

Distribution System

Capability Statement
2024-2026



PREFACE

This Distribution System Capability Statement (DSCS) is provided by Nama Electricity Distribution Company (NEDC) to fulfil its regulatory obligations under Condition number 33 of the NEDC Distribution Licence as well as the Oman Distribution Planning Code 4.4.

NEDC is distributing electricity to customers throughout the Sultanate of Oman excluding Dhofar Governorate as the owner and operator of its electricity distribution system originating from the 33kV busbars of the Oman Electricity Transmission Company (OETC) 132/33kV grid substations down to the final customer's point of connection, which.

incorporates 33kV, 11kV and Low Voltage (LV) distribution system voltage levels and associated assets.

The aim of this DSCS is to provide an up-to-date distribution system capability for the next three years (2024-2026) along with data to enable customers in identifying parts of the system, which offer opportunities for future connections or upgrading of existing connections to the NEDC system and where constraints currently exist or potentially could exist in future.

In addition to the required data made available annually as part of DSCS; NEDC additionally has provided improved detailed system connectivity and additional technical data of assets, impact analysis of Cost Reflective Tariff (CRT) on NEDC customers and an overview of the Low Carbon Technologies (LCTs) especially the photovoltaic (PV) system penetration in the NEDC distribution system which is gaining momentum in our licenced area as well. These additions are expected to provide customers and other stakeholders with a transparent understanding of NEDC distribution system and operational overview, sufficient technical parameters to undertake initial system capabilities assessment and the overall distribution system development.

NEDC have determined this three-year plan to clarify and highlight NEDC's key priorities over the DSCS planning period. The plan will form the basis for the company's investments to provide economic and efficient system development along with serving to inform NEDC's contributions to the Oman electricity sector and in turn aligning with the Oman Vision 2040 goals.

Eng. Ala Hassan Al Lawati

Chief Executive Officer



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LIST OF ABBREVIATIONS

APSR Authority for Public Services Regulation (formerly known as AER - Authority for Electricity Regulation)

CAGR Compound Annual Growth Rate

CRT Cost Reflective Tariff

DCC Distribution Connection Code

DNS Demand Not Secured

DPC Distribution Planning Code

DSCS Distribution System Capability Statement

DSSS Distribution System Security Standard

D&SL Distribution & Supply Licence

GSS Grid Substation

IEC International Electro Technical Commission

NEDC Nama Electricity Distribution Company

OES Oman Electrical Standards

OETC Oman Electricity Transmission Company

PCR-5 Price Control Review-5 (2018-2021)

PCR-6 Price Control Review-6 (2022-2025)

PSS Primary Substation

PSS@SINCAL Power System Simulator® Siemens Network Calculation

PV Photovoltaic

SCADA Supervisory Control and Data Acquisition

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Reviewer: Acting / Planning Manager Zone 1	Aisha Saif Al Muqarshi
Approval: General Manager Planning	Abdul Aziz Mubarak Al Sinani
Authorisation to Issue	
Corporate Affairs General Manager	Yousuf Mohammed Al Mahrooqi
Chief Planning Project and asset Management Officer	Majid Nasser Al Busaidi
Chief Executive Officer	Ala Hassan Al Lawati

Contact details for further info:

Request for a copy of this DSCS, the associated system studies or for any assistance in interpreting or clarifying any information contained within it; please contact:

NEDC Planning Team

P.O. Box: 1239 Hamriyah

P.C. 131 - Oman

Email: systemplanning@distribution.nama.om

1. INTRODUCTION

1.1. Who We Are & What We Do

The electricity sector in the Sultanate of Oman has been extensively restructured following the law's implementation to regulate and privatize the electricity and related water sector ("The Sector Law"). Royal Decree 78/2004 promulgated the Law for the Regulation and Privatisation of the Electricity and Related Water Sector. Article 90 of the D&SL places an obligation on Distribution Companies to undertake financing, operation, maintenance, development, and expansion of the distribution system in a safe, economic and efficient manner and in accordance with the relevant performance and security standards.

In 2022 a direction has been taken to merge all Distribution Companies (excluding Dhofar Governorate). In Jun 2023 Nama Electricity Distribution Company (NEDC) has been established and it is under the umbrella of the Nama Group and is licensed to carry out electricity network management and related activities such as extension and new connection work in The Sultanate of Oman, except for Dhofar Governorate.

The company is providing the following services: Planning and extension of electricity network, connecting new properties to the electricity network, connecting additional load to existing properties, receiving solar projects applications, receiving requests related to the work on the electricity network, electricity drawings approval for new properties, inspection, replacement and shifting of electricity meters of existing properties, managing scheduled and emergency outages information, testing electricity technicians, Issuing electricity technician license, Receiving and managing requests, queries and complaints about electricity network, receiving customers enquiries about electricity outages in properties. The Figure 1 shows the authorized area for NEDC.

NEDC to achieve the above services, it set vision, mission and values which are:

- **Vision:** Nama Distribution company is a leading reference for electricity services excellence in the Region.
- **Mission:** Empower Oman through safe, reliable, sustainable, economic and customer focused electricity.
- **NEDC Value:** Care, Deliver and Do Better.

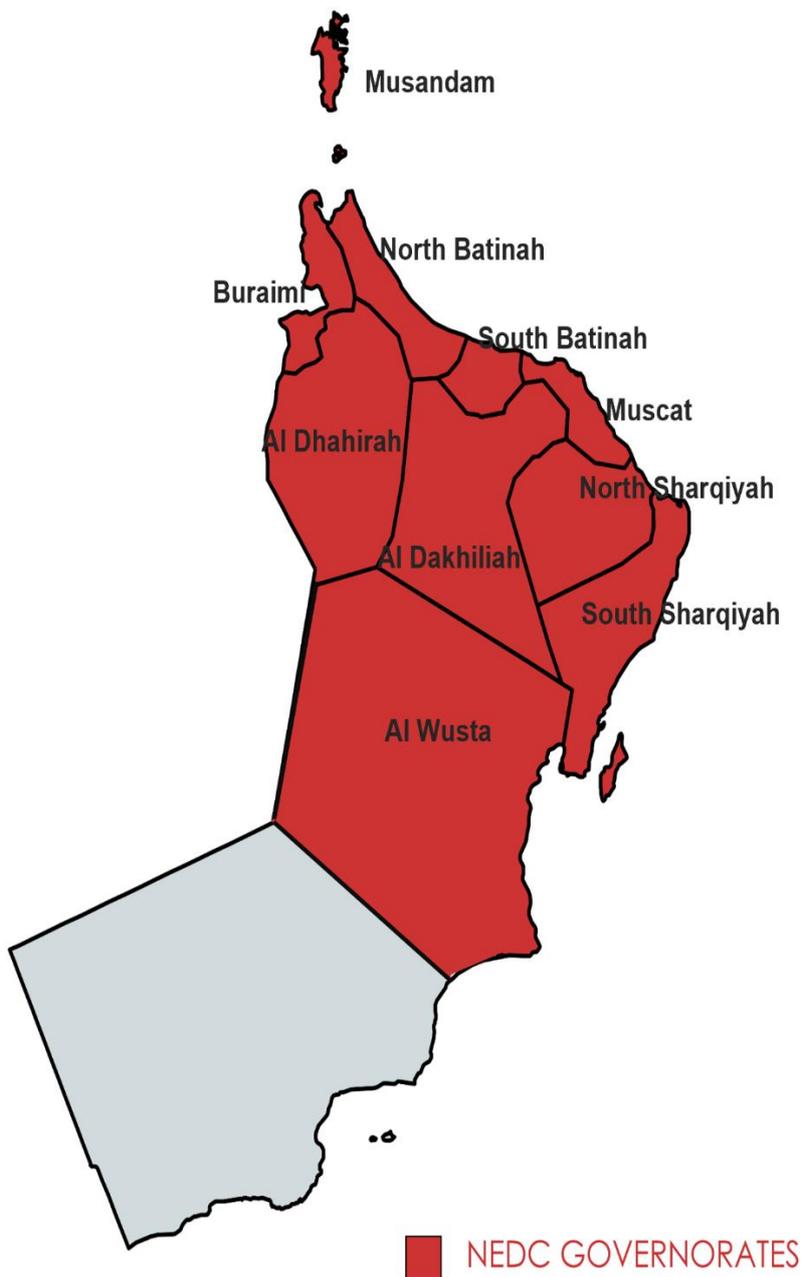


Figure 1: NEDCs Licenses Area

1.2. NEDC Key Statistical Data

The key statistical figures related to the existing electricity distribution network are enumerated in Table 1 below:

Table 1: NEDC key statistical data

Asset Type	Overhead line (All voltage levels)	Underground Cable (All voltage levels)	Distribution Substation (11/0.415 kV)	Primary Substation (33/11 kV)	Grid Station (220/132/33 kV)	Customer Number	Licensed Area
Unit	km	km	No.	No.	No.	No.	km2
Dakhiliah	7,878.30	6,016.40	7,229	88	9	149,669	31,900
North Sharqiyah	7,058.90	3,622.70	4,953	47	6	88,481	21,136
South Sharqiyah	4,264.80	3,797.80	3,257	48	4	89,229	12,000
South Batinah	5,072.10	6,486.00	5,912	103	14	144,742	3,500
Al Wusta	1,609.20	1,327.80	1,063	49	1	25,225	79,700
North Batinah	1,789.60	2,402.80	1,731	82	14	48,144	12,500
Muscat	3,702.20	14,812.10	9,139	184	39	442,278	3,500
Dhahirah	5,239.20	2,964.50	3,674	42	6	65,928	37,000
Musandam	729.2	1,086.60	811	16	3	16,555	1,800
Buraymi	2,231.40	1,628.50	2,089	27	5	42,252	7,000
NEDC Total	39,575	44,145	39,858	686	101	1,112,503	210,036

1.3. Purpose of Statement

The information in the Distribution System Capability Statement (DSCS) is published annually to fulfil NEDC regulatory obligation under Condition 33 of its Distribution and Supply Licence (D&SL) and Distribution planning code 4.4 of the Oman Distribution Code.

This DSCS is intended to provide an understanding of NEDC's 33kV, 11kV and LV distribution system along with presenting NEDC's development plans for the 33kV and 11kV distribution system for the years 2024-2026. This statement includes power system data for the primary substation loads, overhead lines, cable circuits, transformers, switchgear, and capacitors which forms the NEDC distribution system and used in the preparation of distribution system models for the power system studies. The results of load flow, short circuit studies and system technical losses are presented thereby providing an assessment of the capability of the distribution system.

Implementation of the system development plans is necessary to meet future forecast demand growth, maintain and/or improve the capability in the distribution system to meet the system growth and to address the issues of actual or forecast non-compliance with the Distribution System Security Standard (DSSS). Implementation of these plans will enhance the available system capacity as well as potentially

increase the number of 33/11.5kV primary substations (PSS) providing enhanced opportunities for new and increased customer connections.

The impact of NEDC's forecast demand growth and distribution system development plans on the Transmission System, which is owned and operated by Oman Electricity Transmission Company (OETC), has been fully assessed in the development of NEDC's development plans. Where appropriate 33kV load transfers from one 132/33kV grid substation (GSS) to another are feasible they have been considered and where this option is not feasible; applications for additional 132/33kV GSS capacity have been submitted to OETC, resulting in OETC plans to construct and build additional 132/33kV GSS capacity within the NEDC licence area.

1.4. Structure of this DSCS

The following summarises the structure of this Distribution System Capability Statement:

- **Chapter 1 - Introduction:** An overview of the NEDC area, the main function, and the statement's purpose. Moreover, it presents the key statistical data of NEDC to date.
- **Chapter 2 - Planning philosophy and Practices:** This chapter presents the governing standard that NEDC follows in planning, designing, operating, and maintaining the network. And it illustrates the asset characteristic, configuration, selection, and details of asset data.
- **Chapter 3 - Planning Drivers:** this chapter provides the overall distribution system connectivity in each governorate with future indications projects per wilayat.
- **Chapter 4 - NEDC Distribution System:** provides a summary view of the distribution system, together with details of the 2023 demand profile along with projected demand forecast, CRT impact analysis of NEDC system, system constraints, a summary of the required technical power system analysis of the distribution system. Furthermore, this chapter presents the power flow results for NEDC networks by listing the study methodology and data considered. In addition, it shows the technical losses percentage.
- **Chapter 5 - Challenges and Opportunities within the System:** This chapter presents the future Low Carbon technologies that going to affect directly in the power system such as PV solar systems, Electric vehicles, and the ambition plan of Oman for zero carbon.
- **Chapter 6 - Investment Plan:** The future projects, Network Suitability for New Connections and system constraints are presented in section Six.

2. PLANNING PHILOSOPHIES AND PRACTICES

2.1. Governing Standard

NEDC has an operating philosophy that underlies the development of the distribution system at the three-voltage level 33, 11, and 0.415 kV. Furthermore, it ensures that the whole distribution system satisfies the following fundamental design criteria throughout the planning period:

- Sector Law Royal Decree 78/2004: Enabling legislation that established the Oman Electricity and Water Sectors. Article 90 obligates Distribution Companies to finance, operate, maintain, develop and expand the Distribution System safely and under the relevant performance and security standards.
- NEDC's license conditions 4, 32, and 33.
- Distribution Code Version 1.1 (April 2020).
- Grid Code Version 3.0 (August 2020).
- Oman Electrical Standard (OES) and international standards.
- Security of Supply standards (APSR letter 2008).
- Connection Statement Version 1 (October 2006).
- Electrical Safety Rules.

Copies of the above standards and codes are available on APSR's website (<https://apsr.om/en/home>). Moreover, the distribution system must also be capable of being operated, maintained, repaired, extended and replaced as necessary during its life without exceeding design levels of risk to the customers it serves.

2.2. System Characteristic

NEDC designs its electricity distribution system based on several technical characteristics to fulfil the requirements of the regulations and standards. System fundamental characteristics are described below:

2.2.1 System Parameters: NEDC will ensure that the Distribution System complies with the following technical, design, and operational criteria concerning the Distribution System at the Connection Site with a Distribution System User. System parameters are briefed in the following Table 2:

Table 2: System Parameter

No.	Parameter	Unit	Distribution System Voltage (KV)		
			LV	11	33
1	Nominal Voltage	kV	0.415	11	33
2	Rated Frequency	Hz	50	50	50
3	Short Circuit Level	kA	40	18.4 ¹	25 ²
5	Harmonic Level	%	2.5	2	2
6	Voltage fluctuations	%	3	3	3

¹ There are different short circuit level 25 kA and 31.5 kA based on Substation design requirements.

² There are different short circuit level 31.5 kA based on Substation design requirements.

2.2.2 Voltage regulation: The voltage on the 33 kV and 11 kV sides of Distribution transformers at Connection Sites with Distribution System Users shall typically be controlled within limits $\pm 6\%$ of the nominal value.

Table 3: Voltage Regulation

Nominal Voltage Level	Tolerance	
	+6%	-6%
33kV	34.98kV	31.02kV
11kV	11.66kV	10.34kV
415V	439.90V	390.10V
240V	254.40V	225.60V

2.2.3 Frequency Deviation: During normal operating conditions, the nominal System Frequency of the Transmission and Distribution Systems will be 50.00 Hz and usually will be controlled by Oman Electricity Transmission Company (OETC) between 49.95Hz and 50.05Hz. During exceptional steady-state conditions, Frequency deviations will not exceed 49.90Hz to 50.10Hz unless disturbed circumstances prevail. Under disturbed conditions, System Frequency could rise transiently to 51.50 Hz or fall to 48.00 Hz.

2.2.4 Voltage Waveform Quality: The maximum total levels of harmonic distortion on the Distribution System at 33 kV and 11 kV, from all sources under both normal, planned outage and fault outage conditions, shall not exceed a total harmonic distortion of 2.0 % with no individual harmonics greater than 1.5 % unless abnormal conditions prevail. At LV, the maximum levels of harmonic distortion from all sources shall not exceed a total harmonic distortion of 2.5 %.

The maximum negative phase sequence component of the phase voltage on the Distribution System should remain below 1.0 % unless abnormal conditions prevail. A maximum value of 2.0 % is permitted for phase unbalance.

2.2.5 Voltage Fluctuation: Voltage fluctuations arising from fluctuating Demands Connected at a Connection Point to the Distribution System shall not exceed 1.0% of the voltage level for step changes that may occur repetitively. Any large voltage excursions other than step changes may be allowed up to a level of 3.0%, provided this does not constitute a risk to the Distribution System or any Distribution System User.

2.2.6 Distribution System Security Standard (DSSS): After the approval of Distribution System Security Standards in November 2008, as shown in Table 4 below, NEDC is obliged to comply with the Planning requirements of Security Standards. Since NEDC's Distribution License grant, NEDC has started planning its distribution network to comply with simple planning principles to supply its customers with high-quality products.

Table 4: Distribution System Security Standards DSSS

Class	Demand Group	First Outage	Second Outage
A	Less than 2 MW	Repair Time	No Requirement
B	2MW to 6MW	3 Hours ³	No Requirement
C	6MW to 20MW	Within 15 minutes	Restoration time of planned outage
D	20MW to 100MW	Immediately	Restoration time of planned outage
E	Greater than 100MW	Immediately	Immediately, 2/3 of demand

According to the Security Class, a 33 kV feeder is considered not complying with the standards if, upon a fault on the feeder, the Demand Group cannot be supplied within the prescribed period. A portion of the feeder cannot be fed back, and the feeder is considered and classified as non-compliant.

For the 33/11 kV substations, two situations are of interest. In the first case, if two transformers are installed in a substation but the total load is greater than the capacity of one transformer, then the substation is considered non-compliant. The second situation is where only one transformer is installed, and there is no link to a nearby substation that can take the affected demand group, then the substation is considered non-compliant. It is worth mentioning that non-compliance is only during the summer period. For most of the year, many feeders and substations comply with the DSSS except the radial feeders, T-Offs, and substations with only one installed transformer. All investments in NEDC Network are to make all substations comply with DSSS.

2.3. System Configuration

2.3.1 33 kV system: The 33 kV System of NEDC serves a distribution role between the OETC and the 11 kV system as direct 132/11 kV transformation is also in use. The System consists mainly of 33 kV feeders, 33/11kV primary substations, and 33/0.415 kV transformers installed on some feeders where it is not feasible to develop an 11 kV network due to limited demand. The 33 kV feeders from the 132/33 kV grid stations supply the 33/11 kV primary substations.

Primary substations are of two types, namely indoor and outdoor. Indoor primary substations are mainly 2x10 MVA, 2x20 MVA and 3x20 MVA with 33 kV outdoor/indoor circuit breakers and 11 kV indoor switchgear panels. Indoor primary substations are proposed to be constructed during the coming years to supply highly growing areas. Outdoor primary substations are installed throughout the ten governorates of NEDC in urban and rural areas where demand usually is less than 6 MW. The regular

³ For 11kV networks in remote areas this restoration time may be extended by the time it reasonably takes for a repair crew to reach the area with the outage as long as the total restoration time will not exceed 6 hours.

practice is to supply each primary substation with two 33 kV feeders; each feeder feeds one transformer and serves as an alternative supply for the whole substation if the other feeder fails.

Along with the 33 kV feeders, Tees are used to connect primary substations. The entire network is interconnected, except in a few situations where radial feeders without interconnections with other feeders feed primary substations. The number of 33/11 kV substations and transformers in the System up to September 2023 is shown in Table 5.

Table 5: Number of 33/11 kV transformers

Power Transformer Size	Governorate										NEDC
	Muscat	Dhakliyah	Dhahirah	Wusta	North Sharqiyah	South Batinah	South Sharqiyah	North Batinah	Buraymi	Musandam	
1 MVA	1	-	-	8	-	-	2	-	1	5	17
3 MVA	8	6	10	15	7	1	3	6	2	6	64
5 MVA	4	-	-	-	-	-	-	-	-	-	4
6 MVA	51	81	29	19	58	79	38	26	18	7	406
10 MVA	10	2	10	13	2	4	9	11	5	3	69
15 MVA				1							1
16 MVA	16	-	-	-	-	-	-	-	-	-	16
20 MVA	322	93	37	30	29	115	44	126	24	8	828
31.5 MVA	2	-	-	7	-	-	-	-	-	-	9
40 MVA				1							1
Total	414	182	86	94	96	199	96	169	50	29	1415

The 33 kV indoor switchgear is a single bus bar, totally enclosed metal-clad type with withdrawable circuit breakers or metal-clad SF6 insulated with vacuum or SF6 circuit breakers. 11 kV and 33 kV current ratings of the bays are shown in Table 6.

Table 6: Current Ratings of Bus Bar, Bus-section, Transformer, and Feeder Bays

Rating ⁴	11 kV at Primary Substations	33 kV
Bus-bar	2000 A	2000A
Bus-Section	1200 A	1200A
Transformer	1200 A	600A
Feeder	400 A	600A

Most of NEDC's primary substations are standard two transformers with two separate 33 kV and 11 kV busbars. In some cases where demand is much less than the capacity of two transformers, which is expected in remote rural areas, primary substations with only one 33/11 kV transformer are installed. The 33 kV network is designed and will be developed to meet its customer's satisfaction and comply with the Distribution System Security Standards (DSSS).

