



Northland Network

Supplementary Information - Substation Load Characteristics

EECA

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CONSULTING

Document history and status

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A	24-04-2023	Willem Rawlins	Kane Morison	Kane Morison	Draft
B	05-07-2023	Caitlin Bergervoet	Kane Morison	Kane Morison	Draft

Revision details

Revision	Details
A	Supplementary document created to reduce size of overall "spare capacity and load conversion opportunity report"
B	Added zone substation loadings

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1. Introduction

The following figures illustrate the characteristics of the major electrical substations (both GXPs and Zone Substations) in the Northland region. This document supplements the main report titled “Northland – Spare Capacity and Load Characteristics”.

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

- **Kaikohe GXP**
 - Figure 1 Kaikohe: Apparent power (MVA) load characteristics
 - Figure 2 Kaikohe: Reactive power (MVA_r) load characteristics
- **Kaitaia transmission substation**
 - Figure 3 Kaitaia TX substation: Active power (MW) load characteristics
- **Maungatapere GXP**
 - Figure 4 Maungatapere GXP: Apparent power (MVA) load characteristics
 - Figure 5 Maungatapere: Reactive power (MVA_r) load characteristics
 -
- **Bream Bay GXP**
 - Figure 8 Bream Bay: Apparent power (MVA) load characteristics
 - Figure 9 Bream Bay: Reactive power (MVA_r) load characteristics
- **Maungaturoto GXP**
 - Figure 10 Maungaturoto: Apparent power (MVA) load characteristics
 - Figure 11 Maungaturoto: Reactive power (MVA_r) load characteristics

KAIKOHE MVA

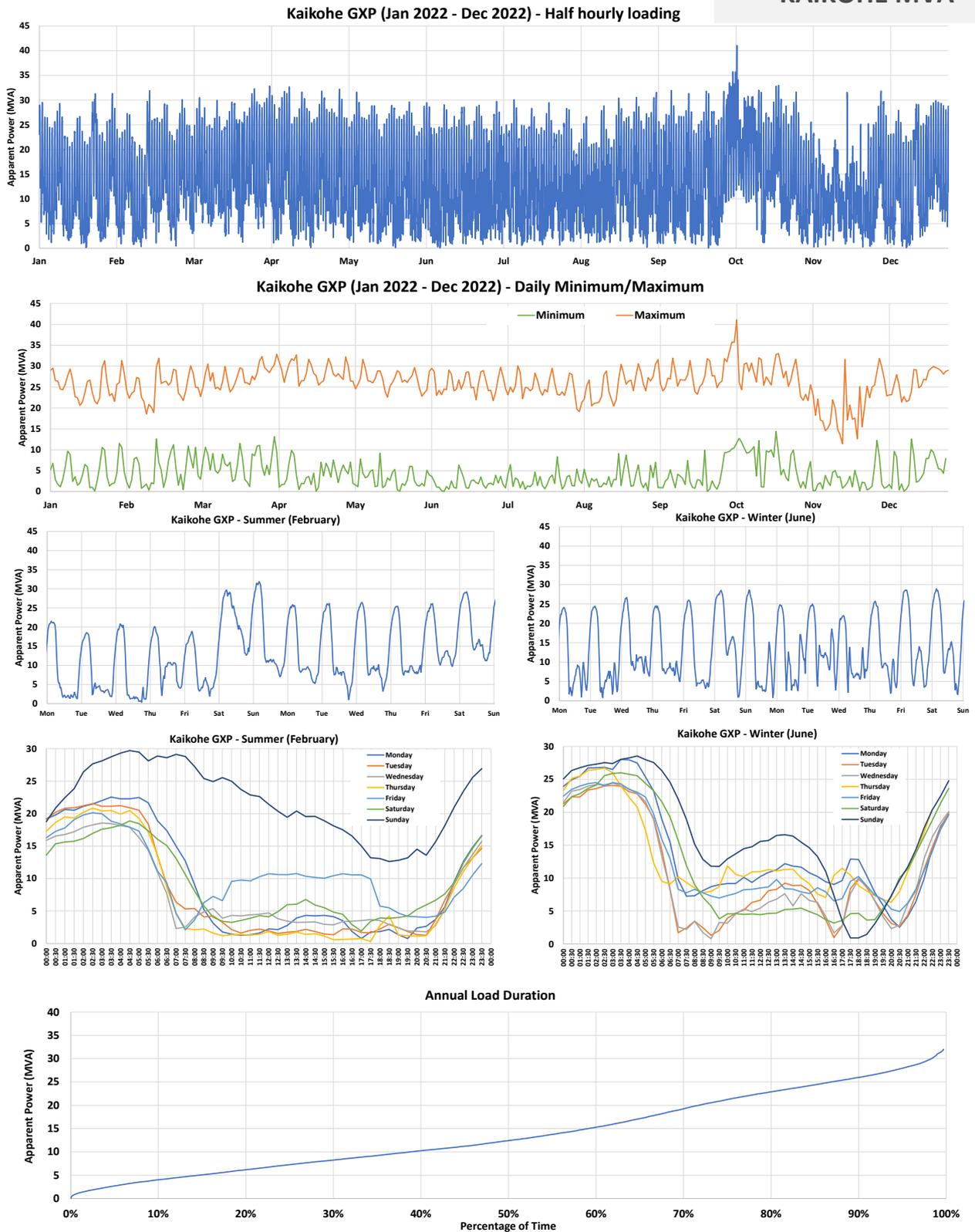


Figure 1 Kaikohe: Apparent power (MVA) load characteristics

KAIKOHE MVar

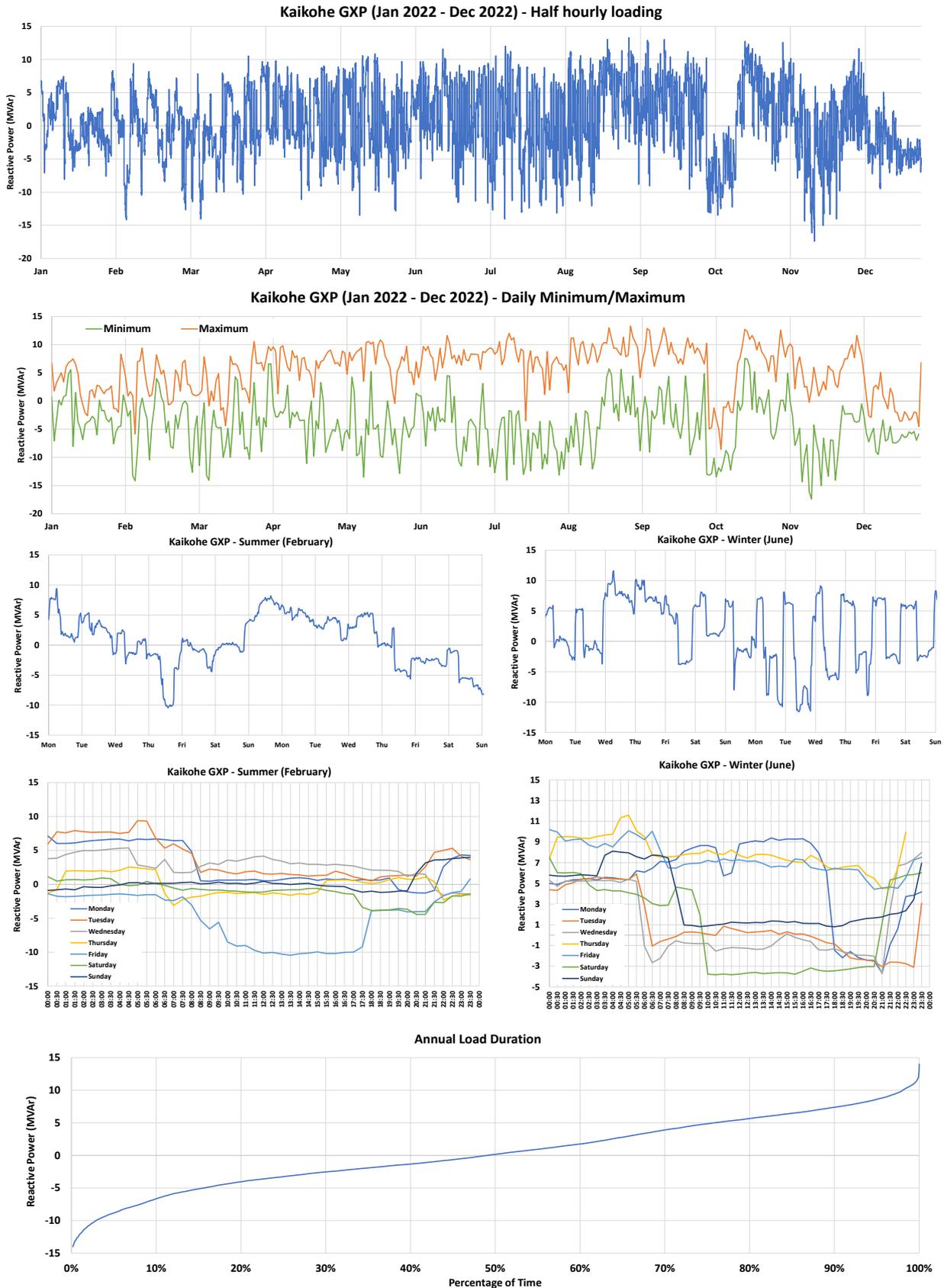


Figure 2 Kaikohe: Reactive power (MVar) load characteristics

KAITAIA MW

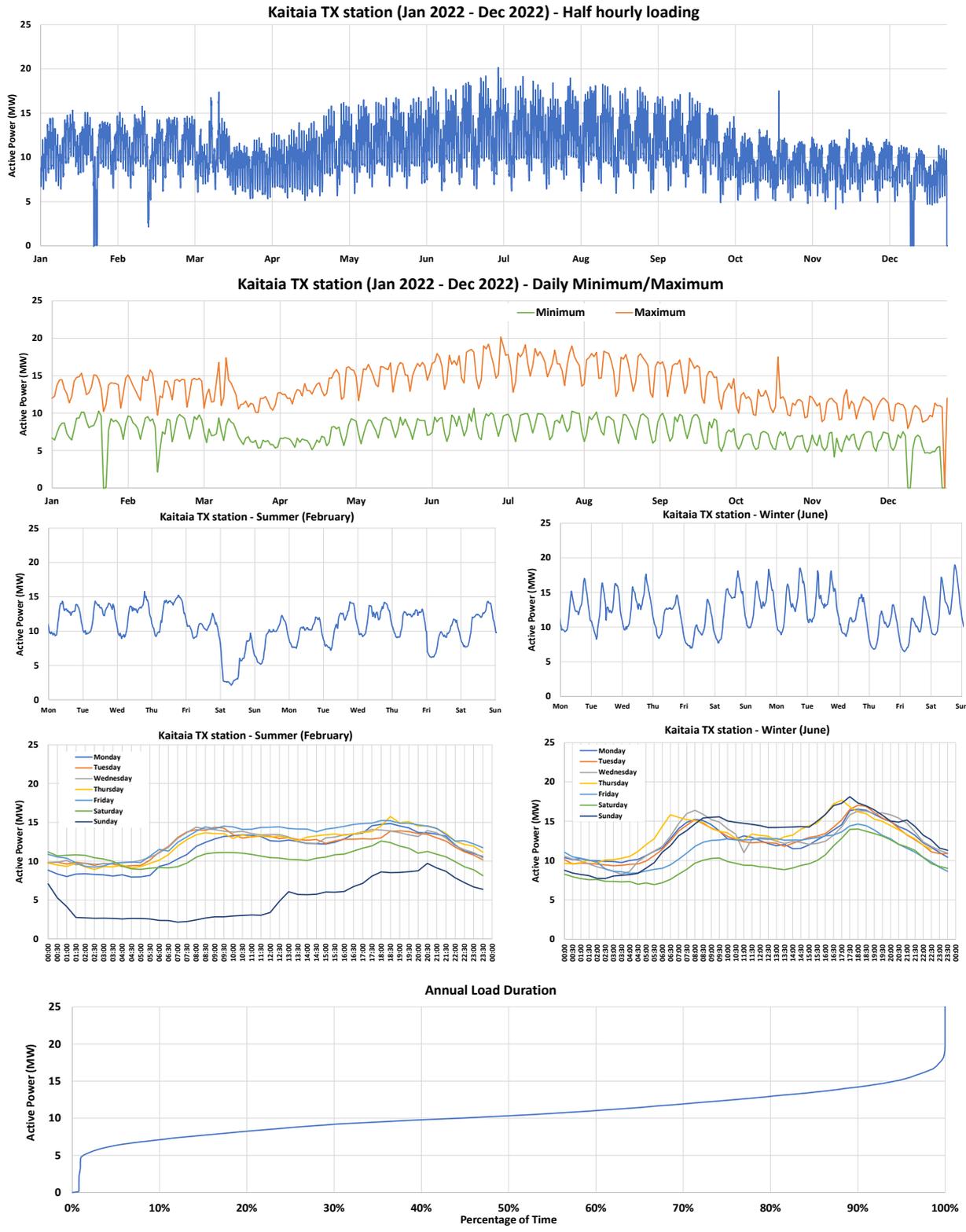


Figure 3 Kaitaia TX substation: Active power (MW) load characteristics

MAUNGATAPERE GXP MVA

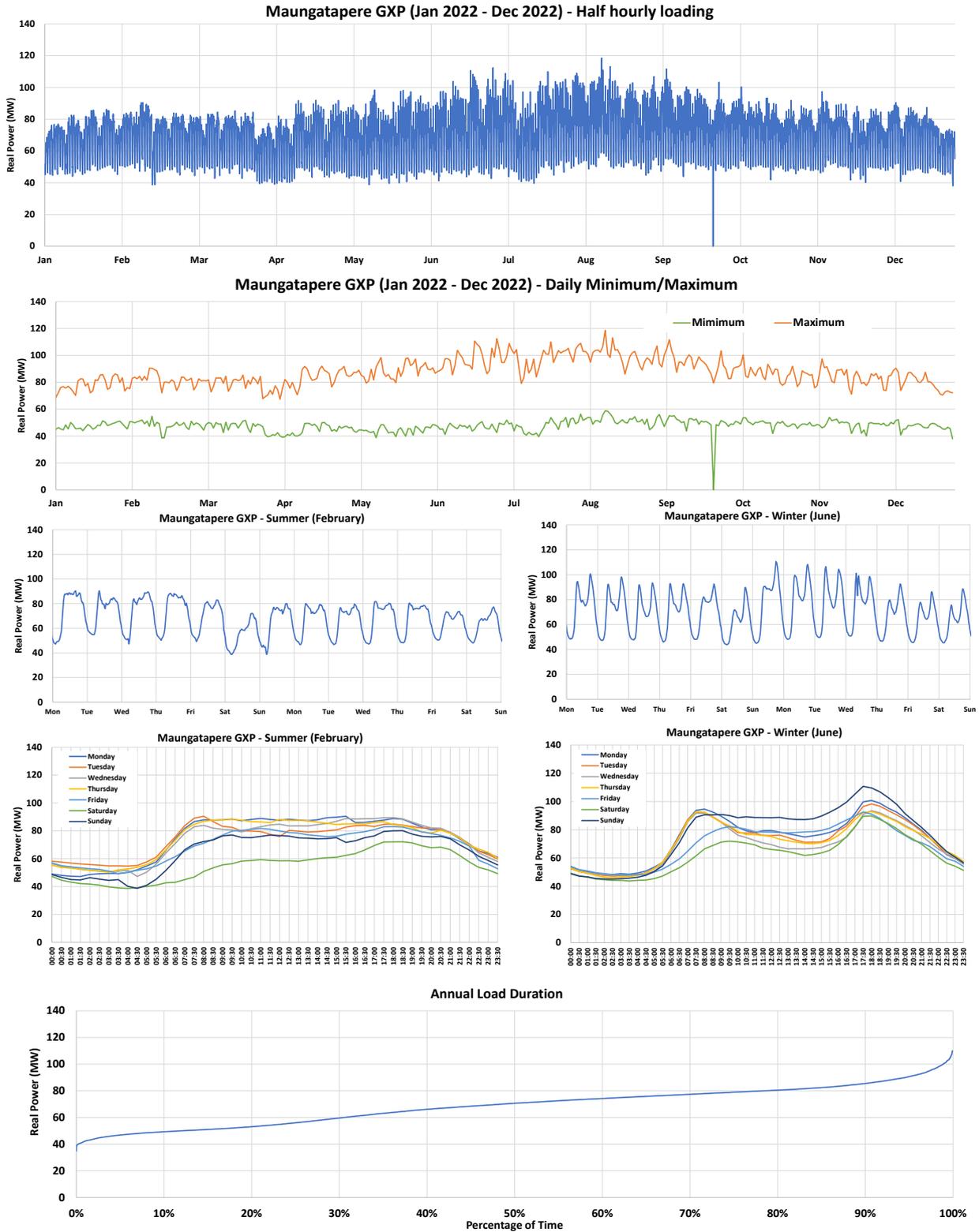


Figure 4 Maungatapere GXP: Apparent power (MVA) load characteristics

MAUNGATAPERE MVAR

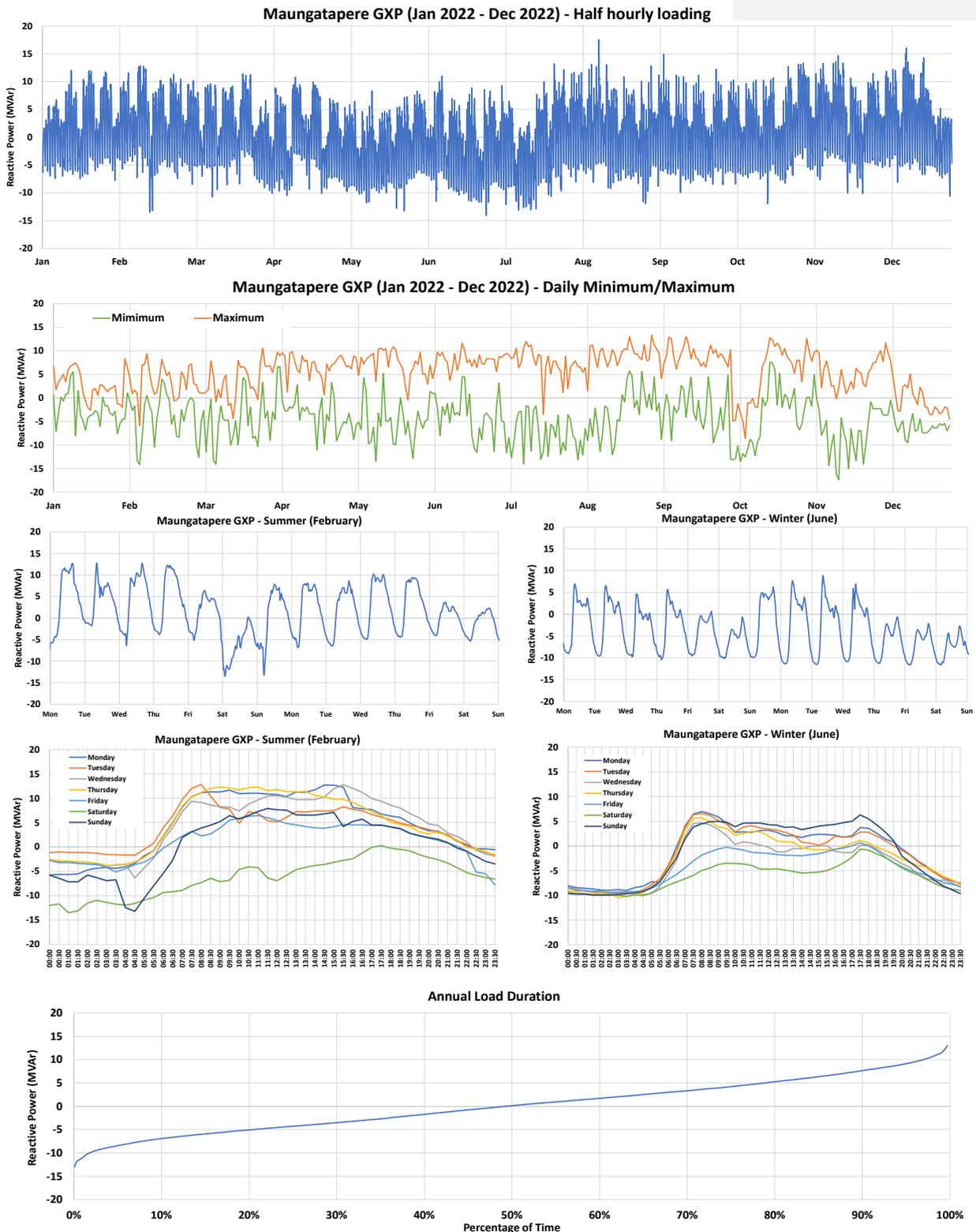


Figure 5 Maungatapere: Reactive power (MVAR) load characteristics

MAUNGATAPERE 33kV MW

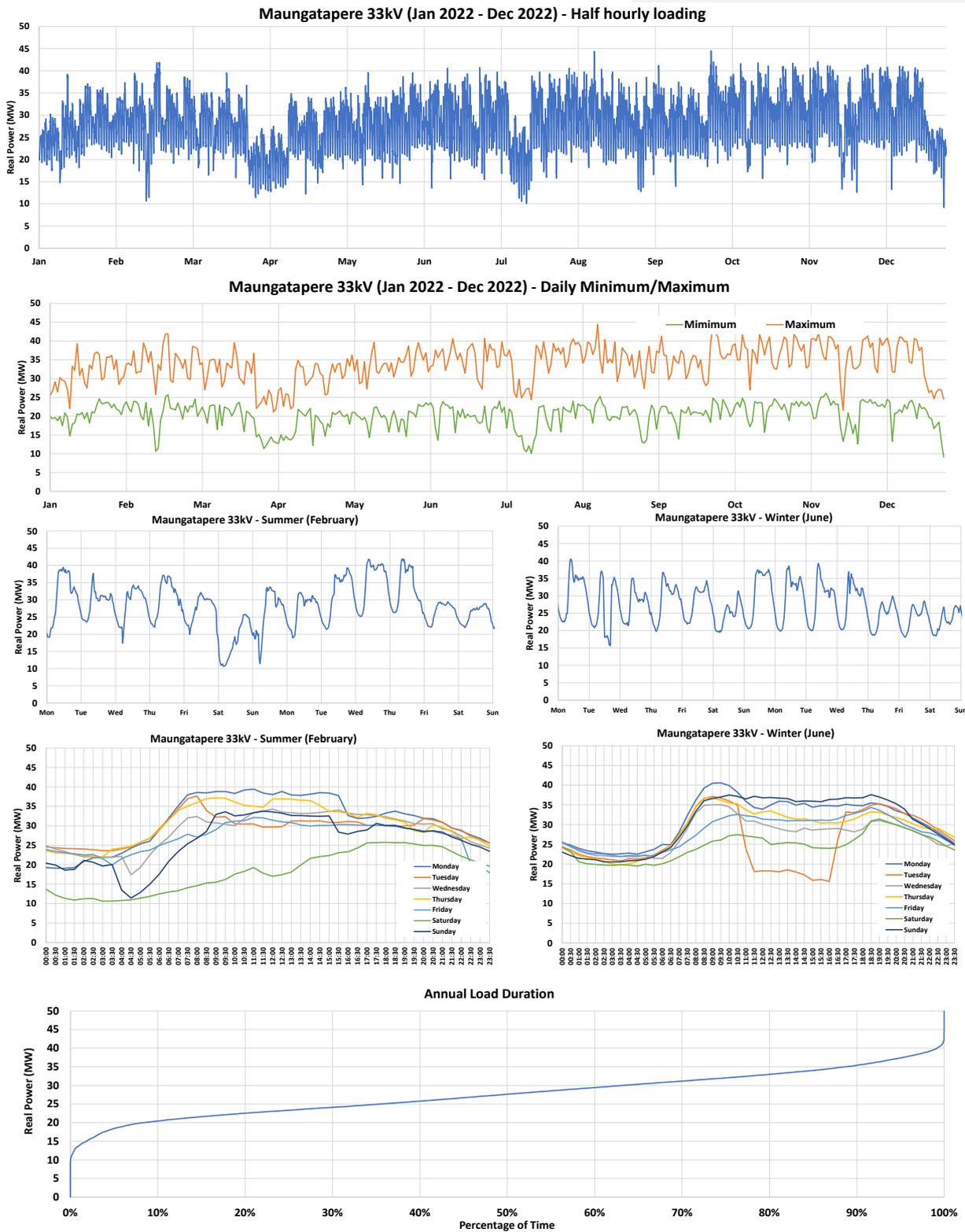


Figure 6 Maungatapere 33 kV: Real power (MW) load characteristics.

MAUNGATAPERE 50kV MW

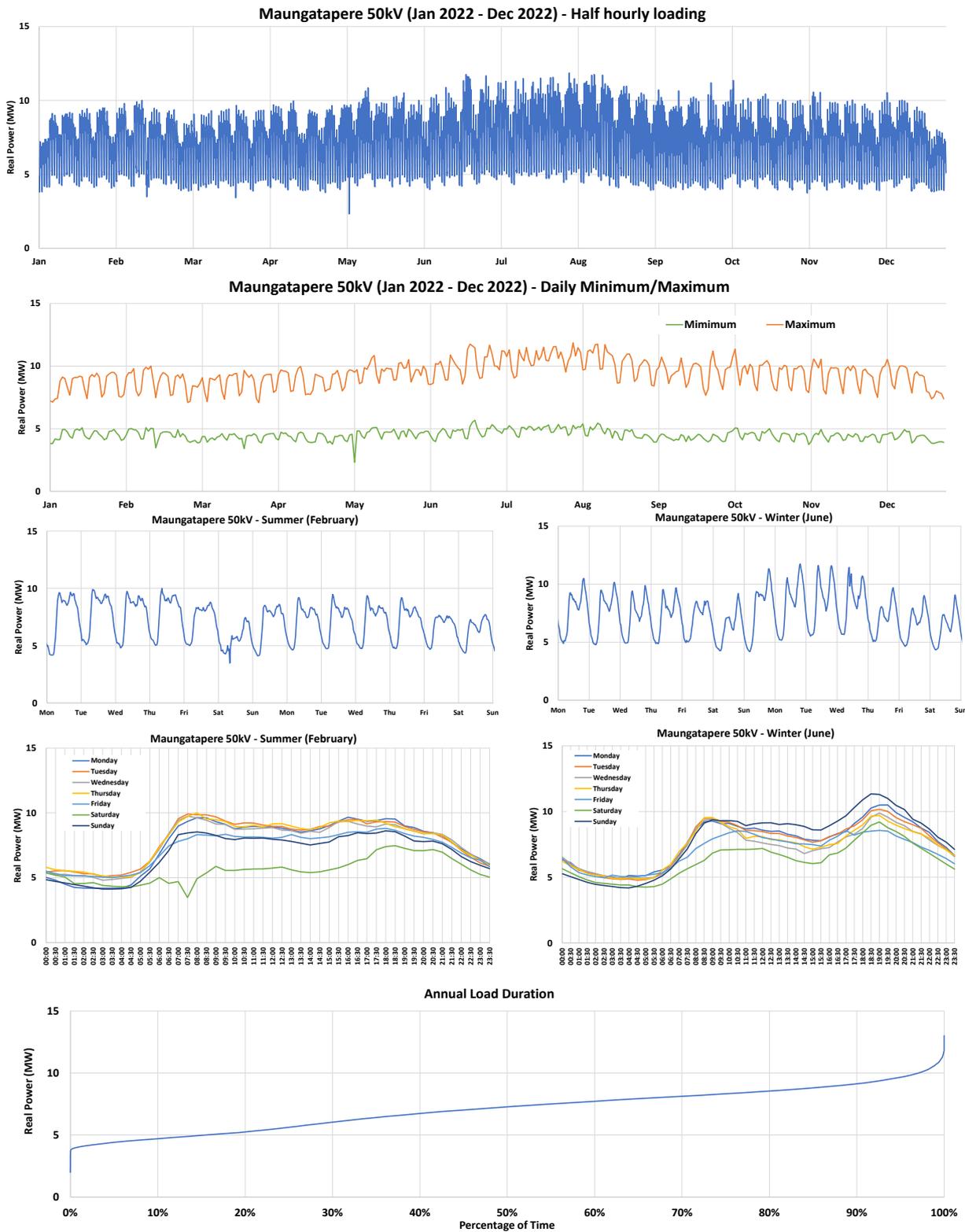


Figure 7 Maungatapere 50 kV: Real power (MW) load characteristics.

