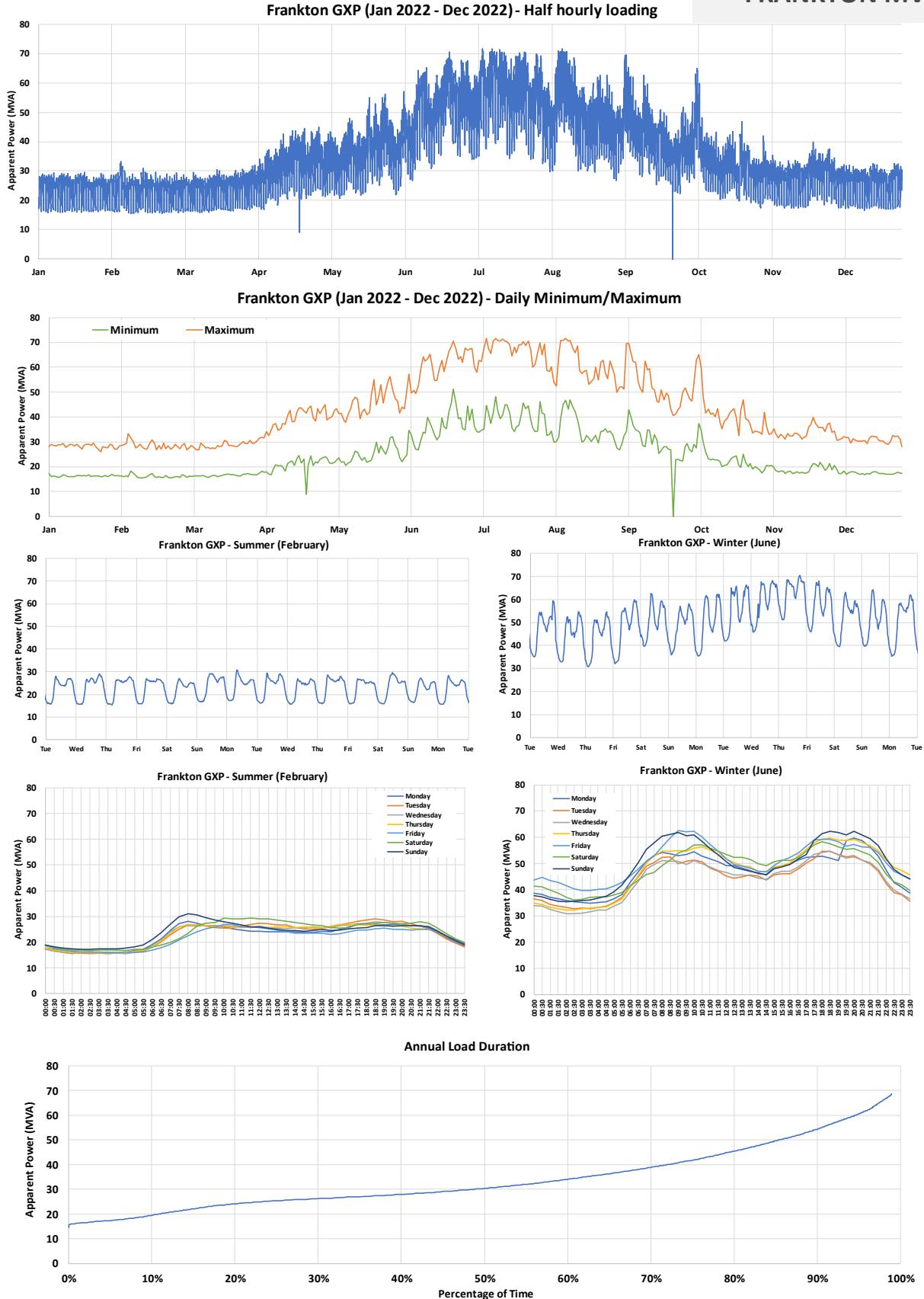
FRANKTON MVA


Figure 5 Frankton: Apparent power (MVA) load characteristics

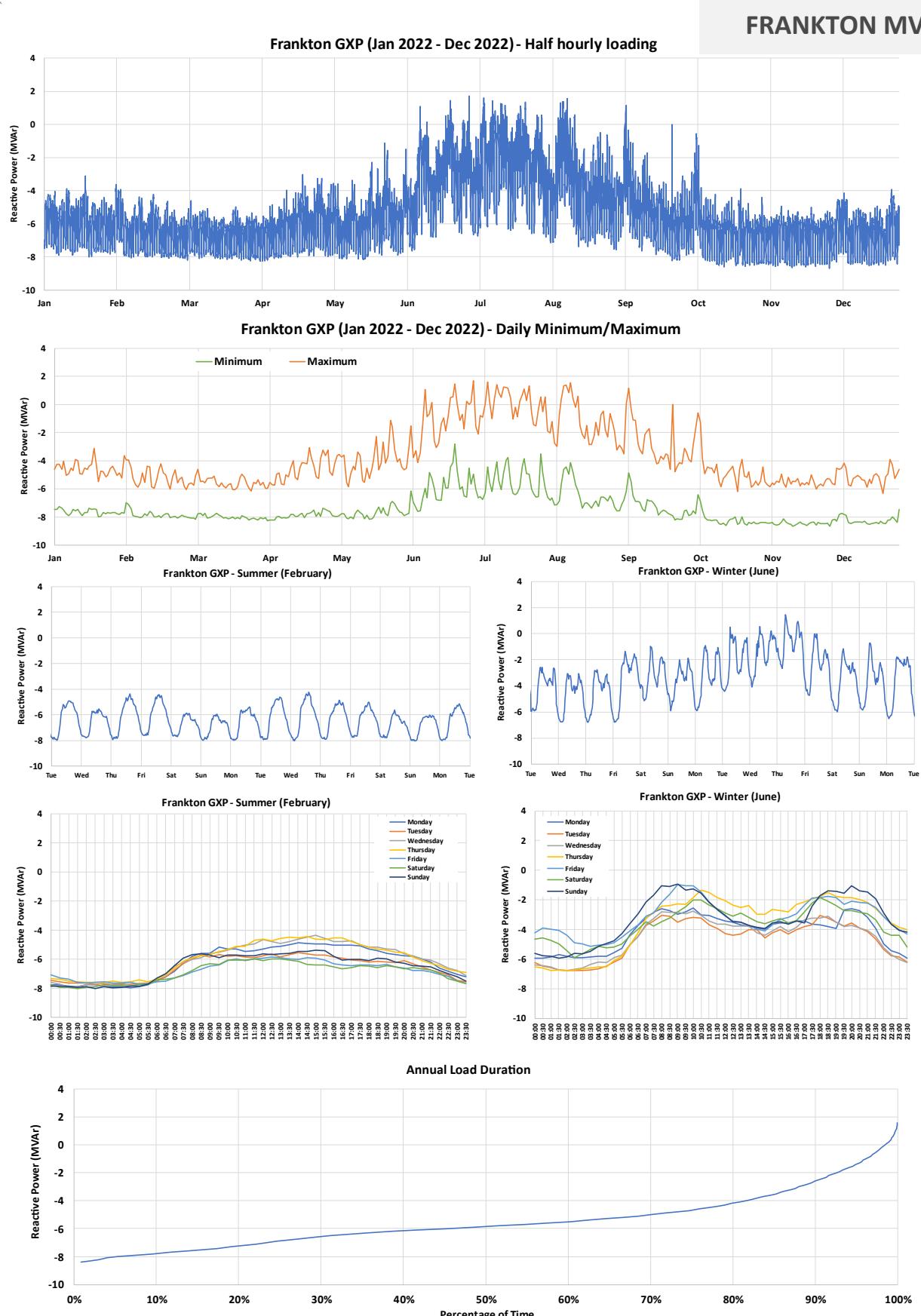


Figure 6 Frankton: Reactive power (MVAr) load characteristics

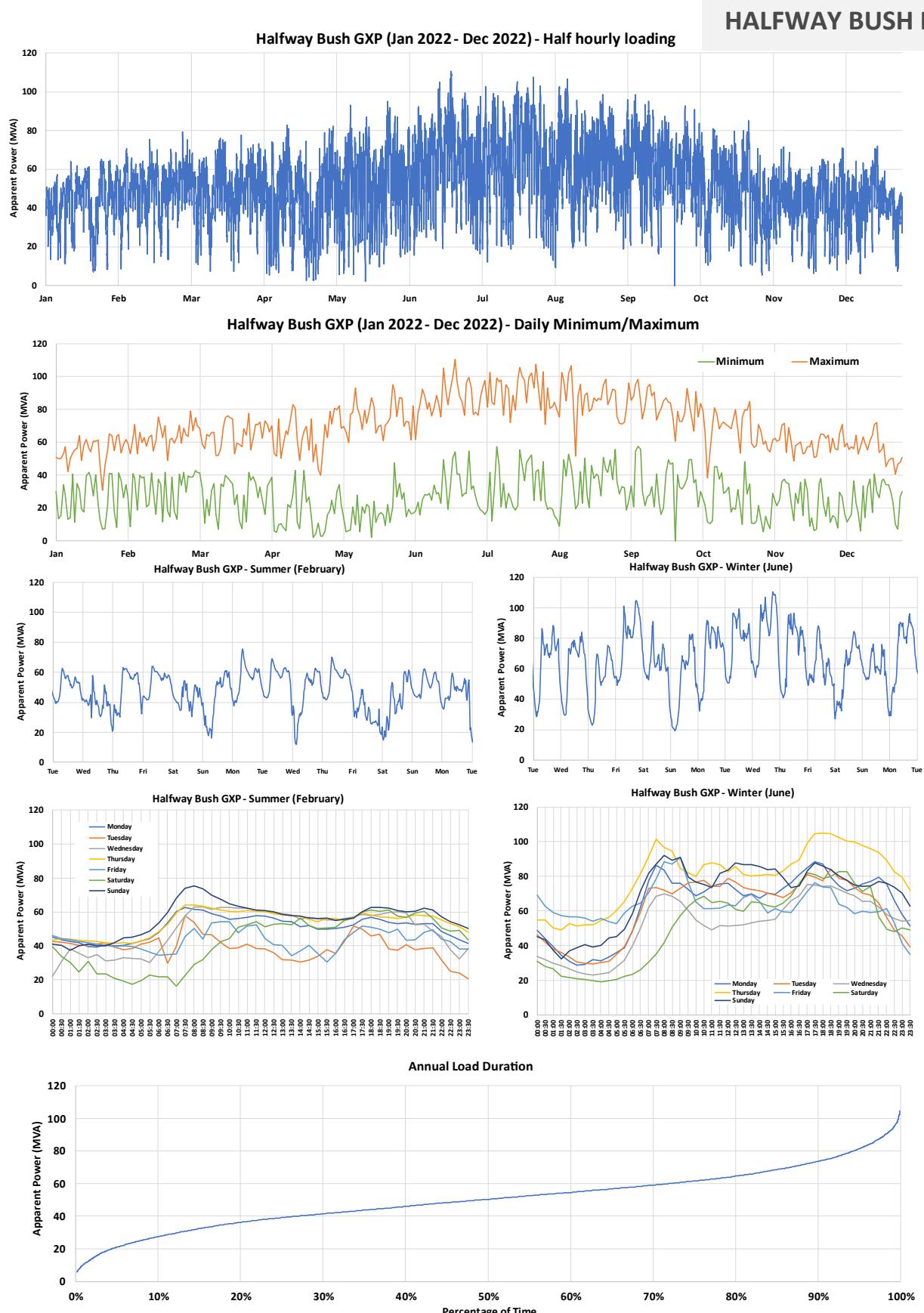


Figure 7 Halfway Bush: Apparent power (MVA) load characteristics

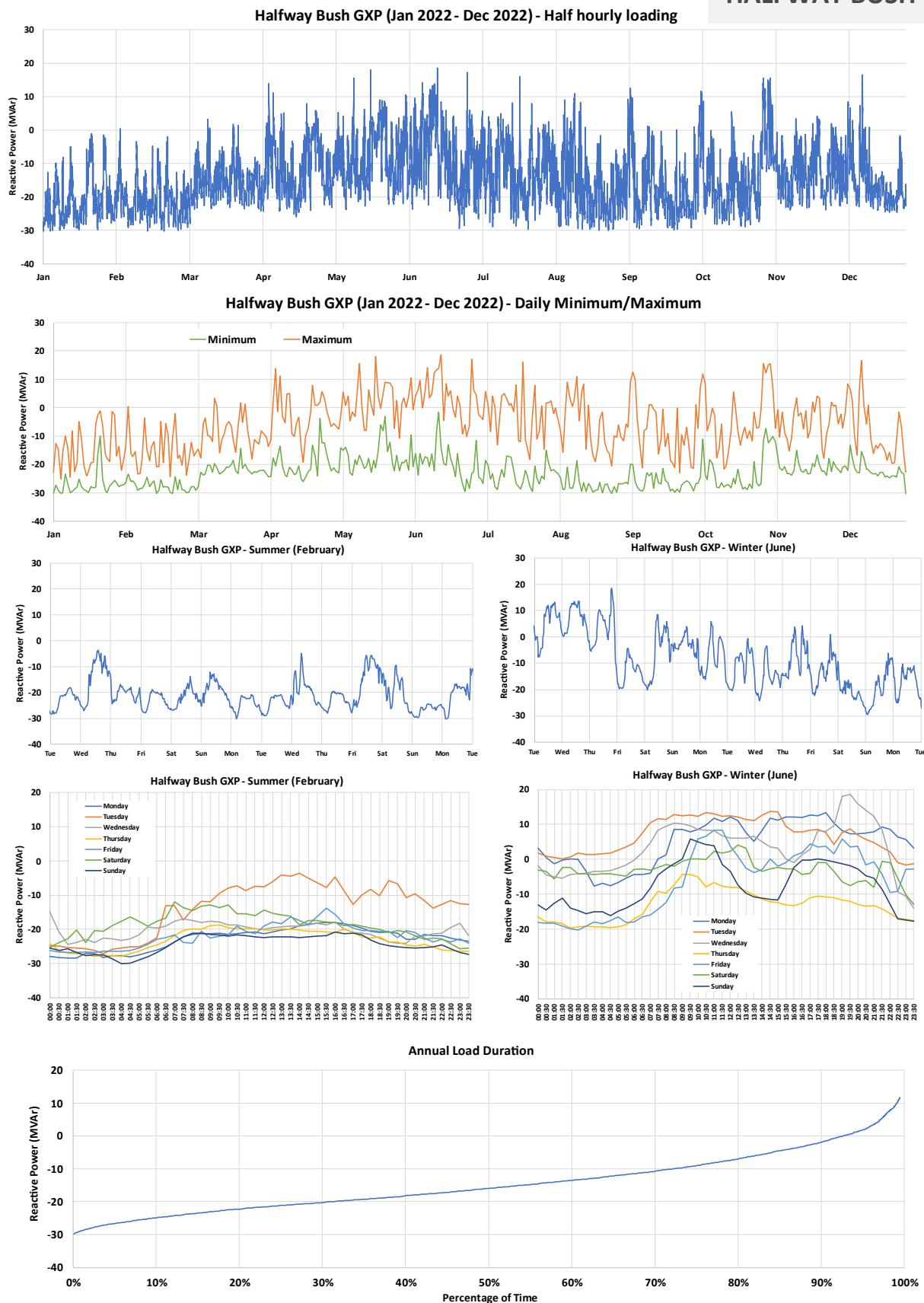
HALFWAY BUSH MVar


Figure 8 Halfway Bush: Reactive power (MVA) load characteristics

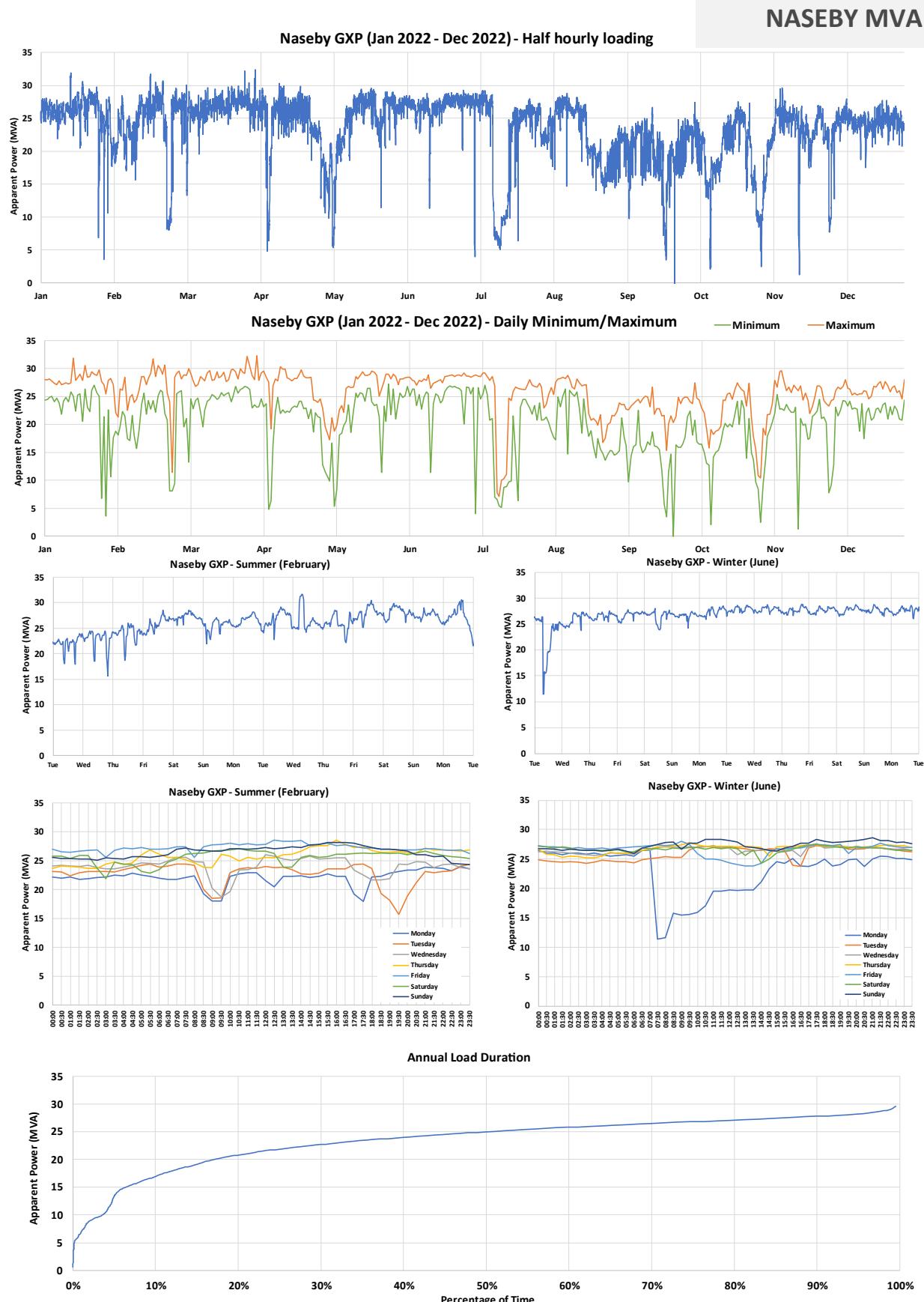


Figure 9 Naseby: Apparent power (MVA) load characteristics

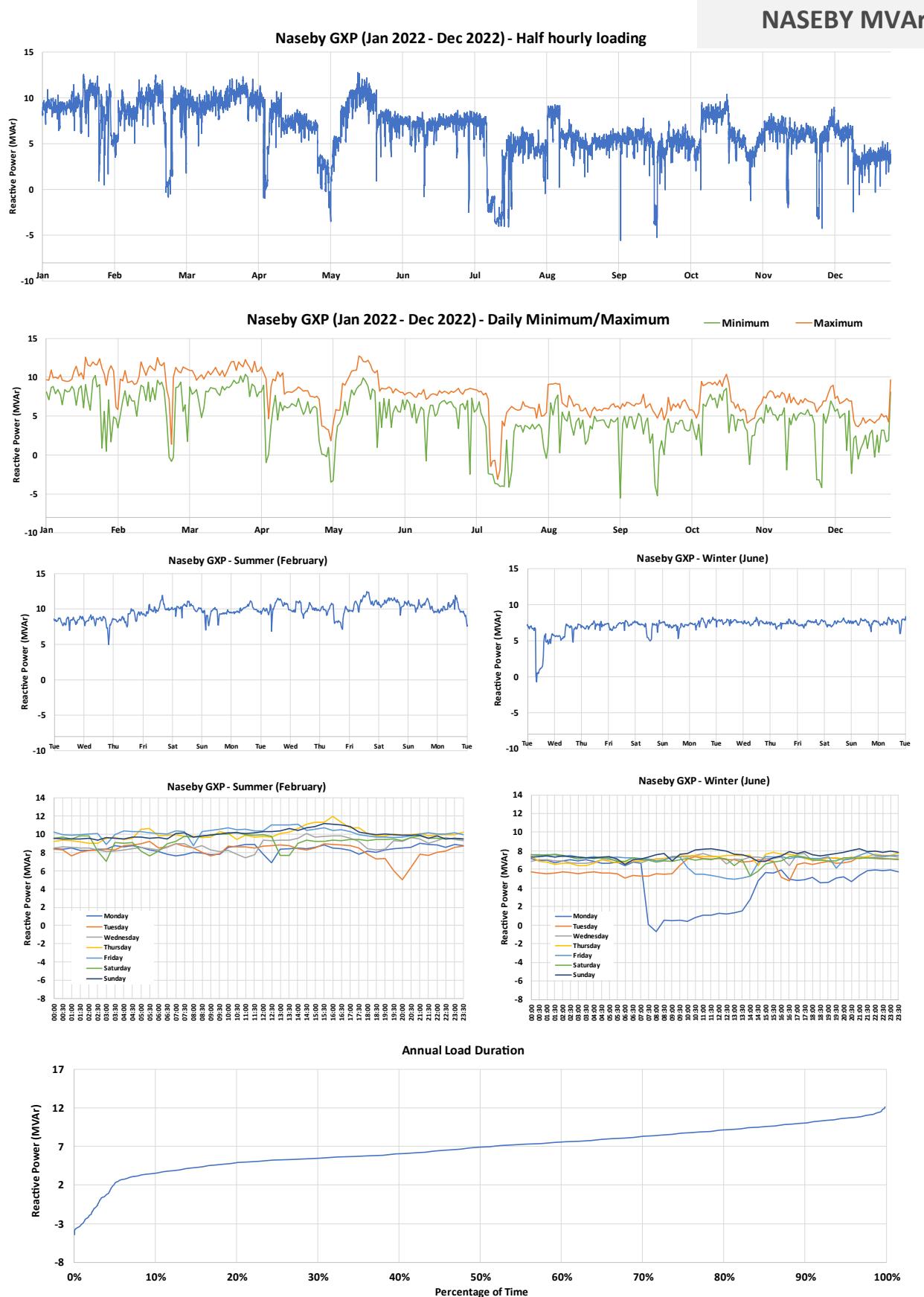


Figure 10 Naseby: Reactive power (MVAr) load characteristics

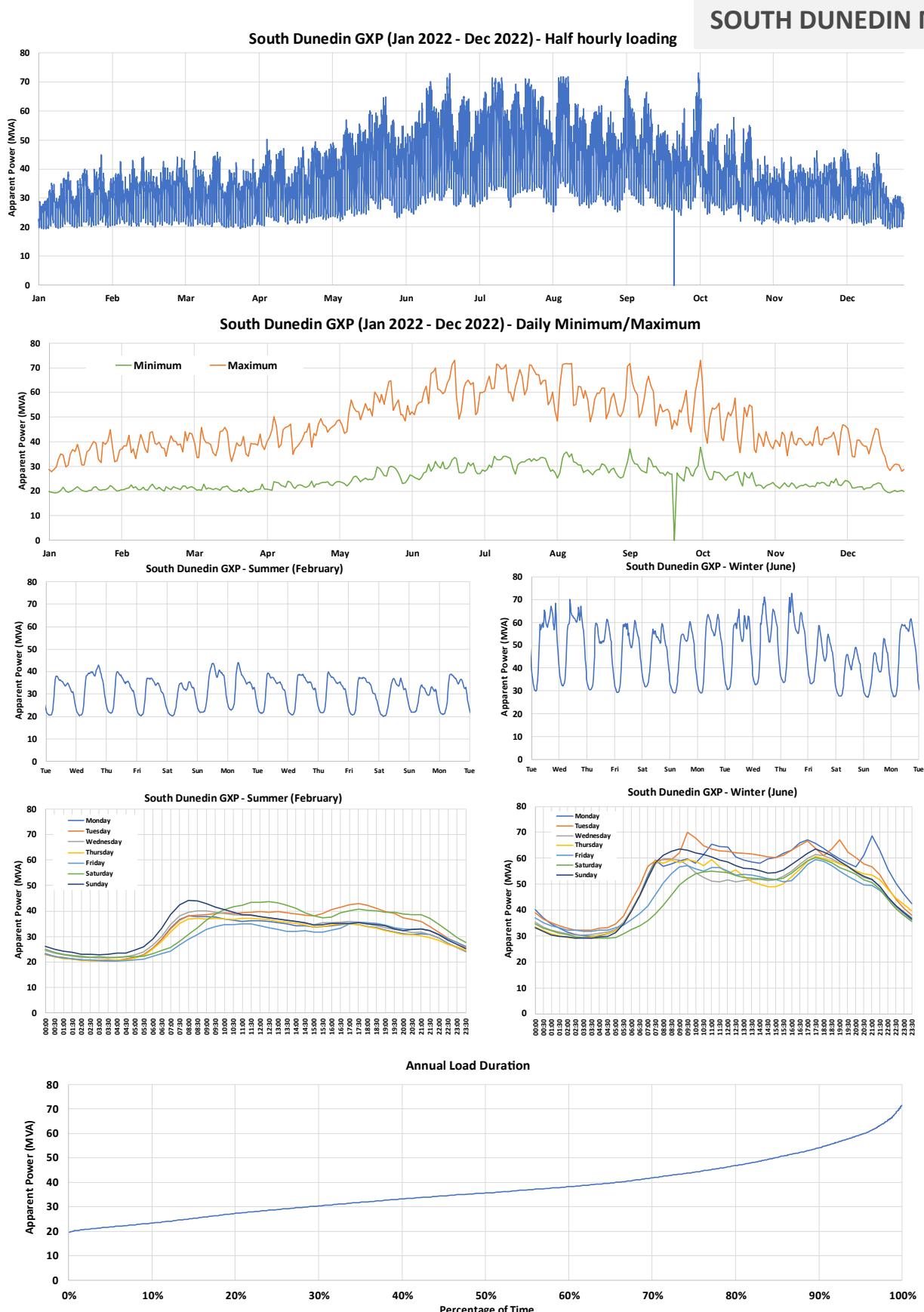


Figure 11 South Dunedin: Apparent power (MVA) load characteristics

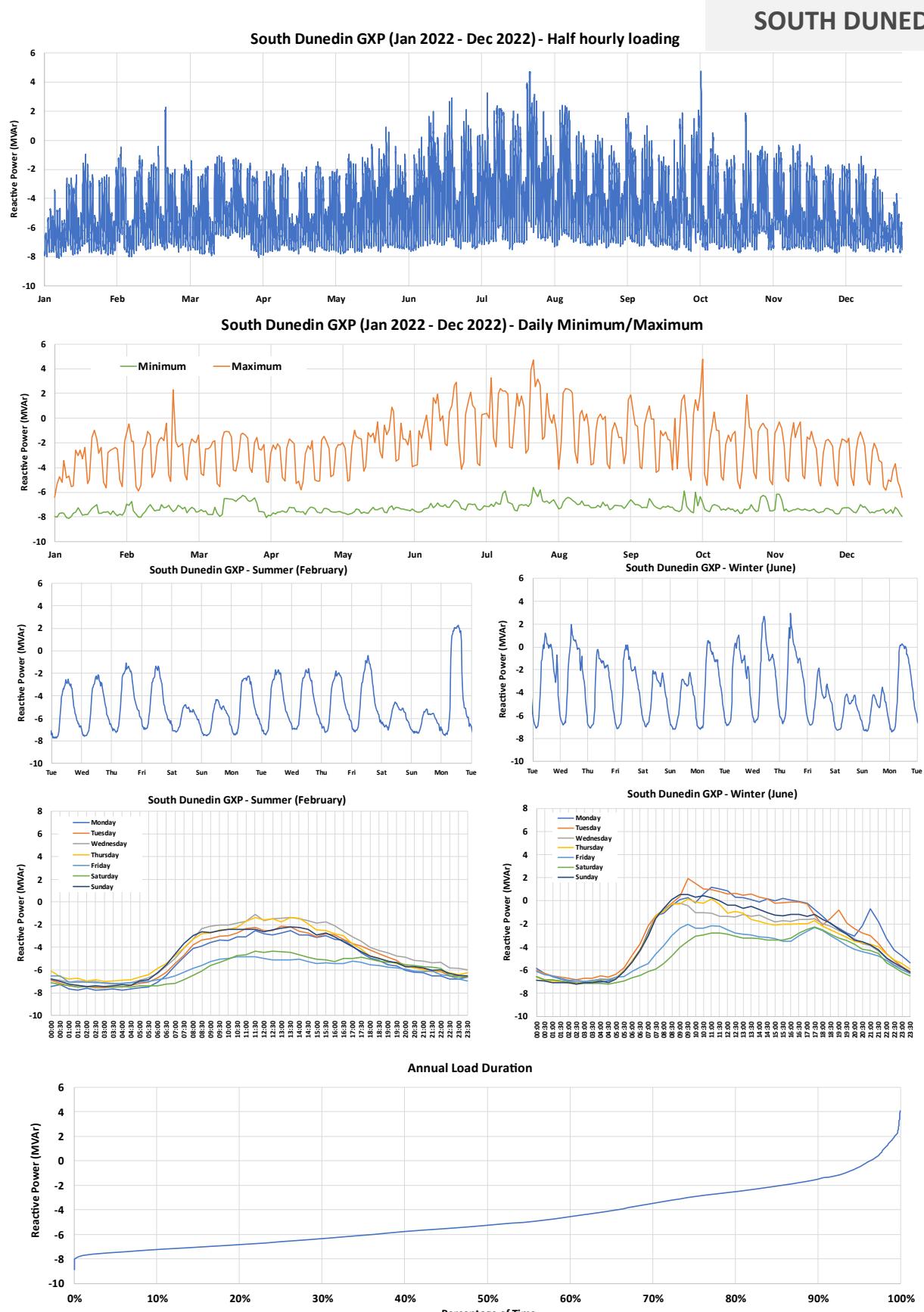


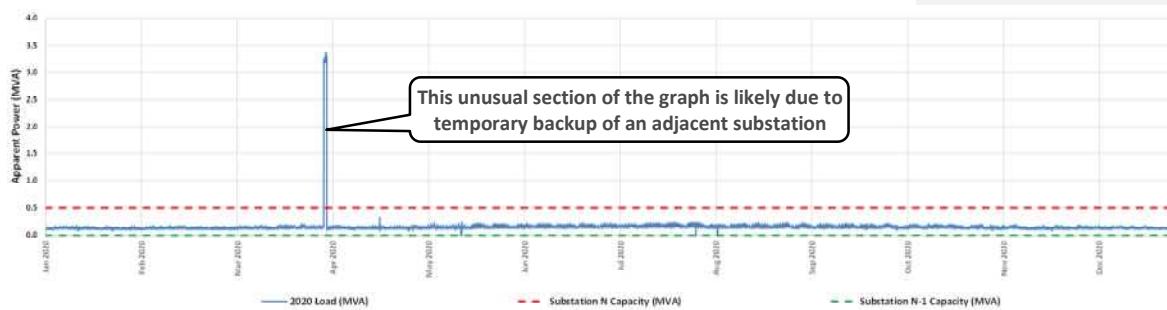
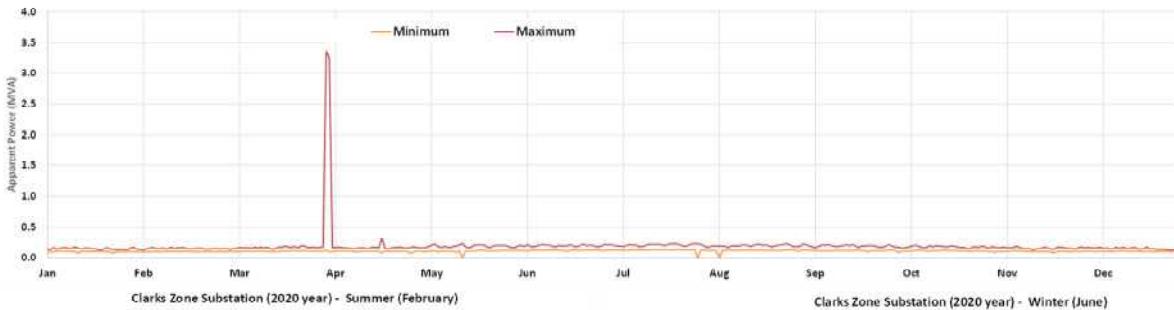
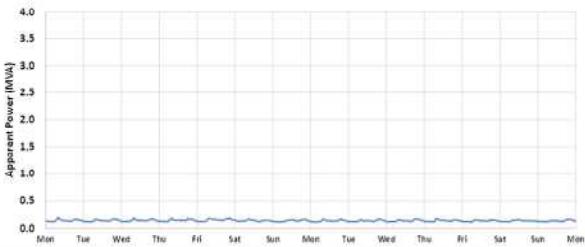
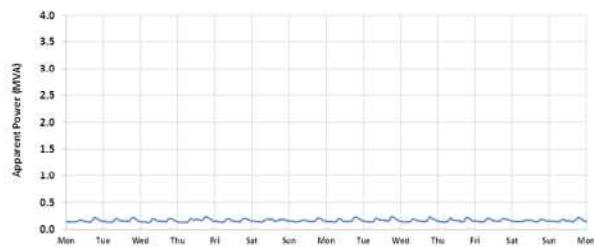
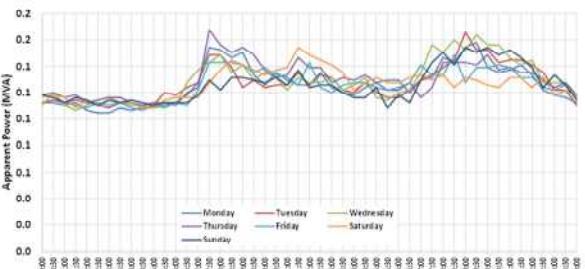
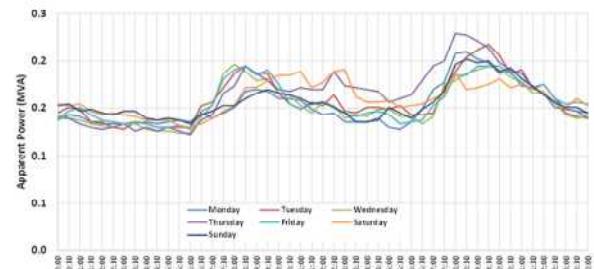
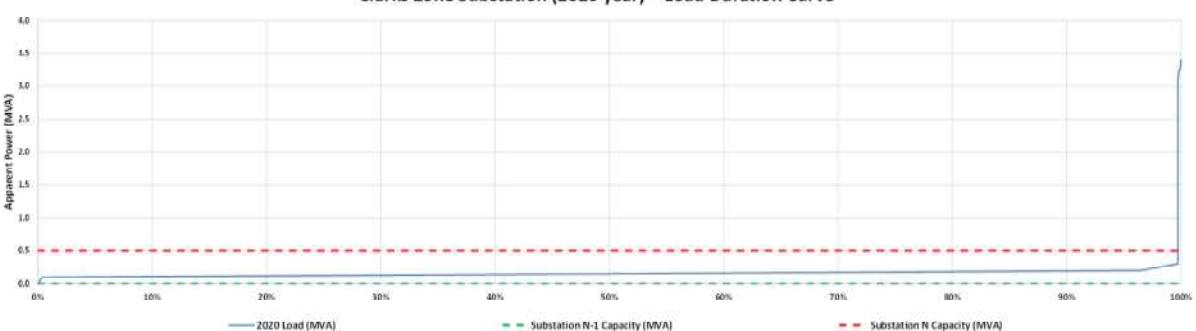
Figure 12 South Dunedin: Reactive power (MVAr) load characteristics

3. Zone Substations

3.1 OtagoNet

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

- **Figure 13** Clarks 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 14** Deepdell 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 15** Golden Point 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 16** Hindon 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 17** Hyde 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 18** Linnburn 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 19** Merton 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 20** Middlemarch 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 21** Oturehua 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 