# DISTRIBUTION SYSTEM
# CAPABILITY STATEMENT
# (2026-2028)

نماء
nama
لتوزيع الكهرباء
ELECTRICITY DISTRIBUTION

# 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 at 132/33kV grid substations owned by Oman Electricity Transmission Company 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 (2025-2028) 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 technologies contributing to Oman's net zero target by 2050, particularly the increasing penetration of photovoltaic (PV) systems in the NEDC distribution network, which is gaining momentum in our licensed area. 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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| | |
|---|---|
| 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 |
| DIgSILENT | Digital Simulation and Electrical Network calculation program |
| DNS | Demand Not Secured |
| DPC | Distribution Planning Code |
| DSCS | Distribution System Capability Statement |
| DSSS | Distribution System Security Standard |
| D&SL | Distribution & Supply Licence |
| DL | Distribution Licence |
| ETAP | Electrical Transient and Analysis Program |
| EV | Electrical Vehicles |
| 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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# 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 DL 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 marge all Distribution Companies (excluding Dhofar Governorate). In June 2023 Nama Holding Electricity Distribution Company (NEDC) has been established and it is under the umbrella of the Nama with an obligation to undertake financing, operation, maintenance, development, and expansion of the distribution system in a safe, economic and efficient manner.

The company offers a diverse and comprehensive portfolio of services aimed at ensuring the seamless operation, expansion, and maintenance of the electricity network, as well as delivering exceptional customer support. These services include strategic planning and the development of new electricity infrastructure to meet growing demand. The company facilitates connections for newly built properties to the grid and manages the integration of additional loads for existing properties to accommodate upgrades or increased energy requirements.

In line with supporting renewable energy adoption, the company processes applications for solar projects, ensuring compliance with technical and regulatory standards. It also handles various requests related to operational work on the electricity network, providing timely and effective solutions. Electrical design approvals are offered for new developments to ensure they align with safety and performance standards.

The company plays an active role in maintaining and upgrading customer infrastructure by conducting inspections, replacements, and relocations of electricity meters for existing properties. To enhance network reliability, it oversees both scheduled and emergency outage management, keeping customers informed of power disruptions and restoration timelines.

As part of its commitment to service quality, the company tests and certifies electrical technicians, issuing licenses to ensure a skilled workforce. It also manages a wide range of customer interactions by receiving and addressing requests, inquiries, and complaints related to network operations. Additionally, the company responds promptly to customer queries regarding electricity outages, ensuring transparent communication and support throughout the resolution process. 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.

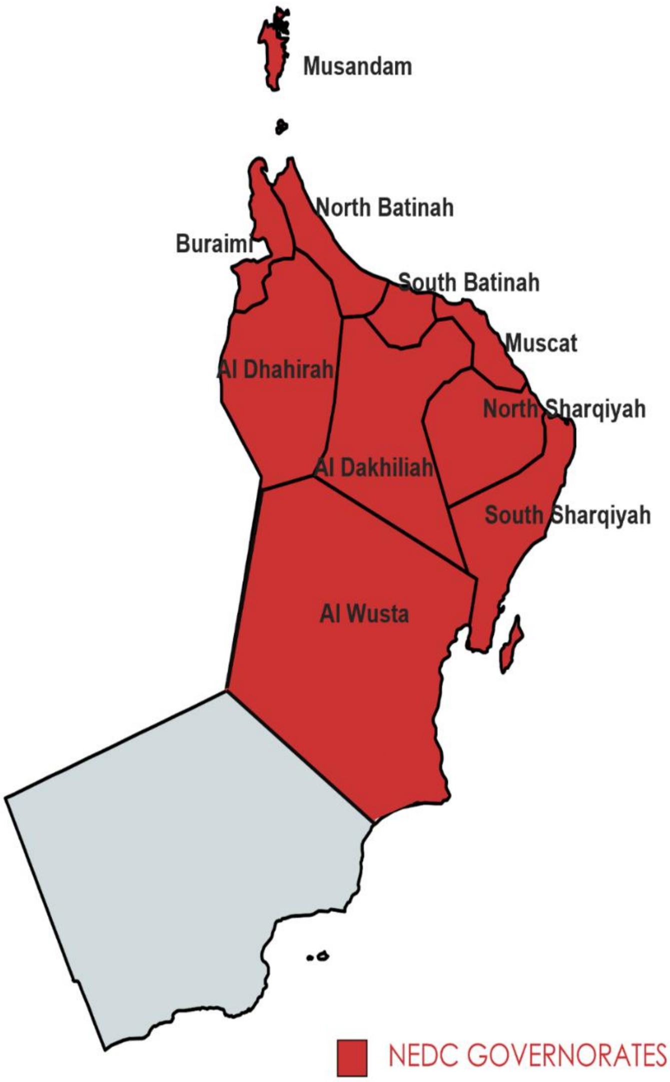


**Figure 1: NEDCs Licenses Area**

### 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 |
| Ad Dakhiliyah | 7,852.59 | 6,558.84 | 7,620 | 91 | 11 | 160,061 | 31,900 |
| Ash Sharqiyah North | 7,450.07 | 3,945.88 | 5,412 | 49 | 6 | 95,062 | 21,136 |
| Ash Sharqiyah South | 3,782.89 | 3,917.16 | 3,162 | 49 | 5 | 96,641 | 12,000 |
| Al Batinah South | 6,853.85 | 10,051.16 | 8,265 | 82 | 10 | 209,245 | 3,500 |
| Al Wusta | 2,228.89 | 2,095.37 | 1,512 | 35 | 4 | 19,708 | 79,700 |
| Al Batinah North | 6,113.75 | 7,941.36 | 7,073 | 109 | 18 | 186,583 | 12,500 |
| Muscat | 3,629.45 | 15,681.37 | 9,256 | 187 | 39 | 473,728 | 3,500 |
| Ad Dhahirah | 5,632.48 | 3,295.74 | 3,941 | 40 | 7 | 72,956 | 37,000 |
| Musandam | 745.39 | 1,180.70 | 831 | 17 | 3 | 17,769 | 1,800 |
| Al Buraimi | 2,229.13 | 1,731.72 | 2,149 | 28 | 5 | 43,231 | 7,000 |
| NEDC Total | 46,518.49 | 56,399.30 | 49,221.00 | 687 | 108[1] | 1,374,985 | 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 Licence (DL) 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 2026-2028. 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

[1] The grid has been calculated as A&B

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 2024 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 and potentially would introduce new 66kV system for some of rural areas that mandate long distribution network. 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.
- Distribution System Security Standard (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) | | |
|---|---|---|---|---|---|
| | | | 0.415 kV | 11 kV | 33 kV |
| 1 | Nominal Voltage | kV | 0.415 | 11 | 33 |
| 2 | Rated Frequency | Hz | 50 | 50 | 50 |
| 3 | Short Circuit Level | kA | 40 | 18.4[2] | 25[3] |
| 4 | Harmonic Level | % | 2.5 | 2 | 2 |
| 5 | Voltage fluctuations | % | 3 | 3 | 3 |

[2] There are different short circuit level 25 kA and 31.5 kA based on Substation design requirements.
[3] 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[4] | 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 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.

[4] 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.

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 2024 is shown in Table 5.

**Table 5: Number of 33/11 kV transformers**

| Power Transformer Size | Governorate | | | | | | | | | | NEDC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Muscat** | **Ad Dakhiliyah** | **Ad Dhahirah** | **AL Wusta** | **Ash Sharqiyah North** | **Al Batinah South** | **Ash Sharqiyah South** | **Al Batinah North** | **Al Buraimi** | **Musandam** | |
| 1 MVA | 1 | | | 3 | | | 2 | | 1 | 5 | 12 |
| 2 MVA | | | | | | | | | | 1 | 1 |
| 3 MVA | 7 | 8 | 6 | 12 | 8 | 1 | 2 | 4 | 2 | 6 | 56 |
| 5 MVA | 3 | 1 | | | | | | | | | 4 |
| 6 MVA | 52 | 81 | 25 | 19 | 61 | 61 | 36 | 51 | 19 | 5 | 410 |
| 10 MVA | 10 | 6 | 5 | 14 | 2 | 2 | 8 | 12 | 4 | 6 | 69 |
| 15 MVA | | | | 1 | | | | | | | 1 |
| 16 MVA | 16 | | | | | | | | | | 16 |
| 20 MVA | 337 | 98 | 44 | 30 | 34 | 97 | 48 | 162 | 24 | 8 | 882 |
| 31.5 MVA | 2 | | | | | | | | | | 2 |
| 40 MVA | | | | 1 | | | | | | | 1 |
| **Total** | **428** | **194** | **80** | **80** | **105** | **161** | **96** | **229** | **50** | **31** | **1454** |

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[5]** | **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).

[5] 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[6].

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 2025 is shown in the below table.

[6] A Complex Connection customer may build a private network without following full OES specifications, but all assets will remain under the customer's responsibility inside his property. Compliance with OES standards is required only at the connection point as will be defined in the Connection Agreement.

