OMAN POWER AND WATER PROCUREMENT CO. (SAOC)

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GLOSSARY

APSR	Authority for Public Services Regulation, Oman
BST	Bulk Supply Tariff
BTU/scf	British thermal units per standard cubic foot
CCGT	Combined-cycle gas turbine
COD	Commercial operation date
CRT	Cost reflective tariff
CSP	Concentrated Solar Power
DISC	Dhofar Integrated Services Company
DR	Demand Response
DPS	Dhofar Power System
EE	Energy Efficiency
ESCO	Energy Services Company
EWEC	Emirates Water and Electricity Company
GCCIA	Gulf Cooperation Council Interconnection Authority
HHV	Higher Heating Value
IPP	Independent power project
IWP	Independent water project
IWPP	Independent water and power project
kWh	Kilowatt hour(s)
LOLH	Loss of load hours
m^3	Cubic metre(s)
m^3/d	Cubic metres per day
MEDC	Muscat Electricity Distribution Company (SAOC)
MEM	Ministry of Energy and Minerals
MIGD	Million imperial gallons per day
MIS	Main Interconnected System
MISC	Majis Industrial Services Company (SAOC)
MJEC	Majan Electricity Company (SAOC)
MMS	Market Management System
MSF	Multi-stage flash (desalination technology)
MW	Megawatt(s)
MZEC	Mazoon Electricity Company (SAOC)
OCGT	Open-cycle gas turbine
OETC	Oman Electricity Transmission Company (SAOC)
OPWP	Oman Power and Water Procurement Company (SAOC)
OWWSC	Oman Water & Wastewater Services Company
PDO	Petroleum Development Oman (LLC)
PPA	Power purchase agreement
PWPA	Power and water purchase agreement
PV	Photovoltaic
RE	Renewable Energy
RFP	Request for Proposal
RFQ	Request for Qualification
RO	Reverse osmosis (desalination technology)
SAC	Sohar Aluminium Company
Sm^3	Standard cubic metre(s)
Sm^3/d	Standard cubic metres per day
SMP	System Marginal Price
TWh	Terawatt hour(s)
WRA	Wind Resource Assessment

OVERVIEW

Introduction

This statement provides a 7-year outlook for power in the main power systems of Oman: the Main Interconnected System (MIS), the Duqm Power System, the Dhofar Power System (DPS), and the Musandam Power System. The 7-Year Statement also provides an outlook for desalinated water supply in the Main Interconnected System, the Sharqiyah Water Network, and the Dhofar Water Network.

Over the next seven years, OPWP is committed to achieve ambitious goals to diversify the sources of electricity generation. New solar and wind projects are forecast to contribute almost 13% of electricity production by 2025, and efficient utilisation of gas consumption will continue to improve over the planning horizon. In 2021, OPWP plans to launch the region's first wholesale electricity spot market. It will drive further efficiency improvements and provide a means for generation capacity that is not contracted to OPWP to sell power into the national grid.

OPWP prepares the 7-Year Statement annually in accordance with Condition 5 of its license. This is Issue 15, for the period 2021 to 2027; previous issues and additional information are available on the OPWP website at www.omanpwp.com.

Demand for Electricity

In the MIS, peak demand is expected to grow at about 4% per year on average, from 6,237 MW in 2020 to 8,370 MW in 2027. Most of this growth is expected to occur in the near term from 2021 to 2024, as the economy recovers from the effects of the COVID-19 pandemic. Peak demand growth will continue to show the impact of consumer responses to the time-of-use tariffs (Cost-Reflect Tariff or CRT) that were introduced in 2017. OPWP anticipates that the introduction of solar projects over the planning horizon will reduce BST prices during the afternoon period, leading to a gradual increase in peak demand during the mid-to-later years of the 7 year planning period as CRT customers respond to these price signals. The CRT changes are not expected to stimulate energy consumption, with the result that the growth in average demand is less than peak demand growth, at an annual average of 2% per year.

High and Low Case scenarios are also considered. The Low Case projects 2% annual growth in peak demand, reaching 7,130 MW in 2027, 1,240 MW below the Expected Case. The High Case projects 6% annual growth in peak demand at 9,610 MW by 2027, exceeding the Expected Case by 1240 MW.

In the Dhofar Power System, peak demand is expected to grow at 4% per year, from 527 MW in 2020 to 707 MW in 2027. The Low Case projects 2% growth, reaching 602 MW by 2027, by 105 MW below the Expected Case. The High Case, on the other hand, projects 6% growth in peak demand, reaching 811 MW by 2027, exceeding the Expected Case by 104 MW.

Power Generation Requirements

In the Main Interconnected System, the major developments include the start of the Spot Market in 2021, completion of the 400 kV North-South Interconnect to the Duqm Power System in 2023 (with potential exchanges via the PDO system commencing in 2023), and the continuing push for RE projects to reduce energy costs, driven by economics. The North-South Interconnect will stimulate development of the Special Economic Zone of Ad Duqm and development of RE projects in Al Wusta.

Project developments in the MIS are expected to include: (1) procurement of capacity via a combination of uncontracted contributions from the Spot Market and dedicated, contract-based procurement rounds (Power 2024 and/or Power 2026/27, to the extent required); (2) termination of Power 2022 procurement round; (3) commencement of phase 2 of the Wind Resource Assessment by Q3 2021; (4) commencement of commercial operations at Ibri II Solar IPP in 2021; (5) reassessment of the Waste-to-Energy project in 2021; (6) Manah I & II Solar IPPs to commence operation in 2024; (7) an additional Solar IPP of capacity 500 MW planned for COD in 2025; and (8) a wind IPP of around 100 MW planned for COD in 2025 and to be located in the Sharqiyah region.

In the Dhofar Power System, OPWP seeks to develop an additional Wind IPP with a capacity of around 100 MW and to be located adjacent to the existing project in Harweel.

In the Duqm Power System, OPWP plans several projects to be completed in the forecast period, including wind IPPs of around 360 MW to be potentially located across multiple sites. OPWP also plans to prepare a feasibility study of Concentrated Solar Power (CSP) project with thermal storage, potentially located near to Ad Duqm, which may be considered for procurement during the forecast period.

Fuel Requirements

The planned solar and wind projects are forecasted to contribute about 13% of total electricity production by 2025. This percentage is anticipated to increase further to 20% by 2027.

In the MIS, the contributions of RE are expected to reduce fuel requirements by 2% per year on average through 2027, despite the 2% annual growth in electrical energy requirements. Average gas utilisation by the generation fleet (sm^3 per MWh produced) is projected to improve by 26% from 2021 to 2027. From 2021, the main improvements will be due to the introduction of solar and wind IPPs.

In the Dhofar Power System, gas requirements are projected to increase at 2% per year, which follows the same growth of 2% in electrical energy requirements. The projections include Dhofar II Wind IPP in 2025, which is expected to have a positive impact on gas savings.

Desalinated Water Requirements

Peak water demand in the Main Interconnected System (MIS) is projected to increase at 3% per year, from 1,067 thousand m^3/d in 2020 to around 1,341 thousand m^3/d in 2027. In the Sharqiyah Zone, water demand is expected to increase at 5%, from 145 thousand m^3/d in 2020 to 204 thousand m^3/d in 2027.

In the MIS, developments include: (1) Sohar IWPP and Barka IWPP contract expiration in 2022; (2) addition of Barka V IWP (100,000 m^3/d, 22 MIGD) in 2024; (3) new desalination capacity (150,000 m^3/d, 33 MIGD) in the North Batinah region, in 2026; (4) addition of Ghubrah III IWP capacity (300,000 m^3/d, 66 MIGD) in 2024; (5) Barka II IWPP contract expiration in 2024; and (6) replacement desalination capacity (100,000 m^3/d, 26.4 MIGD) in the Barka Zone in 2024.

In the Sharqiyah Zone, the major development is the addition of Aseelah IWP (80,000 m^3/d, 18 MIGD) in 2021.

In Dhofar, DISC forecasts water demand to grow at 8%, and peak water demand to increase from 165,000 m^3/d in 2020 to 285,000 m^3/d in 2027. The main development is the addition of the Dhofar Water IWP 2025 (150,000 m^3/d, 33 MIGD) in 2025.

Procurement Activities

The main procurement activities for power projects in 2021 include: (1) completion of Manah Solar I & II IPPs procurement; and (2) commencement of MIS Solar IPP 2025 procurement. Beyond 2021, future procurement initiatives include additional RE IPPs, and potentially a Power 2024 procurement round.

The main procurement activities for water projects in 2021 include: (1) Barka V and Ghubrah III IWPs. Beyond 2021, future procurement initiatives include the addition of Barka Water 2024 , North Batinah IWP and Dhofar Water 2025 IWP.

SECTION 1 POWER

1.1 MAIN INTERCONNECTED SYSTEM

The Main Interconnected System (MIS) extends throughout the Governorates of Muscat and Buraymi, and most of the Governorates of Al Batinah North, Al Batinah South, Ad Dakhiliyah, Ash Sharqiyah North, Ash Sharqiyah South and Ad Dhahirah, serving 1,277,278[1] electricity customers.

The MIS comprises twelve power generation facilities (ten of which are operational and provides capacity contribution to the system, one of which is contracted to provide just ancillary services to the system, and one is under construction), owned and operated by separate companies; the 400/220/132 kV transmission grid, owned and operated by Oman Electricity Transmission Co. (OETC); and three distribution networks, owned and operated by Muscat Electricity Distribution Co. (MEDC), Mazoon Electricity Co. (MZEC) and Majan Electricity Co. (MJEC). The three distribution network operators also act as licensed electricity suppliers, supplying existing and new electricity customers in their respective service areas. The MIS is interconnected with the power system of Petroleum Development Oman (PDO), and with the power system of the Emirate of Abu Dhabi and other Member States of the GCC Interconnection Authority via the Abu Dhabi Interconnect.

OPWP's role is to aggregate the power and desalinated water requirements of licensed electricity suppliers and water departments, and to economically procure the required power and desalinated water in bulk from generation/production facilities connected to the MIS and water transmission systems. OPWP is required to ensure that sufficient power generation resources are available to meet licensed electricity suppliers' demands. Wherever beneficial, OPWP co-procures desalinated water to meet the needs of water departments in joint power-water facilities and procures stand-alone desalinated water facilities upon the direction of OWWSC in accordance with Article 78 of the Sector Law.

a. Demand for Electricity

OPWP evaluates electricity demand at the system level, including transmission and distribution system losses with consumer-level loads. This must be secured by the total output capacity of power generation plants at the power system delivery points, excluding the internal power consumption of auxiliary systems.[2]

Historical Demand

In 2020, electricity demand was lower than what was expected under OPWP's previous forecast. The average demand shows 1.6% decline over 2019 demand, which is consistent with negative economic growth due to the drop in oil prices and COVID 19 impact[3], and the below-normal temperature profile in 2020. Peak demand dropped by about 1.8% to 6,237 MW and the average demand declined to 3,690 MW (corresponding to 32.4 TWh of energy).

Over the last 7-year period (2013-2020), peak electricity demand in the MIS grew at an average annual rate of about 4%, from 4,634 MW in 2013 to 6,237 MW in 2020. Energy consumption and average demand grew by about 5% annually during the same period. Single year growth rates have fluctuated widely, influenced strongly

[1] APSR Annual Report 2019

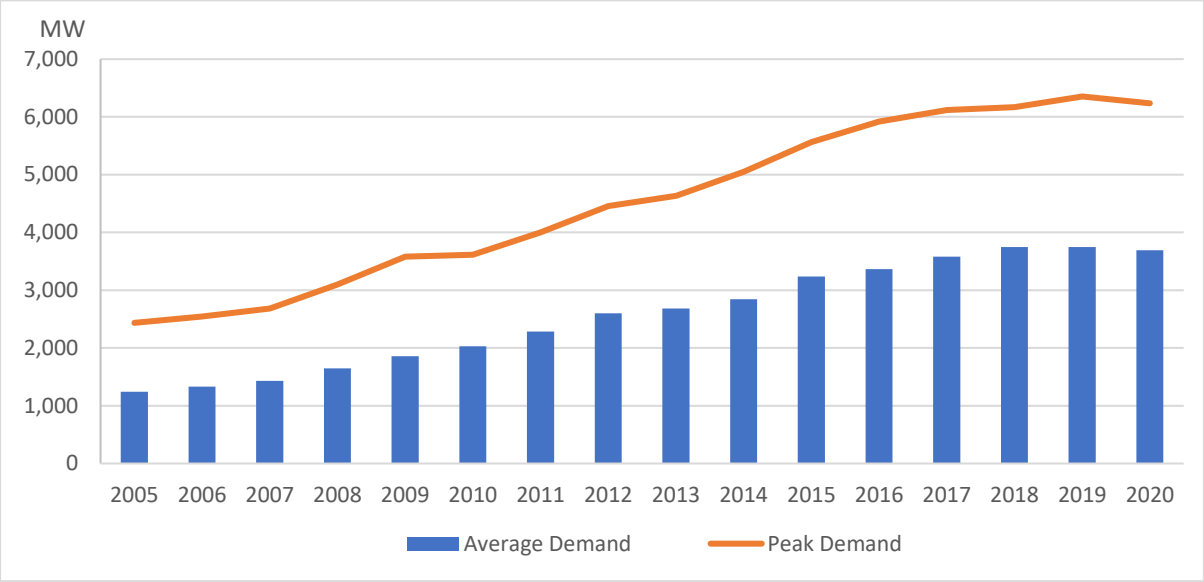
[2] This approach assures equivalence toward planning the generation supply required to meet consumer demand. However, from the perspective of power system operations, electricity demand and output are monitored at available metering points located at substations and power plants. The system "gross demand" at any point in time is the sum of the metered output at all power generators, although a portion of that generator output must be consumed by plant auxiliary systems. System peak demand is considered as net of plant auxiliaries and any exports to other power systems. The hourly consumption of plant auxiliary systems is not measured directly at some plants and in these cases must be estimated. Consequently, there may be differences in peak demand reports, depending on how auxiliary consumption at each plant is estimated.

[3] International Monetary Fund estimates 2020 GDP contracted by 6.4% (International Monetary Fund, World Economic Outlook, April 2021).

by weather and economic growth: annual peak demand growth has ranged from a low of -1.8% to a high of 15.6% since 2006.

Figure 1 illustrates the growth in peak and average demand in the MIS from 2005 to 2020.

Figure 1 Historical Electricity Demand – MIS



	Average Demand (MW)	*Growth (%)*	Peak Demand (MW)	*Growth (%)*
2005	1,240	-	2,435	-
2006	1,329	*7.2%*	2,544	*4.5%*
2007	1,430	*7.6%*	2,682	*5.4%*
2008	1,646	*15.1%*	3,100	*15.6%*
2009	1,859	*12.9%*	3,581	*15.5%*
2010	2,028	*9.1%*	3,613	*0.9%*
2011	2,285	*12.7%*	4,000	*10.7%*
2012	2,599	*13.7%*	4,455	*11.4%*
2013	2,684	*3.3%*	4,634	*4.0%*
2014	2,845	*6.0%*	5,047	*8.9%*
2015	3,237	*13.8%*	5,565	*10.3%*
2016	3,364	*3.9%*	5,920	*6.4%*
2017	3,578	*6.4%*	6,116	*3.3%*
2018	3,748	*4.8%*	6,168	*0.9%*
2019	3,748	*0.0%*	6,353	*3.0%*
2020	3,690	*-1.6%*	6,237	*-1.8%*
Average Growth (%)		***7.7%***		***6.6%***

Demand Projections

OPWP's 7-year electricity demand projections cover energy, average demand, and peak demand requirements. Peak demand is the most relevant parameter for purposes of assessing capacity expansion requirements. The projections of energy demand are necessary to identify fuel requirements over the forecast period, which is illustrated further in the Fuel section.