22** Paerau 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 24** Patearoa 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 25** Ranfurly 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 26** Ranfurly 33/66kV auto-transformer substation: Apparent power (MVA) load characteristics
- **Figure 23** Palmertson 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 27** Remarkables 33/11kV zone substation: Apparent power (MVA) load characteristics
- **Figure 28** Waipiata 33/11kV zone substation: Apparent power (MVA) load characteristics

CLARKS MVA
Clarks Zone Substation (2020 year) - Half hourly loading

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

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

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

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

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

Clarks Zone Substation (2020 year) - Load Duration Curve

Figure 13 Clarks 33/11kV zone substation: Apparent power (MVA) load characteristics

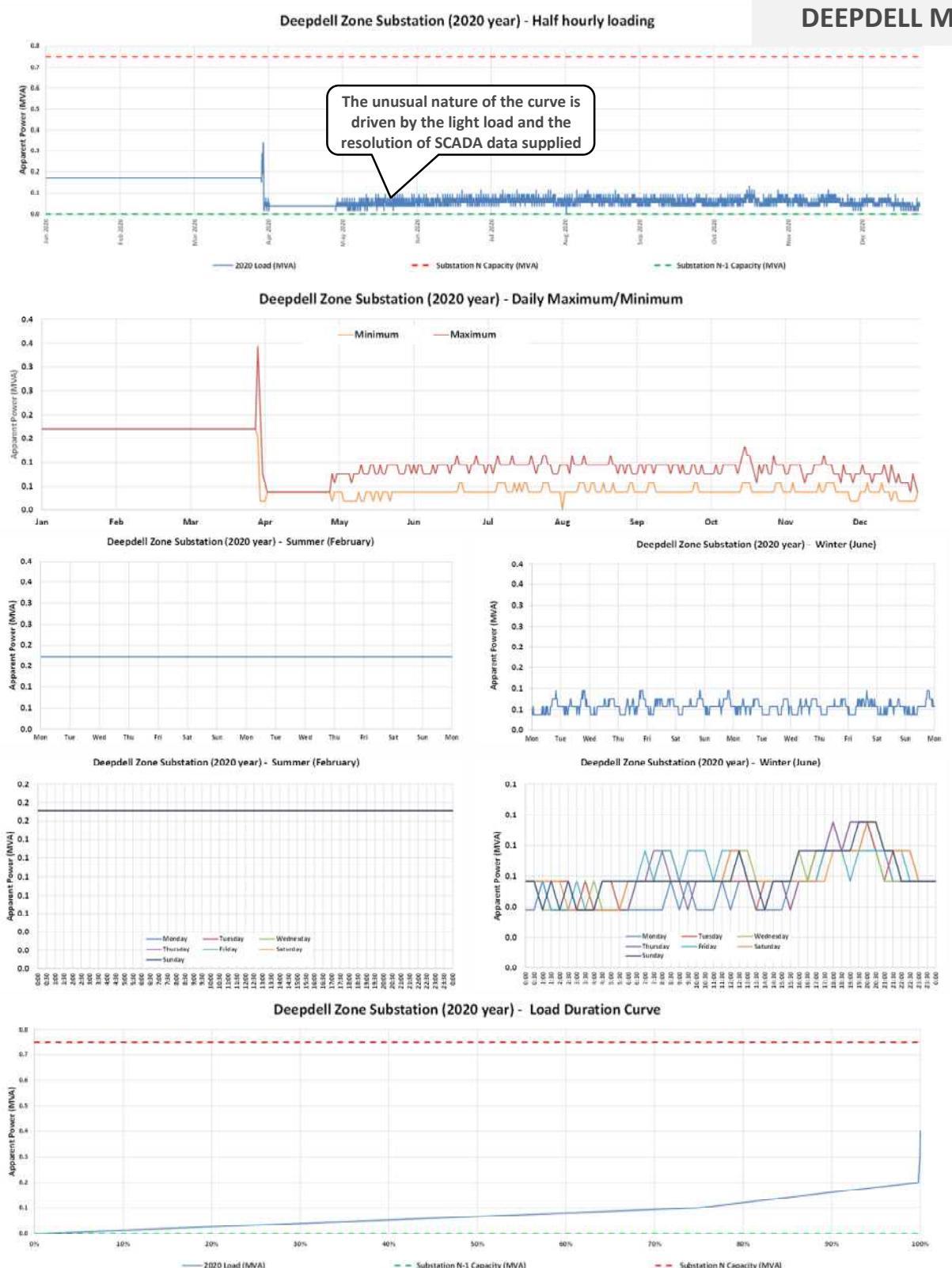


Figure 14 Deepdell 33/11kV zone substation: Apparent power (MVA) load characteristics

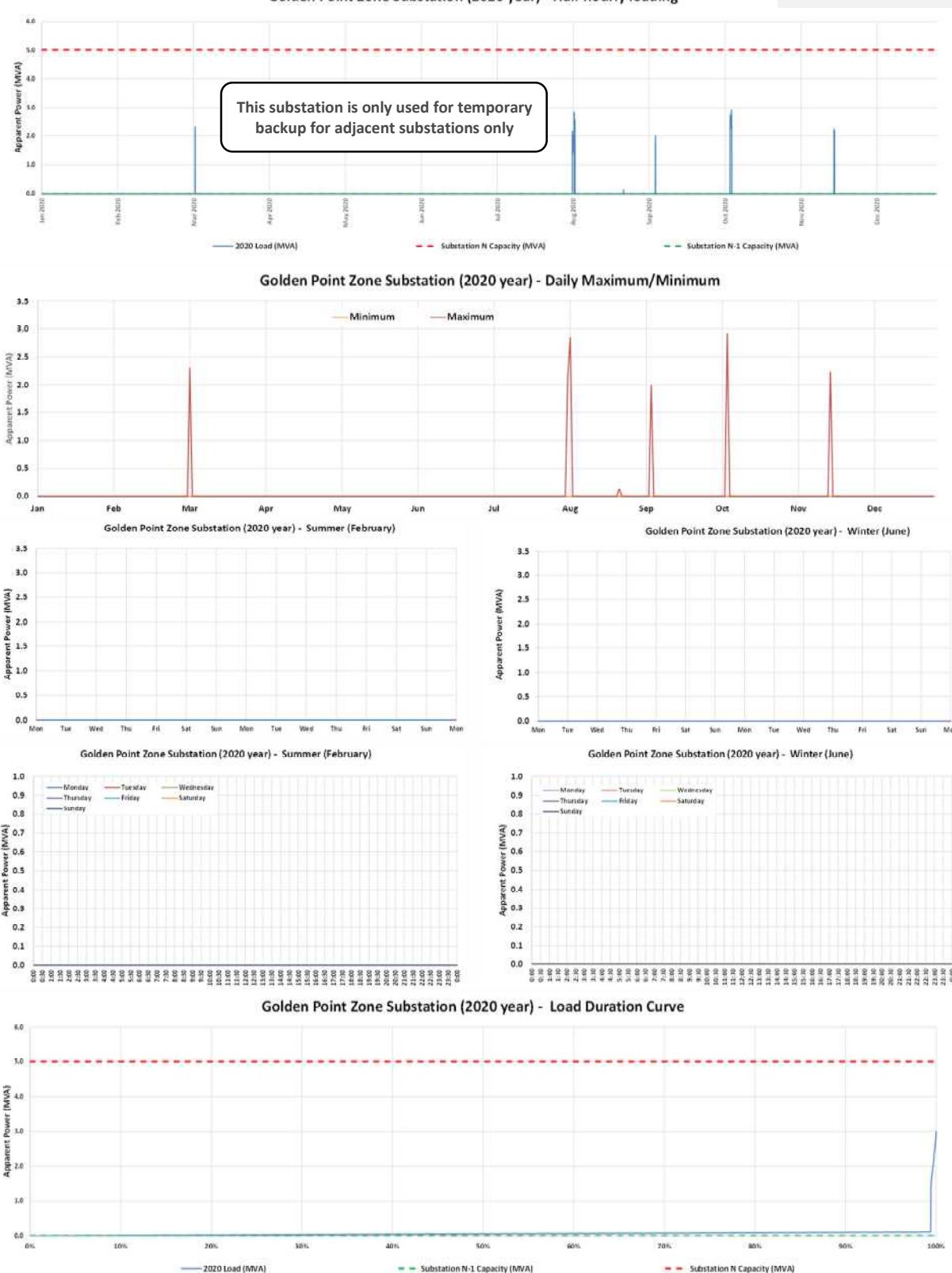
GOLDEN PT MVA


Figure 15 Golden Point 33/11kV zone substation: Apparent power (MVA) load characteristics

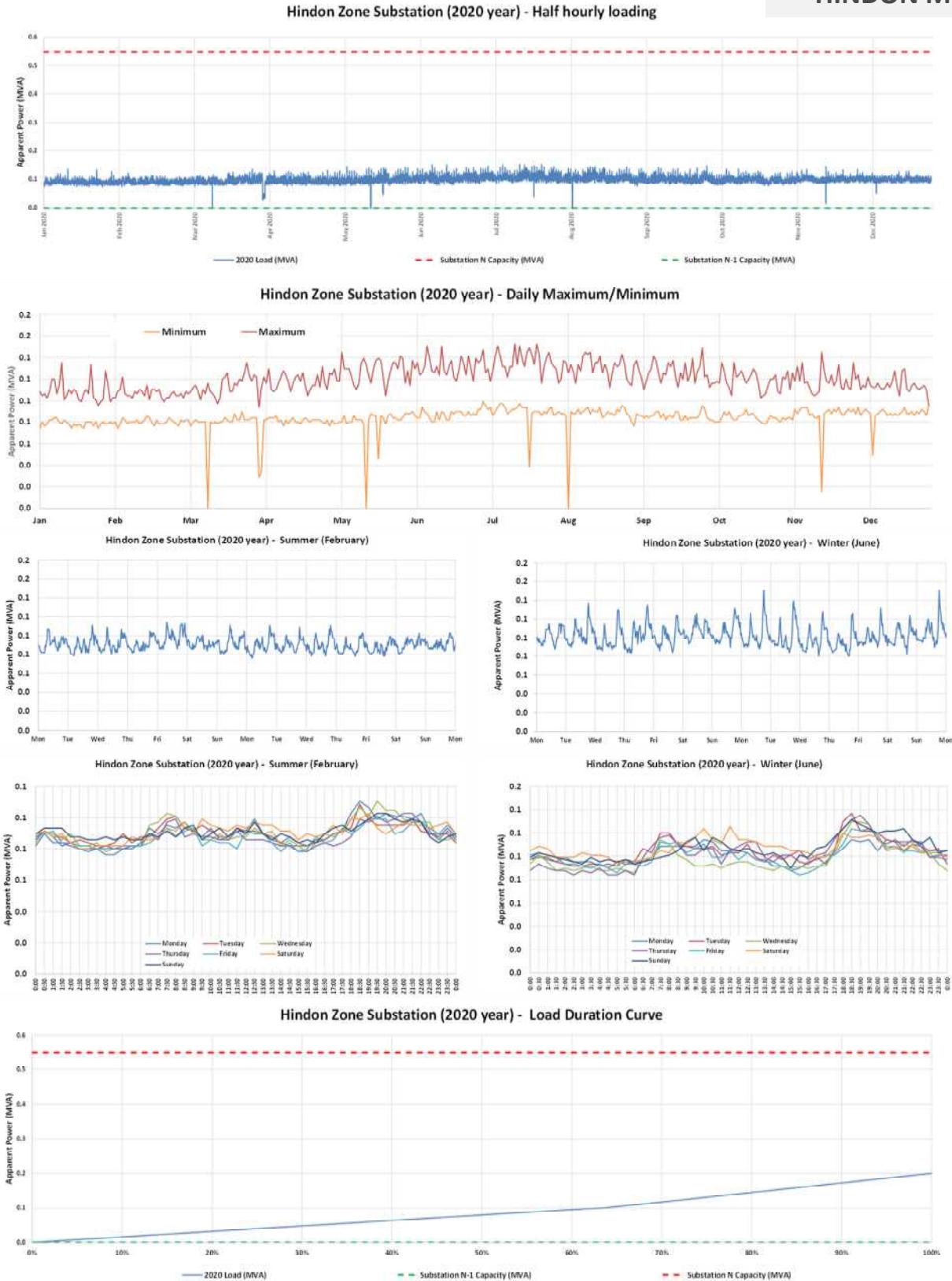
HINDON MVA


Figure 16 Hindon 33/11kV zone substation: Apparent power (MVA) load characteristics

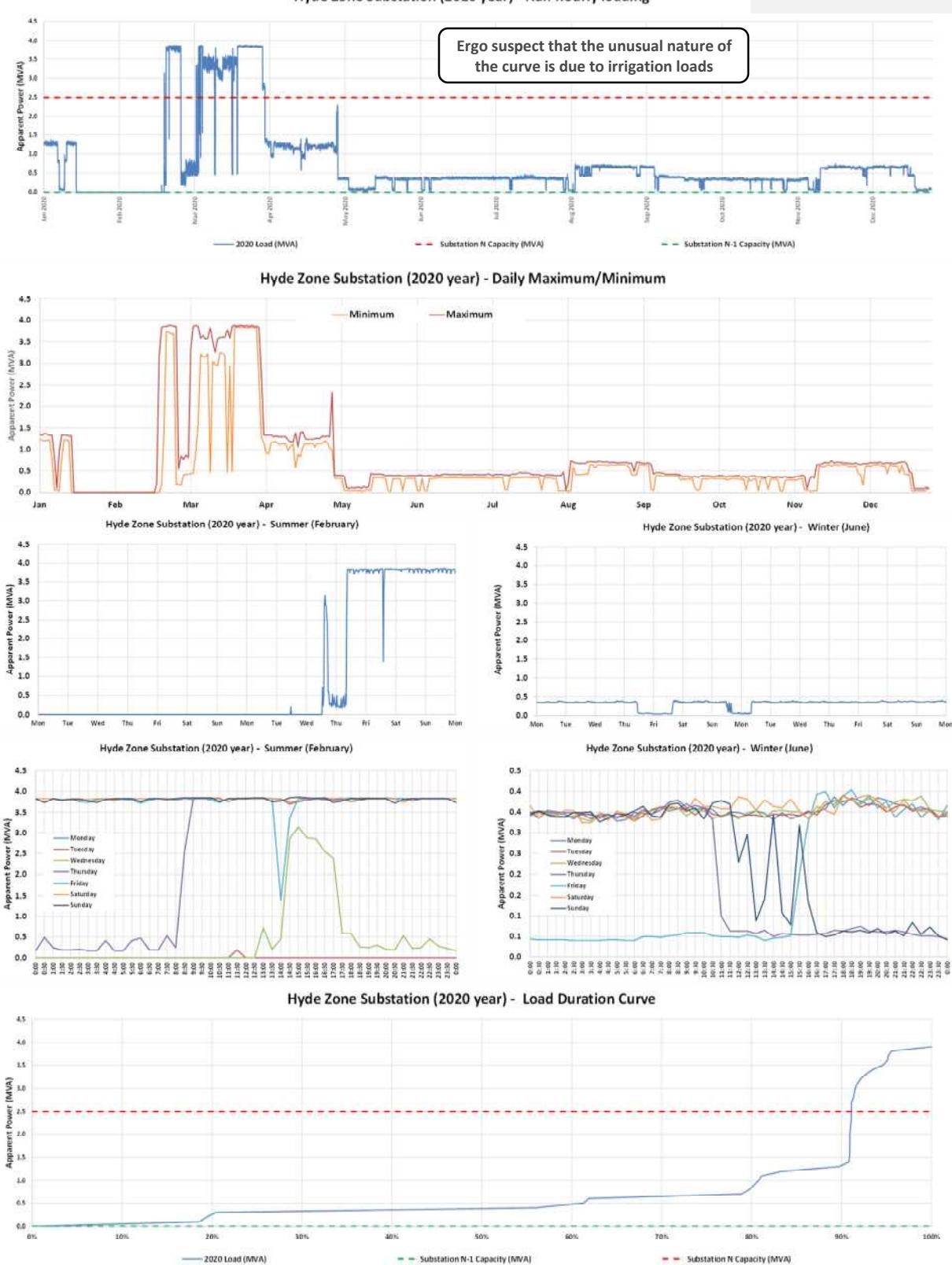
HYDE MVA


Figure 17 Hyde 33/11kV zone substation: Apparent power (MVA) load characteristics

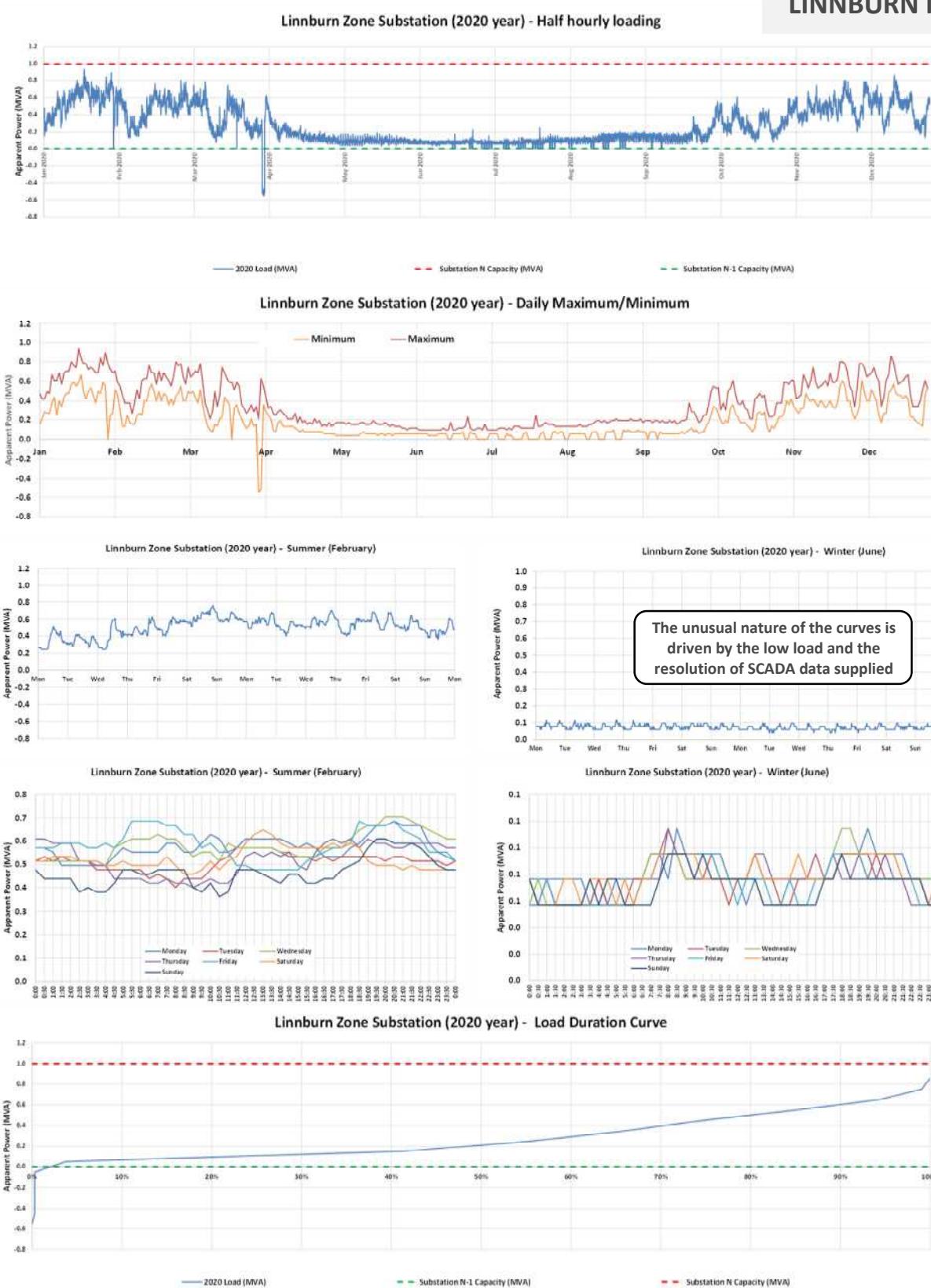
LINNURN MVA


Figure 18 Linnburn 33/11kV zone substation: Apparent power (MVA) load characteristics

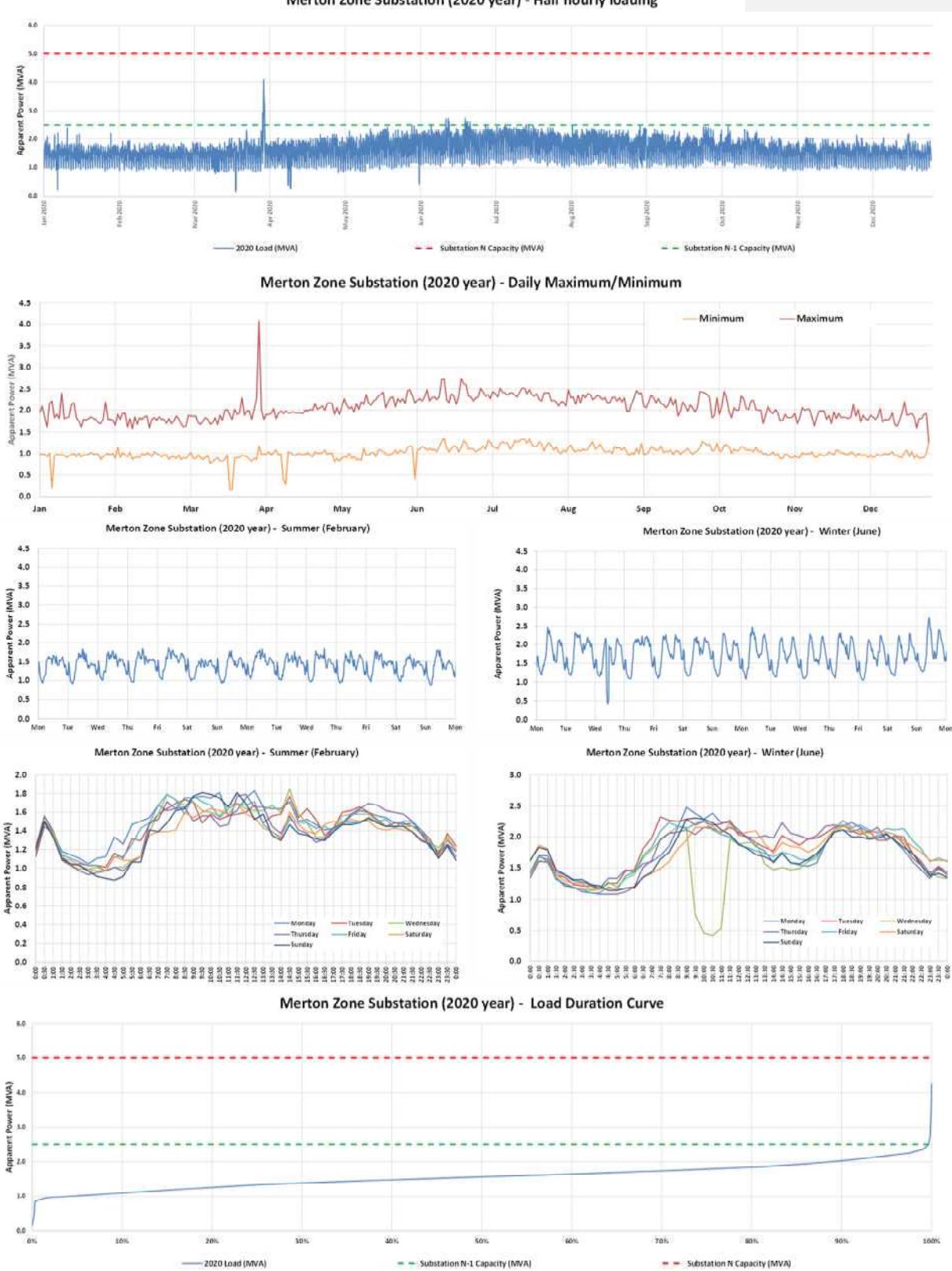
MERTON MVA

Figure 19 Merton 33/11kV zone substation: Apparent power (MVA) load characteristics