BREAM BAY MVA

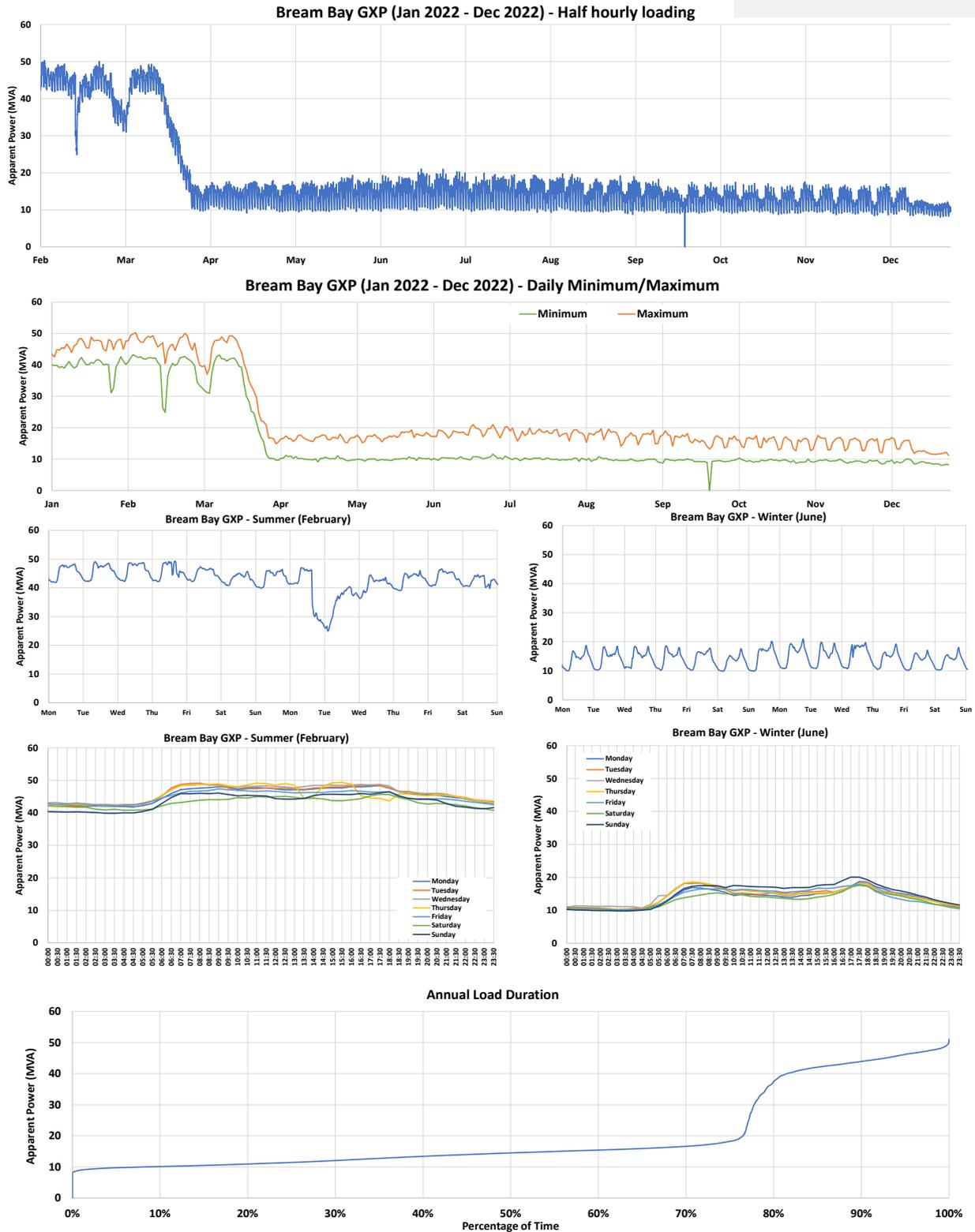


Figure 8 Bream Bay: Apparent power (MVA) load characteristics

BREAM BAY MVAR

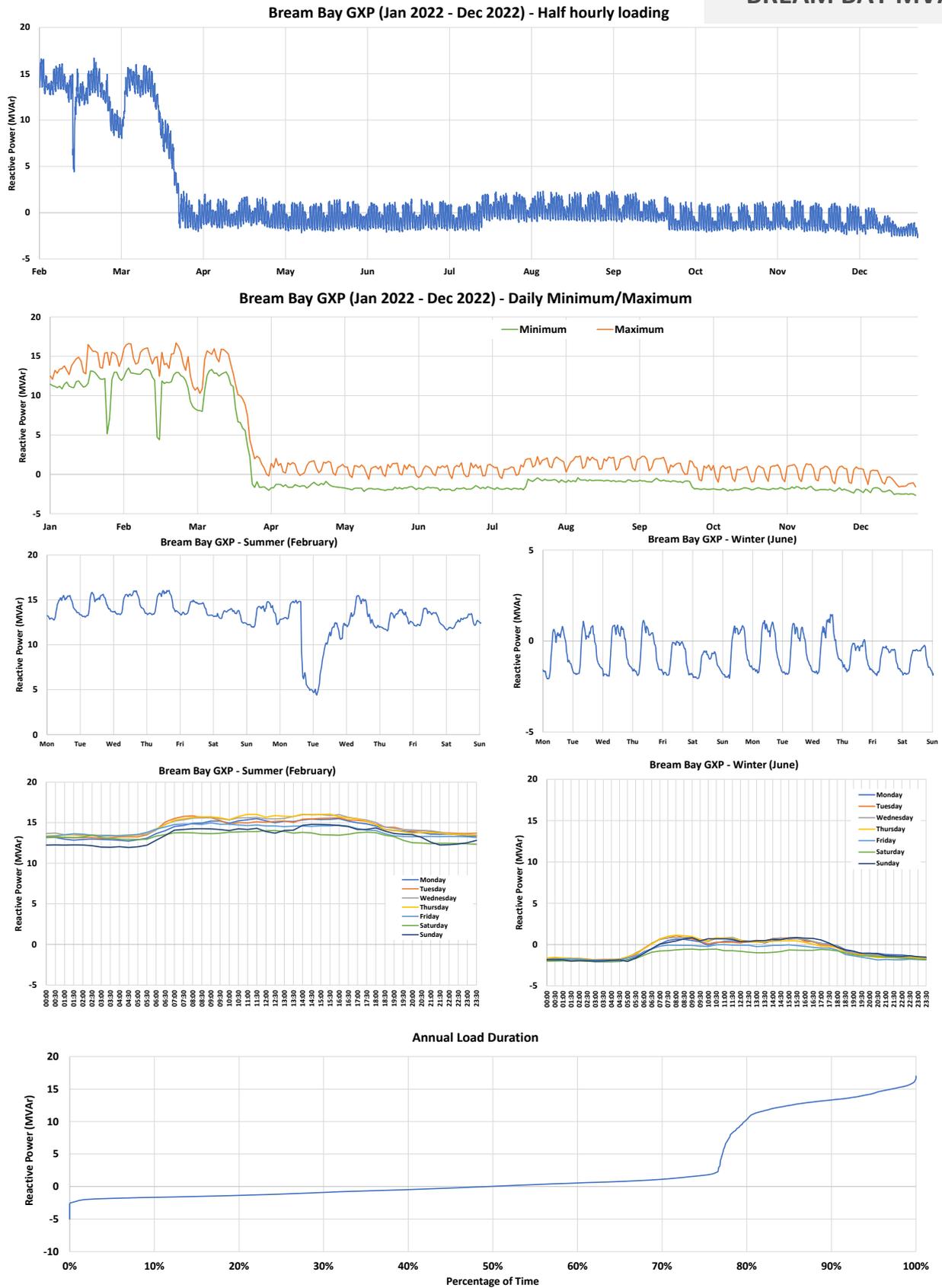


Figure 9 Bream Bay: Reactive power (MVAR) load characteristics

MAUNGATUROTO MVA

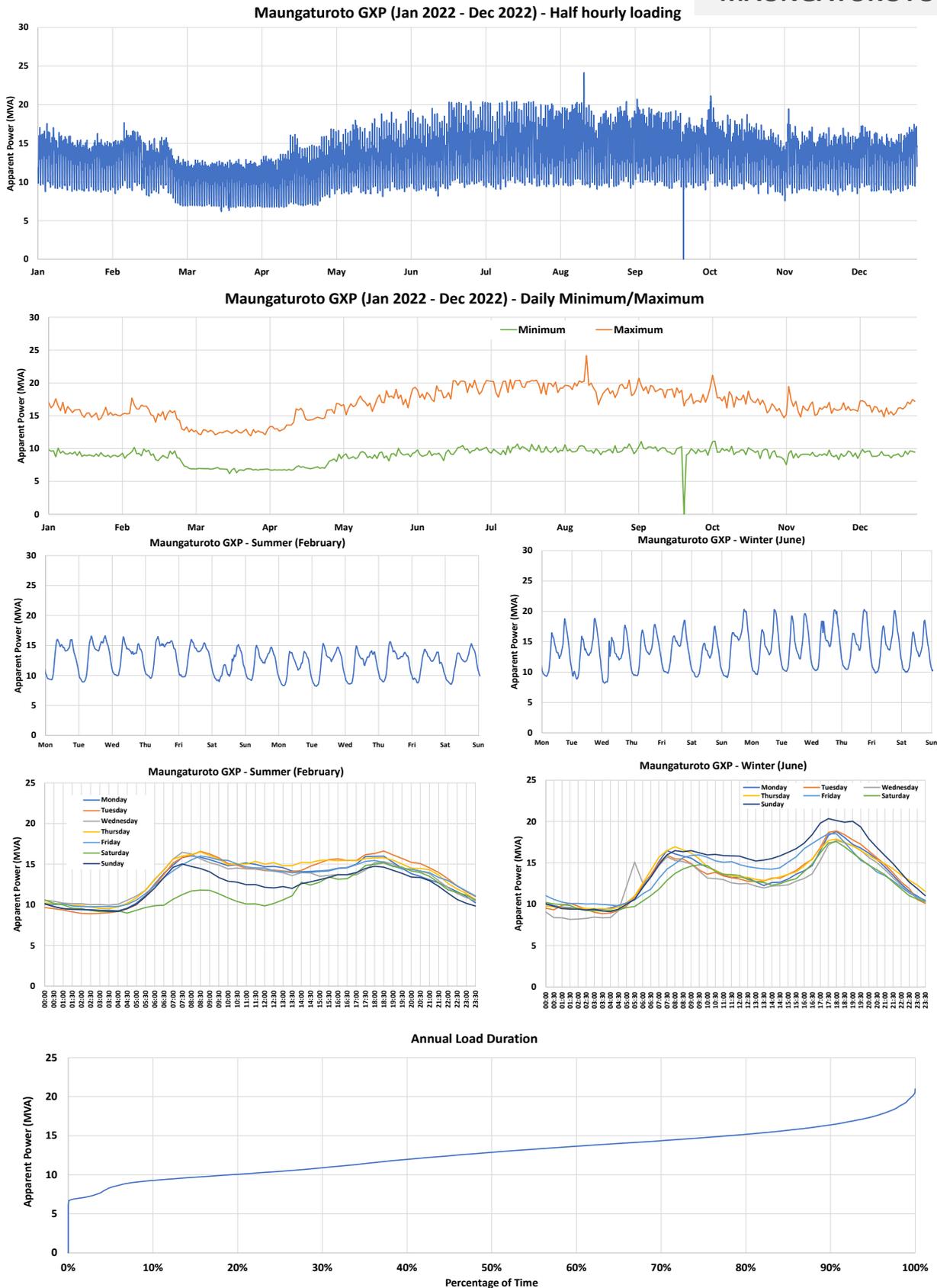


Figure 10 Maungaturoto: Apparent power (MVA) load characteristics

MAUNGATUROTO MVAR

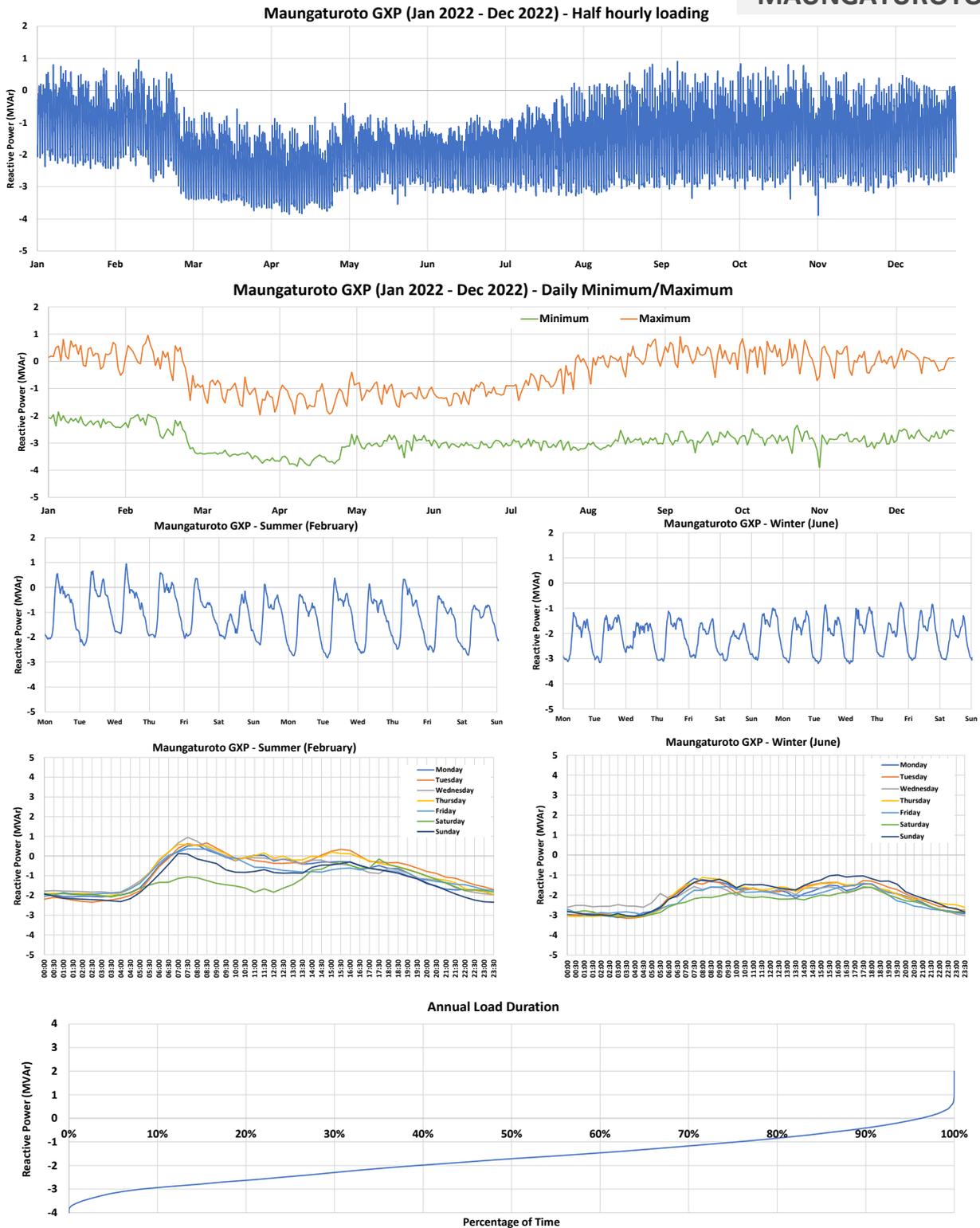


Figure 11 Maungaturoto: Reactive power (MVAR) load characteristics

KENSINGTON MW

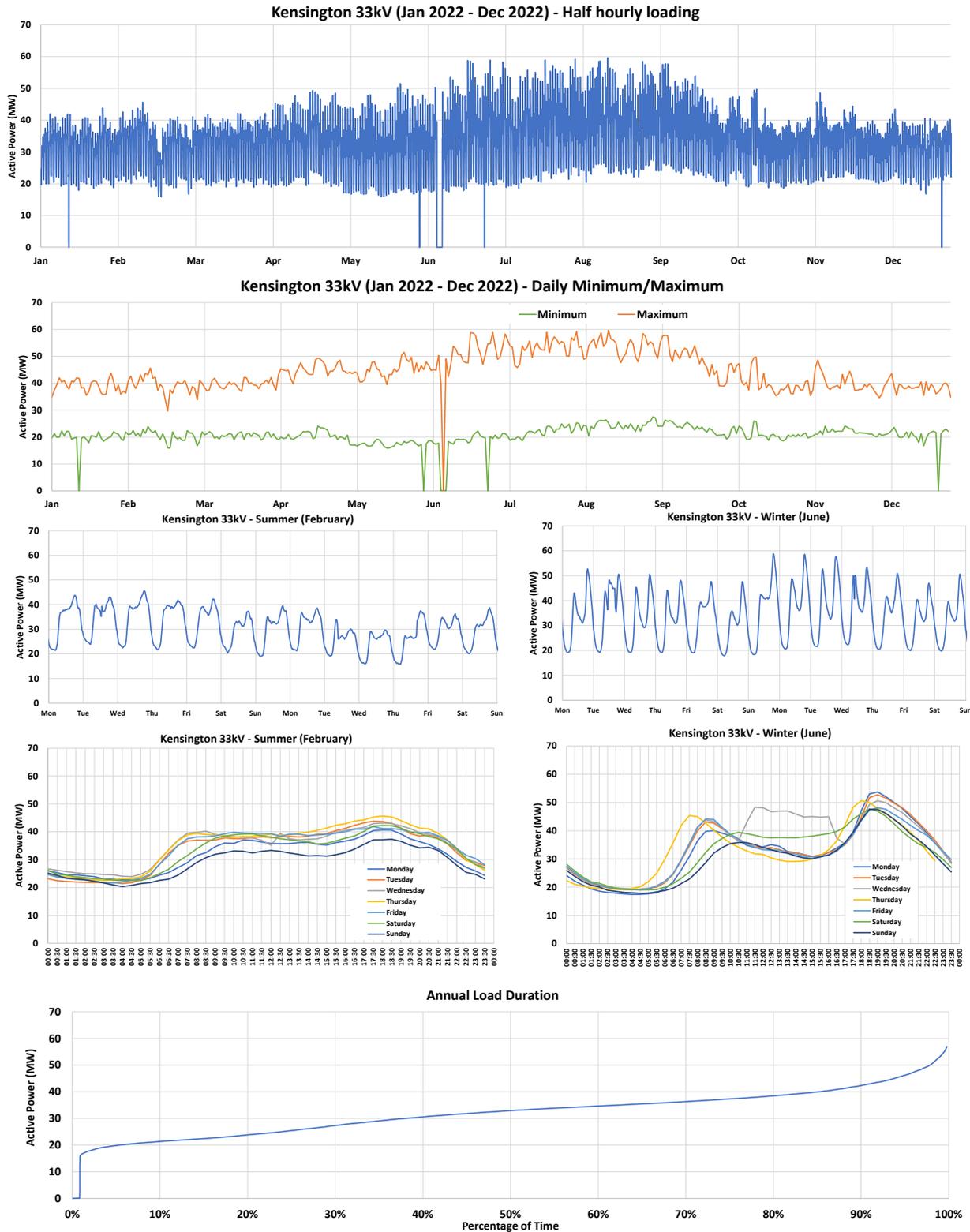


Figure 12 Kensington: Active power (MW) load characteristics

3. Zone Substations

3.1 Top Energy

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

- **Figure 131313** Kaikohe 33/11kV zone substation: Real Apparent power (MVAMW) load characteristics
- **Figure 141414** Kawakawa 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics
- **Figure 151515** Moerewa 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics
- **Figure 161616** Waipapa 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics
- **Figure 171717** OmanaiaHyde 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics
- **Figure 181818** HaruruLinnburn 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics
- **Figure 191919** Mt PokakaMerton 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics
- **Figure 202020** KerikeriMiddlemarch 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics
- **Figure 212121** KaeoOturehua 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics
- **Figure 222222** Okahu RdPaerau 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics
- **Figure 242424** NPLPatearoa 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics
- **Figure 252525** Pukenui 33/11kV zone substation: Apparent Real power (MVAMW) load characteristics

KAIKOHE MW

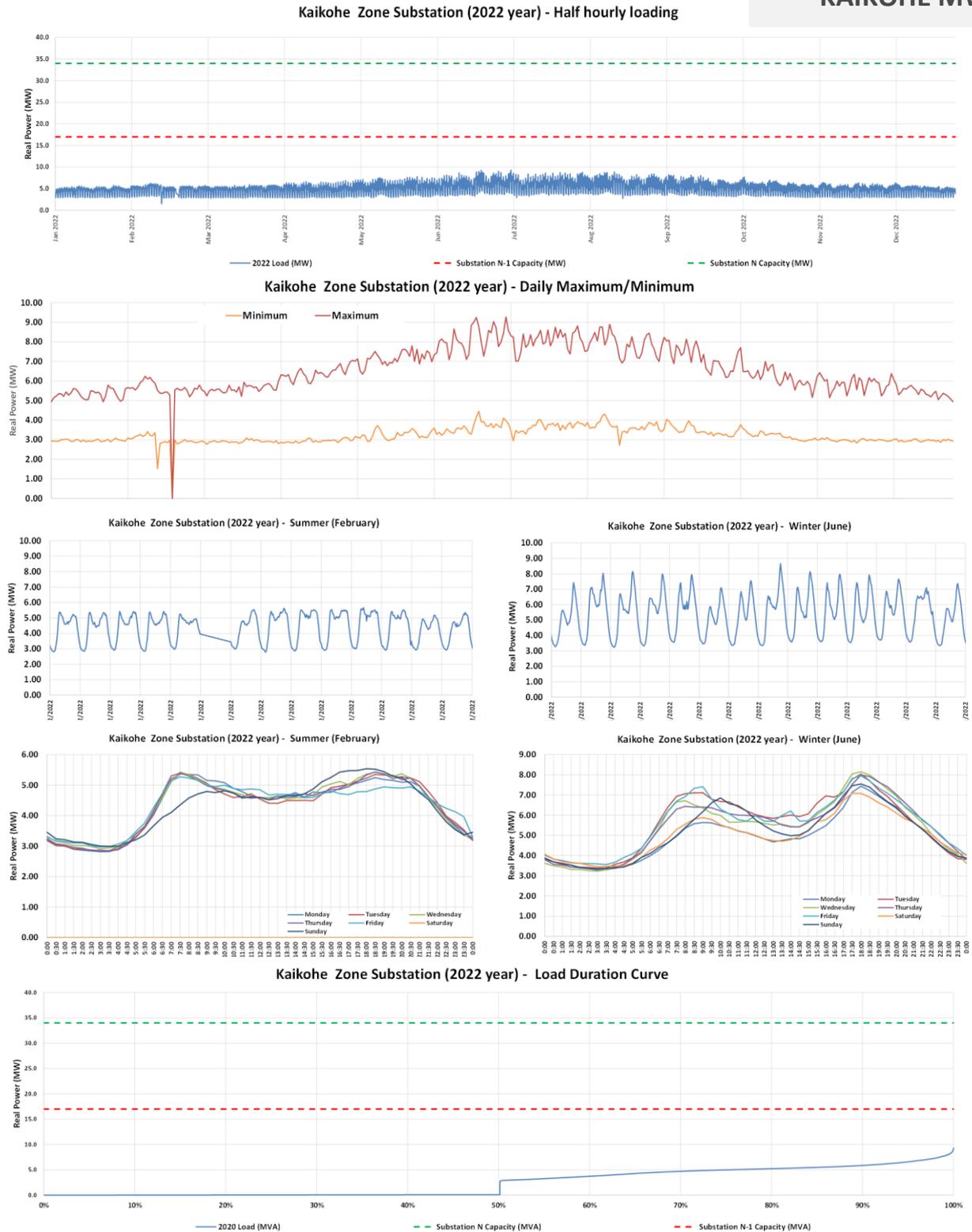


Figure 13 Kaikohe 33/11kV zone load substation: Real power (MW) load characteristics

KAWAKAWA MW

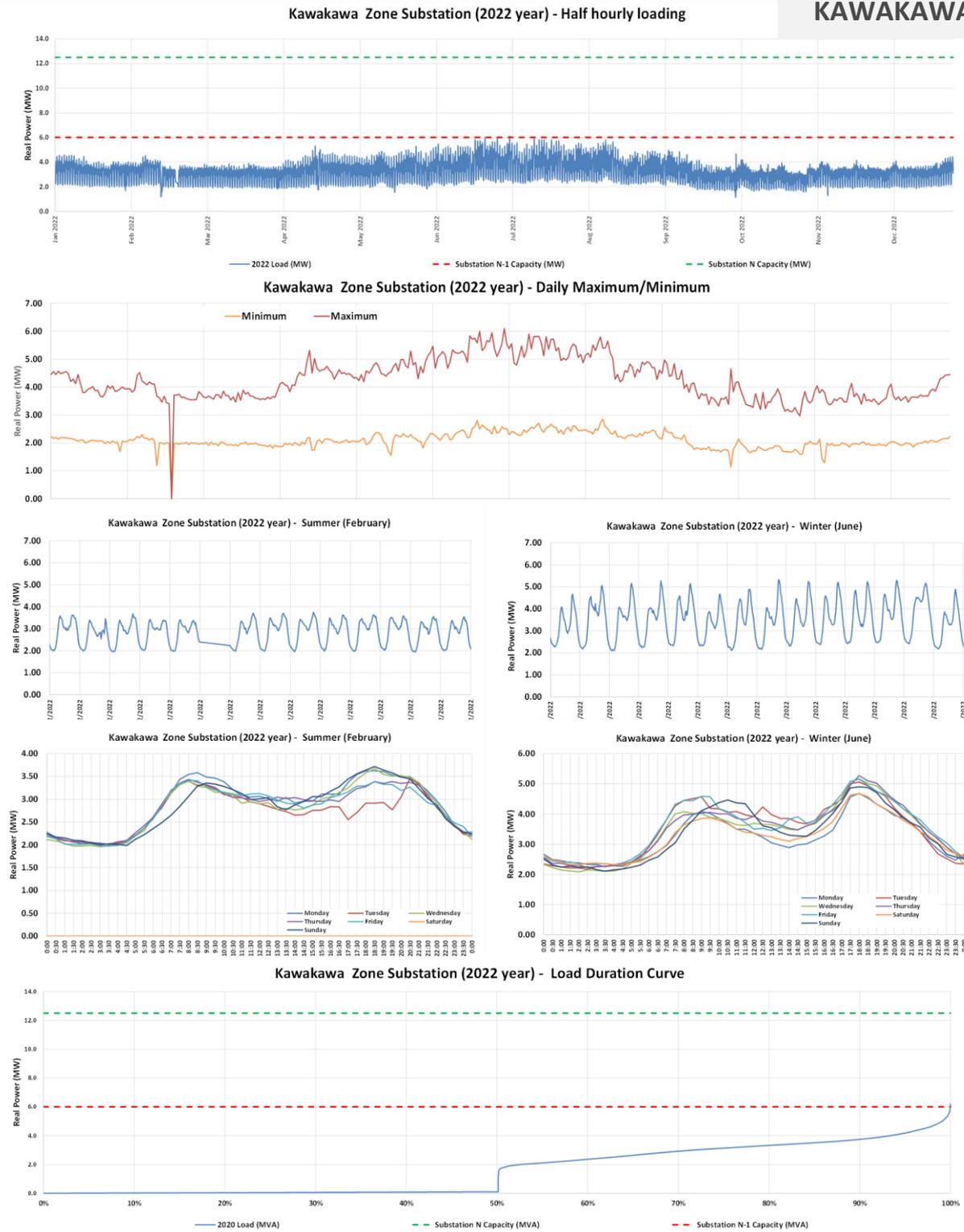
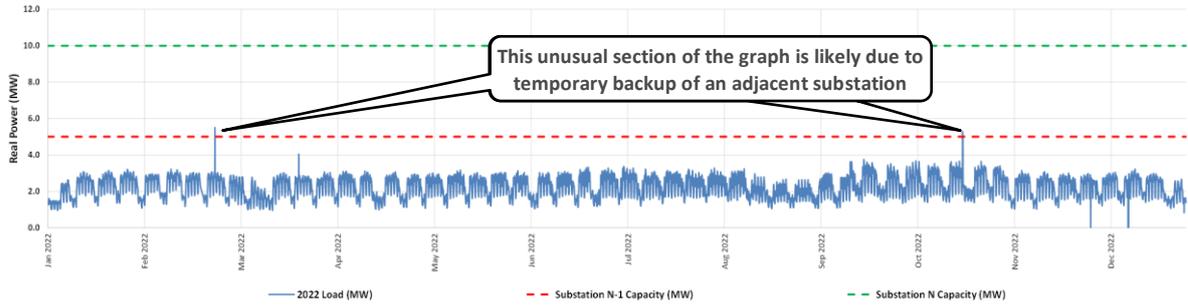