Table 7: Number of distribution transformers

| Distribution Transformer Size | Governorate | | | | | | | | | | NEDC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Muscat | Ad Dakhiliyah | Ad Dhahirah | AL Wusta | Ash Sharqiyah North | Al Batinah South | Ash Sharqiyah South | Al Batinah North | Al Buraimi | Musandam | |
| 16 KVA | | | | 1 | | | | | | | **1** |
| 25 KVA | | 42 | | 1 | 20 | 5 | 4 | | | | **72** |
| 50 KVA | 19 | 144 | 54 | 2 | 456 | 58 | 117 | 101 | 44 | 4 | **999** |
| 100 KVA | 575 | 2569 | 1527 | 543 | 2181 | 1415 | 800 | 1494 | 824 | 220 | **12148** |
| 200 KVA | 231 | 521 | 327 | 98 | 459 | 738 | 227 | 631 | 201 | 83 | **3516** |
| 250 KVA | | | 1 | | | | | | | | **1** |
| 315 KVA | 512 | 1636 | 950 | 106 | 980 | 1443 | 516 | 2294 | 294 | 44 | **8775** |
| 500 KVA | 998 | 899 | 318 | 343 | 624 | 2417 | 539 | 809 | 256 | 327 | **7530** |
| 630 KVA | 1 | 1 | | 4 | | | | | | | **6** |
| 750 KVA | 2 | | | | | | | | | | **2** |
| 800 KVA | 3 | 1 | | | 1 | | | | | | **5** |
| 1000 KVA | 7577 | 1735 | 811 | 433 | 681 | 2216 | 840 | 1825 | 631 | 215 | **16964** |
| 1250 KVA | 17 | 1 | | 4 | | 4 | | | | | **26** |
| 1500 KVA | 18 | | | 1 | 2 | | | 22 | | | **43** |
| 1600 KVA | 218 | 10 | 1 | 1 | | 5 | 1 | 13 | | | **249** |
| 1750 KVA | 1 | | | | | | | | | | **1** |
| 2000 KVA | 1960 | 80 | 4 | 67 | 23 | 181 | 125 | 195 | 1 | 1 | **2637** |
| 2500 KVA | 35 | | | 3 | | | | 6 | 3 | | **47** |
| **NEDC Total** | **12167** | **7639** | **3993** | **1607** | **5427** | **8482** | **3169** | **7390** | **2254** | **894** | **53022** |

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 has put in place and is actively tracking the code of practice and the policy 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 |

| Voltage Level (kV) | Equipment | Size/Type |
|---|---|---|
| | | 3 MVA |
| | | 1 MVA |
| | Switchgear | SF6 GIS |
| | | AIS |
| 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 |
| | | 25 kVA |
| | Switchgear | Oil RMU |
| | | SF6 RMU |
| 0.415 | Over Headline XLPE Covered Aluminium Conductor | 120 Sq.mm |
| | | 70 Sq.mm |
| | Under Ground XLPE Insulated Copper Cable | 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=dfb78b59fc294e3082ed3c213ee360e4[7]

[7] The Username and password to be provided upon request.

## 3. PLANNING DRIVERS

### 3.1. Background

NEDC's electricity distribution system serves around 1,374,985 customers as per end of September 2025 cover Muscat, Al Batinah South, Ad Dakhiliyah, Ash Sharqiyah North, Ash Sharqiyah South, Al Wusta, Al Batinah North, Musandam, Al Buraymi and Ad 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 2025 maximum demand recorded for NEDC MIS system as per OETC LDC was 7179.0 MW[8] (on Thursday – 23rd June 2025 at 15:16 Hrs) and Musandam Area was 104.5 MW[9] on Sunday 28th May 2025 at 14:44. For Al Wusta Area the Non-coincident peak was 125.47 MW[10].

As of 2025 peak period, the total existing number of 132/33kV grid substations is 108, 33/11.5kV primary substations connected to the NEDC distribution system is 692 with a Total Firm Capacity of 11,675.5 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.

### 3.2. Muscat Governorate

Muscat Governorate comprises the wilayats of Muscat, Muttrah, Amerat, Quriyat, Bousher, and Seeb, collectively serving approximately 473,728 customers, which represents around 34.5% of NEDC's total customer base. The governorate is supported by a robust electricity infrastructure consisting of 39 grid stations and 187 primary substations operating at 132/33 kV and 33/11 kV voltage levels, respectively.

While Wilayat Muscat is largely saturated, the Yitti area remains an exception due to the ongoing Yitti Tourism Development. To accommodate future demand, two new primary substations (PSSs) are planned—one nearing energization and the other in the design phase to support the upcoming Aida Project. Wilayat Muttrah has

[8] MIS Transmission peak excluding of transmission technical losses and Grid Stations auxiliary load
[9] Including 8.3 MW of isolated Madha load

[10] Al Wusta Load: 73.5 MW connected to MIS and 52.0 MW supplied through isolated D.G. systems.

shown minimal growth over the past two years, with one potential bulk load development currently under planning.

Amerat has recorded the highest demand growth in Muscat over the past five years, indicating continued expansion during the current planning period. Quriyat is expected to experience a moderate average load growth of 2.6% over the next three years, with no major projects currently underway except the Automation Project between Quriyat PSS and Shahbari PSS.

In Wilayat Bousher, Al Khuwair Downtown and the Bousher Heights Smart City ( Al Thuraya City ) stands out as a key development, although the area's overall growth remains modest at around 2.1%.

Wilayat Seeb continues to see steady growth, particularly in the Mabelah area—one of the largest residential and commercial zones—further driven by the Sultan Haitham City development. A new PSS for Mabela Phase 10 is also in the planning stage.

### 3.3. Al Batinah South Governorate

The South Batinah Governorate, comprising the wilayats of Barka, Musanah, Nakhal, Rustaq, Wadi Mawel, and Awabi, is served by a robust electricity distribution infrastructure managed by NEDC. As of the current planning period, the governorate accommodates 209,245 customers through 10 grid stations operating at 132/33 kV and 220/33 kV, and 82 primary substations at 33/11 kV voltage levels. Among these areas, Barka stands out with the highest growth rate, prompting the Ministry of Housing and Urban Planning to initiate two major Surooh projects.

The first, located in Nakhal's Hay Luban, includes 1,050 residential units, while the second in Rustaq's Hay Al Azm comprises 422 units along with a mosque and commercial facilities. To support these developments, a new primary substation is proposed for Hay Luban, and a new 11 kV feeder is planned for Hay Al Azm, ensuring adequate capacity and reliable service for the expanding communities. shows all existing primary substations with their installed and firm capacity within South Al Batinah Governorate.

### 3.4. Ad Dakhiliyah Governorate

Ad Dakhiliyah Governorate, which includes the wilayats of Sumail, Izki, Nizwa, Bahla, BidBid, Manah, Hamra, Jabal Akhader, and Adam, is served by a comprehensive electricity distribution network managed by NEDC. The governorate supports 160,061 customers through 11 grid stations operating at 132/33 kV and 220/33 kV, and 91 primary substations at 33/11 kV voltage levels.

Similar to South Batinah, Ad Dakhiliyah is witnessing significant urban development through the national Surooh initiative led by the Ministry of Housing and Urban Planning. Notable projects include Al Muzn in Samail with 194 residential units, Al Namaa in Izki with 182 units, Sama in Bahla with 172 units, and Husn Al Zain in BidBid featuring 639 high-quality units with integrated facilities such as mosques, commercial areas, and green spaces.

Additionally, Al Noor in Nizwa offers 662 residential units across 674,000 square meters, designed to provide a modern and sustainable living environment. These developments reflect the growing demand and strategic planning efforts to enhance infrastructure and service delivery across the governorate, aligning with Oman Vision 2040 goals. According, upgrading Saih Maydin from 2x20 MVA to 3x20 MVA proposed to cover the new load of Husn Al Zain and the supply to the rest of Surooh project will be propose according to submitted load for each project.

### 3.5. Ash Sharqiyah North Governorate

Ash Sharqiyah North Governorate includes Mudhaibi, Ibra, Dima Wa Taiyyin, Wadi Bani Khalid, Qabil and Bidiyah, is supported by a growing electricity distribution infrastructure managed by NEDC. As of the current planning horizon, the governorate serves over 95,062 customers through 6 Grid Station (132/33 & 220/33 kV), and 49 primary substations (33/11 kV) are feeding the governorate.

The national Surooh initiative, two major residential developments are underway. The Hay Al Sumu in Al Mudhaibi spans 275,000 square meters and includes 183 units, a mosque, and a commercial mall offering retail and entertainment services. Meanwhile, the Hay Al Ula in Bidiyah covers 110,839 square meters and comprises 99 residential units, a mosque, commercial areas, and green spaces. Additionally, the Al Mudhaibi Industrial City with spans 14 million square meters and Al Nama Hospital.

These projects are expected to drive demand growth in the region. Accordingly, NEDC is evaluating the need for new primary substations and 11kV feeders to support these developments and ensure reliable service delivery. Upgrading Saih Nama PSS from 2x20 MVA to 3x20 MVA have started in design stage to accommodate the load of Al Nama Hospital and Hay Al Sumu in Al Mudhaibi.

### 3.6. Ash Sharqiyah South Governorate

Ash Sharqiyah South Governorate includes Sur, Jalan Bani Bu Hassan, Kamil wa Wafi, Masirah, and Jalan Bani Bu Ali. The number of customers served in the region is 96,641. The governorate is currently fed by 5 grid stations (132/33 & 220/33 kV) and 49 primary substations (33/11 kV). In alignment with Oman Vision 2040 and national development initiatives, several new projects are expected to drive significant electricity demand growth. Among these is the Nismat Zain Neighbourhood in Sur, a mixed-use residential development covering 268,339 square meters with 407 housing units, a mosque, and commercial facilities.

Additionally, infrastructure upgrades such as the 149.2 km internal road network connecting key wilayats and the mountain road enhancements in Sur will support urban expansion. Tourism and recreational developments like the Al Ashkhara Waterfront, Falaj Al Mashaikh Park, and Al Suwaih Park in Jalan Bani Bu Ali are designed to attract visitors and stimulate local economies. The Al Shamkhiya Multipurpose Centre in Masirah and the lighting of the coastal road from Ras Al Hadd to Al Ashkhara further contribute to regional growth.

### 3.7. AL Wusta Governorate and Surrounding Areas.

The Al Wusta Governorate and its surrounding rural areas in Al Dhahirah and South Sharqiyah are supplied by multiple power sources, including PDO, diesel power plants, and Marafiq facilities. These networks remain geographically dispersed and operate with limited or no interconnection between them, resulting in isolated electrical systems separated by long distances. The total number of customer services across these areas is approximately 19,708.

Within Al Wusta and the rural extensions of Al Dhahirah, the existing primary substations (PSS) are distributed as follows:

- Al Duqum: 19 PSS
- Haima: 4 PSS
- Masirah: 4 PSS
- Mahout: 7 PSS
- Kuwimah: 1 PSS
- Al Jazir: 2 PSS
- Al Dhahirah (rural areas): 5 PSS
- PDO Connections: 22 connections (varying between 33 kV and 11 kV tapping connections).

However, NEDC is currently planning to reconnect several diesel-generated areas to the Main Interconnected System (MIS), with completion targeted by summer 2028. In parallel, NEDC is studying the possibility of transferring selected PDO customers to its network to further enhance supply reliability and achieve system integration across the region.