MIDDLEMARCH MVA

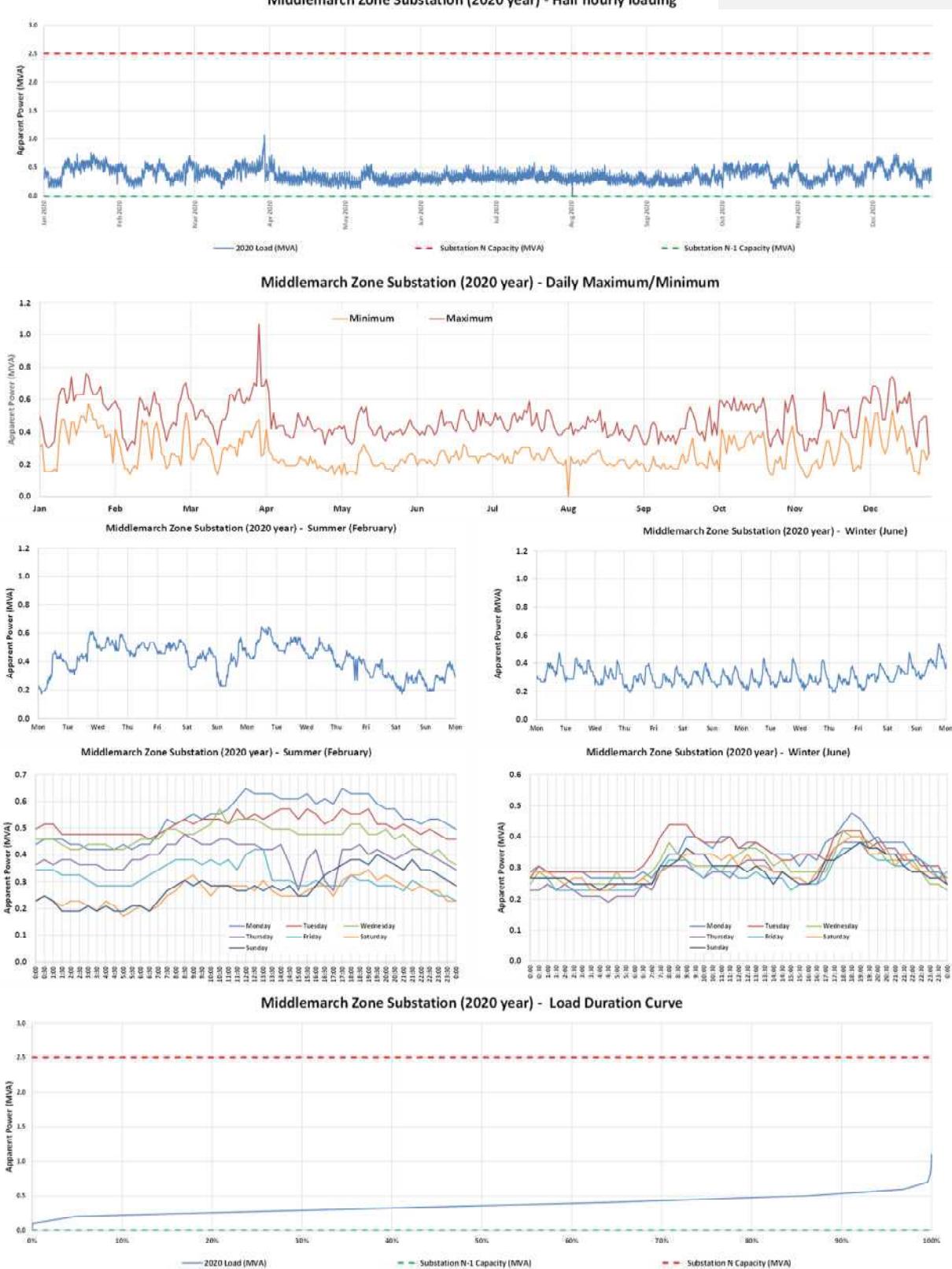


Figure 20 Middlemarch 33/11kV zone substation: Apparent power (MVA) load characteristics

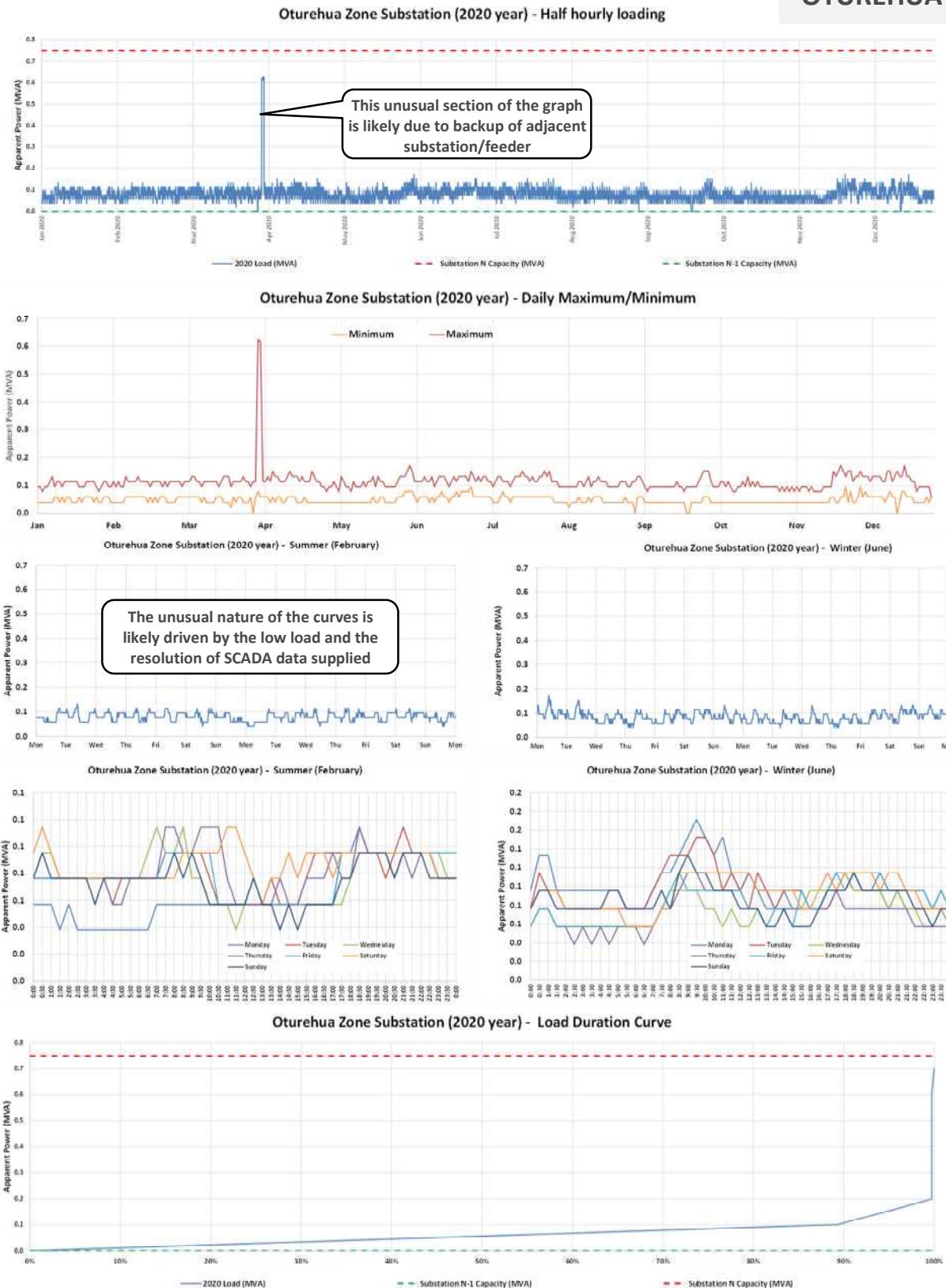
OTUREHUA MVA


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

PAERAU MVA

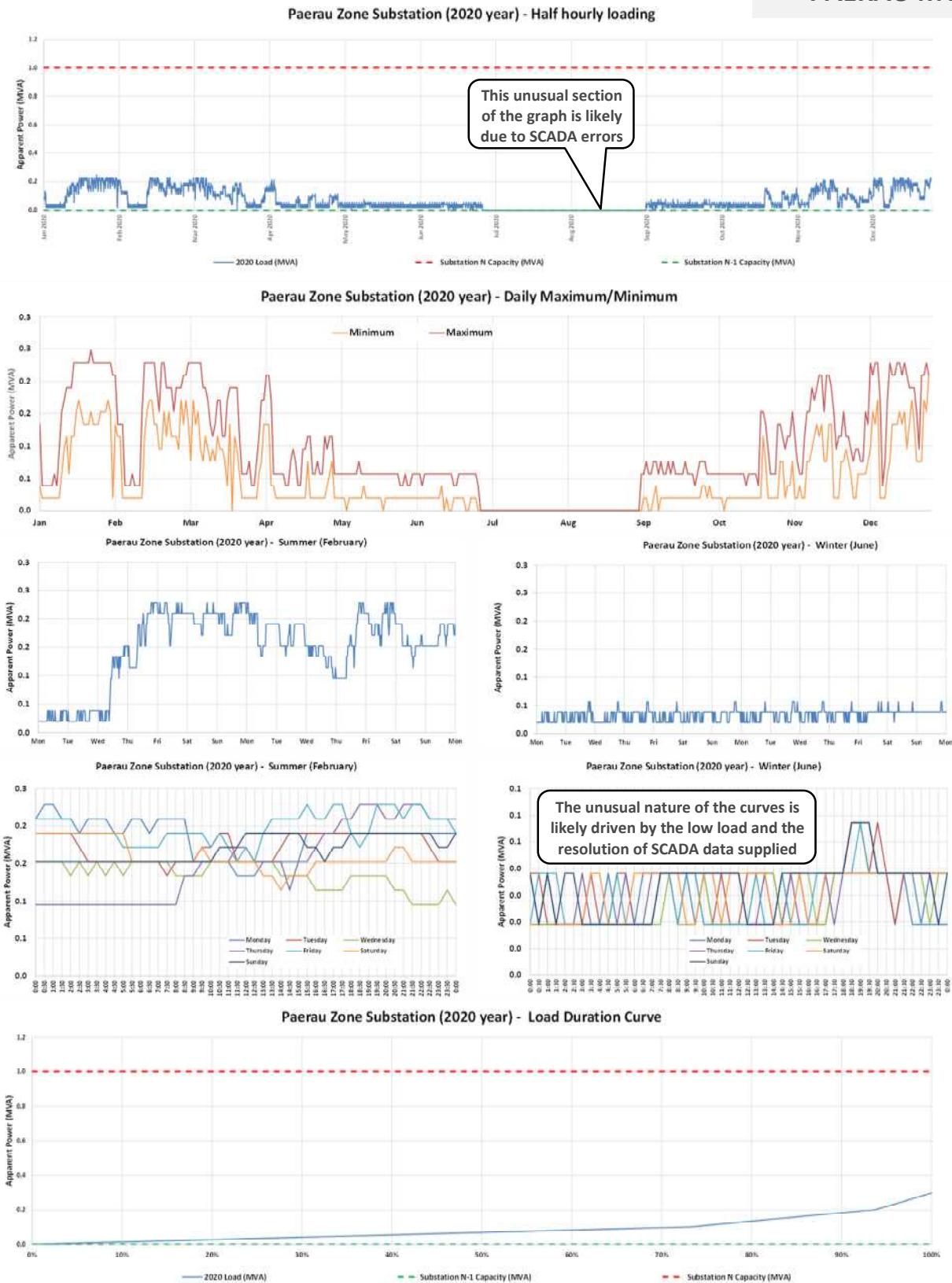


Figure 22 Paerau 33/11kV zone substation: Apparent power (MVA) load characteristics

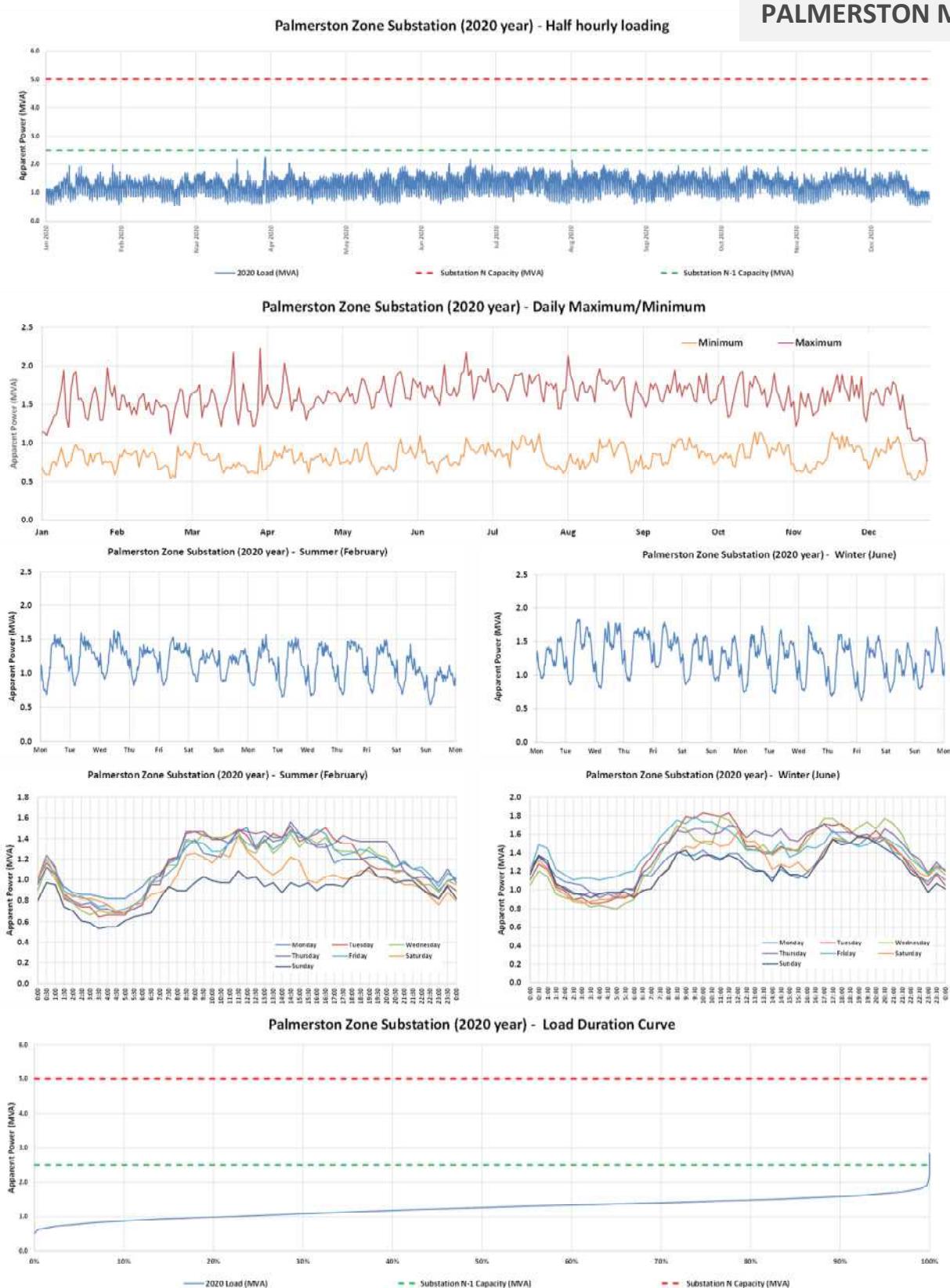


Figure 23 Palmerston 33/11kV zone substation: Apparent power (MVA) load characteristics

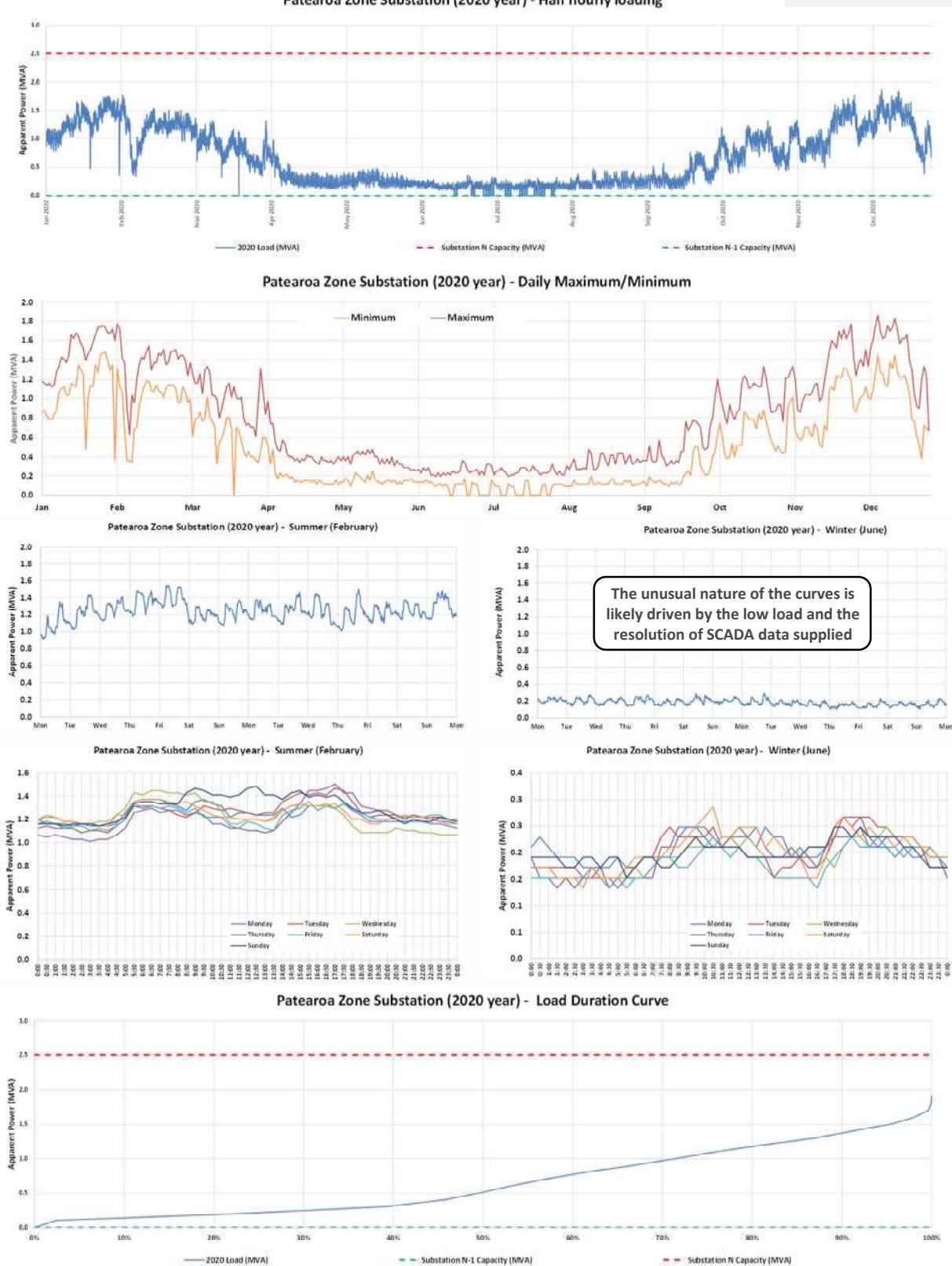
PATEAROA MVA


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

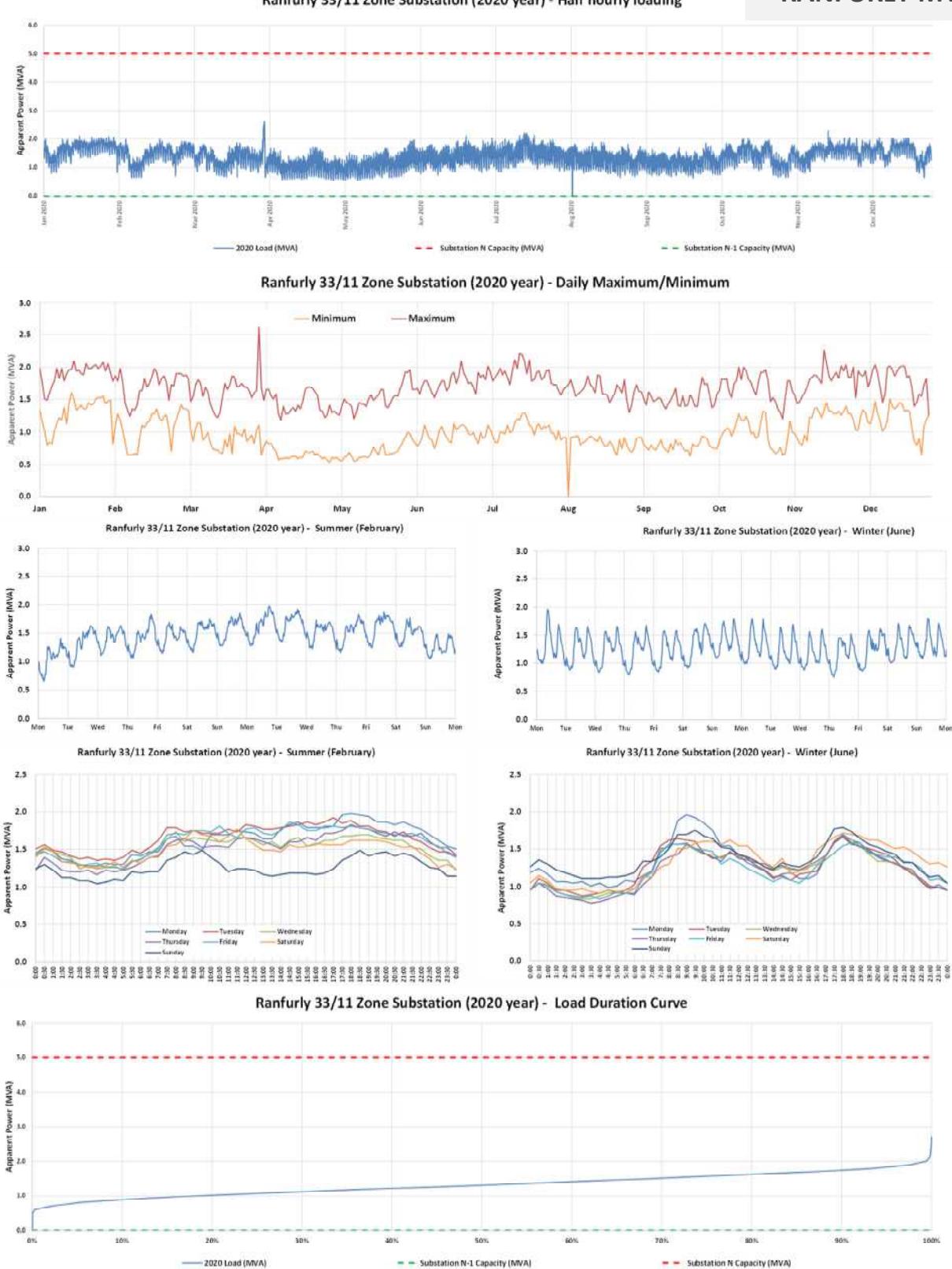
RANFURLY MVA


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

RANFURLY 33/66 MVA

YET TO BE SUPPLIED

Figure 26 Ranfurly 33/66kV auto-transformer substation: Apparent power (MVA) load characteristics

REMARKABLES MVA

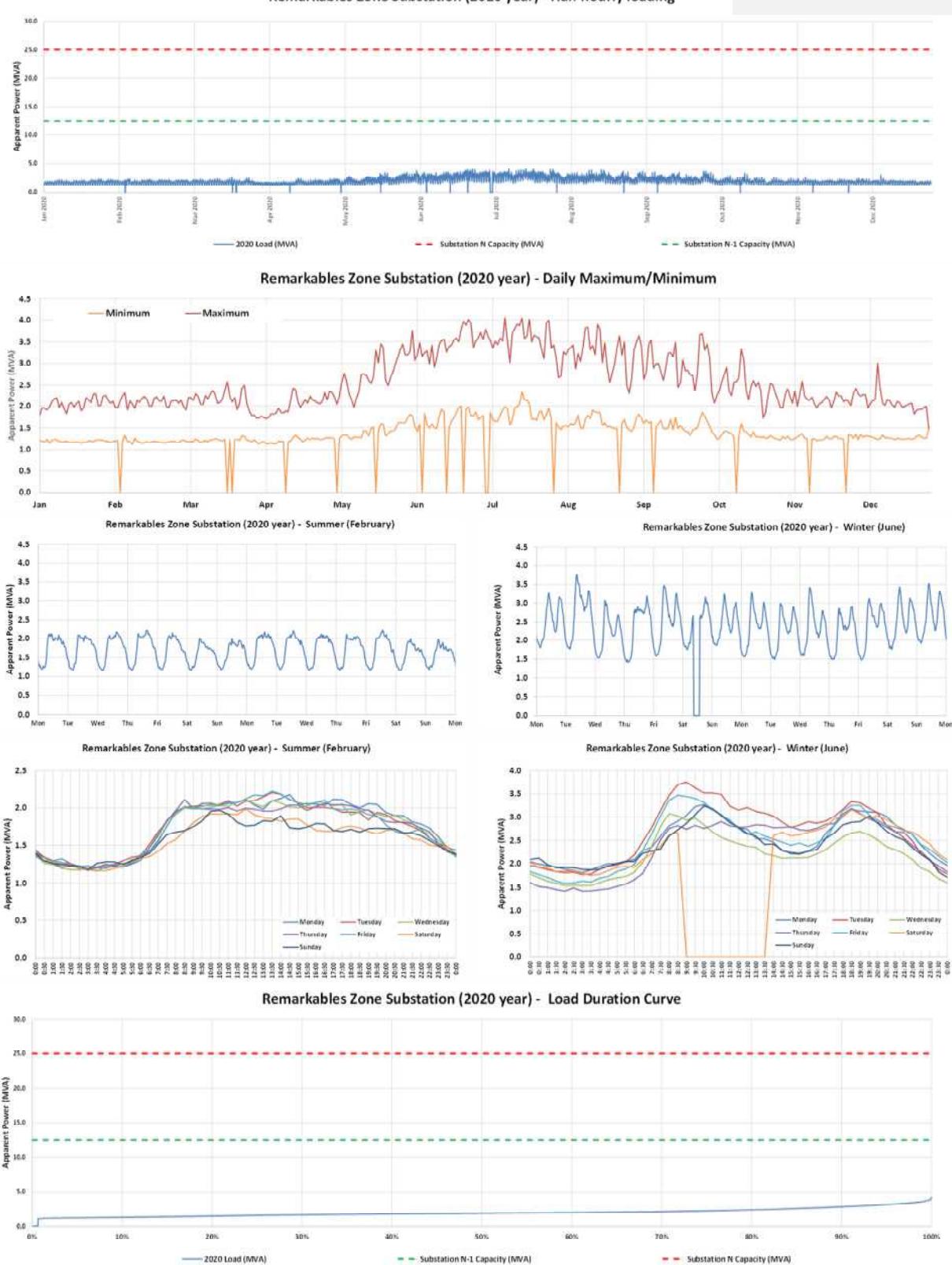


Figure 27 Remarkables 33/11kV zone substation: Apparent power (MVA) load characteristics

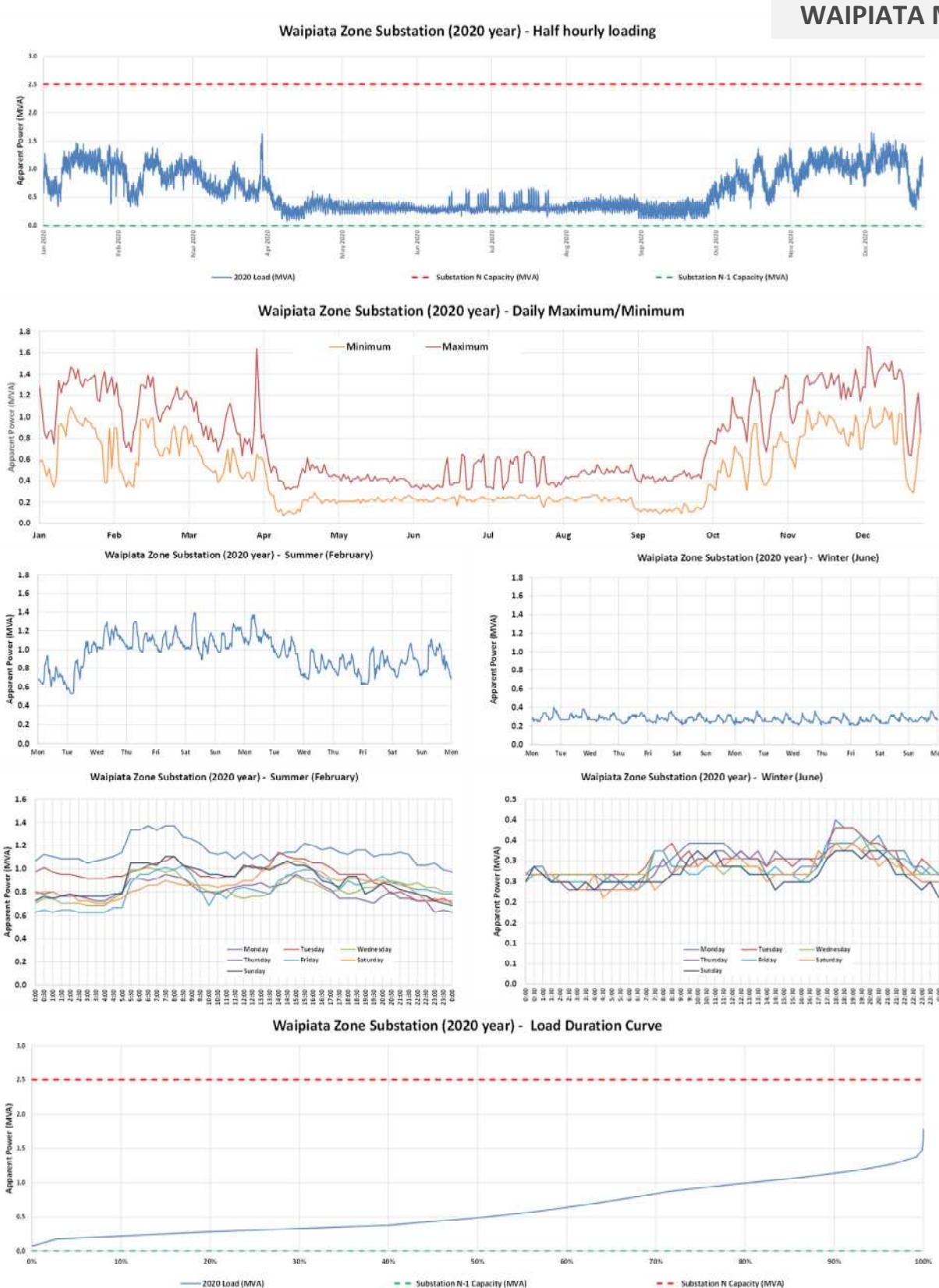


Figure 28 Waipiata 33/11kV zone substation: Apparent power (MVA) load characteristics