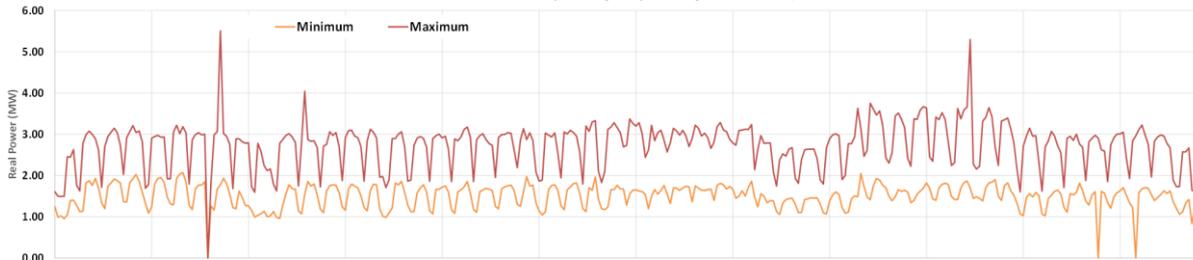
Figure 14 Kawakawa 33/11kV zone substation: Real power (MW) load characteristics

MOEREWĀ MW

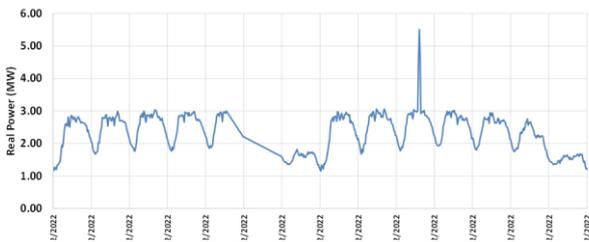
Moerewa Zone Substation (2022 year) - Half hourly loading



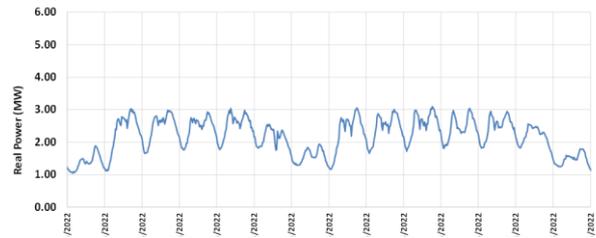
Moerewa Zone Substation (2022 year) - Daily Maximum/Minimum



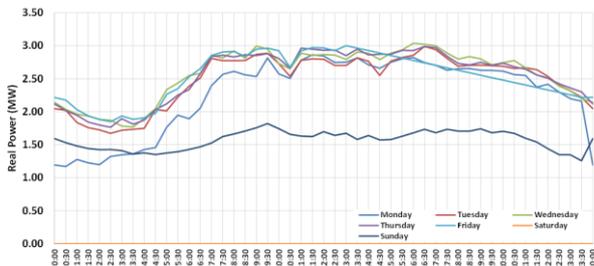
Moerewa Zone Substation (2022 year) - Summer (February)



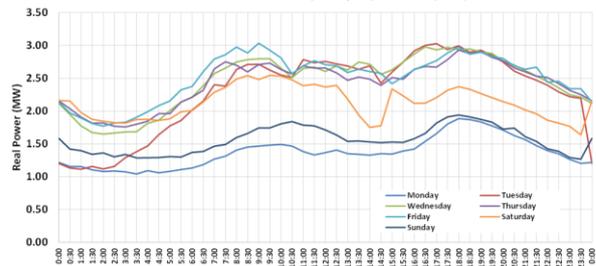
Moerewa Zone Substation (2022 year) - Winter (June)



Moerewa Zone Substation (2022 year) - Summer (February)



Moerewa Zone Substation (2022 year) - Winter (June)



Moerewa Zone Substation (2022 year) - Load Duration Curve

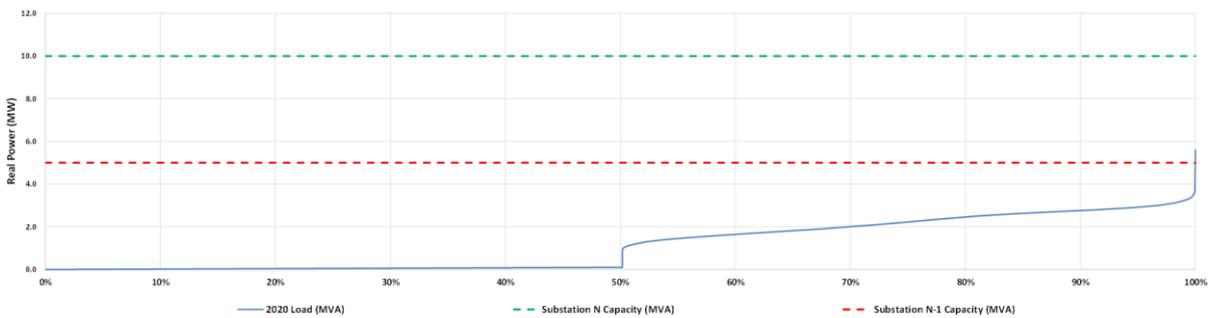


Figure 15 Moerewa 33/11kV zone substation: Real power (MW) load characteristics

WAIPAPA MW

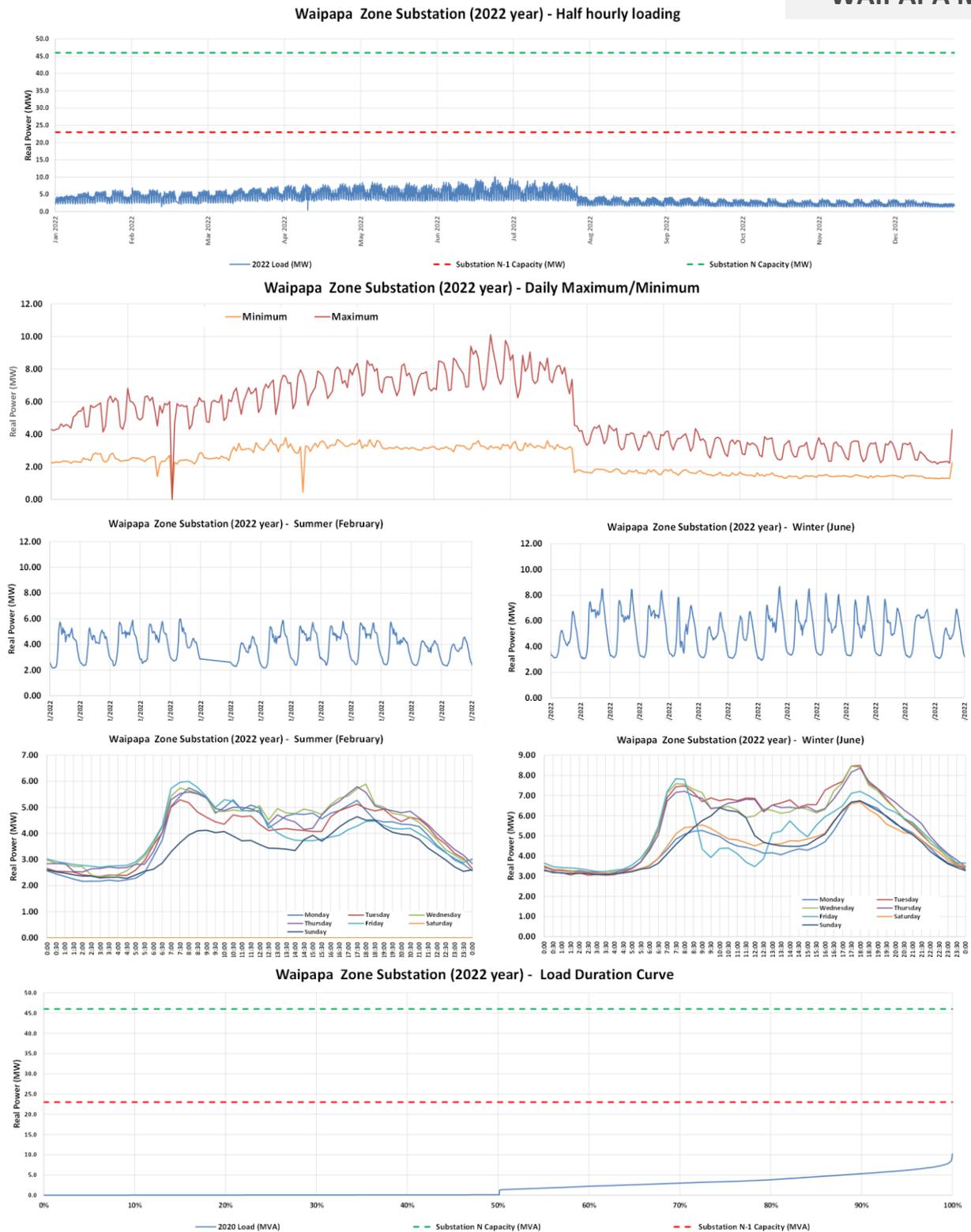


Figure 16 Waipapa 33/11kV zone substation: Real power (MW) load characteristics

OMANAIA MW

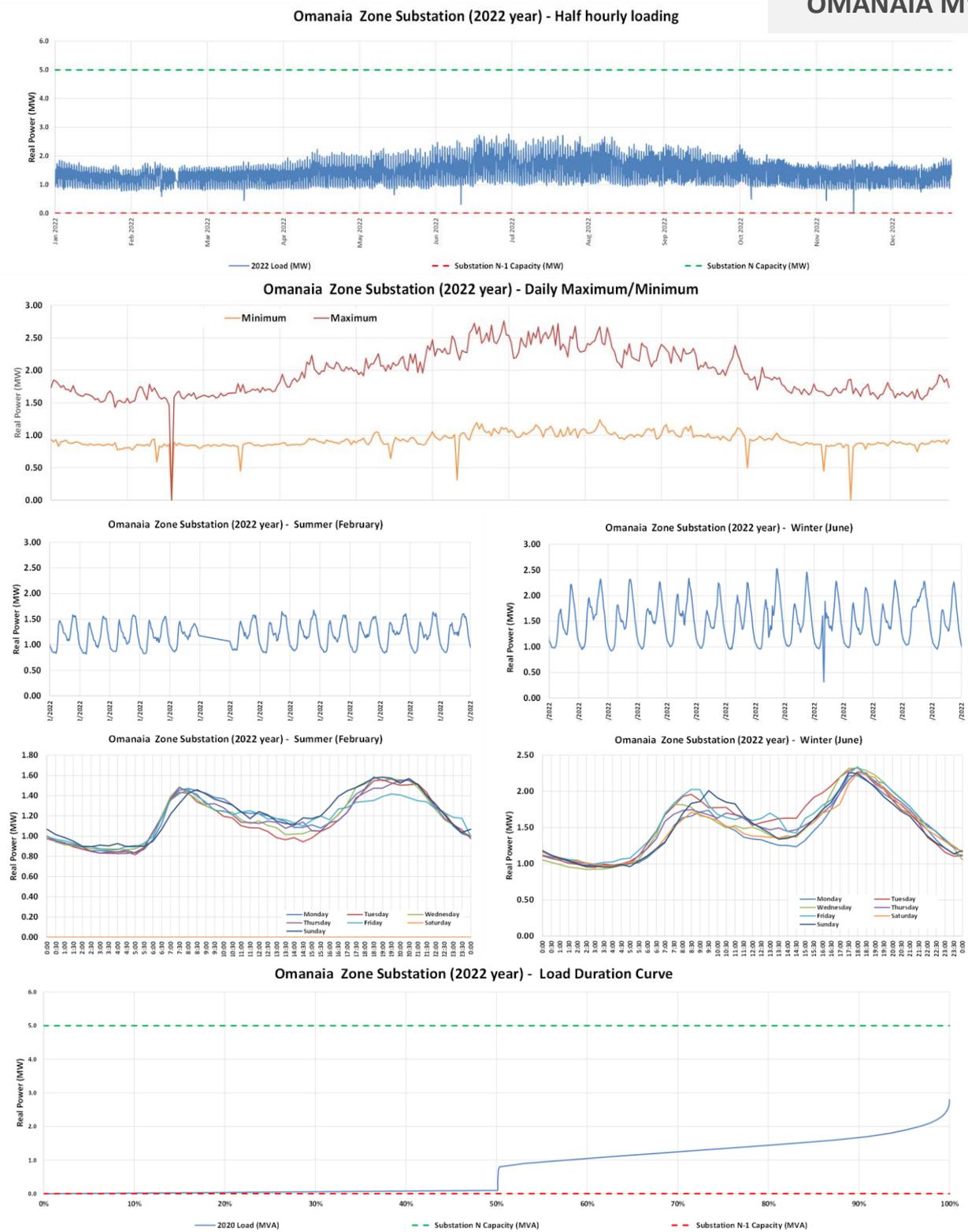


Figure 17 Omanaia 33/11kV zone substation: Real power (MW) load characteristics

HARURU MW

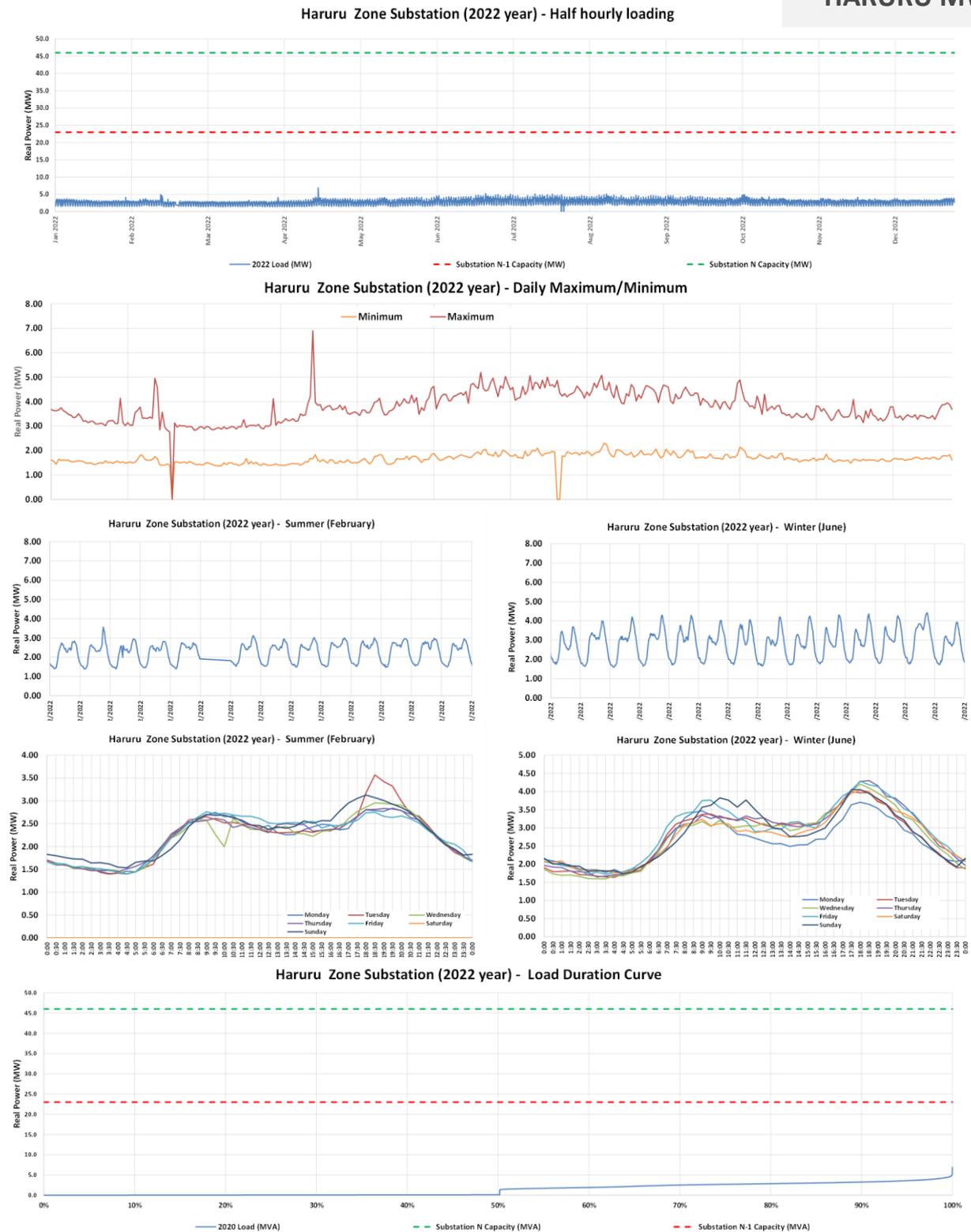
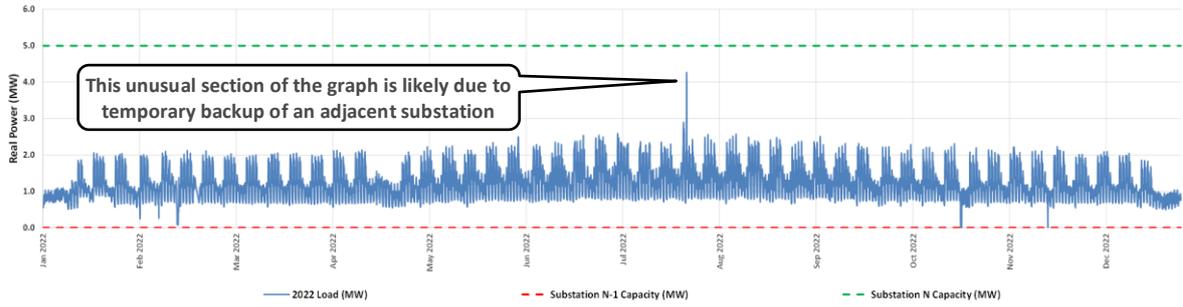


Figure 18 Haruru 33/11kV zone substation: Real power (MW) load characteristics

MT POKAKA MW

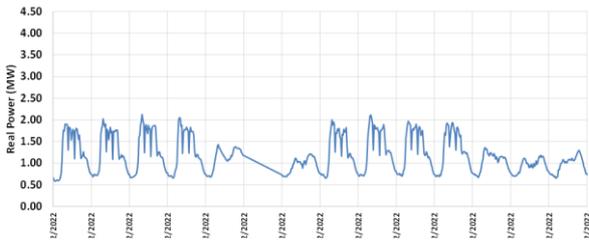
Mt Pokaka Zone Substation (2022 year) - Half hourly loading



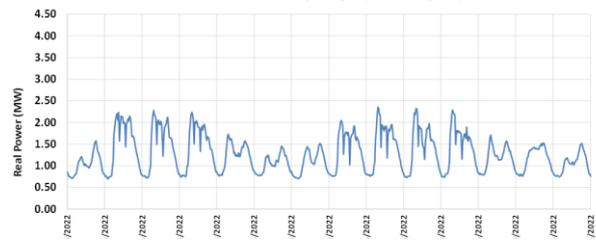
Mt Pokaka Zone Substation (2022 year) - Daily Maximum/Minimum



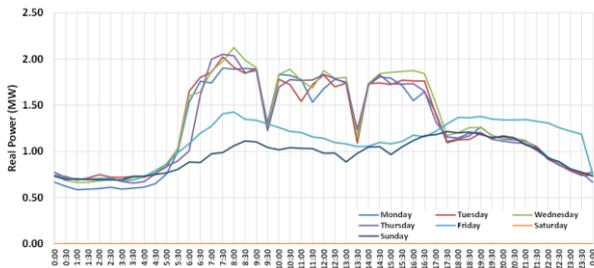
Mt Pokaka Zone Substation (2022 year) - Summer (February)



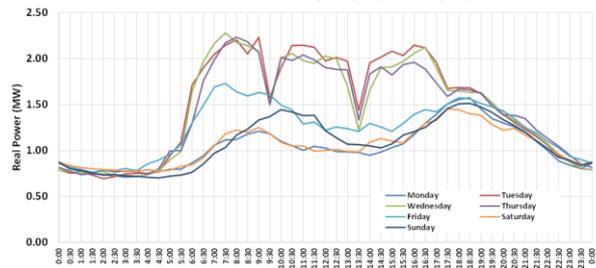
Mt Pokaka Zone Substation (2022 year) - Winter (June)



Mt Pokaka Zone Substation (2022 year) - Summer (February)



Mt Pokaka Zone Substation (2022 year) - Winter (June)



Mt Pokaka Zone Substation (2022 year) - Load Duration Curve

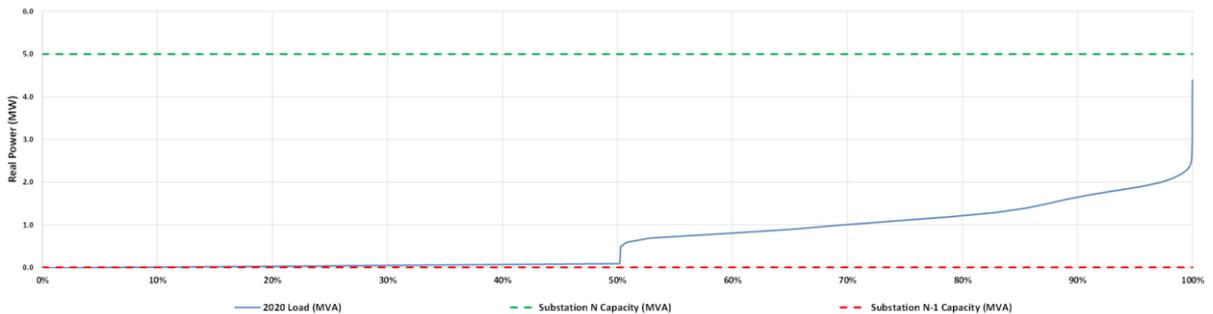


Figure 19 Mt Pokaka 33/11kV zone substation: Real power (MW) load characteristics

KERIKERI MW

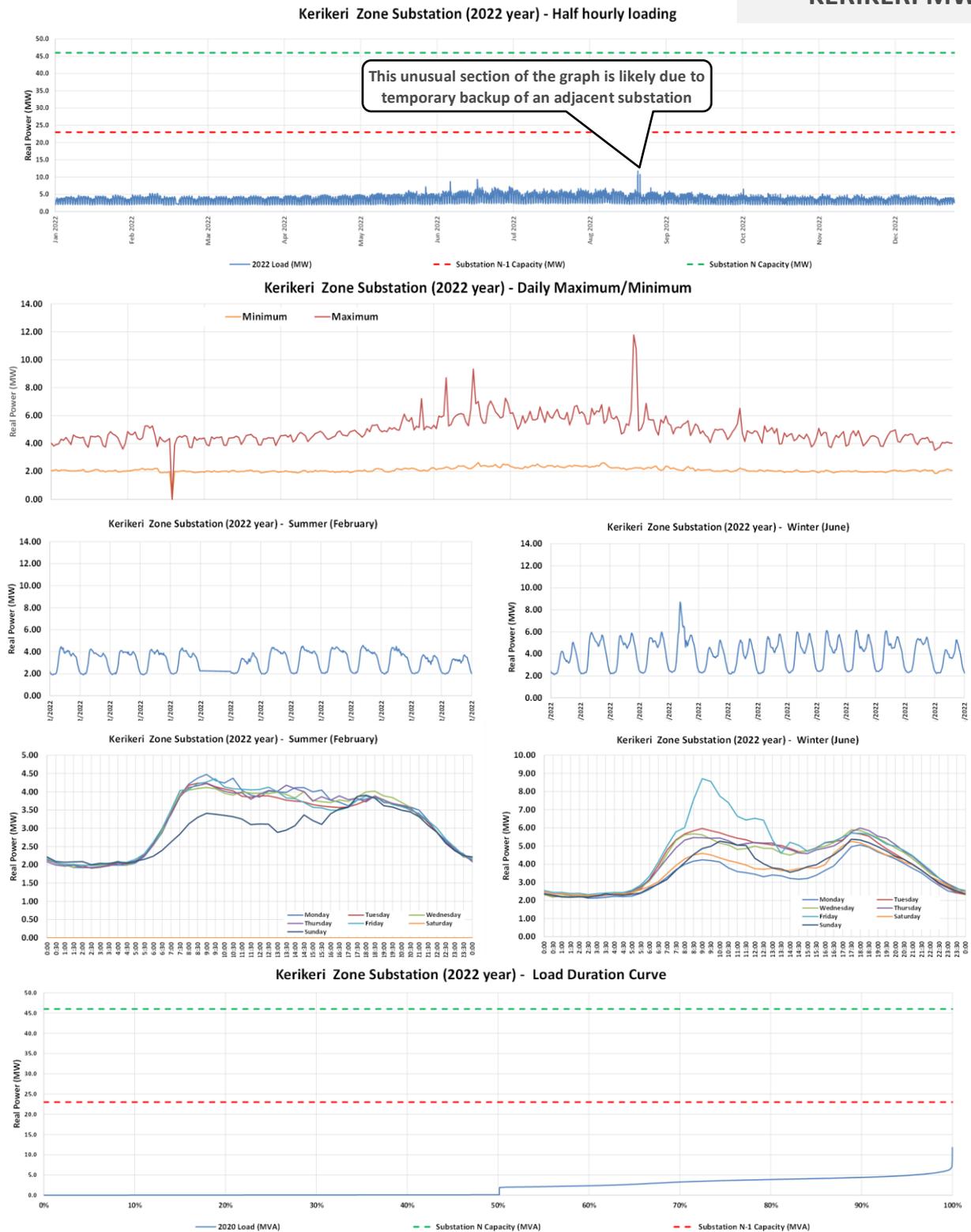
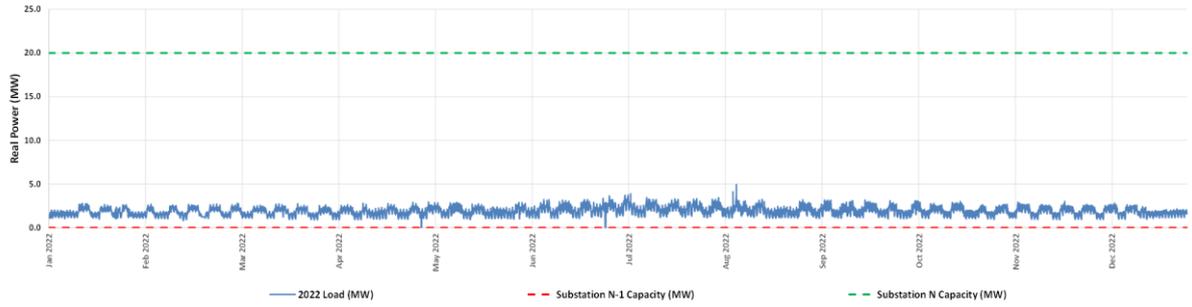
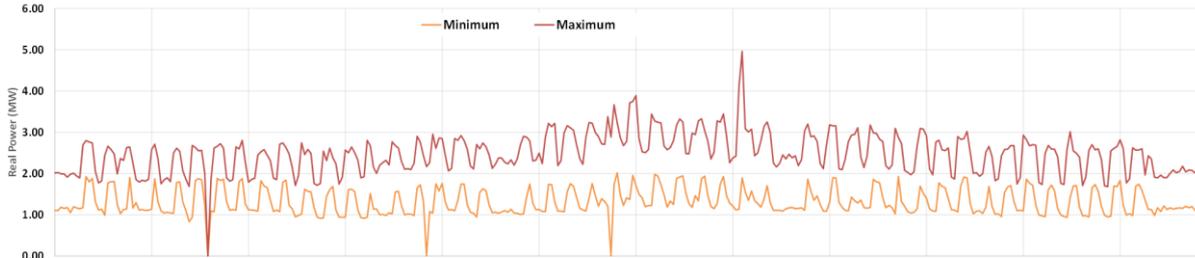