### 3.8. Al Buraimi Governorate

Al Buraimi Governorate includes Wilayat Al Buraimi, Mahadah and Sunaynah. The number of customers served in Al Buraimi Governorate region is 43,231 which is approximately 3.1% of the total customer population within NEDC. There are 5 Grid Station (132/33 kV), and 28 primary substations (33/11 kV) are feeding the governorate.

### 3.9. Ad Dhahirah Governorate

Ad Dhahirah Governorate includes Wilayat Ibri, Dank and Yanqul. The number of customers served in Ad Dhahirah Governorate region is 72,956 which is approximately 5.3% of the total customer population within NEDC. There are 7 Grid Stations (132/33 & 220/33 kV), and 40 primary substations (33/11 kV) are feeding the governorate.

### 3.10. Al Batinah North Governorate

Al Batinah North Governorate includes Wilayat Shinas, Liwa, Sohar, Saham, Al Khabourah and AL Suawiq. The number of customers served in Al Batinah North Governorate region is 186,583 which is approximately 13.6% of the total customer population within NEDC There are 18 Grid Station (132/33 & 220/33 kV), and 110 primary substations (33/11 kV) are feeding the governorate.

### 3.11. Musandam Governorate

Musandam Governorate includes Wilayat Khasab, Madha, Dibba and Bakha. The number of customers served in Musandam Governorate region is 17,769 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.

# 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.

During 2025, the total Firm capacity for all governorates is circa 11,675.5 MVA, where the maximum load (non-coincident) is around 8,413.2 MVA which is 72% utilization of the firm Capacity. The below table and figure present these data.

Table 9: Summery of Firm Capacity and Max Load per Governorate

| Governorate Name (2024) | Max Load (MVA) | Firm Capacity (MVA) | Utilization % |
|---|---|---|---|
| **Muscat** | 3162 | 4319.5 | 73% |
| **Al Buraimi** | 228.2 | 312 | 73% |
| **Ad Dhahirah** | 390.7 | 515 | 76% |
| **Al Batinah North** | 1498.3 | 1974 | 76% |
| **Musandam** | 96.7 | 205 | 47% |
| **Ad Dakhiliyah** | 924.1 | 1351 | 68% |
| **Al Batinah South** | 940.7 | 1254 | 75% |
| **Ash Sharqiyah North** | 480.3 | 580 | 83% |
| **Ash Sharqiyah South** | 504.9 | 682 | 74% |
| **AL Wusta** | 187.3 | 483 | 39% |
| **Total** | **8413.2** | **11,675.5** | **72%** |

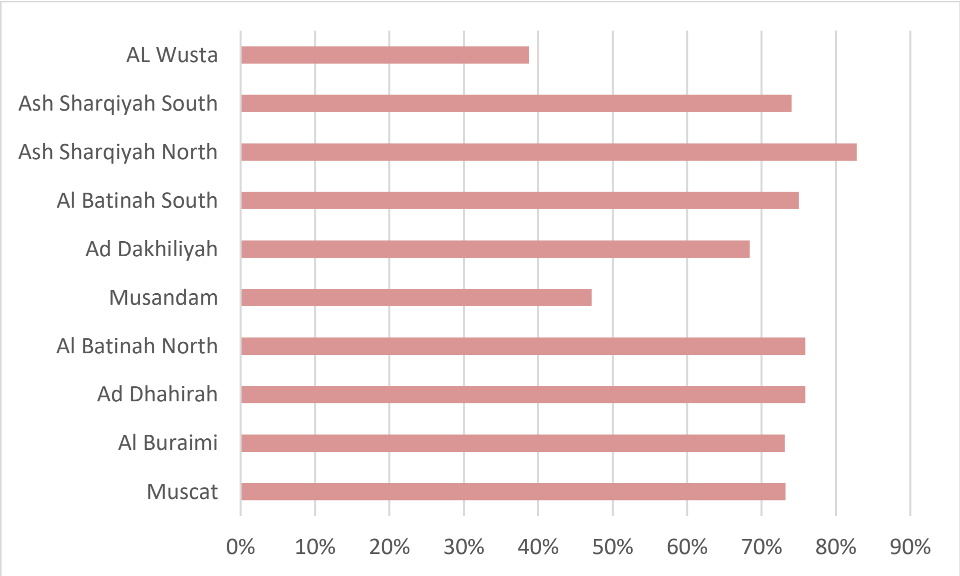


Figure 2: Utilization % from Firm Capacity per Governorate

System maximum demand is occurring generally during summer period; although there seems to be no exact corelation 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 2025, and future are:

- Temperature and Humidity.
- Customer numbers and types of customer's 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 [2018-2025]; 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

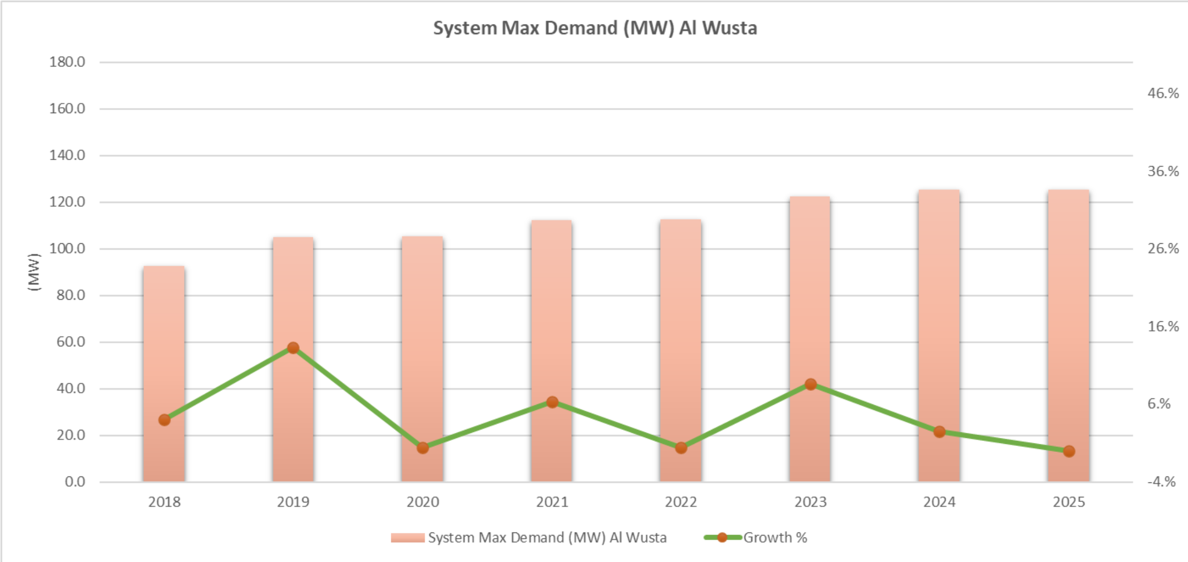


Figure 4: System Max Demand (MW) Al Wusta

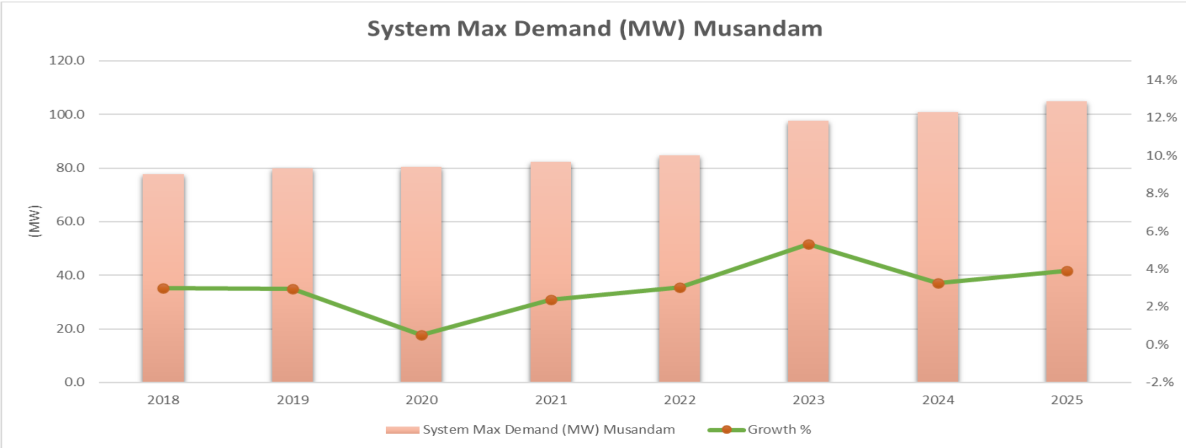


Figure 5: System Max Demand (MW) Musandam

The Maximum and Minimum Demand for the NEDC distribution systems in 2025 is illustrated in Figure 6 and Figure 7 below. This shows that the 2025 minimum demand is circa 34.8% of the 2025 maximum demand for the MIS NEDC system.