The demand projections for the MIS have been developed on the basis of: (1) quantitative analyses of weather, macroeconomic, and demographic demand drivers; (2) assessment of demand drivers' uncertainty (3)

consultations with the electricity distribution companies and other relevant entities such as large industries; (4) historical growth trends; and (5) assessment of past forecasts against out-turns.

Energy demand is modelled separately for the residential and non-residential sectors. The residential demand projections are derived from population growth scenarios while the non-residential demand projections are derived principally from scenarios of economic growth in the Sultanate, using an econometric model of the relationship of electricity demand to real Gross Domestic Product (GDP) over a recent period, with adjustments for weather, price, and other effects. Economic growth has been relatively slow since oil prices fell in 2014 and 2015, and has been affected by the impacts of the COVID-19 pandemic in 2020. The most recent GDP growth estimates for 2020 and 2021 are -6.4% and 1.8% respectively.[4]

OPWP demand scenarios reflect the assessment of uncertainty in several factors such as: GDP forecast, population forecast, econometric model coefficients, energy efficiency programs, tariff reform, CRT impact, and development of rooftop solar and other private solar PV installations. Based on the associated risk of the factors, OPWP developed a range determining the Low, Expected, and High Case scenarios for electricity demand projections. These influences on the demand projections are described further as follows:

- **GDP Forecast.** The forecast model for peak demand and non-residential energy demand uses a GDP forecast as the main influence. The GDP forecast is subject to error, and the forecast uncertainty considers the historical record of forecast vs. out-turn GDP for the Sultanate.

- **Econometric Model Uncertainty.** OPWP has observed that the model itself adapts to out-turn events over the course of the forecast period. The COVID-19 pandemic has introduced a greater-than-"normal" level of uncertainty in the demand forecast, as lockdowns and related government interventions to stem the pandemic have disrupted the historical relationship between GDP and demand growth. The forecast considers the uncertainty in the period needed to restore the previous GDP-to-demand relationship, and potential for a reset to a new level of GDP-to-demand growth rates.

- **CRT Impact.** Many large customers shifted their demand away from the peak period following the introduction of the Cost Reflective Tariff (CRT) in 2017. OPWP expects further demand shifts in response to tariff changes as the CRT develops and consumers shift consumption to periods of lower cost. In 2022 and 2024, the additions of solar capacity in the system will contribute to increased capacity margins during the afternoon period and will lead to lower costs. Subsequently the electricity rate for the afternoon Bulk Supply Tariff (BST, the main component of CRT) will be lower relative to other periods in the BST. By 2024, the afternoon tariff level is expected to be similar to the current off-peak tariff. In parallel, the night-time tariff will increase. OPWP expects that many CRT consumers will revert to pre-CRT consumption profiles benefiting from low afternoon tariffs and the initial CRT impact on peak demand may reverse. They will increase demand during the afternoon.

- **Permitted Tariff Reform**. A tariff reform policy has been initiated in 2021 aiming to remove the subsidies in residential and small commercial tariffs completely by 2025. Consumers are expected to modify their consumption behaviour accordingly which will reduce the demand. OPWP assessed the scope for demand reduction on the basis of electricity price elasticity and energy efficiency improvement potential.

- **Private Solar PV Development.** While the level of rooftop solar PV and industrial solar PV is currently modest, the demand forecast considers that the growth rate may accelerate rapidly, particularly once public policies are defined with respect to electricity market evolution, transmission wheeling charges,

[4] International Monetary Fund, World Economic Outlook, April 2021.

etc. Private Solar PV development is considered as an offset to energy and peak demand requirements that need to be met by the power system.

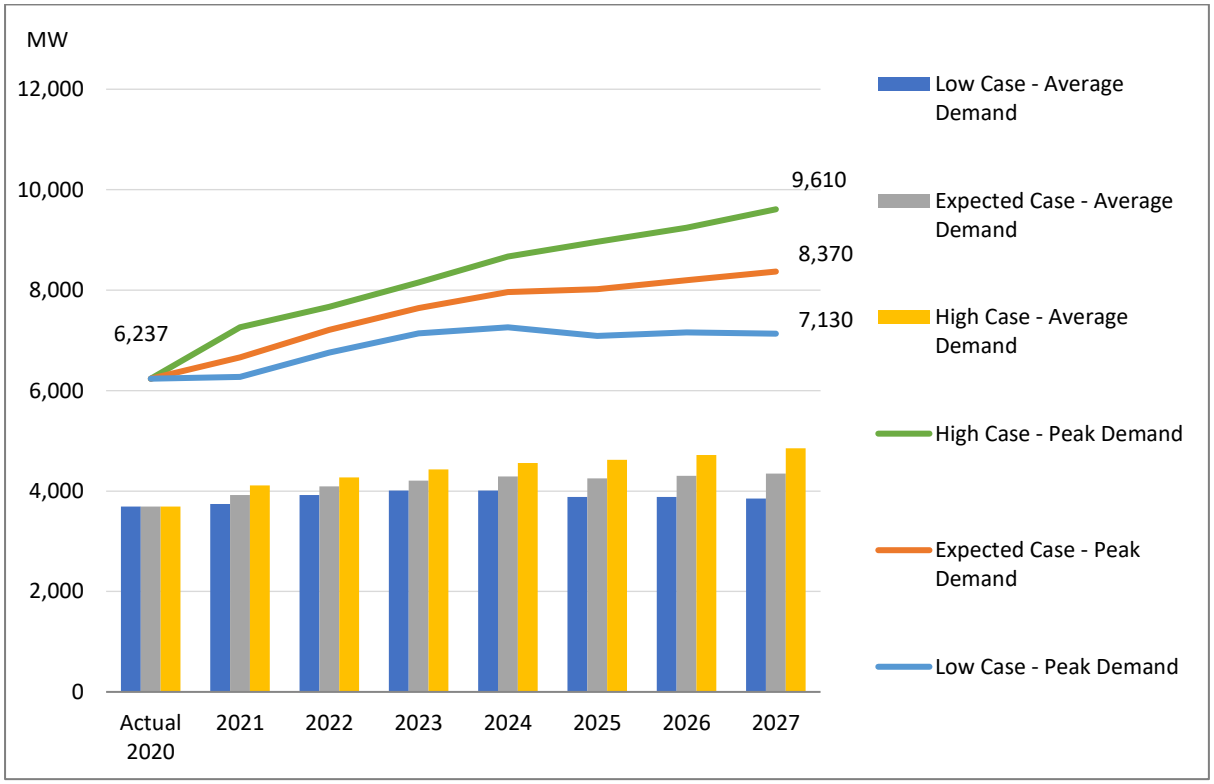
- **Energy Efficiency Policy Initiatives.** OPWP expects that energy efficiency (EE) promotion and appliance standards programs will reduce the demand in the coming period. The Ministry of Commerce, Industry and Investment Promotion has launched an electronic system for issuing energy efficiency cards for air conditioners (ACs) in 2019 / 2020 that assist consumers in choosing more efficient models. An Energy Services Company (ESCO) program for government buildings is also under implementation to carry out energy audits leading to energy saving investments. The forecast considers energy efficiency impacts to occur gradually, mainly as the equipment asset base is replaced by more efficient devices, such as LED lamps and efficient AC units.

The projections are then aligned with analyses of distribution system demands, which are assessed on a "macro" basis by distribution company zone, and certain bulk loads that are assessed on a specific customer basis. Distribution system demand is comprised mainly of residential, service sector (including government and commercial buildings, tourism facilities), and small- to medium- scale industrial demand in all MIS regions.

The growth in demand from very large loads (generally large industries and infrastructure projects) comprises both new projects and expansion of existing industrial plants. Industrial projects are located mainly in the Sohar Industrial Port and Sohar Free Zone. Infrastructure projects include, for example, the desalination plants and airports.

The projections are presented as a range bounded by Low Case and High Case scenarios, and a central Expected Case forecast. These are summarized in Figure 2.

Figure 2 Electricity Demand Projections – MIS



	Actual 2020	2021	2022	2023	2024	2025	2026	2027	Average Growth (%)
Expected Case Demand									
Average Demand (MW)	**3,690**	**3,920**	**4,090**	**4,210**	**4,290**	**4,250**	**4,300**	**4,350**	**2%**
Distribution Loads	3,031	3,120	3,250	3,350	3,370	3,320	3,340	3,380	2%
Directly-Connected Loads	658	800	840	860	920	930	960	970	6%
Annual Energy (TWh)	**32**	**34**	**36**	**37**	**38**	**37**	**38**	**38**	**2%**
Peak Demand (MW)	**6,237**	**6,660**	**7,210**	**7,640**	**7,960**	**8,020**	**8,200**	**8,370**	**4%**
Change from 2020-2026 Statement (MW)	*-303*	*90*	*560*	*340*	*220*	*-70*	*-290*		-
Low Case Demand									
Average Demand (MW)	**3,690**	**3,740**	**3,920**	**4,010**	**4,010**	**3,880**	**3,880**	**3,850**	**1%**
Distribution Loads	3,031	3,040	3,180	3,260	3,200	3,040	3,020	2,970	0%
Directly-Connected Loads	658	700	740	750	810	840	860	880	4%
Annual Energy (TWh)	**32**	**33**	**34**	**35**	**35**	**34**	**34**	**34**	1%
Peak Demand (MW)	**6,237**	**6,270**	**6,760**	**7,140**	**7,260**	**7,090**	**7,160**	**7,130**	**2%**
Change from 2020-2026 Statement (MW)	*397*	*160*	*550*	*610*	*550*	*210*	*80*		-
High Case Demand									
Average Demand (MW)	**3,690**	**4,110**	**4,270**	**4,430**	**4,560**	**4,620**	**4,720**	**4,850**	**4%**
Distribution Loads	3,031	3,220	3,340	3,470	3,540	3,580	3,650	3,770	3%
Directly-Connected Loads	658	890	930	960	1,020	1,040	1,070	1,080	7%
Annual Energy (TWh)	**32**	**36**	**37**	**39**	**40**	**41**	**41**	**42**	4%
Peak Demand (MW)	**6,237**	**7,260**	**7,670**	**8,150**	**8,670**	**8,960**	**9,240**	**9,610**	**6%**
Change from 2020-2026 Statement (MW)	*-433*	*450*	*610*	*80*	*-190*	*-530*	*-980*		-

The Expected Case scenario projects 2% annual growth in energy demand (i.e., average demand). Peak demand is projected to increase at an annual average of 4% per year, from 6,237 MW in 2020 to 8,370 MW in 2027.

The Expected Case projections for energy requirements are lower than that in the previous 7-Year Statement (Issue 14), mainly due to current expectations of permitted tariff reform impact. By 2025 the energy demand is expected to drop due to the full removal of electricity tariffs subsidies, followed by low growth in demand of around 1%. The peak demand is expected to grow along with the economy. In this scenario, peak demand is projected to register high growth in 2021, considering several large industrial projects completed early in the year, followed by annual growth ranging from 1% to 8%.

The addition of solar projects in 2022 and 2024 will affect the CRT. CRT consumers are expected to begin reacting to changes in CRT in 2022 by shifting their demand back to the afternoon period. The CRT would change further in 2024 once the Manah solar projects begin operation. These shifts toward the peak period may occur gradually in response to the CRT changes but are expected to represent a persistent increase in peak demand for the remainder of the period. The aggregate impact is about 560 MW in the Expected Case.

The Low Case scenario projects peak demand growth at an average of 2% per year, from 6,237 MW in 2020 to 7,130 MW in 2027. Annual average demand under this scenario is expected to grow at around 1% per year. This follows an assumption of lower economic growth than the Expected Case scenario, a higher consumer response to CRT changes, EE program and tariff reform policy.

The High Case scenario projects peak demand to grow at 6% annually, to 9,610 MW by 2027. The total energy growth rate is projected to grow at a slightly lower rate, at 4% per year. These higher growth rates correspond

to lower demand reduction through energy efficiency program and tariff reform policy. From 2023 onwards it is assumed that CRT consumers responses to change in BST will be larger than the Expected Case Scenario.[5]

The three demand projections are reference scenarios assuming normal weather conditions. Extreme weather may occur in any year, potentially increasing or decreasing demand up to 200 MW against the projected peak demand. These potential fluctuations are not shown in the demand forecast, as they do not affect the underlying multi-year trend. However, they are taken into account in the assessment of capacity requirements, though with low probability of occurrence.

[5] There is a further possibility that the shift in BST prices will attract demand from industries that currently self-supply using their own generators, because afternoon CRT rates may be below their cost of generation.

b. Power Generation Resources

Sources of Power

OPWP purchases power from a number of sources via power purchase agreements (PPAs), power and water purchase agreements (PWPAs) and other similar agreements. The contractual arrangements for power delivery under these agreements may be differentiated as firm capacity, reserve-sharing, non-firm capacity, and energy-only. These terms are relevant for generation planning purposes.

All of the main power plants in the MIS are contractually committed to provide a specific generation capacity (in MW) upon demand, to be dispatched by the OETC, and to maintain specific availability levels. These are firm capacity contracts, also termed **"contracted capacity"**.

OPWP also purchases power from a number of sources where the contractual arrangements do not provide a guaranteed level of capacity upon demand. They may be termed collectively as **"non-firm resources"**. They currently include: (1) reserve-sharing arrangements with other power systems via international interconnection agreements; (2) capacity exchanges/energy purchases from industries with captive power generation facilities, where such industries use their embedded generators mainly for self-supply; and, (3) renewable energy (RE) projects from intermittent sources, such as solar PV (without storage) and wind. Collectively, non-firm resources provide reliability benefits to the MIS, and that capacity is generally available according to pre-arranged schedules or during contingency events. Accordingly, a portion of this capacity can be considered to provide contributions towards meeting peak demand requirements.

The Government of Oman adopted a fuel diversification policy in 2017, which requires that RE projects contribute at least 10% of generation output by 2025. A key objective of this policy is to release domestic gas committed to the power sector, to be available to stimulate industrial and economic development. OPWP has embraced this policy and expects to exceed the 2025 target, as low costs are now driving RE development on their economic merits alone.

Solar and wind projects are non-firm resources to the extent that their energy output is intermittent and non-dispatchable. OPWP has estimated the energy production and expected contribution to system reliability standards of RE projects on the basis of power system simulations using ground measurement data collected over a number of years and correlations with satellite data where no such ground measured data is available. Once specific projects are under development, and later in operation, OPWP will look to re-assess these estimates on the basis of specific locations, technology being deployed, and production out-turns.

Contracted Capacity

OPWP's present portfolio of contracted capacity for electricity generation in the MIS comprises eleven P(W)PAs. A summary of these contracted capacities can be found in Table 1.

A summary of the generation capacity that is expected to be provided under these P(W)PAs over the 2021-2027 period is set out in Figure 3[6]. This shows total contracted capacity of 9,495 MW in 2021, which then steadily decreases to 6,823 MW by 2024. The reduction in contracted capacity is due to a number of contract expirations during the period as detailed amongst the following main developments:

Al Kamil IPP: Contracted capacity of 291 MW at 45°C. The PPA is scheduled to expire on 31st December, 2021.

Barka IWPP: PWPA is scheduled to expire on 31st December, 2021. The current agreement provides contracted capacity of 397 MW during normal operation in CCGT mode without MSF water production.

[6] While RE projects are to be contracted under a PPA, they are classified as a non-firm resources, and so are represented in (Table 2 Non-Firm Contracts).

Barka II IWPP: Contracted capacity of 688 MW at 45°C. The P(W)PA is scheduled to expire in 2024.

Rusail IPP: Contracted capacity of 694 MW at 45°C. The PPA is scheduled to expire on 31st March 2022.