Figure 20 Kerikeri 33/11kV zone substation: Real power (MW) load characteristics

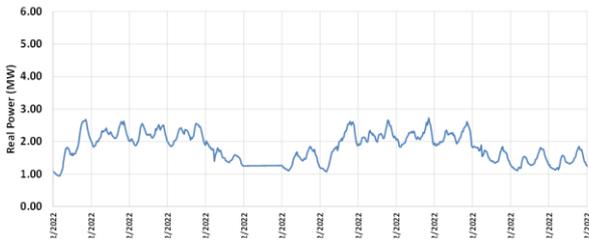
Kaero Zone Substation (2022 year) - Half hourly loading



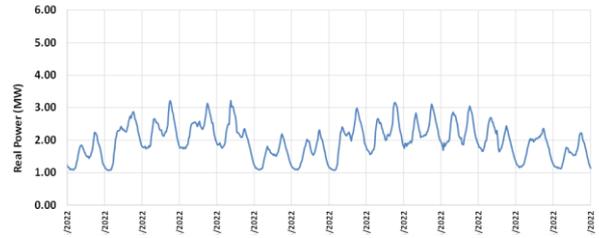
Kaero Zone Substation (2022 year) - Daily Maximum/Minimum



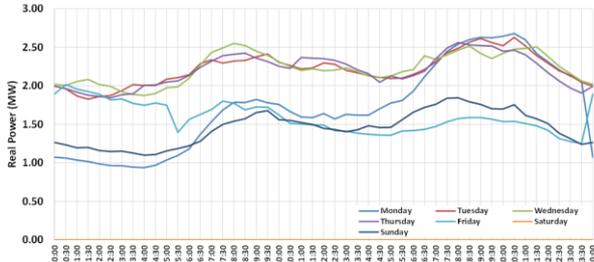
Kaero Zone Substation (2022 year) - Summer (February)



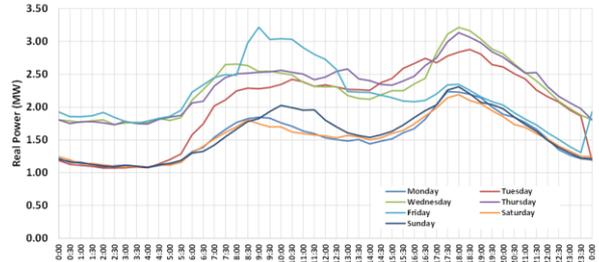
Kaero Zone Substation (2022 year) - Winter (June)



Kaero Zone Substation (2022 year) - Summer (February)



Kaero Zone Substation (2022 year) - Winter (June)



Kaero Zone Substation (2022 year) - Load Duration Curve

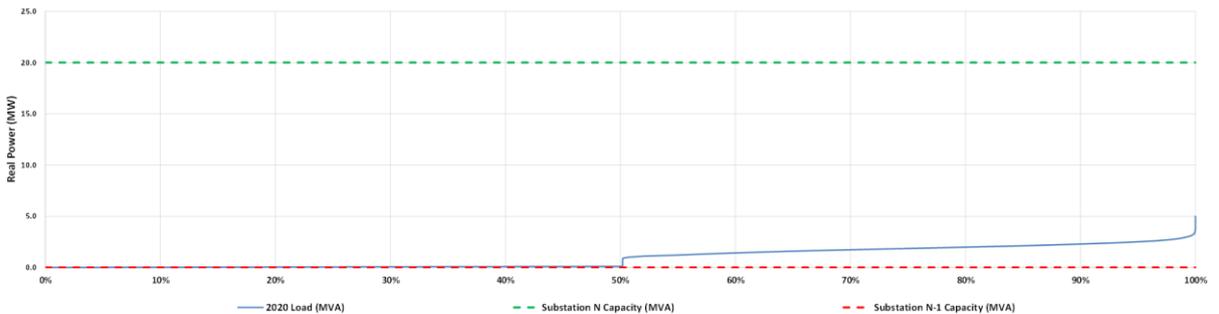
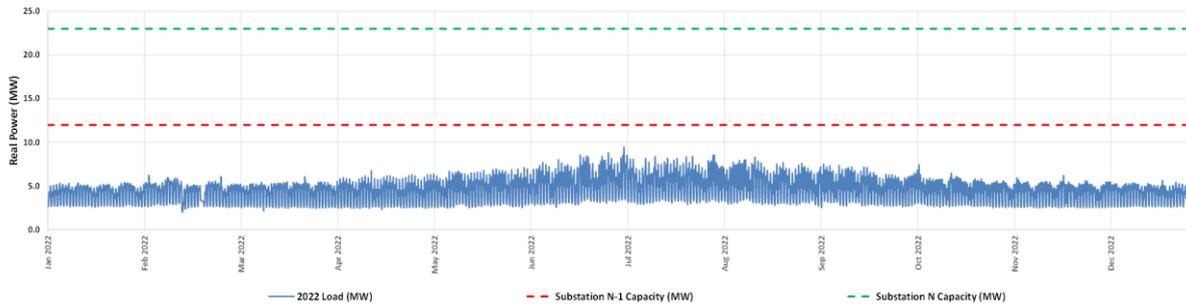


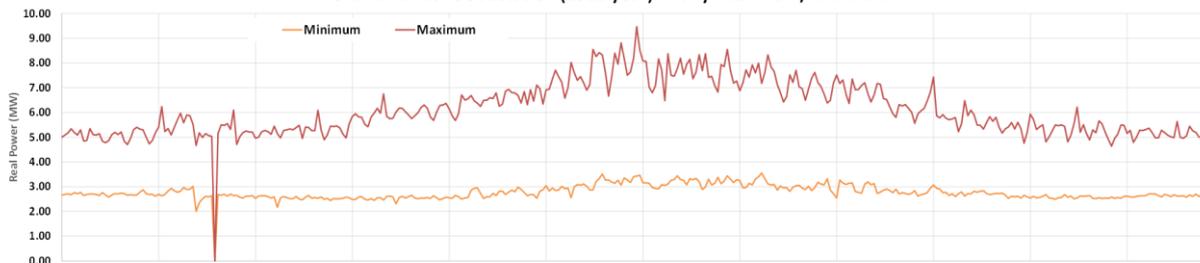
Figure 21 Kaero 33/11kV zone substation: Real power (MW) load characteristics

OKAHU RD MW

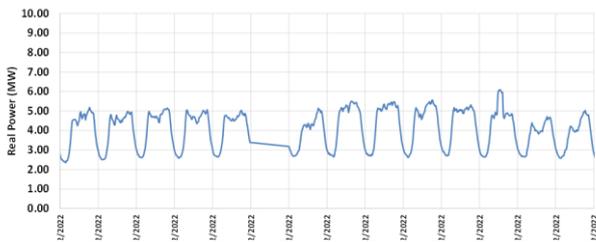
Okahu Rd Zone Substation (2022 year) - Half hourly loading



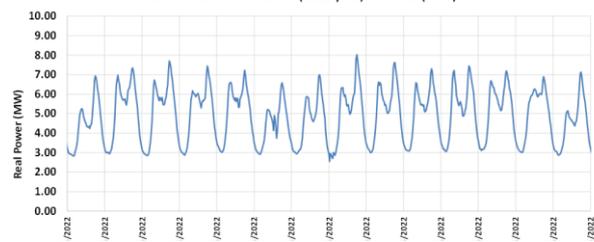
Okahu Rd Zone Substation (2022 year) - Daily Maximum/Minimum



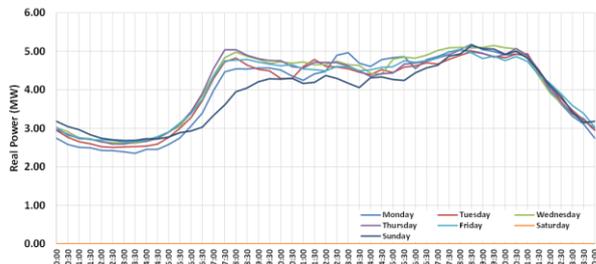
Okahu Rd Zone Substation (2022 year) - Summer (February)



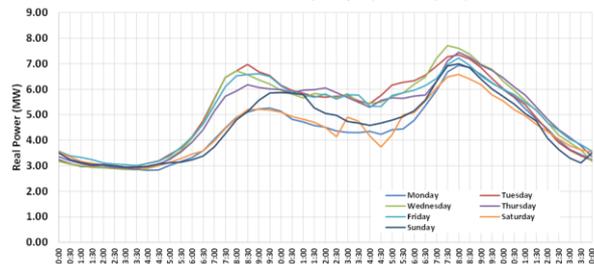
Okahu Rd Zone Substation (2022 year) - Winter (June)



Okahu Rd Zone Substation (2022 year) - Summer (February)



Okahu Rd Zone Substation (2022 year) - Winter (June)



Okahu Rd Zone Substation (2022 year) - Load Duration Curve

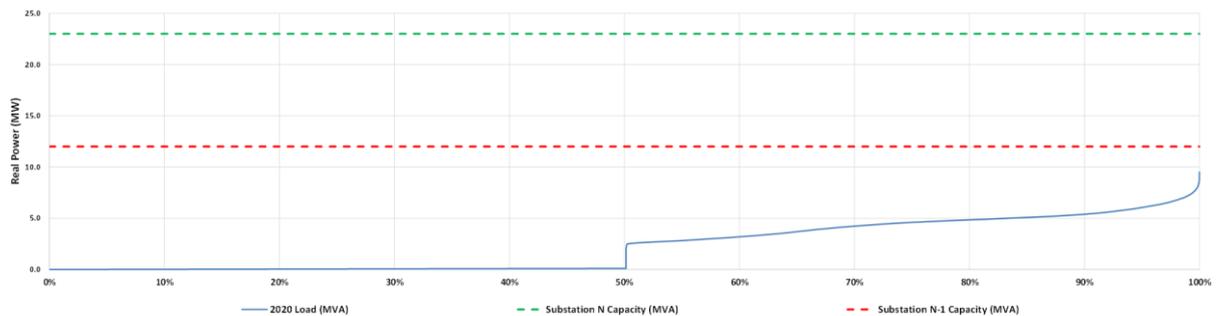


Figure 22 Okahu Rd 33/11kV zone substation: Real power (MW) load characteristics

TAIPA MW

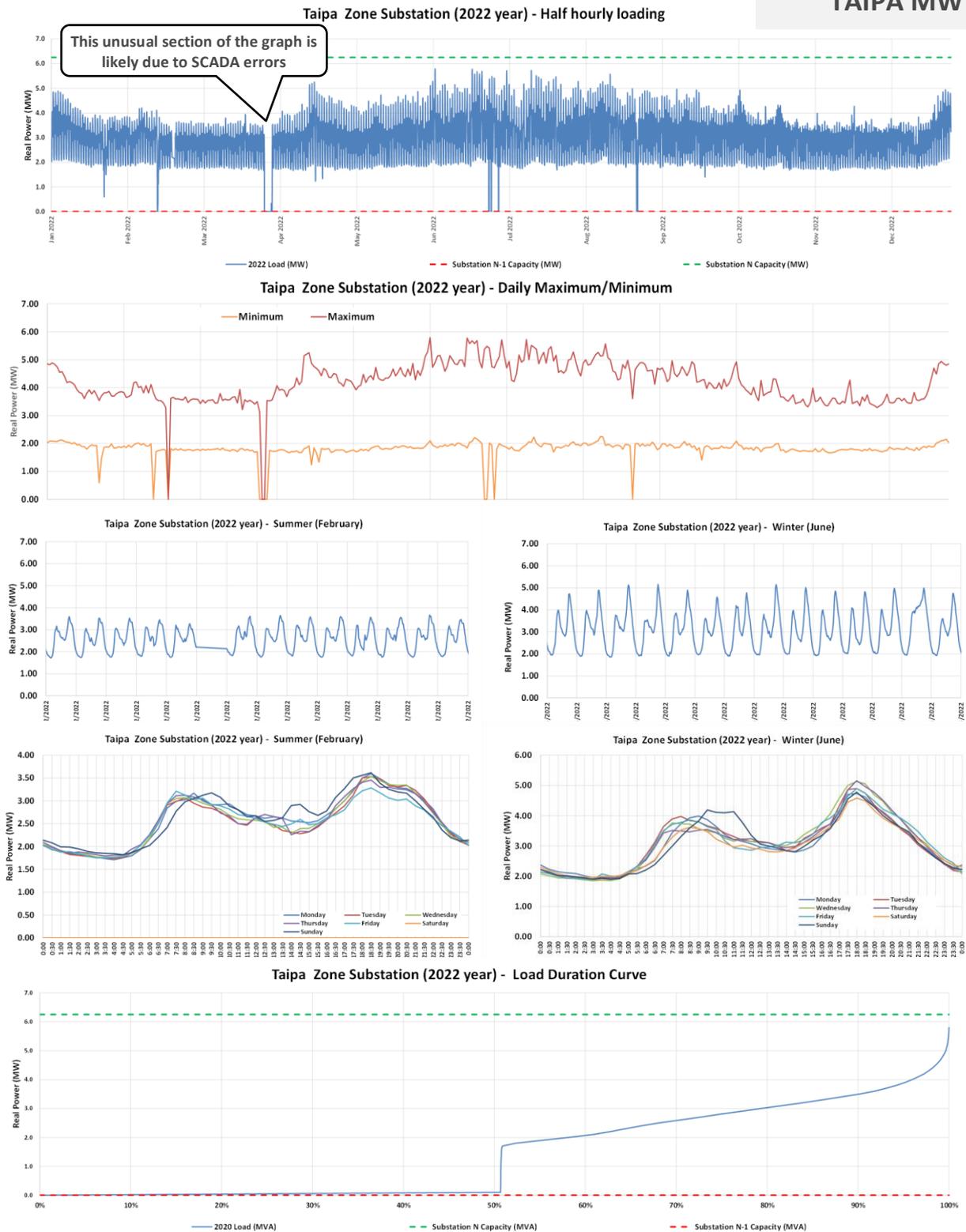
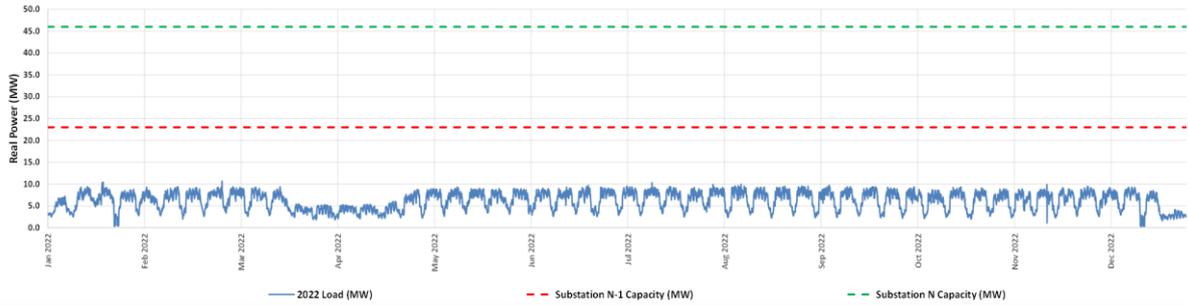


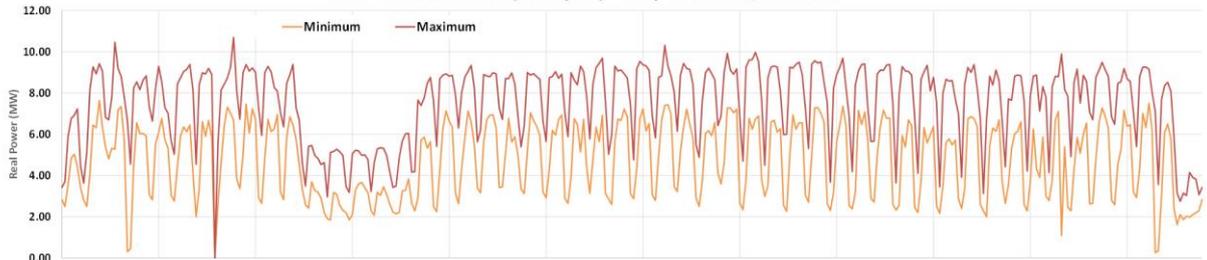
Figure 23 Taipa 33/11kV zone substation: Real power (MW) load characteristics

NPL MW

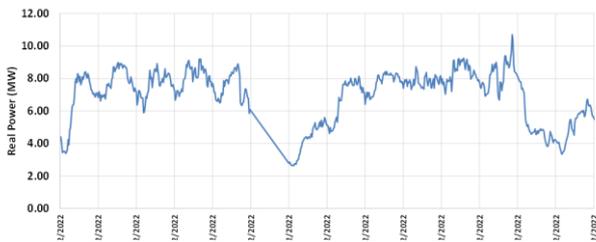
NPL Zone Substation (2022 year) - Half hourly loading



NPL Zone Substation (2022 year) - Daily Maximum/Minimum



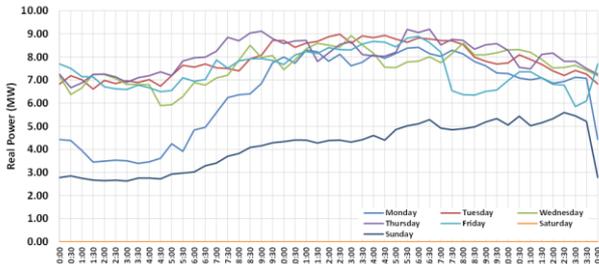
NPL Zone Substation (2022 year) - Summer (February)



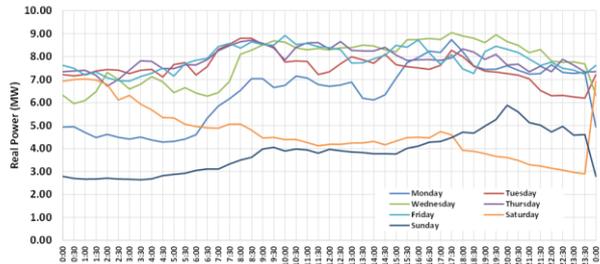
NPL Zone Substation (2022 year) - Winter (June)



NPL Zone Substation (2022 year) - Summer (February)



NPL Zone Substation (2022 year) - Winter (June)



NPL Zone Substation (2022 year) - Load Duration Curve

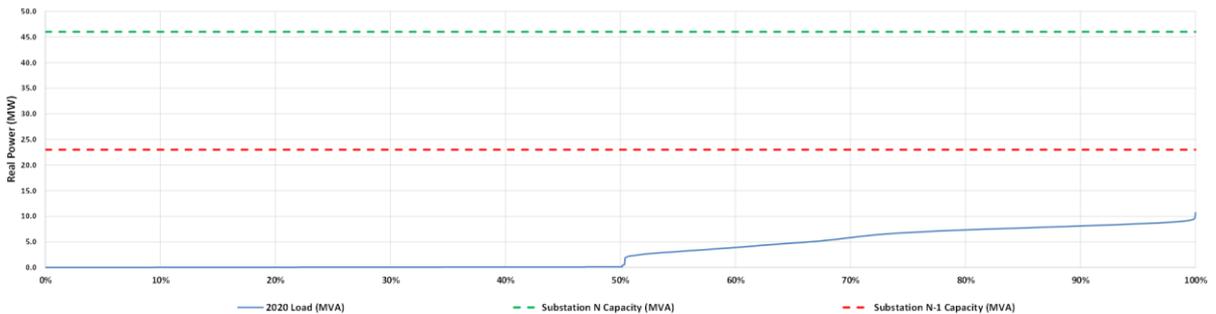
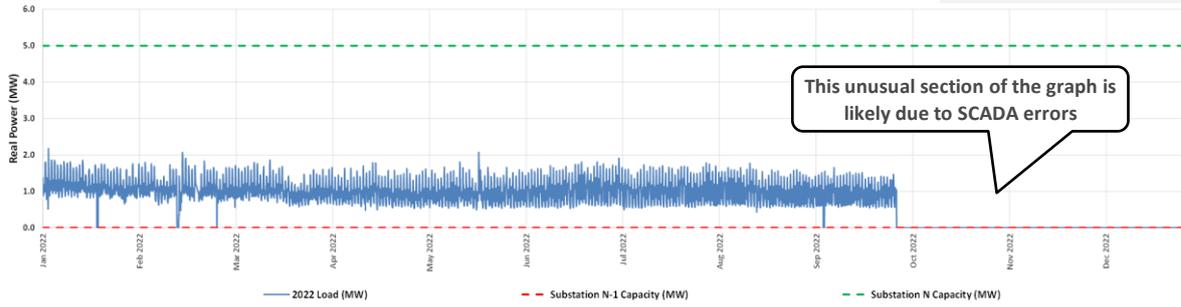


Figure 24 NPL 33/11kV zone substation: Real power (MW) load characteristics

PUKENUI MW

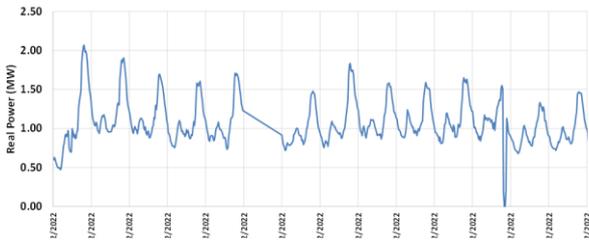
Pukenui Zone Substation (2022 year) - Half hourly loading



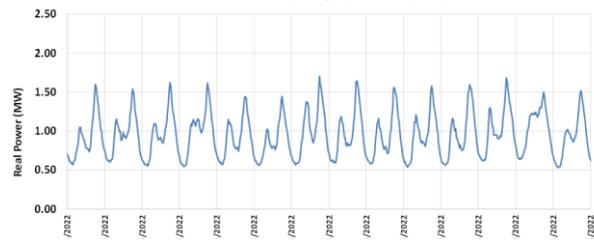
Pukenui Zone Substation (2022 year) - Daily Maximum/Minimum



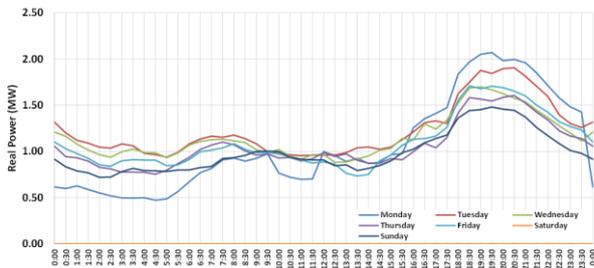
Pukenui Zone Substation (2022 year) - Summer (February)



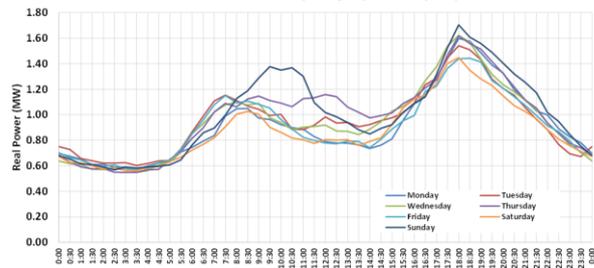
Pukenui Zone Substation (2022 year) - Winter (June)



Pukenui Zone Substation (2022 year) - Summer (February)



Pukenui Zone Substation (2022 year) - Winter (June)



Pukenui Zone Substation (2022 year) - Load Duration Curve

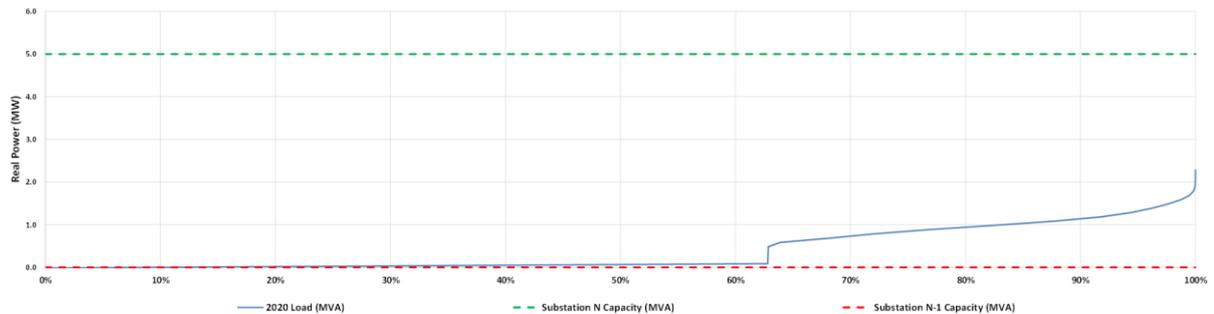


Figure 25 Pukenui 33/11kV zone substation: Real power (MW) load characteristics

3.2 Northpower

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

- **Figure 262631** Alexander Stndra 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 272732** BreamAndersons Bay 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 282833** DargavilleArrowtown 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 292934** HikurangiBerwick 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 303035** KaiwakaCamp Hill 33/11kV zone substation: Real power (MW) load **characteristics**
- **Figure 313136** KamoCardrona 66/11kV zone substation: Real power (MW) load characteristics
- **Figure 323237** KensingtonCarisbrook 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 333338** KioreroaClyde/Earnsclough 33/11kV zone substation: Real power (MW) load **characteristics**
- **Figure 343439** MangawhaiCommonage 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 353540** MarertetuCoronet Peak 33/11kV zone substation: Real power (MW) load **characteristics**
- **Figure 363641** MaungatapereCorstorphine 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 373742** MaungaturotoCromwell 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 383843** MaunuDalefield 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 393944** NgunguruEarnsclough 33/11kV substation: Real power (MW) load characteristics
- **Figure 404045** OnerahiEast Taieri 33/11kV zone substation: Real power (MW) load **characteristics**
- **Figure 414146** Parua BayEttrick 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 424247** PorotiFernhill 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 434348** RuakakaFrankton 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 444449** Green IslandRuawai 33/11kV zone substation: Real power (MW) load **characteristics**
- **Figure 454550** Halfway BushTikipunga 33/11kV zone substation: Real power (MW) load **characteristics**
- **Figure 464651** Whangāārei South 33/11kV zone substation: Real power (MW) load characteristics
- **Figure 5959** Port Chalmers 33/11kV zone substation: Real power (MW) load characteristics