⁴ There are special cases where the thermal rating may vary.

2.3.2 11 kV System: The main purpose of the 11 kV systems is to distribute electricity into and around local urban and rural areas in an economical, efficient, safe and secure manner while meeting customers' needs. The general design principle for configuring the distribution system is based on primary substations, indoor and outdoor, with mainly two transformers and 11 kV busbars, providing a continuous firm 11 kV supply.

The 11 kV feeders from the 33/11 kV indoor and outdoor primary substations are overhead lines or underground cable feeding the distribution transformers. 11 kV circuit breakers are provided at all indoor primary substations, whereas 11 kV Auto-Reclosers are provided at the outdoor primary substations. Regular practice is usual when connecting feeders from the same primary substation or different primary substations through Ring Main Units (RMU), Air Break Switches (ABS), and Open Jumpers.

These 11 kV feeders are generally operated as radial feeders, with the open point selected for ease of operational access to minimize customer minutes lost while considering the need to meet security requirements and reduce system losses and voltage drops.

Distribution substations are of two types, ground-mounted and pole-mounted. One transformer with a rated capacity of 500 kVA or higher is commonly used for ground-mounted distribution substations, whereas those transformers with ratings less than 500 kVA are installed on H-Pole structures. Both substations are fed directly from the 11 kV feeders with jumpers (Pole-Mounted) or through 11 kV cables (Ground-Mounted). Expulsion fuses protect both substations on the high voltage side, and HRC fuses on the low-tension side. However, Ground-mounted transformers connected through HFU are protected by HRC fuses of 125 A, 63 A and 31.5 A for 2000 kVA, 1000 kVA & 500 kVA, respectively.

NEDC has already started implementing two smaller ratings, 25 and 50 kVA, to minimize transformer losses arising from higher ratings for loads far away less than the capacity of the transformer. The number of distribution substations in the system up to September 2023 is shown in the below table.

Table 7: Number of distribution transformers

Distribution Transformer Size	Governorate										NEDC
	Muscat	Dhakliyah	Dhahirah	Wusta	North Sharqiyah	South Batinah	South Sharqiyah	North Batinah	Buraymi	Musandam	
16 KVA	5	-	-	1	-	-	-	-	-	-	6
25 KVA	2	60	3	1	23	8	6				103
50 KVA	20	127	253	2	407	86	129	82	43	4	1153
100 KVA	575	2345	1159	523	2102	1368	772	1427	793	218	11282
200 KVA	229	479	284	94	458	743	228	594	194	86	3389
250 KVA	8	-	-	-	-	-	-	-	-	-	8
315 KVA	503	1559	900	102	923	1358	518	2188	282	43	8376
500 KVA	1166	915	278	316	634	2428	545	740	243	315	7580
630 KVA	1	1	-	7	-	-	-	-	-	-	9
750 KVA	2	-	-	2	-	-	-	-	-	-	4
800 KVA	3	1	11		1						16
1000 KVA	7524	1641	743	369	658	2090	789	1672	630	221	16337
1250 KVA	17	-	-	7	-	4	-	-	-	2	30
1500 KVA	18	-	-	16	2	-	-	20	-	4	60
1600 KVA	214	4	-	1		5	1	13	-	-	238
2000 KVA	1877	70	2	26	15	120	100	168	-	1	2379
2500 KVA	35	-	-	3	-	-	-	6	3	-	47
NEDC Total	12199	7202	3633	1470	5223	8210	3088	6910	2188	894	51017

2.3.3 Low Voltage System: The main purpose of the LV distribution system is to distribute electricity in local urban or rural areas and deliver it to customers' LV entry points in an economical, efficient, safe and secure manner. The LV system will generally be developed as a network of taped radial mains supplied from a distribution substation near the load Centre.

NEDC's low-tension network is designed and will be developed to meet its customer's satisfaction and comply with the approved Distribution System Security Standards.

2.3.4 Small Scale Grid Connected Solar PV Systems: The minimum technical specifications and connection methodologies for installation of small-scale grid connected Solar PV systems within Oman are specified in the Technical and Connection Guidelines published by APSR in May 2017; these shall be adhered by PV system installers and users for PV system installations. Furthermore, other national & international standards, network codes, and other specific technical requirements of NEDC may apply to solar PV generating plants and therefore shall be complied with.

2.3.5 Electric Vehicles (EV) Charging Technical Requirements: In July 2023, APSR published the EV Charging Technical Requirements Guidelines. The guidelines include the required technical specifications and connection methodologies for installation of EV charging within Oman. NEDC is in process of setting up the code of practice and the policy to be followed for EV applications.

2.4. Selection of Asset

The choice of network assets suitable to connect a specific demand is subject to many factors, including the following:

- Geographical location.
- Size and nature of the demand.
- Available network voltage level within the vicinity of the demand area.
- Spread of demand distribution (load density).

Based on NEDC technical specifications, standards, and regulations, the size and rating of network assets have been determined and can be summarized network common assets as per below Table 8:

Table 8: Standard Substation Size and Rating

Voltage Level (kV)	Equipment	Size/Type	
33	Over Headline ACSR Conductor	200 Sq.mm (panther)	
	Under Ground XLPE Insulated Copper Cable	3C X 300 Sq.mm	
	Power Transformer		20 MVA
			16 MVA
			10 MVA
			6 MVA
			5 MVA
			3 MVA
		1 MVA	
	Switchgear		SF6 GIS
		AIS	

Voltage Level (kV)	Equipment	Size/Type
11	Over Headline ACSR Conductor	150 Sq.mm (wolf)
		100 Sq.mm (dog)
	Under Ground XLPE Insulated Copper Cable	3C X 240 Sq.mm
		3C X 185 Sq.mm
	Distribution Transformer	2000 KVA
		1000 KVA
		500 kVA
		315 kVA
		200 kVA
		100 kVA
50 kVA		
Switchgear	25 kVA	
	Oil RMU	
0.415	Over Headline XLPE Covered Aluminium Conductor	SF6 RMU
		120 Sq.mm
	Under Ground XLPE Insulated Copper Cable	70 Sq.mm
		4C X 240 Sq.mm
		4C X 185 Sq.mm
	4C X 120 Sq.mm	

2.5. Details Asset Data

NEDC detailed assets list and evolution in Appendixes B.1, B.2, B.3, B.4 and B.5, while the below link presents the geographical maps of the 10 governorates under NEDC service area showing the locations of Interface points with OETC, NEDC primary substations, 11 kV feeders, and distribution transformers.

Geographical map link:

<https://mzgisportal.mzec.co.om/portal/apps/webappviewer/index.html?id=dfb78b59fc294e3082ed3c213ee360e4⁵>

⁵ The Username and password to be provided upon request.

3. PLANNING DRIVERS

3.1. Background

NEDC's electricity distribution system serves around 1,267,808 customers cover Muscat, South Batinah, Dakhiliah, North Al Sharqiyah, South Al Sharqiyah, Al Wusta, North Batinah, Musandam, AL Buraymi and Al Dhahirah Governorates. The characteristics of the distribution system within the NEDC licence areas differ mainly because of three major parameters:

1. The load density.
2. The type and usage pattern of the customer.
3. The majority type of feeder circuits (i.e., overhead, or underground).

The 2023 maximum demand recorded for NEDC MIS system was 6995.5 MW⁶ (on Thursday – 22nd June 2023 at 15:11 Hrs) and Musandam Area was 89.2 MW⁷ on Sunday 16th July 2023 at 13:43. For Al Wusta Area the Non-coincident peak was 155.47 MW.

As of 2023 peak period, the total existing number of 132/33kV grid substations is 101, 33/11.5kV primary substations connected to the NEDC distribution system is 686 with a Total Firm Capacity of 11,075.2 MVA. The tables identifying each Primary Substation capacity and current demand can be found in Appendix B.

The sections remaining from this chapter provide the following:

1. A summary of the individual Governorate built up and the planning drivers for each Governorate.
2. It also provides an overview of the complete current NEDC system connectivity including governorate classification of the primary substation.

⁶ MIS Transmission peak excluding of transmission technical losses and Grid Stations auxiliary load

⁷ Including 7 MW of isolated Madha load

3.2. Muscat Governorate

The Muscat Governorate includes Wilayat Muscat, Muttrah, Amerat, Quriyat, Bousher and Seeb. The number of customers served in the Muscat Governorate region is 448,509 which is approximately 35% of the total customer population within NEDC. Table 9 shows all existing primary substations with their installed and firm capacity within Muscat Governorate.

3.2.1. Wilayat Muscat

Wilayat Muscat is considered as one of the saturated areas within Muscat Governorate except Yitti Area. The Yitti Tourism Development is one of the major projects. Moreover, the plan is to construct two numbers of PSSs; one is under commissioning stage and the other one is in the planning Stage.

3.2.2. Wilayat Muttrah

Wilayat Muttrah has circa zero growth for the last two years. There is one project for Muttrah Development as bulk load customer, and it is still within the planning stage.

3.2.3. Wilayat Amerat

Amerat has seen the highest demand growth for the last 5 years within Muscat Governorate validating for a significant demand growth forecasted for the current planning horizon.

3.2.4. Wilayat Quriyat

Quriyat has an average of 3% load growth for the next three years and there is no major project in the area.

3.2.5. Wilayat Bousher

Bousher Height Smart City is one of the biggest projects in Wilayat Bousher. As load demand the area has low growth with an average of 1%.

3.2.6. Wilayat Seeb

Seeb has seen growing demand for the last 5 years within Muscat Governorate specially Mabelah area. Moreover, Mabelah area is one of the largest commercial and residential areas. In addition, Rusail industrial area is earmarked for some significant development projects by Public Establishment for Industrial Estates (PEIE).

Table 9: Muscat Governorate - Grid and Primary Substations Connectivity

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Falaj[G23] GSS			
Falaj	P178	2 x 16	16
Darsait	P018	2 x 20	20
Muttrah Store	P085	2 x 20	20
Jibrooh	P041	3 x 20	40

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Sea Port	P086	2 x 6	6
P.D.O	P144	3 x 20	40
Mutrah[G21] GSS			
C.B.D	P173	2x10 and 1x16	20
Ruwi Office	P108	2 x 20	20
Bait Al Falaj	P142	3 x 20	40
Riyam	P099	2 x 20	20
Wadi Al Kabir[G19] - A GSS			
M.B.D South	P075	2 x 20	20
Qasr Al Alam	P090	2 x 20	20
Waljah	P130	2 x 20	20
Sidab	P119	2 x 6	6
Wadi Al Kabir Workshop	P126	2 x 6	6
Wadi Al Kabir Housing	P127	1 x 6	-
Ali Shihani	P125	2 x 20	20
Majlis Oman	P066	2 x 20	20
Wadi Al Kabir[G19] - B GSS			
Ruwi Valley	P174	2 x 20	20
Ruwi Market	P076	2 x 20	20
Old Airport	P107	2 x 20	20
Wadi Al Kabir Height	P128	2 x 20	20
Wadi Adai[G22] GSS			
Amerat 1	P005	2 x 16	16
Al Bustan Palace	P017	2 x 16	16
Al Hamryah	P035	2x6	6
Wadi Adai	P175	2 x 20	20
Wattaya	P131	2 x 20	20
Khoula Hospital	P132	3 x 20	40
Al Mahaj	P136	2 x 6	6
Jahlout[G03] GSS			
Sawaqim 1	P112	2 x 6	6
Sawaqim 2	P113	1 x 6	0
Tunis Heium	P137	1 x 6	0
Jahlout	P040	2 x 6	6
Siya	P120	2 x 6	6
Barr Al Jissah	P044	2 x 20	20
Amerat Jahlut [Al Masarat]	P068	2 x 10	10
Al Hajir	P031	2 x 20	20
Wadi Al Mayh	P129	1 x 3	0
Hussan Yiti	P169	2 x 6	6
ROP Al Saleel	P162	2 x 6	6

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Al Atkiya	P182	1 x 6	0
Water Pumping	P193	2 x 6	6
Arqi	P121	1 x 3	0
Yiti[G08] GSS			
Al Khairan	P045	1 x 6 + 1 x 3	3
Yenket	P133	1 x 1 + 1 x 3	1
Saraya Bander	P145	3 x 20	40
Jabal Al Sifah	P159	3 x 20	40
Yiti	P134	2 x 3	3
Muscat Yankit	P199	1 x 6	0
Al Salam Yiti	P135	1 x 6	0
Quriyat[G05] GSS			
Quriyat	P091	2 x 20	20
Al Shahbari	P092	2 x 20	20
Dhagmar 1	P021	4 x 6	18
Debah	P114	1 x 6	0
Dhabab	P019	2 x 6	6
Hail Al Ghaf	P036	2 x 6	6
Al Mazara	P074	2 x 6	6
Wadi Al Arbyeen	P124	1 x 6	0
Street Light	P020	1 x 6	0
RoyalCamp	P170	1 x 3	-
Amerat[G10] - A GSS			
Post Office	P150	3 x 20	40
Amerat Heights	P152	3 x 20	40
Amerat 3	P179	3 x 20	40
Amerat[G10] - B GSS			
Al Nahdah	P006	3 x 20	40
Seih Dhab	P118	2 x 20	20
Madinat Al Nahdah	P065	2 x 20	20
Al Jufaina	P194	1 x 6	0
Amerat Amerat [Amerat 4]	P180	3 x 20	40
Ghubrah 2[G09] GSS			
Azaibah North 2	P012	2 x 20	20
Ghubrah North 2	P149	3 x 20	40
Ghubrah North 1	P023	3 x 20	40
Diplomatic City	P022	3 x 20	40
Ghubrah GPS	P166	2 x 16	16
MSQ[GP06] - A GSS			
Al Khuwair North	P054	3 x 20	40
MSQ Grid	GP06	2 x 20	20

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Royal Office	P097	2 x 20	20
Intercontinental	P109	2 x 20	20
Information City 2	P038	1 x 5	-
Sarooj -Shati Al Qurum	P110	2 x 20	20
MSQ[GP06] - B GSS			
Al Khuwair 25	P053	2 x 20	20
Al Khuwair School	P146	3 x 20	40
MSQ 1	P083	2 x 20	20
ROP -Shati Al Qurum	P111	2 x 20	20
Digital TV Studio	P039	2 x 20	20
Qurum[G06] GSS			
Information City 1	P037	2 x 20	20
Qurum 1	P093	2 x 20	20
Qurum 2	P094	2 x 20	20
Lulai	P095	2 x 20	20
MSQ 2	P155	3 x 20	40
Rabiat Al Qurum	P096	2 x 20	20
Bousher [GP02] - A GSS			
Bousher Grid	GP02	2 x 20	20
Al Khuwair South	P052	3 x 20	40
Al Khuwair 17/1	P050	2 x 20	20
Bousher [GP02] - B GSS			
Azaibah North 1	P011	2 x 20	20
Bousher 2	P163	3 x 20	40
Holiday Inn	P051	3 x 20	40
Al Muna	P084	2 x 20	20
Tilal Al Khuwair	P055	3 x 20	40
Ghala Heights[G24] -A GSS			
Al Ansab 1	P007	2 x 20	20
Azaibah South 1-A	P014	2 x 20	20
Ghubrah South 1	P026	3 x 20	40
Ghala Heights[G24] -B GSS			
Mall Of Oman	P171	3 x 20	40
Azaibah South 1-B	P147	3 x 20	40
Royal Hospital	P024	3 x 20	40
Ghala[G11] - A GSS			
ROP Hospital	P172	3 x 20	40
Oman Exhibition	P165	3 x 20	40
Ghala 1	P015	3 x 20	40
MOD Al Ansab	P167	2 x 10	10
Al Ansab STP	P009	2 x 20	20

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Ghala[G11] - B GSS			
Ghala 2	P156	3 x 20	40
Al Ansab 2	P008	2 x 20	20
Airport Heights [G01] - A GSS			
Airport Height 2	P002	2 x 20	20
Airport Height 1	P001	2 x 20	20
Airport Height 5	P151	2 x 20	20
MOD Technical College	P081	2 x 20	20
Airport Height 3	P003	2 x 20	20
Airport Height 4	P004	2 x 20	20
Airport Heights [G01] - B GSS			
Azaibah North 3	P013	3 x 20	40
Rusail Industry[G13]-A GSS			
SQU 1	P122	3 x 16	32
SQU 2	P123	2 x 16	16
Rusail Industrial 1	P103	2 x 16	16
Rusail Industrial 2	P104	2 x 20	20
Al Jifnain	P042	1 x 6	0
Al Jifnain 2	P196	1 x 6	0
Seeb Muaskar Murtafiah [AFH]	P204	2 x 20	20
Cement Housing	P088	2 x 5	5
Rusail Industry[G13]-B GSS			
Rusail Industrial 3	P105	2 x 20	20
Rusail Housing	P056	2 x 20	20
Rusail08(KOM)	P164	3 x 20	40
ROP Al Khoudh	P161	2 x 20	20
Rusail Private Factory	P106	2 x 20	20
Rusail Industrial 4	P158	3 x 20	40
SQU 3	P160	3 x 20	40
Misfah[G04] GSS			
Al Misfah	P080	3 x 20	40
Al Awabi	P139	3 x 20	40
Orpic	P192	2 x 6	6
Cement Factory 1	P079	2 x 31.5 + 3x20	91.5
Barka[G02] GSS			
Manomah	P067	2 x 20	20
Mabelah [GP04] GSS			
Mabelah Grid	GP04	2 x 20	20
Sur Al Hadid	P116	3 x 20	40
Botanic Garden	P016	2 x 20	20
ROP Dog Kennel	P183	2 x 6	6

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Mabelah STP	P140	2 x 10	10
Al'Salam [G12] - A GSS			
Mabelah C	P064	3 x 20	40
Mabelah South PH-4	P062	3 x 20	40
PalmMall	P168	3 x 20	40
Al'Salam [G12] - B GSS			
Mabelah Shabiya	P060	3 x 20	40
Seeb Mabelah South [PH-6]	P185	3 x 20	40
Seeb Mabelah South [Pumping]	P198	2 x 20	20
Seeb Mabelah South	P061	3 x 20	40
Mabelah Industrial[G26] - A GSS			
Old Mabelah	P059	2 x 20	20
Palace Communication	P033	1 x 6	0
RGO Halban Camp	P034	1 x 5	0
Mabelah Industrial[G26] - B GSS			
Mabelah South PH-8	P157	3 x 20	40
Mabelah South PH-7	P141	3 x 20	40
Mabelah A	P063	3 x 20	40
Seeb [GP08] - A GSS			
Al Khoudh Shabiya [A]	P046	3x20	40
Wadi Bahayis (RGO)	P098	2 x 20	20
Wadi Al Aresh	P115	2 x 20	20
Wadi Al Lawami	P117	3 x 20	40
Seeb [GP08] - B GSS			
Seeb Grid	GP08	2 x 20	20
Sultan School	P029	2 x 20	20
Al Hail South 2	P153	3 x 20	40
New Al Khoudh	P047	2 x 20	20
Boulevard Mall	P186	3 x 20	40
Mawaleh South [GP05] - A GSS			
Al Hail North 2	P028	2 x 20	20
Mawaleh South Grid	GP05	2 x 20	20
Mawaleh C	P072	2 x 20	20
Rusail B	P101	2 x 10	10
Royal Flight	P100	2 x 20	20
Mawaleh South [GP05] - B GSS			
Mawaleh B	P071	3 x 20	40
Al Khoudh PH-6	P049	2 x 20	20
Al Hail South 1	P030	2 x 20	20
Seeb Muaskar Murtafiah [MOD]	P203	3 x 20	40
Mawaleh South 5	P148	3 x 20	40

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Al Khoudh[G25]- A GSS			
Mawaleh A	P070	3 x 20	40
Al Khoudh PH-3	P048	2 x 20	20
Seeb Muaskar Murtafiah [Al Bander]	P197	3 x 20	40
Seeb Khoudh [Al Khoudh Shabiya (B)]	P187	2 x 20	20
Al Khoudh[G25]- B GSS			
Al Khoudh PH-7	P154	3 x 20	40
Mawaleh North [GP01] GSS			
Al Hail North 1	P027	2 x 20	20
Mawaleh North	P069	3x20	40
Mawaleh North Grid	GP01	3 x 20	40
City Centre	P073	2 x 20	20
Dhagmar [GP11] GSS	It is 132/11 kV Grid Station. So, no PSS is connected in this Grid.		