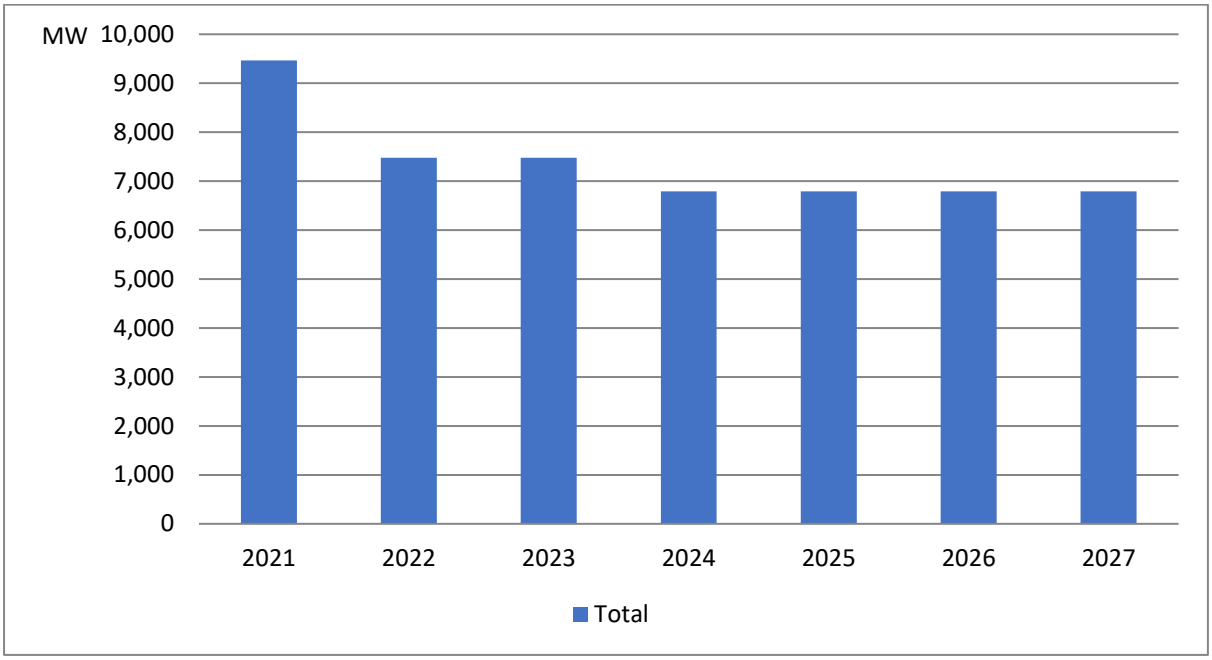
Sohar IWPP: Contracted capacity of 597 MW at 45°C. The PWPA is scheduled to expire on 31st March 2022.

Table 1 Details of PPAs/PWPAs – MIS

Project Name	Contracted Capacity [a]	Contract Type	Project Company	Project Status	Technology	Contract Expiry
Al Kamil IPP	291 MW	PPA	Al Kamil Power Co. (SAOG)	Operational	OCGT Natural gas fired Fuel oil as back-up	2021
Barka IWPP	397 MW	PWPA	ACWA Power Barka (SAOG)	Operational	CCGT Natural gas fired Fuel oil as back-up	2021
Barka II IWPP	688 MW	PWPA	SMN Barka Power Co. (SAOC)	Operational	CCGT Natural gas fired Fuel oil as back-up	2024
Barka III IPP	766 MW	PPA	Al Suwadi Power Co. (SAOG)	Operational	CCGT Natural gas fired Fuel oil as back-up	2028
Ibri IPP	1,537 MW	PPA	Ad-Dhahirah Generating Co. (SAOC)	Operational	CCGT Natural gas fired Fuel oil as back-up	2034
Ibri II Solar IPP	500 MW	PPA	Shams Ad-Dhahirah Generating Co. (SAOC)	Under Construction	Solar PV - Tracking	2035
Rusail IPP	694 MW	PPA	Rusail Power Co. (SAOC)	Operational	OCGT Natural gas fired Fuel oil as back-up	2022
Sohar IWPP	597 MW	PWPA	Sohar Power Co. (SAOG)	Operational	CCGT Natural gas fired Fuel oil as back-up	2022
Sohar II IPP	766 MW	PPA	Al Batinah Power Co. (SAOG)	Operational	CCGT Natural gas fired Fuel oil as secondary fuel and back-up	2028
Sohar III IPP	1,741 MW	PPA	Shinas Generating Co. (SAOC)	Operational	CCGT Natural gas fired Fuel oil as back-up	2034
Sur IPP	2,018 MW	PPA	Phoenix Power Co. (SAOG)	Operational	CCGT Natural gas fired Fuel oil as back-up	2029

[a] Contracted capacities are shown as of summer 2021 at 45°C, adjusted from the reference condition of 50°C using contractually agreed upon correction factors and as reported as net of plant auxiliaries.

Figure 3 Contracted Generation Capacity – MIS



	2021	2022	2023	2024	2025	2026	2027
Contracted Capacity	Net MW [a]						
Al Kamil IPP	291	-	-	-	-	-	-
Barka IWPP[b]	397	-	-	-	-	-	-
Rusail IPP	694	-	-	-	-	-	-
Sohar IWPP	597	-	-	-	-	-	-
Barka II IWPP	688	688	688		-	-	-
Sohar II IPP	766	766	766	766	766	766	766
Barka III IPP	766	766	766	766	766	766	766
Sur IPP	2,018	2,018	2,018	2,018	2,018	2,018	2,018
Ibri IPP	1,537	1,535	1,535	1,535	1,535	1,535	1,535
Sohar III IPP	1,741	1,738	1,738	1,738	1,738	1,738	1,738
Total	**9,495**	**7,511**	**7,511**	**6,823**	**6,823**	**6,823**	**6,823**

[a] All capacities are rated on a net basis (i.e. after allowing for auxiliary consumption inside the plants) at 45°C ambient temperature.

[b] Barka IWPP's accessible contracted capacity is 439 MW. The plant is expected to be operated in open cycle configuration allowing the MSF unit to be available in standby mode. This configuration allows a dispatch of 397 MW only.

In addition to the contracted generation capacities presented above, OPWP also currently maintains a contract with Manah Power Plant to provide ancillary services to the system. The term of the contract is from 2020 until the end of 2024.

Non-Firm Contracts

In addition to the contracted capacity described above, OPWP has contracts with a number of other generation sources, although these contracts are not for firm capacity commitments. They include the following and are summarised in Table 2:

- the 220 kV interconnect with the GCCIA via the UAE (Abu Dhabi) power system at Mahadha; and,
- the surplus generation of industries (and other parties) with captive power generation facilities.

Table 2 Non-Firm Contracts - MIS

	2021	2022	2023	2024	2025	2026	2027
Non-Firm Contracts	MW						
SAC [a]	180	180	180	180	180	180	180
GCCIA Interconnection	200	200	200	200	200	200	200
Total	**380**	**380**	**380**	**380**	**380**	**380**	**380**

[a] Current agreement with SAC is scheduled to expire at the end of 2021. Following such, the agreement with SAC may be extended further, or SAC may opt to participate in the Spot Market.

GCCIA Interconnect. A 220 kV interconnection between the Oman (MIS) and the GCCIA power systems, via the UAE (Abu Dhabi) has been commercially operational since 2012. Oman has been a member of the GCCIA since December 2014 and has access to the other five Member State power systems via this link. Benefits of the interconnection include firm support during emergencies, and opportunities to trade electricity and coordinate both planning reserves and operating reserves.

The interconnection is a double circuit link that supports reliable transfers of up to 400 MW and can carry up to 800 MW in emergencies. The link has provided emergency reserves on a number of occasions, preventing power failures in the MIS. In 2016, APSR approved OPWP's recognition of the interconnect's assessed capacity benefit of reserve-sharing arrangements and contribution to planning reserve requirements of 200 MW. This is based on its record of performance and the contractual obligations with the GCCIA to provide reserves support. That said, the capacity benefit associated to this resource may vary over the 7-year period. This would be influenced by a number of different factors, including the demand profile, the amount of reserve capacity in the system, and amount of renewable energy resources. OPWP will re-assess the capacity contribution from time to time in consideration of developments in the power system.

GCCIA is conducting a detailed study of a second interconnect to connect Oman directly from Ibri to Salwa (KSA). The proposed link is a 400 kV DC link of about 700 km. The study's initial outcomes indicate that the net transfer capacity to Oman would increase from 400 MW to about 1,600 MW. Accordingly, it is expected that the two interconnects would contribute more to the planning reserve requirements. The time horizon for the project as per the study outcome is around 2025, pending final approvals. Following approval and a confirmed development timetable, the expanded interconnect capacity would be included in OPWP's 7-year resource planning.

Surplus Generation. OPWP has an agreement with Sohar Aluminium Co. (LLC), whereby Sohar Aluminium exports up to 180 MW to the MIS during the summer, and imports similar amounts of energy during the winter on an annually determined schedule. The schedule and operations are managed to assure that energy exports balance with energy imports. This arrangement benefits both parties: Sohar Aluminium is better able to schedule the maintenance of its generating units and gains reliability of supply, while OPWP gains an efficient generating resource during the summer and improves the system load factor. The agreement with Sohar Aluminium (180 MW) was renewed for a third time in 2018, for an additional three years. The agreement is expected to be

renewed again in 2021 subject to assessments and necessary approvals, or SAC may instead continue to supply via the spot market after the PPA expires.

Resource Development Plan

OPWP continues to commit to the Fuel Diversification Policy issued by the Government, as the resource development plan features rapid development of renewable energy (RE) resources that meet or exceed the policy target. The resource development plan comprises new capacity contracts, renewable energy contracts and capacity contributions from other non-firm resources. New capacity contracts and Spot Market resources are considered as flexible resources, where the amount of capacity made available from these resources can closely match capacity needs as the demand forecast changes throughout the years.

Renewable Energy (RE) Development Plan

OPWP's renewable energy development plan currently comprises solar and wind projects. OPWP plans to procure around 2,200 MW of RE IPPs in the MIS by 2027, in addition to the 500 MW Ibri II IPP which is under construction. Additional RE IPPs are being planned for other systems and are reported later in this publication. Table 3 summarizes the plan through 2027. The locations and type of future RE projects depend on demand growth, approval of transmission projects and site allocations. Procurement timelines may be amended following demand forecast updates.

OPWP's currently contracted renewable energy projects are described as follows:

- **Ibri II Solar IPP.** The 500 MW Solar PV project (Ibri II Solar IPP) is under construction. The project was awarded in February 2019 to Shams Ad Dhahira Generating Company. The expected COD is Q3 2021. The project is configured with single-axis tracking and bi-facial PV panels. Following advancements in OPWP modelling practices that takes better account of weather-influenced intermittencies and its associated impact on resource availability, the capacity contribution value for this project was re-assessed and has since been updated to around 36% (from the previous 44%).[7]

OPWP's plans for solar and wind development are described as follows:

- **Manah I Solar and Manah II Solar IPPs.** OPWP began procurement of its second and third solar IPPs in 2019. The RFQ process is complete and the RFP was completed in 2020 for award in Q2 2022. The projects are located on adjacent sites in Ad-Dakhiliyah. It is a single procurement process, in which there will be separate single awards for each site, to different developers. Each project will have contracted maximum offtake capacity of around 500 MW using PV technology. The two projects have different COD schedules, Q2 2024 and Q3 2024, respectively.

- **MIS Solar IPP 2025.** The site for the fourth solar IPP is currently under review, following completion of a site assessment study in December 2019. Candidate sites include a previously defined site at Adam and a number of sites in other locations. This project is expected to use PV technology, with capacity around 500 MW. The RFQ is planned for release in Q4 2021 and the project will have the COD scheduled in Q2 2025.

- **Jalan Bani bu Ali Wind IPP 2025.** OPWP plans to develop a wind power project in the MIS for COD in Q3 2025. OPWP has reserved a site at Jalan Bani bu Ali in North Sharqiyah Governorate and is currently undertaking a pre-feasibility of developing a Wind IPP at the site. As part of OPWP's Wind Resource Assessment Campaign (WRA), two 100-metre tall wind masts were installed in February 2020 to collect wind resource data prior to release of the RFP (the data collected is made available to the public via OPWP's website). OPWP plans to issue the RFQ in Q1 2022 and the RFP in Q3 2022. The installed capacity is nominally

[7] Ibri II Solar IPP is expected to generate at near its full contracted capacity during the peak demand period on most days. However, it provides no generation at night, which is also an important period for system reliability. It is mainly this lack of night-time generation that causes a low effective capacity contribution to reliability requirements.

estimated at around 100 MW but will be confirmed following assessment of the measured wind data and farm layout optimization analyses.

- **Solar PV 2027.** OPWP plans to develop a fifth utility-scale solar PV project for 2027 COD. This project may be located in the Al Wusta region with a capacity of around 600 MW. OPWP notes that both the capacity and the location of the project may be amended in future iterations of the 7 Year Statement as more assessments are carried out. The procurement activities related to this project may not commence until 2023.

Table 3 Renewable Energy Development Plan – MIS

	2021	2022	2023	2024	2025	2026	2027
Contracted Projects	MW[a]						
Ibri II Solar IPP [b]	-	500	500	500	500	500	500
Total Contracted	**-**	**500**	**500**	**500**	**500**	**500**	**500**
Planned Projects							
Manah I Solar IPP	-	-	-	500	500	500	500
Manah II Solar IPP	-	-	-	-	500	500	500
MIS Solar IPP 2025	-	-	-	-	500	500	500
Jalaan Bani Bu Ali Wind IPP 2025	-	-	-	-	-	100	100
Solar PV 2027	-	-	-	-	-	-	600
Total Planned	-	-	-	**500**	**1,500**	**1,600**	**2,200**
Total Capacity Contributions (Contracted and Planned)	-	**180**	**180**	**225**	**280**	**330**	**330**

[a] The year in which capacities are reported represent the year in which the project is anticipated to contribute to peak demand requirements.

[b] Ibri II Solar IPP Capacity Contribution value has been re-assessed and has been adjusted to 36%. This represents a 8% reduction in the capacity contribution that was assigned and reported in the previous 7 Year Statement-issue 14. This updated value comes after the development of a more sophisticated modelling approach that takes better account of potential daily variations in resource availability. This value maybe be updated further as the project becomes operational and additional data is made available.

OPWP has reassessed the capacity contributions of the forthcoming solar PV and wind projects, based on additional site-specific weather data, and simulations of both the fluctuation of generation due to weather and the availability of generation at the time it is most required. Each solar and wind project has a contracted capacity which is the maximum level of hourly generation at standard ambient conditions. The capacity contribution refers to the equivalent amount of firm capacity that is displaced by this project in its ability to maintain similar system reliability standards.

The first solar PV project, Ibri Solar II IPP, has been assessed a capacity contribution of 36% (180 MW). It is expected to be generally available at full capacity during the middle of the day, but less capacity will be available during the late afternoon or during cloudy conditions, and no capacity will be available during peak conditions at night. After the Ibri Solar II IPP is in operation, the periods of greatest capacity need begin to shift to the night when there is less capacity available relative to demand.

The Manah I and II Solar IPPs have been assessed a capacity contribution of 9% (90 MW total). They would also generally be available at full capacity at mid-day. However, the Ibri II Solar project will have eliminated most of the capacity need at this time, such that the Manah Solar IPPs' contribution to net capacity needs is much less. The Ibri II, Manah I and Manah II Solar IPPS collectively provide 1,500 MW of capacity at mid-day on most summer days. They address daytime capacity requirements well, such that the marginal capacity benefit of

subsequent solar projects becomes quite low until demand increases. The following solar project, provisionally designated MIS Solar IPP 2025, has been assessed a capacity contribution of 2% (10 MW). Further, the Solar PV 2027 project is not anticipated to provide any capacity contribution.

OPWP may revise the capacity contribution assessments at a later time as more information becomes available, such as the technology and configuration of projects as defined at the contract award stage, and further information on weather impacts, and the evolution of the demand profile.