ALEXANDER ST MW

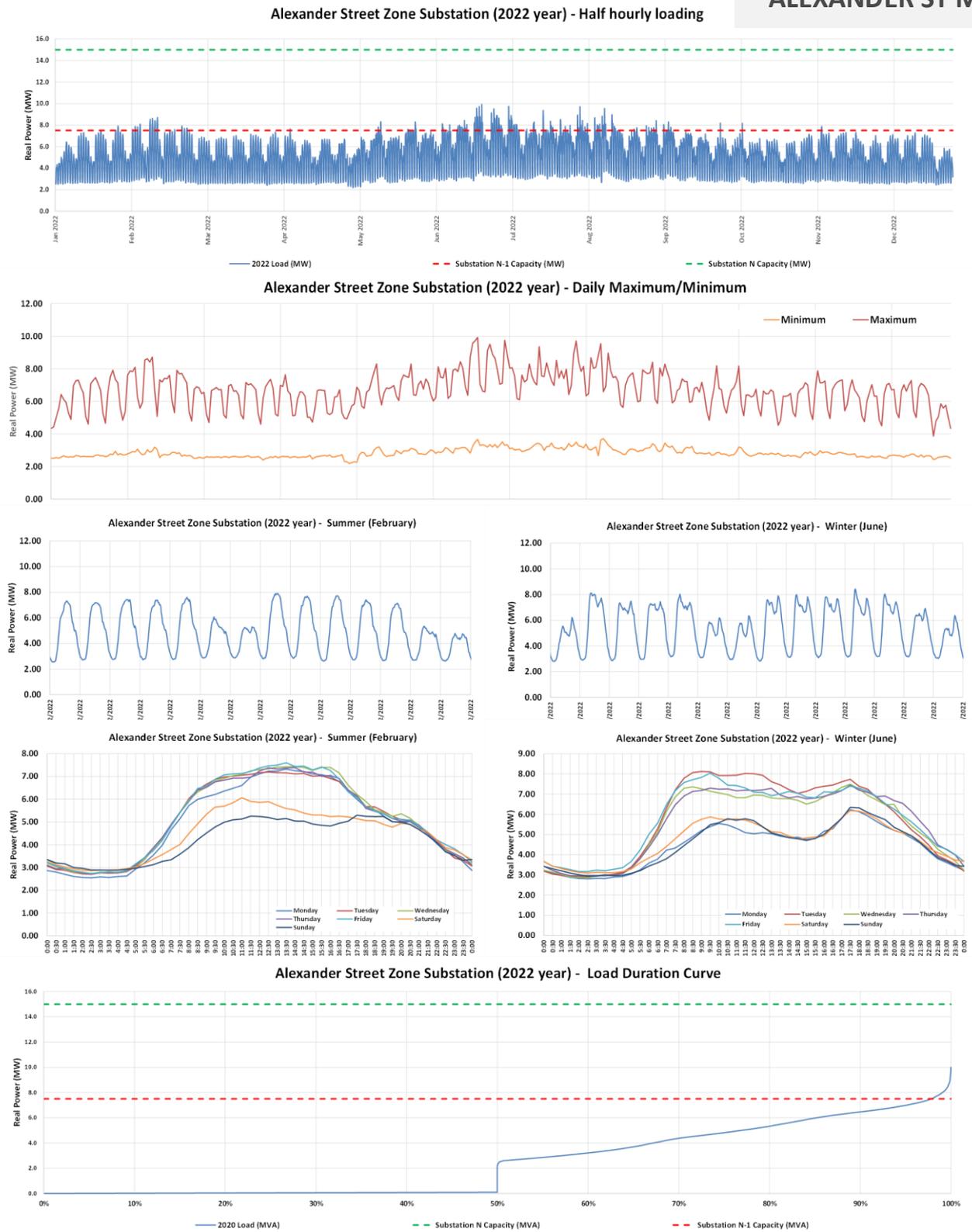
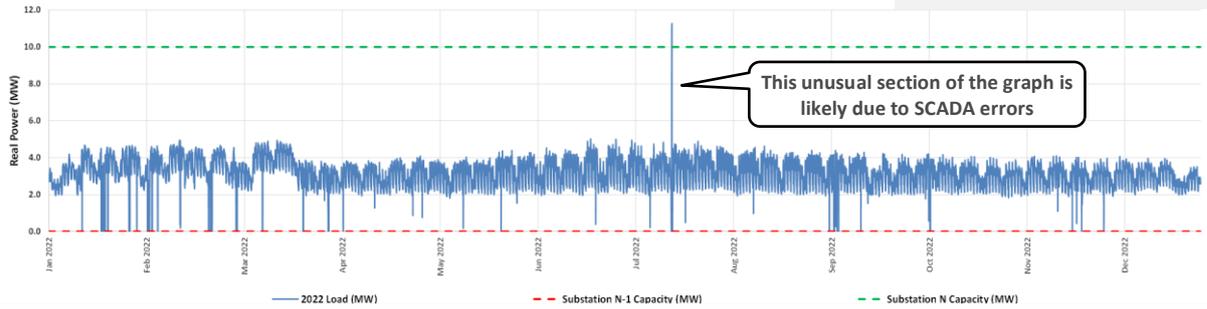


Figure 26 Alexander St 33/11kV zone substation: Real power (MW) load characteristics

BREAM BAY MW

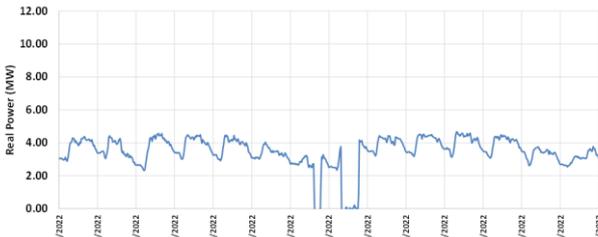
Bream Bay Zone Substation (2022 year) - Half hourly loading



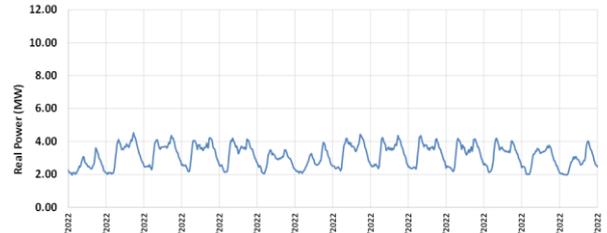
Bream Bay Zone Substation (2022 year) - Daily Maximum/Minimum



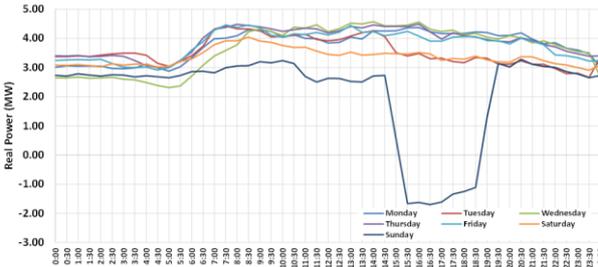
Bream Bay Zone Substation (2022 year) - Summer (February)



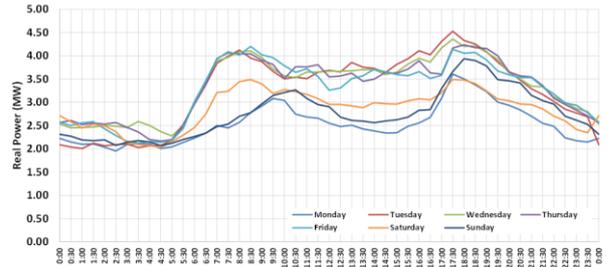
Bream Bay Zone Substation (2022 year) - Winter (June)



Bream Bay Zone Substation (2022 year) - Summer (February)



Bream Bay Zone Substation (2022 year) - Winter (June)



Bream Bay Zone Substation (2022 year) - Load Duration Curve

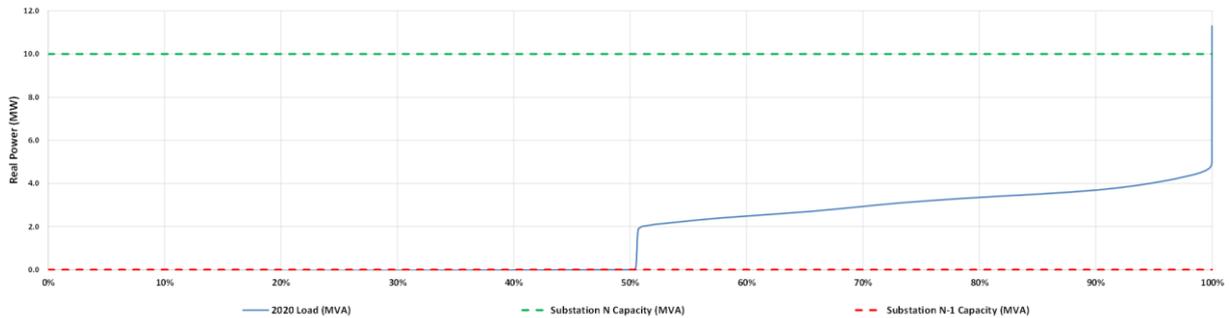


Figure 27 Bream Bay 33/11kV zone substation: Real power (MW) load characteristics

DARGAVILLE MW

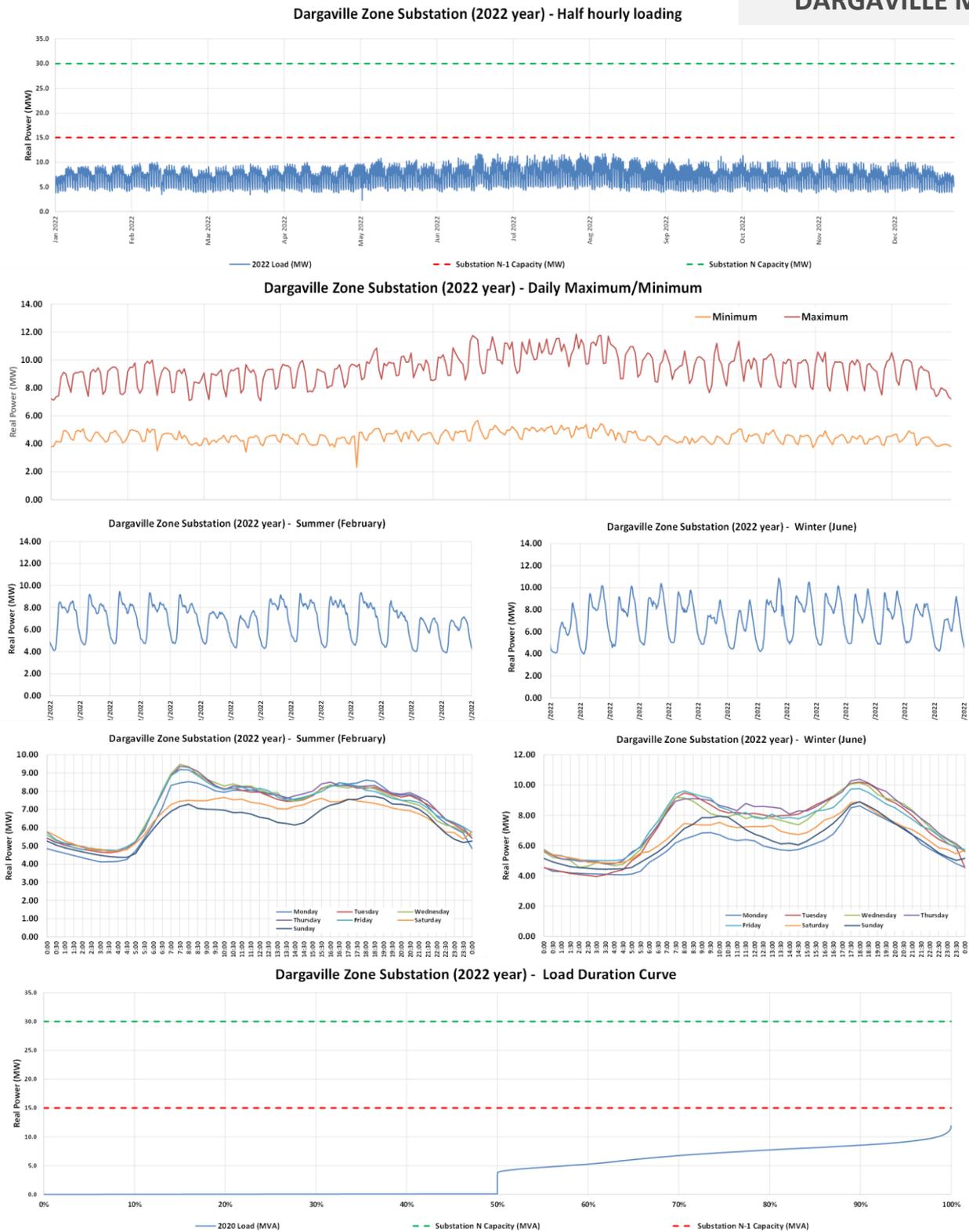
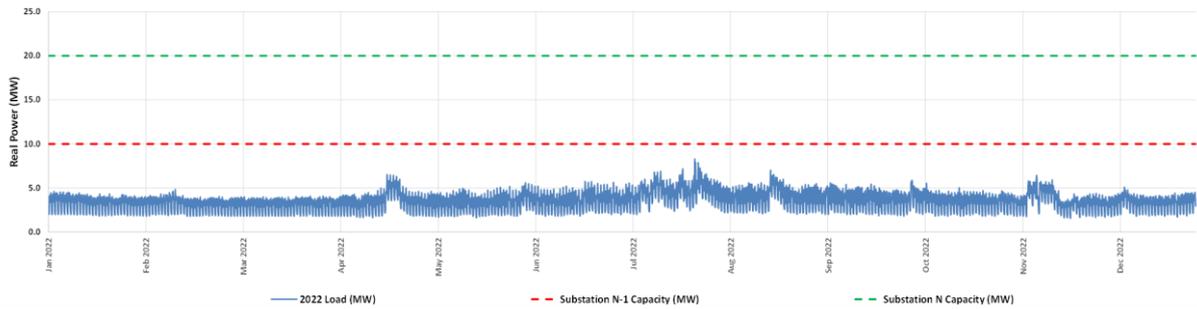


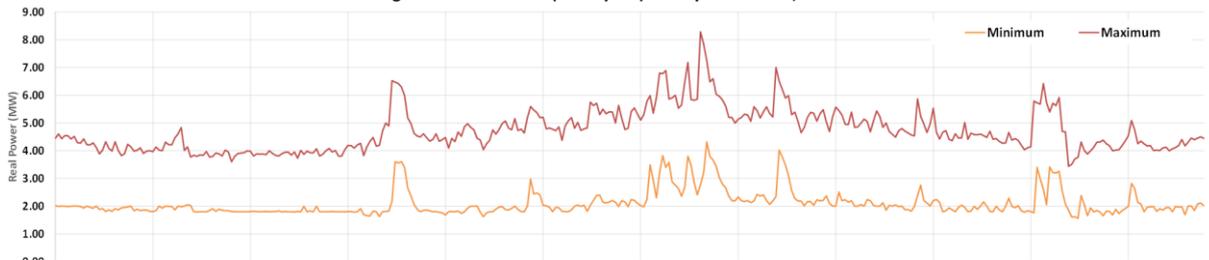
Figure 28 Dargaville 33/11kV zone substation: Real power (MW) load characteristics

HIKURANGI MW

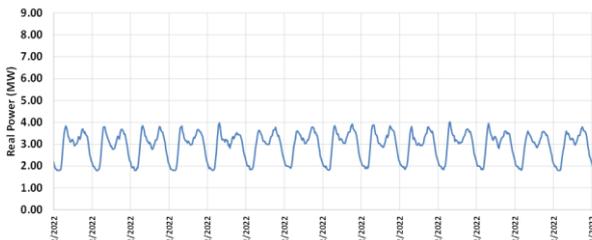
Hikurangi Zone Substation (2022 year) - Half hourly loading



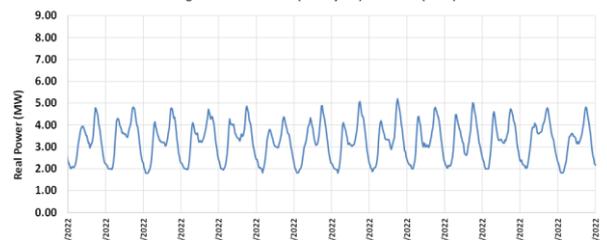
Hikurangi Zone Substation (2022 year) - Daily Maximum/Minimum



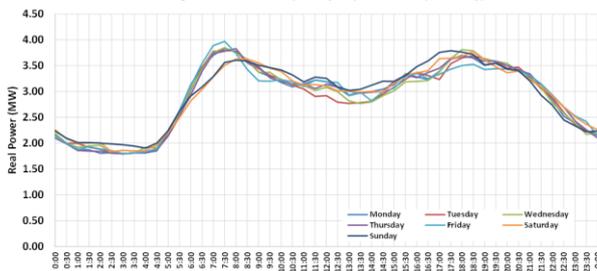
Hikurangi Zone Substation (2022 year) - Summer (February)



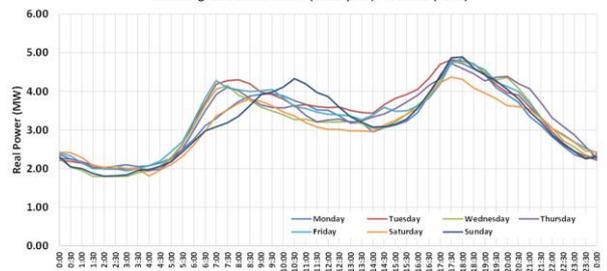
Hikurangi Zone Substation (2022 year) - Winter (June)



Hikurangi Zone Substation (2022 year) - Summer (February)



Hikurangi Zone Substation (2022 year) - Winter (June)



Hikurangi Zone Substation (2022 year) - Load Duration Curve

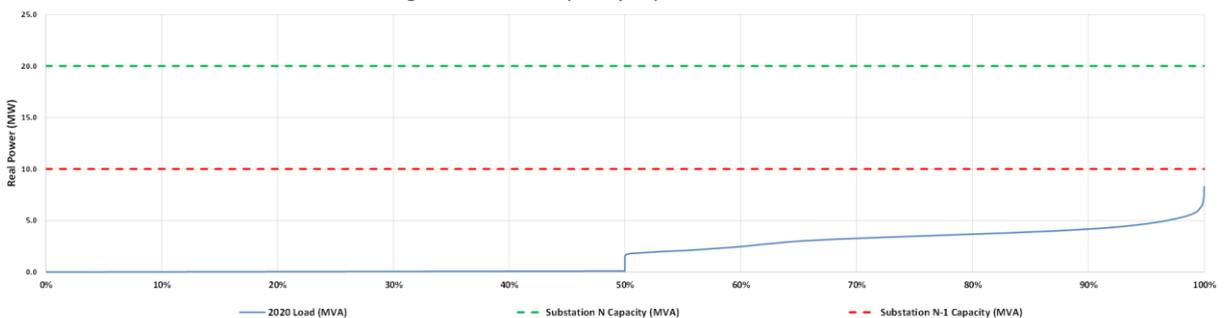
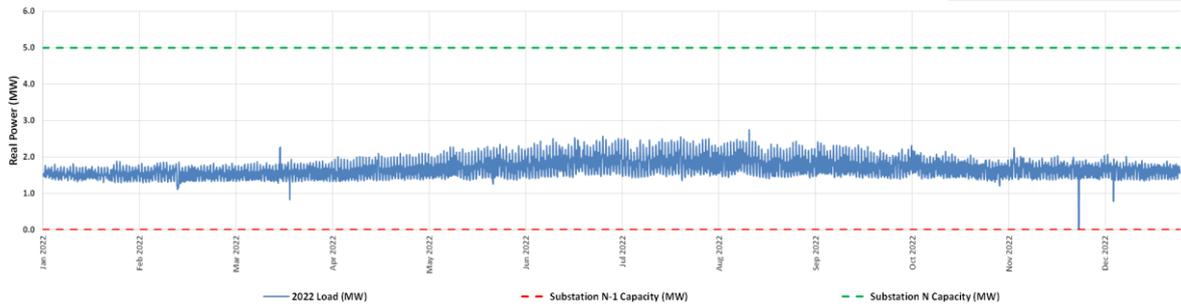


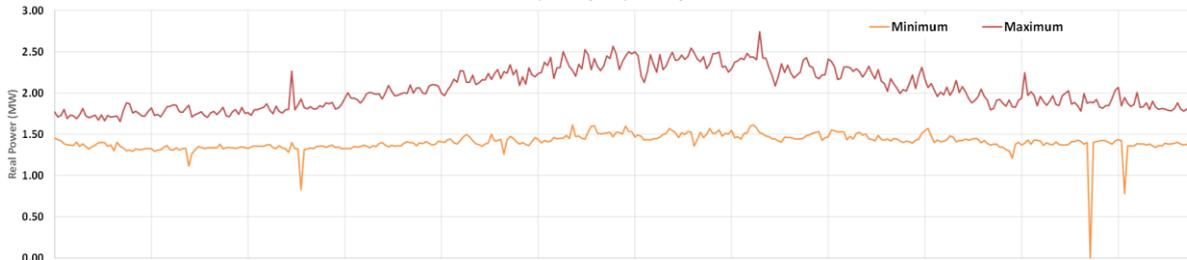
Figure 29 Hikurangi 33/11kV zone substation: Real power (MW) load characteristics

KAIWAKA MW

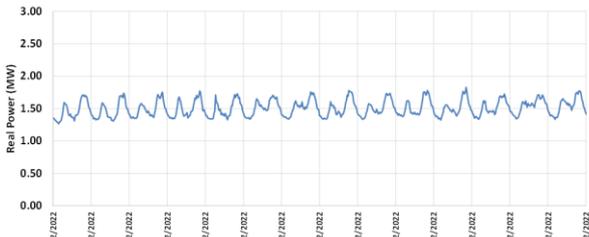
Kaiwaka Zone Substation (2022 year) - Half hourly loading



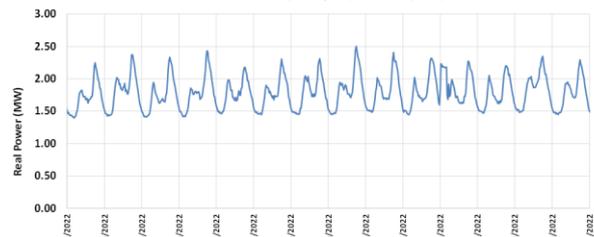
Kaiwaka Zone Substation (2022 year) - Daily Maximum/Minimum



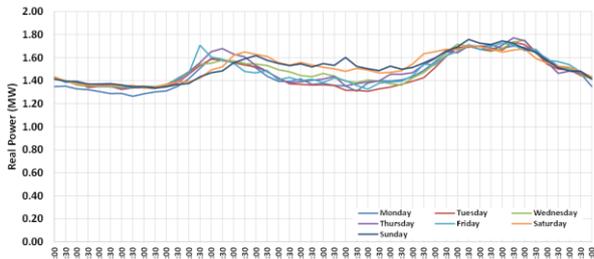
Kaiwaka Zone Substation (2022 year) - Summer (February)



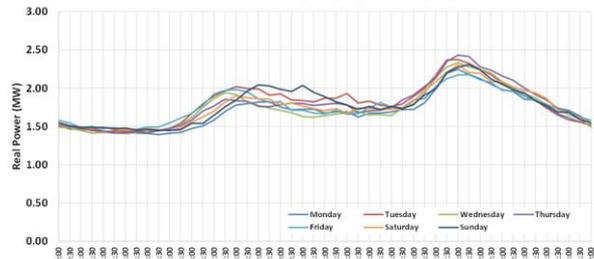
Kaiwaka Zone Substation (2022 year) - Winter (June)



Kaiwaka Zone Substation (2022 year) - Summer (February)



Kaiwaka Zone Substation (2022 year) - Winter (June)