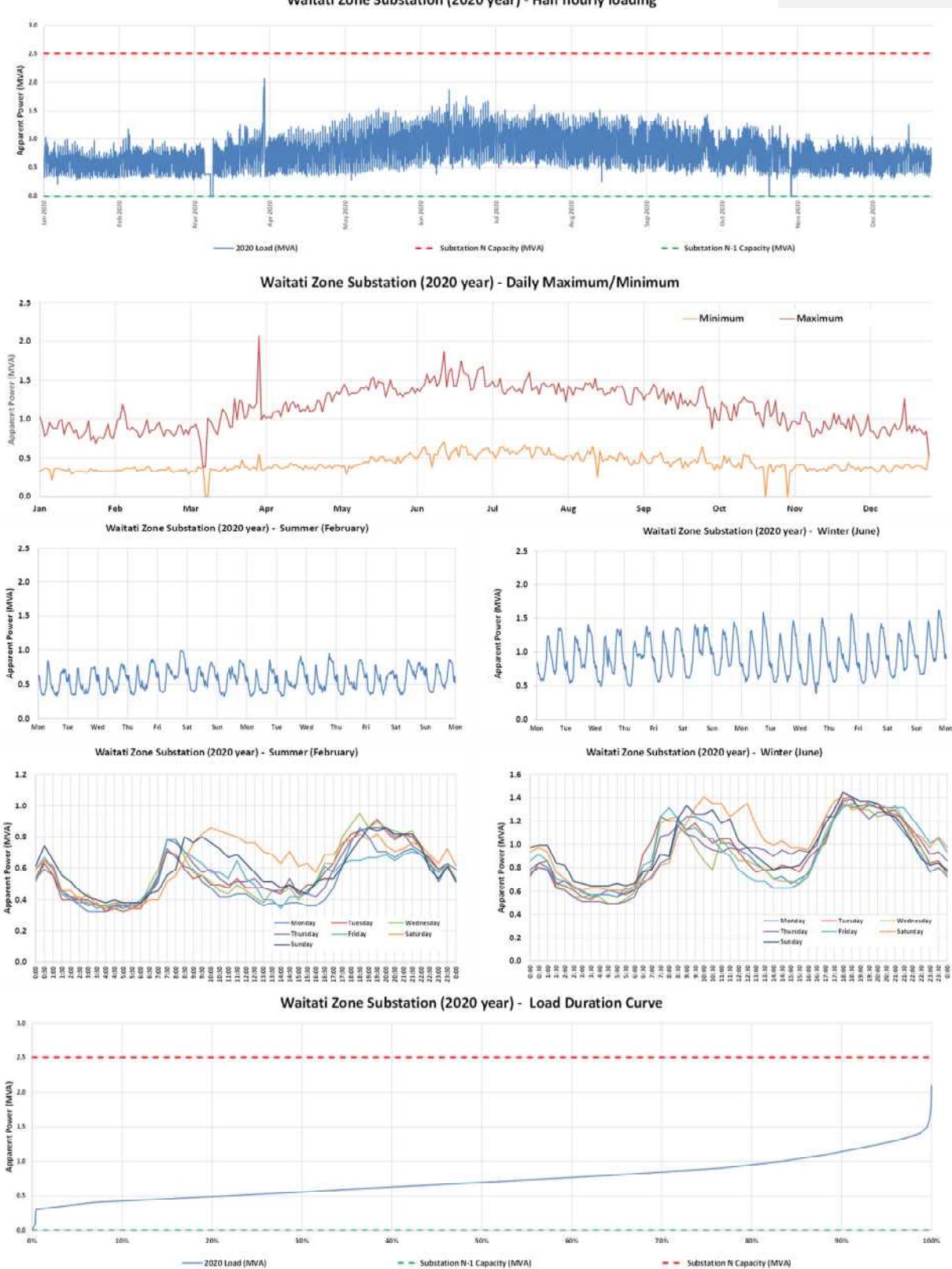
WAITATI MVA


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

WEDDERBURN MVA

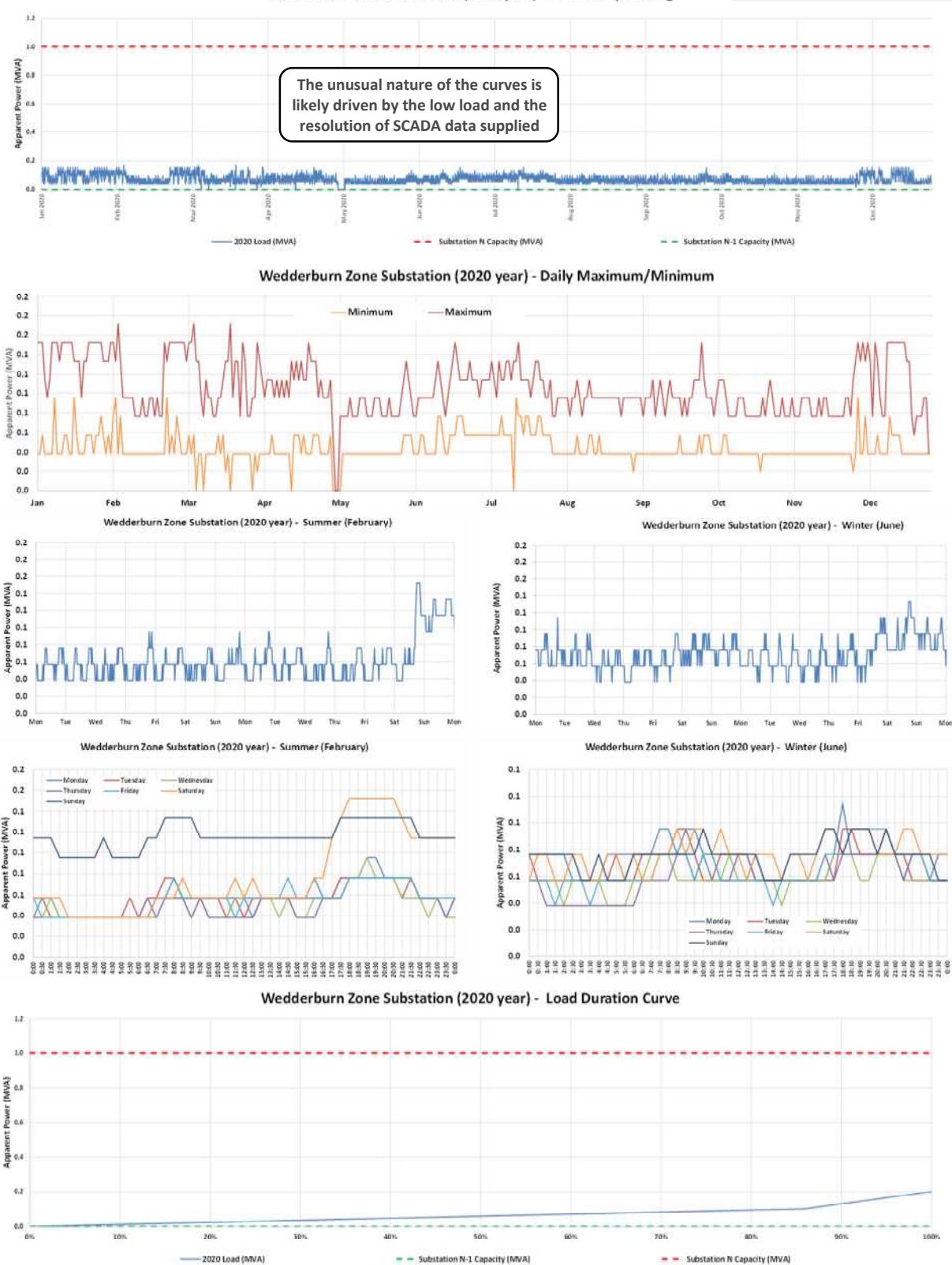


Figure 30 Wedderburn 33/11kV zone substation: Apparent power (MVA) load characteristics

3.2 Aurora Energy

The characteristics of the zone substation **real power loadings** within Aurora Energy's network are shown in the following:

- **Figure 31** Alexandra 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 32** Andersons Bay 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 33** Arrowtown 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 34** Berwick 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 35** Camp Hill 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 36** Cardrona 66/11kV zone substation: Real power (MW) load characteristics
- **Figure 37** Carisbrook 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 38** Clyde/Earnsbleugh 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 39** Commonage 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 40** Coronet Peak 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 41** Corstorphine 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 42** Cromwell 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 43** Dalefield 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 44** Earnsbleugh 33/11kV substation: Real power (MW) load characteristics
- **Figure 45** East Taieri 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 46** Ettrick 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 47** Fernhill 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 48** Frankton 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 49** Green Island 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 50** Halfway Bush 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 51** Kaikorai Valley 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 52** Lauder Flat 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 53** Lindis Crossing 66/11kV zone substation: Real power (MW) load characteristics
- **Figure 54** Mosgiel 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 55** North City 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 56** North East Valley 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 57** Omakau 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 58** Outram 33/11kV zone substation: Real power (MW) load characteristics.
- **Figure 59** Port Chalmers 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 60** Queensbury 66/11kV zone substation: Real power (MW) load characteristics
- **Figure 61** Queenstown 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 62** Remarkables 33/11kV substation: Real power (MW) load characteristics
- **Figure 63** Roxburgh 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 64** Smith Street 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 65** South City 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 66** St Kilda 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 67** Wanaka 66/11kV zone substation: Real power (MW) load characteristics
- **Figure 68** Ward Street 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 69** Willowbank 33/11kV zone substation: Real power (MW) load characteristics

ALEXANDRA MW

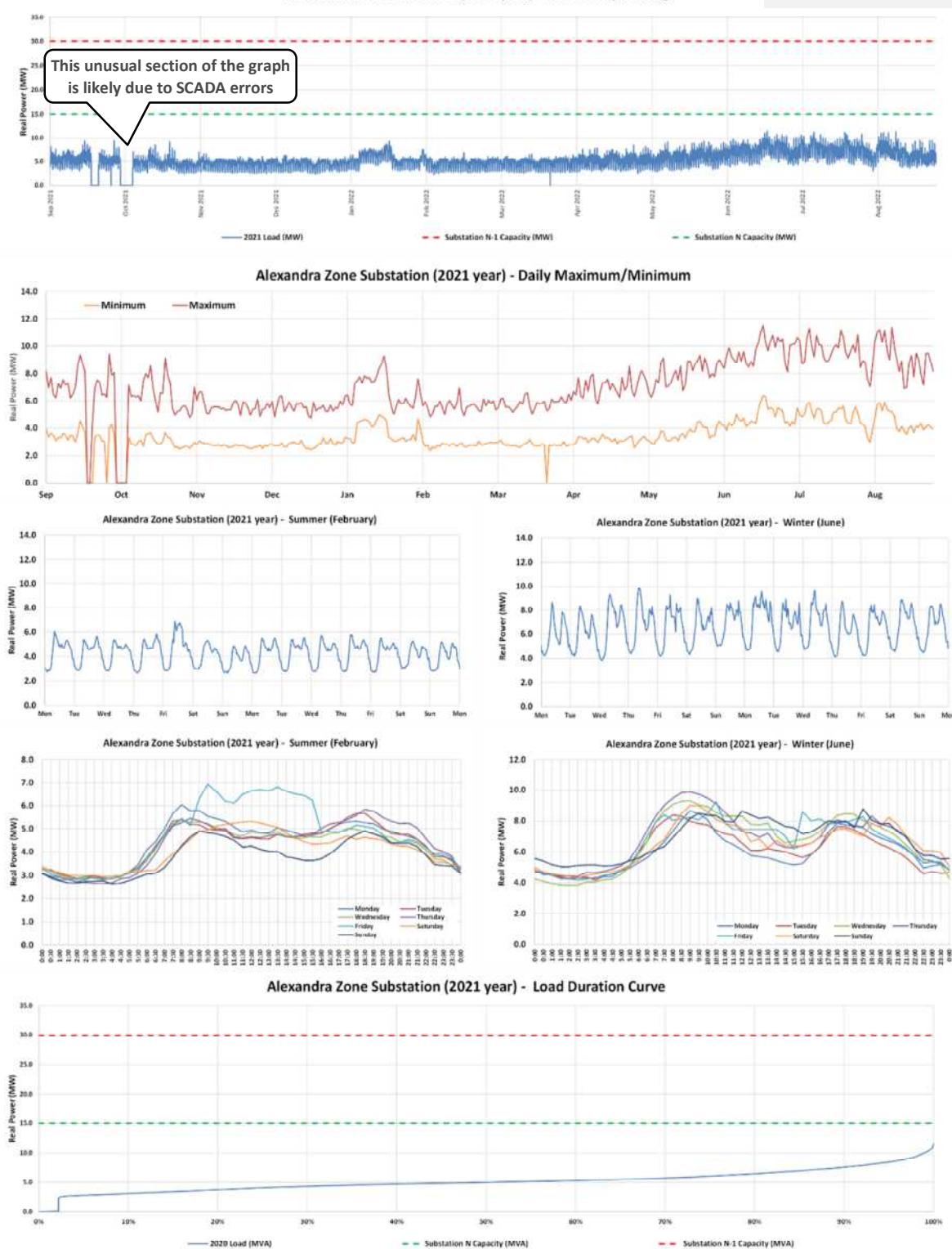


Figure 31 Alexandra 33/11kV zone substation: Real power (MW) load characteristics

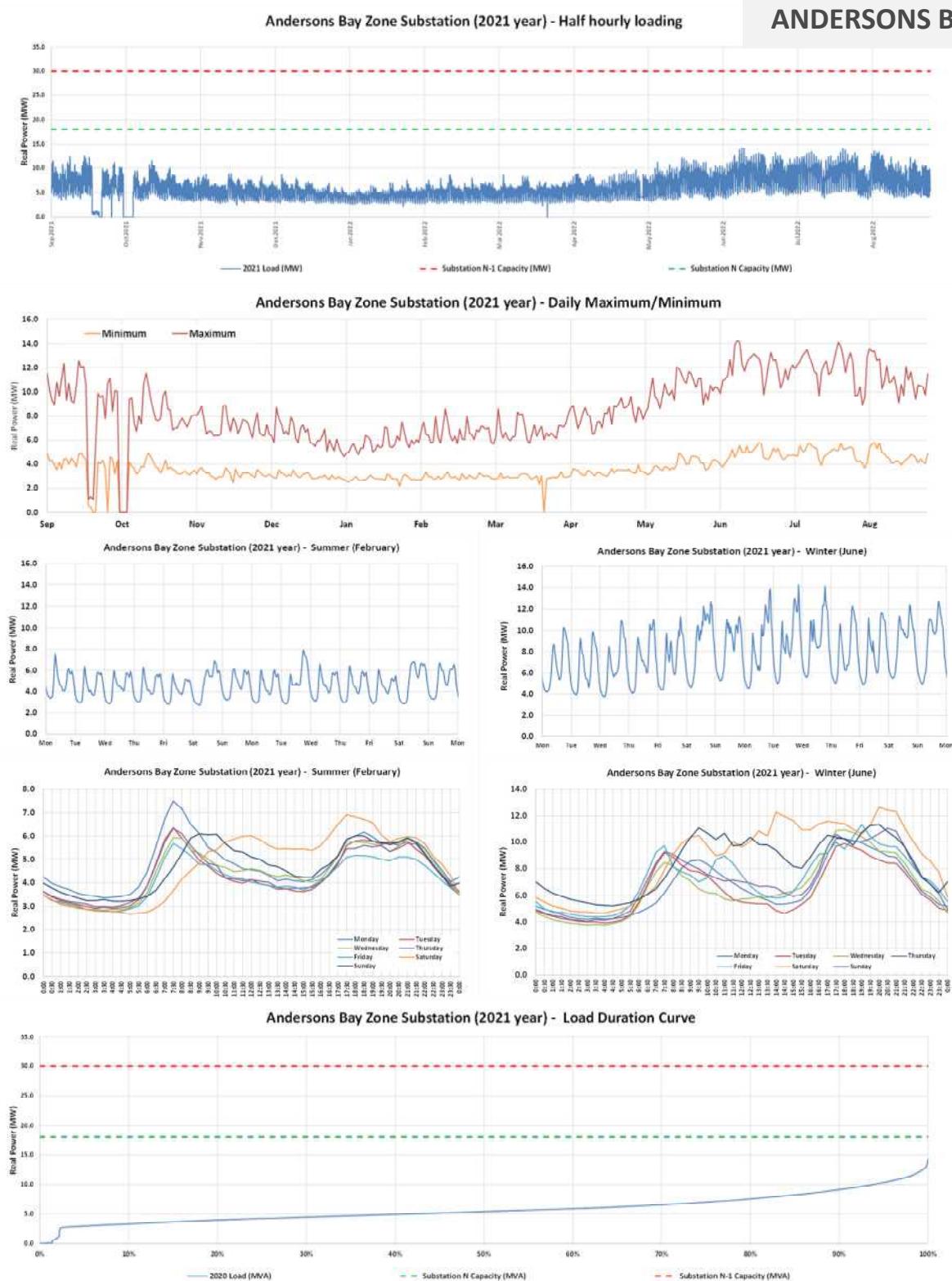


Figure 32 Andersons Bay 33/11kV zone substation: Real power (MW) load characteristics

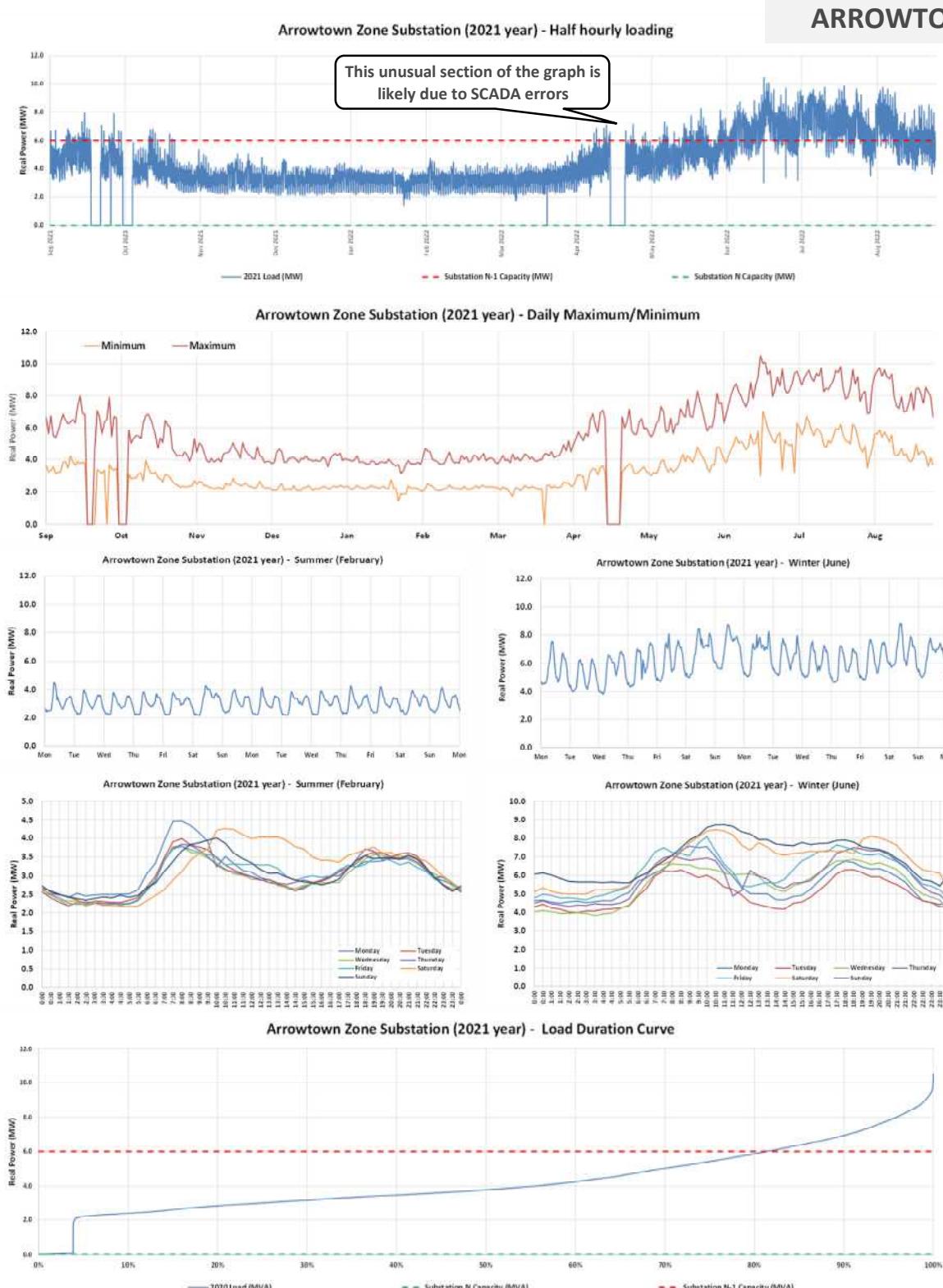


Figure 33 Arrowtown 33/11kV zone substation: Real power (MW) load characteristics

BERWICK MW

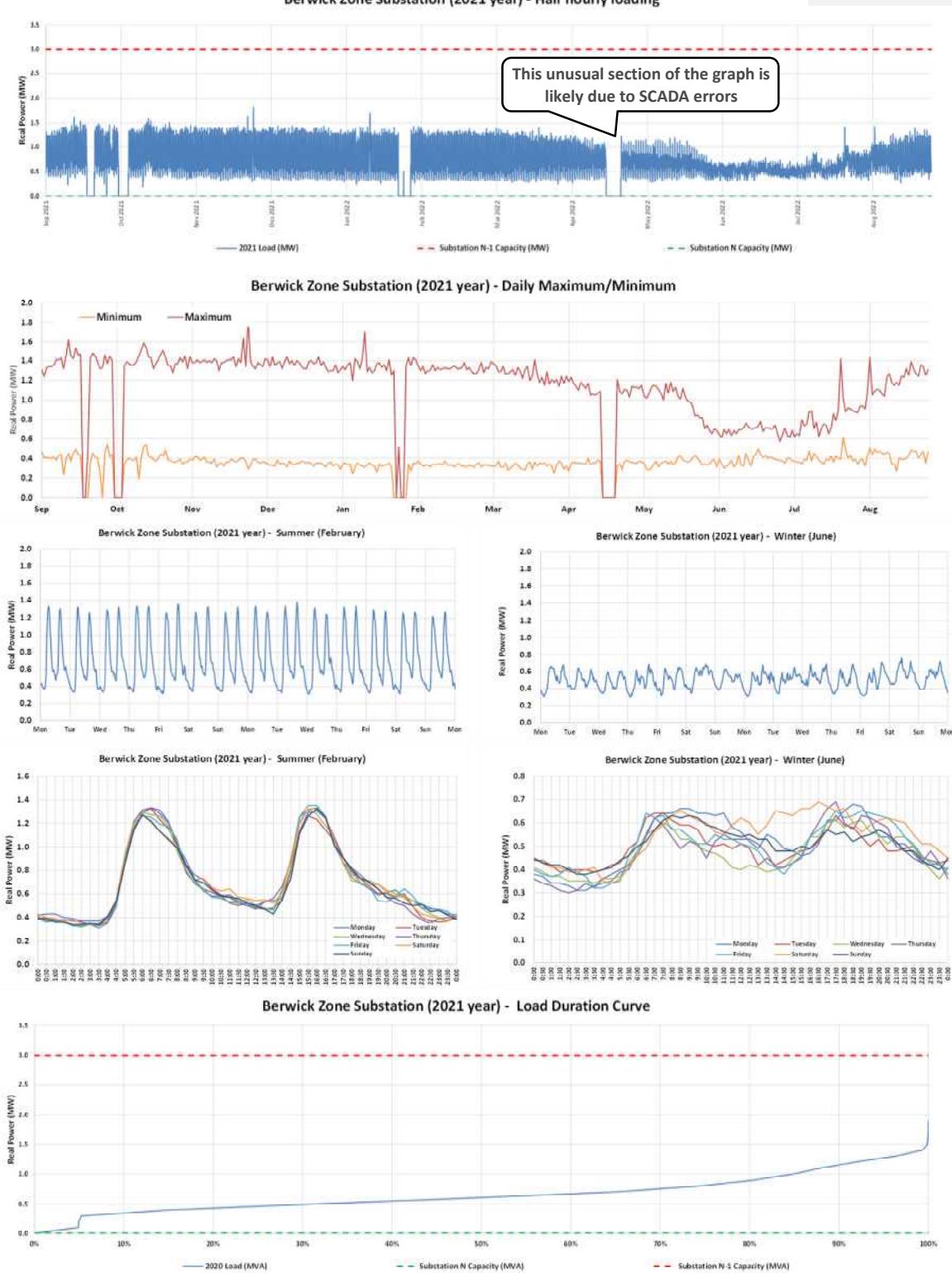


Figure 34 Berwick 33/11kV zone substation: Real power (MW) load characteristics

CAMP HILL MW

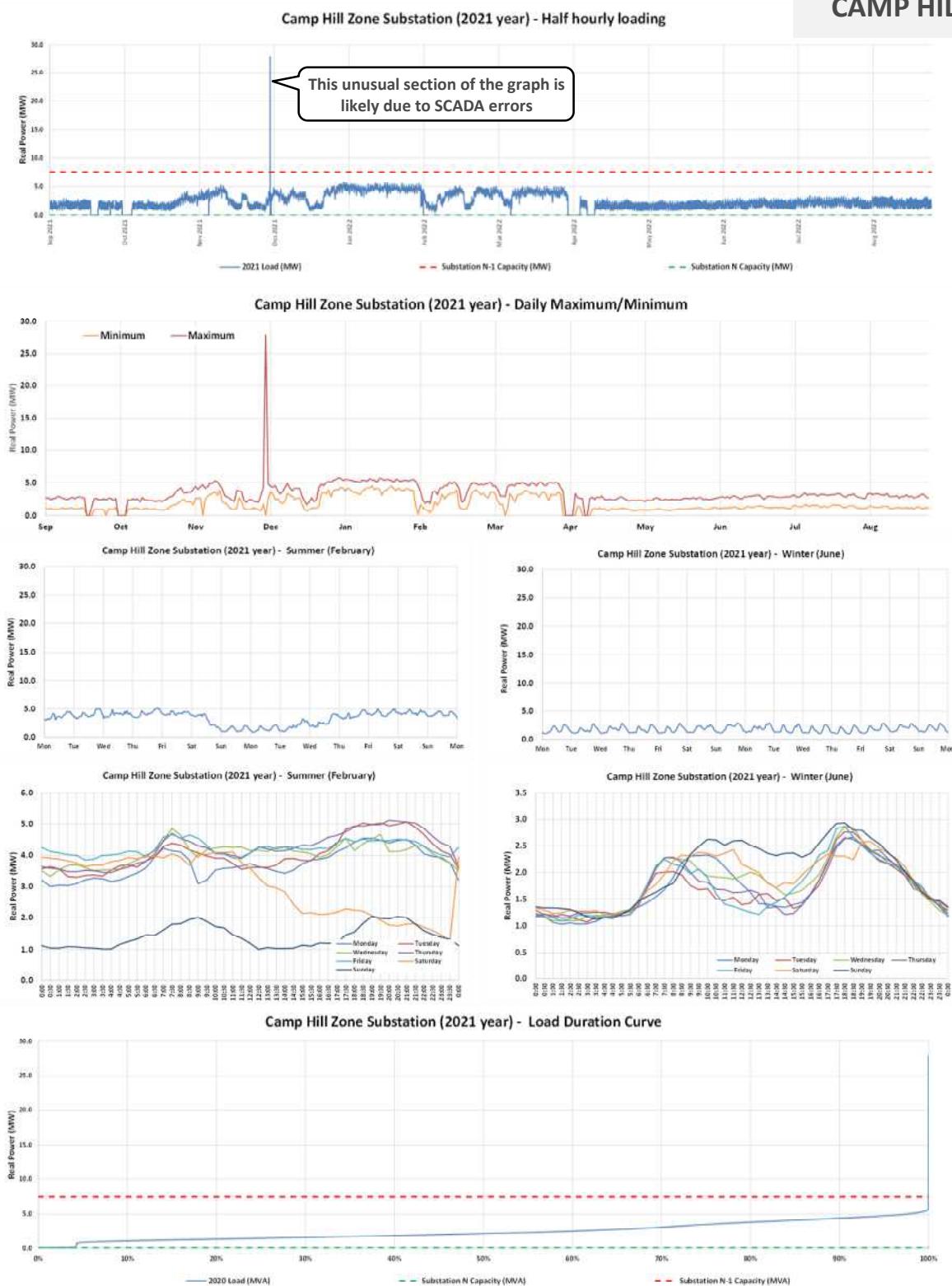


Figure 35 Camp Hill 33/11kV zone substation: Real power (MW) load characteristics