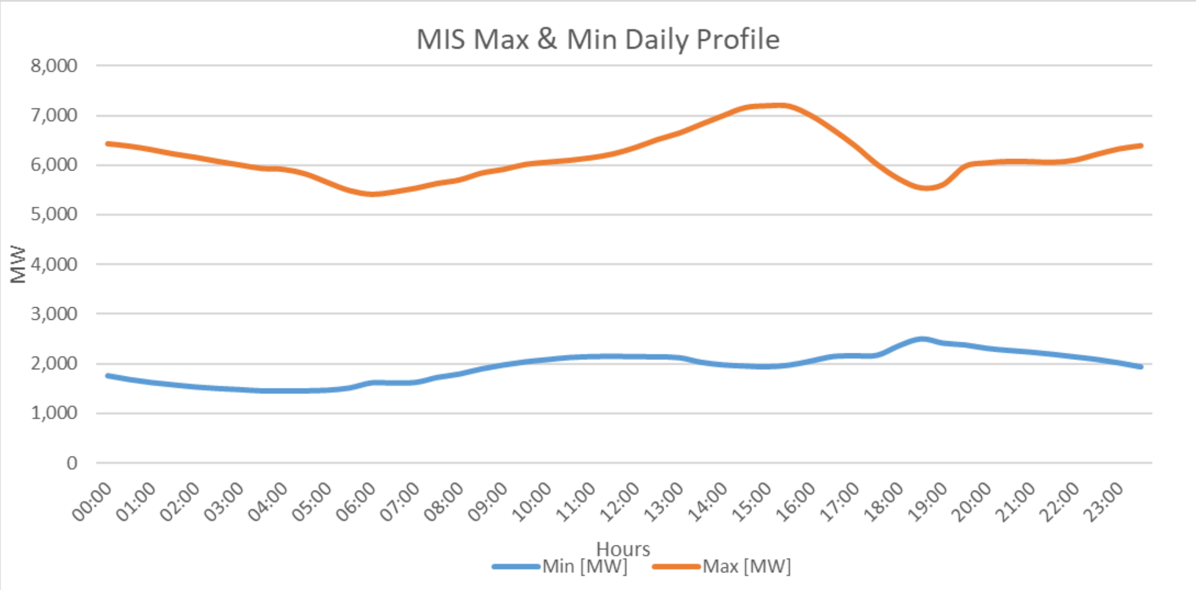


**Figure 6 : Hourly Demand – MIS System Maximum and Minimum Day Profile**

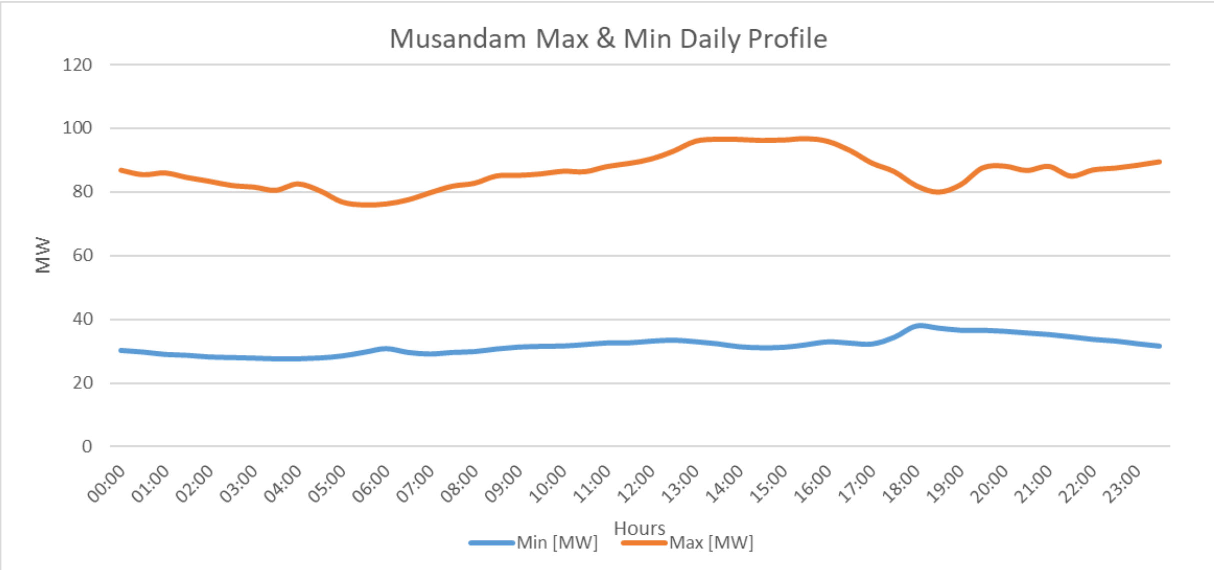


**Figure 7 : Hourly Demand – Musandam System Maximum and Minimum Day Profile**

The Maximum load profiles for NEDC taken on Monday, 23rd June 2025, the day of NEDC Peak, were plotted and presented in Figure 6. The highest load was reached at 15:16 hours; on this day, the load recorded was 7,179 MW.

### 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 2025 cycle hasn't been completed yet, an impact analysis was undertaken on 2024 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 2025 was 17,370, circa 1.3% of the total connected customers. Figure 8 below shows some of high consumption customers load profiles during peak day and the direct effect of CRT tariff during 2025 peak hours.

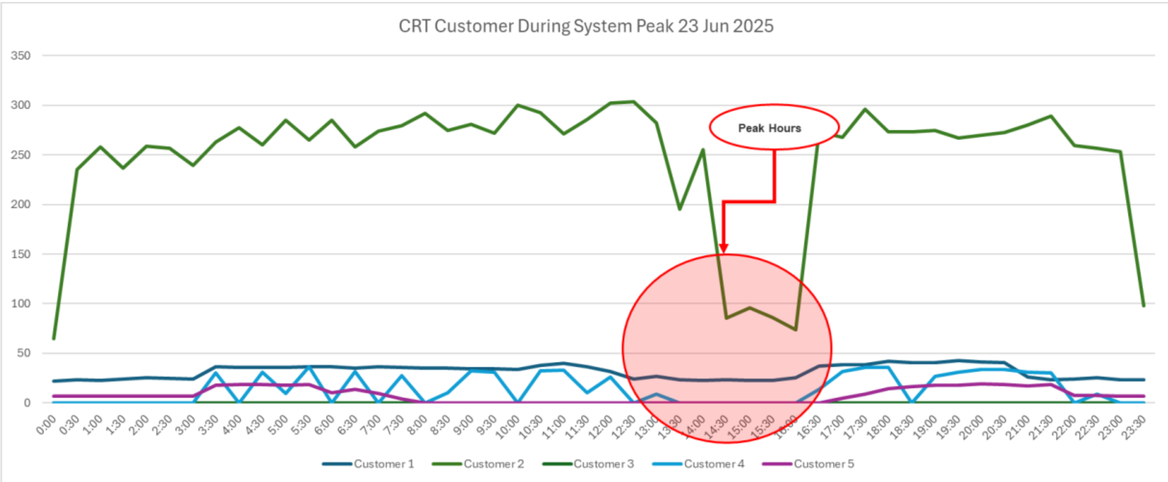


Figure 8: CRT Customer During System Peak 23 Jun 2025

### 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. The audited 2024 DNS is 432.9 MVA[11] which is a circa 0.27 % higher compared to 2023 DNS value of 431.7 MVA.

NEDC distribution system is mixed of urban dense interconnected network and rural areas. Therefore, for urban areas the 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. However, for the

[11] Audited figure waiting APSR approval.

rural area feeders the automation and fast isolation of faulty section will play an important role in optimizing the operation of the 11kV network.

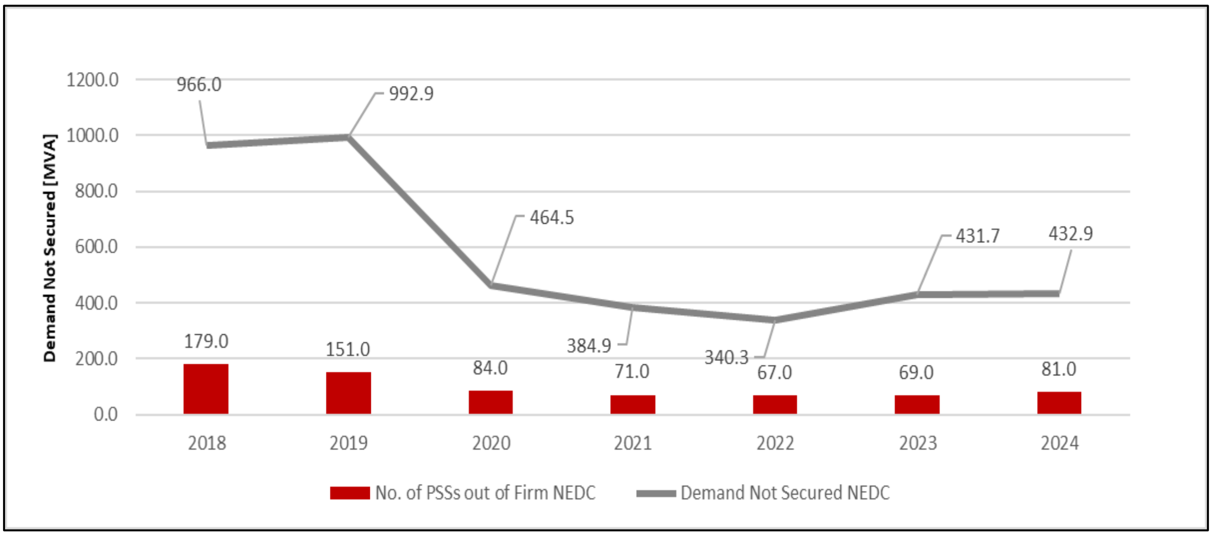


**Figure 9 : History of NEDC Demand Not Secured and Out of Firm PSS**

### 4.5. 11kV Feeder Loadings

As detailed in the Appendix B-5, 41 number 11kV feeders were observed in 2025 which exceeded the derated thermal loading limit under normal operational configuration; these will be solved by appropriate 11kV load transfers, projects schemes in 2026 and 2027 itself shown in Table 10 below. The maximum loadings of all the 11kV feeders are attached in Appendix B-5