Kaiwaka Zone Substation (2022 year) - Load Duration Curve

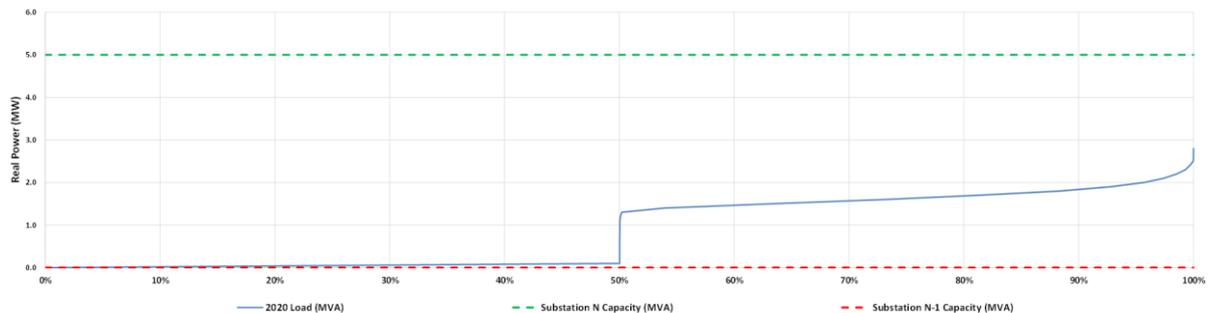


Figure 30 Kaiwaka 33/11kV zone substation: Real power (MW) load characteristics

KAMO MW

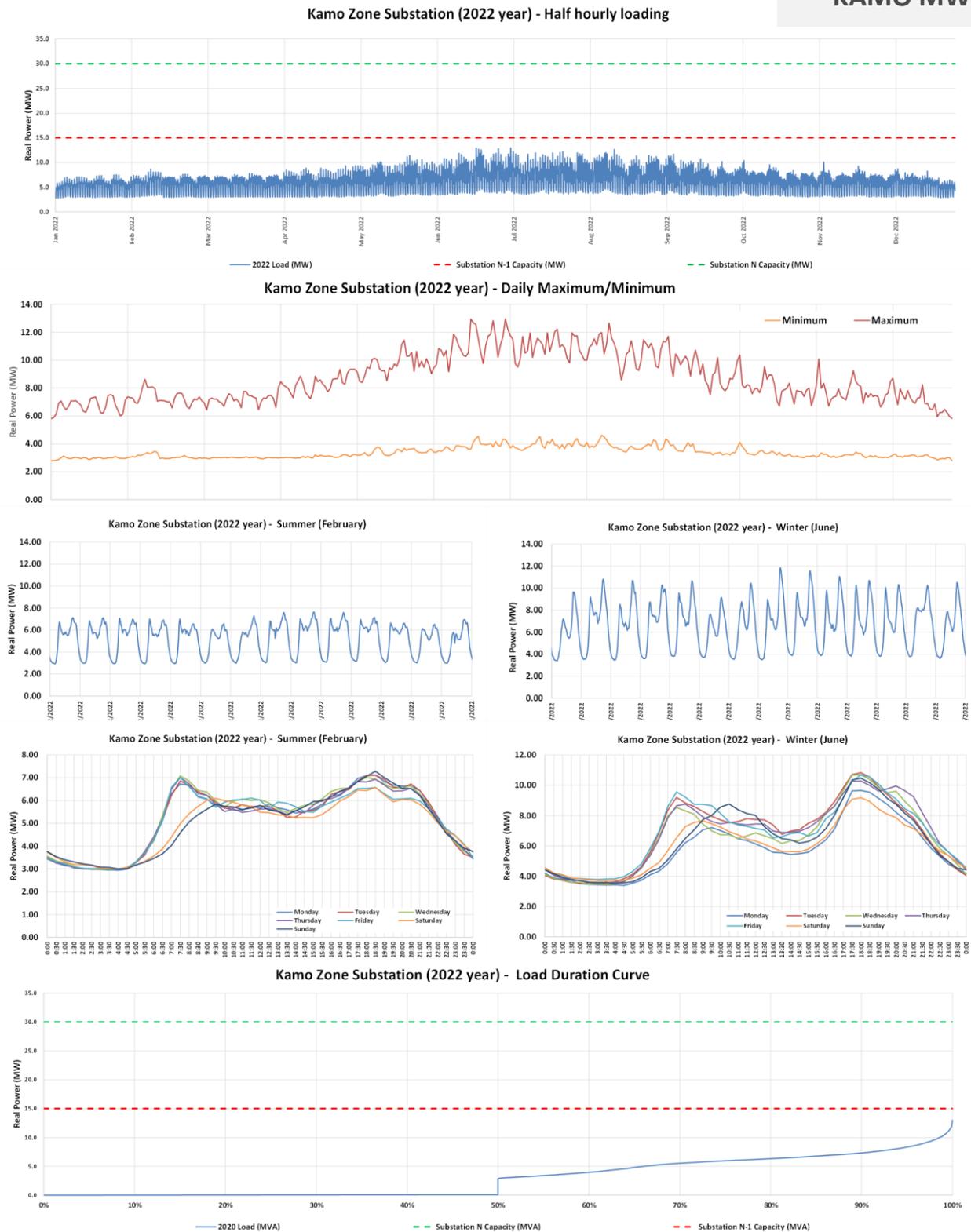


Figure 31 Kamo 66/11kV zone substation: Real power (MW) load characteristics

KENSINGTON MW

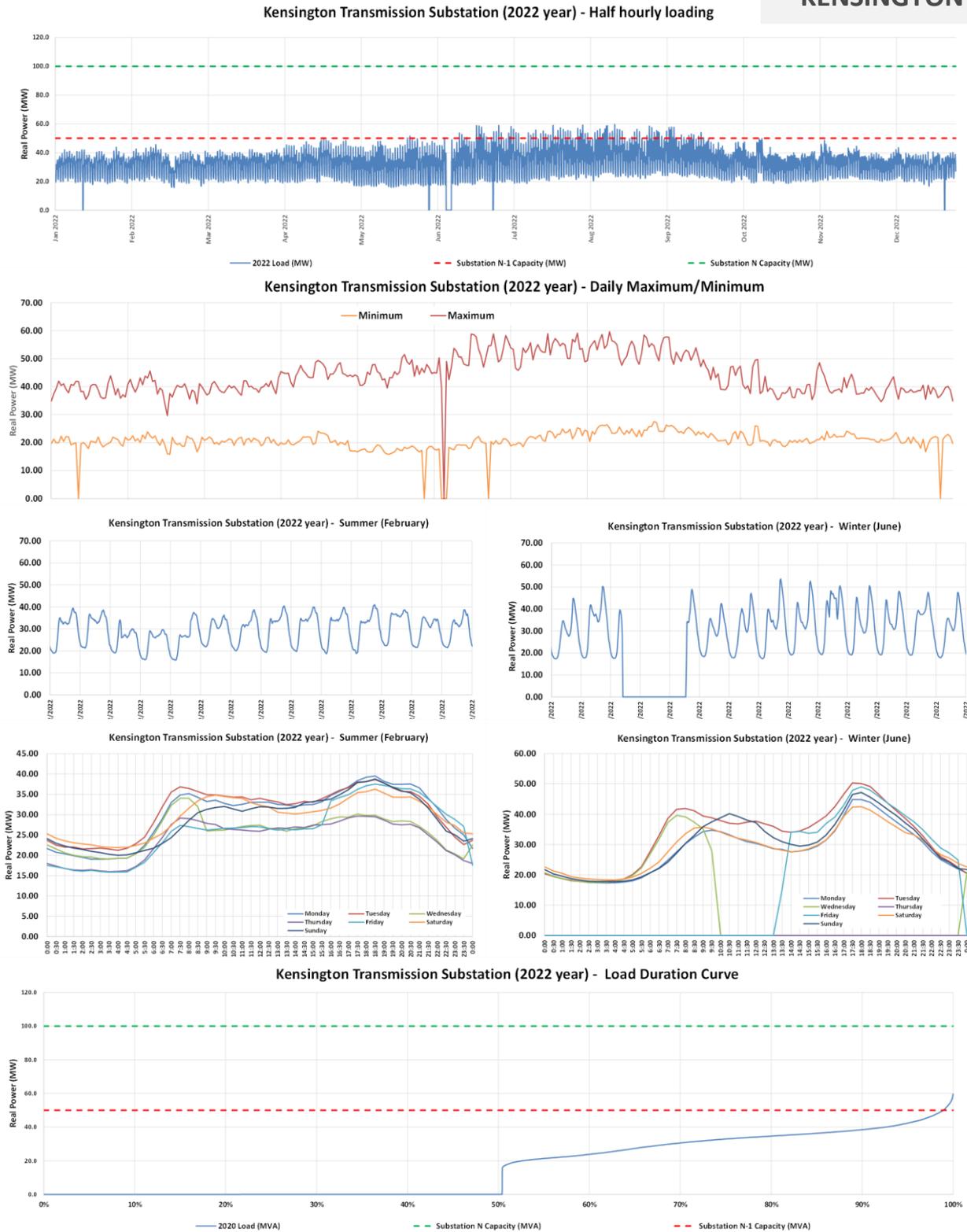
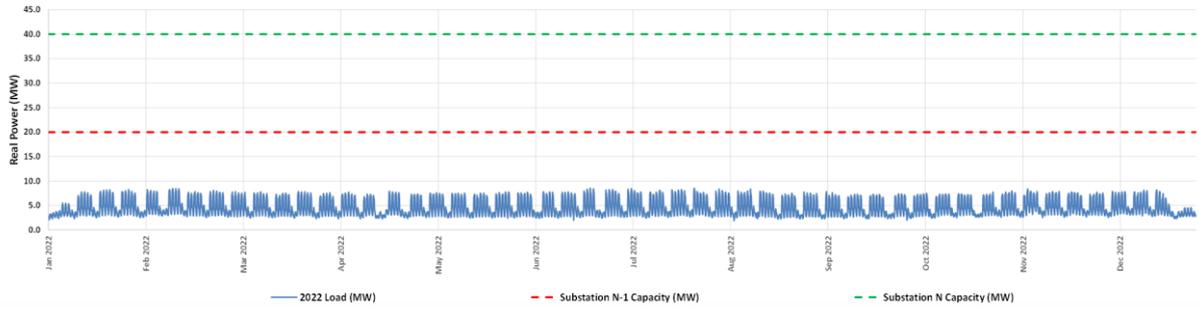


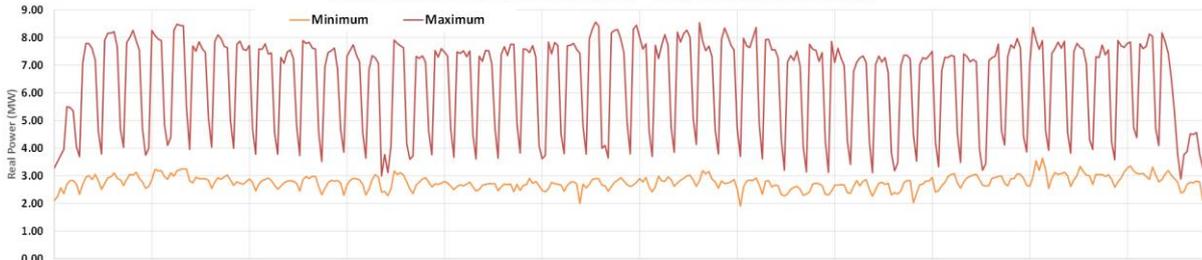
Figure 32 Kensington 33/11kV zone substation: Real power (MW) load characteristics

KIOREROA MW

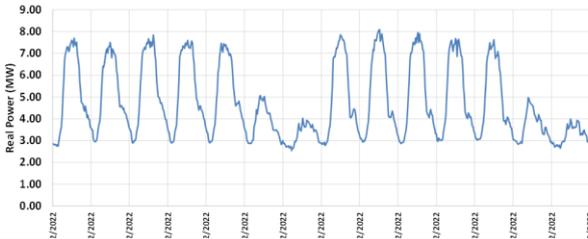
Kioreroa Zone Substation (2022 year) - Half hourly load



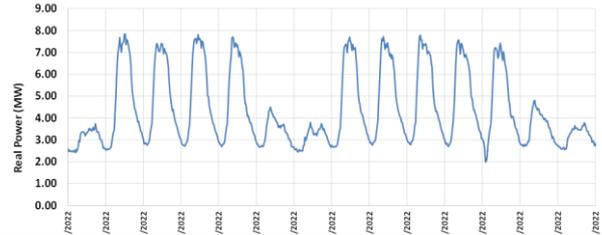
Kioreroa Zone Substation (2022 year) - Daily Maximum/Minimum



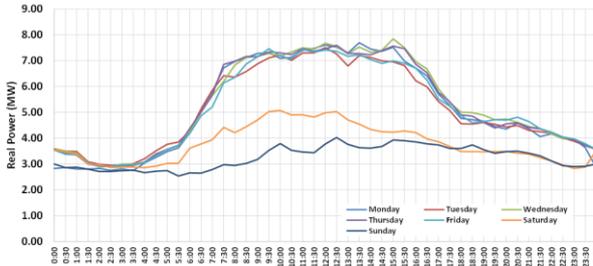
Kioreroa Zone Substation (2022 year) - Summer (February)



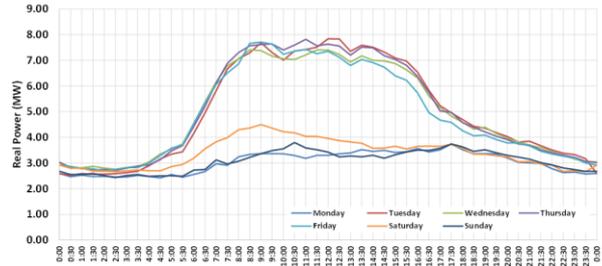
Kioreroa Zone Substation (2022 year) - Winter (June)



Kioreroa Zone Substation (2022 year) - Summer (February)



Kioreroa Zone Substation (2022 year) - Winter (June)



Kioreroa Zone Substation (2022 year) - Load Duration Curve

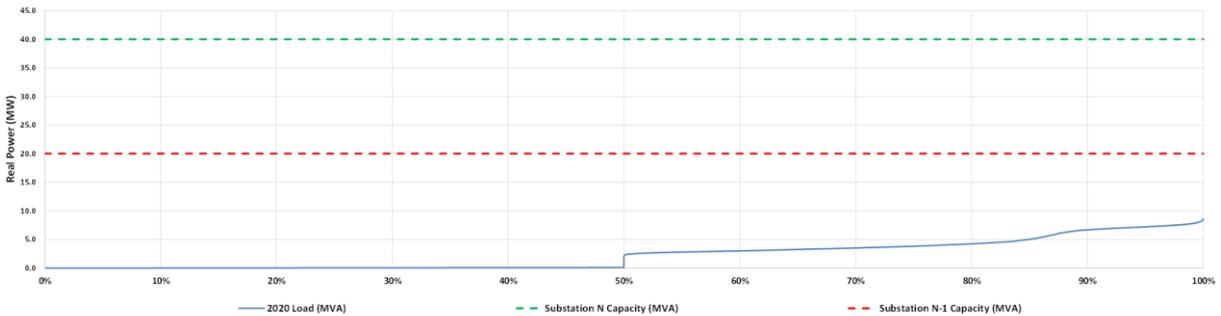
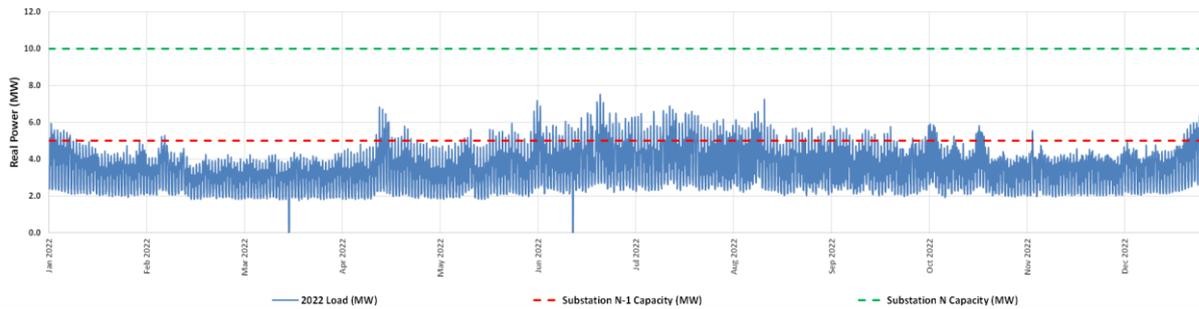


Figure 33 Kioreroa 33/11kV zone substation: Real power (MW) load characteristics

MANGAWHAI MW

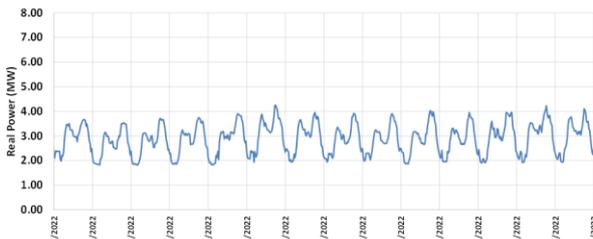
Mangawhai Zone Substation (2022 year) - Half hourly loading



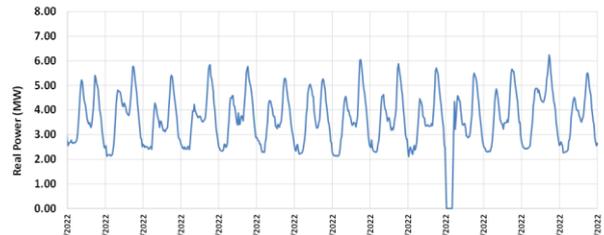
Mangawhai Zone Substation (2022 year) - Daily Maximum/Minimum



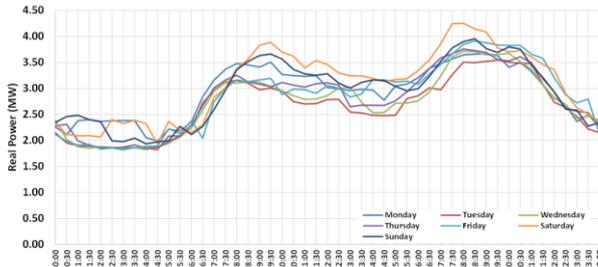
Mangawhai Zone Substation (2022 year) - Summer (February)



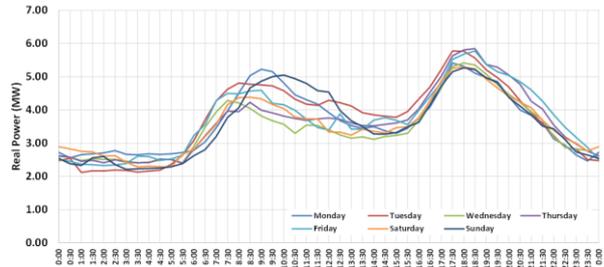
Mangawhai Zone Substation (2022 year) - Winter (June)



Mangawhai Zone Substation (2022 year) - Summer (February)



Mangawhai Zone Substation (2022 year) - Winter (June)



Mangawhai Zone Substation (2022 year) - Load Duration Curve

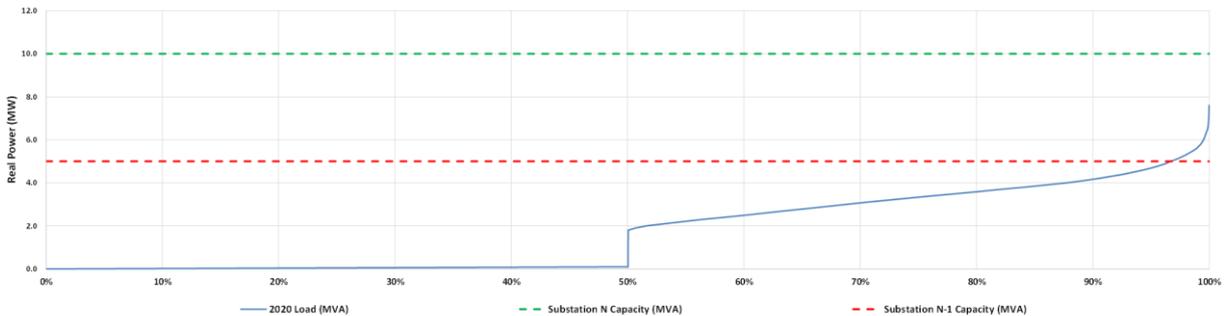


Figure 34 Mangawhai 33/11kV zone substation: Real power (MW) load characteristics

MARERETU MW

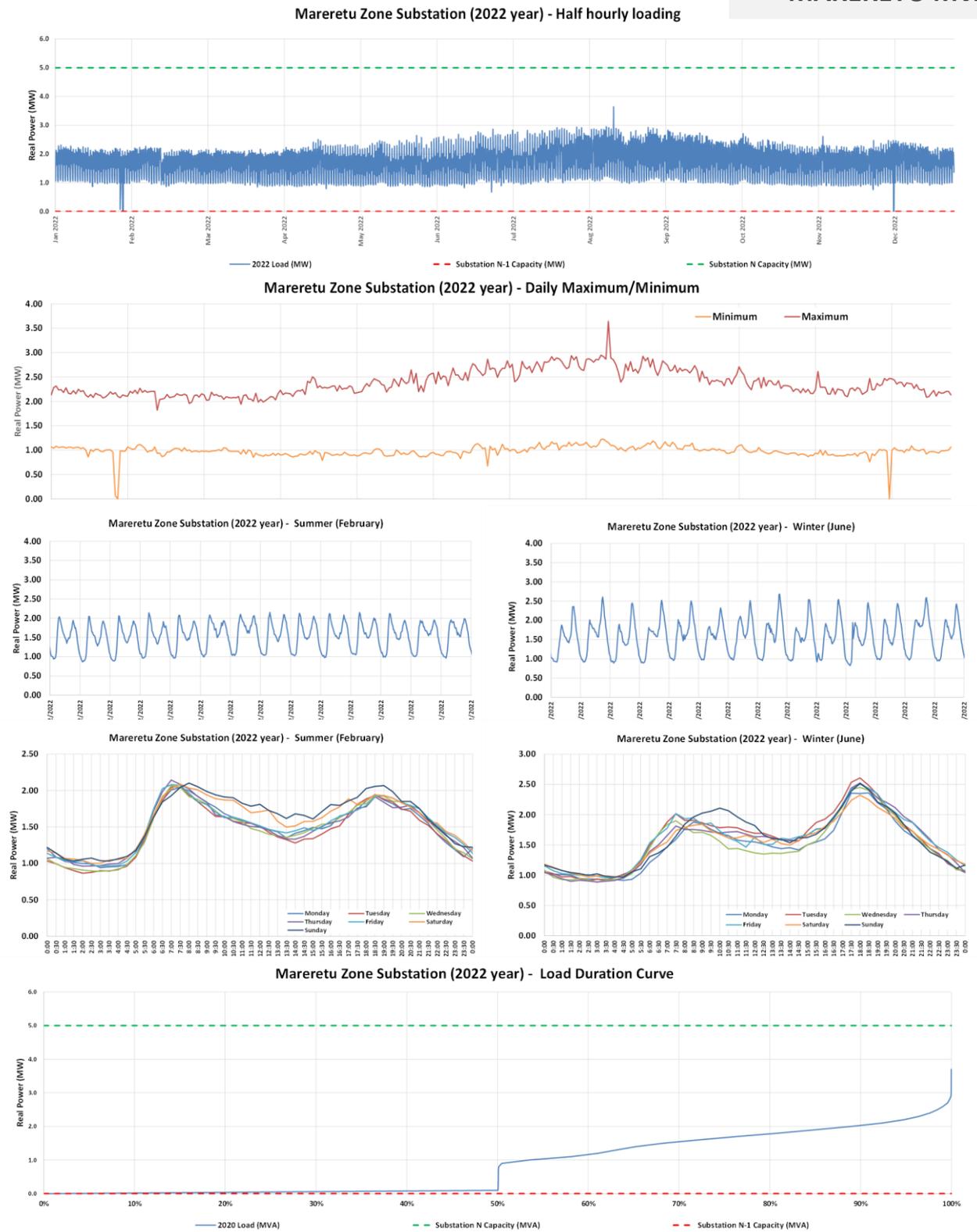
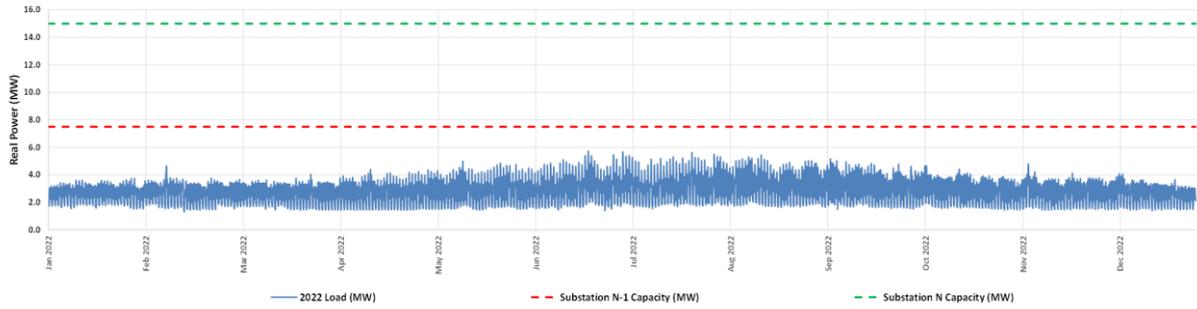


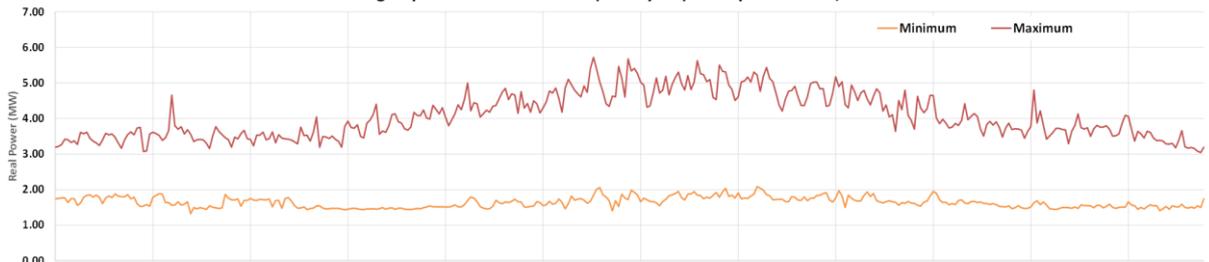
Figure 35 Mareretu 33/11kV zone substation: Real power (MW) load characteristics

MAUNGATAPERE MW

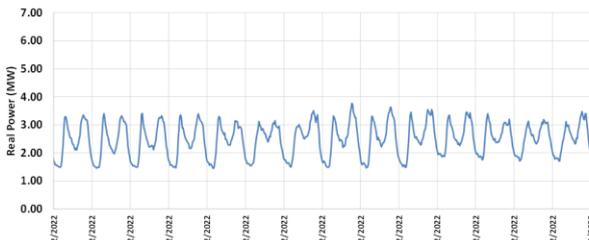
Maungatapere Zone Substation (2022 year) - Half hourly loading



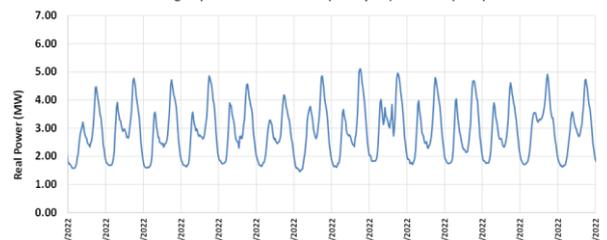
Maungatapere Zone Substation (2022 year) - Daily Maximum/Minimum



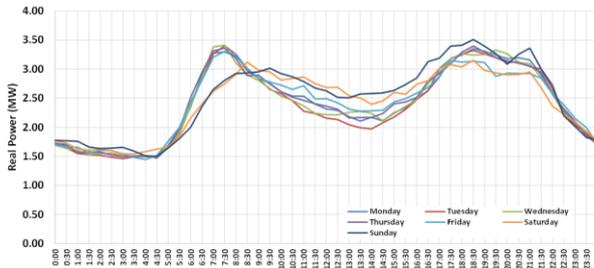
Maungatapere Zone Substation (2022 year) - Summer (February)



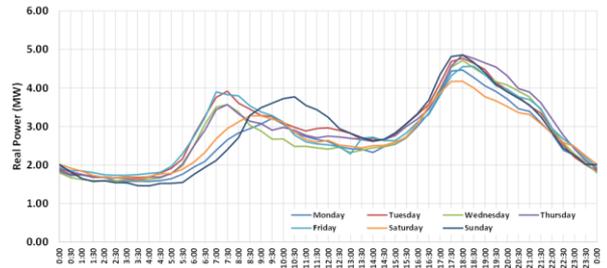
Maungatapere Zone Substation (2022 year) - Winter (June)



Maungatapere Zone Substation (2022 year) - Summer (February)



Maungatapere Zone Substation (2022 year) - Winter (June)



Maungatapere Zone Substation (2022 year) - Load Duration Curve

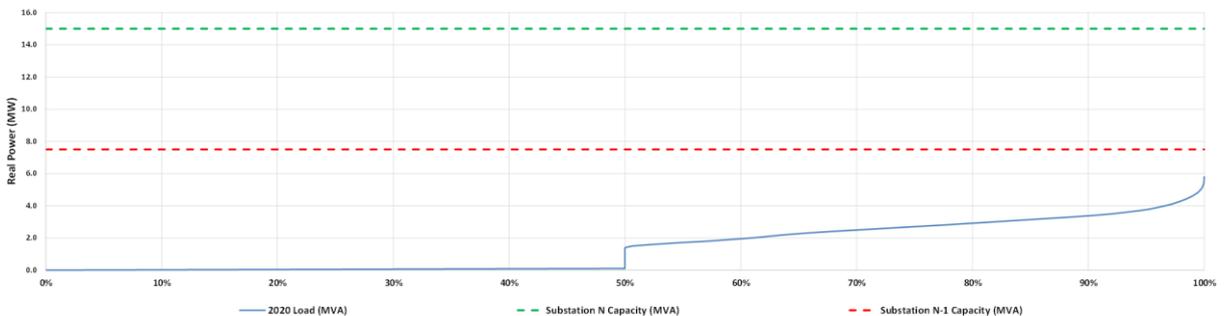
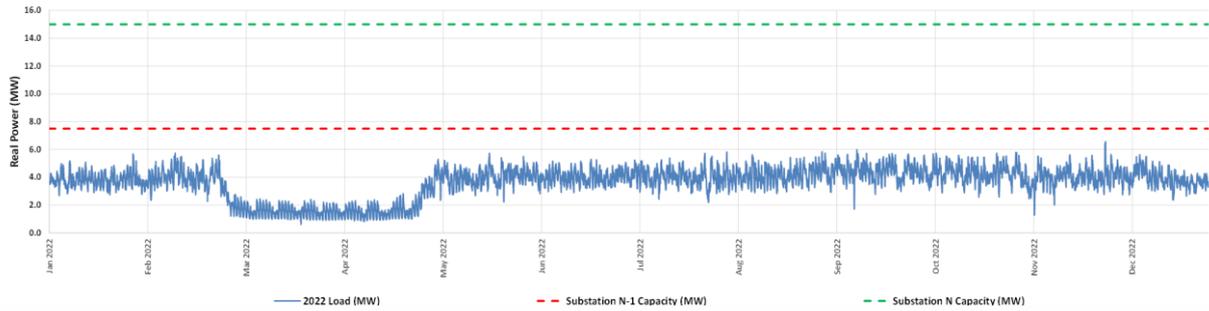