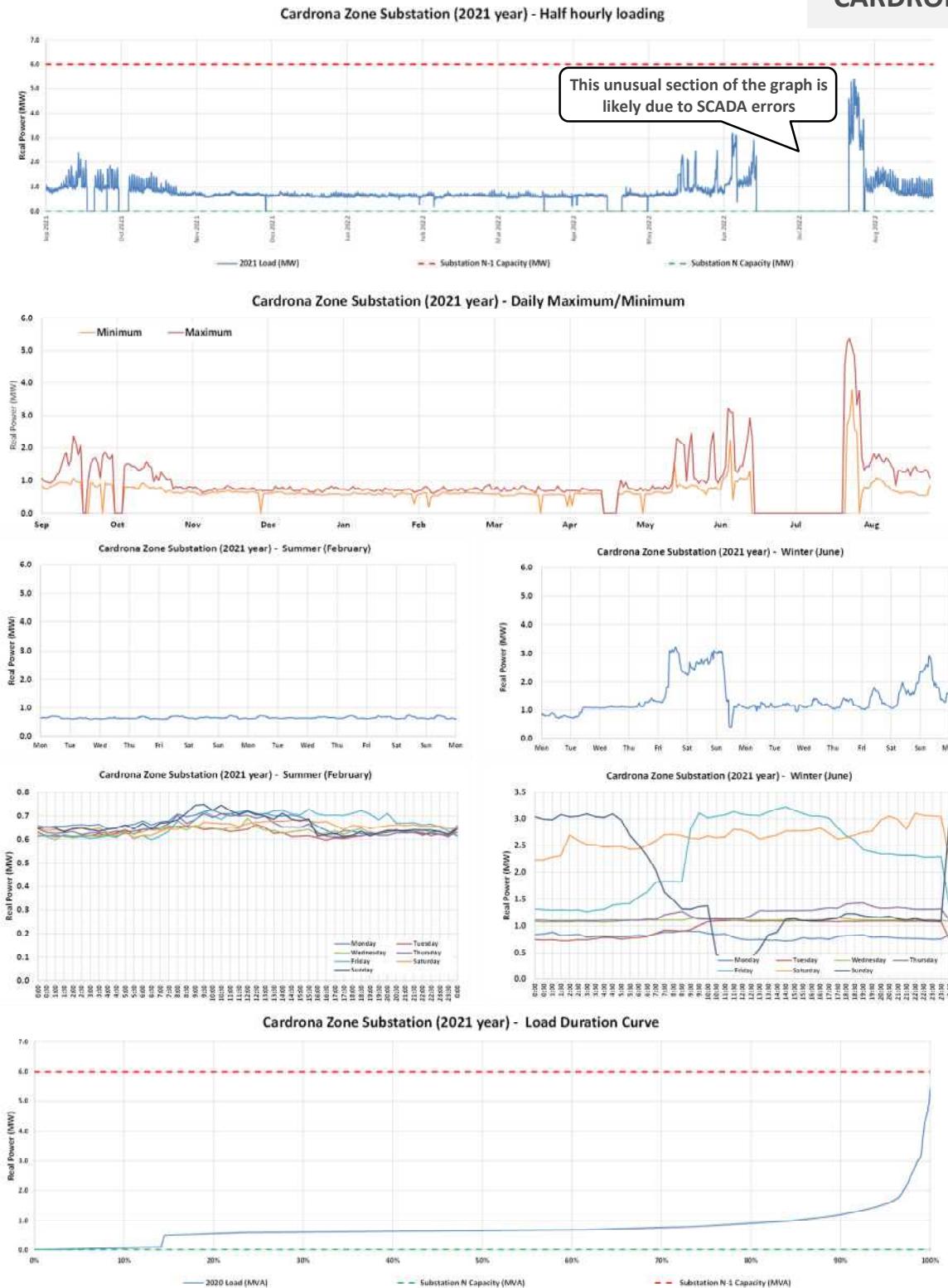
CARDRONA MW


Figure 36 Cardrona 66/11kV zone substation: Real power (MW) load characteristics

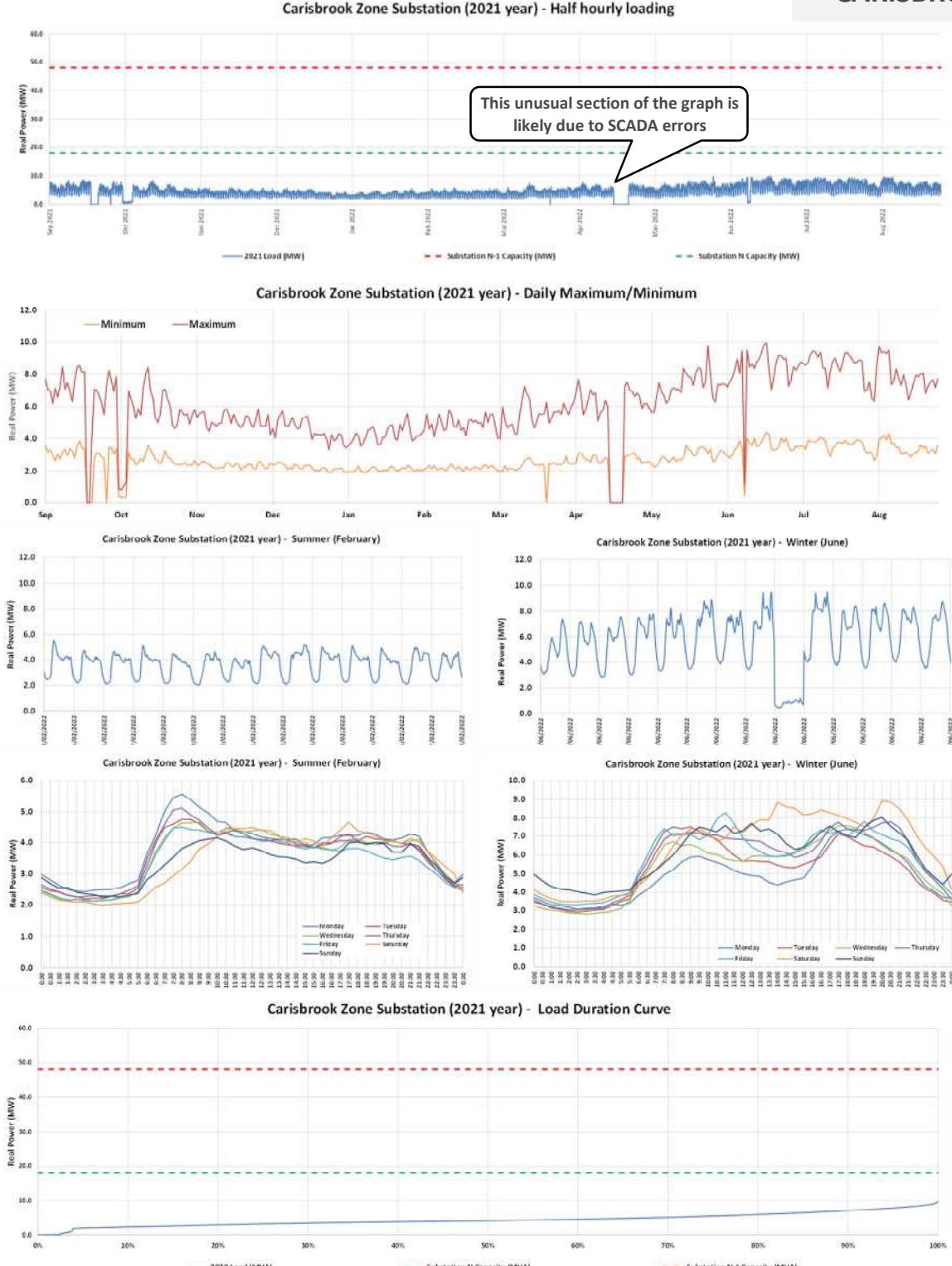
CARISBROOK MW


Figure 37 Carisbrook 33/11kV zone substation: Real power (MW) load characteristics

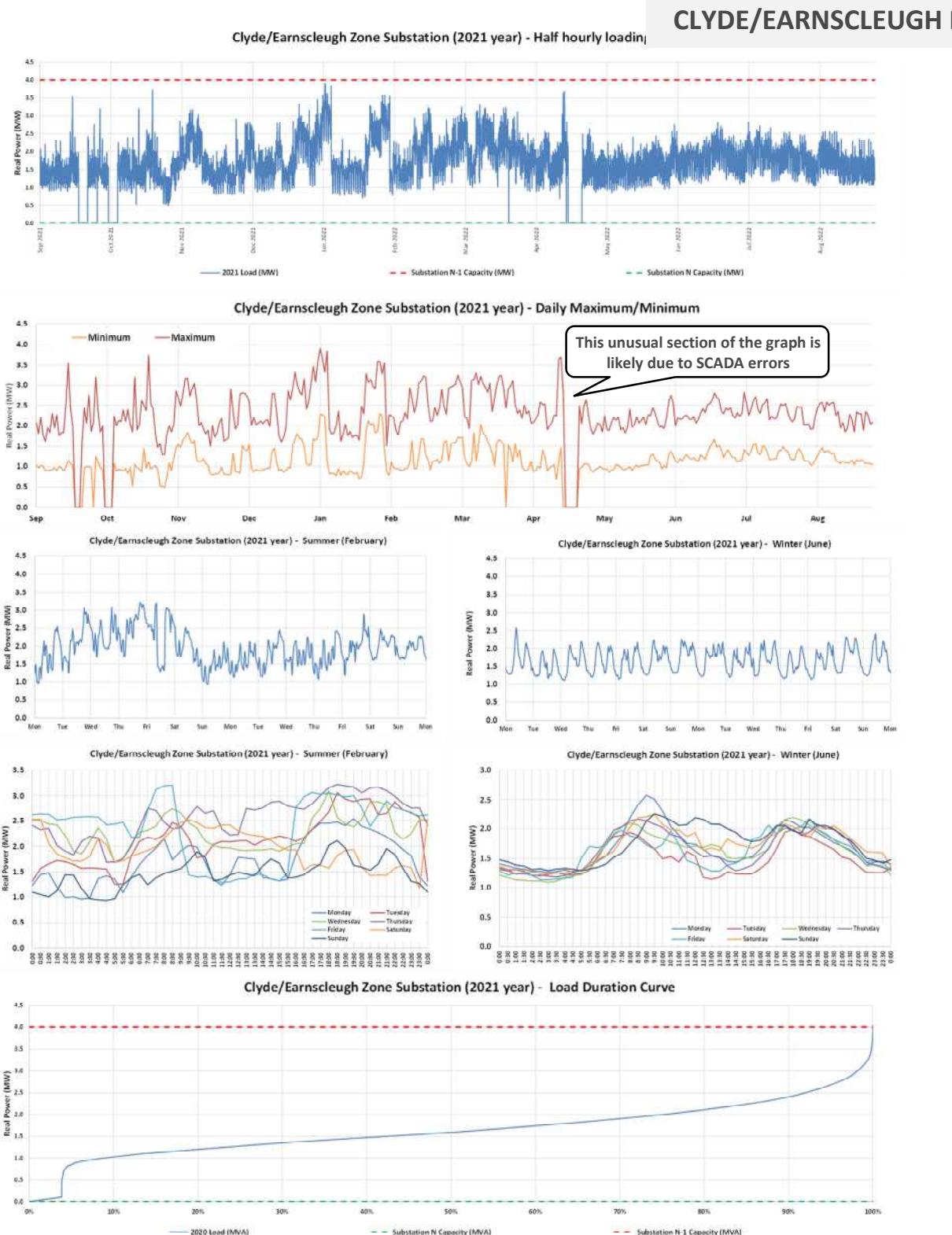


Figure 38 Clyde/Earnscleugh 33/11kV zone substation: Real power (MW) load characteristics

COMMONAGE MW

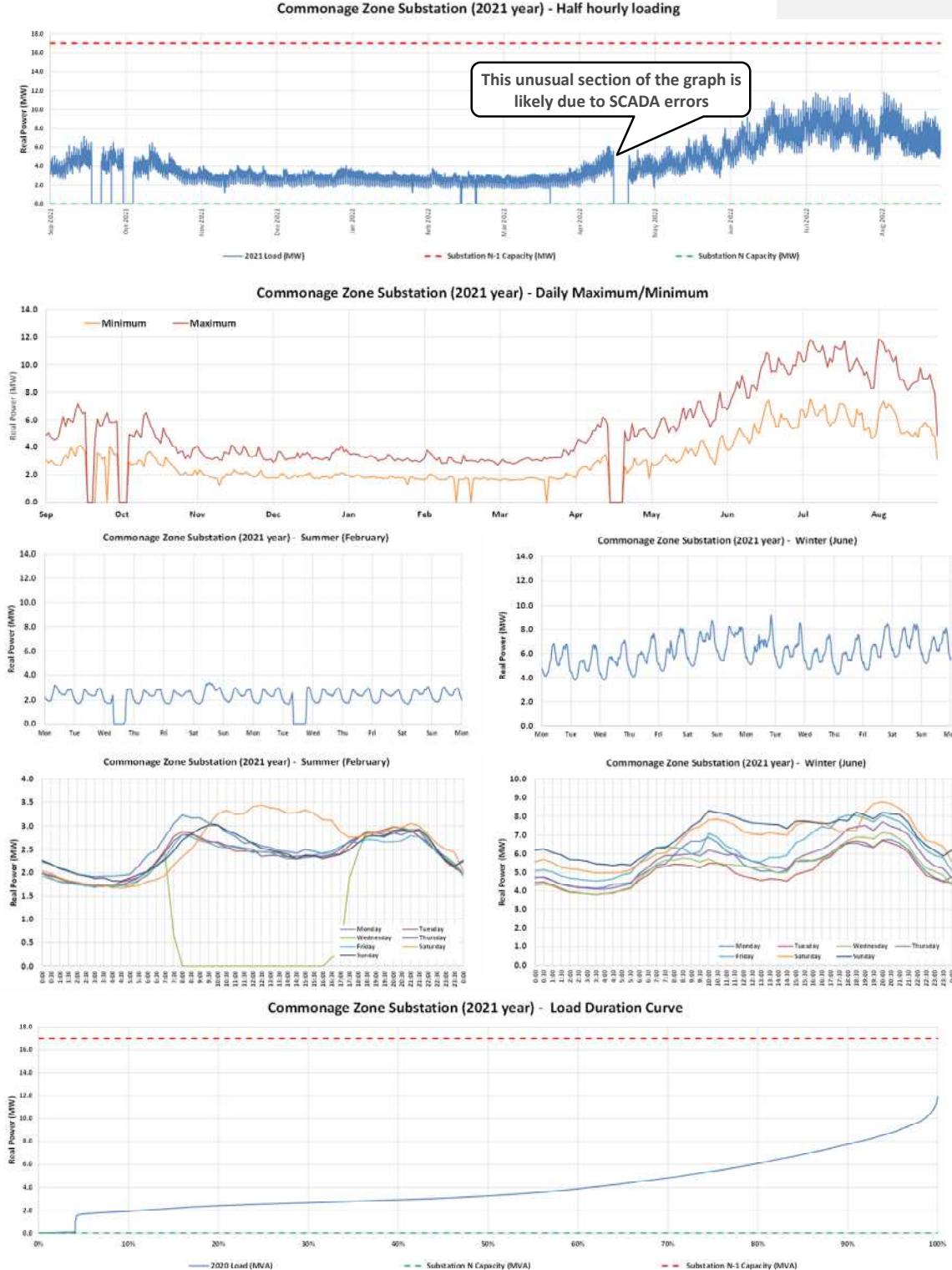


Figure 39 Commonage 33/11kV zone substation: Real power (MW) load characteristics

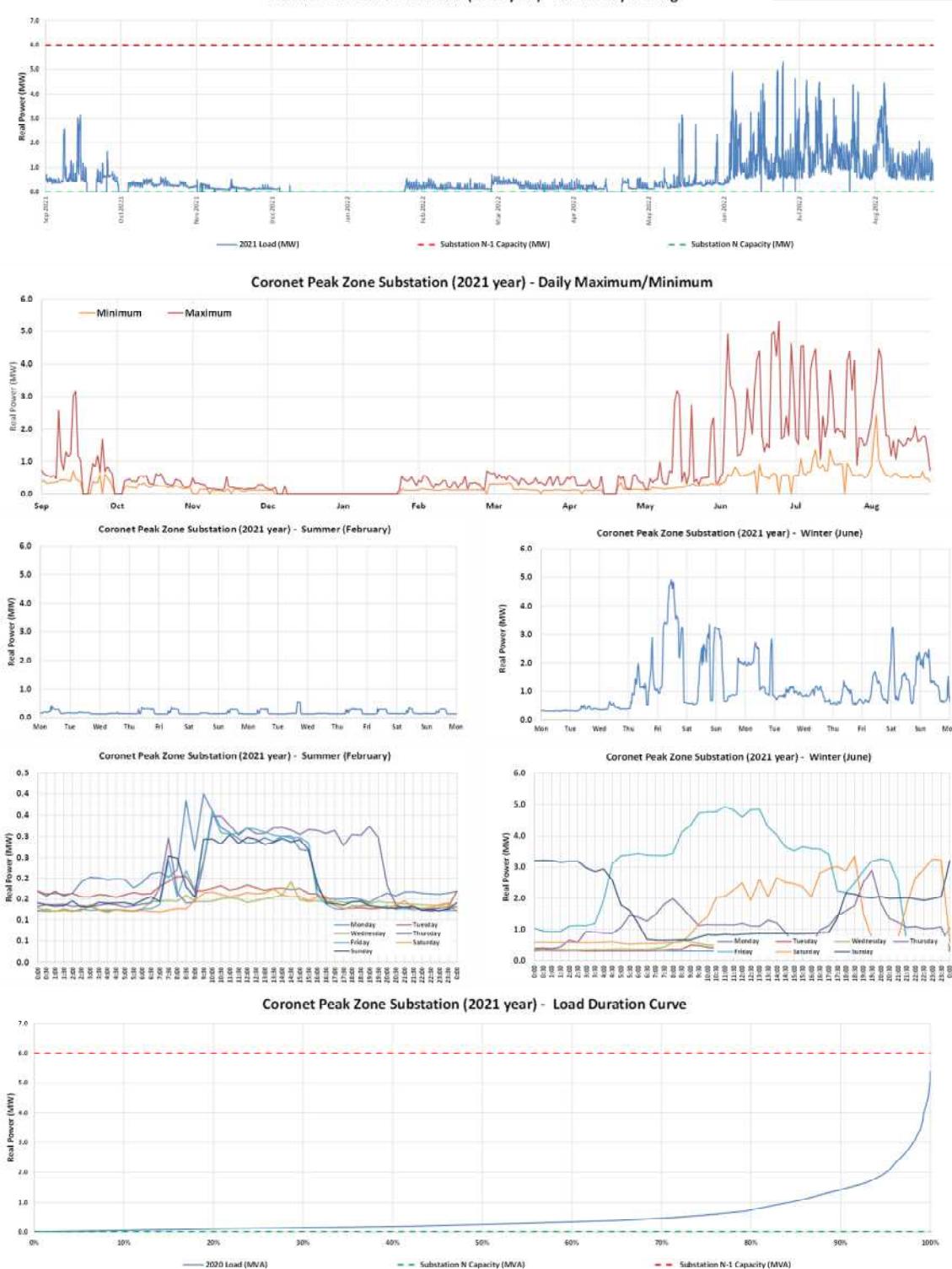
CORONET PEAK MW


Figure 40 Coronet Peak 33/11kV zone substation: Real power (MW) load characteristics

CORSTORPHINE MW

YET TO BE SUPPLIED

Figure 41 Corstorphine 33/11kV zone substation: Real power (MW) load characteristics

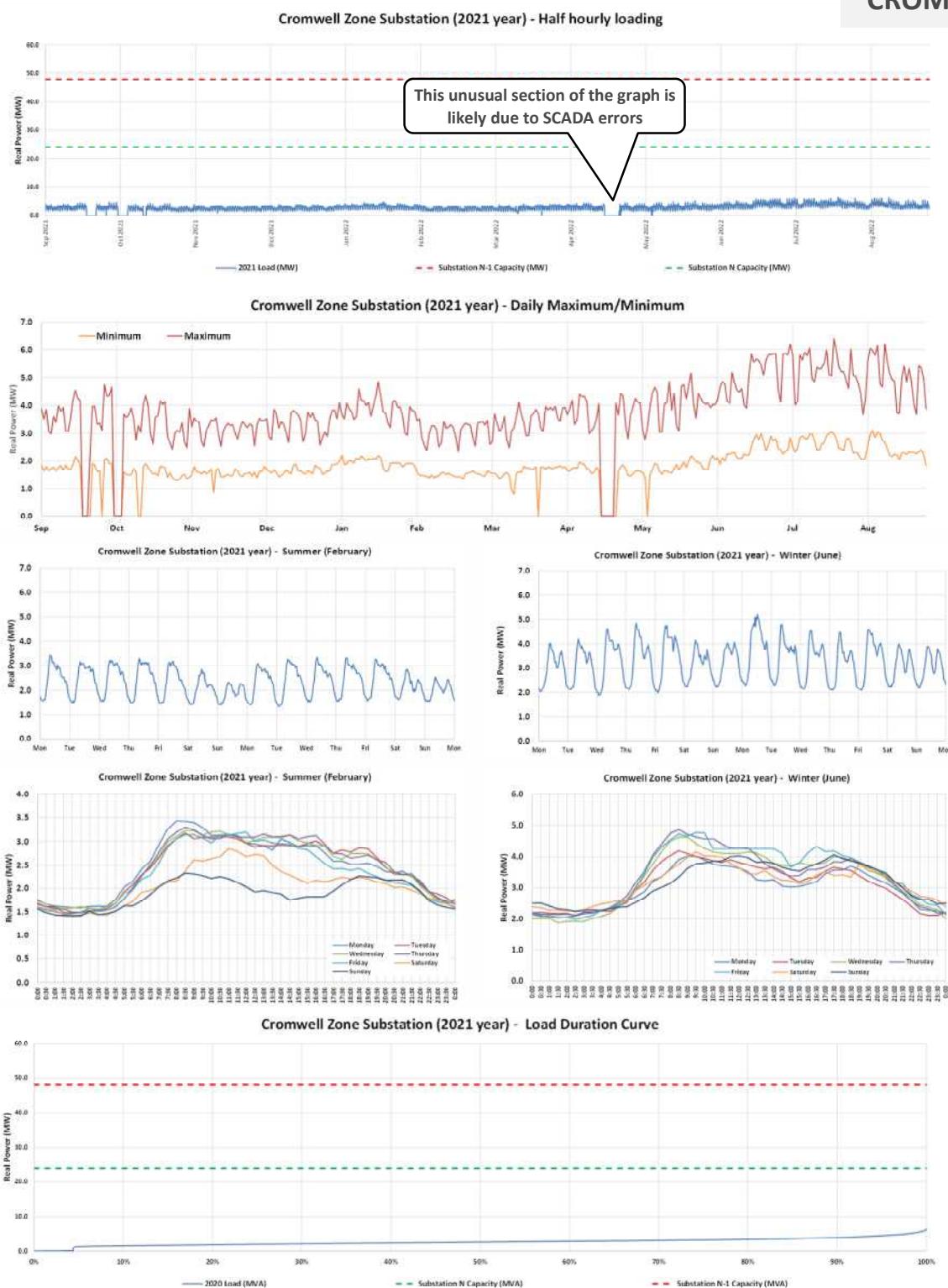
CROMWELL MW


Figure 42 Cromwell 33/11kV zone substation: Real power (MW) load characteristics

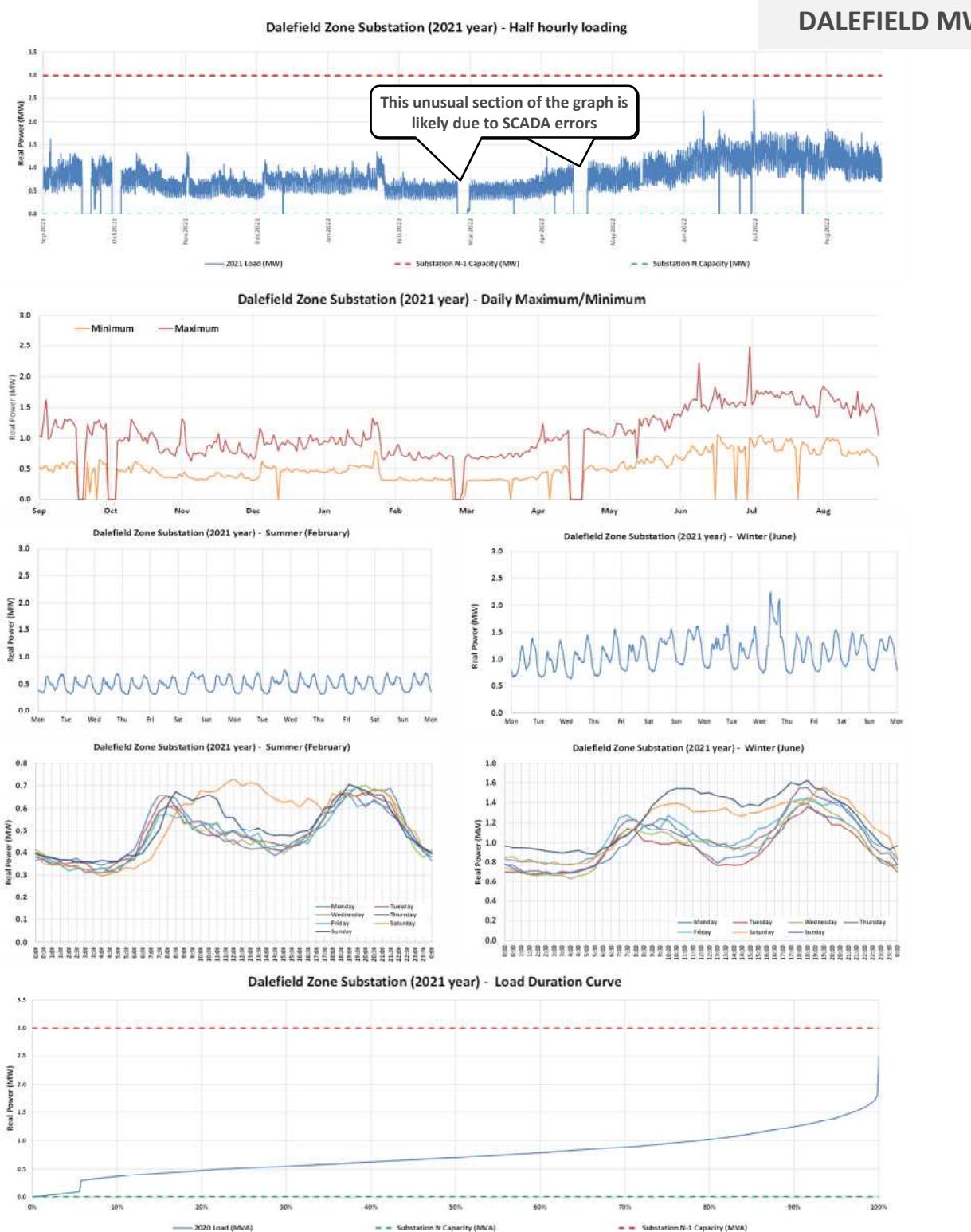


Figure 43 Dalefield 33/11kV zone substation: Real power (MW) load characteristics

EARNSCLEUGH MW

YET TO BE SUPPLIED

Figure 44 Earnscleugh 33/11kV substation: Real power (MW) load characteristics

EAST TAIERI MW

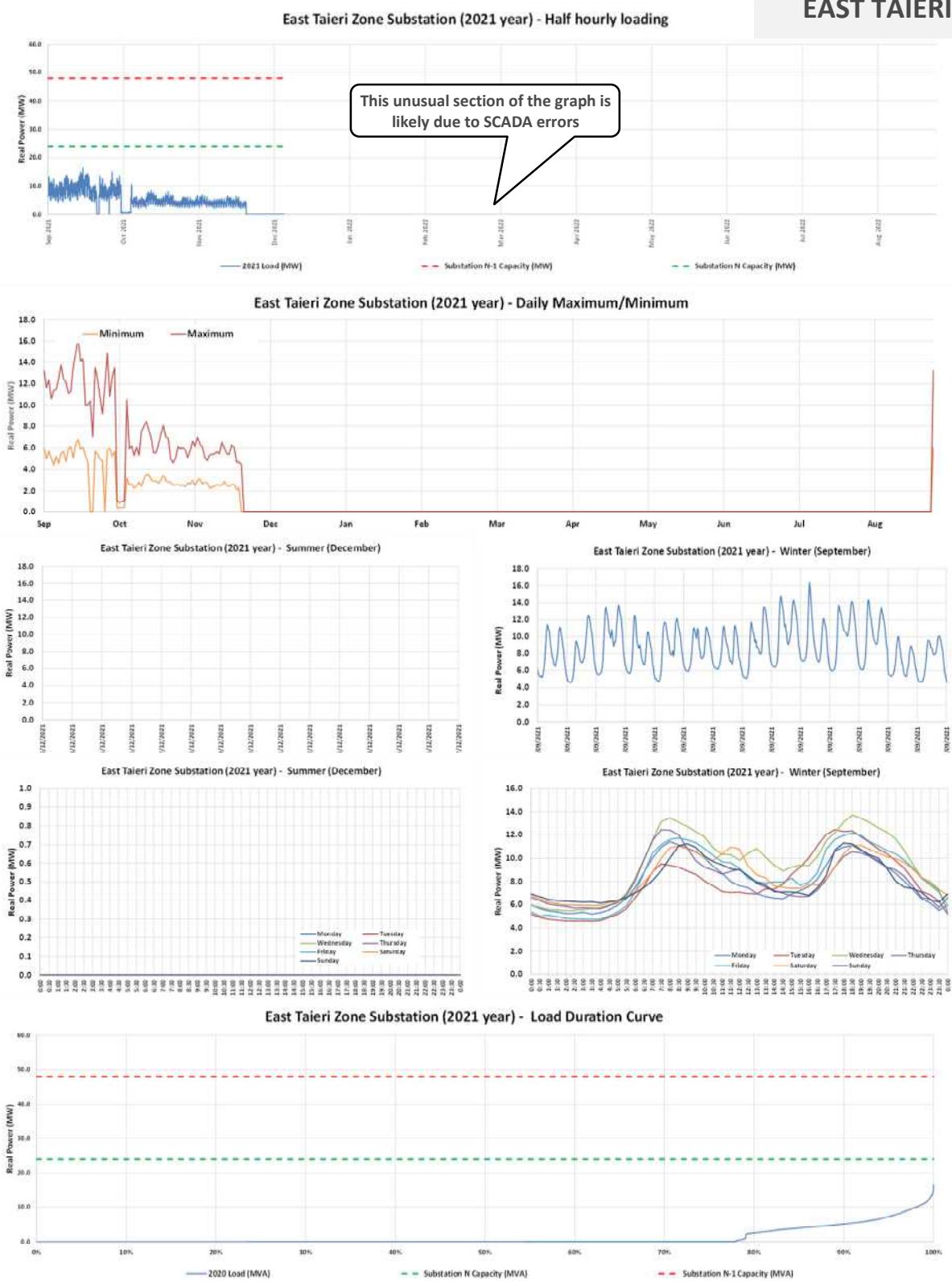


Figure 45 East Taieri 33/11kV zone substation: Real power (MW) load characteristics