3.3. South Al Batinah Governorate and Suawiq Area

South Batinah Governorate and Suawiq Area includes Barka, Musanah, Nakhal, Rustaq, Wadi Mawel, Awabi and Suawiq. The number of customers served in South Batinah Governorate is 145,043. There are 14 Grid stations (132/33 & 220/33 kV) and 103 primary substations (33/11 kV) are feeding the governorate. Barka area has the largest growth among other areas in South Batinah governorate and there are many NEDC Investments in the area to cover the need of load demand. One of the major projects is new primary substation in Khazaen Economic City which is part of Oman Vision 2020-2040. The below table provides a list of primary substations in the South Al Batinah Governorate and Suawiq Area. Table 10 shows all existing primary substations with their installed and firm capacity within South Al Batinah Governorate.

Table 10 : South Al Batinah Governorate and Suawiq Area- Grid and Primary Substations Connectivity

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Rustaq Grid			
Dahas	DAHASP01B	2x20	20
Hazim	HAZIMP01B	2x20	20
Hoqain	HOQAINP01B	2x6	6
Iraqi	IRAQIP01B	2x20	20
Kahaf	KAHAFP01B	2x6	6
Maksofah	MAKSOFAHP01B	2x6	6
Marji	MARJIP01B	2x6	6
Musanah Air Base-2	MSNABASEP02B	1x3	0
Rustaq Grid	RSQGRIDP01B	2x20	20
Rustaq Hospital	RSQHSPTLP01B	2x6	6
Rustaq Ind.	RSQINDP01B	2x6	6
Rustaq Roual Camp	RSQRCAMPP01B	1x6	0
Rustaq	RUSTAQP01B	2x20	20
Tabaqah	TABAQAHP01B	1x6	0
Tawi Bado	TAWIBADOP01B	1x6	0
Tikhah	TIKHAHP01B	2x6	6
Wadi Sahtan	WDISAHTNP01B	2x6	6
Wishayl	WISHAYLP01B	2x20	20
Rustaq Al Bashair	RSQBSHIRP01B	2x20	20
Wadi Bani Auf Grid			
Awabi	AWABIP01B	2x20	20
Kasfah	KASFAHP01B	2x20	20
Wadi Bani Awf	WDIBAWFP01B	2x20	20
Wadi Bani Kharous	WDIBKROSP01B	2x6	6
Nakhal Grid			
Abyad	ABYADP01B	3x6	12
Afi	AFIP01B	2x20	20

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Halban	HALBANP01B	1x6	3.3
Modern Poultry Farms	MODERNPFP01B	2x6	6
Nakhal	NAKHALP01B	2x20	20
Khazaen Temp PSS	KHAZAENP02B	1x6	0
Subaikha Temp	SUBAIKHAP01B	1x6	0
Taww	TAWWP01B	2x6	1.2
TurKi	TURKIP01B	1x6	0
Tuwayah	TUWAYAHP01B	1x6	2.4
Wadi Mstal	WDIMSTALP01B	2x6	6
Barka Grid			
Aman Camp	AMANCAMPP01B	2x20	20
Filayj Village PSS	FLAYJVLGP01B	1x6	0
Filayj Ind Area-1 Temp	FLAYJINDP01B	1x6	0
Filayj Ind Area-2 Temp	FLAYJINDP02B	1x6	0
German University	GERMNUNIP01B	2x20	20
Madeena Logistics	MDENALOGP01B	1x6	0
Rumays	RUMAYSP01B	2x20 + 1x6	20
Sandan	SANDANP01B	3x6	12
Shakakit	SHAKAKITP01B	3x20	40
Sultan Special Force	SSFORCEP01B	2x6	6
Barka-3 PS			
Barka IWP 1	BARIWPP01B	2x20	20
Barka IWP 2	BARIWPP02B	2x20	20
Barka-5 IWP	BARIWPP03B	2x20	20
Hay Asim Temp	N/A	1x6	0
Madinat Barka-A			
Barka Town	BARTOWNP01B	3x20	40
Salahah	SALAHAFP01B	2x20	20
Saqsuq	SAQSUQP01B	3x20	40
Sumhan North	SUMHANNRP01B	2x20	20
Madinat Barka-B			
Aqir	AQIRP01B	2x20	20
Atyab Bakery	ATYBBKRYP01B	2x6	6
Haram	HARAMP01B	3x20	40
Khuwyrat	KHUWYRATP01B	3x20	40
Sumhan South	SUMHANSUP01B	2x20	20
Khadra-A			
Badi Amoud	BADIAMODP01B	2x20	20
Bidayah	BIDAYAHP01B	3x20	40
Diyan	DIYANP01B	2x20	20
Khadra	KHADRAP01B	2x20	20

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Suwaiq Shabiyah	SWQSHBYHP01B	1x6 + 1x6	2.8
Suwaiq ROP	SWQROPP01B	2x6	6
Khadra-B			
Alam	ALAMP01B	2x6	6
Khadra Bu Reshaid	KBRSHAI DP01B	2x20	20
Nasr Marble Factory-1	NSRMRBLFP01B	2x6	6
Nasr Marble Factory-2	NSRMRBLFP02B	2x6	6
Saih Rahamat	SIHRHMATP01B	1x6	0
Uriq	URIQP01B	3x20	40
Wadi Haimly	WDIHIMLYP01B	2x6	6
Wadi Jahawer	WDIJHAWRP01B	2x6	6
Bidayah Ind Area	BDAYHINDP01B	1x6	0
Bidayah Souq	BDAYHSUQP01B	2x6	6
MIS			
Hatheeb	HATHEEBP01B	2x20	20
Khabah	KHABAHP01B	3x20	40
Said Bin Sultan Naval Base	SBSNBASEP01B	2x20	20
Tharmad Temp-1	THARMADP02B	2x6	6
Tharmad Temp-2	THARMADP03B	1x6	0
Widam Sahil	WDMSAHILP01B	2x10	10
Widam Sahil Temp	WDMSAHILP02B	1x6	0
Suwaiq			
Bathaa	BATHAAP01B	3x20	40
Subaykhi	SUBAYKHIP01B	3x20	40
Suwaiq	SUWAIQP01B	2x20	20
Suwaiq Ind Area	SWQINDP01B	2x6	6
Muladah-A			
Musanaah Air Base	MSNABASEP01B	2x10	10
Musanaah Ind Area	MSNINDP01B	2x20	20
Muladah	MULADAHP01B	3x20	40
Musanaah	MUSANAHP01B	2x20	20
Saih Muladah	SIHMLDHP01B	1x6	0
Sport City	SPRTCITYP01B	2x20	20
Tharmad	THARMADP01B	1x6 + 1x10	6
Muladah-B			
Maghsar South	MAGHSRSUP01B	2x6	6
Maharah	MAHARAHP01B	3x20	40
Uwayd	UWAYDP01B	3x20	40
Jamma Temp	JAMMAP02B	1x6	0
Blue City			
Barka New	BARNEWP01B	2x20	20

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Barka Sahil	BARSAHILP01B	3x20	40
Billah	BILLAHP01B	2x20	20
Billah Wadi	BILAHWDIP01B	1x6	0
Blue City	BLUECITYP01B	2x6	4.7
Hay Sharq Temp	HAYSHARQP02B	1x6	0
Hufri	HUFRIP01B	2x20	20
Musanaah Sahil	MSNSAHILP01B	3x20	40

3.4. Al Dakhiliah Governorate

Al Dakhiliah Governorate includes Sumail, Izki, Nizwa, Bahla, BidBid, Manah, Hamra, Jabal Akhader and Adam. The number of customers served in the Al Dakhiliah Governorate region is 148,882. There are 9⁸ Grid stations (132/33 & 220/33 kV) and 88 primary substations (33/11 kV) are feeding the governorate. One of the tourism areas in Al Dakhiliah governorate is Jabal Akhader, new two double circuits 33 kV feeders is under construction to secure the electricity need of new tourism investments. Table 11 below provides list of primary substations in Al Dakhiliah Governorate.

Table 11: Al Dakhiliah Governorate- Grid and Primary Substations Connectivity

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Adam Grid			
Adam Grid	ADMGRIDP01B	2x20	20
Zoubar	ZOUBARP01B	2x20	20
Adam Air Base	ADMABASEP01B	2x10	10
Adam Bashair	ADMBSHIRP01B	2x6	2.76
Mitan	MITANP01B	2x6	6
Bahla Grid			
Bahla Grid	BHLGRIDP01B	2x20	20
Bilad Sayt	BLADSAYTP01B	2x6	6
Hamra	HAMRAP01B	2x20	20
Hamra 2	HAMRAP02B	3x20	40
Tanuf	TANUFP01B	2x6	6
Mamorah	MAMORAH P01B	2x20	20
Buwaydah	BUWAYDAHP01B	2x6	6
Sint	SINTP01B	2x3	3
Jabrin Grid			
Bidoou	BIDOOUP01B	2x20	20
Bisya	BISYAP01B	2x6	6
Ghafat	GHAFATP01B	2x20	20
Habbi	HABBIP01B	2x20	20
Jabrin	JABRINP01B	2x20	20
New Bahla	NEWBHLP01B	2x20	20
Wadi Qurayat	WDIQRYP01B	2x20	20
ROP Academy 2	ROPACDMYP02B	2x20	20
Saih Shamakhat	SIHSHMKTP01B	1x3	0
Nizwa Grid			
Farq	FARQP01B	3x20	40
Hisn Shmoukh	HSNSHMUKP01B	3x20	40

⁸ Excluding AL Rusail Indst. Grid as it is considered within Muscat Zone

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Izz	IZZP01B	2x20	20
Hay Al Tourath	HAYTRATHP01B	2x20	0
Karsha	KARSHAP01B	3x6	12
Maara Temp	MAARAP01B	1x6	0
Mamad	MAMADP01B	1x6	0
Manah	MANAHP01B	2x20	20
Oman Across Age Museum	OMAAMUSMP01B	2x20	20
Oman Across Age Museum Temp	OMAAMUSMP02B	1x6	0
Nizwa Grid	NZWGRIDP01B	2x20	20
Nizwa Ind Area	NZWINDP01B	2x20	20
Nizwa RDC Temp	NZWRDCP02B	1x3	0
Nizwa Stadium	NZWSTDUMP01B	3x6	12
Nizwa University 2	NZWUNIP02B	2x20	20
ROP Academy	ROPACDMP01B	3x6	12
ROP Cadet Academy Temp	ROPCADETP02B	1x6	0
Taymsa	TAYMSAP01B	2x20	20
Madinat Nizwa Grid			
Kamah	KAMAHP01B	2x20	20
Marfa Daris	MRFADARSP01B	3x6	12
Hay Ayn	HAYAYNP01B	3x6	12
Madinat Nizwa	MDINTNZWP01B	3x20	40
Nizwa Town	NZWTOWNP01B	2x20	20
Izki Grid			
Afiyah	AFIYAHP01B	2x20	20
Birkat Mawz	BRKTMAWZP01B	2x6	6
Birkat Mawz 2	BRKTMAWZP02B	2x20	20
Humaydah	HUMAYDAHP01B	3x6	12
Izki Grid	IZKGRIDP01B	2x20	20
Jabal Akhdar	JBLAKDARP01B	2x6	6
Jabal Akhdar 2	JBLAKDARP02B	2x20	0
Nizwa ROP	NZWROPP01B	2x6	6
Nizwa University	NZWUNIP01B	3x6	12
Wadi Maydin	WDIMAYDNP01B	1x6	0
Sayma	SAYMAP01B	2x6	6
Sumrah	SUMRAHP01B	3x6	6
Wadi Mahram	WDIMAHRMP01B	2x6	0
Wusad	WUSADP01B	2x6	6
New Izki Grid			
Aqil	AQILP01B	2x6	6
Izki Heights	IZKHIGHTP01B	3x20	40
MOD Shafa	MODSHAFAP01B	1x20	0

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Qalat Awamir	QLTAWAMRP01B	2x20	20
Samail A Grid			
Heel	HEELP01B	3x20	40
Hub Water Pump	HUBWPUMPP01B	2x6	6
Samail	SAMAILP01B	3x20	40
Jaylah	JAYLAHP01B	1x6	0
Manal Water Pump	MANALWPP01B	2x6	6
Saih Rasiyat	SIHRASYTP01B	1x3	0
Samail B Grid			
Bidbid	BIDBIDP01B	2x6	6
Central Prison	CNTPRSONP01B	2x20	20
Fanja Water Pump	FANJAWPP01B	3x6	12
Fayha	FAYHAP01B	2x6	6
Hassas	HASSASP01B	2x20	20
Hassas 2	HASSASP02B	2x6	6
Khubar	KHUBARP01B	3x6	12
MOD Bidbid	MODBIDP01B	1x6	0
Multaqa Crusher Temp	MULCRSHRP01B	1x3	0
Fanja	FANJAP01B	2x20	20
OMPC	OMPCP01B	2x20	20
Saih Maydin	SIHMAYDNP01B	2x20	20
Sumail Ind Zone 1	SMLINDP01B	3x20	40
Sumail Ind Zone 2	SMLINDP02B	2x20	20
Stadly Temp	STADLYP01B	1x6	0
Surur	SURURP01B	2x6	6
Wadi Saygani	WDISYGNIP01B	3x6	12
Rusail Ind Grid⁹			
Fanja 2	FANJAP02B	2x20	20
Saih Ahmer	SIHAHMERP01B	2x6	6

⁹ The GSS counted as number in Muscat Governorate

3.5. North Al Sharqiyah Governorate

The North Al Sharqiyah Governorate includes Mudhaibi, Ibra, Dima Wa Taiyyin, Wadi Bani Khalid, Qabil and Bidiyah. The number of customers served in the North Al Sharqiyah Governorate region is 25,836. There are 6 Grid Station (132/33 & 220/33 kV) and 47 primary substations (33/11 kV) are feeding the governorate. Table 12 below provides a list of primary substations in North Al Sharqiyah Governorate.

Table 12 :North Al Sharqiyah Areas – Power Plant, Grid, PDO and Primary Substations Connectivity

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Samad Grid			
Samad	SAMADP01B	2x20	20
Samad 2	SAMADP02B	2x20	20
Khadra Bani Dafa'a 2	KDRABDFAP02B	2x20	20
Mudhaibi Grid			
Aflaj	AFLAJP01B	3x6	12
Hadeetha	-	3x6	12
Khadra Bani Dafa'a	KDRABDFAP01B	3x6	12
Khashbah	KHASHBAHP01B	3x6	12
Lizq	LIZQP01B	3x6	12
Mudhaibi Grid	MDBGRIDP01B	2x20	20
Saih Al Nama	SIHNAMEP01B	2x20	20
Mudhaibi Royal Camp PSS	MDBRCAMPP01B	1x3	0
Sinaw Grid			
Jaza	JAZAP01B	3x3	6
Quwayaah	QUWAYAAHP01B	2x6	6
Sinaw	SINAWP01B	2x20	20
Sinaw 2	SINAWP02B	2x20	20
Uyun	UYUNP01B	3x6	12
Zain Poultry Farms	ZAINPFP01B	1x6	0
Mudhairib Grid			
Dhabahah	DHABAHHP01B	1x6	6
MOD Ibra	MODIBAP01B	1x6	0
Feshgah	FESHGAHP01B	1x6 + 1x3	9
Masrun 2	MASRUNP02B	2x6	12
Hayal	HAYALP01B	2x6	12
Ibra ROP	IBAROPP01B	2x6	12
Ibra Hospital	IBAHSP01B	2x10	20
Maghsar	MAGHSARP01B	2x3	3.8
Masrun	MASRUNP01B	2x6	12

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Mudhairib Grid	MDRBGRIDP01B	2x20	20
Shanah	SHANAHP01B	1x3	3
Sooqah	SOOQAHP01B	2x6	2.3
Wadi Nam	WDINAMP01B	3x6	18
Ibra Grid			
Ghayadah	GHAYADAHP01B	3x6	12
Ghubbrat Tam	GBRATTAMP01B	2x6	4.8
Hajer	HAJERP01B	2x6	3.2
Haymah	HAYMAHP01B	2x6	6
Ibra 1	IBRAP01B	2x20	20
Ibra 2	IBRAP02B	2x20	20
Khanadiq	KHANADIQP01B	2x6	6
Sharqiya University	SHARQUNIP01B	2x6	6
Wadi Tayin	WDITAYINP01B	2x20	20
Yahmadi	YAHMADIP01B	2x6	6
Yahmadi 2	YAHMADIP02B	2x20	20
Bidiyah Grid			
Liwariyah	LIWARIYHP01B	2x6	6
Mintrib	MINTRIBP01B	3x20	40
Shariq	SHARIQP01B	2x20	20
Tawi Salim	TWISALIMP01B	2x6	6
Wasil	WASILP01B	2x6	6
Wadi Bani Khalid	WDIBKHLDP01B	3x6	12

3.6. South Al Sharqiyah Governorate

The South Al Sharqiyah Governorate includes Sur, Jalan Bani Bu Hassan, Kamil wa Wafi, Musirh and Jalan Bani Bu Ali. The number of customers served in the North Al Sharqiyah Governorate region is 84,805. There are 4 Grid Station (132/33 & 220/33 kV) and 48 primary substations (33/11 kV) are feeding the governorate. Jalan Bani Bu Ali and Jalan Bani Bu Hassan areas have the highest growth in the governorate, two 2x20 MVA primary substations are under construction to cover the high growth. Table 13 provides a list of existing primary substations in South Al Sharqiyah Governorate.

Table 13: South Al Sharqiyah Areas – Power Plant, Grid, PDO and Primary Substations Connectivity

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Sur Grid			
Ayjah	AYJAHP01B	3x6	12
Filayj Water Pump	FILAYJWPP01B	2x6	6
Hay Sharooq	HAYSHROQP01B	2x10	10
Jenah	JENAHP01B	2x10	10
MOD Sur	MODSURP01B	1x6	0
Musfayyah	MUSFAYAHP01B	3x20	40
Qalhat	QALHATP01B	1x6	0
Qawda	QAWDAP01B	1x1	0
Shariya	SHARIYAP01B	2x20	20
Sur Filayj	SURFLAYJP01B	1x6 + 1x6	0
Sur Grid	SURGRIDP01B	2x20	20
Sur Ind Area	SURINDP01B	2x20	20
Sur IWP	SURIWPP01B	2x20	20
Sur IWP 2	SURIWPP02B	2x20	20
Sur ROP	SURROPP01B	3x6	12
Tiwi	TIWIP01B	2x6	6
Ayjah Grid			
Ayjah Heights	AYJHIGHTP01B	2x20	20
Ras Had	RASHADP01B	2x6	6
Shamah	SHAMAHP01B	1x1	0
Shiyaa	SHIYAAP01B	1x6	0
Skaykrah	SKAYKRAHP01B	3x20	40
Sur Hospital	SURHSPTLP01B	2x10	10
Sur Stadium	SURSTDUMP01B	2x20	20
Sur Town	SURTOWNP01B	2x20	20
TV Heights	TVHEIGHTP01B	2x6	6
Diar Ras Had	DIRASHADP01B	2x20	20
JBB Ali Grid			
Ashkharah	ASHKHARHP01B	2x20	20
Asilah IWP	ASILAIWPP01B	2x20	20

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Asilah IWP Temp	ASILAIWPP02B	2x6	6
BBC	BBCP01B	1x10	0
JBB Ali Grid	JBAGRIDP01B	2x20	20
JBB Ali Royal Camp	JBARCAMP01B	1x3	0
JBB Ali	JBBALIP01B	3x20	40
JBB Ali 2 Temp	JBBALIP11B	2x6	6
Qarhah Temp	QARHAHP01B	1x6	0
Ras Had Airport	RASHADAPP01B	2x10	10
Rumaylah	RUMAYLAHP01B	1x6	0
Saih Ramath	SIHRAMTHP01B	3x6	6
Saih Ula	SIHULAP01B	3x20	40
Wadi Batha Temp	WDIBATHAP01B	1x3	0
Wadi Sal	WDISALP01B	3x6	12
JBB Hassan Grid			
JBB Hassan	JBBHASANP01B	2x20	20
Hadri Bilad	HDRIBLADP01B	2x6	6
JBB Hassan 2	JBBHASANP02B	3x20	40
Kamil	KAMILP01B	3x20	40
Kamil Water Pump	KAMILWPP01B	2x6	6
Tawi Aishah	TWIAISHAP01B	2x6 + 1x6	4.6
Wafi Temp	WAFIP11B	2x6	6

3.7. AL Wusta Governorate and Surrounding Areas.

The Al Wusta Governorate and its Surrounding areas are supplied with power from various sources, including PDO, Diesel Power Plants, and Marafiq. These power sources serve the entire Al Wusta Governorate as well as the rural areas in Al Dhahirah and South Sharqiyah Governorates. However, those systems are scattered through areas isolated from each other with long-distance separation, with limited or no interconnection between them. The total number of customer services in these areas amounts to approximately 25,225. Table 14 shows all existing primary substations with their installed and firm capacity within Al Wusta Governorate.