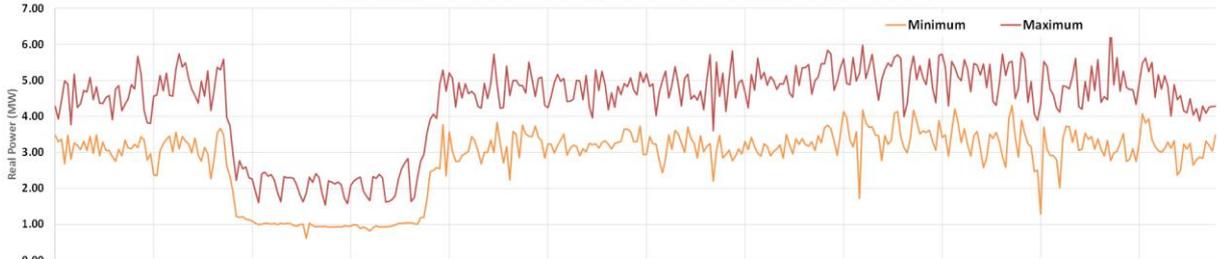
Figure 36 Maungatapere 33/11kV zone substation: Real power (MW) load characteristics

MAUNGATUROTO MW

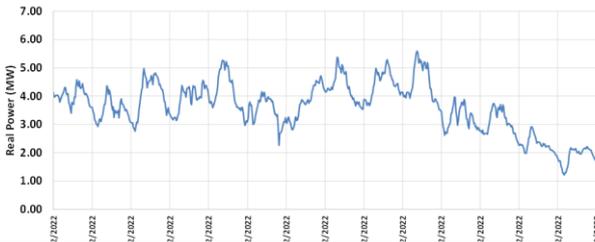
Maungaturoto Zone Substation (2022 year) - Half hourly loading



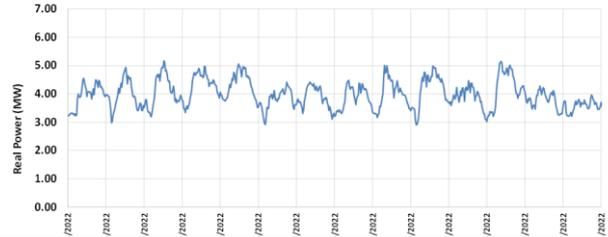
Maungaturoto Zone Substation (2022 year) - Daily Maximum/Minimum



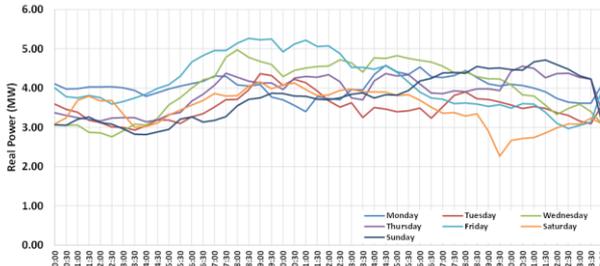
Maungaturoto Zone Substation (2022 year) - Summer (February)



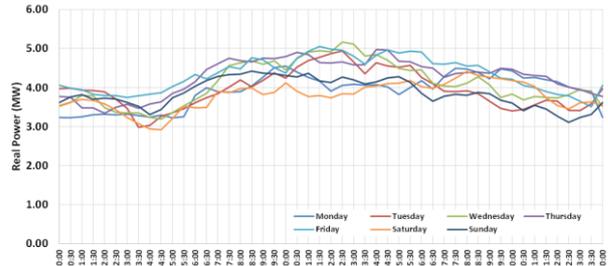
Maungaturoto Zone Substation (2022 year) - Winter (June)



Maungaturoto Zone Substation (2022 year) - Summer (February)



Maungaturoto Zone Substation (2022 year) - Winter (June)



Maungaturoto Zone Substation (2022 year) - Load Duration Curve

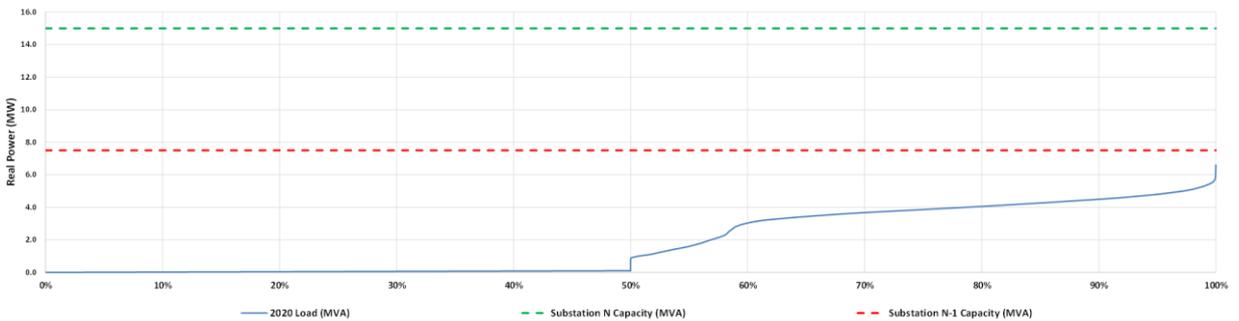
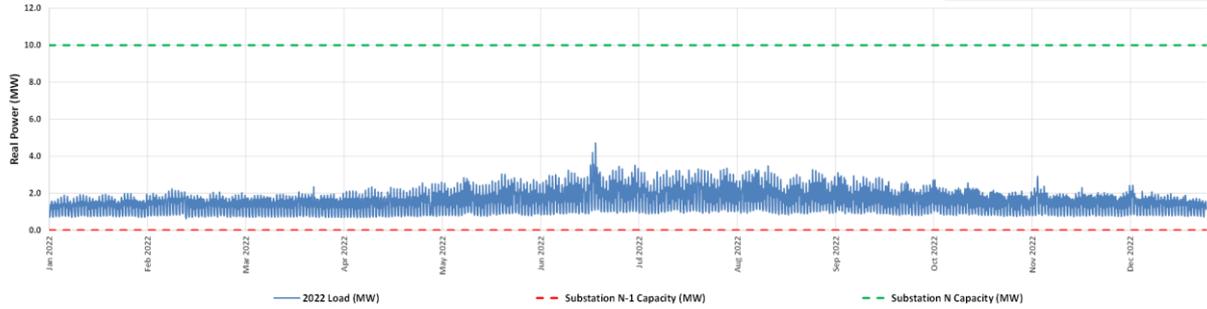


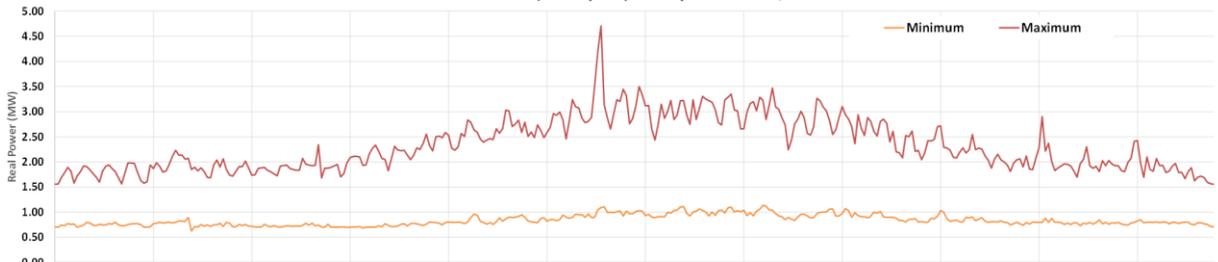
Figure 37 Maungaturoto 33/11kV zone substation: Real power (MW) load characteristics

MAUNU MW

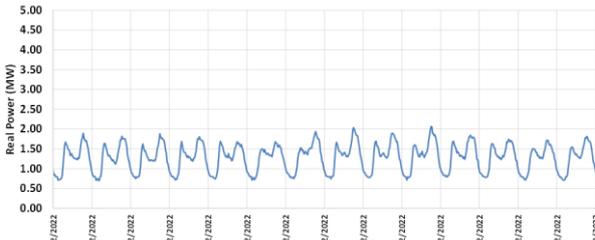
Maunu Zone Substation (2022 year) - Half hourly loading



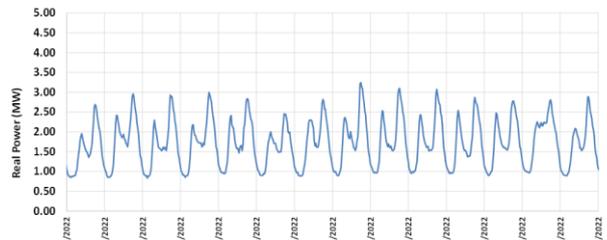
Maunu Zone Substation (2022 year) - Daily Maximum/Minimum



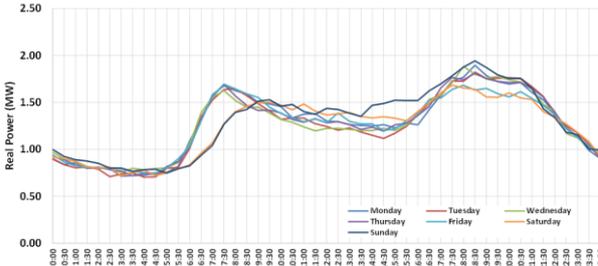
Maunu Zone Substation (2022 year) - Summer (February)



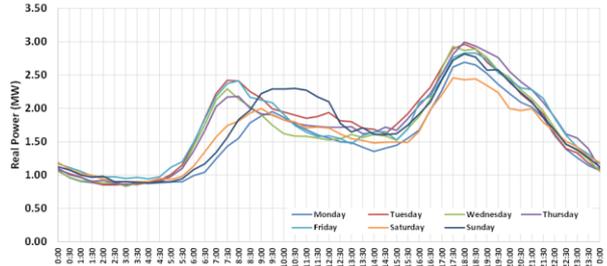
Maunu Zone Substation (2022 year) - Winter (June)



Maunu Zone Substation (2022 year) - Summer (February)



Maunu Zone Substation (2022 year) - Winter (June)



Maunu Zone Substation (2022 year) - Load Duration Curve

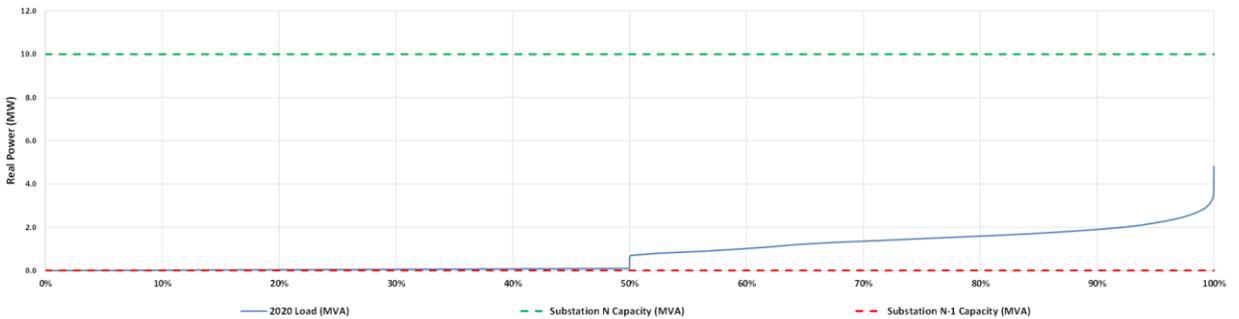
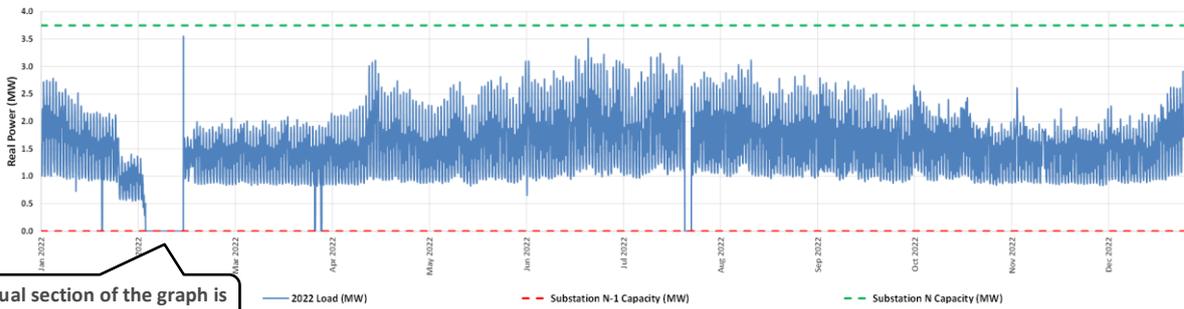


Figure 38 Maunu 33/11kV zone substation: Real power (MW) load characteristics

NGUNGURU MW

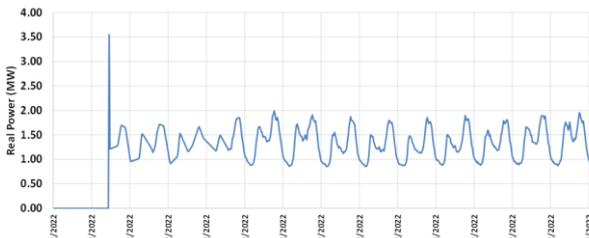
Ngunguru Zone Substation (2022 year) - Half hourly loading



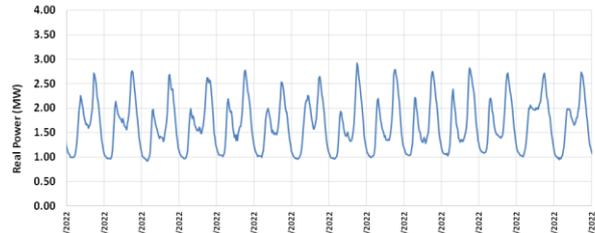
Ngunguru Zone Substation (2022 year) - Daily Maximum/Minimum



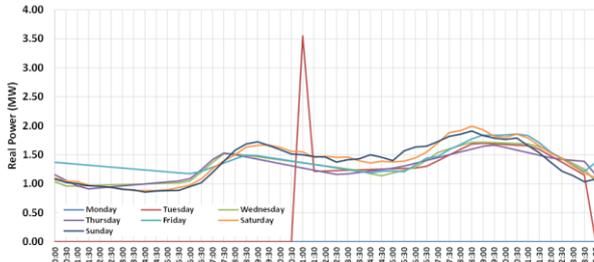
Ngunguru Zone Substation (2022 year) - Summer (February)



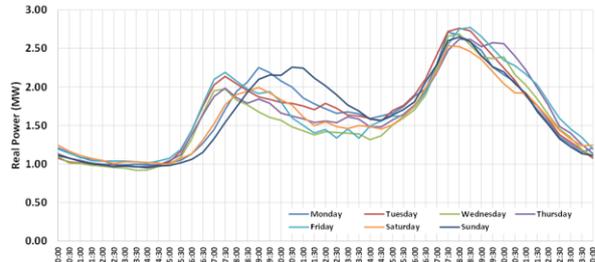
Ngunguru Zone Substation (2022 year) - Winter (June)



Ngunguru Zone Substation (2022 year) - Summer (February)



Ngunguru Zone Substation (2022 year) - Winter (June)



Ngunguru Zone Substation (2022 year) - Load Duration Curve

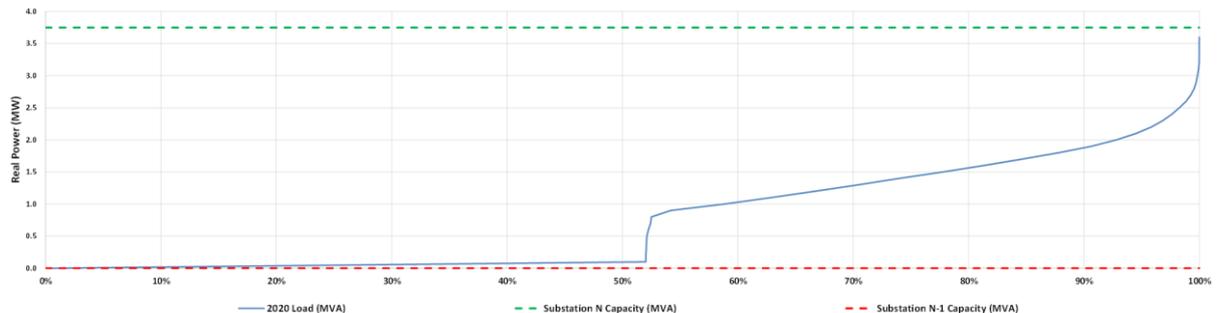
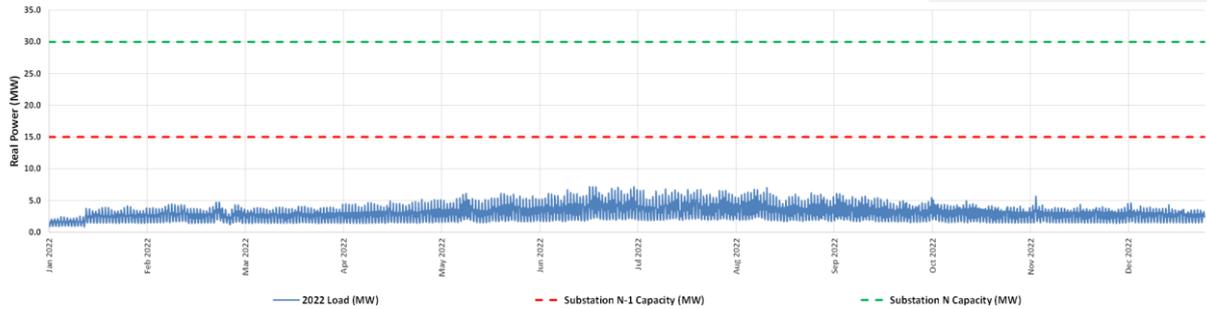


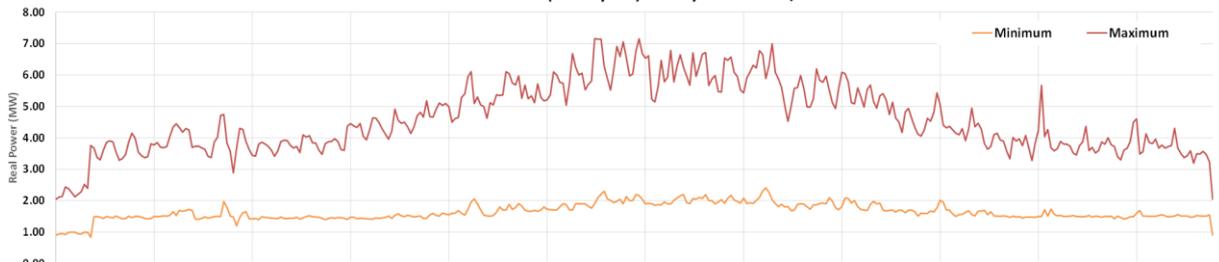
Figure 39 Ngunguru 33/11kV substation: Real power (MW) load characteristics

ONERAHI MW

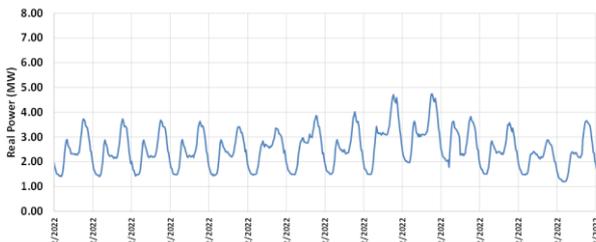
Onerahi Zone Substation (2022 year) - Half hourly loading



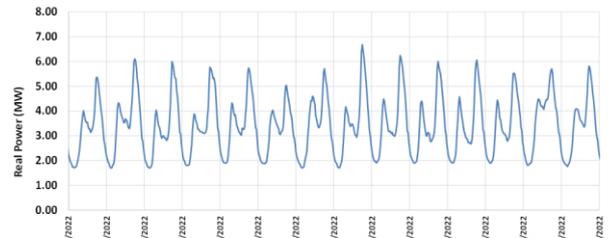
Onerahi Zone Substation (2022 year) - Daily Maximum/Minimum



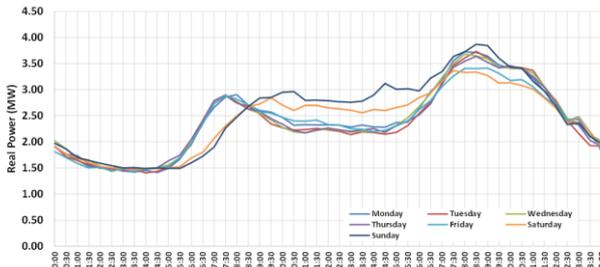
Onerahi Zone Substation (2022 year) - Summer (February)



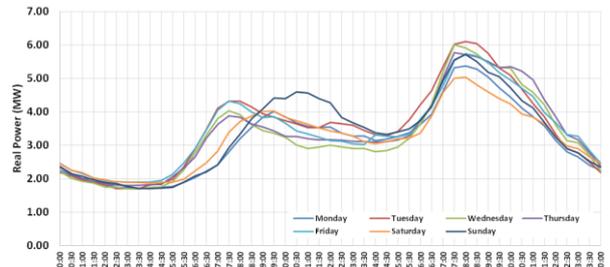
Onerahi Zone Substation (2022 year) - Winter (June)



Onerahi Zone Substation (2022 year) - Summer (February)



Onerahi Zone Substation (2022 year) - Winter (June)



Onerahi Zone Substation (2022 year) - Load Duration Curve

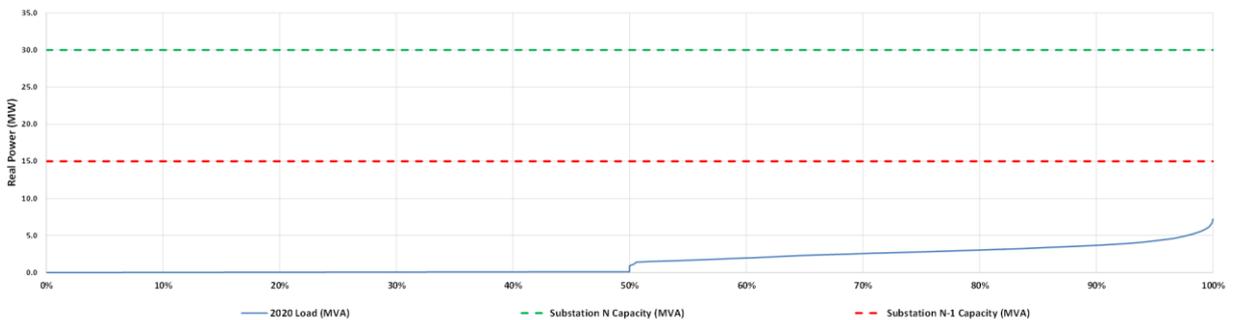


Figure 40 Onerahi 33/11kV zone substation: Real power (MW) load characteristics

PARUA BAY MW

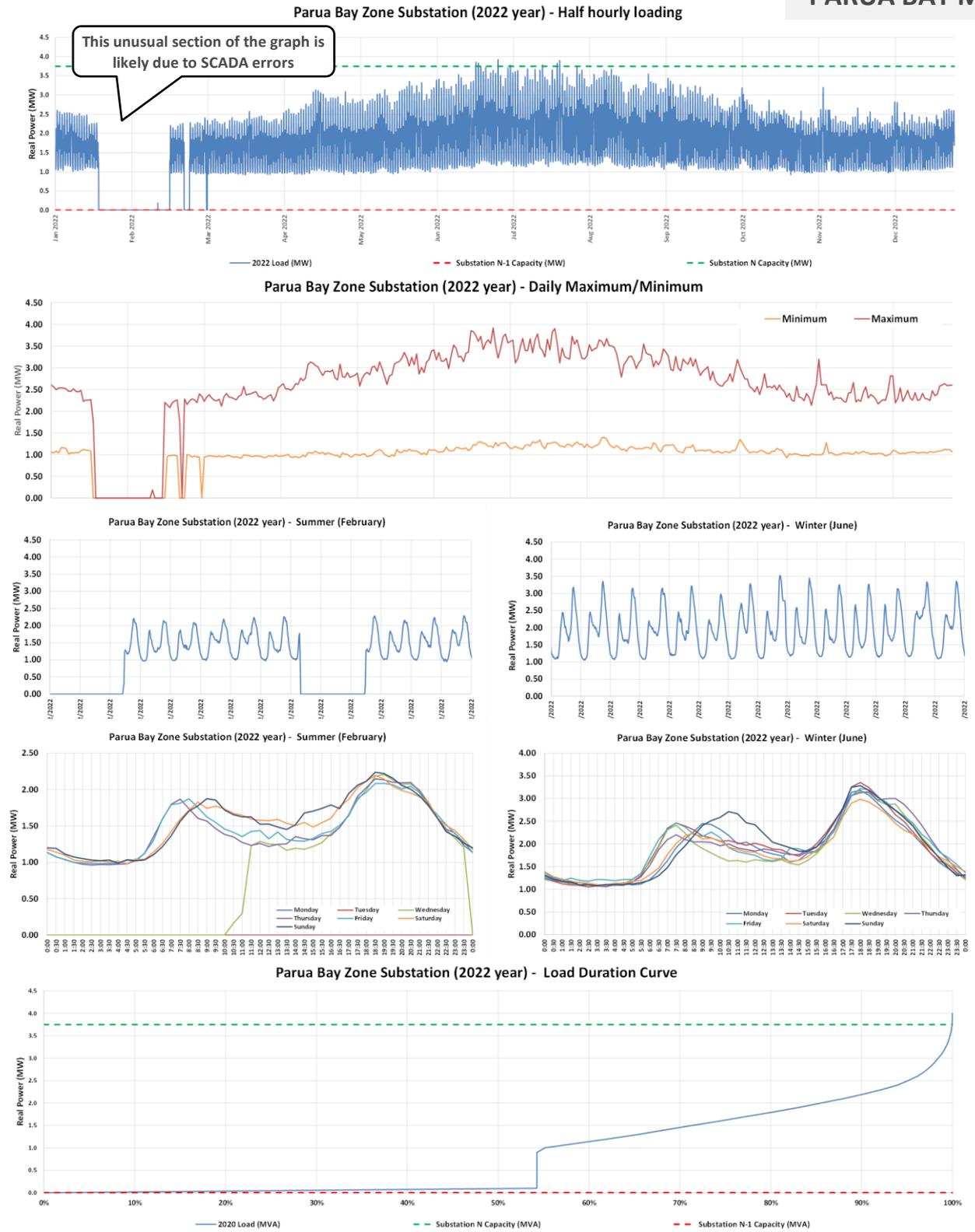
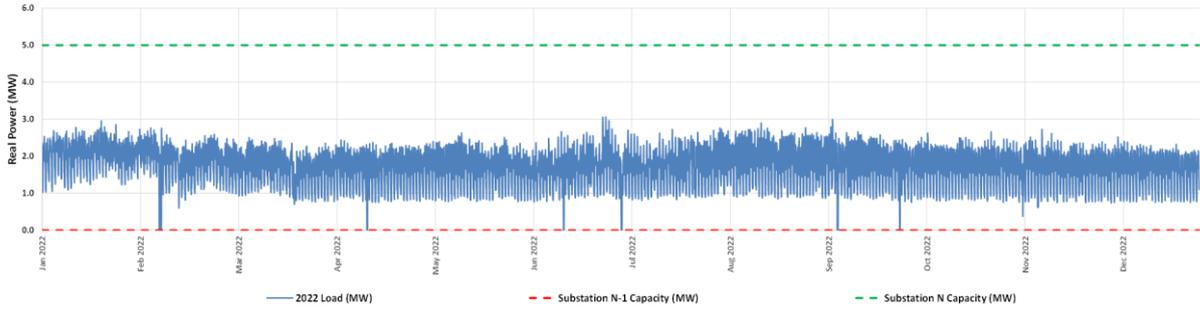