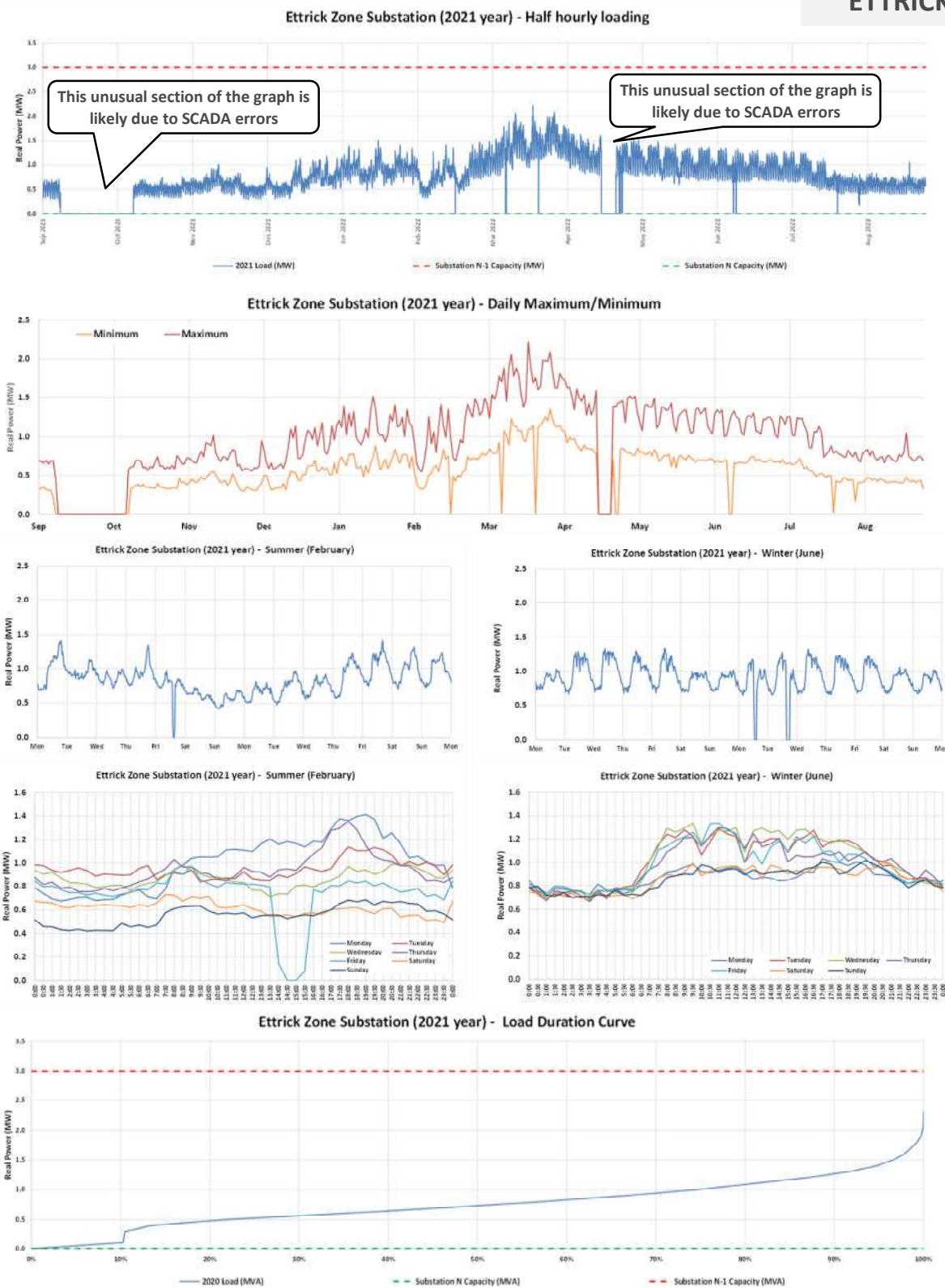
ETTRICK MW


Figure 46 Ettrick 33/11kV zone substation: Real power (MW) load characteristics

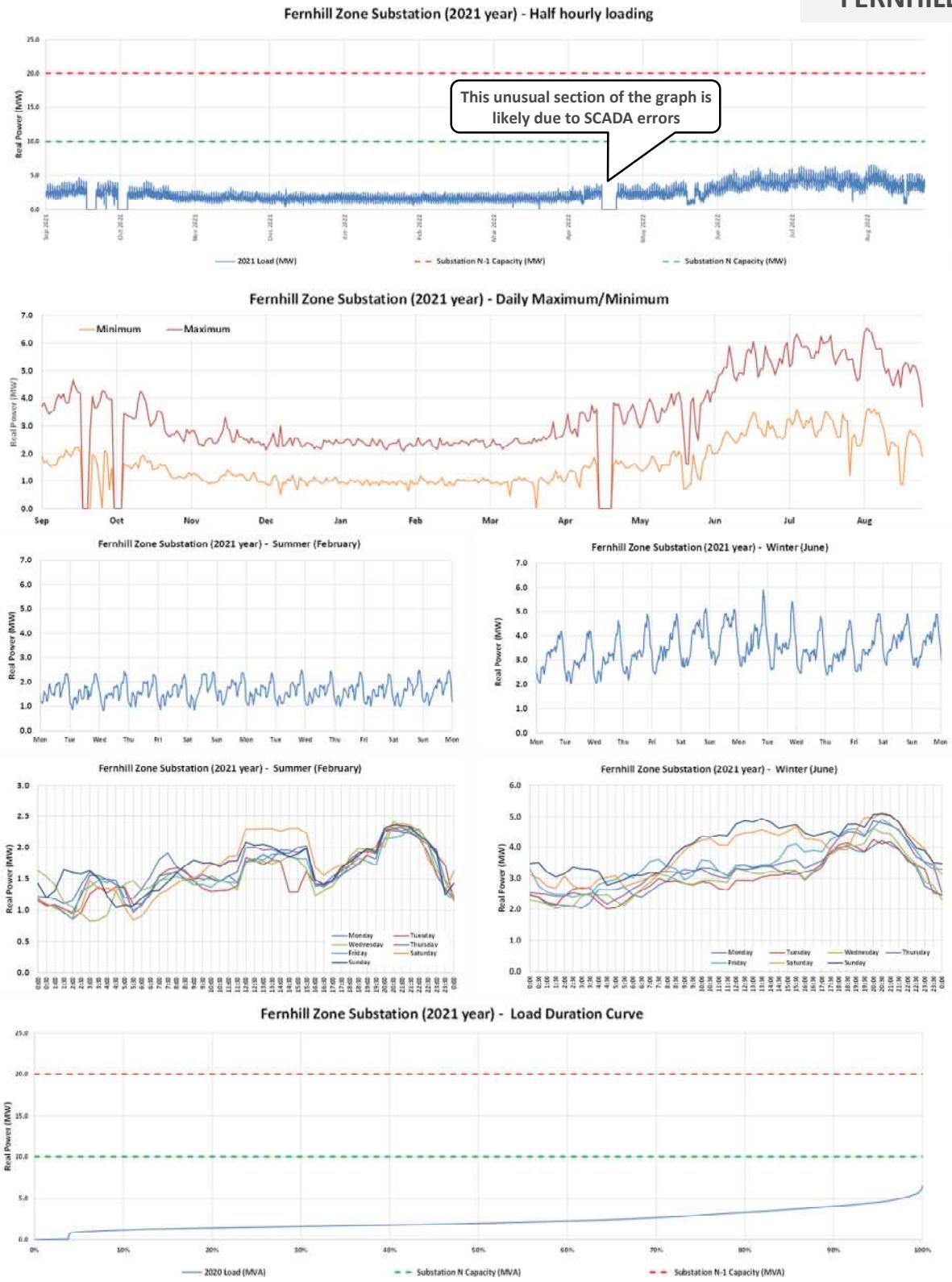
FERNHILL MW


Figure 47 Fernhill 33/11kV zone substation: Real power (MW) load characteristics

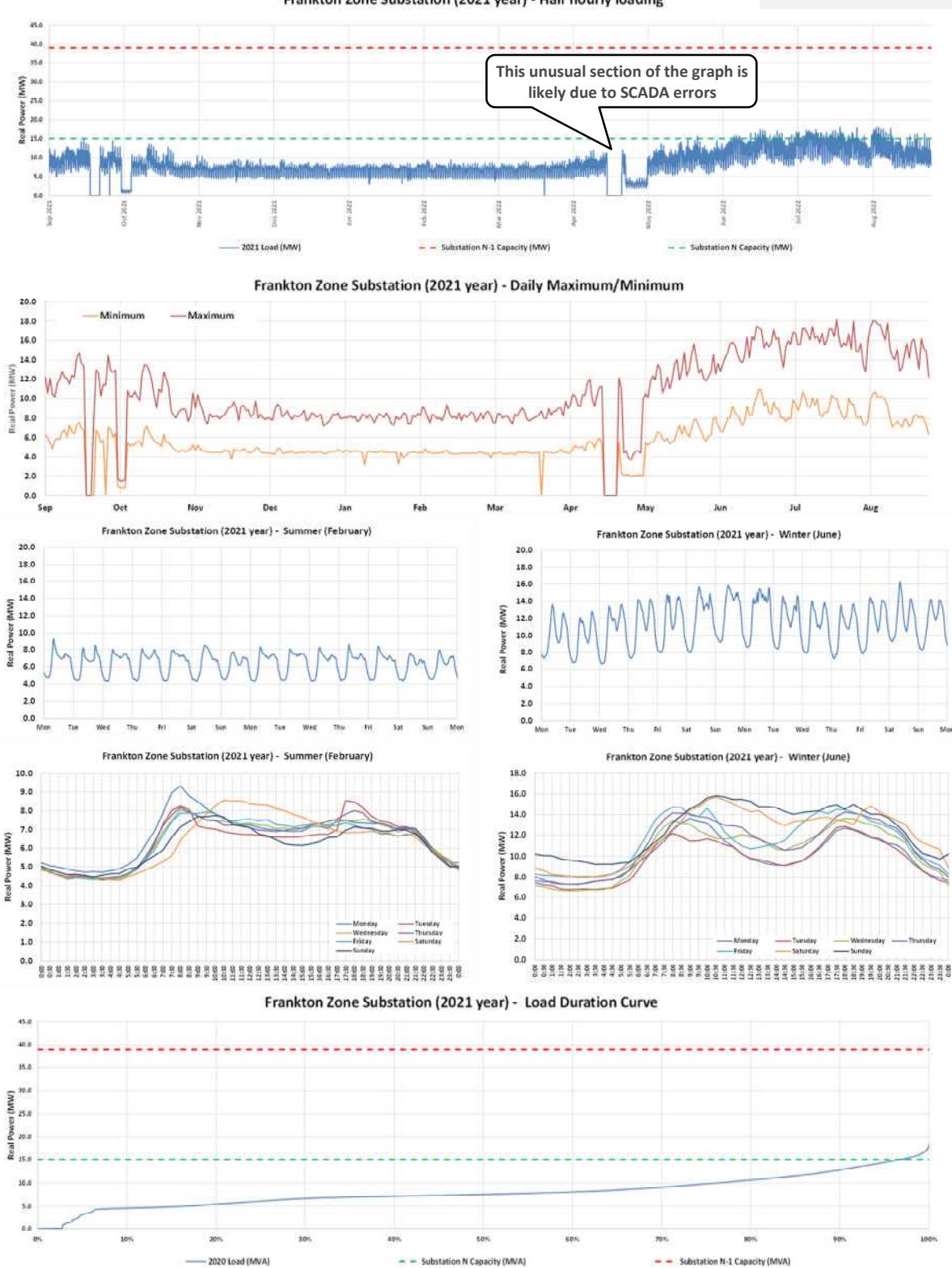
FRANKTON MW


Figure 48 Frankton 33/11kV zone substation: Real power (MW) load characteristics

GREEN ISLAND MW

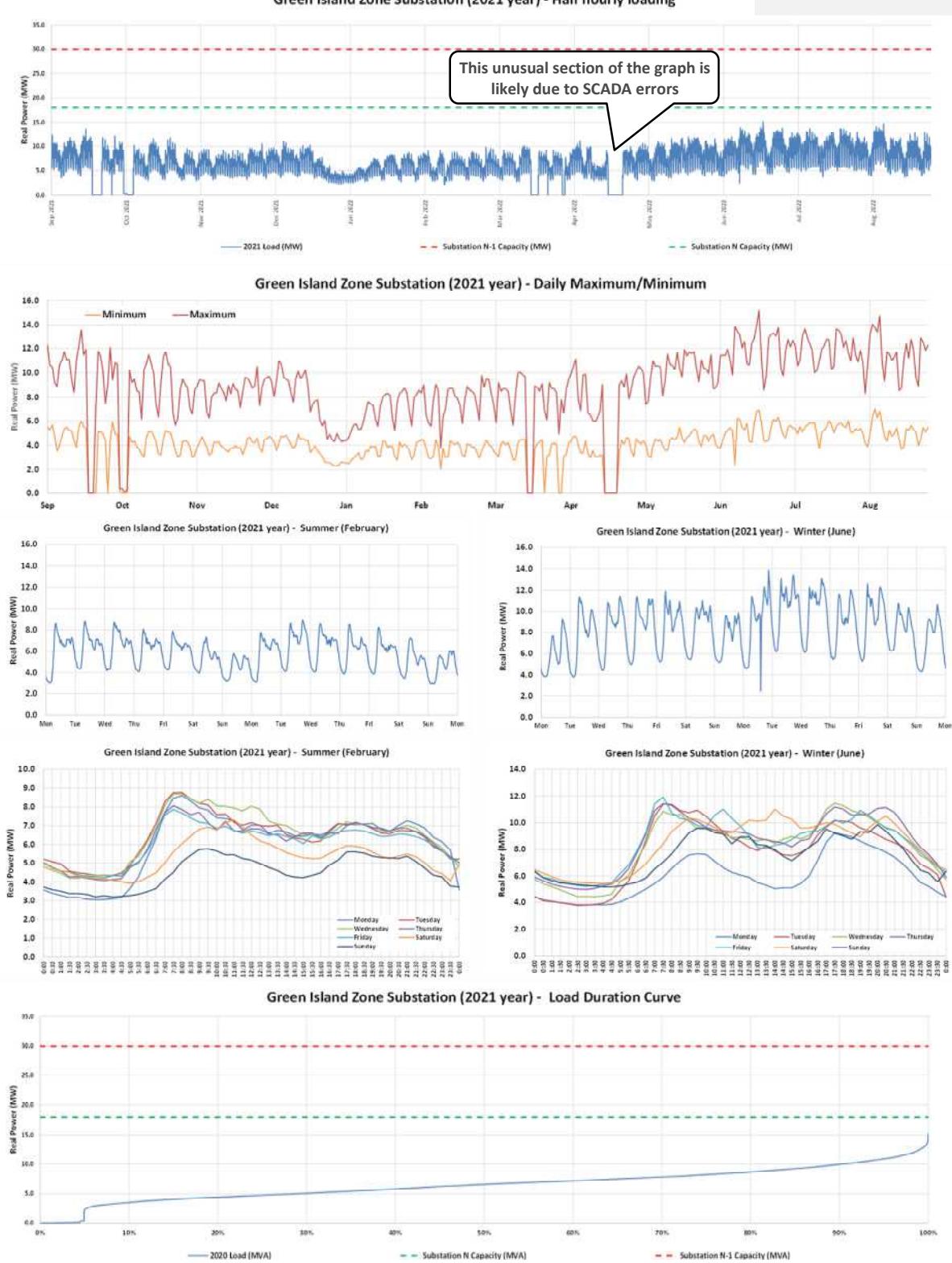


Figure 49 Green Island 33/11kV zone substation: Real power (MW) load characteristics

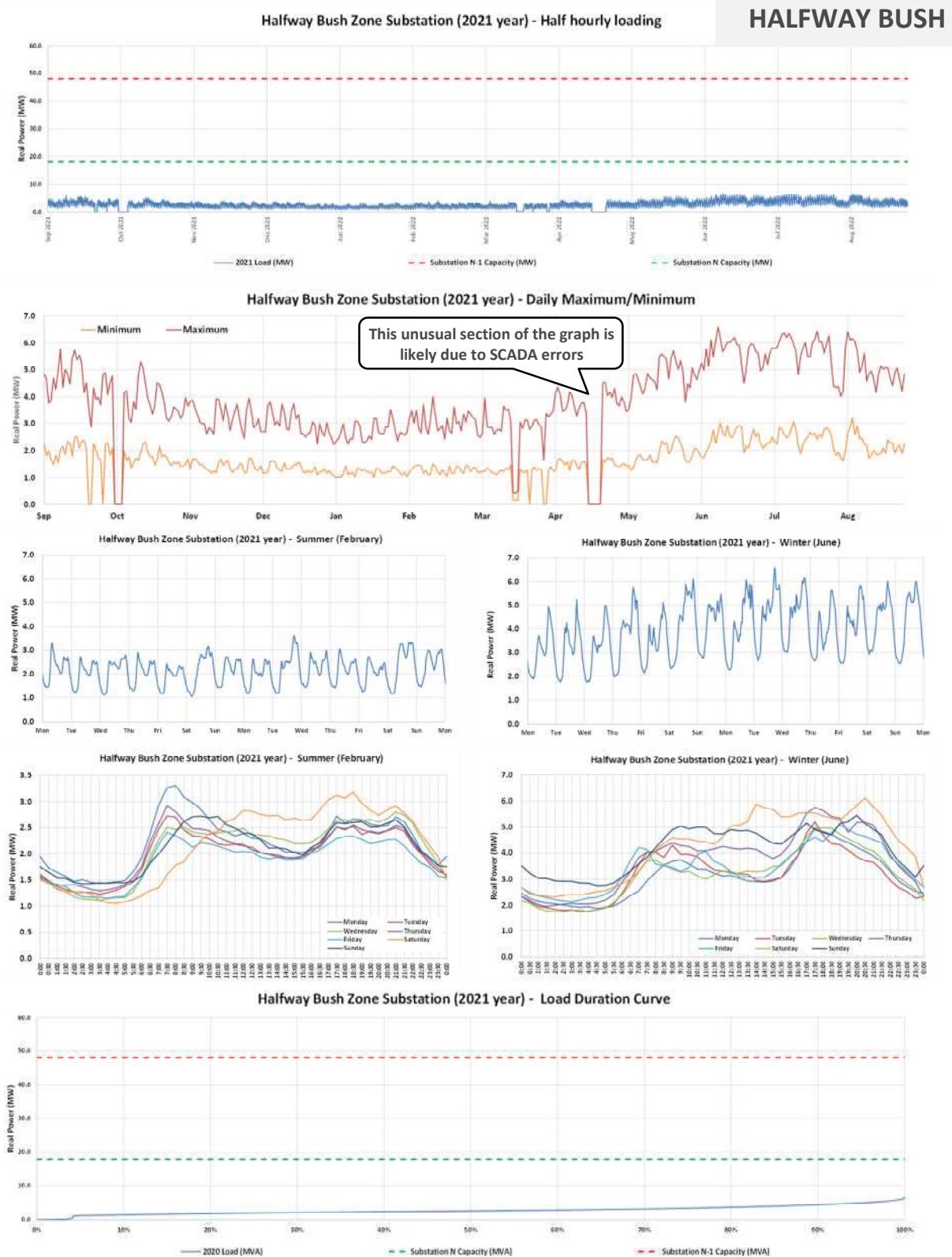


Figure 50 Halfway Bush 33/11kV zone substation: Real power (MW) load characteristics

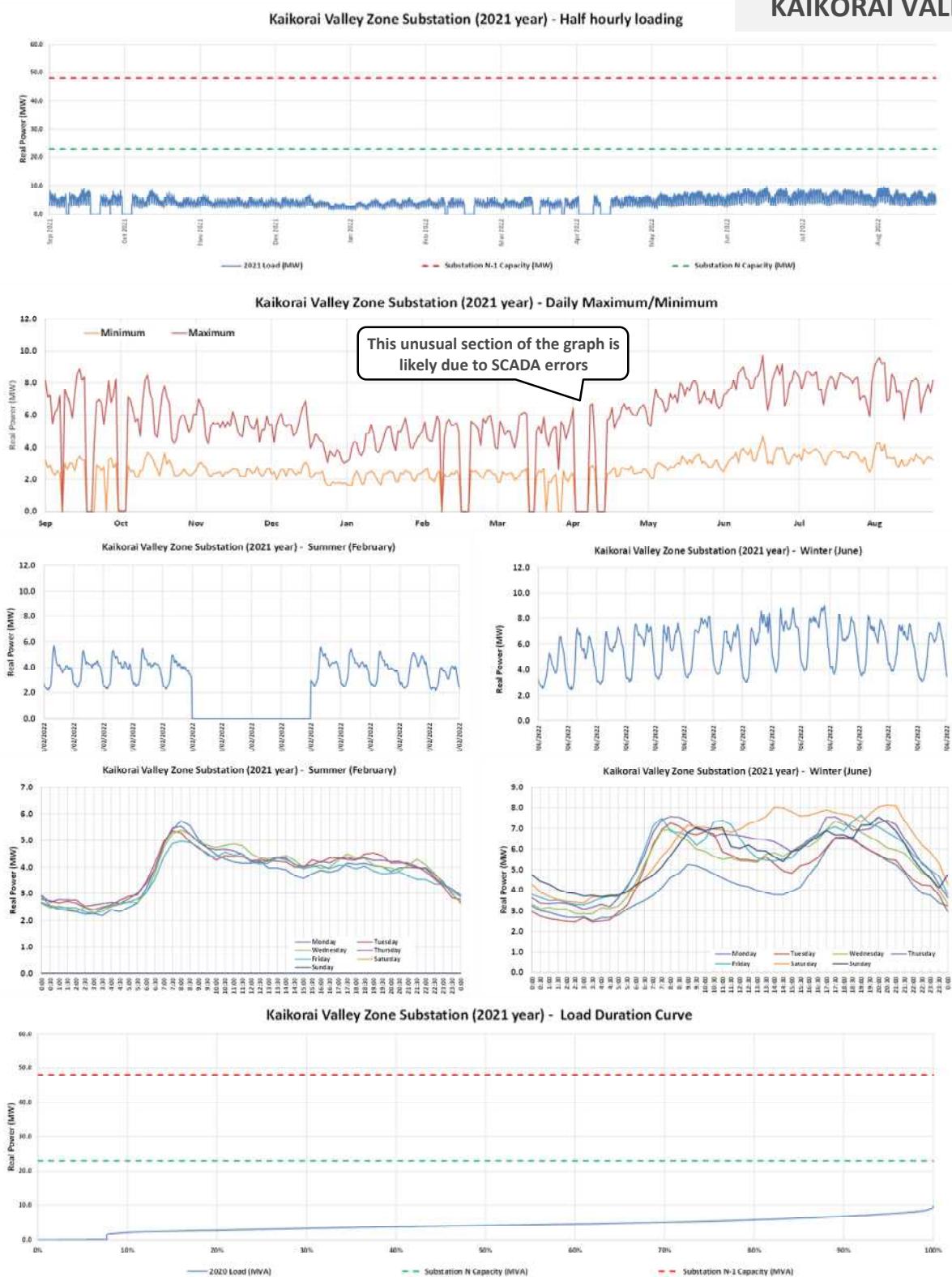
KAIKORAI VALLEY MW


Figure 51 Kaikorai Valley 33/11kV zone substation: Real power (MW) load characteristics

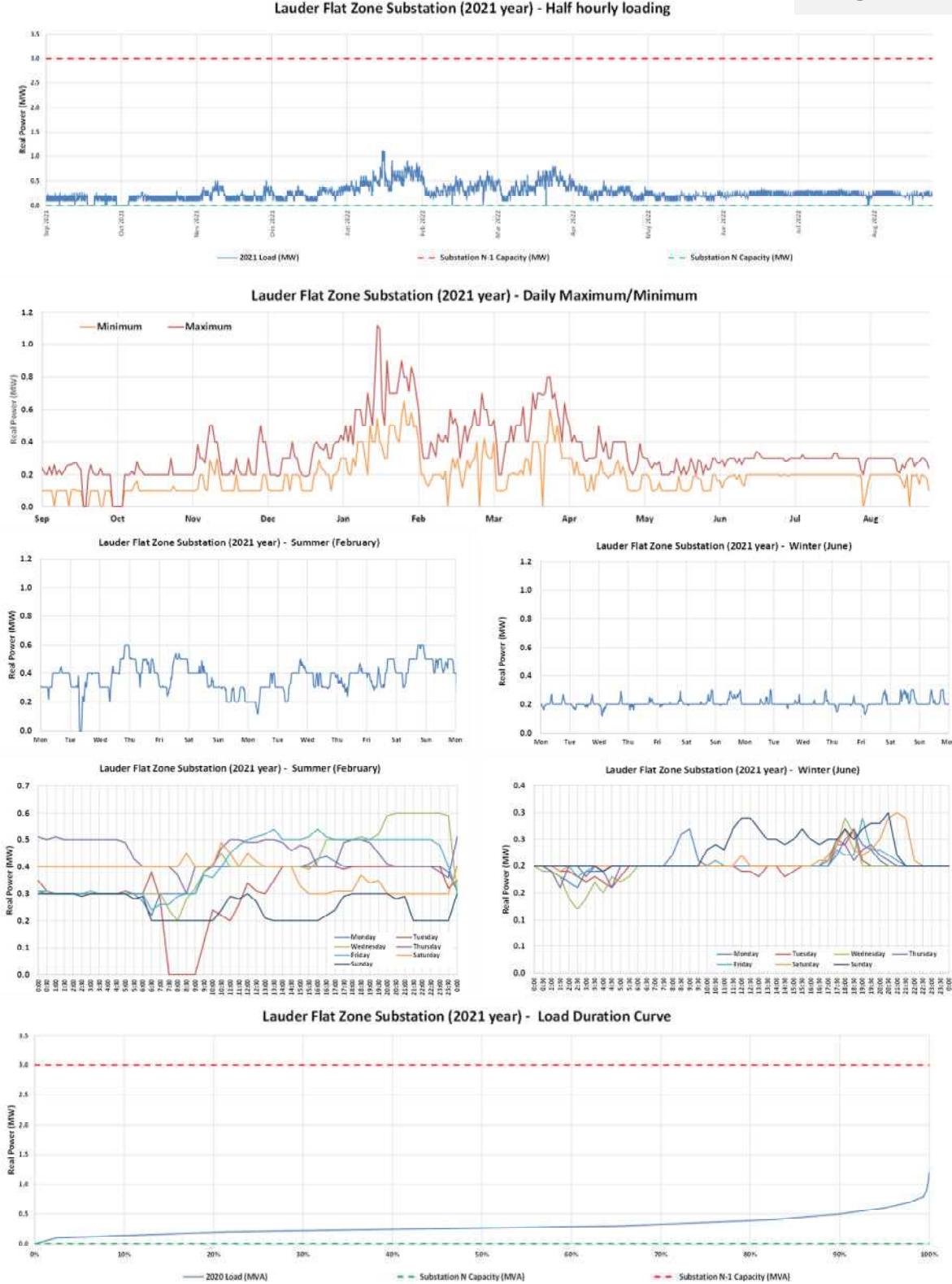
LAUDER FLAT MW


Figure 52 Lauder Flat 33/11kV zone substation: Real power (MW) load characteristics