Table 14 AL Wusta Governorate and Surrounding Areas – Power Plant, Grid, PDO and Primary Substations Connectivity

PSS	Installed Capacity (MVA)	Firm Capacity (MVA)
Duqum Grid-Duqum North Switching Station (DNSS1)		
Duqum Old Powerhouse	1x 6	0
Duqum Town 1	2X20	20
Duqum Town 2	2X20	20
Duqum Beach	2X20	20
Duqum South	3X10	20
Duqum Port 1	2X20	20
Duqum Frontier Town	2X20	20
Duqum Port 2(CQPS)	2X20	20
Duqum Grid-Duqum North Switching Station (DNSS1)-Duqum South PSS		
Duqum Airport	2X10	10
Duqum Grid-Duqum North Switching Station (DNSS1)-Duqum Port 1 PSS		
Duqum Dry Dock	1X40+1x15	15
Duqum Grid-Duqum Switching Station (DSS2)		
Duqum PSS	1x6	0
Duqum Fishery (Ind 5)	2x6	6
Duqum IND1 (DILIC)	2x20	20
Duqum IND 2 (KARWA PS)	3X20	20
Duqum IND 3	2x20	20
Duqum Grid-Duqum Switching Station (DSS2)- Duqum IND 2 PSS		
Duqum IND 4	3X20	20
Duqum Grid-Duqum Switching Station (DSS2)- Duqum IND 4-Duqum Gantry SS		
GALONI/AJAIZ	2x3	3
Dahar PSS	2X1	1
Duqum Grid-Duqum Switching Station (DSS2)- Duqum IND 4-Duqum Gantry SS-Dahar PSS		
Rasmadraka PSS	2x3	3
Masirah Power Plant		
Step-Up PSS	3 X 31.5	63
Dawwah primary Station	2X6	6
Al Nahdah Primary Substation	2 X 10	10

PSS	Installed Capacity (MVA)	Firm Capacity (MVA)
Ras Hilf Primary Substation	2 X 10	10
MOD Primary Substation	2 X 20	20
Mahout Grid		
New Jouba	2x6	6
Hijj	2x6	6
New Hijj PSS	2x6	6
Mahout Ind	1x6	0
Mudairah	2x6	6
NUHAIDAH PDO		
Nuhaidah	2x3	3
A waifiah	2x3	3
Al Orf	2x1	1
NATIH PDO		
HAMRA AL DRO	2x10	10
ZUBRA	1x1	0
YIBAL PDO		
AL ROB'A AL KHAL	2x10	10
GNS RACK PDO		
GHABET AL HAQF	1x3	0
BURHAN PDO		
BURHAN	1x1	
KAUTHER PDO		
AL ZAHIAH	1x1	
Ghaba North		
BUTHAILA	1x1	
Hima Grid (Suwaihat PDO 132/33)		
New Sahma bus 1	2x20	20
Sahma SS buss F 1	2x6	6
Haima Bus 1	3x10	20
Haima ROB Bus 1	2x20	20
Ghafeen PDO (Sayyala switch rack) Tapping Point		
Ghafeen	1x3	0
Saih Nihayda PDO-Qara Alam		
Al Zamaim	1x3	0
BAHJA PDO		
MOD	1x6	0
Ghobrah North PDO		
Ghobrah North	1x3	0
Runib P-SS-PDO		
Goubrah South	1x2	0
Al-khadrah Power Plant		
Lakhbi load	2x6	6

3.8. AL Buraymi Governorate

AL Buraymi Governorate includes Wilayat AL Buraymi, Mahadah and Sunaynah. The number of customers served in AL Buraymi Governorate region is 42,509 which is approximately 3.4% of the total customer population within NEDC. There are 5 Grid Station (132/33 kV), and 27 primary substations (33/11 kV) are feeding the governorate. Table 15 provides a list of existing primary substations in AL Buraymi Governorate.

Table 15 : AL Buraymi Governorate - Grid and Primary Substations Connectivity

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
Buraimi_A GSS			
AL KHADRA B6 01	KDRB01	2x20	20
AL BURAIMI 01	BRMI01	2x20	20
HAMASSA 01	HMSA01	2x20	20
SA'ARA AL JADIDA 02	SARJ02	2x20	20
Buraymi_B Tx1 & Tx2 GSS			
AL KHDRAH AL JADIDA 01	KDRJ01	2x20	20
AL KHDRAH AL JADIDA 02	KDRJ02	2x20	20
MAHDAH 04	MHDA04	2x20	20
MAHDAH 03	MHDA03	1x6	3
AL BURAIMI IND. EST 01	BRIE01	2x6	6
AL BURAIMI IND. EST 02	BRIE02	2x20	20
Buraymi_B Tx3 & Tx4 GSS			
ARDH JAW 01	ARJW01	2x20	20
HAY AL-NAFAHAT 01	HNFT01	2x20	20
SA'ARA AL JADIDA 01	SARJ01	2x20	20
AL ZAROUB 02	ZRUB02	2x6	6
MAHDAH GSS			
AL AFRADH 01	AFRD01	2x6	6
AL RABI 01	RABI01	2x6	6
AL JUWAIF 01	JWIF01	1x3	3
AL KHADRA 01	KDRA01	1x3	3
AL MADAM 01	MDAM01	2x10	10
AL ARHAMIYH 01	ARHM01	2x6	6
AL ZAROUB 01	ZRUB01	2x6	6
AL JEL ¹⁰	AJEL01	2x10	10
AL GINENA 01	GNNA01	1x1	1

¹⁰ The PSS feeding from two Sources, the other feeder from SOHAR SFZ Tx3 & Tx4 GSS

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
WADI SAA GSS			
RADAT SA'A 01	RDSA01	2x6	6
HAFEET 01	HFIT01	2x10	10
SELLAHEYYAH 01	SLHY01	1x6	3
Saih AL Nafahat	SFNT01	1x6	3
SELLAHEYYAH 02	SLHY02	2x20	20

3.9. AL Dhahirah Governorate

AL Dhahirah Governorate includes Wilayat Ibri, Dank and Yanqul. The number of customers served in AL Dhahirah Governorate region is 65,192 which is approximately 5.1% of the total customer population within NEDC. There are 6 Grid Stations (132/33 & 220/33 kV) and 42 primary substations (33/11 kV) are feeding the governorate. Table 16 shows all existing primary substations with their installed and firm capacity within AL Dhahirah Governorate.

3.9.1. Wilayat Ibri

The load at Ibri Grids is forecasted to increase and NEDC is planning to replace old assets and manage load between grid stations by reconstructing the 33kV portion of Ibri Old Grid and moving AL Akhdar PSS from Ibri Grid to Ibri old Grid. The Project is currently in the execution stage. Moreover, a future expansion project is under execution including the new proposed 3X20 MVA PSS “Named as Hellat Al Nahadah”, Upgrade AL Akhdar PSS from 2x10 to 2x20 and upgrading Baat PSS from 2X6 MVA to 2X20 MVA. In addition, NEDC will rearrange the 33kV network between Dreez & AL Hail Grid Stations where Hugermat & Kahant PSSs will be transferred to AL Hail Grid Station & Provide second feeding source to each of AL Mahual & Kahanat PSSs. Furthermore, there is a new 2X6 MVA primary substation will be constructed for the new Ibri Industrial Area “MADAYN” by 2025 to provide the power supply for the new expected industrial load in the area.

Table 16: AL Dhahirah Governorate - Grid and Primary Substations Connectivity

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
DANK GSS			
AL-MASSRAT 02	MSRT02	1x3	0
ABU KRABAH 01	AKRB01	2x20	20
AL-BUSAILI 01	BSLI01	2x6	6
DOWT 01	DOWT01	2x10	10
AL-MAZEM 01	MZEM01	1x6	5
AL RAYHANI 01	RYHN01	2x6	6
HAY AL BARAKAH 01	HBRK01	2x20	20
AL-MAZEM 02	AL MAZEM02	2x6	6
AL SUBAIKI	SBKH01	2x6	6
ALHAIL GSS			
ALAYAT FIDAH 01	AFDA01	2x6	6
AL-MAHUL 01	MHUL01	3x6	2.7
SAFALAT FIDAH 01	SFDA01	2x6	6
DREEZ GSS			
ABLH 01	ABLH01	2x20	20
BAAT 01	BAAT01	2x6	6
AL-DREEZ 01	DREZ01	2x20	20
AL-BANAH 01	BANH01	2x20	20

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
MAQNYAT 01	MQNT01	2x20	20
AL-NUJAYD 01	NJYD01	2x6	6
AL-ARED 01	ARID01	2x20	20
QARN AL-KABSH 01	QRKB01	2x3	3
AL TAYYEB INDUSTRIAL 01	TYBI01	2x20	20
HUGERMAT 01	HGMT01	2x10	10
KAHANAT 01	KHNT01	2x6	1.5
IBRI Old Tx3 & Tx4 GSS			
AL-ARAQI 01	ARQI01	2x20	20
AL-MURTAFA 01	MRTF01	2x20	20
AL-EYNIN 01	ANIN01	2x20	20
IBRI Tx1 & Tx2 GSS			
AL-AKHDAR 01	AKDR01	2x10	10
AL-SANAEEYAH 01	SNEY01	3x20	40
KUBARAH 01	KBRH01	2x20	20
MINISTRY OF DEFENSE 01	MODF01	1x3	1.9
SWAIDA ALMA 01	SWMA01	2x6	3.9
MAZER'A BIN KHATER 01	MKTR01	2x20	20
AL-SULAIF 01	SLIF01	2x20	20
HAI AL SAADAH 01	HSAD01	2x20	20
AL-MASSRAT 01	MSRT01	1x10	0
Al-Massarar 3	MSRT03	1x6	0
YANQUL GSS			
AL-SAWADER 01	SWDR01	2x20	20
AL RAKEI 01	RAKE01	2x20	20
AL-WAQBAH 01	WQBA01	2x6	6
AL-SHWAYAH 01	SHWY01	2x6	6
AL-MUREE 01	MURY01	1x3	3
TAWI AL NAWAMEYA 01	TNWM01	1x3	3

3.10. North AL Batinah Governorate

North AL Batinah Governorate includes Wilayat Shinas, Liwa, Sohar, Saham and Al Khabourah. The number of customers served in North AL Batinah Governorate region is 174,751 which is approximately 13.8% of the total customer population within NEDC. There are 14 Grid Station (132/33 & 220/33 kV) and 82 primary substations (33/11 kV) are feeding the governorate. Table 17 shows all existing primary substations with their installed and firm capacity within North AL Batinah Governorate.

3.10.1. Wilayat Shinas

Shinas has average of 3% load growth for the next three years and there one major project on area where AL Wajajah PSS will be upgraded from 2X3 MVA to 2X6 MVA with connecting a new 33kV feeder from MD Shinas Grid to supply Ajeeb and AL Wajajah PSSs.

3.10.2. Wilayat Sohar

Sohar has seen growing with demand for the last 5 years within North AL Batinah Governorate where Sohar downtown area is one of the largest commercial and residential areas. In addition, Sohar Free Zone, Sohar Industrial Port and Sohar Industrial Estate area are earmarked for some significant development projects in the area.

3.10.3. Wilayat Al Khabourah

Overall load growth in Al Khabourah remains constant with average growth of 3%. there is one a major project in Al Khabourah under design stage where Sana Bani Gafer PSS will be upgraded from 2x6 MVA to 2x20 MVA.

Table 17: North AL Batinah Governorate - Grid and Primary Substations Connectivity

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
SHINAS_B GSS			
FIZAH 01	FIZH01	2x20	20
SUR AL BALOOSH 01	SURB01	2x20	20
AL RUMAILAH 01	RMLH01	2x20	20
NABER 01	NABR01	2x20	20
NABER 02	NABR02	2x20	20
GHADAFAN 02	GDFN02	3x6	6
TEMPORARY-GHADAFAN-03	TEMP03	1x6	3
SUR AL ABRI 01	SABR01	2x20	20
MD SHINAS GSS			
TARIF AL MAKAMRAH 01	TRMK01	2x20	20
AJEEB 01	AJEB01	2x6	3
AL WAJAJAH 01	WJAJ01	2x3	0
KHADRAWEEEN 01	KDWN01	3x20	40

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
AL UQR 01	AUQR01	2x20	20
AL GHURIFAH 01	GURF01	3x20	40
LIWA Tx1 & Tx2 GSS			
AL JUFFRAH 01	JFRH01	2x20	20
FALAJ AL QABAIL 03	FAQB03	2x20	20
GHADAFAN 01	GDFN01	2x20	20
LIWA AL JADIDAH 01	LIWJ01	2x20	20
AL KHUWAYRIYAH 01	KWRH01	3x20	40
LIWA Tx3 & Tx4 GSS			
Airport	SAPT01	2x10	10
SOHAR INDUSTRIAL ESTATE 01	SIET01	3x20	40
SOHAR INDUSTRIAL ESTATE 02	SIET02	3x20	40
SOHAR INDUSTRIAL ESTATE 03	SIET03	2x20	20
SOHAR INDUSTRIAL ESTATE 04	SIET04	2x20	20
SOHAR INDUSTRIAL ESTATE 05	SIET05	2x20	20
SOHAR SFZ Tx1 & Tx2 GSS			
LIWA 01	LIWA01	2x20	20
SOHAR FREE ZONE 01	SFZN01	2x20	20
SOHAR SFZ Tx3 & Tx4 GSS			
FALAJ AL QABAIL 02	FAQB02	2x20	20
WADI AL OWAINAH 01	WOWN01	2x10	10
FALAJ AL SUQ 01	FASQ01	2x6	6
SOHAR Industrial Port GSS			
AL GHUZIL 01	GUZL01	2x6	6
FALAJ AL QABAIL 01	FAQB01	2x20	20
SOHAR INDUSTRIAL PORT 01	SIPT01	2x20	20
SOHAR INDUSTRIAL PORT 02	SIPT02	2x20	20
SOHAR INDUSTRIAL PORT 03	SIPT03	2x20	20
SOHAR INDUSTRIAL PORT 04	SIPT04	2x20	20
SOHAR Tx1 & Tx2 GSS			
AL HOJRAH 01	HJRH01	3x20	40
AL WOQAIBAH 01	WQIB01	2x20	20
AL HUMBAR 01	HMBR01	3x20	40
SOHAR HOSPITAL 01	SHOS01	2x10	10
SOHAR Tx3 & Tx4 GSS			
AL MULTAQA 01	MLTQ01	3x20	40
AL TAREEF 01	TREF01	3x20	40
AL MUWAILH 03	MWLH03	2x20	20
WADI SALLAN 01	WSLN01	2x20	20
FALAJ AL-OUHI 01	FOHI01	2x20	20
AL GHUSHBAH 01	GSHB01	2x10	10
UWAYNAT Tx1 & Tx2 GSS			

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
OUTAB 01	OUTB01	2x20	20
MAJAZ AL KUBRA 01	MJKU01	2x20	20
AL KHISHDAH 01	KSDH01	2x20	20
AL UWAINAT 01	UWNT01	2x20	20
UWAYNAT Tx3 & Tx4 GSS			
PALM GARDEN 01	PGRD01	2x20	20
AL MUWAILH 02	MWLH02	2x20	20
AI SUWAIHRAH 01	SWHR01	2x20	20
HIL AL ASHKAREEN 01	HASK01	2x3	0
WADI AHIN 01	WAHN01	2x6	2.7
HAY AL-REFAAH 01	HRFA01	2x6	0
Wadi Al Halti	WHLT01	2x6	6
SAHAM GSS			
AL HUWAIL 02	HUWL02	2x20	20
AL HUWAIL 01	HUWL01	2x20	20
SAHAM INDUSTRIAL 01	SHMI01	2x20	20
AL FALAIJ 01	FLAJ01	2x20	20
AL MAHAB 01	MHAB01	2x6	6
MUKHEILIF JADIDAH 01	MKLJ01	2x20	20
HILLAT AL SUQ 01	HLTS01	2x20	20
WADI HIBI ¹¹	WHBI01	2x10	10
DAS GSS			
MUKHEILIF 01	MKLF01	2x20	20
DIL AL ABDASALAM 01	DASL01	2x20	20
UMM AL JARIF 01	JARF01	2x20	20
HAFEET 01	HFET01	2x20	20
HAFEET 02	HFET02	2x20	20
AL HEJARI 01	HJRI01	2x20	20
KHABOURAH GSS			
AL KHABOURAH 01	KHBR01	2x20	20
AL KHABOURAH 02	KHBR02	2x20	20
QASBIYAT AL HAWASINAH 01	QHWS01	2x20	20
AL BREIK 01	BREK01	2x20	20
AL LEHBAN 01	LHBN01	2x6	0
SANA BANI GAFFER 01	SBGF01	2x6	0
WADI BANI OMAR 01	WBOM01	2x6	6
AL HAILASHI 01	HLSH01	2x3	3
AL KASF 01	KASF01	2x20	20
AL KASF 02	KASF02	2x6	0

¹¹ The PSS feeding from two Sources, the other feeder from UWAYNAT Tx3 & Tx4 GSS

3.11. Musandam Governorate

Musandam Governorate includes Wilayat Khasab, Madha, Dibba and Bakha. The number of customers served in Musandam Governorate region is 16,730 which is approximately 1.3% of the total customer population within NEDC. Musandam Governorate's overall demand growing slowly until recently when development in the major cities of Khasab, Bakha and Dibba have seen steadily increasing growth in the form of new residential and commercial loads. Table 18 shows all existing primary substations with their installed and firm capacity within Musandam Governorate.

3.11.1. Wilayat Khasab

NEDC will Upgrading Siwi PSS from 2X6 MVA to 2X20 MVA with installing new 33kV feeder from Khasab Grid Station and Adding Backup Transformer to secure the PSS. These two projects are under the Execution stage. In addition, there are two projects under Planning Stage: New Khasab Port PSS (2X20 MVA) with two 33kV Feeders and Modification to secure Musandam Network.

Table 18: Musandam Governorate - Grid and Primary Substations Connectivity

PSS	PSS Code	Installed Capacity (MVA)	Firm Capacity (MVA)
KHASAB GSS			
KHASAB 01	KHSB01	4x20	60
KHASAB 01	KHSB01	3x20	40
LIMA 01	LIMA01	2x6 + 1X3	6
MAHAS 01	MHAS01	2x20	20
SIBI 01	SIBI01	1x3	3
SAWI 01	SAWI01	2x6	6
WADI BANA 01	WBNA01	2x1	1
QUADA 01	QUADA01	1x2 + 1x3	2
AL HARF 02	HARF02	1x1	1
AL HARF 01	HARF01	2x20	20
AL HABALIN 01	HBLN01	1x1	1
KUMZAR 01	KMZR01	2x6	6
TIBAT GSS			
KHASAB INDUSTRIAL AREA 01	KSBI01	1x6	6
WADI MAWA 01	WMWA01	1x1 + 1x3	1
GHUMDHA 01	GMDH01	2x10	10
AL JERY 01	JERY01	1x10	10
MOD - BUKHA 01	MODB01	2x6	6
DIBBA GSS	It is 132/11 kV Grid Station. So, no PSS is connected in this Grid.		
MADHA (Isolated)	MDHA01	11.3 MW (D.G)	11.3

4. NEDC DISTRIBUTION SYSTEM

4.1. Introduction

NEDC is authorized to undertake all regulated activities of electricity distribution business at 33kV and below across the whole area of Sultanate of Oman excluding Dhofar Governate.

The distribution system has three nominal voltages, i.e., 33kV, 11kV and 415V. Most customers connect at LV (415 Volt) and there are bulk customers connected at 11kV and 33kV. Similarly, there are large customers connected on the OETC 132kV side but are NEDC customers for the purposes of energy supply and billing.

During 2023, the total Firm capacity for all governorates is circa 11,100 MVA, where the maximum load (non-coincident) is around 7,353 MVA which is 66% utilization. The below table and figure present these data.