**Table 10: 11kV Highly Loaded feeder Plan**

| PSS Name | Plant Code | Feeder Code | Feeder Rated Capacity [Amp] | Feeder De-rated Capacity [Amp] | Actual Load 2025 [Amp] | Plan |
|---|---|---|---|---|---|---|
| **North Al Sharqiyah** | | | | | | |
| **Sinaw Grid** | | | | | | |
| Sinaw 2 | SINAWP02B | 25L5 | 400 | 350 | 383 | New investment to share load with surrounding primary substations |
| **Muscat** | | | | | | |
| **Quriyat [G05] Grid** | | | | | | |
| Al Shahbari | P092 | KLN04 | 400 | 350 | 357 | Share the load with surrounding primary substations |
| **Amerat[G10] - A Grid** | | | | | | |
| Amerat 3 | P179 | KLN04 | 400 | 350 | 367 | New investment to share load with surrounding primary substations |
| Amerat 3 | P179 | KLN11 | 400 | 350 | 363 | New investment to share load with surrounding primary substations |
| Amerat 3 | P179 | KLN15 | 400 | 350 | 379 | New investment to share load with surrounding primary substations |
| **Amerat[G10] - B Grid** | | | | | | |
| Madinat Al Nahdah | P065 | KLN02 | 400 | 350 | 358 | Transfer load with surrounding primary substations |

| PSS Name | Plant Code | Feeder Code | Feeder Rated Capacity [Amp] | Feeder De-rated Capacity [Amp] | Actual Load 2025 [Amp] | Plan |
|---|---|---|---|---|---|---|
| Amerat Amerat [Amerat 4] | P180 | KLN07 | 400 | 350 | 385 | New investment to share load with surrounding primary substations |
| **Ghubrah 2[G09] Grid** | | | | | | |
| Azaibah North 2 | P012 | KLN07 | 400 | 350 | 353 | New investment to share load with surrounding primary substations |
| Azaibah North 1 | P011 | KLN09 | 400 | 350 | 354 | |
| **Bousher[GP02] - B Grid** | | | | | | |
| Bousher 2 | P163 | KLN08 | 400 | 350 | 386 | Transfer load with surrounding primary substations |
| Bousher 2 | P163 | KLN12 | 400 | 350 | 351 | Transfer load internally |
| Al Muna | P084 | KLN06 | 400 | 350 | 351 | Transfer load with surrounding primary substations |
| Tilal Al Khuwair | P055 | KLN20 | 400 | 350 | 381 | Transfer load with surrounding primary substations |
| **Ghala[G11] - B Grid** | | | | | | |
| Ghala 2 | P156 | KLN02 | 400 | 350 | 363 | Transfer load with surrounding primary substations |
| **Rusail Industry[G13]-B Grid** | | | | | | |
| Rusail08(KOM) | P164 | KLN02 | 400 | 350 | 388 | Transfer load internally |
| **Misfah[G04] Grid** | | | | | | |
| Al Misfah | P080 | KLN09 | 400 | 350 | 363 | New PSS in the area to share load with Al Misfah & Al Awabi PSSs 11 kV feeders |
| Al Awabi | P139 | KLN12 | 400 | 350 | 362 | |
| **Mabelah[GP04] Grid** | | | | | | |
| Mabelah Grid | GP04 | KLN06 | 400 | 350 | 373 | New investment to share load with surrounding primary substations |
| Sur Al Hadid | P116 | KLN04 | 400 | 350 | 352 | New investment to share load internally |
| Botanic Garden | P016 | KLN02 | 400 | 350 | 372 | New investment to share load with surrounding primary substations |
| **Mabelah[GP04] Grid** | | | | | | |
| Mabelah C | P064 | KLN12 | 400 | 350 | 350 | New investment to share load internally |
| Mabelah South PH-4 | P062 | KLN04 | 400 | 350 | 400 | New investment to share load with surrounding primary substations |
| Palm Mall | P168 | KLN11 | 400 | 350 | 370 | New investment to share load with surrounding primary substations |
| **Mabella 2[G12] - B Grid** | | | | | | |
| Mabelah Shabiya | P060 | KLN15 | 400 | 350 | 403 | Transfer load internally |
| Seeb Mabelah South [PH-6] | P185 | KLN06 | 400 | 350 | 372 | New investment to share load internally |
| Seeb Mabelah South | P061 | KLN06 | 400 | 350 | 387 | New investment to share load internally |

| PSS Name | Plant Code | Feeder Code | Feeder Rated Capacity [Amp] | Feeder De-rated Capacity [Amp] | Actual Load 2025 [Amp] | Plan |
|---|---|---|---|---|---|---|
| **Mabelah Industrial[G26] - A Grid** | | | | | | |
| Mabelah South PH-8 | P157 | KLN01 | 400 | 350 | 395 | Transfer load internally |
| Mabelah South PH-7 | P141 | KLN02 | 400 | 350 | 374 | New investment to share load internally |
| Mabelah South PH-7 | P141 | KLN04 | 400 | 350 | 403 | New investment to share load with surrounding primary substations |
| Mabelah South PH-7 | P141 | KLN05 | 400 | 350 | 369 | New investment to share load with surrounding primary substations |
| Mabelah South PH-7 | P141 | KLN13 | 400 | 350 | 370 | New investment to share load internally |
| **Seeb [GP08] - A Grid** | | | | | | |
| Al Khoud Shabiya | P046 | KLN07 | 400 | 350 | 373 | New investment to share load internally |
| **Seeb [GP08] - B Grid** | | | | | | |
| Sultan School | P029 | KLN04 | 400 | 350 | 354 | New investment to share load with surrounding primary substations |
| **Mawaleh South [GP05] - A Grid** | | | | | | |
| Mawaleh South Grid | GP05 | KLN01 | 400 | 350 | 374 | New investment to share load with surrounding primary substations |
| Mawaleh C | P072 | KLN01 | 400 | 350 | 357 | New investment to share load internally |
| **Mawaleh South [GP05] - B Grid** | | | | | | |
| Mawaleh B | P071 | KLN04 | 400 | 350 | 372 | New investment to share load internally |
| Al Khoud PH-6 | P049 | KLN02 | 400 | 350 | 360 | Load transfer between feeders |
| **Al Khoudh[G25]- A Grid** | | | | | | |
| Mawaleh A | P070 | KLN08 | 400 | 350 | 372 | New investment to share load internally |
| **Al Khoudh[G25]- B Grid** | | | | | | |
| Al Khoud PH-7 | P154 | KLN01 | 400 | 350 | 402 | New investment to share load internally |
| Al Khoud PH-7 | P154 | KLN02 | 400 | 350 | 397 | New investment to share load internally |
| Al Khoud PH-7 | P154 | KLN03 | 400 | 350 | 360 | New investment to share load with surrounding primary substations |

### 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 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 connected demand 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 forecasted 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; 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. Table 11 shows the actual and forecasted NEDC expected peak demand including 33kV and 11kV bulky customers future connections. Although 2026 and 2027 show higher expected load growth rates of 6.3% and 5.4% respectively, this increase is primarily driven by the large number of 33 kV connection applications, particularly in major industrial zones such as Sohar Free Zone, Sohar Industrial Port, and Al Duqm Port.

For 2028, the demand growth is forecasted to moderate to 3.2%. This reflects the fact that no official applications have yet been confirmed for that year. Considering the typical time required to process and energize bulk customer connections is approximately two years, the growth forecast for 2028 will be revisited and adjusted in the next load forecast update for the upcoming capability statement once new official applications are received.

**Table 11 : NEDC Non-Coincidence Forecast with Growth**

| Year | 2025 | 2026 | 2027 | 2028 |
|---|---|---|---|---|
| Total NEDC Connected to MIS (MW) | 7,179.0 | 7,629.4 | 8,098.3 | 8,353.9 |
| Al Wusta D.G (MW) | 52 | 54 | 0 | 0 |
| Musandam (MW) | 96.5 | 103.6 | 106.8 | 112.7 |
| Madha (MW) | 8.3 | 8.6 | 9.0 | 9.3 |
| NEDC Total (MW) | 7,335.8 | 7,795.6 | 8,214.1 | 8,475.9 |
| Yearly Growth % | 2.8% | 6.3% | 5.4% | 3.2% |

Figure 10 shows the historical trend in NEDC system maximum demand with the forecast maximum demand over the period 2026 to 2028. 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.

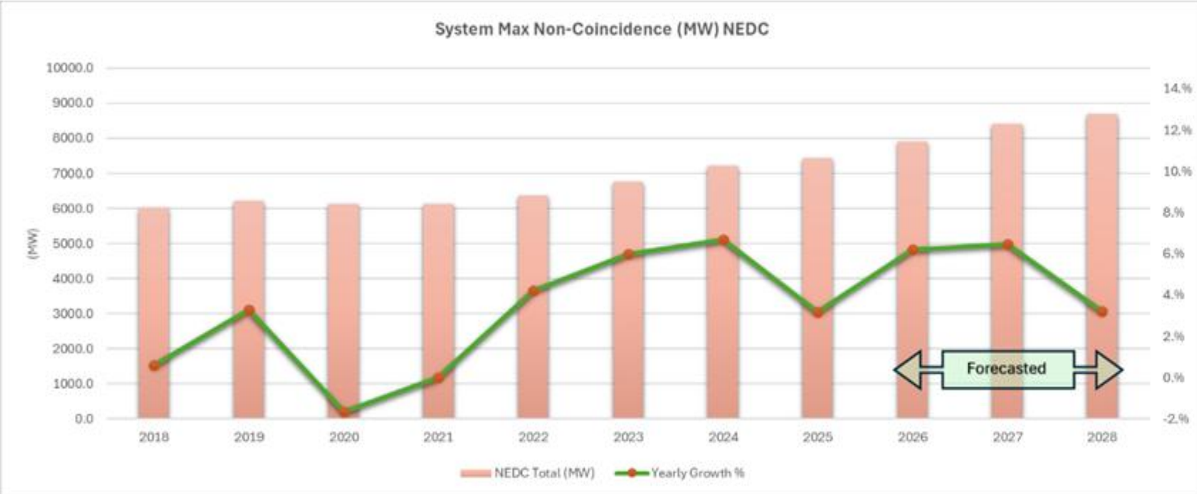


**Figure 10 : Historical Trend in NEDC System Maximum Demand with Three Years Forecast**

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 [2018-2028]; NEDC demand growth expected to continue growing with average rate of 4.97% for the next three coming years. 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 92% 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 2025 summer, recorder peak load of Madah substation was around 8.3 MW and it is forecasted to remain almost the same for the period of 2026 to 2028 as there is no expectation for new major development in Madha. Overall Musandam load growth expected to grow within the limit of 5 % as seen in Figure 11 below.