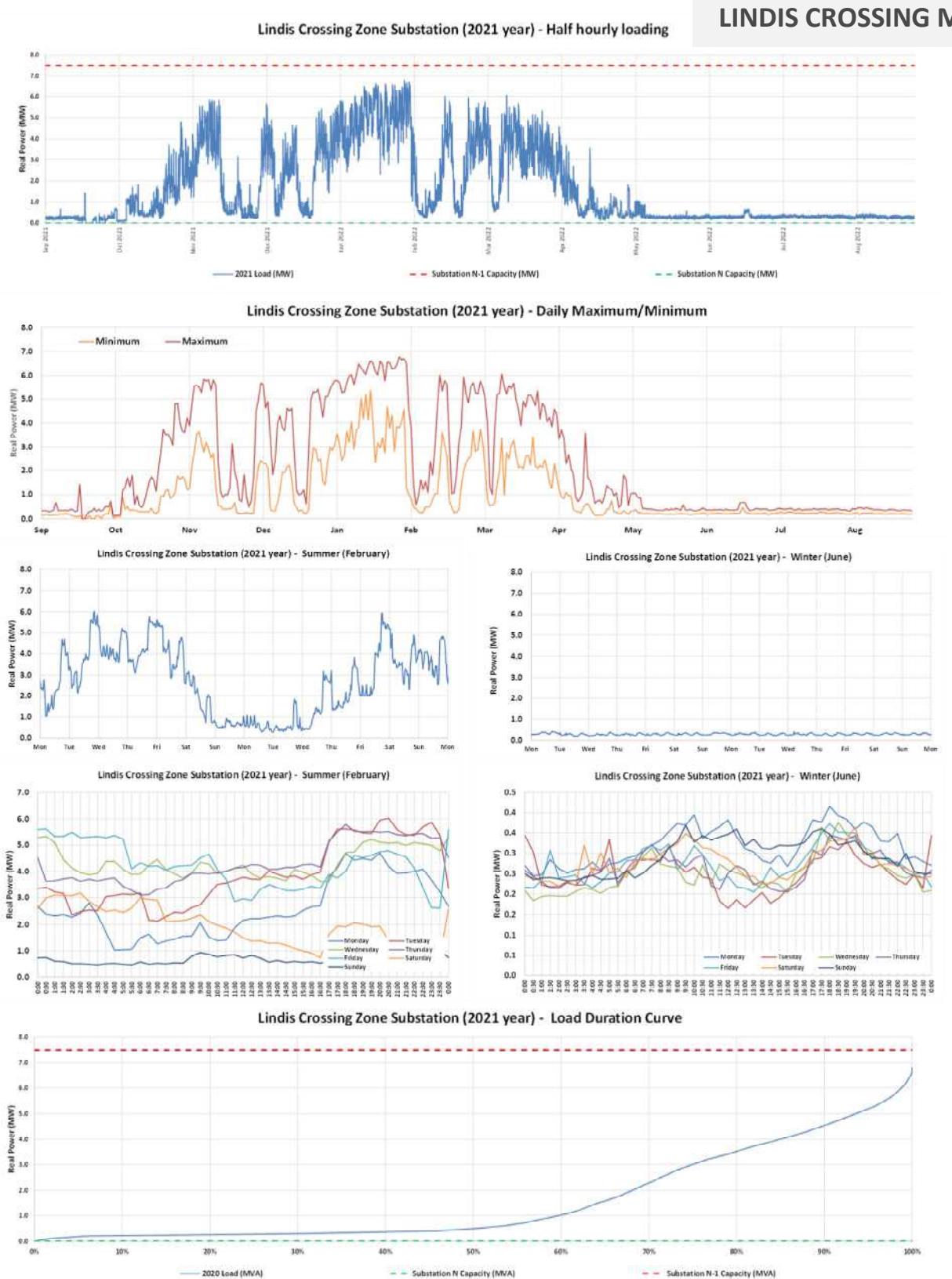


Figure 53 Lindis Crossing 66/11kV zone substation: Real power (MW) load characteristics

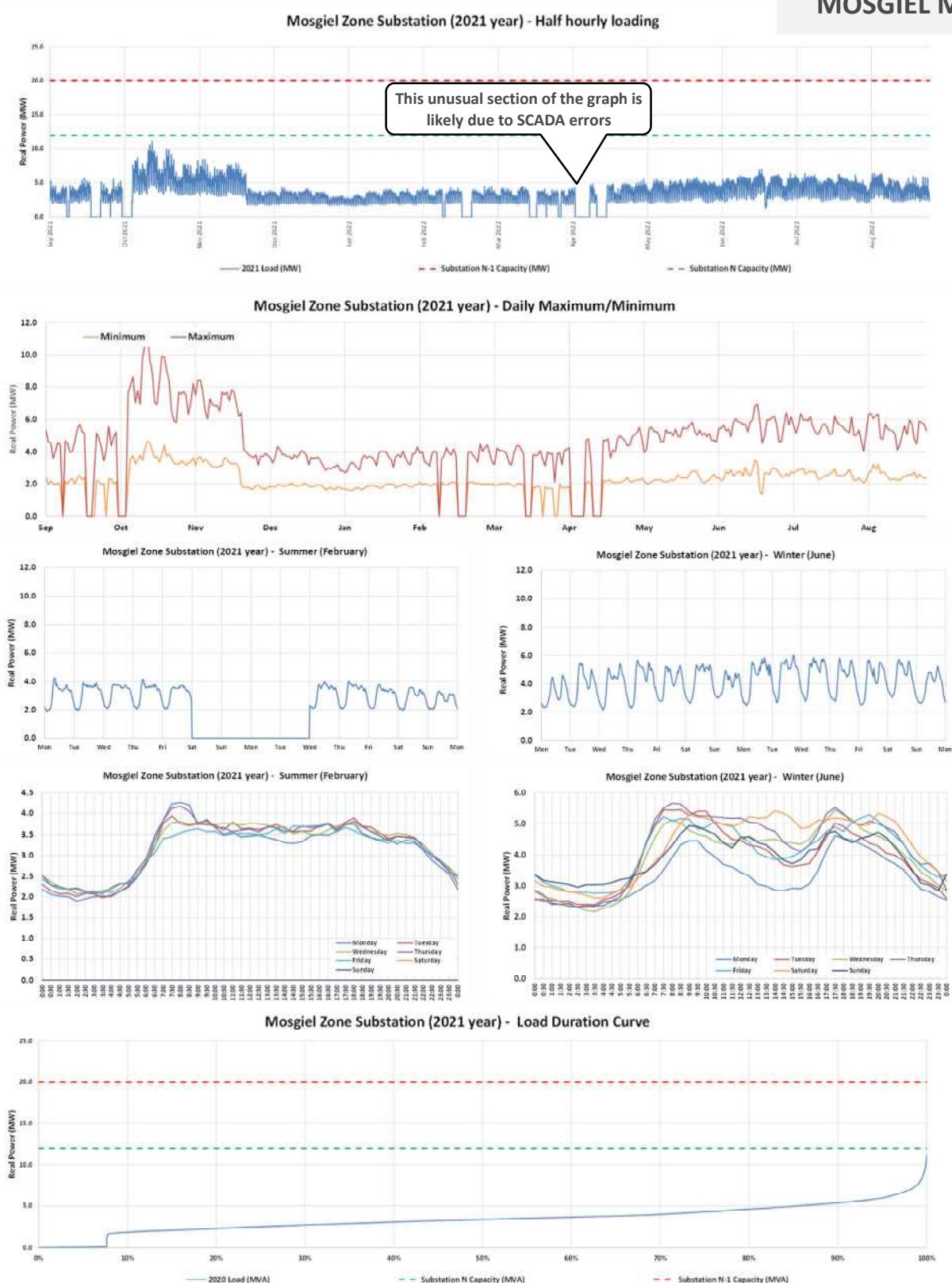
MOSGIEL MW


Figure 54 Mosgiel 33/11kV zone substation: Real power (MW) load characteristics

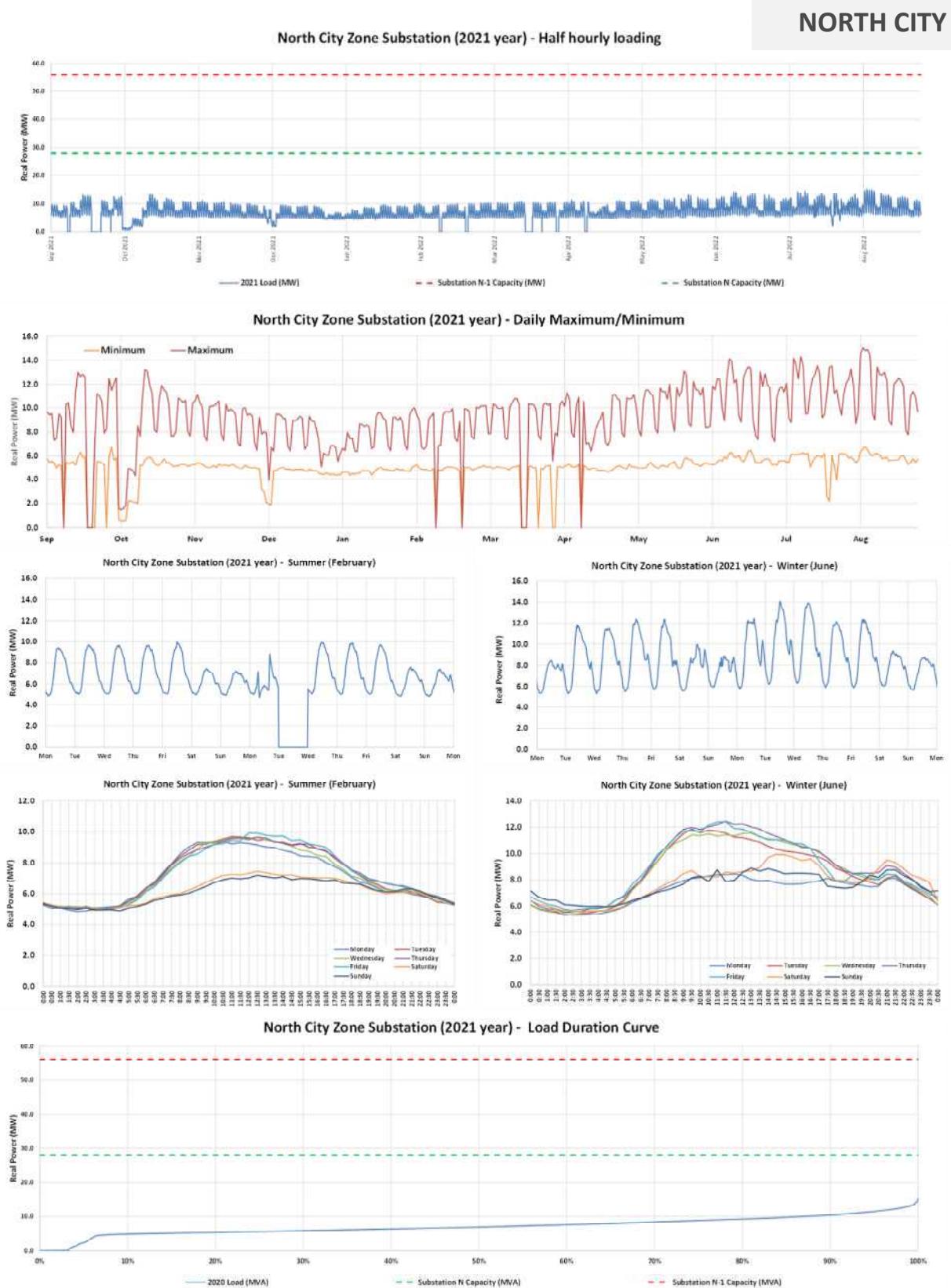


Figure 55 North City 33/11kV zone substation: Real power (MW) load characteristics

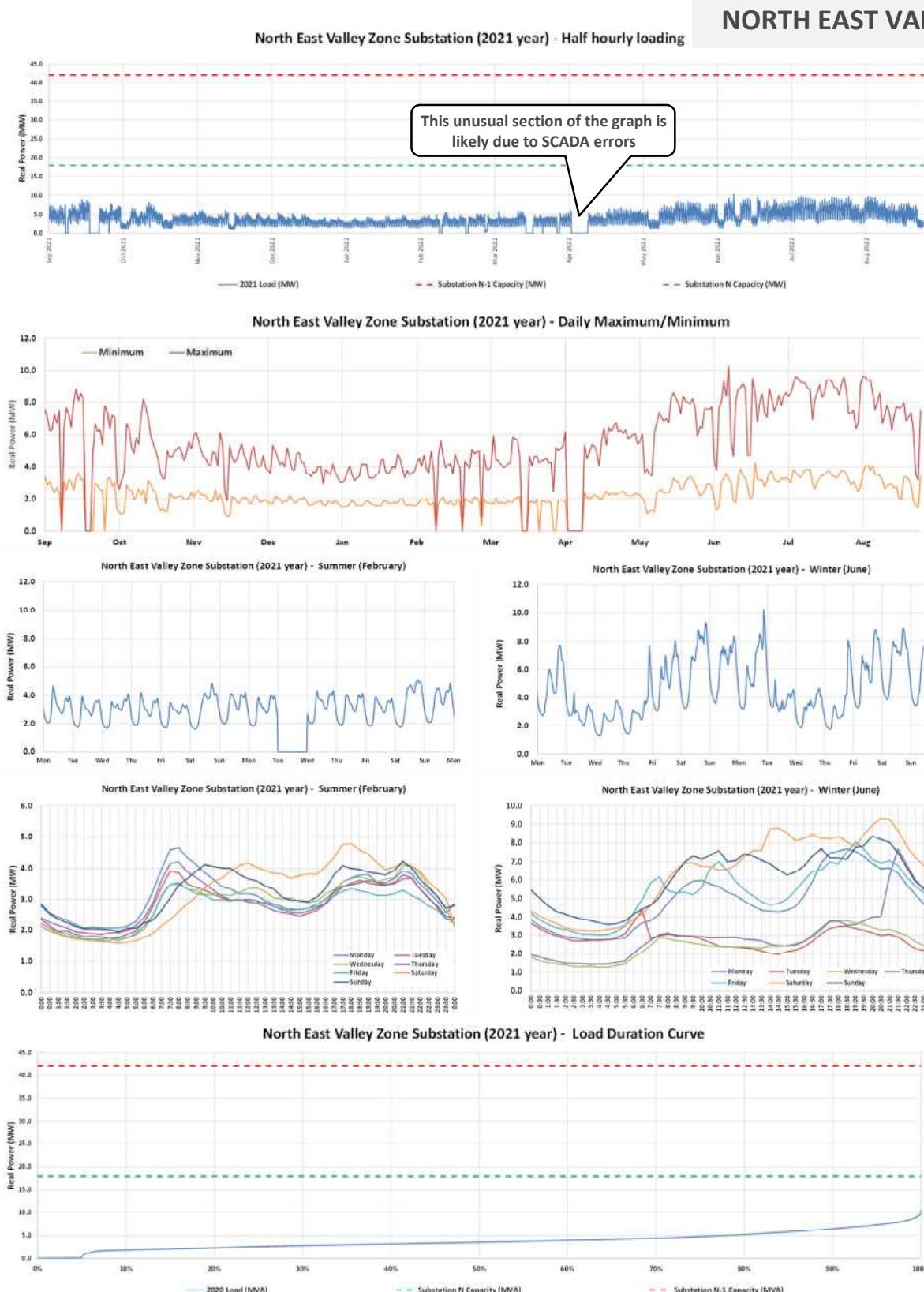


Figure 56 North East Valley 33/11kV zone substation: Real power (MW) load characteristics

OMAKAU MW

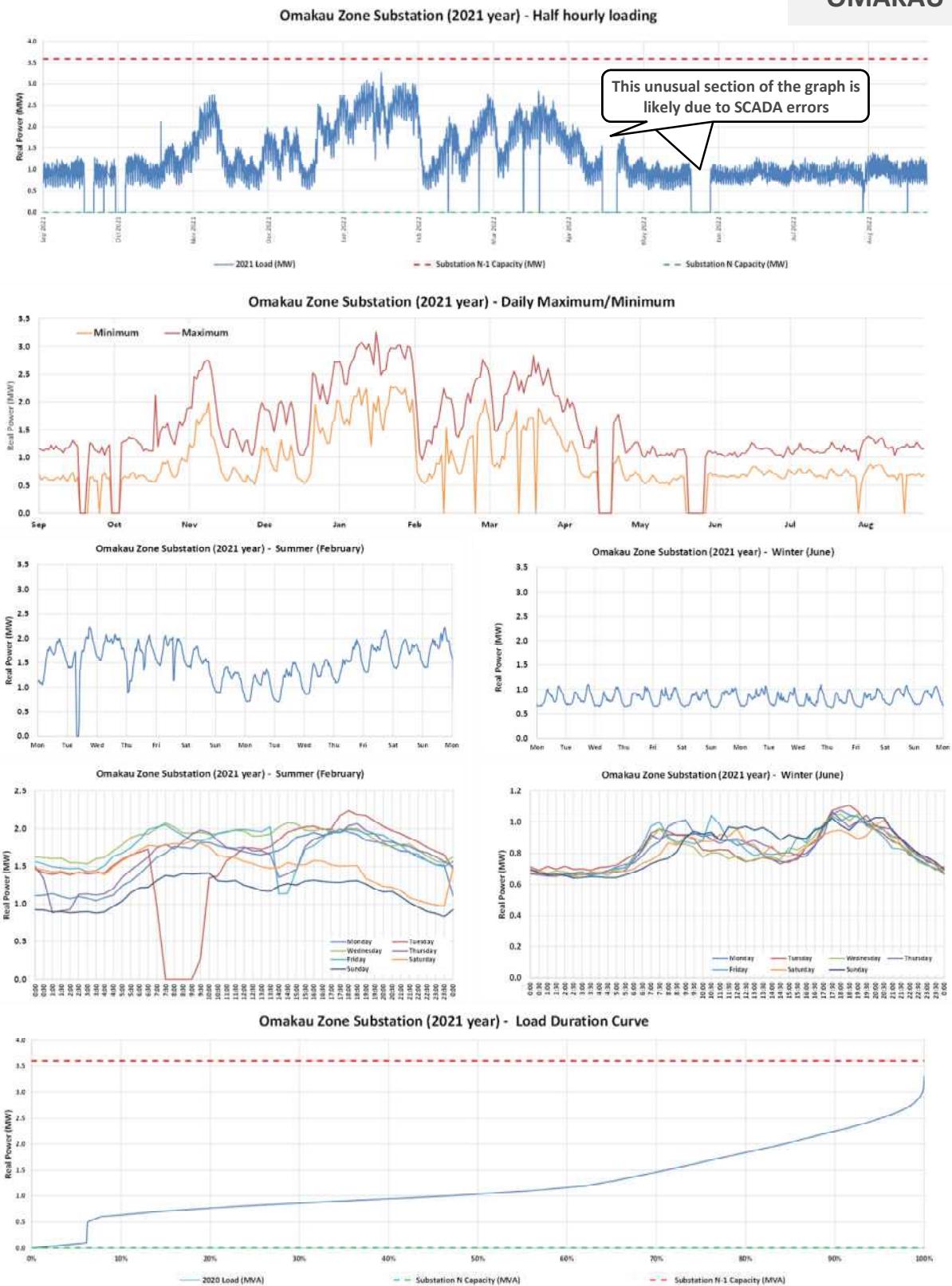


Figure 57 Omakau 33/11kV zone substation: Real power (MW) load characteristics

OUTRAM MW

YET TO BE SUPPLIED

Figure 58 Outram 33/11kV zone substation: Real power (MW) load characteristics

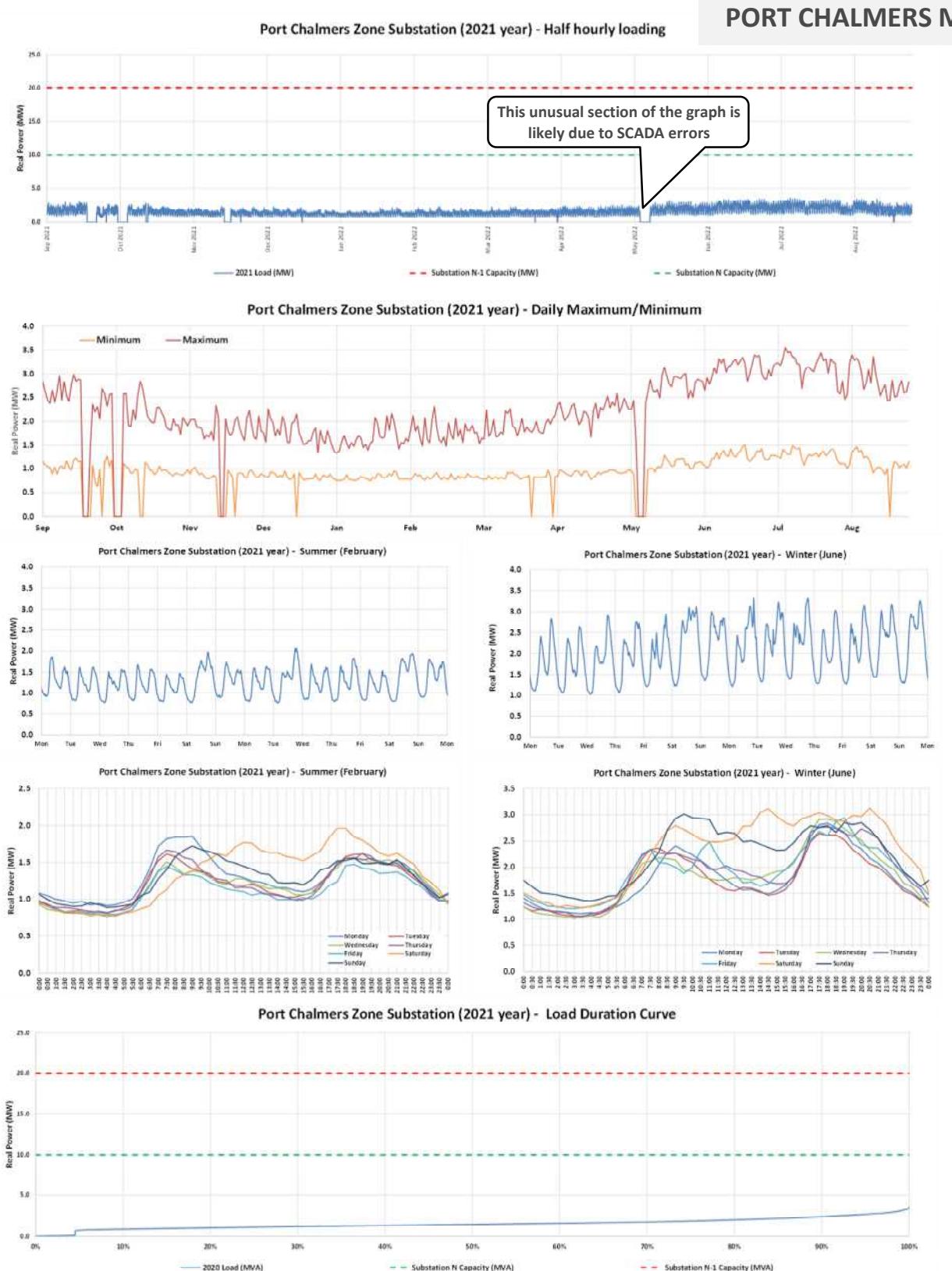


Figure 59 Port Chalmers 33/11kV zone substation: Real power (MW) load characteristics

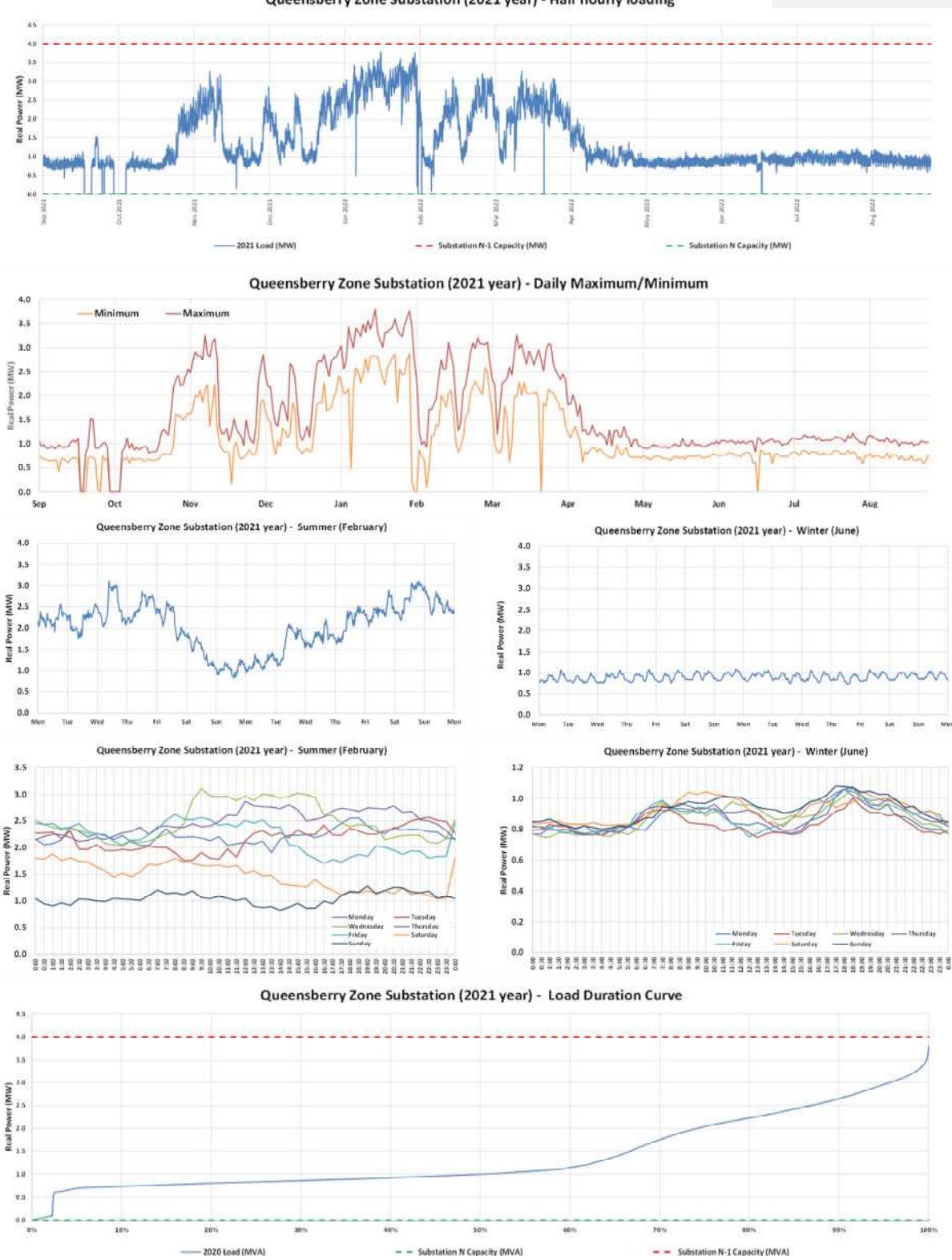
QUEENSBURY MW


Figure 60 Queensbury 66/11kV zone substation: Real power (MW) load characteristics

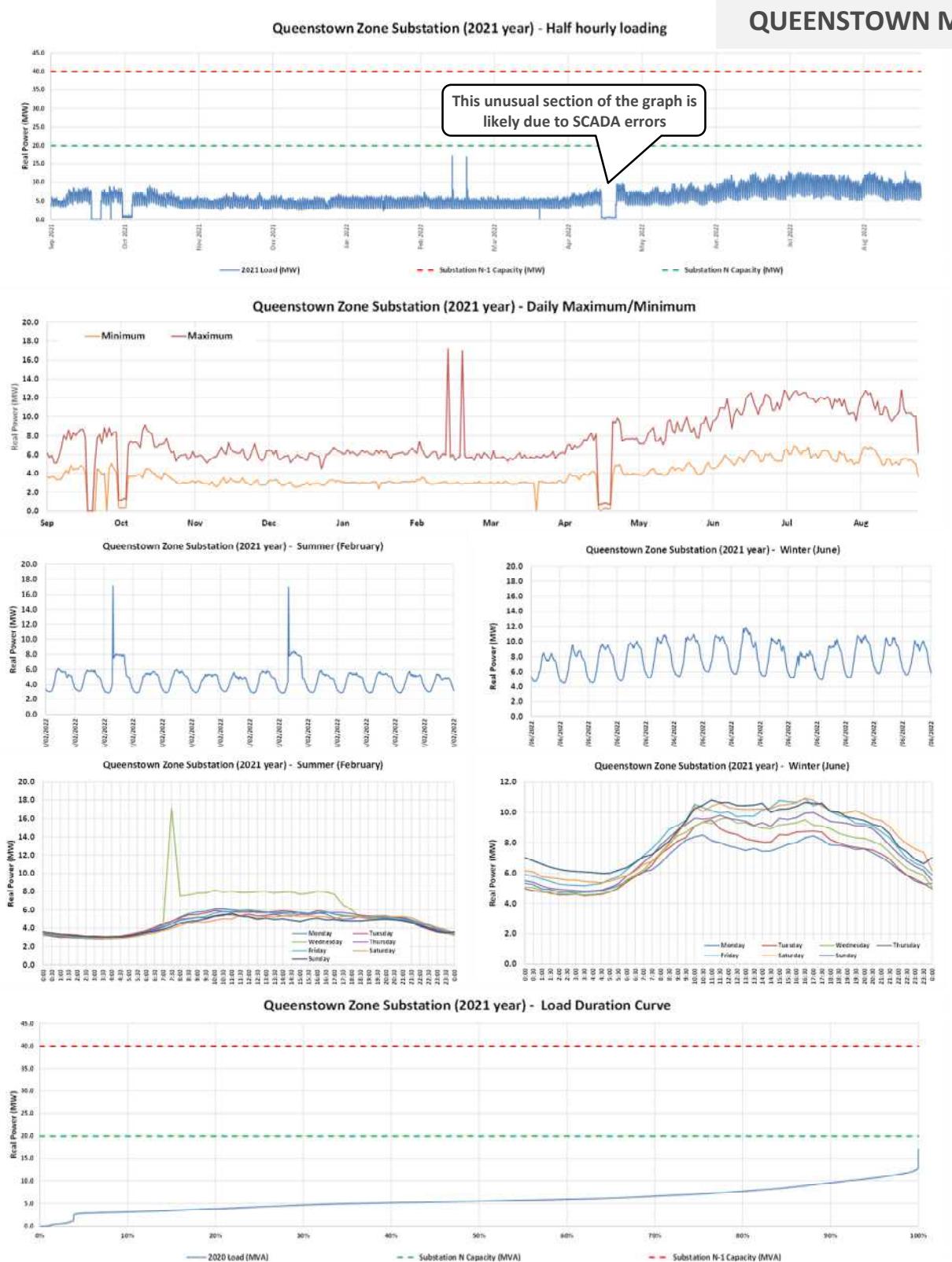


Figure 61 Queenstown 33/11kV zone substation: Real power (MW) load characteristics