Despite diminishing contributions to capacity needs, the solar PV projects provide tremendous value to electricity customers by reducing the cost of generation during the daytime, when electricity demand is highest, and by reducing the electricity sector's reliance on natural gas, which can be better utilized to stimulate economic development in other sectors. OPWP's RE development plan will continue to feature solar PV as we have demonstrated that this technology will continue to reduce the total system cost of electricity generation.

OPWP has also re-assessed the capacity contributions of wind projects. OPWP has utilised ground-measured wind data in Harweel, and satellite data for the proposed sites at JBB and Duqm. The wind data provides the basis to assess hourly wind output profiles, as they fluctuate daily and seasonally. Wind project output is expected to be generally high throughout the night during the summer season, complementing the output profile of solar IPPs. OPWP estimates the contribution of wind projects to generation adequacy at around 50% of the projects' installed capacity. This may change as on-going measurements through the WRA are utilized in energy yield assessments to support project feasibility analyses. Subsequently, these values may change once again after project award as OPWP would update the analyses based on the awarded project, technology, and layout.

OPWP also notes that it is in the process of improving its own modelling practices in order to obtain a more accurate survey of the level of capacities that may be installed at the sites allocated for the development of wind power projects. OPWP notes that the capacities presented in this 7 Year Statement for the wind power projects represents a conservative indication of what is achievable and may seek to modify these indicative capacities in future iterations of the 7 Year Statement.

In 2018, OPWP completed a feasibility study of a waste-to-energy (WTE) project, for a project at Barka to be supplied by Be'ah[8] with municipal waste collected from Muscat and South Batinah Governorates. The project was included in Issue 13 of OPWP's 7-Year Statement, with a minimum capacity of 100 MW. The project was suspended, but OPWP has since received instructions from the APSR to engage in discussions with Be'ah with respect to revised project parameters, to update the feasibility study and then resubmit the project for government review. OPWP is currently in the process of reviewing the feasibility study and is engaging with the relevant stakeholders. OPWP plans to complete the updated feasibility study in Q3 2021. If the Government approves the project, OPWP would include it in the RE development plan and 7-Year Statement to be issued next year.

Private Solar Projects and Demand Response

In Issue 14 of the 7-Year Statement, OPWP described plans for developing a Demand Response program, and projected the impact of private solar PV developments on capacity needs. OPWP continues to project the scale of private solar PV development for its impact on the power system, but the assessed system impact is now embedded within the demand forecast (rather than being treated as an explicit supply resource). Rooftop solar projects and other private solar PV developments are expected to grow steadily.

[8] Be'ah (Oman Holding Company for Environment Services SAOC) was established by Royal Decree (46/2009) to undertake solid waste management and framing sustainability goals in terms of resource preservation in the Sultanate of Oman.

Demand Response (DR) can provide a significant and cost-effective resource toward reducing capacity requirements. OPWP had planned to conduct a study of DR potential and develop a roadmap, however this has been postponed as part of budget reduction directives in response to the COVID-19 pandemic crisis. OPWP expects to take up this activity at a later time.

Procurement Plans and Spot Market

OPWP currently plans to procure future capacity and energy needs via dedicated procurement rounds (i.e., long-term contracts) and the Spot Market. In Q4 2020, Authority began a process of reviewing the overall capacity procurement framework with a view of establishing a plan that will provide clarity to all stakeholders for the next 10 years.

Current plans for procurement rounds and Spot Market initiatives are described below. Details of the plans may be subject to change following the capacity procurement framework review:

- **Power 2024.** The target for procurement in the possible Power 2024 is dependent upon the review of capacity procurement framework and the capacity target for procurement through the Spot Market.

- **Power 2026 / 2027.** At the time of preparing this publication and in alignment with OPWP intent to review procurement needs for long-term contracts every two years, Power 2026 / 2027 is maintained as a potential round for procurement that may materialize following the outcome of Power 2024 and if OPWP identifies a need for capacity that was not met by Power 2024 nor procured through the Spot Market.

- **Electricity Spot Market.** The introduction of the Spot Market in Oman will have OPWP purchasing some electricity through a short-term market run each day, with prices for each half hour set each day based on what Generators have offered to sell. The electricity Spot Market will operate alongside the existing system of long-term P(W)PAs; only generation capacity not covered by existing P(W)PAs will receive payments via the Spot Market.

  Generators in the Spot Market are paid two types of charges on monthly basis:

  - **Energy Credits:** Reimburses for energy delivered based on the System Marginal Price (SMP), which is calculated using the offer curves of the Pool Scheduling Units as the price to meet a marginal increase in pool demand.

  - **Scarcity Credits**: A type of availability payment which contributes to generation plant fixed cost. Scarcity prices will vary up and down depending on system supply-demand tightness.

  The Spot Market will be implemented in the MIS initially. The development phase of the MMS IT System has concluded, and it is currently undergoing acceptance testing. The market is scheduled to begin operational trials during Q3 2021 with commercial operation following thereafter.

Considering the uncertainty about the level of market participation by uncontracted generators prior to market launch, OPWP has not yet assigned a value to their expected capacity contributions. This value will be assessed and updated in future 7 Year Statements once more information can be made available.

OPWP notes that pervious iterations of the 7 Year Statement included plans for a Power 2022 procurement round. However, given the impact of the COVID-19 pandemic on the economy and the subsequent effect it has had on electricity demand (current and forecasted), OPWP is unable to proceed with the Power 2022 procurement round as any award would lead to further over-capacity and may undermine potential contributions from the Spot Market. OPWP notes that APSR is developing an alternative framework in the form

of bilateral agreements that would allow generators to undertake direct-sales agreement with certain customers. APSR will coordinate further with relevant stakeholders regarding their participation under the bilateral agreements framework.

Table 4 summarizes the capacity expectations from these resources.

Table 4 Procurement Plans and Spot Market - MIS

	2021	2022	2023	2024	2025	2026	2027
				MW			
Power 2024	-	-	-	TBD	TBD	TBD	TBD
Power 2026 / 2027	-	-	-	-	-	TBD	TBD
Spot Market	-	TBD	TBD	TBD	TBD	TBD	TBD
Total Capacity Need[a]	**-**	**-**	240	1,250	1,270	1,310	1,420

[a] "Total Capacity Need" represents amount of capacity required to achieve targeted reserve margins. Values from 2023-2027 may change subject to the updates to demand forecasts.

Capacity Transactions with Other Power Systems.

Energy trades or firm capacity purchases from neighbouring power systems are important potential resources. Firm capacity exchanges have taken place between OPWP and EWEC in 2016 and 2018, and a capacity export to EWEC took place in 2020. OPWP finalized arrangements with GCCIA to facilitate trade agreements with other GCCIA Member States.

The 400 kV North-South Interconnect project is currently on schedule for completion in 2023. OPWP and Tanweer have coordinated supply plans accordingly for Duqm, Mahout and the MIS. These systems will be fully integrated and power flows between them will not be considered as capacity transactions.

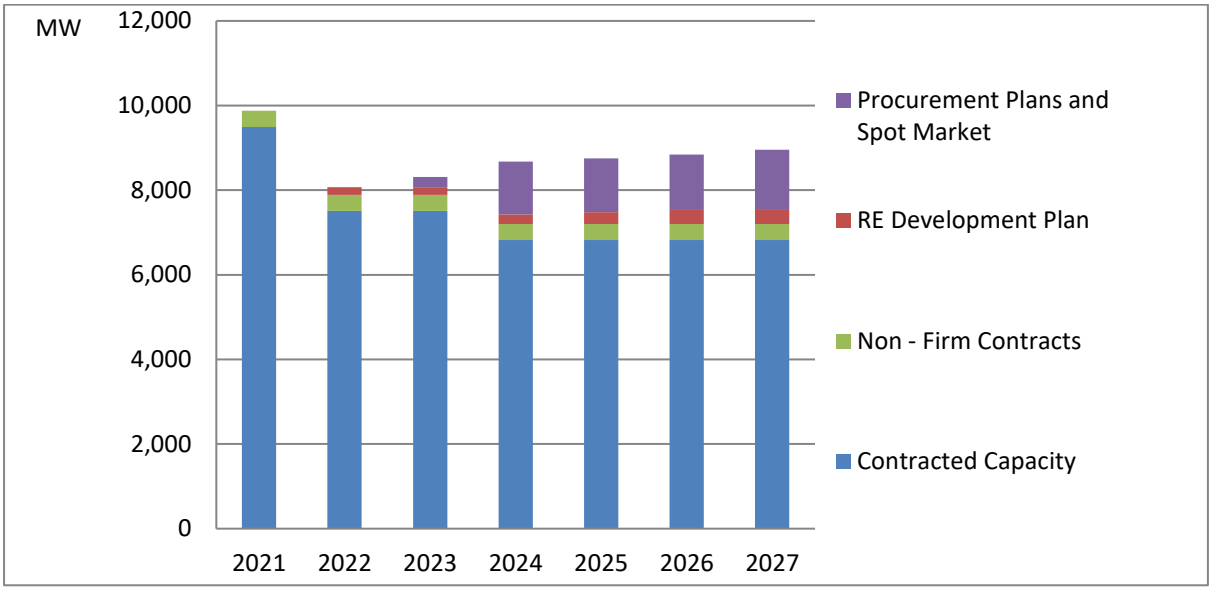
The 400 kV connection with the PDO system at Nahadah will enable large-scale capacity transactions and operational integration with PDO. No specific transactions have yet been planned, but OPWP and PDO are currently integrating resource plans relevant to the MIS and northern PDO system.

A direct 400 kV interconnect from Ibri to the Kingdom of Saudi Arabia and linking to GCCIA has also been evaluated and is in the planning process. This project would provide direct access to all GCCIA Member States and would enhance the benefits in stability, generation planning, and trade opportunities relative to the existing 220 kV link via UAE.

Summary

Figure 4 provides a summary of OPWP's current plans for generation capacity and resource development in the MIS for the period 2021 to 2027. The capacity indicated for each year corresponds to the quantity available as of the onset of the summer peak.

Figure 4 Capacity Contributions from Generation Resources – MIS



	2021	2022	2023	2024	2025	2026	2027
				MW			
Contracted Capacity	**9,495**	**7,511**	**7,511**	**6,823**	**6,823**	**6,823**	**6,823**
Capacity Contributions from:							
Non - Firm Contracts	380	380	380	380	380	380	380
RE Development Plan	0	180	180	225	280	330	330
Procurement Plans and Spot Market	-	-	240	1,250	1,270	1,310	1,420
Total	**9,875**	**8,071**	**8,311**	**8,678**	**8,753**	**8,843**	**8,953**

c. Resource Adequacy and Mitigation Plans

Statutory and Regulatory Requirements

OPWP is required by the Sector Law and its license to ensure the adequacy of generation resources to meet future power demands. The Sector Law establishes OPWP's general responsibility to secure sufficient generation resources to meet the aggregated demands of licensed electricity suppliers. Further to this, the license issued to OPWP by the Authority for Public Services Regulation, Oman (APSR) stipulates a specific generation security standard for the MIS that OPWP must comply with.

The generation security standard sets a maximum duration of power outage for the system, termed Loss-of-Load Hours ("LOLH"). OPWP must enter into agreements for enough production capacity to ensure that expected demand does not exceed available capacity for more than 24 hours in any year. This LOLH measure considers relevant uncertainties such as the reliability of generation units and the availability of non-firm generation resources. On a short-term basis, OPWP must demonstrate to the APSR that sufficient supply agreements are in place to prevent an excess of 24 LOLH. On a long-term basis, OPWP must demonstrate that it has credible plans to put such agreements in place (via the procurement of new capacity or otherwise).

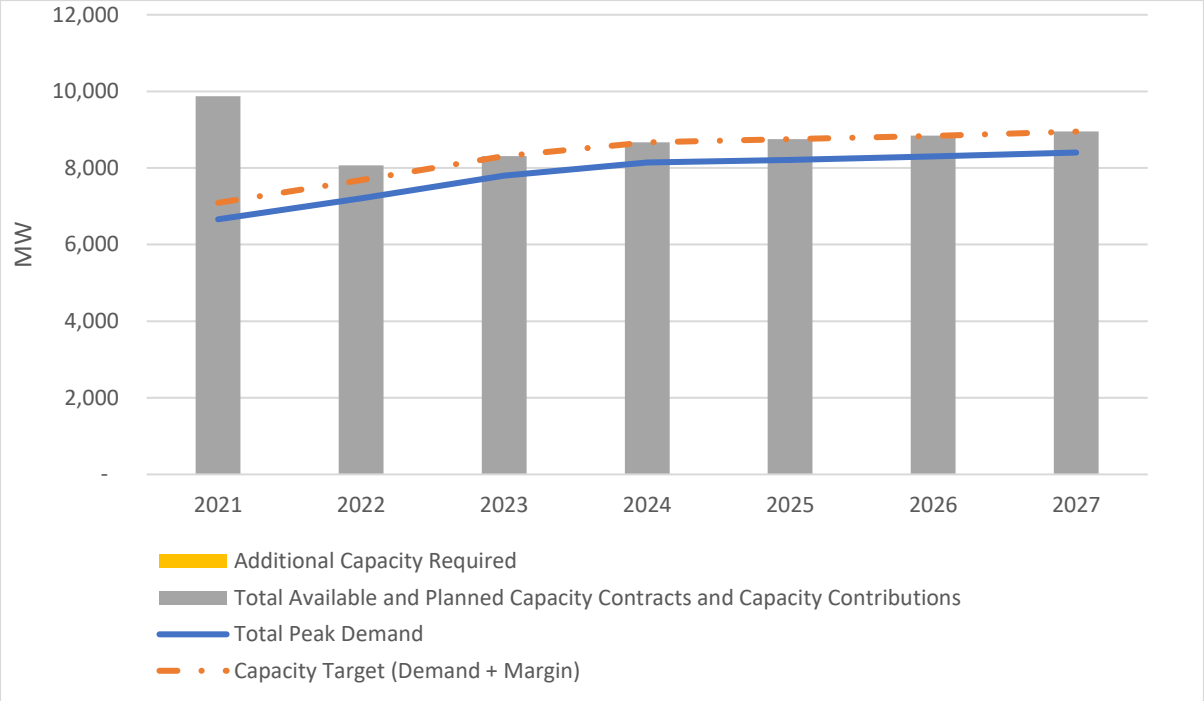
OPWP conducts computer simulations of power system performance to assess LOLH under a wide range of conditions that fluctuate randomly. The simulations are the basis for determining the expected level of LOLH and the adequacy of generation to meet the statutory standard. Generally, the number and type of generating units and the demand profile affect the expected LOLH level, which may also be sensitive to generation technology and other factors.

Resource Adequacy in the Expected Demand Scenario

During the 7-year planning horizon OPWP commits to meeting the minimum reliability standard of 24 LOLH, ensuring that after accounting for demand variability and potential forced outages from generators, the potential occurrences of insufficient supply does not exceed 24 hours in a given year. In order to translate this reliability standard into power capacity planning, OPWP assesses that, on average, a reserve margin of at least 6.5% over forecast peak demand is necessary to assure that expected LOLH in the MIS is 24 hours or less. The 6.5% reserve margin provides a capacity target, and OPWP evaluates resource adequacy on this basis for 2021 to 2027. The assessment can change as the power system develops. In future, as OPWP investigates the impact of new technologies, such as intermittent RE projects, the assessment of loss-of-load incidence may change.

The resource development plan is developed to provide sufficient capacity to meet the generation security standard for the Expected Demand scenario, with allowances for feasible mitigations that address requirements of the Low and High Demand scenarios. Figure 5 compares planned capacity with the capacity target under the Expected Demand scenario. The resource development plan provides sufficient capacity to exceed the capacity target in every year, as described below.