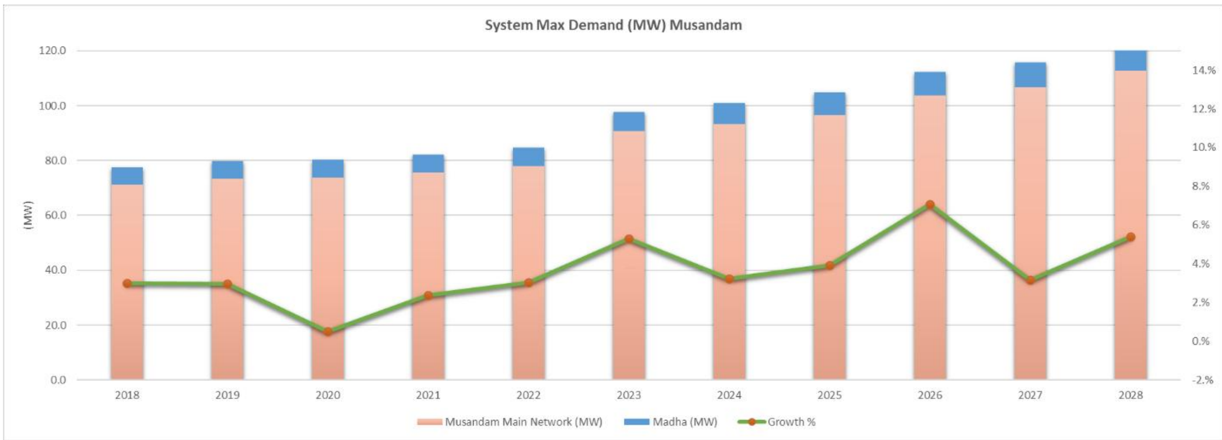


**Figure 11 : Musandam 2018-2027 Peak Load with Growth percentage**

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 9 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 12 below displays the NEDC plan and the target date for the interconnection with MIS.

**Table 12: Al Wusta Diesel Plants**

| Power Plant | Target Date |
|---|---|
| Masirah | Q4,2026 |
| Al-Khuwaima | Q4,2026 |
| Khalouf | Q2,2026 |
| Najdah | Q4,2026 |
| Sarab | Q4,2026 |
| Masrooq | Q4,2026 |
| Khadra | Q4,2026 |
| Hitam | Q4,2026 |
| Wadi Aswad (Nuhaidah & Hamara AL Droua areas) | Q4,2026 |

In 2025, The peak load in the Al Wusta Governorate and its surrounding areas has reached 125.47 MW, Al Wusta system maximum demand continues rising with average growth of 3% for the next three years. Despite the high growth increase in 2027 which can be referring to the new bulk load that intended to be connected in AL Duqm (22MW of Cement factory and 19 MW of New Future Technology) as seen in Figure 12 below.

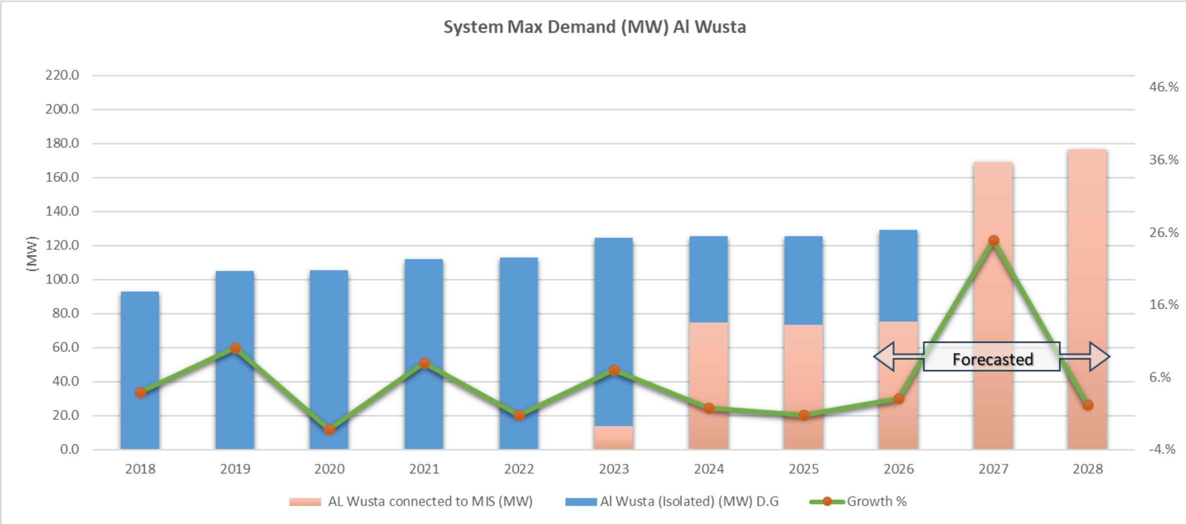


**Figure 12 : Al Wusta 2018-2028 Peak Load with Growth percentage**

## 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 2025 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 (2026-2028) 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 (2025) and future 3 years (2026-2028) 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-3.
- 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-1 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 27 primary substations are facing voltage issue in 2025 with 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 except 3 PSS. By 2028, the number of primary substations experiencing voltage drops at the 33kV busbars is expected to increase to 30, primarily due to higher load demand and network expansion. 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 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 2025 Capability Statement which covers up the transmission system developments up to 2028.

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" position[12].
- 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)[13].
- All existing 2x20 MVA PSSs and 3x20 MVA PSSs are simulated for operation of 33kV bus-section circuit breakers within the PSSs (wherever present)[14] 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 new and upgraded primary substations are designed to 18.4 kA or higher based on short circuit requirement to comply with system requirements.

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[12] 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).

[13] 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.

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

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 has 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:

- Mudhairib Grid (24.04kA in 2025 and 25.72 kA in 2028)
- MSQ Grid-GP06 (24.99kA in 2025 and 26.23kA in 2028) (99.9% of 25 kA rating))
- Rusail Industry[G13]-A GSS- 1-P103 (24.00kA in 2025 and 24.24kA in 2028) (95.9% of 25 kA rating))
- Rusail Industry[G13]-B GSS-P106 (24.19kA in 2025 and 24.60kA in 2028) (96.7% of 25 kA rating))
- Sur IWP2 (24.46kA in 2025 and 24.92kA in 2028) (97.8% of 25 kA rating))

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

- Rusail Ind 4-P158 (26.18kA in 2025) (104% of 25 kA rating))
- Nizwa Grid (29.84 kA in 2025 and 29.28 kA in 2028 (119% of 25 kA rating))
- Sur Grid (26.45 kA from 2025 and 27 KA by 2028 (105% of 25 kA rating))
- Rustaq Grid- (30.33 kA in 2025, 121% of 25 KA rating and 30.81 kA by 2028)
- Sur Grid (26.45 kA in 2025 to 2027 and 27 kA in 2028)
- Mawaleh South Grid-F1-GP05 (25.67 kA in 2025 & 2026 and 25.3kA in 2028)
- Sur IWP (25.08 kA in from 2025 and 25.68 kA in 2028)

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.

#### 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 2025 distribution system operation is calculated to be 5.16%. The breakdown of technical losses by voltage level is shown in Table 13 below.

**Table 13 : Technical Losses**

| System Component | Zone 1 | Zone 2 | Zone 3, Musandam & Al Wasta | % Total |
|---|---|---|---|---|
| 33 KV OHL, UGC & PT Losses | 0.64% | 1.39% | 1.24% | 1.06% |
| 11 KV OHL & UGC Losses | 0.64% | 1.33% | 1.22% | 1.03% |
| 11/ 0.415kV Distribution Tx Losses | 1.71% | 1.99% | 1.62% | 1.79% |
| LT OHL & UGC Losses | 1.31% | 1.64% | 0.69% | 1.28% |
| Total | 4.31% | 6.35% | 4.78% | 5.16% |

# 5. CHALLENGES AND OPPORTUNITIES WITHIN THE SYSTEM

## 5.1. Meeting Oman's Net-Zero 2050

Meeting Oman's Net-Zero 2050 by 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 and Oman's Net-Zero 2050 Objective. To achieve the above and other sustainable goals of the Sultanate National Energy Strategy for 2040 recommended that around 30% of Oman's generation mix expected to come from renewable energy sources (RES)—primarily onshore wind and Solar PV—by 2030.

NEDC recognises that the utilization of 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 seen as indication uptake in electric vehicle charging thus, the associated demand characteristics for electric vehicles (EV) are considered to be a contributing factor to our system planning in the mid-term planning horizon. However, this will be closely monitored to check the penetration rate of EV charges 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 2024 is Solar PV. Authority for Public Services Regulation (APSR) continues in revising the existing regulatory framework to facilitate the adoption of small-scale grid connected solar PV systems by customers in Oman. The current PV guidelines detail which has been published in 2017 contains of but not limited 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.

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 systems may have the impact of reducing transmission and distribution 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 is 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. NEDC continues to experience a surge in applications for connecting solar PV systems of various sizes. As of September 30, 2025, a total of 779 PV systems is connected to the NEDC grid, contributing a combined generation capacity of 71.64 MW / 83.45 MWp. Of these, 91 systems were newly energized in 2025, adding 7.03 MW / 8.24 MWp to the year-to-date total. Additionally, the total number of received applications as of September 2025 has reached 977, representing a total requested generation capacity of 114.86 MW / 133.42 MWp.