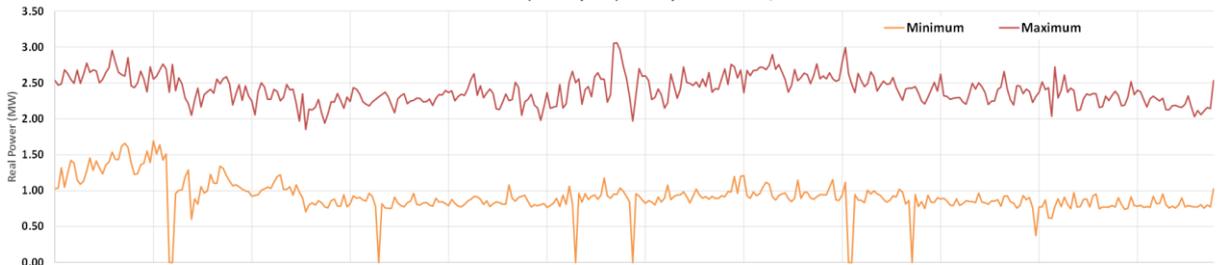
Figure 41 Parua Bay 33/11kV zone substation: Real power (MW) load characteristics

POROTI MW

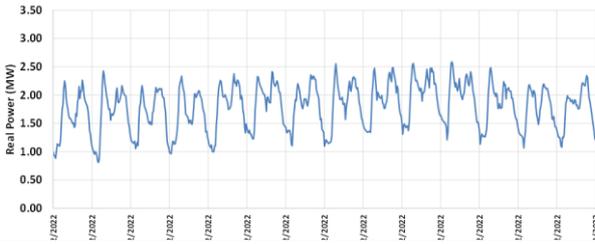
Poroti Zone Substation (2022 year) - Half hourly loading



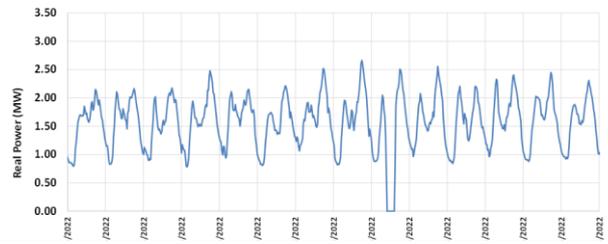
Poroti Zone Substation (2022 year) - Daily Maximum/Minimum



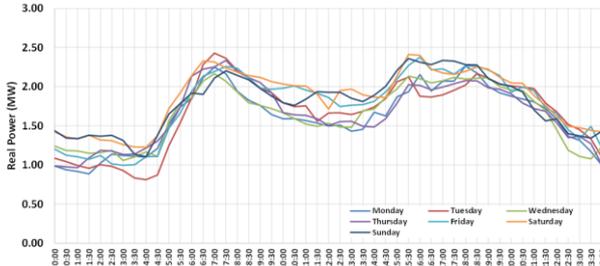
Poroti Zone Substation (2022 year) - Summer (February)



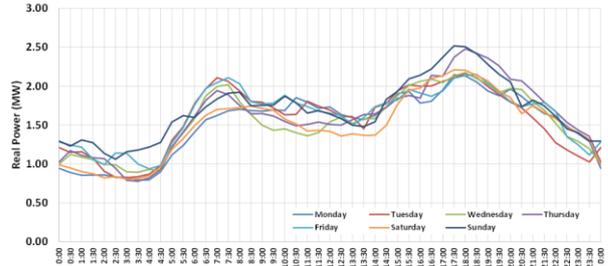
Poroti Zone Substation (2022 year) - Winter (June)



Poroti Zone Substation (2022 year) - Summer (February)



Poroti Zone Substation (2022 year) - Winter (June)



Poroti Zone Substation (2022 year) - Load Duration Curve

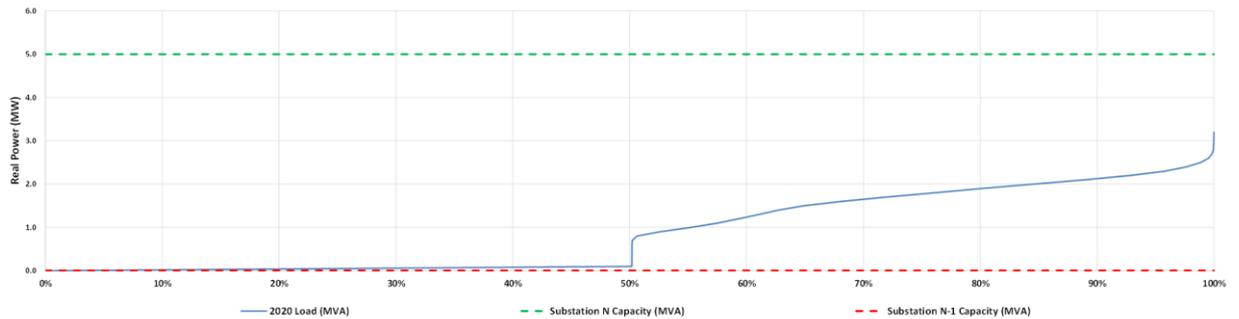
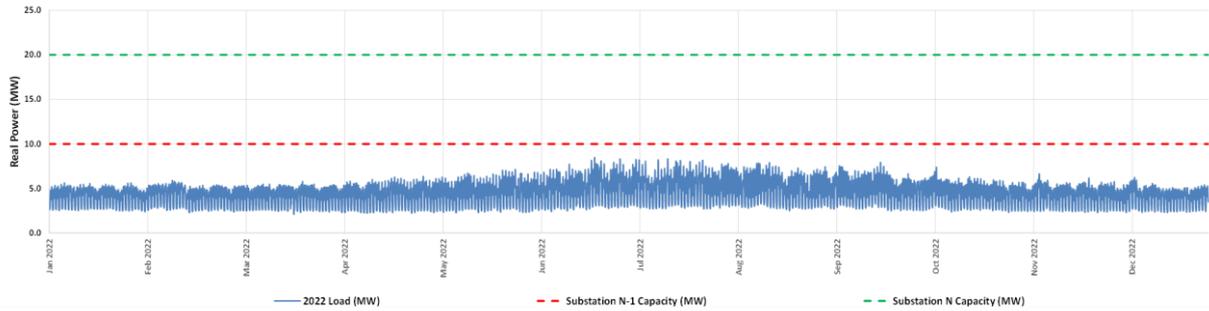


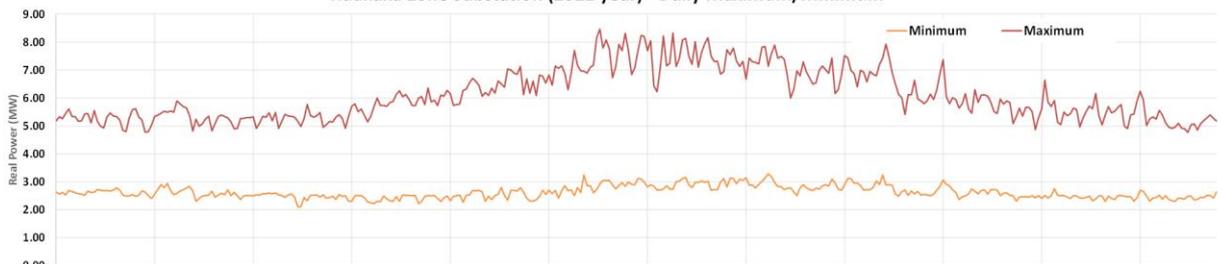
Figure 42 Poroti 33/11kV zone substation: Real power (MW) load characteristics

RUAKAKA MW

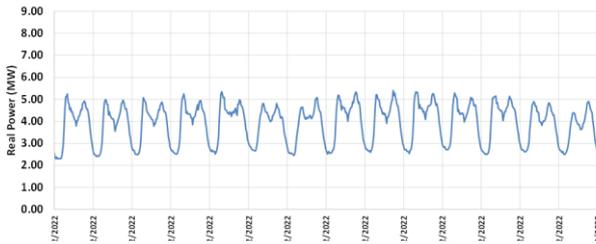
Ruakaka Zone Substation (2022 year) - Half hourly loading



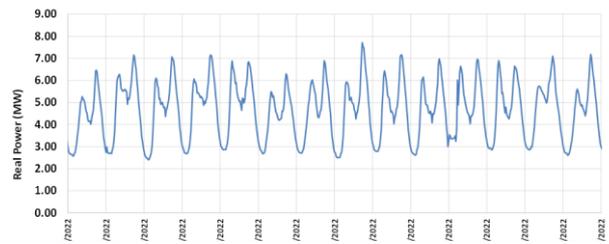
Ruakaka Zone Substation (2022 year) - Daily Maximum/Minimum



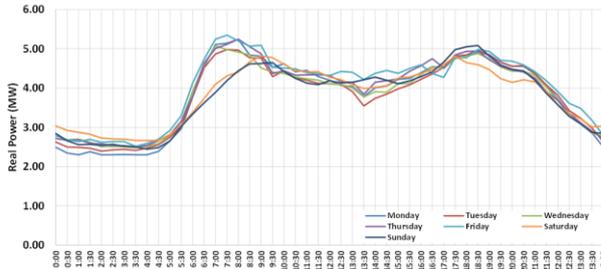
Ruakaka Zone Substation (2022 year) - Summer (February)



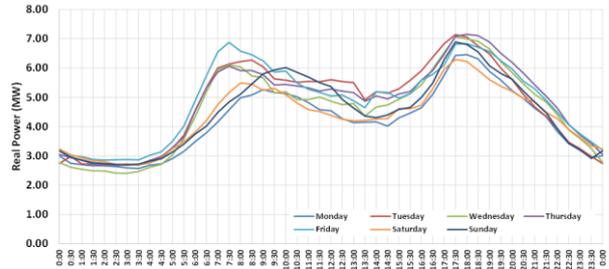
Ruakaka Zone Substation (2022 year) - Winter (June)



Ruakaka Zone Substation (2022 year) - Summer (February)



Ruakaka Zone Substation (2022 year) - Winter (June)



Ruakaka Zone Substation (2022 year) - Load Duration Curve

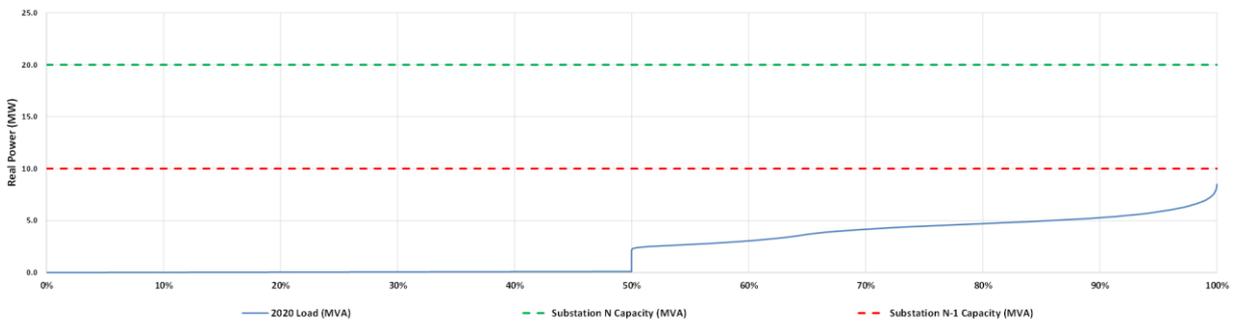
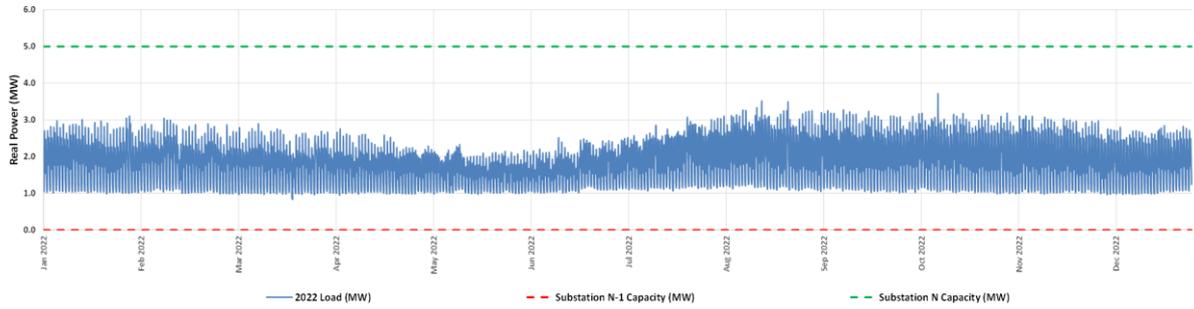


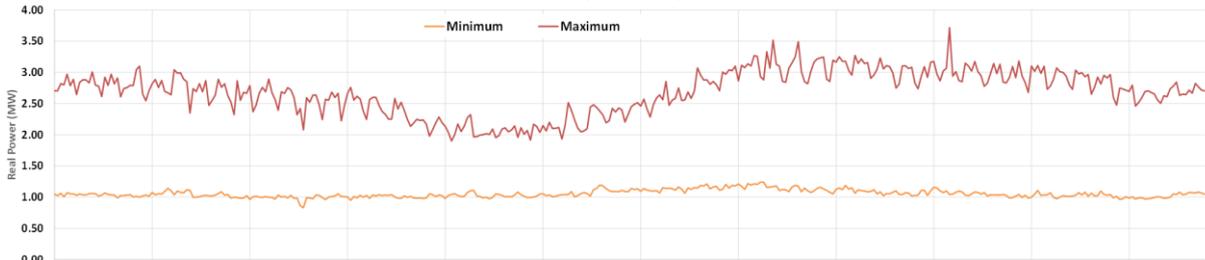
Figure 43 Ruakaka 33/11kV zone substation: Real power (MW) load characteristics

RUAWAI MW

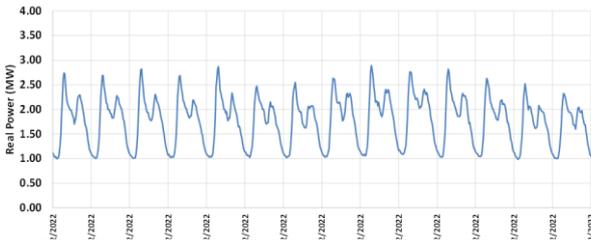
Ruawai Zone Substation (2022 year) - Half hourly loading



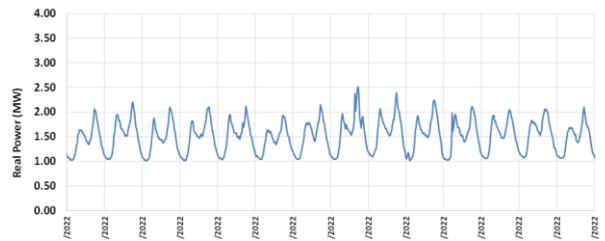
Ruawai Zone Substation (2022 year) - Daily Maximum/Minimum



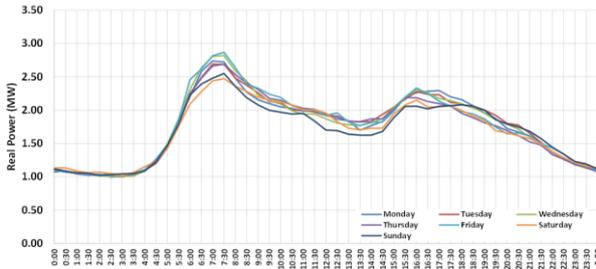
Ruawai Zone Substation (2022 year) - Summer (February)



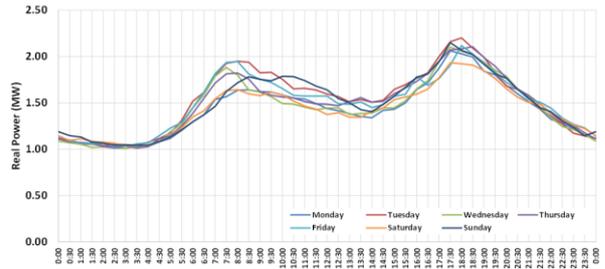
Ruawai Zone Substation (2022 year) - Winter (June)



Ruawai Zone Substation (2022 year) - Summer (February)



Ruawai Zone Substation (2022 year) - Winter (June)



Ruawai Zone Substation (2022 year) - Load Duration Curve

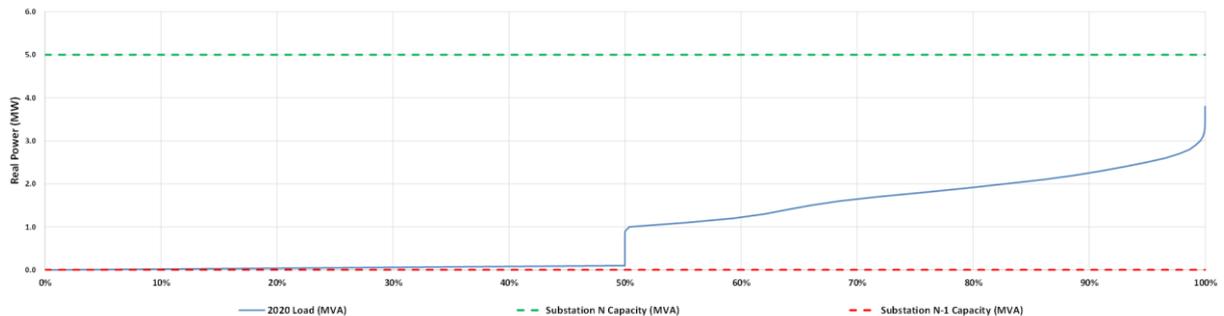
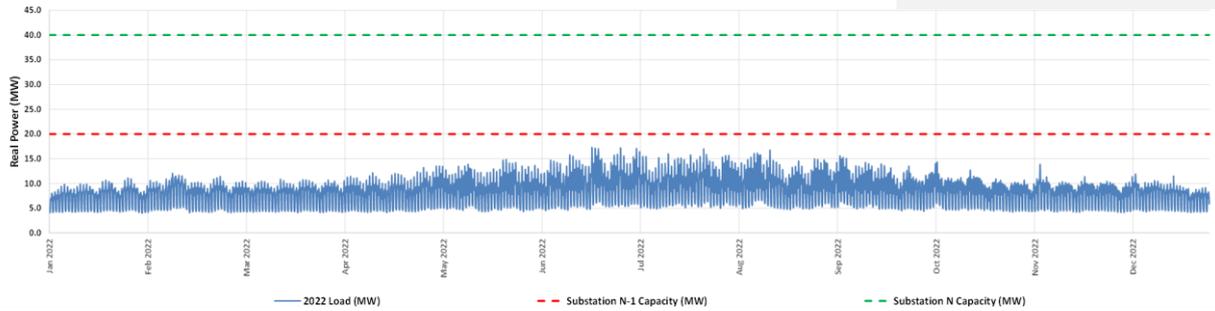


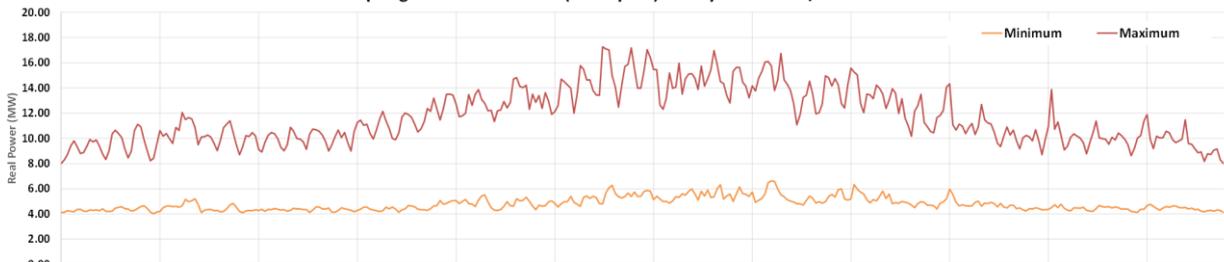
Figure 44 Ruawai 33/11kV zone substation: Real power (MW) load characteristics

TIKIPUNGA MW

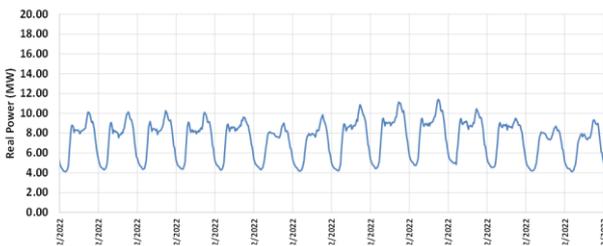
Tikipunga Zone Substation (2022 year) - Half hourly loading



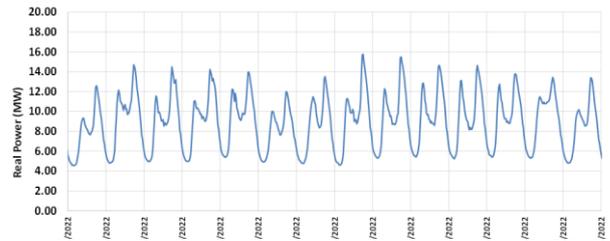
Tikipunga Zone Substation (2022 year) - Daily Maximum/Minimum



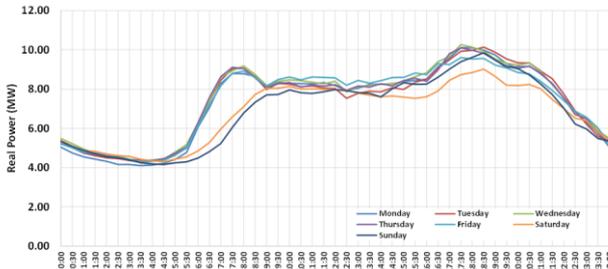
Tikipunga Zone Substation (2022 year) - Summer (February)



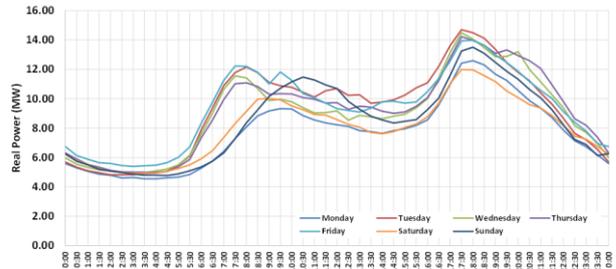
Tikipunga Zone Substation (2022 year) - Winter (June)



Tikipunga Zone Substation (2022 year) - Summer (February)



Tikipunga Zone Substation (2022 year) - Winter (June)



Tikipunga Zone Substation (2022 year) - Load Duration Curve

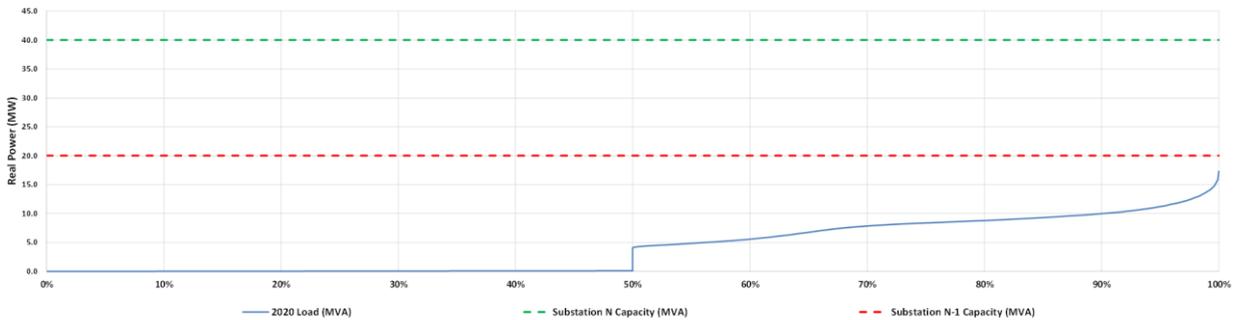


Figure 45 Tikipunga 33/11kV zone substation: Real power (MW) load characteristics

WHANGĀREI SOUTH MW

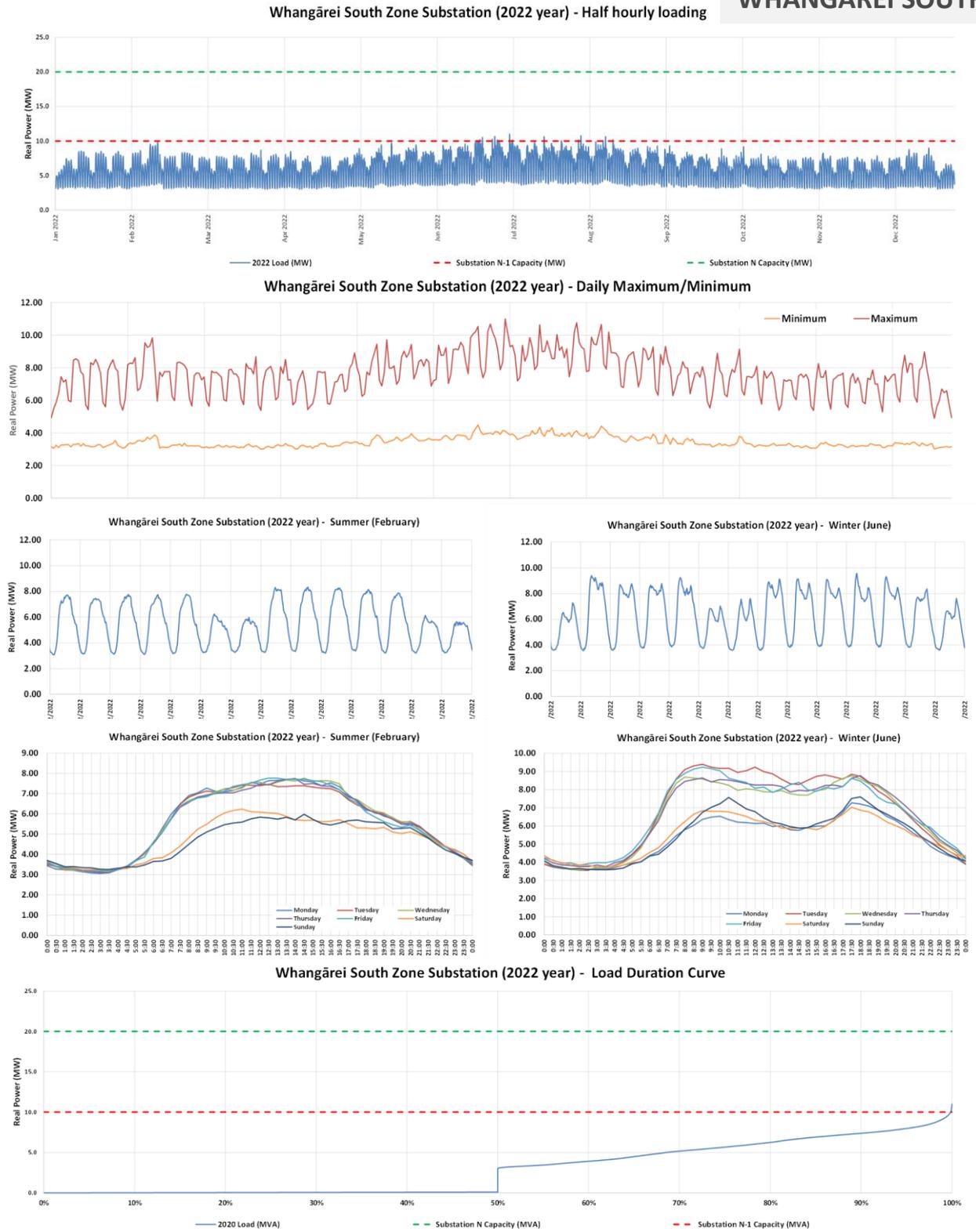


Figure 46 Whangārei South 33/11kV zone substation: Real power (MW) load characteristics