Figure 5 Resource Adequacy in the Expected Demand Scenario - MIS



	2021	2022	2023	2024	2025	2026	2027
Expected Case Scenario	MW						
Peak Demand	6,660	7,210	7,640	7,960	8,020	8,200	8,370
Duqm Export/Import (+/-) [a]			160	182	193	101	32
Total Peak Demand	**6,660**	**7,210**	**7,800**	**8,142**	**8,213**	**8,301**	**8,402**
Capacity Target (Demand + Margin)	**7,090**	**7,680**	**8,310**	**8,670**	**8,750**	**8,840**	**8,950**
Total Available and Planned Capacity Contracts and Capacity Contributions	**9,875**	**8,071**	**8,311**	**8,678**	**8,753**	**8,843**	**8,953**
Additional Capacity Required	-	-	-	-	-	-	-

[a] The 400 KV MIS - Duqm Interconnect is expected to be completed by June 2023 allowing MIS supply.

In 2021, contracted capacity exceeds demand by a significant margin. This is due to capacity additions that were committed before the extent and effects of the economic downturn on demand became evident. However, the costs of additional capacity were largely offset by the value of fuel savings enabled by the highly efficient generators that were added. In 2022, the capacity surplus is expected to fall by 85%, reaching a state of balance with the capacity requirements in 2023.

For 2022, OPWP has identified that, due to the impact of COVID-19 and global economic recession on the demand forecast, the Power 2022 procurement round has been terminated. APSR is leading the efforts for the development of bilateral agreements as an alternative framework to facilitate direct-sales arrangements between generators and certain customers. APSR will coordinate with the relevant stakeholders in this regards.

Under the Expected Demand scenario, currently contracted capacity along with contributions from contracted RE projects and non-firm resources are sufficient to meet the capacity target in 2022. In 2023, an additional 240

MW is needed to maintain reliability standards in the system (in order to achieve 24 LOLH), which OPWP plans to procure through the Spot Market.

In June 2023, it is anticipated that the first phase of the North-South Interconnect project (including from Izki to Nahadah in the PDO system, Barik and Suweihat in the PDO system and then to the Duqm Power System, and on to Mahout) will be completed. As such, Figure 5 accounts for additional demand requirements of the Duqm Power System (Expected Case) that can be met by utilising capacity in the MIS.

In 2024, Barka II IWPP will reach the end of its P(W)PA term. The long-term capacity needs through 2027 may be met by a potential Power 2024 procurement process and the Spot Market, although OPWP may also consider a procurement round in 2026 or 2027 depending upon developments. The procurement target and timeline for a possible Power 2024 is dependent upon the conclusions from the review of the capacity procurement framework and the capacity target for procurement through the Spot Market.

OPWP currently envisions that procurements for guaranteed capacity would occur approximately every two years. The timing will depend on the need for capacity, the scope and timing of expiring contracts, lessons learned in the Power 2022 and possible Power 2024 procurements, capacity contributions from the Spot Market, and other factors such as the objective to foster competition in the procurement. A significant amount of capacity is scheduled to come out of contract in 2028 (Barka III and Sohar II IPPs) and in 2029 (Sur IPP). This will be taken into account in the plan for the next major procurement round in the future.

Mitigation Options for the High Case Demand Scenario

In the High Case demand scenario, the capacity requirement in 2023 is about 580 MW higher than under the Expected Case scenario, and about 1,400 MW higher in 2027. Similar to the Expected Case above, the High Case also accounts for supply requirements to the Duqm Power System, also under the High Case for that demand area. The High Case is a plausible, upper-bound demand scenario: it is possible but unlikely that demand would exceed this level. But it is also quite likely that demand will be between the High Case and Expected Case scenarios. The following paragraphs consider options to mitigate capacity needs in the range between these two demand scenarios.

Figure 6 illustrates resource adequacy for this scenario. In 2022, there is a minor deficit of about 99 MW less than the capacity target, and in 2023 there is a deficit of nearly 589 MW. This deficit increases to almost 1,400 MW by 2027. Contingency options to cover these potential deficits if demand trends against the High Case, are illustrated in described below:

- **Power 2026/2027 Procurement Round.** OPWP has considered the potential for the next round of procurement to be in 2026 or 2027, depending on the need for capacity. The amount of capacity may be adjusted in consideration of needs in 2027 and 2028, existing contract expirations in those years, the competition process to be developed for the procurement round, and developments in the Spot Market. As per current forecasts of the High Case Demand scenario, an additional 500 MW of Capacity through a Power 2027 Procurement Round would be required.

- **Spot Market Capacity.** The largest of the contingency options is our assessment of spot market resources, comprising plants that represent generators with expiring P(W)PAs and may participate in the Spot Market as uncontracted generation. OPWP anticipates that up to 1,475 MW may be available from the Spot Market in 2022. The feasibility to extend permits or other necessary conditions for plant operation would alter this assessment accordingly, as would changes in the assessment of market prices.

- **GCC Interconnection Exchange.** OPWP notes that the interconnection with the GCCIA is a double circuit link that support reliable transfers of up to 400 MW. This transfer of energy has already been

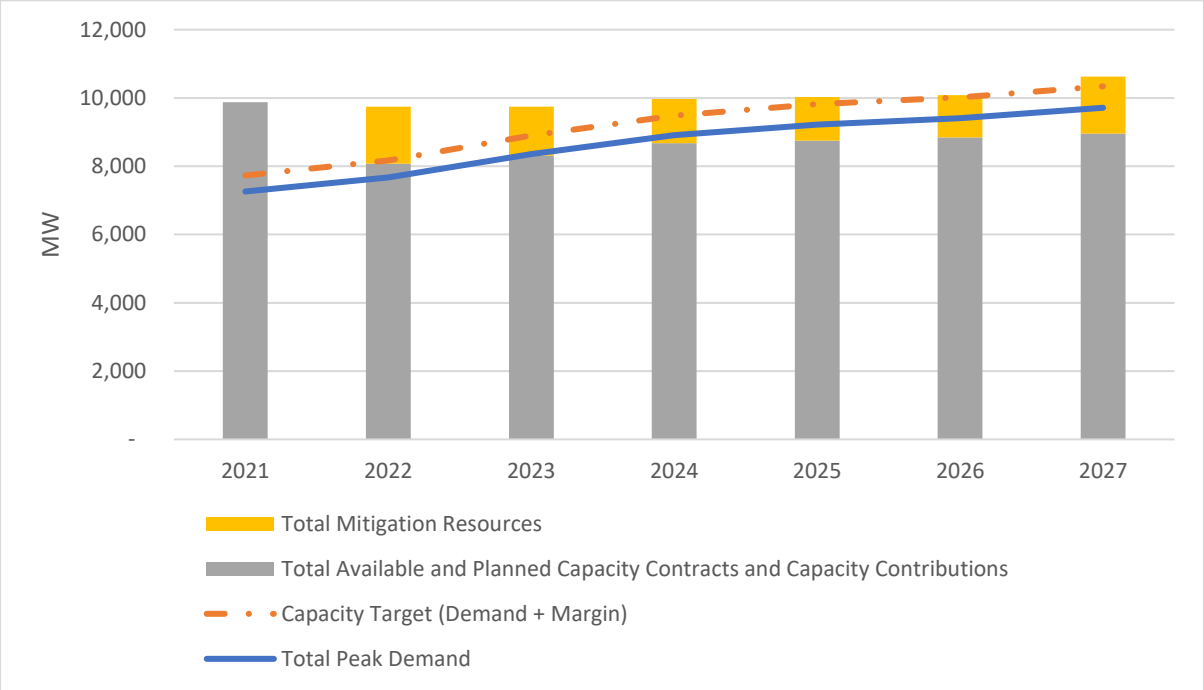
demonstrated in the recent years and, accordingly, OPWP is able to rely on potentially cost-effective exchanges across the GCCIA to secure an additional 200 MW (200 MW is in addition to the 200 MW already accounted for under the Expected Case for a total of 400 MW). OPWP reviews these opportunities and the economic benefits of conducting an exchange across the GCCIA on an annual basis.

- **Demand Response.** Under a High Case Demand Scenario, Demand Response may become a useful contingency resource due to its ability to directly incentivize a reduction in demand during specific periods in the year and during specific periods in the day. This would allow OPWP to directly reduce peak demand requirements for a given year. While this option still requires further research, study, and approvals to be implemented, OPWP recognizes its potential cost-effective application in certain circumstances.

- **Captive Power Plants.** As a number of industrial plants have captive generators that may not be fully utilized for their own internal processes, OPWP may seek to undertake negotiations with such generators on a short-term basis to assist in covering peak demand requirements for a given year.

These mitigation options confirm OPWP's ability to respond to a surge in demand beyond our Expected Demand forecast. This is important considering the Sultanate's aspirations to stimulate economic growth, and particularly to attract investment in the new industrial hub of Ad Duqm and other industrial zones.

Figure 6 Mitigation Options for the High Case Demand Scenario – MIS



	2021	2022	2023	2024	2025	2026	2027
High Case Scenario	MW						
Peak Demand	7,260	7,670	8,150	8,670	8,960	9,240	9,610
Duqm Export/Import (+/-)	-	-	203	236	257	168	103
Total Peak Demand	**7,260**	**7,670**	**8,353**	**8,906**	**9,217**	**9,408**	**9,713**
Capacity Target (Demand + Margin)	**7,730**	**8,170**	**8,900**	**9,480**	**9,820**	**10,020**	**10,340**
Total Available and Planned Capacity Contracts and Capacity Contributions	**9,875**	**8,071**	**8,311**	**8,678**	**8,753**	**8,843**	**8,953**
Additional Capacity Required	**-**	**99**	**589**	**802**	**1,067**	**1,177**	**1,387**
Mitigation Strategy for Deficit							
2026/2027 Procurement Target	-	-	-	-	-	TBD	500
Spot Market Capacity	-	1,475	1,235	1,095	1,075	1,035	925
GCC Interconnection Purchase[a]	-	200	200	200	200	200	200
Demand Response	-	-	-	-	TBD	TBD	TBD
Captive Power Plants	-	TBD	TBD	TBD	TBD	TBD	TBD
Total Mitigation Resources	**-**	**1,675**	**1,435**	**1,295**	**1,275**	**1,235**	**1,675**
Total Available and Mitigation Resources	**9,875**	**9,746**	**9,746**	**9,973**	**10,028**	**10,078**	**10,628**
Remaining Capacity Need	**-**	**-**	**-**	**-**	**-**	**-**	**-**

[a] Value provided here represents the maximum import considered.

Mitigation Options for the Low Case Demand Scenario

In the Low Case demand scenario, the capacity target is around 1,410 MW less than in the Expected Demand scenario by 2027. In order to minimize capacity surpluses in case of low demand growth, OPWP would implement mitigation options such as reducing capacity procurement targets and improving capacity utilisation via exports. Mitigation options are described below, and shown with their impacts in Figure 7:

- **Adjust Procurement Round and Spot Market Targets.** The capacity requirement in 2023 and 2024 is currently planned to be met through a combination of Spot Market contributions and new contracts via the possible Power 2024, with an increased reliance on Spot Market contributions throughout to 2027. The amount from possible Power 2024 will be assessed prior to the launch of the procurement activities. If demand were to track the current Low Case, the capacity requirement for the Spot Market and possible Power 2024 may be less, and the procurement target would be adjusted accordingly. The values presented here reflect the inverse of the Procurement Plans and Spot Market, and represent the upper end of possible reductions in procurement activities, whether through long term contracts or via the Spot Market.

- **GCCIA Interconnection Export.** The GCCIA interconnect via UAE will accommodate up to 400 MW of capacity export. OPWP would explore export contracts with GCC Member States, provided they would cover generation costs and the economic value of gas supply as defined by MEM. OPWP exported 400 MW to one of the Member States in 2020 and OPWP explores the possible trading opportunities with other GCC member state.

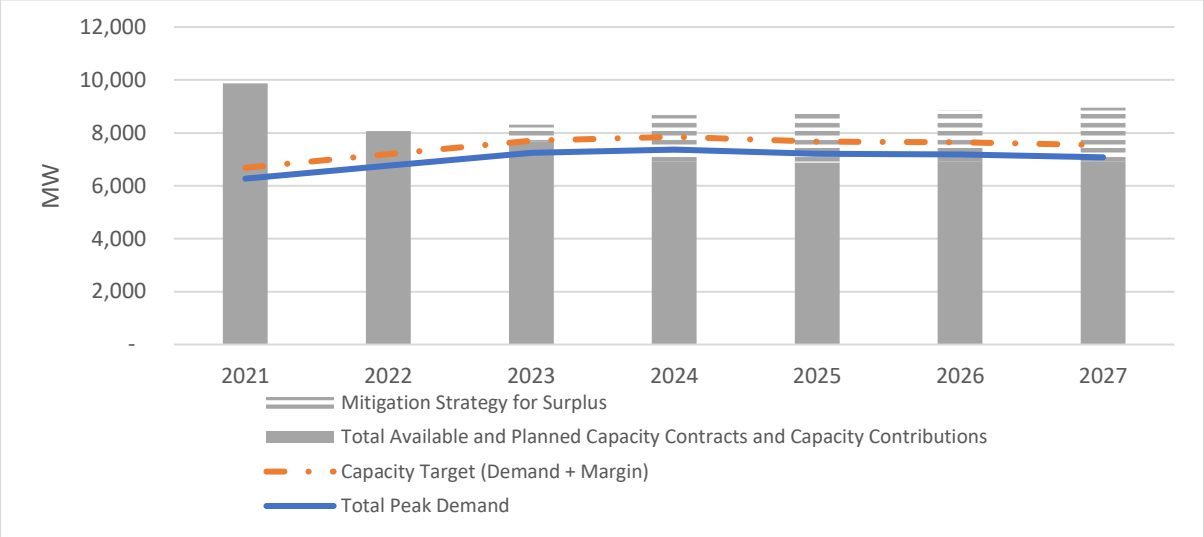
- **PDO (and other oil developers) Export.** The North-South Interconnect will permit increased levels of energy trading with PDO mid of 2023. The potential for export to PDO is currently uncertain. A large share of PDO generation is dedicated to steam generation for oilfields, with electricity as a by-product, and cannot be displaced. Other generators would be candidates for displacement by lower cost energy

imports. However, PDO and the other oil developers are also currently considering development of solar PV plants to offset thermal generation. OPWP currently coordinates resource development plans with PDO. Exports to PDO as a capacity mitigation option by OPWP would be explored if needed through this coordination. PDO can import at least 100 MW using the new North-South Interconnector without major system modification.

- **Exports to Displace Captive Power Generation.** A number of industrial plants have captive generation plants, which they utilise either as a cost-saving measure or to provide a high level of supply security. OPWP would explore opportunities to supply to these industries during periods when costs may be less than their own cost of generation. The potential for such exports in the MIS may be 100 MW or more.

Figure 7 demonstrates that, under a low demand scenario, OPWP has options available to minimize the potential for capacity surpluses and thereby manage costs.