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

Table 14: 2024 PV connection Applications with total installed PV capacity

| Sr. | Category | No. of Connected Applications | | Connected Generation [MW AC] | | Connected Generation [MW DC] | | Total Applications | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | YTD 2025 | As End Sep, 2025 | YTD 2025 | As End Sep 2025 | YTD 2025 | As End Sep 2025 | No applications As End Sep, 2025 | Requested Generation as End Sep 2025 (MW AC) | Requested Generation as End Sep 2025 (MW DC) |
| 1 | Commercial | 17 | 152 | 2.14 | 44.85 | 2.62 | 52.56 | 225 | 76.51 | 89.6 |
| 2 | Government | 10 | 104 | 1.14 | 15.75 | 1.23 | 18.4 | 150 | 26.3 | 30.27 |
| 3 | Residential | 59 | 440 | 0.7 | 5.54 | 0.74 | 5.94 | 517 | 6.53 | 6.96 |
| 4 | Agricultural | 5 | 83 | 3.05 | 5.5 | 3.64 | 6.55 | 85 | 5.52 | 6.58 |
| Total | | 91 | 779 | 7.03 | 71.64 | 8.24 | 83.45 | 977 | 114.86 | 133.42 |

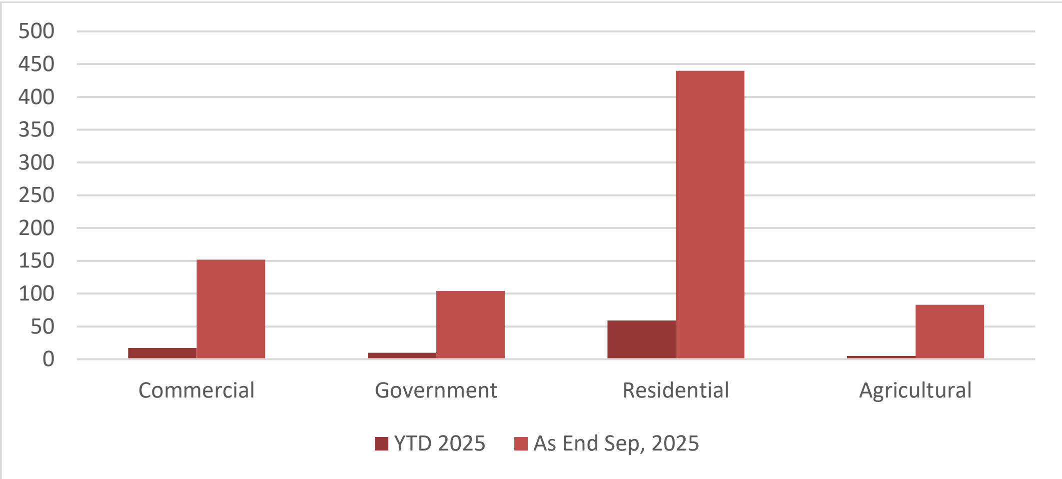


Figure 13: Number of PV Applications

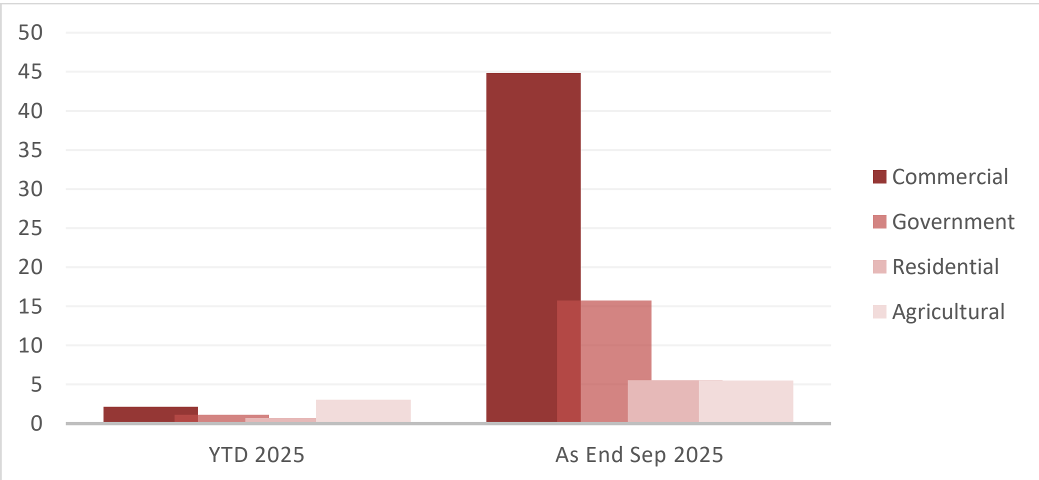


Figure 14: Connected Generation from PV [MW]

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 2025-2027 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 15 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 15: A summary of the 33 kV Expansion Plan

| Governorate | Planning Stage | Designing Stage | Tendering Stage | Execution stage | Commission Stage | Completed Stage |
|---|---|---|---|---|---|---|
| Muscat | 2 | 2 | 3 | 6 | 1 | 2 |
| Ad Dakhiliyah | 3 | 1 | 1 | 4 | 2 | 0 |
| Ash Sharqiyah South | 0 | 2 | 2 | 1 | 2 | 0 |
| Ash Sharqiyah North | 4 | 1 | 0 | 0 | 0 | 0 |
| Al Batinah South | 1 | 2 | 1 | 1 | 4 | 0 |
| Al Batinah North | 0 | 3 | 2 | 1 | 0 | 0 |
| Ad DHAHIRAH | 1 | 5 | 0 | 0 | 0 | 1 |
| AL Buraimi | 0 | 2 | 0 | 0 | 0 | 0 |
| Musandam | 0 | 1 | 0 | 1 | 0 | 0 |
| AL Wusta | 1 | 0 | 2 | 3 | 0 | 0 |
| NEDC | 12 | 19 | 11 | 17 | 9 | 3 |

Moreover, Table 16 show the summary of sponsored projects in the NEDC network per governorate in the different stages, the details are illustrated in Appendix D.

Table 16: A summary of the Sponsored Projects

| Governorate | Planning Stage | Designing Stage | Tendering Stage | Execution stage | Commission Stage |
|---|---|---|---|---|---|
| Muscat | 0 | 0 | 0 | 1 | 0 |
| Ad Dakhiliyah | 0 | 0 | 1 | 0 | 0 |
| Total | 0 | 0 | 1 | 1 | 0 |

### 6.2. Network Suitability for New Connections

Since January 2025 up to end of September NEDC connected 19,330 applications with worth of 939.85 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 0.05 MW.

Table 17: Summary of Connected Customer during 2025

| Type of Applicant | No. of Applications | Connected load [MW] |
|---|---|---|
| Simple connection | 19,314 | 855.79 |
| Complex Connection | 16 | 84.06 |
| Total | 19,330 | 939.85 |

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 previse 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 2025, 2026, and 2027 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 demand for each year from 2025 to 2028.

### 1. Primary Substations Maximum Demand and Percentage Loading

The maximum demand with real and reactive power loads at the PSS individual peak time in 2024 planning cycle and as accordingly forecasted for the period from 2026 to 2028. 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/PrimarySubstationMaxDemand-V1.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 2025 to 2028. 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/33kVFeedersLoading-V1.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/Bus-Voltages.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/ShortCircuitResults-V1.xlsx

## 5. 11kV Feeder Loads

Below web link drives to the actual maximum demand in (Amp) on 11kV circuits/feeders for 2025 tables:

https://mzgisportal.mzec.co.om/portal/apps/webappviewer/11kVFeedersPeakLoad-2025.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. | Project Name | Wilayat | Expected Completion Year | Project Status | Project Purpose |
|---|---|---|---|---|---|
| **Muscat** | | | | | |
| 1 | Upgrading Sarooj Shati Al Qurum (P110) PSS | Bousher | 2025 | Completed | To accommodate the load required from the expansion |
| 2 | Construction of 3X20MVA Ruwi Valley (P174) PSS. | Seeb | 2025 | Completed | Replacing of old Assets |
| 3 | Upgrading of Al Hail North 2 PSS (P028) | Seeb | 2026 | Commissioning | To accommodate the load required from the expansion |
| 4 | Automation Project between AL Shahbari PSS and Quriyat PSS | Quriyat | 2026 | Design | To accommodate the load and compliance with DSSS |
| 5 | Rusail Industrial 1 (P103) 2x20MVA PSS | Seeb | 2026 | Execution | Replacing of old Assets |
| 6 | Bousher Ansab Height[P202] PSS | Bousher | 2026 | Execution | To accommodate the load and compliance with DSSS |
| 7 | Construction of Sultan Haitam City PSS -6-8-9 | Seeb | 2026 | Execution | To accommodate the load and compliance with DSSS |
| 8 | Supply of 11kV Capacitor Banks at Various PSS's | Muscat | 2026 | Execution | To enhance Power Factor in PSS |
| 9 | Azaiba South - 1A PSS P014 Asset Replacement | Bousher | 2026 | Execution | Replacing of old Assets |
| 10 | Construction of new Building, replacing 33kV Switchgear and adding a new 33kV SF6 RMU at Muttrah Store (P085) PSS | Muttrah | 2026 | Execution | Replacing of old Assets |

| No. | Project Name | Wilayat | Expected Completion Year | Project Status | Project Purpose |
|---|---|---|---|---|---|
| 11 | Upgrading Yenket [P133] | Muscat | 2026 | Design | To accommodate the load required from tourism projects |
| 12 | Bousher Bousher Height[P206] PSS | Bousher | 2026 | Planning | To accommodate the load and compliance with DSSS |
| 13 | Mabelah South 10 PSS | Seeb | 2027 | Planning | To accommodate the load required from the expansion |
| 14 | Construction of new Building, replacing 33kV Switchgear and adding a new 33kV SF6 RMU at Quriyat PSS (P091) | Quriyat | 2027 | Tendering | Replacing of old Assets |
| 15 | Construction of Sultan Haitam City PSS - 4, 15,17 | Seeb | 2027 | Tendering | To accommodate the load required from the expansion |
| 16 | Construction of Seeb Misfa[P200] PSS | Seeb | 2027 | Tendering | To accommodate the load required from the expansion |
| 17 | Falaj P178 PSS - Replacement of Transformers | Muscat | 2028 | Execution | Replacing of old Assets |
| **AL Batinah South** | | | | | |
| 1 | Construction of 2x20MVA PSS (Shuaybah south) at Al Musanah | AL Musanaah | 2025 | Commissioning | To Comply with DSSS |
| 2 | Construction of 2X20MVA Khazaen | Barka | 2025 | Commissioning | To accommodate the load required from the expansion |
| 3 | Construction of 2X20MVA PSS (Al Wasit) with 33&11kV feeders at Nakhal in South Al Batinah Governorate | Nakhel | 2026 | Commissioning | To accommodate the load required from the expansion |