Table 19: Summary of Firm Capacity and Max Load per Governate

Governate Name (2023)	Max Load (MVA)	Firm Capacity (MVA)	Utilization %
Muscat	2,854	4,166	69%
Buraymi	173	328	53%
AL Dhahirah	309	494	63%
North AL Batinah	986	1,494	66%
Musandam	82	209	39%
Dakhiliah	810	1,204	67%
South Batinah	1,101	1,502	73%
North Al Sharqiyah	415	556	75%
Al Sharqiyah South	456	641	71%
Wusta	167	507	33%
Total	7,353	11,100	66%

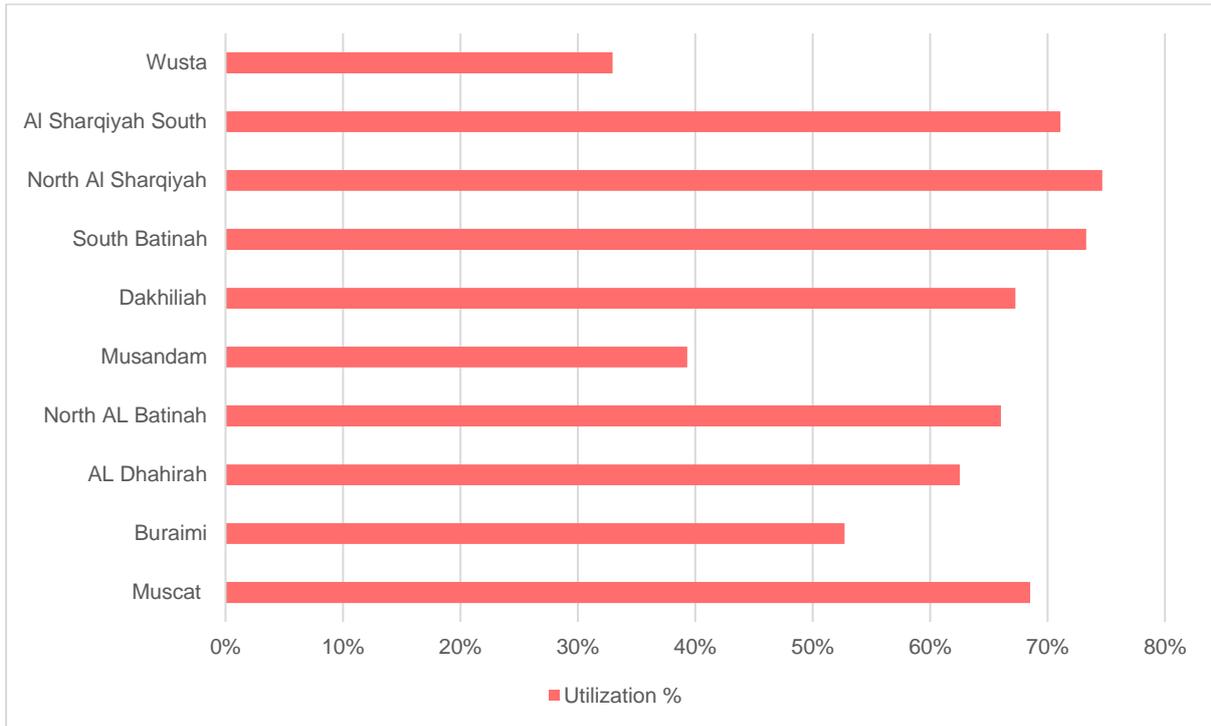


Figure 2: Utilization % from Firm Capacity per Governorate

System maximum demand has occurred generally during summer period; although there seems to be no exact co-relation on the exact timing as expected. There are various parameters which affect the occurrence of the system maximum demand hence the future forecast; we expect more parameters in the upcoming future especially due to the macro-economic condition of the Oman economy and due to the developments in newer technologies. Few of the significant parameters which have impacted NEDC distribution system growth in 2023 and future are:

- Temperature and Humidity.
- Customer numbers and types of customers growth.
- Socio-economic factors like state of economy due to oil prices.
- Implementation of CRT and the continuous effect.
- Introduction of Tariff reforms for all.

This can result in a lack of consistent predictability as to the precise date of future system peaks, although provides a good indication in general of the period and pattern. For this reason, associated demand transfers are operationally planned to occur before May period each year to ensure NEDC are in the best position possible to meet regulatory requirements and ensure quality and security of supply to consumers.

4.2. System Demand and Load Duration

Figure 3 below shows the historical data [2018-2023]; the system MIS maximum demand and % growth excluding Al Wusta and Musandam. In addition, Al Wusta and Musandam Governorate historical data are illustrated in Figure 4 and Figure 5.

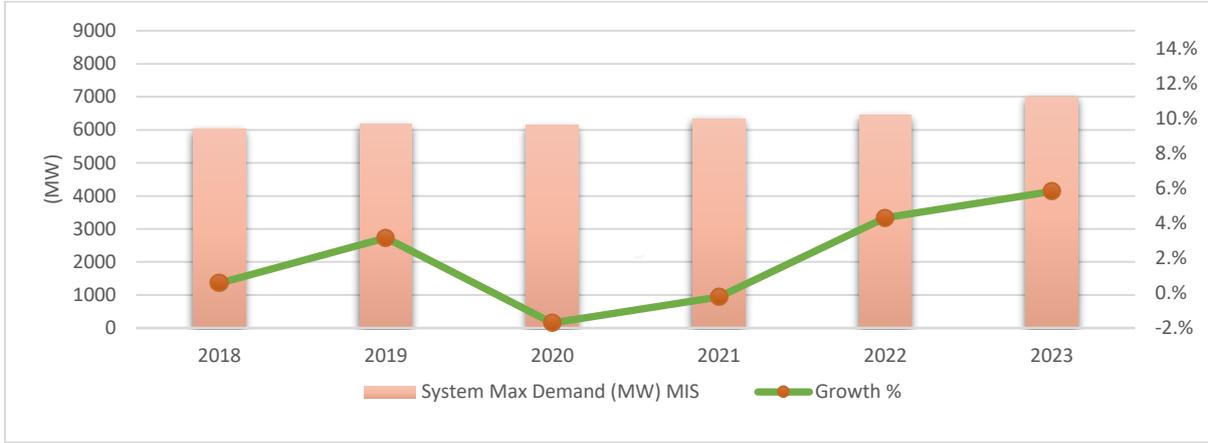


Figure 3: System Max Demand (MW) MIS



Figure 4: System Max Demand (MW) Al Wusta

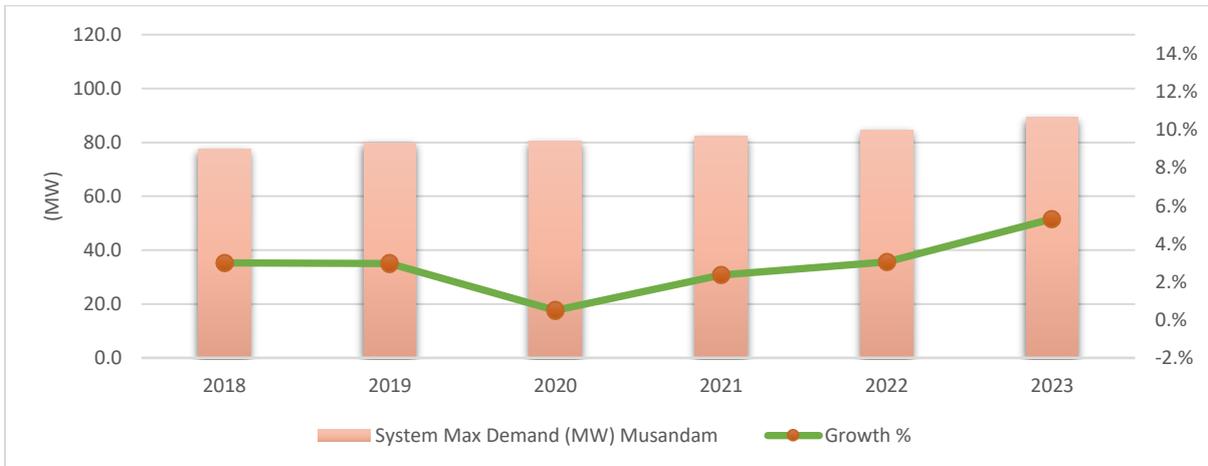


Figure 5: System Max Demand (MW) Musandam

The Maximum and Minimum Demand for the NEDC distribution systems in 2023 is illustrated in Figure 6 and Figure 7 below. This shows that the 2023 minimum demand is circa 41% of the 2023 maximum demand for the MIS NEDC system.

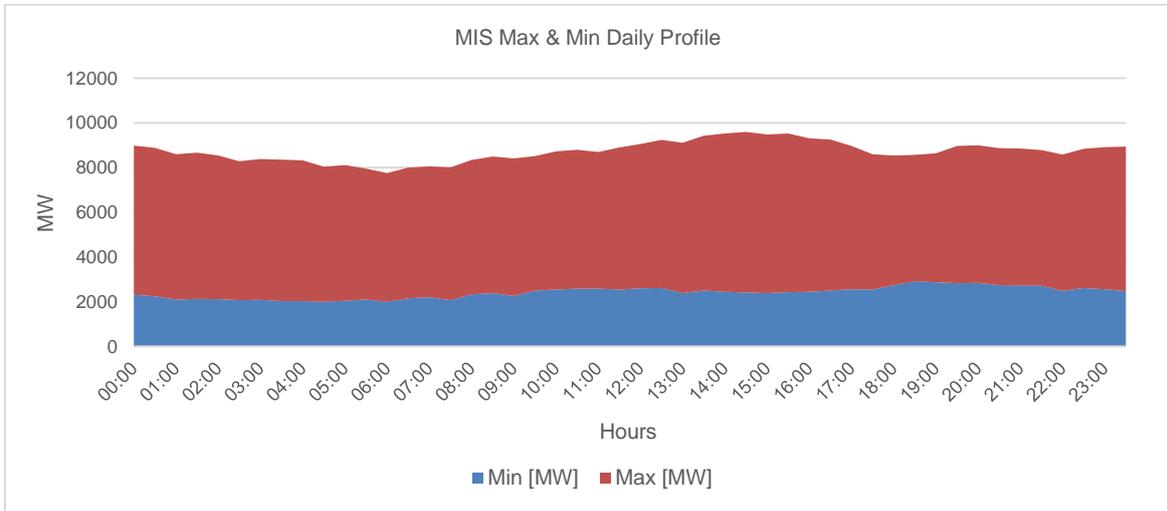


Figure 6 : Hourly Demand – MIS System Maximum and Minimum Day Profile

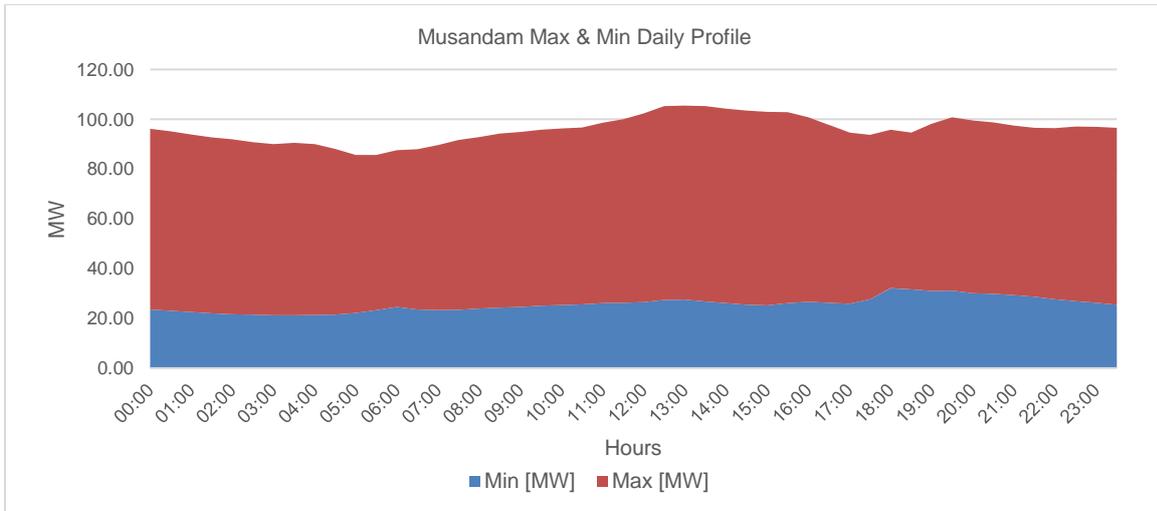


Figure 7 : Hourly Demand – Musandam System Maximum and Minimum Day Profile

The Maximum load profiles for NEDC taken on Thursday, 22nd June 2023, the day of NEDC Peak, were plotted and presented in Figure 6. The highest load was reached at 14:30 hours; on this day, the load recorded was 7181MW¹².

¹² Transmission System peak

4.3. Cost Reflective Tariff (CRT)

In October 2016, The Regulator announced that the Council of Ministers had approved the introduction of a new tariff for high value customers called the Cost Reflective Tariff (CRT) and implemented fully in 2017. The new tariff is designed to reflect the actual costs of providing a supply of electricity more accurately to large government, commercial and industrial customers without government subsidy. Till 2020 the approval for CRT implementation is for application only to the high value customers who consume 150 MWh and above in a year, for the above-mentioned customer categories.

In 2021, CRT was revised, and the current approval is for application to the high value customers who consume 100 MWh and above in a year and the new tariff is designed to all the customer category except residential customers.

As the full 2023 cycle hasn't been completed yet, an impact analysis was undertaken on 2022 NEDC customers base to understand the full year impact of CRT on the NEDC distribution system and described as below.

The number of CRT customers in 2023 was 19,435, circa 1.6% of the total connected customers. Figure 8 below shows some of highly loaded customers load profile during peak day and the direct effect of CRT tariff during 2023 peak hours.

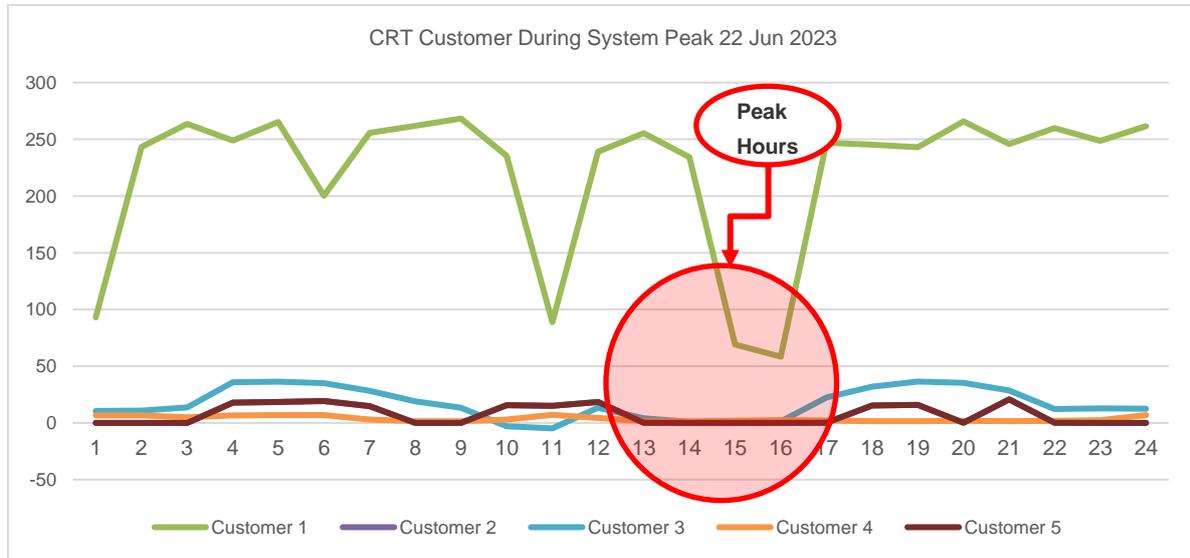


Figure 8 : CRT Customer During System Peak 22 Jun 2023

4.4. Demand Not Secured (DNS)

As per the licence condition, NEDC is obliged to comply with the DSSS and moreover one of our major investment drivers for the CAPEX programme is to meet the N-1 operational capability for each Primary Substation.

Figure 9 below provides a trend of the NEDC Demand Not Secured (DNS) MVA performance as a measure to show DSSS compliance improvement along with number of Primary Substations contributing to the DNS. In the recent years the DNS performance is consistently improving and the audited 2022 DNS for NEDC realised is 356.90MVA which is a circa 8% reduction compared to 2021 DNS value of 384.90MVA.

NEDC distribution system predominantly is an urban dense interconnected network and as part of network design optimum effort is made to maintain that level of interconnection leading to majority of the 11kV feeders except minor rural feeders having no single but multiple interconnections. Hence majority of the 11kV feeders will come under the Class A and Class B categories. Typically, with the assistance of these 11kV interconnections, the supply can be generally restored within the allowed DSSS time frame.

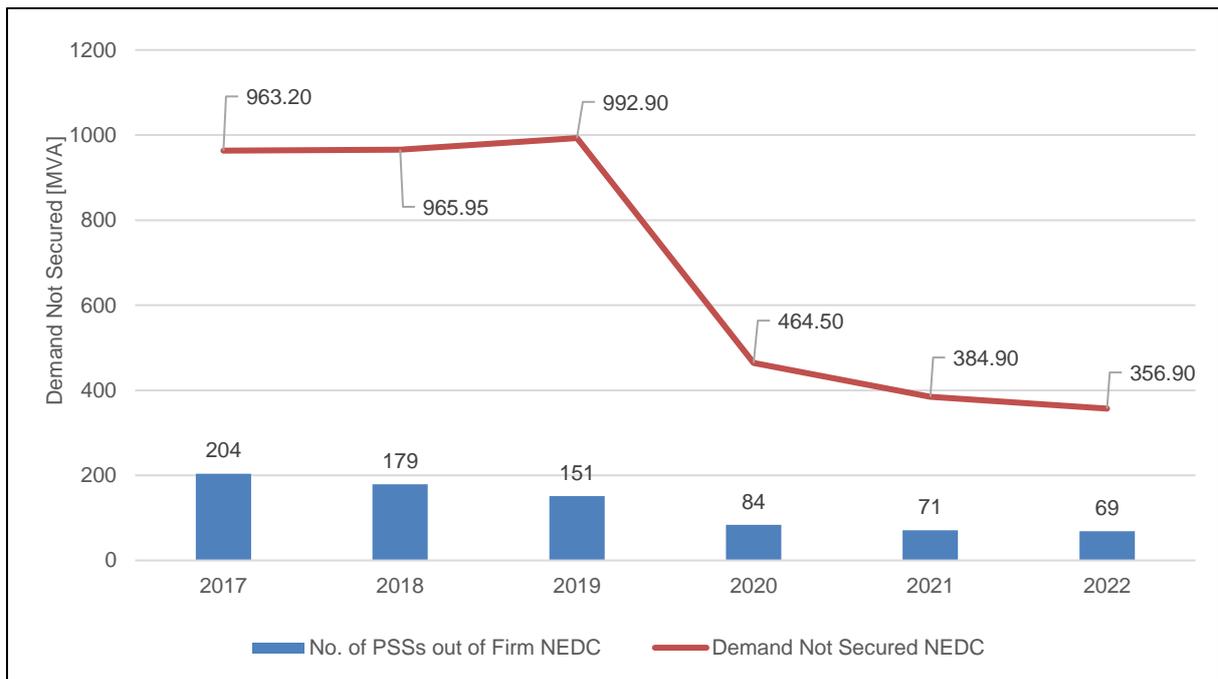


Figure 9 : History of NEDC Demand Not Secured and Out of Firm PSS

4.5. 11kV Feeder Loadings

As detailed in the Appendix B-5, 15 number 11kV feeders were observed in 2023 which exceeded the derated thermal loading limit under normal operational configuration; these will be solved by appropriate 11kV load transfers, reinforcement schemes and/or automation in 2023 itself shown in Table 20 below. The maximum loadings of all the 11kV feeders are attached in Appendix B-5

Table 20: 11kV Highly Loaded feeder Plan

PSS Name	PSS No.	Feeder Name	Feeder Rated Capacity [Amp]	Feeder De-rated Capacity [Amp]	Load	Plan
					[Amps]	
Muscat						
Amerat[G10] - A GSS						
Amerat Heights	P152	KLN04	400	350	353.18	Internal Load Shifting
Bousher [GP02] - B GSS						
Al Muna	P084	KLN06	400	350	354.04	11kV Load shifting to [Ghubrah South 1 PSS]
Mawaleh South [GP05] - B GSS						
AlKhoudPH6-P049	P049	KLN02	400	350	361.19	11kV Load shifting to New PSS [Al Khoudh Shabiya-B PSS]
		KLN07	400	350	366.99	11kV Load shifting to New PSS [Al Khoudh Shabiya-B PSS]
Al'Salam [G12] - A GSS						
Mabelah South PH-4	P062	KLN04	400	350	380.47	Internal Load Shifting
Mabelah Industrial[G26] - B GSS						
Mabelah South PH-8	P157	KLN04	400	350	363.44	11kV Load shifting to New PSS [Mabelah PH.9]
		KLN06	400	350	378.7	11kV Load shifting to New PSS [Mabelah PH.9]
Al'Salam [G12] - A GSS						
PalmMall	P168	KLN11	400	350	355.06	Internal Load Shifting
Mabelah[GP04] GSS						
Sur Al Hadid	P116	KLN01	400	350	363.41	Internal Load Shifting
South Batinah						
Madinat Barka-A						
Saqsuq	33L5	400	350	396	150 A (3 MW) will be transferred to new feeder from Saqsuq PSS in 2024.	
Muladah-B						
Uwayd	22L5	400	350	356	70 A (1.3 MW) will be transferred to Musanah Ind PSS in 2024	
Dakhiliah						
Nizwa Grid						
Manah	27L5	400	350	367	100 A (2 MW) will be transferred to Manah 26L5 in 2024	
Al Sharqiyah South						
JBB Ali Grid						

PSS Name	PSS No.	Feeder Name	Feeder Rated Capacity [Amp]	Feeder De-rated Capacity [Amp]	Load	Plan
					[Amps]	
JBB Ali	37L5		400	350	351	100 A (2 MW) will be transferred to new 11 kV feeder from JBB Ali PSS
JBB Hassan Grid						
JBB Hassan 2	33L5		400	350	363	110 A (2.1 MW) will be transferred to new 11 kV feeder from JBB Hassan 2 PSS
North Al Sharqiyah						
Bidiyah Grid						
Mintrib	31L5		400	350	359	150 A (3 MW) will be transferred to new 11 kV feeder from Mintrib PSS

4.6. System Demand Forecast

Accurate and realistic load demand forecasting is critical for the effective operation of the distribution system and is the principal driver for capital expenditure. Realistic assumptions must be made for inherent uncertainties in forecasting and the underlying socio-economic factors, such as the sustained low oil price, population growth and impact of Oman wide customer tariff reforms.