Figure 7 Mitigation Options for the Low Case Demand Scenario - MIS



	2021	2022	2023	2024	2025	2026	2027
Low Case Scenario	MW						
Peak Demand	6,270	6,760	7,140	7,260	7,090	7,160	7,130
Export to Duqm	0	0	100	108	115	20	- 51
Total Peak Demand	**6,270**	**6,760**	**7,240**	**7,368**	**7,205**	**7,180**	**7,079**
Capacity Target (Demand + Margin)	**6,680**	**7,200**	**7,710**	**7,850**	**7,670**	**7,650**	**7,540**
Total Available and Planned Capacity Contracts and Capacity Contributions	**9,875**	**8,071**	**8,311**	**8,678**	**8,753**	**8,843**	**8,953**
Surplus over Capacity Target	**3,195**	**871**	**601**	**828**	**1,083**	**1,193**	**1,413**
Mitigation Strategy for Surplus							
Adjust Procurement Round and Spot Market Targets	-	-	- 240	- 1,250	- 1,270	- 1,310	- 1,420
GCC Interconnection Export	-	-	- 400	- 400	- 400	- 400	- 400
PDO (and other oil developers) Export	-	-	-	-	- 100	- 100	- 100
Export to Displace Captive Power Generation	-	-	-	- 100	- 100	- 100	- 100
Total Mitigation Resources	**-**	**-**	**- 640**	**- 1,750**	**- 1,870**	**- 1,910**	**- 2,020**
Remaining surplus	**3,195**	**871**	**-**	**-**	**-**	**-**	**-**

d. Combining Power Generation and Water Desalination

In developing its plans for procuring power generation resources, OPWP is required to consider the opportunity for combining power generation with water desalination so as to benefit from economies of co-location and co-procurement. The latest examples of combined development of power and desalination capacity are the Salalah IWPP in Dhofar (COD in 2011) and the Barka II IWPP (COD in 2009) in the MIS. In both cases, bidders proposed to use RO rather than MSF technology for water desalination, although the procurement specifications did not specify the technology to be used. OPWP expects that future plants will also be proposed to use RO technology due to its economic advantage.

OPWP does not anticipate a need both for power and water desalination capacity in a common location during the forthcoming 7-year period.

1.2 AD DUQM POWER SYSTEM

Ad Duqm is located on the eastern coastline of the Al Wusta region, approximately halfway between the Main Interconnected System (MIS) and the Dhofar Power System (DPS). The latest population data from the National Centre for Statistics & Information reports that the total population in Wilayat Al Duqm, as of 2020, is 20,505[9]. This figure represents 28% growth when compared against 2019 population and is linked to the rapid developments of a new economic and industrial centre.

The Ad Duqm region is currently served by a relatively small integrated generation and distribution system, owned and operated by Tanweer, the Rural Areas Electricity Company. Tanweer owns and operates a 67 MW diesel-fuel fired power plant for supply to this grid area. Tanweer is the sole licensed electricity supplier within the service area covered by the system, supplying existing and new electricity customers.

The North-South Interconnect project is under construction by OETC and is expected to connect the Ad Duqm Power System to the MIS in 2023. Following this connection, Ad Duqm demand may be served mainly by lower cost generation in the MIS.

a. Demand for Electricity

Historical Demand

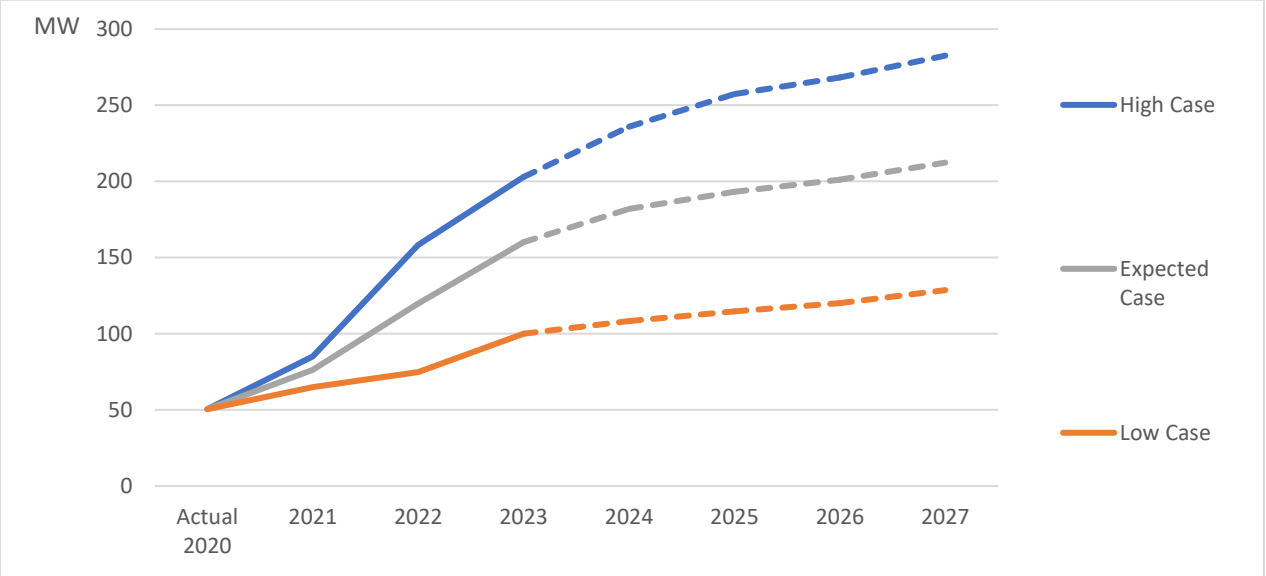
Historically, all requirements to meet electricity demand in Ad Duqm has been within the jurisdiction of Tanweer. However, Duqm is currently experiencing ongoing development of large commercial, tourism, and industrial projects. In addition, the grid will expand further as new demand centres are connected such as Mahout.

Demand Projections

For the purposes of electricity demand projections, OPWP reports demand projections as provided by Tanweer up to the year 2023. These demand projections reflect domestic and industrial/commercial developments as received by Tanweer in the form of applications for new connections. From 2024 towards the end of the forecast period, OPWP has included additional bulk customers in all scenarios assuming different growth pace for the low and high case scenarios.

[9] National Centre for Statistics & Information (2021) *Data Portal - Population.*

Figure 8 Electricity Demand Projections – Ad Duqm Power System



	Actual 2020	2021	2022	2023	2024	2025	2026	2027	Average Growth (%)
					MW				
Expected Case	**51**	**76**	**120**	**160**	**182**	**193**	**201**	**212**	**23%**
Change from Statement (2020-2026)	*-11*	*6*	*38*	*-12*	*-25*	*-26*	*-31*	-	
Low Case	**51**	**65**	**75**	**100**	**108**	**115**	**120**	**129**	**14%**
Change from Statement (2020-2026)	*-5*	*3*	*6*	*25*	*-71*	*-71*	*-73*	-	
High Case	**51**	**85**	**158**	**203**	**236**	**257**	**268**	**283**	**28%**
Change from Statement (2020-2026)	*-17*	*5*	*61*	*18*	*9*	*12*	*-56*	-	

Under the Expected Case scenario, peak demand is expected to grow at an average rate of 23% per year, from 51 MW in 2020 to 212 MW in 2027. The Expected Case scenario accounts for historical demand and normal population growth within the area, the inclusion of interlinked and new demand areas, and demand related to committed and ongoing industrial and infrastructure projects within the Ad Duqm area. Mahout is expected to be connected to Duqm in 2022. Following the completion of the North-South Interconnect project to the MIS in 2023, demand in Mahout is expected to be absorbed by the system, and as such, is included in the demand projections.

The High Case scenario assumes that more of the prospective projects become committed. This scenario anticipates an average growth rate of 28% in peak demand, increasing from 51 MW in 2020 to 283 MW in 2027. This also includes a higher growth scenario in the Mahout demand area.

Alternatively, the Low Case scenario assumes a slower rate of materialisation in prospective projects in the Duqm region, in addition to possible delays in major projects and lower growth rate of demand in Mahout following its interconnect in the year 2024. The Low Case scenario anticipates an average growth rate of 14% in peak demand, increasing from 51 MW in 2020 to 129 MW in 2027.

These projections do not include uncommitted projects in the industrial area, i.e., the potentially large influx of industrial demand associated with SEZAD development plans. SEZAD plans large-scale industrial projects, diverse

economic developments, and associated residential and commercial requirements over the next 30 years Accordingly, the demand growth rate within the zone is expected to accelerate rapidly as key projects are established. OPWP will attend closely to the development pace and implications for electricity demand.

b. Power Generation Resources

Sources of Power

Ad Duqm and its surrounding areas are currently supplied by a single power station in the Ad Duqm system. This power station, which is owned and operated by Tanweer, has a capacity of 67 MW and utilises diesel-fired generators.

Resource Development Plan

The existing 67 MW diesel-fired power plant is insufficient to reliably meet expected demand requirements starting in the year 2021 under the Expected Case scenario. Figure 9 compares the demand trend with supply, including OPWP's resource development plan. As an isolated power system, Tanweer can reliably supply nearly 60 MW of peak demand from its existing plant, allowing a margin equivalent to the loss of its largest generation unit (7.5 MW). The North-South Interconnect will allow electricity supply to Ad Duqm from the MIS by mid of 2023, at much lower cost than Tanweer's existing diesel generation plant. To meet the supply gap from 2021 until that time, Tanweer informed OPWP that they are in final stages to sign a three years PPA with Marafiq. This agreement would allow Tanweer to withdraw up to 60 MW in 2021, increasing to 80 MW by 2022. This PPA has an early termination option that would allow Tanweer to exit the agreement if required to do so upon the completion of the North-South Interconnection. Further, Tanweer intends to decommission their existing diesel generator by 2025, maintaining it in the interim as stand-by capacity.

Wilayat Ad Duqm has substantial potential for wind energy.[10] OPWP's initial plans are to develop around 200 MW of installed capacity in 2025. OPWP expects the capacity contribution to be about 100 MW (50% of installed capacity), based on analysis of the correlation between wind output and the demand profile, and the expected contribution toward meeting LOLH requirements. These plans are illustrated in Table 5.

Table 5 Renewable Energy Development Plan - Ad Duqm Power System

	2021	2022	2023	2024	2025	2026	2027
	MW						
Duqm Wind IPP 2025[a]	-	-	-	-	-	200	200
Duqm II Wind IPP 2027[a]	-	-	-	-	-	-	160 [b]
Total - Installed Capacity	-	-	-	-	-	**200**	**360**
Total - Capacity Contributions	-	-	-	-	-	**100**	**180**

[a] Estimated capacity contribution for this project is tentatively set at 50%, pending the assessment of ground-measured wind data.

[b] Expected capacity for the Duqm II Wind IPP is anticipated to change following further site and resource assessments.

OPWP plans for solar and wind projects in the Ad Duqm Power System are as per the following:

- **Duqm Wind IPP 2025.** OPWP plans to develop a wind power project in the Duqm region for COD in Q3, 2025. OPWP has access to a site in SEZAD and is currently undertaking a pre-feasibility of developing a Wind

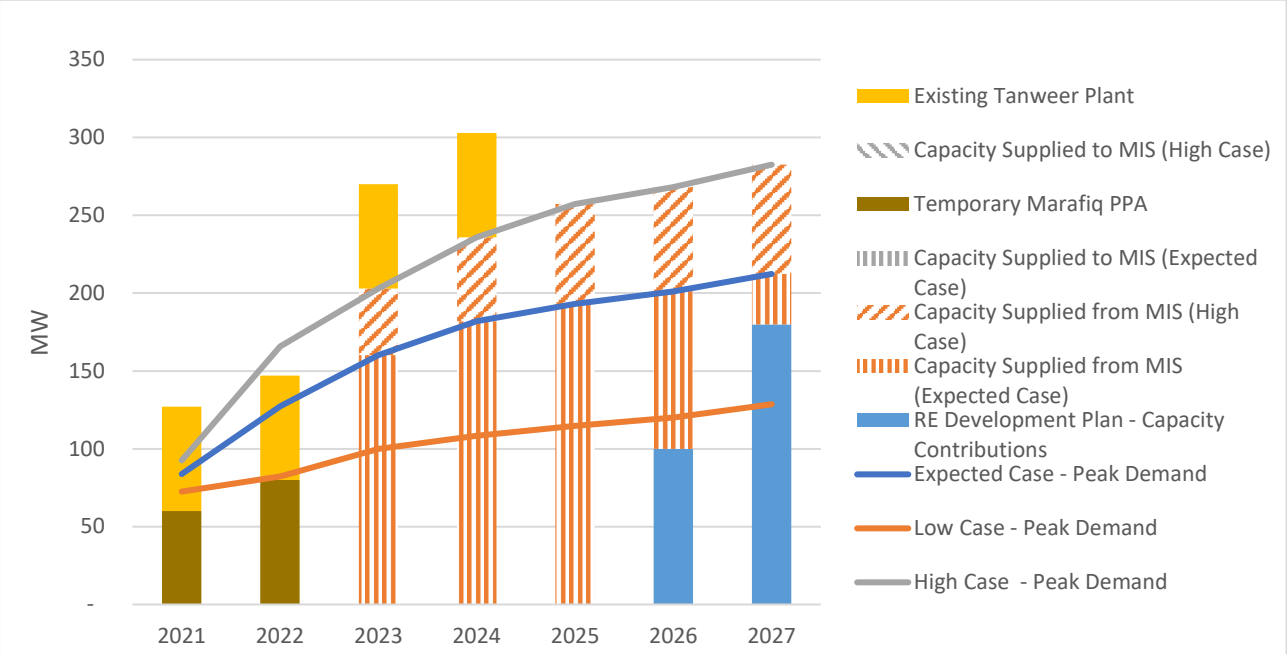
[10] Satellite data illustrates that annual mean wind speeds are in excess of 7 m/s.

IPP at the site. As part of OPWP's Wind Resource Assessment Campaign (WRA), two 100 metre wind masts were installed in February 2020 to collect at least one year of wind data prior to release of the RFP (the data collected here will be made available to the public via OPWP's website). OPWP plans to issue the RFQ in Q1 2022 and the RFP in Q3 2022. The installed capacity is nominally estimated at around 200 MW, but will be confirmed following assessment of the measured wind data and wind farm layout optimization analyses.

- **Duqm II Wind IPP 2027.** OPWP plans to develop additional wind power projects in the Duqm region for COD in 2027. OPWP has access to a site approximately 60 kilometres from the city of Duqm and intends to develop a utility-scale wind power project with a capacity of at least 160 MW. The capacity of this project will likely be updated in the following issue of the 7 Year Statement as additional site assessments are carried out and on-ground data measurements are collected. OPWP plans to have collected at least 1 year of ground-measurement data from this site by Q3 2022 and will proceed with a feasibility study that will guide the development of a wind power project in this location.

Figure 9 demonstrates resource adequacy balance for the Duqm Power System taking into account all of the resource described above. OPWP notes that with the Marafiq Temporary PPA, Tanweer is able to secure all capacity needs for the 2021 – 2022 period until such time where the North-South Interconnect to the Duqm Power System is completed and it would be able to rely on resources from the MIS to meet capacity needs.

Figure 9 Resource Adequacy – Ad Duqm Power System



	2021[a]	2022[a]	2023	2024	2025	2026	2027
Peak Demand				MW			
Expected Case	83	126	160	182	193	201	212
Low Case	72	81	100	108	115	120	129
High Case	92	165	203	236	257	268	283
Contracted Capacity							
Existing Tanweer Plant	67	67	67[b]	67[b]	-	-	-
Prospective Capacity							
Temporary Marafiq PPA	60	80	-	-	-	-	-
RE Development Plan - Capacity Contributions	-	-	-	-	-	100	180
Capacity Supplied from (+) / to (-) MIS							
Expected Case	-	-	160	182	193	101	32
Low Case	-	-	100	108	115	20	-51
High Case	-	-	203	236	257	168	103
Additional Capacity Required							
Expected Case	-	-	-	-	-	-	-
Low Case	-	-	-	-	-	-	-
High Case	-	**19**	-	-	-	-	-

[a] Peak Demand in 2021 and 2022 are inclusive of an additional margin of 7.5 MW for reliability. This value is not included once the Duqm Power System connects to the MIS in 2023 as the 6.5% margin in the MIS would supersede the 7.5 MW margin required by the Duqm Power System.
[b] After the completion of the North-South Interconnect, the existing Tanweer diesel generator will be maintained as stand-by capacity, and all demand in the Duqm Power System, extending to Mahout, will be met by capacity from the MIS. Accordingly, "Capacity Supplied from (+) / to (-) MIS" is exclusive of this capacity.

1.3 DHOFAR POWER SYSTEM

The Dhofar Power System (DPS) covers the city of Salalah and surrounding areas in the Governorate of Dhofar, serving around 121,190[11] electricity customers.