REMARKABLES MW

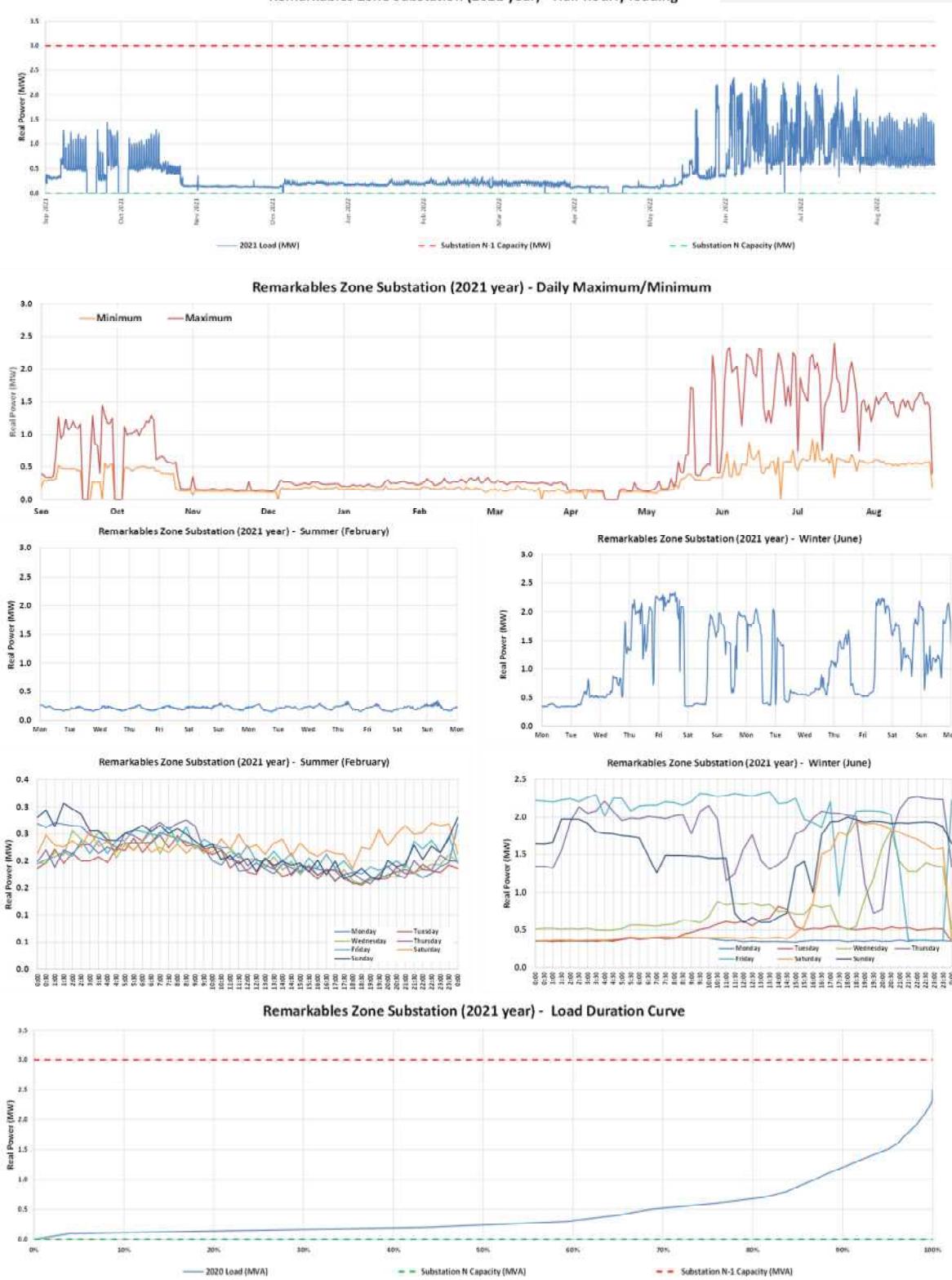


Figure 62 Remarkables 33/11kV substation: Real power (MW) load characteristics

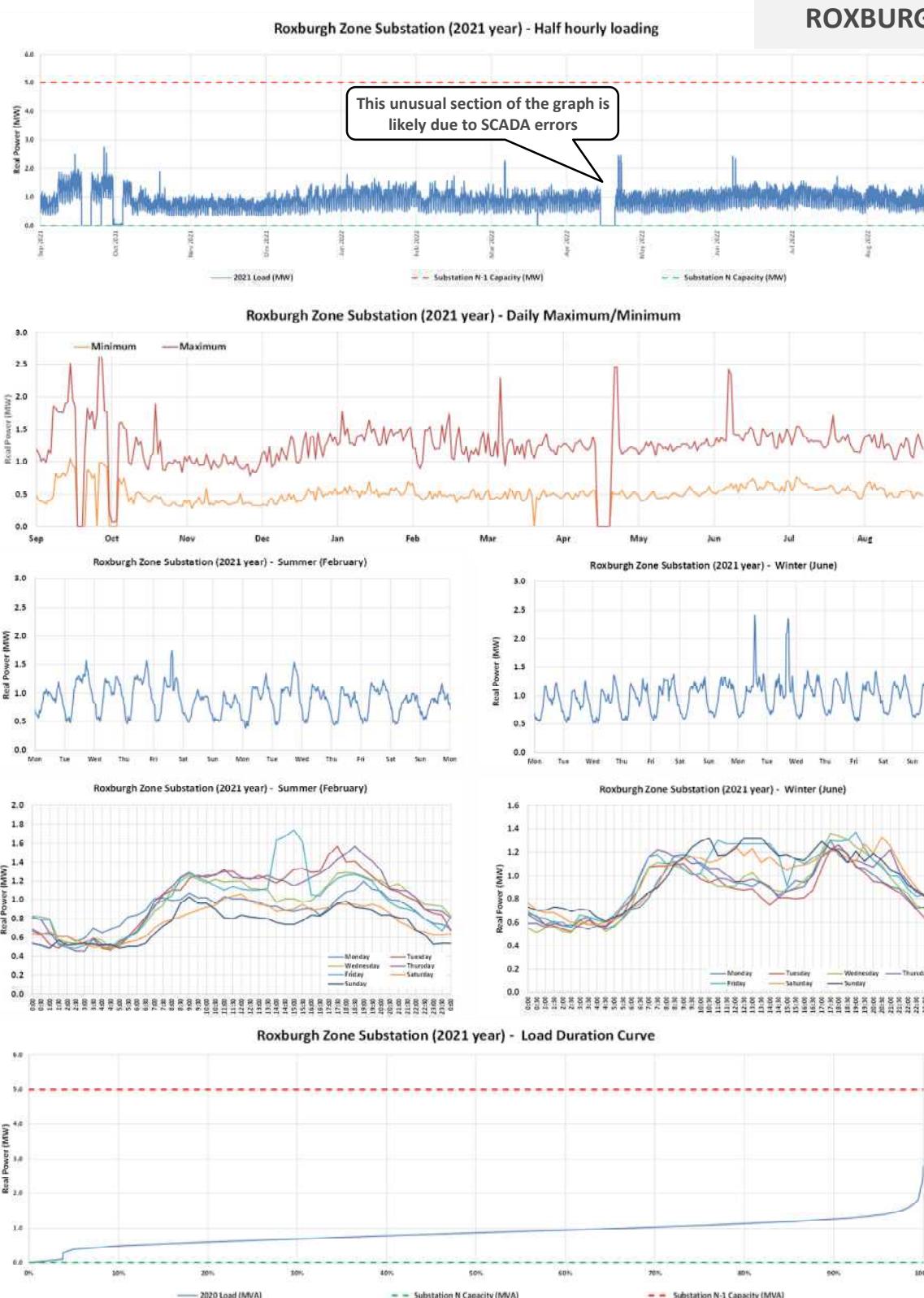


Figure 63 Roxburgh 33/11kV zone substation: Real power (MW) load characteristics

SMITH STREET MW

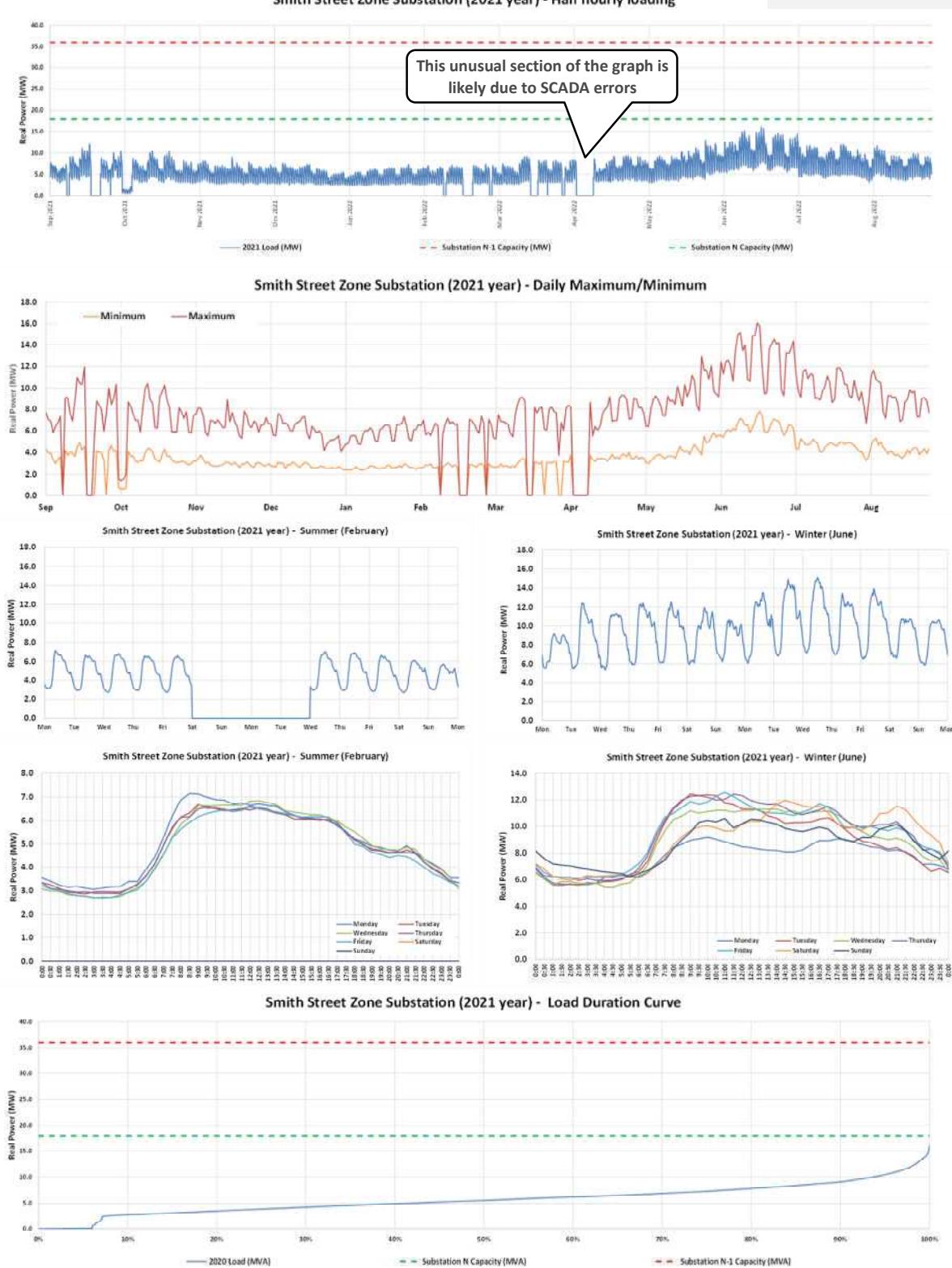


Figure 64 Smith Street 33/11kV zone substation: Real power (MW) load characteristics

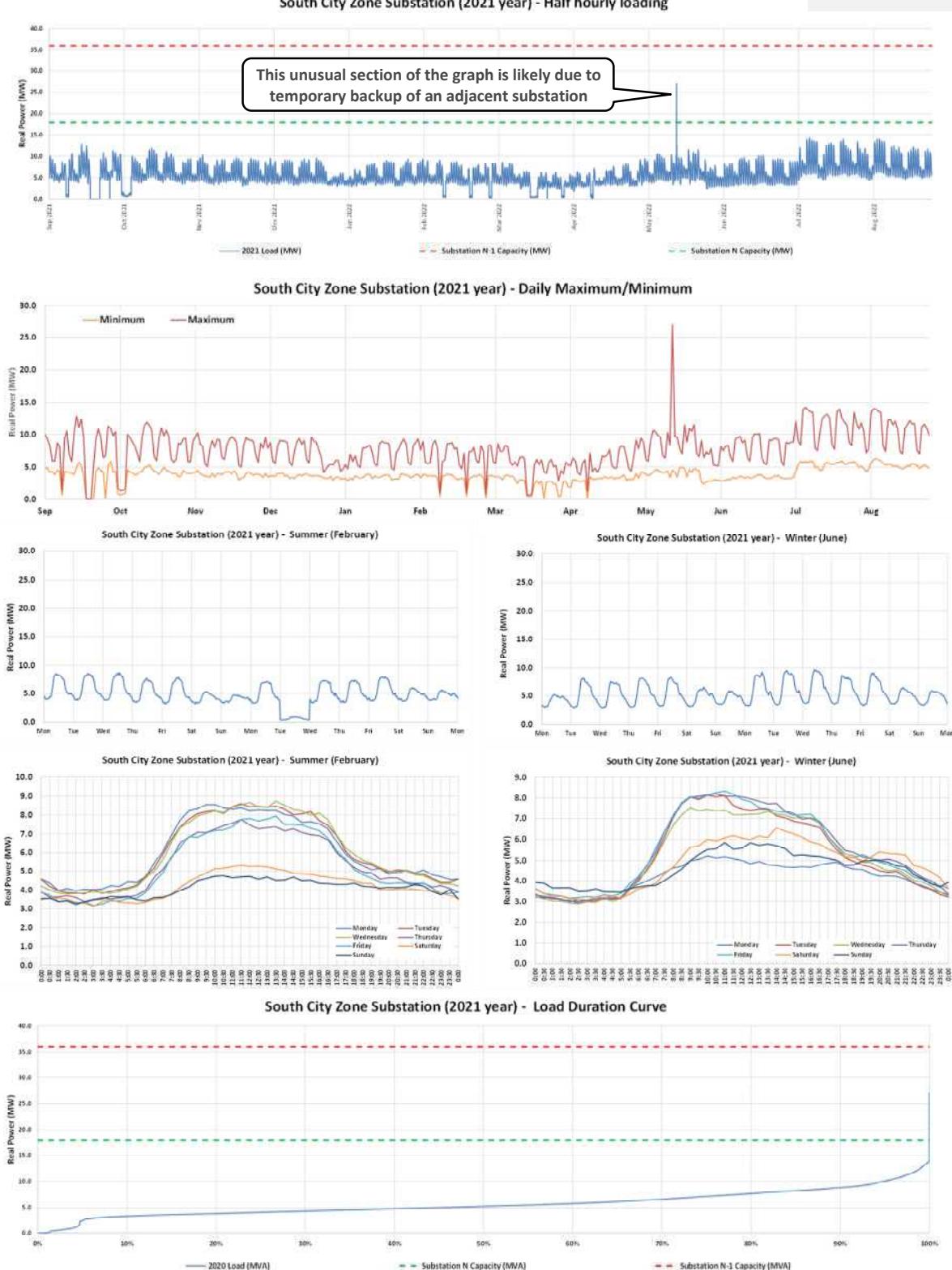
SOUTH CITY MW


Figure 65 South City 33/11kV zone substation: Real power (MW) load characteristics

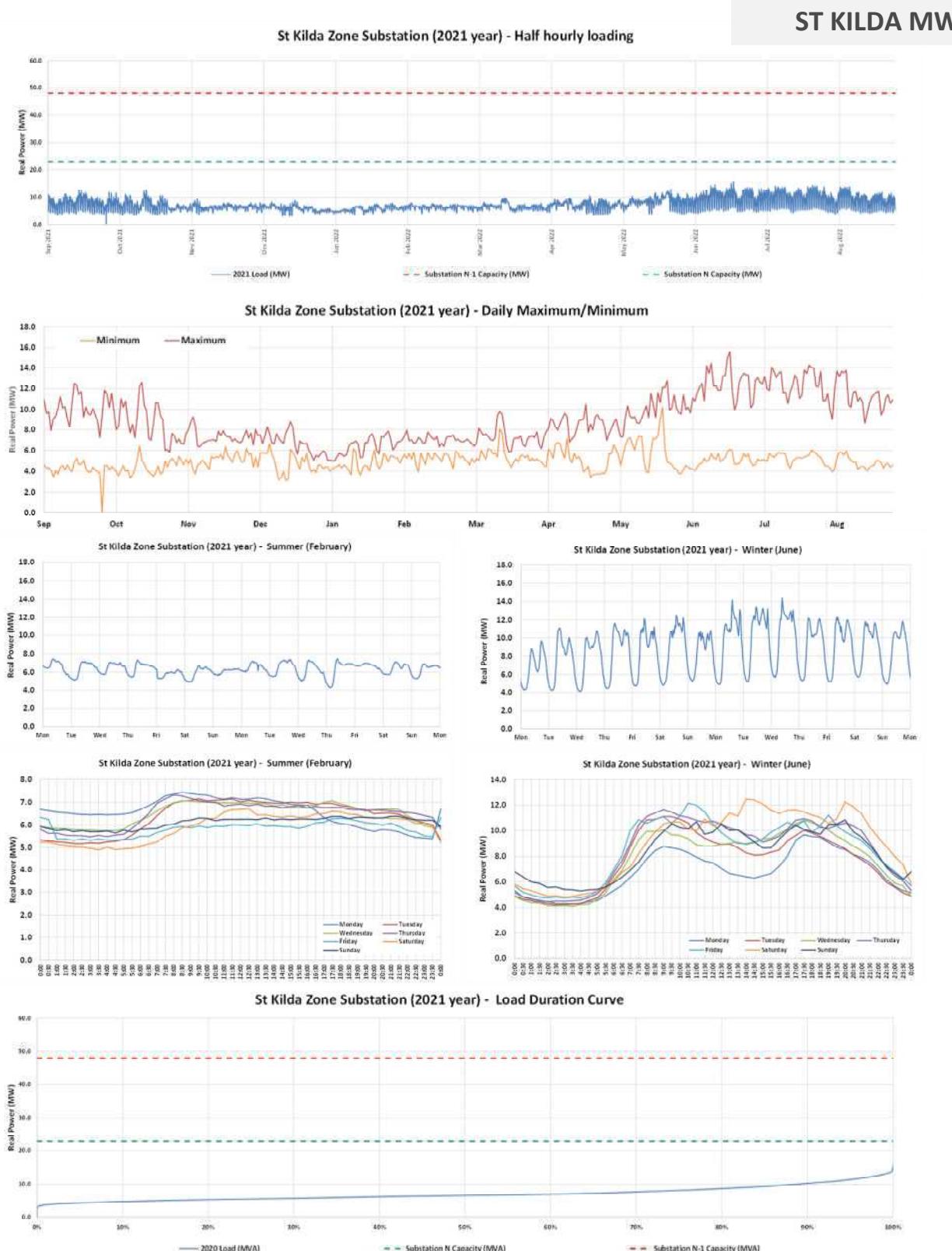


Figure 66 St Kilda 33/11kV zone substation: Real power (MW) load characteristics

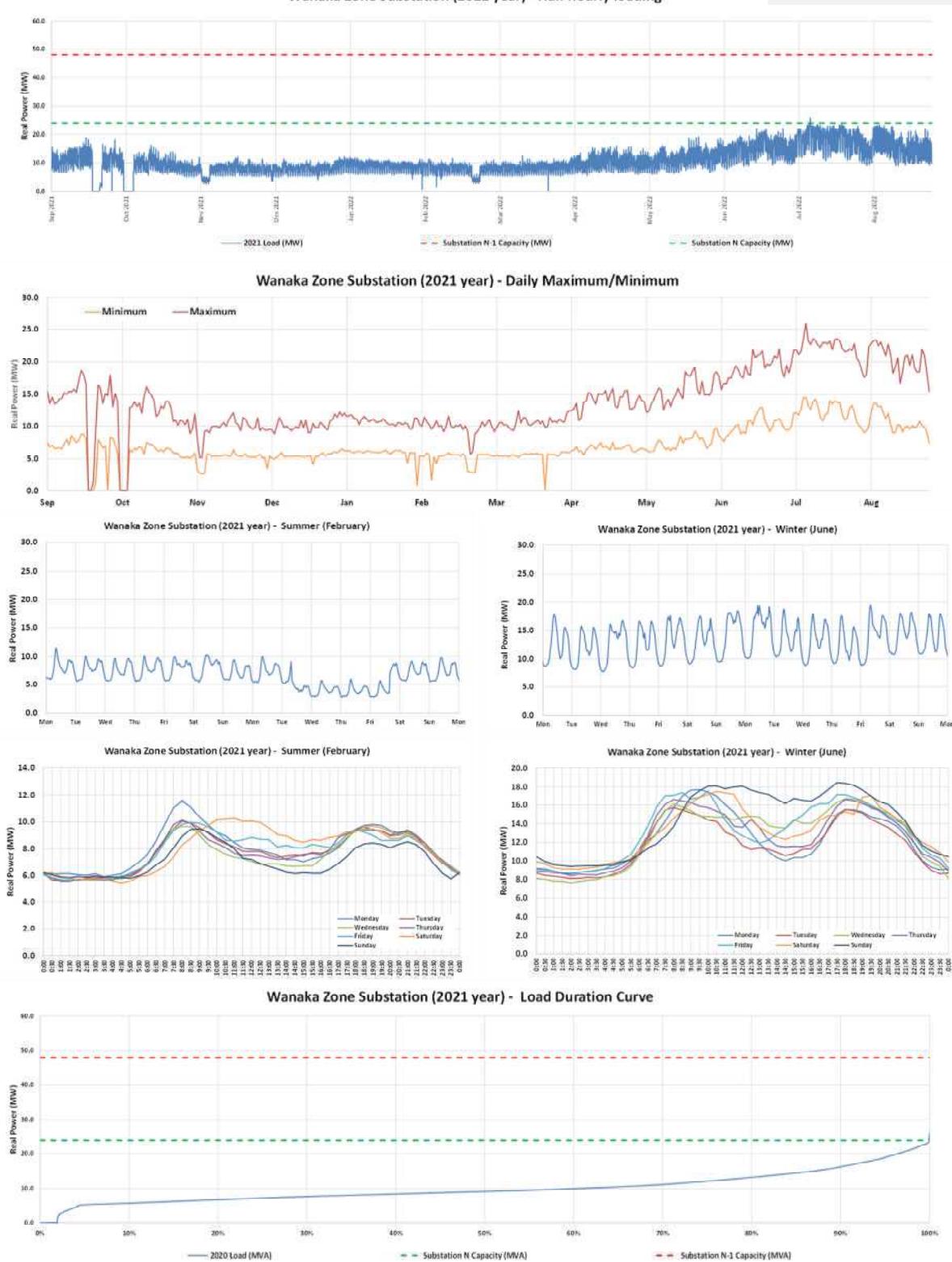
WANAKA MW


Figure 67 Wanaka 66/11kV zone substation: Real power (MW) load characteristics

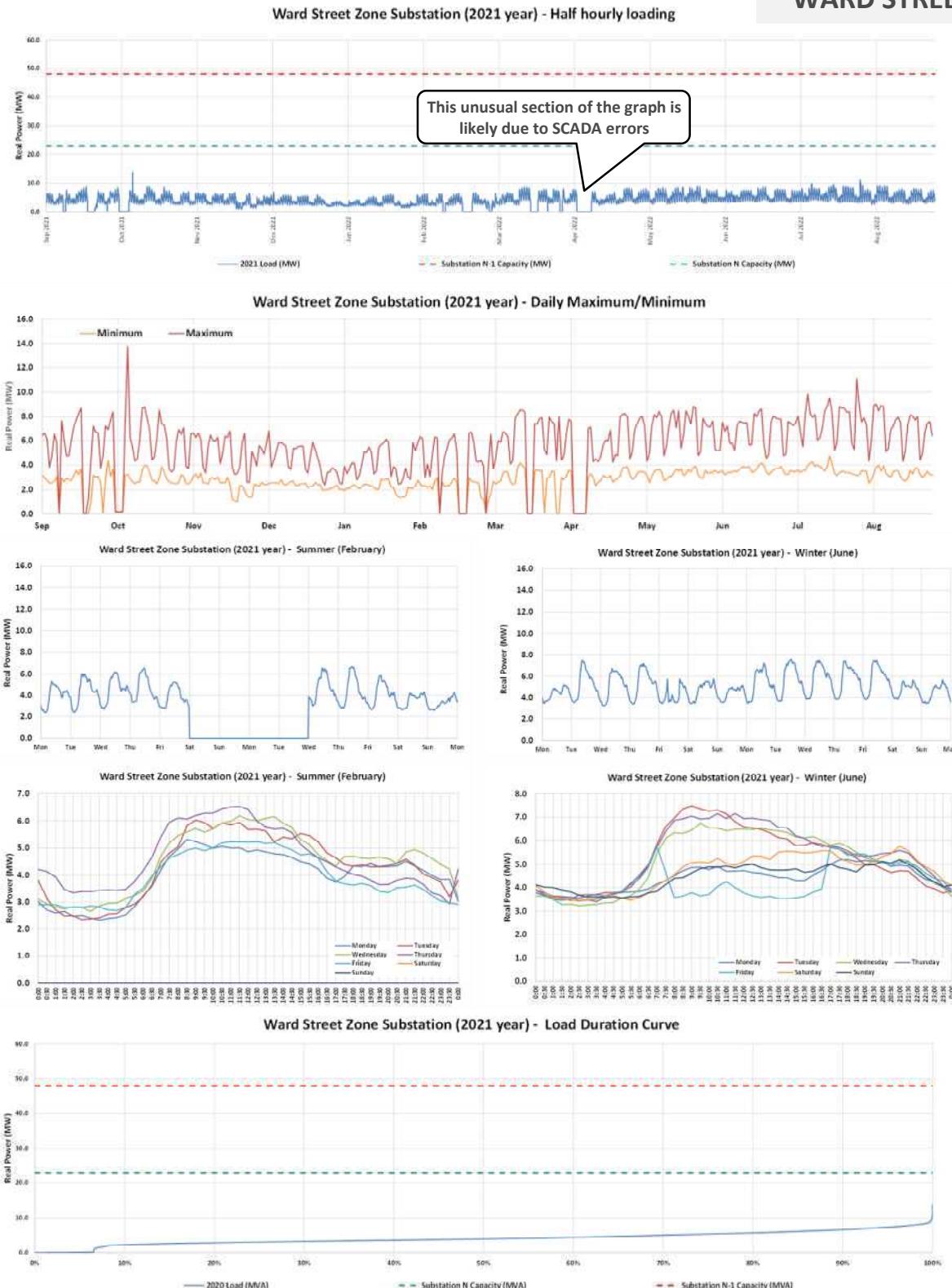
WARD STREET MW


Figure 68 Ward Street 33/11kV zone substation: Real power (MW) load characteristics

WILLOWBANK MW

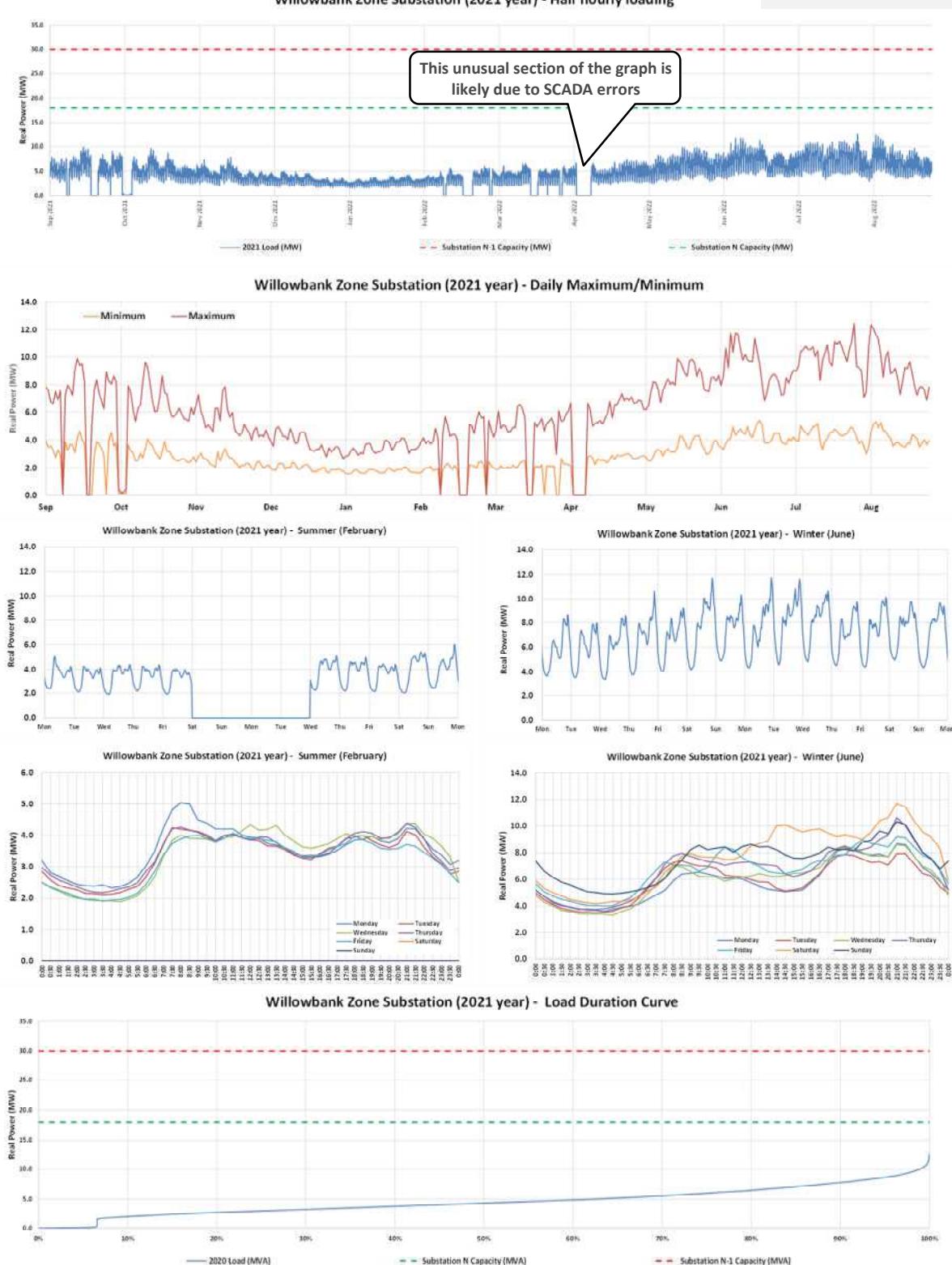


Figure 69 Willowbank 33/11kV zone substation: Real power (MW) load characteristics