Load growth can vary from year-to-year and is not uniform across the whole system. It is not unusual to find parts of the system growing at significantly higher rates than for the system, while other parts of the system can experience periods of low growth or demand reduction.

The forecast model has inputs data from different sources as follows:

- Population data for the area served by NEDC has been taken from data published by the Oman Information and Statistics Centre.
- Data and projections on Oman's GDP economic development are taken from the International Monetary Fund published in its World Economic Outlook Database.
- GIS (Geographic Information System) and CRM (Customer Relationship Management) provide customer account details internally in the company. These two systems offer the customer account numbers with the energy consumption and the primary substations connected to these accounts.
- SCADA provides internally the primary substation's peak loads (Supervisory Control and Data Acquisition).

Then the model will have several calculations using the input data to reach the load growth of each primary substation applied in this capability statement.

NEDC considers the following features are necessary to produce an accurate demand forecast in line with best practice:

- Accurate and unbiased actual demand data – careful management of data and forecasting model construction based on sound theoretical grounds that closely fits the sample data.

- Transparency and repeatability – as evidenced by good documentation, including documentation of the use of judgment, which ensures consistency and minimizes subjectivity in forecasts.
- NEDC also considers the following elements to be relevant to maximum demand forecasting:
- Independent forecasts – spatial (bottom up) forecasts should be validated by independent system level (top down) forecasts and both spatial and system level forecasts should be prepared independently of each other. The impact of macroeconomic and demographic trends is better able to be identified and forecast in system level data, whereas spatial forecasts are needed to capture underlying characteristics of specific areas within the system. Generally, the spatial forecasts should be constrained (or reconciled) to system level forecasts;
- Adjusting for temporary transfers – spatial data is adjusted for historical spot loads arising from peak load sharing and maintenance, before historical trends are determined;
- Adjusting for discrete block loads – large new developments, such as shopping centres and housing developments, are incorporated into the forecasts, taking account of the probability that each development might not proceed. Only block loads exceeding a certain size threshold are included in the forecasts, to avoid potential double counting, as historical demands incorporate block loads and general demand growth.

At the time of writing this DSCS, the volume of grid connected PV systems is expected to make minor impact at system level forecast (including future years as it stands); hence the impact of PV systems is not included in the forecast for this DSCS. With the development of our new regression-based Load Forecasting tool, NEDC will monitor the uptake of all low carbon technologies including PV and include the impact of these on forecast in future appropriately.

4.6.1. Load Forecasting

To address the various uncertainties impacting the forecasting in recent times and going forward as mentioned above; NEDC has an econometric forecast modelling tool rather than historically used Compound Annual Growth Rate (CAGR%) method. The model uses regression analysis to identify relationships between historic system data and historic economic variables. The primary economic variables considered are population growth and the growth in GDP (broken down by economic activity).

These two drivers are commonly accepted as being key descriptive drivers of future growth in underlying RUD and CA and by combining the historic regression-based relationship data to forecasts of the economic variables, projections of CA growth and RUD growth can be made (with average consumption per customer also identified).

Moreover, the tool can capture the Low Carbon Technology (LCT) impacts on load growth can also; these will be considered in future forecasts as these impacts on system demand become significant in future. In addition to the above, the impact of individual large investment projects is also considered separately. These projects are projected to bring around a one-off increase in demand, which is not captured by the economic forecast model. By undertaking sensitivity analysis, the model provides a complete envelope of extremes for the forecasted parameters rather than relying on one-point values.

4.6.2. System Demand Growth

Historical data indicates that the demand rate of growth across NEDC distribution system has slowed in recent years. This is mainly attributed to the sustained low price, general macro-economic factors and exceptional events around the world. The average load growth for the forecasted three years, using the Regression model, is 5.4%. Table 21 shows the actual and forecasted NEDC expected peak demand including and excluding the direct connected customer load.

Table 21 : NEDC Non-Coincidence Forecast with Growth

Year	2023	2024	2025	2026
Excluding Grid Connected Customers (MW)	6,733	7,133	7,498	7,877
Yearly Growth %	5.50%	5.90%	5.10%	5.10%
Including Grid Connected Customers (MW)	7,222	7,676	8,111	9,444
Yearly Growth %	8.30%	6.30%	5.70%	16.40%

Figure 10 shows the historical trend in NEDC system maximum demand with the forecast maximum demand over the period 2024 to 2026. Despite the general slowing in demand growth at the system level, there are areas within the system where maximum demand is forecast to grow well beyond the system average level, while other parts of the system are forecast to experience no load growth or a small reduction in maximum demand.

Furthermore, the direct connected customers peak demand expected to increase by 955 MW¹³ in 2026 considering the application received from customers that planning to connect through 220kV and 132kV systems in the major industrial areas such as AL Duqum, Sohar Free Zone and Sohar Industrial Port.

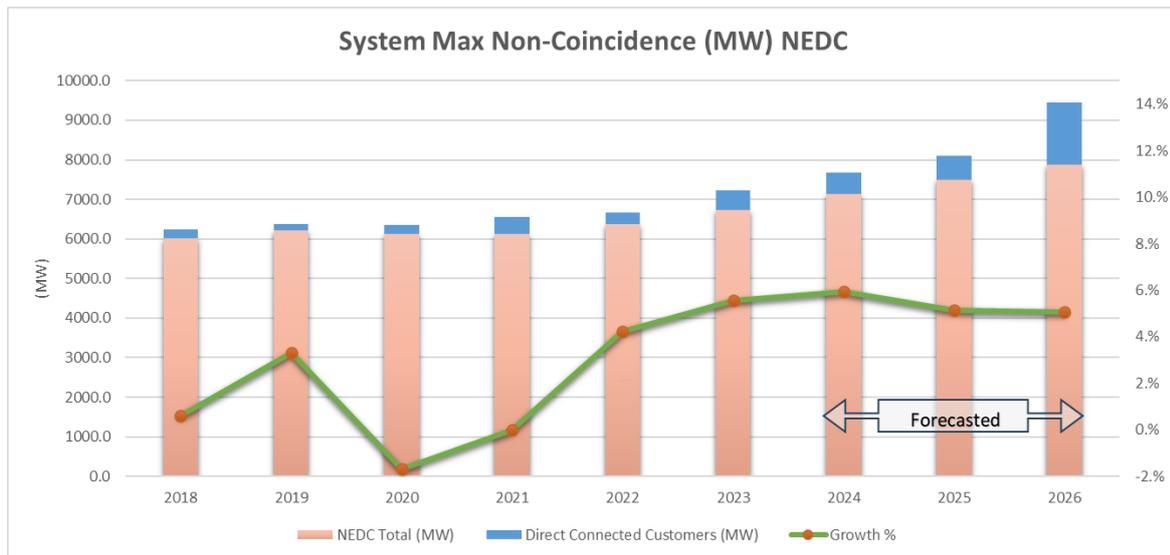


Figure 10 : Historical Trend in NEDC System Maximum Demand with Three Years Forecast

¹³ Based on the received applications and customer forecast without implementing CRT tariff effect.

The peak load of NEDC increases gradually, but the growth changes from year to year depending on the situation of each year. Figure 10 indicates that from the historical and forecast data [2018-2026]; the MIS system maximum demand continues rising compared to the last year in 2024 by around 7.24%. This high growth increase can be referring to the 83 MW of Al Wusta load (Mahout and Duqum) that going to be connected to MIS through OETC’s “Rabt” project. For 2025 and 2026, NEDC demand growth expected to vary between 5% to 6%. This expected growth driven by a considerable number of governmental investments in tourism projects, infrastructure projects, industrial projects, and private sector investments accompanying them.

There are two sperate networks In Musandam Governorate: Main network which consists of three Grid Stations (Tibat, Khasab and Dibba Grid Stations). This network is supplying around 99% of Musandam Governorate. The second network is Madha network. Madha is a small Wilayat surrounded by the UAE therefore the power system there consists of 6-11kV diesel generators (with total capacity of 11.3 MW) located in Madha Primary Substation. In 2023 summer, recorder peak load of Madah substation was around 7 MW and it is forecasted to remain almost the same for the period of 2024 to 2026 as there is no expectation for new major development in Madha. Overall Musandam load growth expected to grow within the limit of 6% as seen in Figure 11 below.

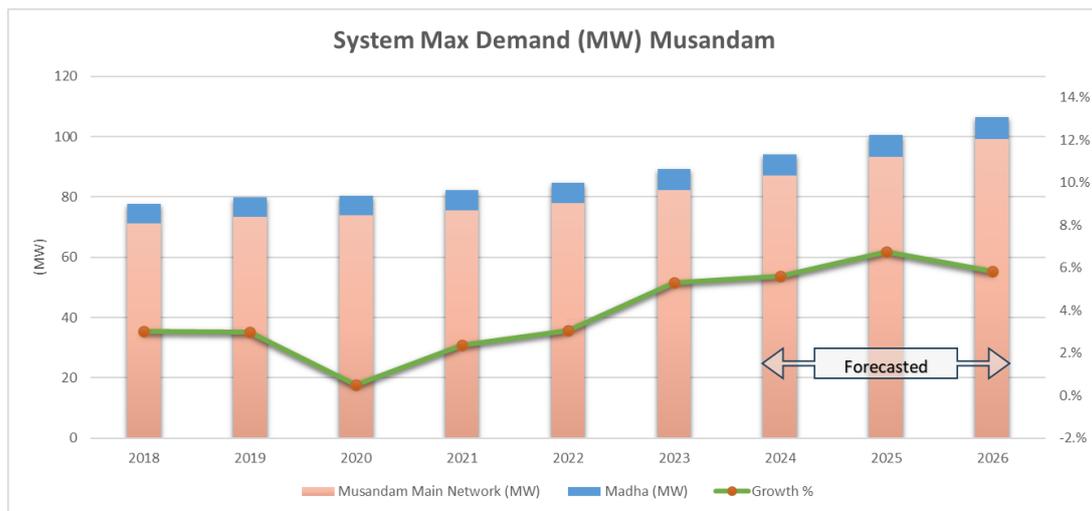


Figure 11 : Musandam 2018-2026 Peak Load with Growth percentage

Currently, most of the distribution networks in the Al Wusta Governorate and rural areas in other governorates are powered by diesel-fuelled power plants, which operate as isolated systems in different areas. There are 11 power plants distributed throughout the whole of Al Wusta and surrounding areas. NEDC has a plan to reconfigure these networks' power sources to be connected to the Main Interconnection System (MIS) and align with the OETC Interconnection Plan in the Phases I & II of “Rabt” project. Table 22 below displays the NEDC plan and the target date for the interconnection with MIS.

Table 22: Al Wusta Diesel Plants

Power Plant	Target Date
Masirah	Q4,2026
Hijj	Q4,2023
Al-Khuwaima	Q4,2026
Dhafrat	Q1,2024
Khalouf	Q2,2025
Najdah	Q1,2024
Sarab	Q2,2025
Duqm	Q4,2023
Masrooq	Q4,2026
Khadra	Q4,2026
Hitam	Q4,2026

In 2023, The peak load in the Al Wusta Governorate and its surrounding areas has reached 155.47 MW, including the PDO source connection. It is anticipated that the load will increase to 178 MW by 2026. Overall, Al Wusta load growth expected to be within 4.8% between 2024 to 2026 as seen in Figure 12 below.

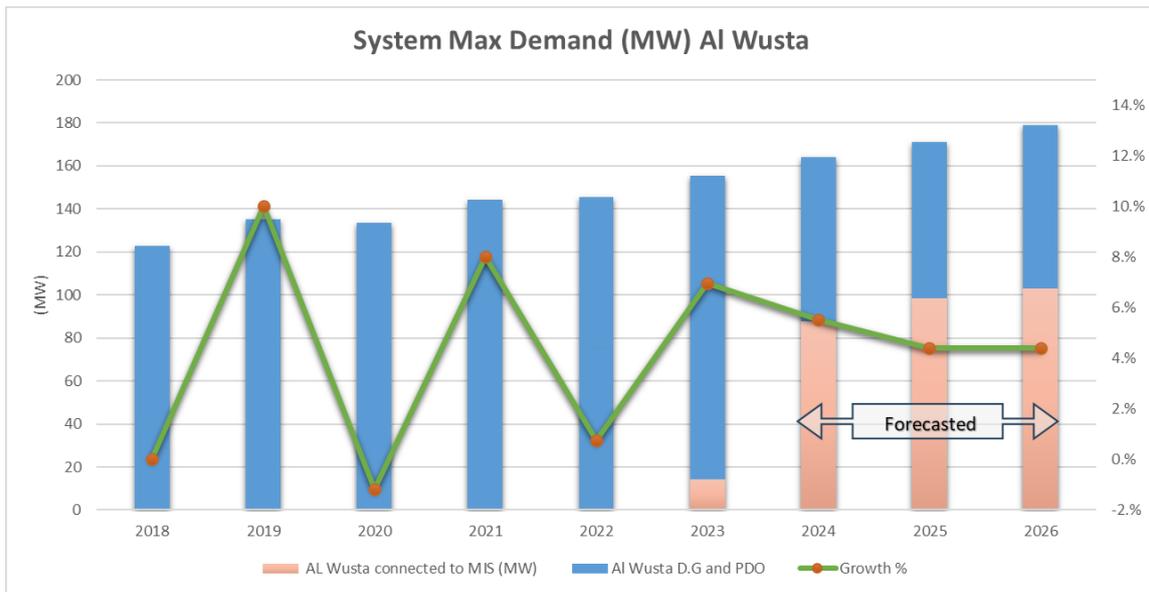


Figure 12 : Al Wusta 2018-2026 Peak Load with Growth percentage

4.7. Distribution System Modelling and Analysis

NEDC maintains up-to-date models of its power system for assessing distribution system performance via power system studies, bulk loads modelling, and undertaking customer connection studies where required; to ensure the distribution system operates in a safe and an efficient manner along with providing the required security of supply to its connected customers.

4.7.1. Power System Models

The planning tool utilised for system modelling and studies are PSS@SINCAL (Power System Simulator® Siemens Network Calculation), ETAP (Electrical Transient and Analysis Program) and DIgSILENT (Digital Simulation and Electrical Network calculation program). The models for each grid substation with their respective connected primary substations are established by representing the 33kV system on an electrical connectivity basis. The system models contain network topology and details in terms of nameplate data for transformers and their tap changers, capacitor banks and their controllers, conductor types along with associated lengths and parameters and the non-coincident demand data on individual primary substations.

The load demands are modelled as lumped loads connected to the main 11kV bus bars and segregated into motoric and non-motoric load types for load flow and fault current calculations. Likewise, the existing connected solar PV plants are also modelled as lumped generation on 11kV bus bars from this year onwards. The recorded maximum (summer) demands on each primary substation; derived from NEDC SCADA system as of 2023 have been used to update the power system models on non-coincidental load basis. Forecasting principles for load determination as mentioned in the previous sections have been adopted to forecast the future year (2024-2026) maximum demands.

4.7.2. Load Flow Analysis

Load flow analysis is undertaken for maximum demand scenarios to define the performance of NEDC distribution system. The analysis determines the active and reactive power flows in the system, percentage loadings for transformers and 33kV circuits along with the voltage profile at the 11kV and 33kV busbars of the primary substations under normal circuit operation. Simulations are carried out for the existing (2023) and future 3 years (2024-2026) for system maximum loadings. All short circuit results have been listed in a downloadable excel sheet files as following:

- Primary Substations Loading in Appendix B-1.
- 33kV feeders loading in Appendix B-2.
- Non-compliance Bus-Voltages in Appendix B-2.
- Short Circuit Fulat Results in in Appendix B-4
- 11kV feeders Loading in Appendix B-5.

From the studies, it is possible to identify where the system is strong and has spare capacity and conversely, where additional mitigation and/or reinforcement, before new connections, potentially needs

be considered. The maximum demand case for instance; identifies where there is a risk of overloading, of operation above firm capacity, or of system voltages falling below the voltage limits.

The power factor values for maximum demand scenarios have been determined based on the actual available information from NEDC SCADA. For maximum demand conditions, the actual recorded power factor data is employed, where available. For the remaining substations, where power factor values are not available via SCADA, a calculated system average is considered for maximum demand scenarios in accordance with the company's defined practice.

The load flow study results are summarised in tabular form in Appendix B and available in a downloadable excel files that supplements this Distribution System Capability Statement.

The simulation results demonstrate the following within the period of this DSCS:

- Voltage drop under maximum demand scenario remains within the statutory limits of - 6% on all 33kV busbars/nodes.
- Voltage drop under maximum demand scenario remains within the statutory limits of - 6% on all 11kV busbars/nodes.
- 33kV circuit loadings assessed for the worst-case maximum demand scenario; across the system are within the acceptable circuit ratings.

From the results it can be observed that 20 primary substations are facing voltage drop below the statutory limit of +/-6% at the 33kV busbars. However, the 11kV busbars are complying with the statutory voltage limits with consideration of operating the capacitor banks and the transformer tap-changer at the suitable tap position. By 2026, the number of primary substations facing voltage drop at the 33kV busbar will be reduced to 18 as a results of network expansion where new 33kV lines will be introduced in the system. NEDC will continue monitoring these primary substations to ensure keeping the 11kV network within statutory voltage limit of +/-6%. Moreover, NEDC and will keep in consideration to improve the 33kV voltage through providing new 33kV lines or installing new Grid connection points whenever is possible.

4.7.3. Short Circuit Analysis

NEDC carries out short circuit calculation studies to establish the capability of equipment to withstand three phase maximum prospective fault current levels. All short circuit results have been listed in a downable excel sheet file in Appendix B-4.

The principal source of fault currents is the generation assets connected to the transmission system with the fault current contribution onto the NEDC distribution system via the 132/33kV GSS transformers. The fault current infeed from the OETC source have been updated in our power system models according to the data provided by the OETC's 2023 Capability Statement which covers up the transmission system developments up to 2027.

The system configurations modelled for short circuit studies in each year, to represent the maximum prospective fault current levels, while also reflecting the realistic operational arrangement are based on the following principles:

- All existing and new 2x20 MVA PSSs are simulated for operation with the 11kV bus-section circuit breaker in the “normally closed” position¹⁴.
- All existing and new 3x20 MVA PSSs are simulated for operation with one 11kV bus-section circuit breaker as “normally closed” and one as “normally opened” (i.e., in N or N-1 scenario, it represents a 4 out of 5 ‘normally closed’ circuit breakers scenario) with an auto transfer scheme (ATS)¹⁵.
- All existing 2x20 MVA PSSs and 3x20 MVA PSSs are simulated for operation of 33kV bus-section circuit breakers within the PSSs (wherever present)¹⁶ as “normally open”.
- All existing and new outdoor primary substations (3x6MVA, 2x6 MVA, 2x3 MVA and 2x1 MVA) are simulated for operation with the 11kV bus-section circuit breaker in the “normally open” position.

The design short circuit breaking ratings of the 11kV switchgear component a new and upgraded primary substations are designed to 18.4 kA or higher based on short circuit requirement to comply with system requirements.

Currently, in the absence of accurate fault level contribution data from low voltage (LV) side, a worst-case allowance is made for LV motor fault contribution majorly due to the nature of the air conditioning load prevalent across the NEDC’s distribution system. A motoric to static load type ratio of 80/20 (in percentage) is considered using the system maximum demand values. System modelling for fault current calculations have been performed in accordance with the principles of the “IEC 60909-Short Circuit Currents in 3 Phase AC Systems” standard.

The maximum prospective fault current values are tabulated in the tables in Appendix B-4. The calculation of maximum prospective fault current is compared against the rated breaking capability of the primary equipment.

The maximum prospective (initial symmetrical) fault current is calculated to be still under but approaching (i.e., >95% and <100%) the rated breaking capacity of the primary 33kV equipment (switchgear) at the following primary substations:

- Wadi Adai-P175 (23.98 kA in 2024 and then within 97% of 25kA rating)

¹⁴ Except for few locations where the 33kV feeders for the individual transformers are connected from two different GSSs in which case, the 11kV bus-section circuit breaker is kept “normally open” for the respective year(s).

¹⁵ If the fault levels are within limits for this worst-case scenario’s then on bus-coupler open scenarios of existing primaries the fault level’s will be even lower.

¹⁶ For new PSS, the 33kV configuration excludes the 33kV bus-section circuit breakers at the PSS.