The DPS comprises three generation facilities, the 132 kV transmission grid that is owned and operated by Oman Electricity Transmission Company (OETC), and the distribution network which is owned and operated by the Dhofar Integrated Services Company (DISC). DISC also acts as the supplier of electricity for consumers in the Dhofar Power System.

The DPS is interconnected with the Petroleum Development Oman (PDO) power system via a 132 kV link between Thumrait and Harweel, with transfer capacity up to 150 MW. This interconnection provides important reliability benefits through the sharing of generation reserves. A proposed expansion of interconnection capacity is currently under consideration as part of the 400 kV North-South Interconnect project.

OPWP's role in the DPS is similar to its role in the MIS, which is to economically procure power required by DISC, respectively, in bulk from generation/production facilities connected to the DPS. OPWP is required to ensure that sufficient power generation resources are available to meet DISC electricity demand. If assessed to be beneficial, OPWP is also required to co-procure desalinated water with power generation in joint facilities.

a. Demand for Electricity

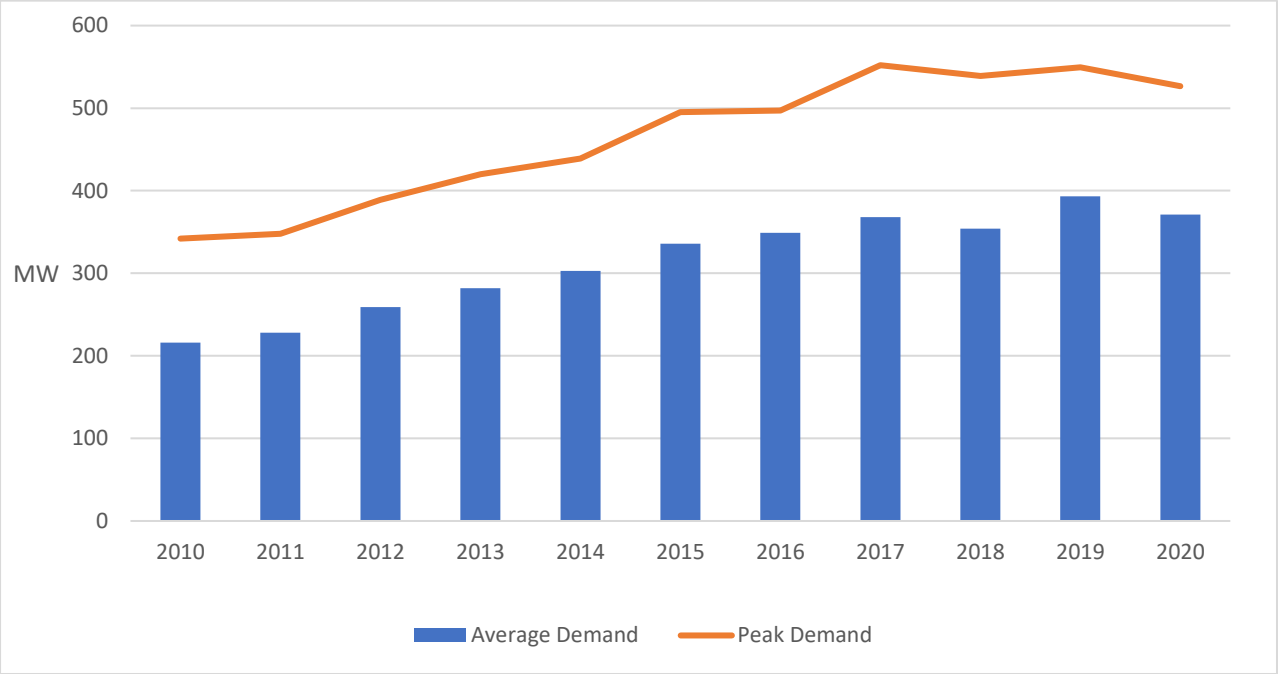
Historical Demand

Electricity demand in 2020 saw, for the second time since reporting the system in the 7 Year Statement publications, a decrease against previous year outturn. Compared to 2019, average demand reduced by 5.6% to 371 MW (corresponding to 3.3 TWh). Peak demand was 527 MW, a decrease of 4.2% when compared against the 2019 peak demand. The reduction in peak and average demand observed in 2020 is due to a combination of factors including the weather condition, COVID-19 pandemic, and reduced oil prices. OPWP notes that the tropical cyclone during the last week of May to early June had a notable impact on both the peak and average demand in DPS which contributed towards the demand reduction. In addition, the pandemic is believed to have had a greater impact on average demand than peak demand as travel and entry to Salalah was suspended during Khareef period in an effort to prevent the spread of COVID-19. This occurred after the peak demand period.

Figure 10 shows that the average growth rate in annual average demand over the past seven years has been 4.2%, while single-year growth has reached as high as 11.1%. In addition, peak demand in the DPS has grown at an annual average of 3.5% over the same period.

[11] APSR Annual Report 2019

Figure 10 Historical Electricity Demand – DPS



	Average Demand (MW)	*Growth (%)*	Peak Demand (MW)	*Growth (%)*
2010	216	-	342	-
2011	228	*5.6%*	348	*1.8%*
2012	259	*13.6%*	389	*11.8%*
2013	282	*8.9%*	420	*8.0%*
2014	303	*7.4%*	439	*4.5%*
2015	336	*10.9%*	495	*12.8%*
2016	349	*3.9%*	497	*0.4%*
2017	368	*5.4%*	552	*11.1%*
2018	354	*-3.8%*	539	*-2.4%*
2019	393	*11.1%*	549	*1.9%*
2020	371	*-5.6%*	527	*-4.2%*
Average Growth (%)		*5.7%*		*4.6%*

Demand Projections

Demand projections represent the "net system demand", in that they are inclusive of assumed transmission and distribution system losses but exclude the internal auxiliary consumption of power and desalination plants. The methodology for demand forecasts assesses the influences of macroeconomic growth in addition to a separate analysis of underlying demand and certain bulk loads, comprising mainly industrial demands, which are assessed on a customer-specific basis.

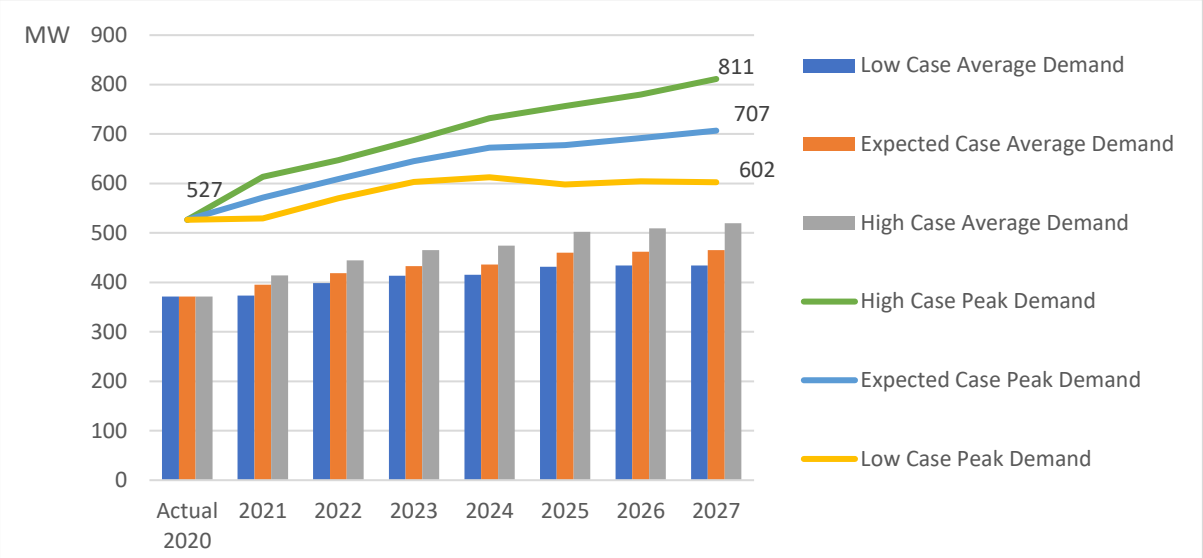
The projections in Figure 11 are presented as a range including Low Case, High Case and central Expected Case scenarios. All scenarios are based on an assumption of normal weather. The Low Case and High Case scenarios assume contrasting growth levels, with the same growth assumptions used for the MIS projections.

Consistent with growth assumptions used for the MIS, the Expected Case scenario, peak demand increases at about 4% per year, from 527 MW in 2020 to 707 MW in 2027. Energy consumption is projected to grow from 3.3 TWh (corresponding to 371 MW average demand) in 2020 to 4.1 TWh (465 MW average demand) in 2027,

with an average increase of 3% per year. Peak demand projections are lower than previous 7 Year Statement projections (5% vs 3%).

The High Case scenario projects growth in annual energy demand at 5% per year and peak demand at 6% per year whereas the Low Case scenario project an annual energy demand growth of 3% and peak demand growth of 2%.

Figure 11 Electricity Demand Projections – DPS



	Actual 2020	2021	2022	2023	2024	2025	2026	2027	Average Growth (%)
Expected Demand									
Average Demand (MW)	**371**	**395**	**419**	**433**	**436**	**460**	**462**	**465**	**3%**
Underlying Demand	263	245	260	269	269	270	271	272	0%
Directly-Connected Loads	108	150	159	164	167	190	191	194	9%
Annual Energy (TWh)	**3.3**	**3.5**	**3.7**	**3.9**	**4.0**	**4.0**	**4.0**	**4.1**	**3%**
Peak Demand (MW)	**527**	**571**	**609**	**646**	**672**	**677**	**692**	**707**	**4%**
Change from 2020-2026 Statement (MW)	*-21*	*-37*	*-24*	*-11*	*-65*	*-87*	*-101*	-	-
Low Case Demand									
Average Demand (MW)	**371**	**373**	**399**	**413**	**415**	**432**	**434**	**434**	**2%**
Underlying Demand	263	226	246	257	257	254	254	254	-1%
Directly-Connected Loads	108	147	152	156	158	178	180	181	8%
Annual Energy (TWh)	**3.3**	**3.3**	**3.6**	**3.9**	**4.0**	**3.9**	**3.9**	**3.9**	**3%**
Peak Demand (MW)	**527**	**529**	**570**	**603**	**613**	**598**	**604**	**602**	**2%**
Change from 2020-2026 Statement (MW)	*-11*	*-55*	*-30*	*-11*	*-61*	*-94*	*-101*	-	-
High Case Demand									
Average Demand (MW)	**371**	**414**	**445**	**465**	**474**	**502**	**510**	**520**	**5%**
Underlying Demand	263	251	274	291	297	301	306	313	2%
Directly-Connected Loads	108	163	171	175	177	201	203	207	10%
Annual Energy (TWh)	**3.3**	**3.6**	**3.9**	**4.1**	**4.3**	**4.3**	**4.4**	**4.6**	**5%**
Peak Demand (MW)	**527**	**613**	**647**	**688**	**732**	**756**	**780**	**811**	**6%**
Change from 2020-2026 Statement (MW)	*-31*	*-24*	*-31*	*-31*	*-95*	*-123*	*-158*	-	-

b. Power Generation Resources

Contracted Capacity and Non-Firm Energy

OPWP's generation portfolio in the DPS includes the two plants that provide guaranteed capacity and a PPA with the wind farm to provide non-firm energy. They are described in Table 6 and are as follows:

- **Salalah IWPP:** Contracted capacity of 445 MW. The Salalah IWPP is a CCGT plant comprising of five gas turbines and two steam turbines. It is located in the Mirbat/Taqah region and achieved COD in 2012. The P(W)PA is scheduled to expire in 2027.
- **Salalah II IPP:** Contracted capacity of 717 MW. Located in Raysut, the facility comprises eight OCGT units with a total capacity of 273 MW and six CCGT units (two blocks of 2 GTs and 1 ST each) with a total capacity of 444 MW.
- **Dhofar I Wind IPP:** The wind farm located in Harweel has an installed capacity of 49.4 MW, comprising of 13 x 3.8 GE wind turbines. Following a similar methodology used for the Solar IPPs, OPWP has estimated a provisional capacity contribution value of 50% following the results of analyses that looked at both correlation between wind speed and demand profile, and the expected impact and contributions towards meeting LOLH requirements whilst adopting a new approach that better reflects the variability in resource availability. OPWP will continue to monitor and analyse relevant data to update capacity contribution estimates, if needed.

Table 6 Contracted Capacities (PPAs/PWPA) - DPS

Project Name	Contracted Capacity	Contract Type	Project company	Project status	Technology	Contract Expiry
Salalah IWPP	445 MW [a] 68,000 m³/d	PWPA	Sembcorp Salalah Power & Water Co. (SAOC)	Operational	CCGT Natural gas fired Fuel oil as back-up	2027
Salalah II IPP	717 MW [a]	PPA	Dhofar Generating Co. (SAOC)	Operational	OCGT CCGT Natural gas fired Fuel oil as back-up	2033
Dhofar I Wind IPP	49.4 MW	PPA	Tanweer	Operational	Wind Turbine	2034

[a] Capacities are rated on a net basis (i.e. after allowing for auxiliary consumption inside the plants) at 35°C ambient temperatures output.

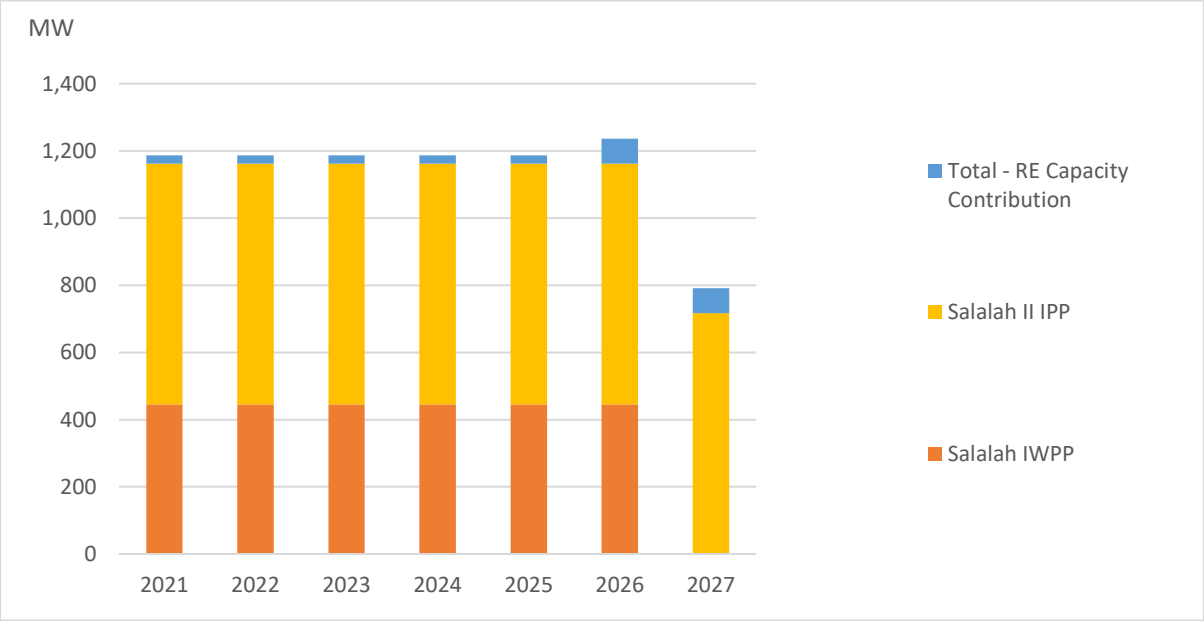
Resource Development Plan

OPWP has no plans to procure new gas-fired generation capacity for the DPS but plans additional RE development. The Dhofar region has excellent potential for wind energy development, consequently, OPWP has plans to develop a second wind energy farm, currently estimated at 100 MW for 2026 COD. Both wind resource and land are available for the power project, Dhofar II Wind IPP, which is expected to be developed adjacent to the existing Dhofar I Wind IPP. This project is anticipated to be competitively tendered. Final capacity of this project may vary slightly from the value mentioned here, and is subject to wind farm layout optimization analyses. OPWP further notes that when the North-South Interconnect project is completed to Dhofar, OPWP expects to develop more renewable energy projects in the DPS.