| No. | Project Name | Wilayat | Expected Completion Year | Project Status | Project Purpose |
|---|---|---|---|---|---|
| 4 | Rehabilitation of 33 KV and 11 KV Network at wadi areas in Rustaq | Rustaq | 2026 | Commissioning | Rehabilitation |
| 5 | Construction of 3X20MVA PSS Khazaen at Barka | Barka | 2026 | Execution | To accommodate the load required from the expansion |
| 6 | Construction of 33kV Feeders with FOC at Barka in South AL Batinah Governorate | Barka | 2027 | Tendering | To enhance network control and reliability |
| 7 | New 33KV Switchgear at old Barka GS | Barka | 2027 | Design | To accommodate the load required from the expansion |
| 8 | Limays 2x20 MVA PSS - Marji and Kahaf | Rustaq | 2028 | Design | To accommodate the load required from the expansion |
| 9 | Upgrading Halban PSS to 2x20 MVA | Barka | 2028 | Planning | To accommodate the load required from the expansion |
| **Ad Dakhilyah** | | | | | |
| 1 | Upgrading 33 kV SWG SS of Adam GS at Adam, Construction of Birkat Al Mouz & Sumail Industrial GS | Adam | 2025 | Commissioning | To accommodate the load required from the expansion |
| 2 | Construction of 33kV Feeders from Birkat Al Mouze GS at Nizwa | Nizwa | 2025 | Commissioning | To accommodate the load required from the expansion |
| 3 | Shifting of existing 33kv feeders from old switchgear room to new switchgear room in Adam grid station | Adam | 2026 | Execution | Rehabilitation of the assets |

| No. | Project Name | Wilayat | Expected Completion Year | Project Status | Project Purpose |
|---|---|---|---|---|---|
| 4 | Testing and Commissioning of Power & Control Cables Related to 33kV/11kV Transformer in Adam Grid Station | Adam | 2026 | Execution | Network Enhancement |
| 5 | Construction of 3X20MVA PSS Al Maimeer | Nizwa | 2026 | Execution | To accommodate the load and compliance with DSSS |
| 6 | Construction of 33kV Feeders in Fumail Industrial area in AL Dhakiliyah Governorate | Sumail | 2026 | Execution | To accommodate the load and compliance with DSSS |
| 7 | Upgrading of Zoubar PSS from 2x20 MVA to 3x20 MVA | Adam | 2028 | Planning | To accommodate the load required from the expansion |
| 8 | Upgrade Saih Maydin PSS FROM 2x20 MVA TO 3x20 MVA | Sumail | 2028 | Planning | To accommodate the load required from the expansion |
| 9 | Upgrade Khubar PSS to 2X20 MVA & Hassas 1 PSS TO 3X20 MVA | Sumail | 2028 | Planning | To accommodate the load required from the expansion |
| 10 | Bisya 2x6 MVA PSS | Bahla | 2028 | Design | To accommodate the load required from the expansion |
| 11 | Nizwa Town-2 3x20 MVA PSS | Nizwa | 2028 | Tendering | To accommodate the load required from the expansion |
| **Ash Sharqiyah North** | | | | | |
| 1 | Upgrading Of Khashbah From 3x6 MVA to 3x20 MVA | AL Mudhaibi | 2028 | Planning | To accommodate the load required from the expansion |
| 2 | Upgrade Quwayaah to 2 X 20 MVA PSS | Sinaw | 2028 | Planning | To accommodate the load required from the expansion |

| No. | Project Name | Wilayat | Expected Completion Year | Project Status | Project Purpose |
|---|---|---|---|---|---|
| 3 | Upgrade Wadi Nam PSS from 3 x 6 to 2 X 20 MVA | AL Qabel | 2028 | Planning | To accommodate the load required from the expansion |
| 4 | New 2x20 MVA PSS – Qarrat Al Jamal | AL Mudhaibi | 2028 | Planning | To accommodate the load required from the expansion |
| 5 | upgrade Saih Nama PSS to 3x20 MVA | AL Mudhaibi | 2028 | Design | To accommodate the load required from the expansion |
| **Ash Sharqiyah South** | | | | | |
| 1 | Rehabilitation of Al Filayj Primary substation with 1No 33kV Feeder at Sur in Al Sharqiyah South Governorate | Sur | 2025 | Commissioning | Rehabilitation |
| 2 | Construction of Al Ashkhrah 2x20 MVA PSS with 33 & 11KV feeders at JBBA at Al Sharqiyah South Governorate. | JBB Ali | 2026 | Commissioning | To accommodate the load and compliance with DSSS |
| 3 | Construction of 33kV Feeder from Jalan Bani Bu Hassan with 33/0.415V PMT/GMT to Thaim Village | JBB Hassan | 2026 | Execution | Electrification |
| 4 | New Al Falah Hospital PSS | JBB Ali | 2028 | Design | To accommodate the required load in the area and load of hospital |
| 5 | New PSS Seah A'salb South Al Sharqia - Seeq (2X20 MVA) | AL Kamil Wa AL Wafi | 2028 | Design | To accommodate the load required from the expansion |
| 6 | Tawi Aisha PSS and Al Kamil Water PSS | AL Kamil Wa AL Wafi | 2028 | Tendering | To accommodate the load required from the expansion |

| No. | Project Name | Wilayat | Expected Completion Year | Project Status | Project Purpose |
|---|---|---|---|---|---|
| 7 | New 3x20 MVA PSS in Qarha | JBB Ali | 2028 | Tendering | To accommodate the load required from the expansion |
| **AL Wusta** | | | | | |
| 1 | Construction Masirah Grid Station 2 X63 MVA | Masirah | 2026 | Execution | To Connect Masirah Island to MIS system |
| 2 | Construction of PSS Al Khuwaima | AL Khuwaimah | 2026 | Execution | Shutdown Khuwaima Power Plant and reduce the OPEX cost |
| 3 | Construction of khaloof PSS 2x3MVA | Mahout | 2026 | Execution | Shutdown Khloof Power Plant and reduce the OPEX cost |
| 4 | New three PSS 2x6 MVA in Hitam, Kehel and Lakbi | Al Jazer | 2026 | Design | Shutdown Hitam and AL Khadra Power Plant and reduce the OPEX cost |
| 5 | Interlinking of Al Najdah networks | Mahout | 2026 | Tendering | Shutdown Najdha Power Plant and reduce the OPEX cost |
| 6 | Construction Of New 2x6 MVA Sarab Primary Substation With 33&11kV Feeders at Al Wusta Governorate | Mahout | 2026 | Tendering | Shutdown Sarab Power Plant and reduce the OPEX cost |
| **AL Buraimi** | | | | | |
| 1 | Installing new 2x10MVAR 33KV capacitor banks in Wadi Saa Grid | Al Buraimi | 2026 | Execution | To enhance Power Factor in PSS |
| 2 | 11 kV Switchgear at Al Rayhani 01 | Al Buraimi | 2027 | Design | Rehabilitation Project |
| 3 | Building New 3X20 MVA PSS– Al Ghuraifah | Al Buraimi | 2028 | Planning | To accommodate the load required from the expansion |

| No. | Project Name | Wilayat | Expected Completion Year | Project Status | Project Purpose |
|---|---|---|---|---|---|
| **Ad Dhahirah** | | | | | |
| 1 | Constructing of a new Ibri Industrial PSS (2X6 MVA) | Ibri | 2025 | Completed | Energized |
| 2 | Relocate and Upgrade Safalat Fidah PSS from 2x6 MVA to 2x20 MVA | Yanqel | 2027 | Planning | Cover the new loads and secure PSS and 33kV network |
| 3 | New 33kV &11 KV feeder to Ibri Industrial PSS | Ibri | 2027 | Design | Providing secure supply to new Industrial Area |
| 4 | New PSS To Supply Al Safa Customers | Ibri | 2027 | Design | To Supply AL Safa Area customers and relieve load from Al Rayhani |
| 5 | Hugermat PSS & Maskan PSS | Ibri | 2027 | Design | To relieve load from Hugermat, Maqnyat Substations |
| 6 | Construction of Masrooq 2X10 MVA primary substation with 33kV feeders from new Latham 400/132kV Grid Station | Ibri | 2026 | Design | Shutdown Masrooq Power Plant and reduce the OPEX cost |
| 7 | Construction new Awaifiah (HAMRA AL DRO) Grid Station 2 X63 MVA to connect Hamra AL Dro, Nuhaidah, Awaifiah, Al Orf, Wadi Aswad and Zubra | Ibri | 2026 | Design | To Connect Hamra AL Dro Area to MIS |
| 8 | Relocate and Upgrade Al Swader to 3X20 MVA PSS | Yanqel | 2028 | Planning | To accommodate the load required from the expansion |
| 9 | Building New 2X6 MVA PSS– Al Waqbah 2 | Yanqel | 2028 | Planning | To accommodate the load required from the expansion |
| **AL Batinah North** | | | | | |

| No. | Project Name | Wilayat | Expected Completion Year | Project Status | Project Purpose |
|---|---|---|---|---|---|
| 1 | Conversion of 33kV overhead lines to underground cables at various location | | 2026 | Execution | Asset Project |
| 2 | Replacement of 33kv switchgear at sohar-1 | Sohar | 2027 | Design | Asset Project |
| 3 | Al Huwail 1 PSS | Saham | 2027 | Design | To relieve load from Mukhalif Jadeedah, Al Huwail 2 and Hilat al Suq |
| 4 | Al Hambar 02 | Sohar | 2027 | Design | To relieve load from Al Muwailh 2 and Palm Garden Substations |
| 5 | Load shifting Falaj AL Qabayl 1 from SIP to SFZ Grid | Sohar | 2027 | Tendering | Load Managing between Grid Stations |
| 6 | New 3X20 MVA 33/11 kV PSS - SIET-6 | Sohar | 2027 | Tendering | Providing secure supply to Sohar Industrial Estate phase 7 |
| **Musandam** | | | | | |
| 1 | New Khasab PSS 2X20 MVA | Khasab | 2027 | Design | Securing Khasab loads |
| 2 | Khasab01 PSS 11kV SWG modification | Khasab | 2027 | Design | Securing Khasab loads |

## APPENDIX D: SPONSORED PEOJECTS

| No. | Project Name | Wilayat | Expected Completion Year | Project Status | Project Purpose |
|---|---|---|---|---|---|
| 1 | Improve Reliability at MOD MAM-B PS By Adding One New 33kV Feeder | Seeb | 2026 | Execution | To accommodate the Sponsor load |
| 2 | Construction New 2x20 MVA PSS In Mod-Shaffa Area With 33kV & 11kV Feeders In Shaffa & Izki | Izki | 2027 | Tendering | To accommodate the Sponsor load |