- Bousher G-GP02 (24.21 kA in 2025 and 2026)
- Seeb Grid-GP08 (24.2 kA in 2025 and 2026)
- Mawaleh South Grid-F1-GP05 (23.8 kA from 2024 to 2026)
- Mawaleh North Grid-GP01(24.2 kA by 2026)
- Barka-5 IWP (24.9 kA by 2026)
- Barka Pumping Station PSS (23.9 kA in 2024 and 24.2 kA by 2026)
- Fayha (23.5 kA in 2023)
- Mudhairib Grid (23.8 kA in 2023 and 24.8 kA by 2026)
- Sur IWP 2 (24.3 kA in 2023 and 24.5 kA by 2026)

However, at the following primary substation(s), minor excursions beyond the rated breaking capacity of the 33kV equipment (switchgear) are observed:

- MSQ Grid-GP06 (25.64 kA by 2026 (103% of 25 kA rating))
- Rusail Ind 4-P158 (25.6 kA by 2026 (103% of 25 kA rating))
- Rustaq Grid (40.4 kA by 2026 (132% of 25 kA rating))
- Hay Sharq Temp (26.5 kA by 2024 (106% of 25 kA rating))
- Hay Sharq (27.5 kA by 2024 (110% of 25 kA rating))
- Nizwa Grid (29.9 kA in 2023 and 27 kA by 2026 (108% of 25 kA rating))
- Izki Grid (27.9 kA in 2023 and 24.8 kA by 2026 (99.9% of 25 kA rating))
- Sur Grid (26.7 kA from 2023 to 2026 (107% of 25 kA rating))
- Sur IWP (25.1 kA by 2026 (101% of 25 kA rating))

Where it marginally exceeds above the switchgear rating; hence NEDC shall monitor this PSS closely and create mitigation plans in form of operational restrictions if required based on the monitoring results.

It is to be noted that all the above primary substations are in close electrical vicinity of the grids substations where these results are based on non-coincident maximum demand fault contributions to represent worst case scenarios of the connected PSSs.

The maximum prospective (initial symmetrical) fault current levels at 11kV busbars of all the primary substations are within their rated breaking capacities except for the following primary substations:

- Rusail Industrial 1-P103 (24.2 kA by 2026 (132% of 18.4 kA rating))
- Billah (18.5 kA in 2023 and 2024 (101% of 18.4 kA rating))
- Hufri (18.5 kA by 2026 (101% of 18.4 kA rating))
- Manah (18.5 kA in 2023 (101% of 18.4 kA rating))
- Mameer (20.1 kA by 2026 (109% of 18.4 kA rating))
- Hay Al Tourath (19.9 kA by 2026 (108% of 18.4 kA rating))
- Sinaw 2 (20.4 kA in 2023 (111% of 18.4 kA rating))
- Mintrib (18.9 kA by 2026 (103% of 18.4 kA rating))
- JBB Ali (18.8 kA by 2026 (102% of 18.4 kA rating))

4.7.4. Technical Losses Assessment

The technical losses in the NEDC distribution system are a factor of the configuration of the system, type and specification of equipment, percentage utilisation of assets and customer energy consumption. Technical losses are attributed to load and no-load losses in the 33kV feeders and 33/11.5kV primary transformers, 11kV feeders and distribution transformers and the LV distribution system. In line with standard international practice for utilities where the distribution system is not fully modelled, we calculate the losses for specific network elements (transformers, overhead lines and cables) across the different voltage levels (33kV, 11kV and LV) and then summate the total losses to obtain a percentage technical loss for each primary substation.

The percentage technical losses are then apportioned according to the proportion of total system energy supplied by each substation. A summation of all apportioned technical losses is then presented as the system percentage technical losses. The summated technical losses based on the 2023 distribution system operation is calculated to be 4.88%. The breakdown of technical losses by voltage level is shown in Table 23 below.

Table 23 : Technical Losses

System Component	Zone 1	Zone 2 (with Al Wasta)	Zone 3 (with Musandam)	% Total
33 KV OHL, UGC & PT Losses	0.64%	1.48%	1.24%	1.08%
11 KV OHL & UGC Losses	0.37%	1.21%	1.29%	0.88%
11/ 0.415kV Distribution Tx Losses	1.85%	2.40%	1.56%	1.97%
LT OHL & UGC Losses	1.18%	0.82%	0.77%	0.96%
Total	4.03%	5.91%	4.86%	4.88%

5. CHALLENGES AND OPPORTUNITIES WITHIN THE SYSTEM

5.1. Low Carbon Technologies

Implementation of Low carbon technologies (LCTs) like Solar PV, Electrical Vehicles (EV), energy efficiency and battery storage are few of the major LCTs successfully being implemented around the globe to achieve sustainability of natural resources and protect the environment. This philosophy is also the cornerstone for Oman as demonstrated in the Oman Vision 2040 Environment and Natural Resources Objective¹⁷. To achieve the above and other sustainable goals of the Sultanate National Energy Strategy for 2040 recommended that around 20% of Oman's generation mix should come from renewable energy sources (RES)—primarily onshore wind and solar—by 2030¹⁸. Lastly the CRT and customer tariff reforms introduced by Oman 2017 onwards are accelerating the adoption of these LCTs.

NEDC recognise that the nature of electricity generation and use is changing. We envisage that recent policy initiatives will result in an increase in photovoltaic (PV) generation on our distribution system. Unlike other utilities in different regions, Oman has not seen significant uptake in electric vehicle charging thus, the associated demand characteristics for electric vehicles (EV) are not considered to be a contributing factor to our system planning in the short-term planning horizon. However, this will be closely monitored to check the penetration rate of EV and PV in general.

5.1.1. Photovoltaic (PV) connections

In accordance with the above, the LCT with significant impact to the NEDC system as of 2023 is Solar PV. In 2017, Authority for Public Services Regulation (APSR) revised the existing regulatory framework to facilitate the adoption of small-scale grid connected solar PV systems by customers in Oman. The PV guidelines detail the following:

- Establishing the minimum technical standards required for small scale grid connected PV systems.
- Detailing the connection process including the installation, metering and operation/maintenance.
- Allowing the distribution companies to act as agents for OPWP (the current single buyer of electricity) to buy PV-generated electricity from customers.

With the introduction of Sahim-I initiative by the APSR since May 2017, there has been an increasing uptake of small grid connected PV systems for households and business as evident from the PV connections list in Appendix B. NEDC does foresee challenges and opportunities in the way we will plan and operate our system. Whilst PV may have the impact of reducing transmission and distribution

¹⁷ https://isfu.gov.om/2040/Vision_Documents_En.pdf

¹⁸ <https://www.apsr.om/en/renewableenergy>

congestion; we do envisage that challenges in terms of power quality, reverse power flow and operating within voltage limits will need to be addressed if PV uptake is significant.

NEDC are responsible for ensuring power quality according to the regulations under which we operate. However, with the addition of intermittent, consumer-owned and non-dispatchable PV units, current standard procedures for guaranteeing power quality might not be as effective as they are without PV.

Overvoltage is one of the main reasons for limiting the capacity (active power) of non-dispatchable PV; that can be connected to a low voltage Distribution System. During high PV generation and low load periods; there is a possibility of reverse power flow and consequently voltage rise in the HV & LV feeder. We envisage that this will be most prominent during the winter period. For this reason, NEDC believe that if uptake is significant, it will impact investment decision making for reinforcement and asset replacement. Consideration of tap range, optimum dispatch of capacitor banks and conductor sizing may be necessary should PV penetration become high.

In accordance with the above NEDC continuous to witness an increase in applications for connecting solar PV systems of various sizes. As end of September 2023, NEDC have received in total 654 PV applications with total requested generation capacity of 72.56 MW, 425 no. applications are connected equating to 43.15 MW and 141 initial applications submitted equating to 11.51 MW YTD.

Table 24 and Figure 13 and Figure 14 below shows these customer classifications for the applications in the category.

Table 24: 2023 PV connection Applications with total installed PV capacity

Sr.	Category	No. of Applications		Connected Generation [MW]	
		YTD 2023	As End Sep, 2023	YTD 2023	As End Sep 2023
1	Commercial	48	128	16.67	27.00
2	Government	33	93	4.16	11.30
3	Residential	94	351	1.73	3.01
4	Agricultural	56	82	0.23	1.84
Total		231	654	22.79	43.15

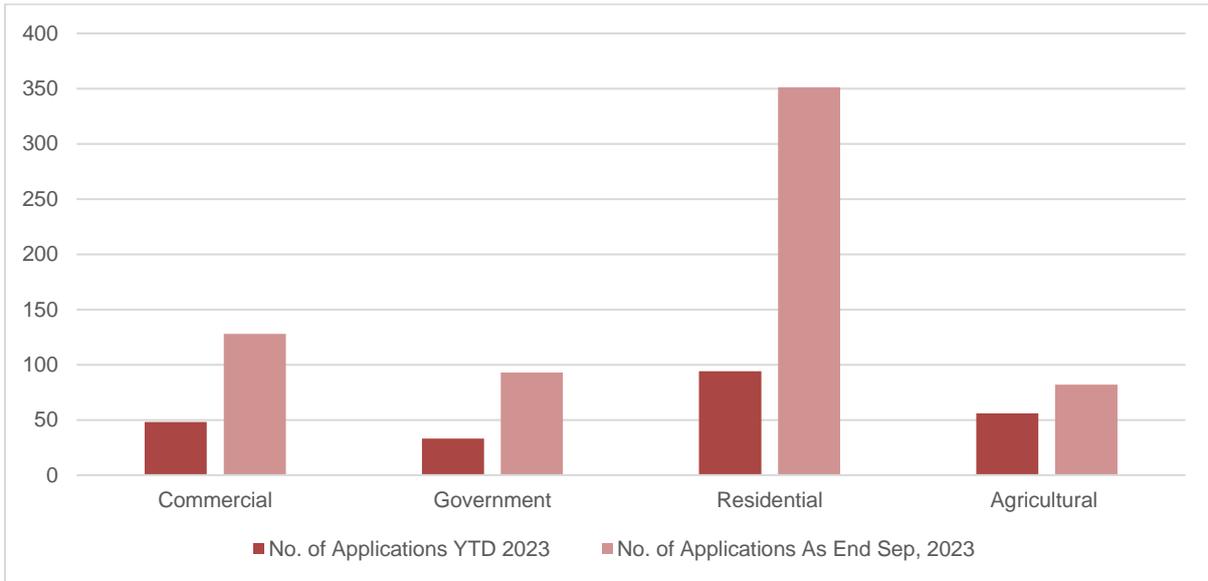


Figure 13: Number of PV Applications

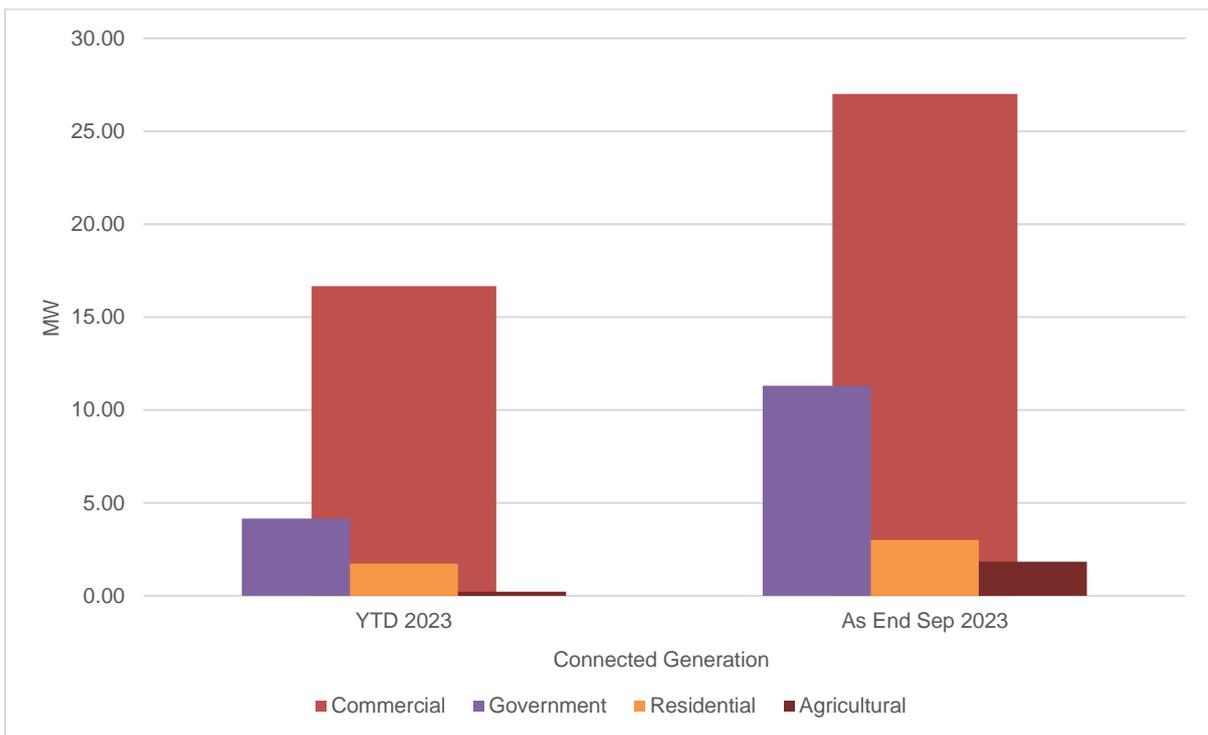


Figure 14: Connected Generation from PV [MW]

In accordance with the current Oman regulations the solar PV systems are required to be firstly installed for self-consumption basis before any excess generation is exported to the distribution system for the consumption of other customers. Net metering allows Residential, Government and Commercial customers who generate their own electricity from solar power, to sell the surplus electricity back into the grid.

6. THE INVESTMENT PLAN

6.1. Future System Development Plans

NEDC has prepared a plan for the new investments required in 2024-2026 to reinforce the 33 kV network and ensure compliance with the security standards. Many substations and feeders will start moving toward compliance situation. However, the NEDC investment plan updates annually to cover other substations and feeders that need more investments. NEDC has taken various steps to tackle any bottlenecks in the project management cycle, and with these interventions, our capabilities to deliver all the required capital expenditures will undoubtedly improve.

Table 25 show the summary of planned 33 kV projects in the NEDC network per governorate in the different stages, the details are illustrated in Appendix C.

Table 25: A summary of the 33 kV Expansion Plan

Governorate	NEDC Investment Planning Stage	NEDC Investment Designing Stage	NEDC Investment Tendering Stage	NEDC Investment Execution stage
Muscat	4	3	3	8
Dakhiliah	0	1	0	4
South Sharqiyah	1	6	0	2
North Sharqiyah	0	0	0	3
South Batinah		1		4
North Batinah	3	2	0	2
DHAHIRAH	1	2	0	5
Musandam	2	0	0	2
Wusta	2	2	0	6
NEDC	13	17	3	36

Moreover, Table 26 show the summary of sponsored projects in the NEDC network per governorate in the different stages, the details are illustrated in Appendix D.

Table 26: A summary of the Sponsored Projects

Governorate	Sponsored Investment Planning Stage	Sponsored Investment Designing Stage	Sponsored Investment Tendering Stage	Sponsored Investment Execution stage
Muscat	0	0	1	0
Dakhiliah	0	0	0	6
South Sharqiyah	0	0	0	3
North Sharqiyah	0	0	0	3
South Batinah	0	2	0	4
NEDC	0	2	1	16

6.2. Network Suitability for New Connections

Since January 2023 up to end of September NEDC connected 21,723 applications with worth of 777 MW for both simple and complex connections. The table below shows the statistic for all governorates for both connections. From the table below it was noted that the for the simple connection the average connected load per customer is 0.03 MW, however the average connected load per customer for the complex customer is around 5.2 MW.

Table 27: Summary of Connected Customer during 2023

Type of Applicant	No. of Applications	Connected load [MW]
Simple connection	21,714	730
Complex Connection	9	47
Total	21,723	777

These connections already implemented in the load forecast and power system analysis. All reinforcement or investment have been considered in the future investment plan as illustrated in the prewise sections.

6.3. System Constraints

Load related system constraints fall into one of two categories:

- Current constraints that can be considered DSSS obligations.
- Load related constraints based on current load growth forecasts.

The required reinforcements and equipment loadings are shown in Appendixes C, D and E give a clear picture of the anticipated constraints that may be imposed on the 33 kV network. The load flow results shown for the years 2024, 2025, and 2026 were obtained assuming that the current ongoing projects (CWIP) are expected to be completed on time and that the planned reinforcements are financed to bring them into operation. Failure to fund these reinforcements or delay in timely completion will constrain the network for three years.

APPENDIX A: DISTRIBUTION LICENCE CONDITION 33: DSCS

1. The licensee shall, within 12 months of the grant of this licence, and thereafter, on an annual basis, prepare a statement, in a form approved by the authority, showing, in respect of each of the three succeeding financial years, circuit capacity, forecast power flows and loading on each part of its distribution system and fault levels for each transmission node, together with:
 - information on the status of distribution circuit capacity and the anticipated future requirements of such capacity, including (i) applications for new Connections; and (ii) applications to Connect Generation capacity to its Systems;
 - a commentary prepared by the Licensee indicating the Licensee's views as to those parts of its Distribution System most suited to new Connections and Distribution of further quantities of electricity
 - information on what constraints are foreseen on the Licensee's Distribution System and where;
 - information relating to progress of ongoing investment in its Distribution System;
 - such further information as shall be reasonably necessary to enable any Person seeking to Connect to or use the Licensee's Distribution System to identify and evaluate the opportunities for so doing;
 - an assessment of technical losses from the Licensee's Distribution System; and
 - such other matters as shall be specified in directions issued by the Authority from time to time for the purposes of this Condition,
 - provided that the Authority may, upon application of the Licensee, relieve the Licensee from the obligation to prepare any such statement in respect of any period and any part or parts of its Distribution System specified in directions issued to the Licensee by the Authority from time to time for the purposes of this Condition.
2. The Licensee shall include in every statement prepared in accordance with paragraph 1 above the information required by that paragraph except that the Licensee may with the prior consent of the Authority omit from any such statement any details as to the capacity, flows, loading or other information, disclosure of which would, in the view of the Authority, seriously and prejudicially affect the commercial interests of the Licensee or any third party.
3. The Licensee may periodically revise the information set out in and, with the approval of the Authority, alter the form of the statement prepared in accordance with paragraph 1 and shall, at least once in every year this Licence is in force, revise such statement in order that the information set out in the statement shall continue to be accurate in all material respects.
4. The Licensee shall, when preparing the statement referred to in paragraph 1 of this Condition, ensure that the statement takes due account of information required to be provided to it by Persons bound by the Distribution Code.
5. The Licensee shall send a copy of the statement prepared in accordance with paragraph 1 and of each revision of such statement in accordance with paragraph 3 to the Authority. Each such revision shall require to be approved by the Authority and shall not become effective until approved by the Authority.
6. The Licensee shall, subject to paragraph 6, give or send a copy of the statement prepared in accordance with paragraph 1 or (as the case may be) of the latest revision of such statement in

accordance with paragraph 3 approved by the Authority pursuant to such paragraph to any Person who requests a copy of such statement.

7. The Licensee may make a charge for any statement given or sent pursuant to paragraph 4 of an amount reflecting the Licensee's reasonable costs of providing such a statement which shall not exceed the maximum amount specified in directions issued by the Authority from time to time for the purposes of this Condition.

APPENDIX B: SYSTEM STUDY RESULTS

Appendix B presents the following series of tables, for each grid substation power system model, which show the expected performance of the distribution network under maximum and minimum demand scenarios for each year from 2023 to 2026.

1. Primary Substations Maximum Demand and Percentage Loading

The maximum demand with real and reactive power loads at the PSS individual peak time in 2023 planning cycle and as accordingly forecasted for the period from 2024 to 2026. Percentage loading is calculated based on the Firm Capacity of the PSS. This data was used in the load flow and fault level studies for maximum demand scenario presented in this section of this DSCS. Below web link drives directly to all Primary Substations Maximum demand tables:

<https://mzgisportal.mzec.co.om/portal/apps/webappviewer/CapabilityStatement2024-2026.xlsx>

2. 33kV Feeder Loads

The resulting maximum demand in MVA on 33kV circuits/feeders, calculated for the individual non-coincident maximum loads of the PSS(s) connected to these feeders for the period 2023 to 2026. Percentage loading is calculated based on the de-rated capacity of the circuits. Below web link drives directly to all 33kV feeders loading tables:

<https://mzgisportal.mzec.co.om/portal/apps/webappviewer/33kVFeedersLoading2023to2026.xlsx>

3. Primary Substations Bus Voltages

The resulting voltage value (expressed in percentage of the nominal 33kV and 11kV) on the busbars of the PSSs, corresponding to maximum and minimum demand scenarios. Below web link drives directly to the voltage non-compliance tables:

<https://mzgisportal.mzec.co.om/portal/apps/webappviewer/VoltageNon-Compliances2023to2026.xlsx>

4. Primary Substation 3-Phase Fault Current Levels (kA)

The resulting 3 phase maximum fault current level on the busbars of the PSSs, corresponding to maximum demand scenarios. The rated breaking fault ratings of the switchgear are also specified. Below web link drives directly to all Primary Substation 3-Phase Fault Current Levels tables:

[https://mzgisportal.mzec.co.om/portal/apps/webappviewer/ShortCircuitLevels\(kA\)_SimulationResults.xlsx](https://mzgisportal.mzec.co.om/portal/apps/webappviewer/ShortCircuitLevels(kA)_SimulationResults.xlsx)

5. 11kV Feeder Loads

Below web link drives to the actual maximum demand in (Amp) on 11kV circuits/feeders for 2023 tables:

[https://mzgisportal.mzec.co.om/portal/apps/webappviewer/11kVFeedersloading\(Actual2023\).xlsx](https://mzgisportal.mzec.co.om/portal/apps/webappviewer/11kVFeedersloading(Actual2023).xlsx)

Explanatory Notes:

1. **1TX** in Firm Capacity means primary substation has single 33/11 kV transformer (i.e., zero N-1 capacity and firm capacity equivalent to 11kV interconnection capacity);
2. **Standby PSS** means primary substation having 33kV and 11kV busbars energized with 11kV outgoing feeders (i.e., loads) disconnected. The load on these PSSs is expected to be connected occasionally, depending on requirement.

In the above-mentioned tables, a “-“(dash) appears in relevant years due to any of the following reasons, as may be applicable:

- The primary substation is shifted (i.e., connected) to another grid station.
- The primary substation, or any of its capacity enhancement project, is planned to be energized/commissioned in the future.
- There are no 11kV busbars (rather a different voltage level exists e.g., 6.9kV for a private customer, operated and maintained by the customer);
- NEDC doesn't own/have the information of the network below 33kV level.
- An “Outage” / “Out of Service” condition exists on concerned 33kV circuit / 33kV busbar at the day/time of the declared maximum demand of the PSS.

APPENDIX C: FUTURE SYSTEM DEVELOPMENT PLANS

No.	PIAD No.	Project Name	Wilayat	Expected Completion Year	Project Status	Project Purpose
Muscat						
1	D/06/2019	New Mabelah South 9 - P184	Seeb	2023	Execution stage	To relieve loads from Mabelah Area
2	D/02/2021	New Airport Height 6 PSS P195	Bousher	2023	Execution stage	To relieve loads from Airport Height area and accommodate the new load
3	MEDC/AMD/2/2018	Replacement of al Hamriyah PSS (P035)	Al Hamriyah	2023	Execution stage	Old asset replacement
4	D/07/2019	Upgrading Al Hail North 1(P027)	Seeb	2023	Execution stage	To relieve loads from Al Hail Area and accommodate the new load
5	D/03/2021	Installation of 33Kv Capacitor Bank in different Grids locations	Different Locations	2023	Execution stage	Enhance the Network reliability and efficiency
6	D/05/2018	Madinat Al Nahdha PSS - 33kV Load Shifting to Amerat Grid from Jahloot Grid	Amerat	2023	Execution stage	Balance the load between the GSS and making the two 33kV feeders from the same GSS
7	D/06/2022	11kV Capacitor Banks at Primary Substations	Different Locations	2023	Designing Stage	Enhance the Network reliability and efficiency
8	PIAD/REP/2019/1/1	Construction of 2X20MVA Ruwi Valley (P174) PSS.	Muttrah	2024	Execution stage	Old asset replacement and upgrading the PSS to relieve loads from the area
9	D/01/2020	Upgrading Sarooj Shati Al Qurum (P110) PSS	Bousher	2024	Execution stage	To relieve loads from Al Sarooj - Al Qurum Area
10	PIAD/REP/2022/2	Asset Replacement at Rusail Industrial 1 P103	Seeb	2024	Tendering Stage	Old asset replacement
11	D/03/2022	Upgrading Al Hail North 2 Upgrade P (028)	Seeb	2024	Tendering Stage	To relieve loads from Al Hail Area and accommodate the new load
12	D/04/2022	Bousher Ansab Height[P202] PSS	Bousher	2024	Tendering Stage	To relieve loads from AL Ansab Area
13	PIAD/REP/2022/4	Aziba South-1A P014 replacement of 11kV SWG	Bousher	2024	Designing Stage	Old asset replacement
14	-	Muttrah Store P085 replacement of 33kV SWG	Muttrah	2024	Designing Stage	Old asset replacement.
15	-	Upgrading Al Shahbari P092 3x220MVA	Quriyat	2025	Planning Stage	To relieve loads from Quriyat Area and accommodate the new load
16	-	Upgrading Amerat 1 P005, 2x20MVA	Amerat	2025	Planning Stage	Old Asset Replacement and to relieve loads from Amerat Area
17	-	New Misfah Phase 2 PSS 3x20MVA	Seeb	2026	Planning Stage	To relieve loads from Misfah Area
18	-	New Mabelah South 10 PSS	Seeb	2026	Planning Stage	To relieve loads from Mabelah Area
Al Batinah South						
1	Internal Note: Date: 25/04/2021	Upgrading Khazaen PSS from 1x6 MVA to 2x6 MVA	Nakal	2023	Execution stage	cover the new loads
2	SB-07/2013	Constructing Hai Asem 3x20MVA substation with three 33kV feeders from Hai Asem Grid	Barka	2024	Execution stage	To relieve loads from Rumais Primary Substation

No.	PIAD No.	Project Name	Wilayat	Expected Completion Year	Project Status	Project Purpose
3	SB 01/2019	Construction Al Sawadi 2x20 MVA substation with two 33 kV feeders from Blue City grid	Barka	2025	Execution stage	To relieve loads from Billah Primary Substation
4	SB-04/2013	Construction of 2x20 MVA PSS Shuaybah South at Al Musanah in Batinah South with 33 kV and 11 kV feeders.	Musanah	2025	Execution stage	To relieve loads from Jamma Temp Primary Substation
5	SB 01/2022	Construction of 2x20 MVA PSS Nakhal Wasit at Nakhal in Batinah South with 33 kV and 11 kV feeders.	Nakhal	2026	Designing Stage	To relieve loads from Afi, MPF and Taww Primary Substations.
Al Dakhiliah						
1	DH-07/2013	Construction of Adam Bashaer 33 kV feeder from Adam grid station to supply Adam Bashaer primary substation	Nizwa	2024	Execution stage	To secure the 33 kV supply for Adam Bashaer primary substation
2	DH 06/2012	Construction of Sumail Industrial 132/33 kV grid station 2x125 MVA with 33 kV feeders	Sumail	2024	Execution stage	Relieve the load form existing Sumail New grid station
3	DH-08/2013	Construction of Birkat Al Mouz 132/33 kV grid station 2x125 MVA with 33 kV feeders	Nizwa	2024	Execution stage	Relieve the load form existing Izki and Nizwa grid stations
4	DH-02/2013	Construction of Jabel Al Akhdher one 33 kV feeder from Izki grid station to supply Jabal Al Akhdher New primary substation	Nizwa	2024	Execution stage	To secure the 33 kV supply for Jabel Al Akhdher primary substation
5	DH 01/2019	Construction of Maemeer 2x20 MVA Substation in Nizwa	Nizwa	2026	Designing Stage	Relieve the load form existing Karsha, Maara temp and Mamad primary substations
North Sharqiyah						
1	SH 05/2012	Construction of New Sinaw C 3x20 MVA primary substation with 11 kV feeders and 33 kV feeders from Al Mudhaib grid station	Mudhaibi	2024	Execution stage	Relieve the load from existing Sinwa A & B primary substations
2	NSH 01/2019	Construction of Al Dreez 2x20 MVA substation with two 33 kV feeders interlink with Mudhairib-3 and Mudhairib-4	Ibra	2024	Execution stage	Relieve the load from existing Al Mudhairib primary substation
3	ASS-DK 1/2022	Construction of New 33 kV feeder from Samad Grid station to Sumrah 3x6 MVA primary substation	Mudhaibi-Sumail	2024	Execution stage	Feeder Sumrah PSS from Samad Grid
South Sharqiyah						
1	SSH 01/2016	Construction of Wafi 2x20 MVA primary substation	Jalan Bani Bu Hassan	2024	Execution stage	Relieve the load from existing Tawi Aishah, Hadri Bilad and Kamil Water Pump primary substations
2	SH 01/2012	Construction of JBB Ali-2 2x20 MVA primary substation	Jalan Bani Bu Ali	2024	Execution stage	Relieve the load from existing Jalan Bani Bu Ali grid and Jalan Bani Bu Ali primary substations
3	SSH 02/2019	Construction of Jawabi Grid 33 kV busbar and 33 kV switchgear	Jalan Bani Bu Ali	2025	Designing Stage	Relieve the load from existing Jalan Bani Bu Ali Grid Station
4	SSH 03/2016	Construction of Al Ashkhara-2 2x 20 MVA substation with two 33 kV incomers from BB Hassan Grid Station	Jalan Bani Bu Ali	2025	Designing Stage	Relieve the load from existing Ashkhara primary substations
5	TS-SSH 2/2022	Modification of Sur Filayj 1x6 + 1x6 MVA substation to 2x6 MVA with additional 33 kV Tapping from feeder 15L5 Sur Grid Station	Sur	2025	Designing Stage	To comply with DSSS

No.	PIAD No.	Project Name	Wilayat	Expected Completion Year	Project Status	Project Purpose
6	-	constructing one 33KV circuit from JBB. Hassan to Tahaim area	JBB. Hassan	2025	Designing Stage	Power Supply to Tahaim area
7	-	Constructing of 33KV and 11KV to overcome non-compliance of Nahddah and Ras Helf PSS	Masirah	2025	Planning Stage	To comply with DSSS
8	-	Interconnection of the Masirah distribution system with MIS by interlinked Switching Station to the Masirah Grid.	Masirah	2026	Designing Stage	Shutdown the Masirah Power Plant and reduce the OPEX cost
9	-	Interconnection of the Khuwaima distribution system with MIS by constructing 2x20MVA	Khuwaima	2026	Designing Stage	Shutdown the Khuwaima Power Plant and reduce the OPEX cost
Al Wusta						
1	Tanweer 38/2021	Interlink of Rural Area Electricity (33 KV) Network in Wilayat Mahout with (400 KV) main Transmission Network	Duqm	2023	Execution stage	Shutdown the Hijj Power Plant and reduce the OPEX cost
2	Tanweer 39/2021	MIS Interconnection Project at Duqm – Construction Of 33kv Cabling with Duqm Grid Station At Wilayat Al Duqm In Al Wusta Governorate	Mahout	2023	Execution stage	Shutdown the Duqm Power Plant and reduce the OPEX cost
3	Tanweer 10/2022	Construction of a New 2x6MVA step-down transformer at Hijj PSS and construct new 33KV line at Hijj	Mahout	2024	Execution stage	To feed Hijj area from the Mahout Grid
4	Tanweer 12/2022	Construction of 2X3 MVA 33/11KV Primary Outdoor Substation Associate with 33KV OHL Interlink with Al Dhafrat Network to MIS at Al Wusta Governorate	Mahout	2024	Execution stage	Shutdown the Dafrat Power Plant and reduce the OPEX cost
5	Tanweer 13/2022	Construction of 2x 6 MVA PSS and 33 & 11KV Feeders (Interlinking Najdha Network to MIS) at Wilayat Mahout in Al Wusta Governorate	Mahout	2024	Execution stage	Shutdown the Najdha Power Plant and reduce the OPEX cost
6	Tanweer 19/2021	Design, Supply & Installation for Upgrading the SCADA System at Wilayat Duqm in Al Wusta Governorate	Duqm.Mahout, Masirah	2024	Execution stage	To integration of Duqm System to SCADA
7	-	Interconnection of the Khaloof distribution system with MIS by constructing one 33KV circuit from the Mahout network and 2x3 MVA PSS in the Khaloof area.	Mahout	2025	Designing Stage	Shutdown the Khloof Power Plant and reduce the OPEX cost

No.	PIAD No.	Project Name	Wilayat	Expected Completion Year	Project Status	Project Purpose
8	-	Interconnection of the Sarab distribution system with MIS by constructing one 33KV circuit from the Duqm network and 2x6 MVA PSS in the Sarab area.	Mahout	2025	Designing Stage	Shutdown the Sarab Power Plant and reduce the OPEX cost
9	-	Upgrade the Dhare PSS	Duqm	2025	Planning Stage	To comply with DSSS
10	-	Extension of 33KV feeder to Um Qurshreb Village.	Mahout	2026	Planning Stage	Power Supply to Um Qurshreb Village.
AL Dhahirah						
1	2017-01	Reconstruction of 33 kV Portion of Ibri Old Grid Station- 33kV Feeders Interlinks	IBRI	2024	Execution stage	Replacing old assets and managing load between grid stations
2	2021-2	Construct New Hilat Al Nahdha PSS 3X20 with 33kV feeder from Ibri Grid	IBRI	2024	Execution stage	Cover the new loads and to relieve loads from Mazra Bani Khater Primary Substation
3	2021-5	Upgrading Baat PSS from 2X6 MVA to 2X20 MVA with 33kV feeder from Dreez Grid	Dreez	2024	Execution stage	Cover the new loads
4	2021-6	Rearrangement of 33kV network between Dreez & AL Hail Grid Stations (transfer Hugerat & Kahant to AL Hail Grid & Provide second feeding source to AL Mahual & Kahanat PSS)	IBRI	2024	Execution stage	To manage Grid Stations loading and provide second 33kV feeding source to AL Mahual and Kahanat PSSs
5	-	Interconnection of the Hamra Al Doroa distribution system with MIS by constructing two 33KV circuits to distribution system.	Ibri	2025	Designing Stage	To meet the demand and to rid of generation rental
6	2022-1	Construction of Ibri Industrial 2x6 MVA Primary Substation	IBRI	2025	Execution stage	Providing secure supply to new Industrial Area
7		Construction of Al Hwmaniah 2x20 MVA Primary Substation	Dreez	2025	Planning Stage	To relieve load from Hugerat, Maqnyat and Al Nujayd Substations
8	2021-2	Upgrade AL Akhdar PSS from 2x10 to 2x20 and Shift from Ibri TX1 & TX2 Grid Station to IBRI Old Tx3 & Tx4	IBRI	2026	Designing Stage	Cover the new loads

No.	PIAD No.	Project Name	Wilayat	Expected Completion Year	Project Status	Project Purpose
North Batinah						
1	SB-04/2013	Construction of New Tharmad 3x20 MVA Substations and three 33 kV feeders tap with Suwaiq-1, Suwaiq-2 and Marble Factory Feeders from MIS Grid.	Suwaiq	2024	Execution stage	To relieve load from Tharmad, Tharmad New and Navel Temp. Substations
2	2021-4	Upgrading AL Wajajah PSS from 2X3 MVA to 2X6 MVA with connect new 33kV feeder from MD Shinas Grid	Shinas	2025	Designing Stage	Cover the new loads
3	-	Transferring and Converting Falaj AL Qbail 1 PSS 33kV feeders from Suhar Industrial Port Grid to SFZ Grid	Sohar	2025	Planning Stage	Load Managing between Grid Stations
4	2021-1	Upgrade Sana Bani Gafer PSS From (2 x 6 MVA) to (2 x 20 MVA) with 33KV feeder interlinks to S.B.G PSS and AL Lehban PSS	Al Khabourah	2025	Execution stage	Cover the new loads
5	-	33kV feeder interlinks to provide second feeding source for Wadi Ahin, Hail Al Asskareen , wadi Al Hilti and Hay Al Rafaa PSSs.	Sohar	2025	Designing Stage	Providing second feeding source to comply with DSSS
6	-	Construct New SIET-6 (Phase 7) PSS 3X20 MVA	Sohar	2026	Planning Stage	Providing secure supply to Sohar Industrial Estate phase 7
7	-	Construction of Murftaat Al Hambar 3x20 MVA Primary Substation	Sohar	2026	Planning Stage	To relieve load from Al Muwailh 2 and Palm Garden Substations
Musandam						
1	2019-4	Upgrading Siwi PSS from 2X6 MVA to 2X20 MVA with installing new 33kV feeder from Khasab Grid Station	Khasab	2023	Execution stage	Cover the new loads
2	-	Adding Backup Transformer to secure the SIB	Khasab	2024	Execution stage	Securing the power supply to Sibi Sea Areas in Khasab
3	-	New Khasab Port PSS (2X20 MVA) with Two 33kV Feeders	Khasab	2025	Planning Stage	Securing Khasab loads
4	-	Modification to secure Musandam Network	Khasab	2025	Planning Stage	Securing Khasab loads

APPENDIX D: SPONSORED PROJECTS

No.	Reference No.	Project Name	Wilayat	Expected Completion Year	Project Status	Purpose
Muscat						
1	-	Improve Reliability at MOD MAM-B PS By Adding One New 33kV Feeder	Seeb	2024	Tendering Stage	The connection will be made by tapping on the existing 33kV cables passing near the AFH which are fed from Rusail Industry Grid(G13) and feeding Rusail B PSS and adding circa 1km of new 33kV sections form the tapping points.
Al Batinah South						
1	CC/10/2016	Construct 2x6 MVA substation to supply the sponsor project of STF Wadi Al Mawel complex.	Nakhal	2023	Execution stage	To meet Customer load required
2	CC/6/2017	Construction of two 11 kV feeders from Saqsuq Substations to South Batinah Pumping Station Oman Logistic	Barka	2023	Execution stage	To meet Customer load required
3	CC/5/2017	Construction of Al Hazam Water Pump 2x6 MVA substation with 33 kV feeders from Muladah Grid	Musanah	2024	Execution stage	To meet Customer load required
4	CC/2/2018	Construction of Hay Al Sharq 2x20 MVA substation	Barka	2024	Execution stage	To meet Customer load required
5	MZ22IC00910	construction new 11 kV feeder from Khazaen temp PSS Tx 2 & tapping from DSSS:2378 as backup feeder to Khazaen fruit & vegetable	Nakhal	2024	Designing Stage	To meet Customer load required
6	MZ23IC04116	Al Nakheel Integrated Tourism Complex	Barka	2026	Designing Stage	To meet Customer load required
Al Dhakilyah						
1	CC/20/2018	Construction of 3x20 MVA ROP College primary substation	Nizwa	2024	Execution stage	To meet Customer load required
2	CC/10/2018 (CC/26/2017)	Construction of 2x10 MVA Al Ain Water Pump primary substation	Samail	2024	Execution stage	To meet Customer load required
3	CC/11/2018 (CC/27/2017)	Construction of 2x10 MVA Hub 2 Water Pump primary substation	Samail	2024	Execution stage	To meet Customer load required
4	CC/9/2018 (CC/25/2017)	Construction of 2x20 MVA Hameem Water Pump primary substation	Samail	2024	Execution stage	To meet Customer load required
5	MZ23IC03209-ND/D/1081/2023	Construction of 2x33 kV feeder from Samail Industrial 132/33 kV grid station 2x125 MVA for Al Thail Metal Recycling LLC	Samail	2024	Execution stage	To meet Customer load required
6	MZ23IC03842-ND/M/1282/2023	Construction of Two 11 kV feeder for Oman Data Park S.A.O.C	Nizwa	2024	Execution stage	To meet Customer load required

No.	Reference No.	Project Name	Wilayat	Expected Completion Year	Project Status	Purpose
North Sharqiyah						
1	MZ191C03217	Construction of Al Hadeetha 2x20 MVA with two 33 kV feeders	Mudhaibi	2024	Execution stage	To supply the requested load of Al Wadi Endam Mine project
2	CC/17/2018	Construction 11 kV feeder from Liwariyah PSS 2x6 MVA to Wadi Bani Khalid water pump ststion	Wadi Bani Khalid	2024	Execution stage	To supply the requested load of Wadi Bani Khalid water pump station
3	CC/18/2018	Construction 11 kV feeder from Mudhairib PSS 2x20 MVA to Al Qabil water pump ststion	Al Qabil	2024	Execution stage	To supply the requested load of Al Qabil Water pump
South Sharqiyah						
1	CC/16/2018	Construction of one 11kV feeder from JBB Hassan 2 substation for water transmission system project in North & South Sharqiah- Jalan Bani Bu Hassan	Jalan Bani Bu Hassan	2024	Execution stage	To supply water transmission system project in North & South Sharqiah- Jalan Bani Bu Hassan
2	CC/15/2019	Construction of one 11kV feeder from Al Ashkharah substation for water transmission system project in North & South Sharqiah- Al Ashkharah	Jalan Bani Bu Ali	2024	Execution stage	To supply water transmission system project in North & South Sharqiah- Al Ashkharah
3	MZ22IC03732	Construction of 11 kV feeders from Sur Ind substation to supply Al Ghaith Chemical Industries LLC factory	Sur	2024	Execution stage	To supply Al Ghaith Chemical Industries LLC factory in Sur Ind Area