Summary

Figure 12 presents the capacity contributions from power generation resources in the DPS.

Figure 12 Capacity Contributions from Generation Resources – DPS



	2021	2022	2023	2024	2025	2026	2027
Contracted Capacity - Thermal				**Net MW [a]**			
Salalah IWPP	445	445	445	445	445	445	-
Salalah II IPP	717	717	717	717	717	717	717
Total - Thermal	**1,162**	**1,162**	**1,162**	**1,162**	**1,162**	**1,162**	**717**
Non-firm Contracts - Renewables							
Dhofar I Wind IPP	49	49	49	49	49	49	49
Dhofar II Wind IPP	-	-	-	-	-	100	100
Total - RE Capacity Contribution [b]	**25**	**25**	**25**	**25**	**25**	**75**	**75**
Total Capacity Contribution to Peak Demand	**1,187**	**1,187**	**1,187**	**1,187**	**1,187**	**1,237**	**792**

[a] All capacities are rated on a net basis (i.e. after allowing for auxiliary consumption inside the plants) at 35°C ambient temperature.

[b] Capacity contribution of 50% is currently assumed for Dhofar I & II Wind IPPs.

c. Resource Adequacy and Mitigation Plans

Statutory and Regulatory Requirements

OPWP is required by the Sector Law and its license to ensure the adequacy of generation resources in the DPS to meet future power demands. The Sector Law establishes OPWP's general responsibility to secure sufficient generation resources to meet demand and the OPWP License establishes the generation security standard as 24 LOLH.

OPWP has concluded that, on the basis of simulation studies of the DPS, a reserve margin of about 12% over peak demand is necessary to achieve the 24 LOLH standard, considering the size of the system, characteristics of generation resources, and limited access to security reserves. This sets the capacity target for each of the three demand scenarios over the 7-year planning horizon, shown in Figure 13.

Subject to the success of the North-South Interconnect project from MIS to Ad Duqm Power System in 2023 and to the outcomes of a feasibility study, OPWP anticipates that the interconnection may then be extended to the DPS. Subsequently, planning and operations of the DPS, PDO System, and MIS will be fully integrated. There is currently no firm date in which the interconnect to the DPS is expected to be complete. OPWP expects that the reserve margin requirement for the DPS would be reduced at that time, aligning with that of the MIS.

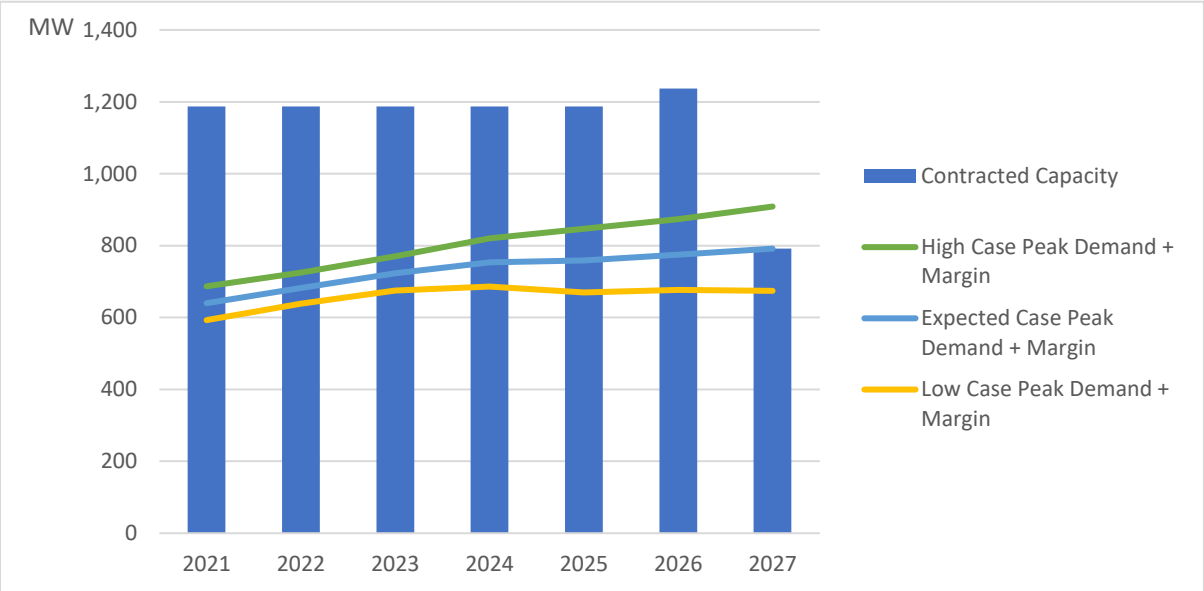
Resource Adequacy and Mitigation Plans

OPWP projects contracted capacity to be sufficient to meet the capacity targets associated with all three demand scenarios throughout the seven-year planning period except for 2027.[12] There is a net reduction in the available contracted capacity in this year due to the expiration of Salalah IWPP before the 2027 peak demand period. This results in a shortfall of around 117 MW against the capacity target for the High Case. Figure 13 and the accompanying table indicate capacity surpluses that reduce gradually with demand growth.

OPWP notes that the PWPA for Salalah IWPP is scheduled to expire in 2027. OPWP will re-assess the procurement requirement in 2027 in consideration of the updated demand forecast, potential timing for the North-South Interconnect to the Dhofar Power System, and progress made by the APSR regarding market liberalization plans.

[12] There is currently a capacity surplus in the DPS. The capacity surpluses arose as demand growth failed to meet expectations. From 2012 to 2015, peak and demand growth averaged more than 9% per year, prompting OPWP to procure new capacity (Salalah 2 IPP) that would meet future needs. The subsequent economic slowdown reduced average annual demand growth to around 1.8% in energy and 3% in peak demand. Although there are costs associated with surplus capacity, the Salalah II IPP project has enabled substantial gas savings due to its high efficiency.

Figure 13 Resource Adequacy – DPS



	2021	2022	2023	2024	2025	2026	2027
Generation Resources				**Net MW**			
Total Contracted Capacity	**1,187**	**1,187**	**1,187**	**1,187**	**1,187**	**1,237**	**792**
Expected Case Demand							
Peak Demand	571	609	646	672	677	692	707
Peak Demand + Margin	640	682	723	753	759	775	792
Additional Capacity Required	-	-	-	-	-	-	-
High Case Demand							
Peak Demand	613	647	688	732	756	780	811
Peak Demand + Margin	687	725	771	820	847	873	909
Additional Capacity Required	-	-	-	-	-	-	**117**
Low Case Demand							
Peak Demand	529	570	603	613	598	604	602
Peak Demand + Margin	593	639	675	686	670	677	675
Additional Capacity Required	-	-	-	-	-	-	-

d. Combining Power Generation and Water Desalination

As in the MIS, OPWP is required to consider opportunities for combining power generation with water desalination in the DPS. This is in order to benefit from economies of co-location and co-procurement.

As needs for additional water desalination and power generation capacity are confirmed, OPWP will continue to assess the potential for economic benefits that may result from co-location and co-procurement.

1.4 MUSANDAM POWER SYSTEM

The Musandam Governorate is located in the northern-most region of the Sultanate of Oman and extends into the Strait of Hormuz. The Musandam Governorate is an exclave of Oman, separated from the rest of the country by the United Arab Emirates. The latest population data from the National Centre for Statistics & Information reports that the total population is estimated at around 49,062[13], which is expected to grow steadily over the coming years.

a. Demand for Electricity

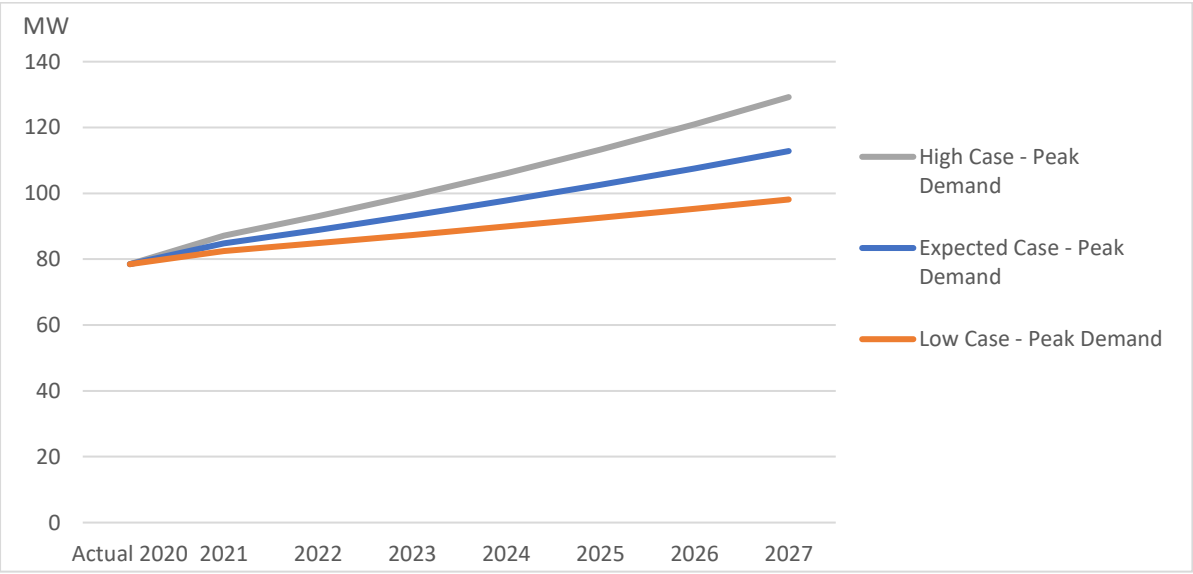
Demand Projections

The pace of demand growth in Musandam is driven mainly by projects that aim to boost tourism, economic, and commercial activities. The Expected, Low, and High Case peak demand scenarios for the Musandam Power System have been prepared by Tanweer.

Similar to the demand forecasts presented for the other power systems, the different cases represent alternate assumptions of annual growth rates for underlying demand and materialisation of identified bulk consumers. These three demand scenarios are shown in Figure 14. Across all three scenarios, the growth projections are higher than those in the previous 7-Year Statement. Further, there are also higher differences between the High and Low peak demand cases in this projection as compared to those presented previously, and this reflects the greater uncertainty currently observed with local and global economic trends.

Under the Tanweer Expected Demand forecast, peak demand is expected to grow from 78 MW in 2020 to 113 MW in 2027, an average increase of 5% per year. The Low Case scenario assumes a growth rate of 3% for peak demand, increasing only to 98 MW by 2027. The High Case scenario assumes a quicker materialization of bulk consumers, as well as increased tourism and fishery activities. Peak demand is projected to grow by an average of 7% per year to reach 129 MW in 2027.

Figure 14 Electricity Demand Projections – Musandam Power System



[13] National Centre of Statistics & Information (2020) *Data Portal - Population.*

	Actual 2020	2021	2022	2023	2024	2025	2026	2027	Average Growth (%)
Peak Demand					MW				
Tanweer Expected Case	**78**	**85**	**89**	**93**	**98**	**103**	**108**	**113**	**5.3%**
Change from 2020-2026 Statement (MW)	*-5*	*0*	*1*	*4*	*6*	*9*	*11*	-	
Tanweer Low Case	**78**	**82**	**85**	**87**	**90**	**93**	**95**	**98**	**3.2%**
Change from 2020-2026 Statement (MW)	*-4*	*-1*	*1*	*1*	*3*	*4*	*6*	-	
Tanweer High Case	**78**	**87**	**93**	**99**	**106**	**113**	**121**	**129**	**7.4%**
Change from 2020-2026 Statement (MW)	*-7*	*0*	*2*	*7*	*9*	*14*	*18*	-	

b. Power Generation Resources

Sources of Power

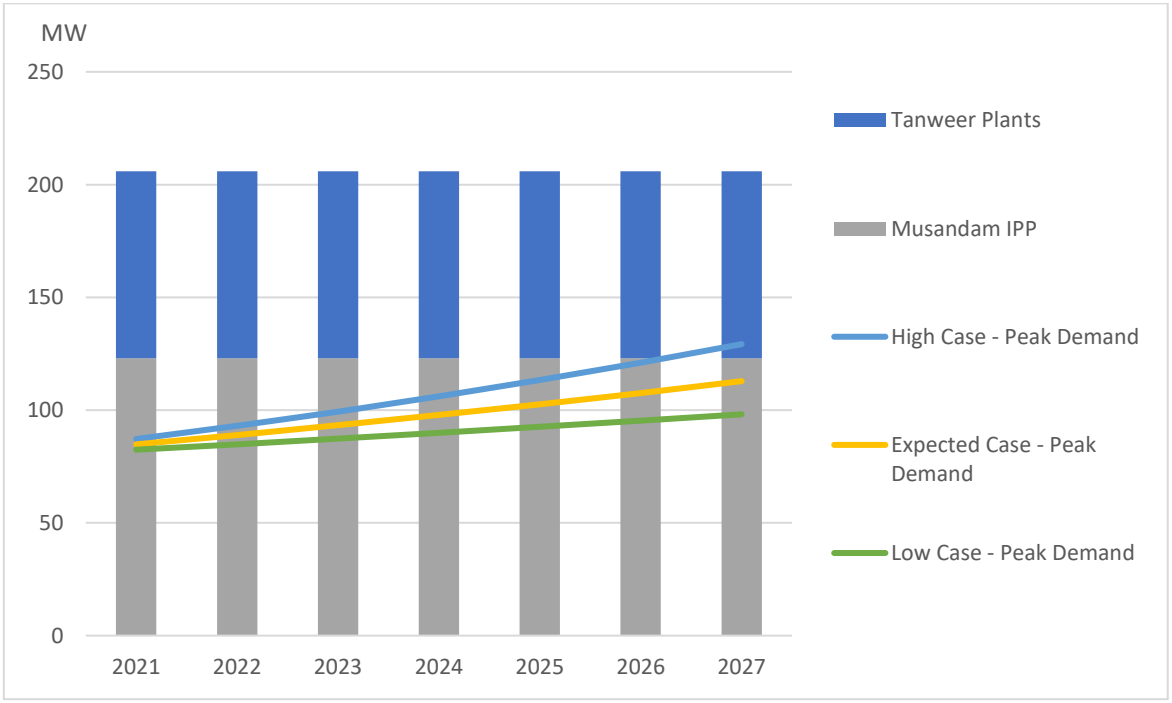
Tanweer owns and operates power stations distributed near load centres in the Musandam Governorate. They are all diesel-fired generators, with a combined installed capacity of about 83 MW – this figure includes additional capacity that was added in 2018.

Musandam IPP commenced operation in 2017 operated by a consortium led by Oman Oil Company under a PPA with OPWP. The IPP provides firm capacity of 123 MW using reciprocating engines fuelled primarily by natural gas.

Resource Development Plan

Figure 15 illustrates Musandam's supply/demand balance. The Musandam IPP provides sufficient capacity to meet electrical energy requirements across all the Low and Expected Case demand scenarios over the coming 7-year planning horizon, and anticipates that 6 MW from Tanweer diesel generator may be required to meet peak demand requirements in 2027. The Tanweer diesel generator will also continue to be available to provide additional capacity if needed throughout the year. No further resources are required during this time period.

Figure 15 Future Power Generation Expansion Plans - Musandam Power System



	2021	2022	2023	2024	2025	2026	2027
Peak Demand				**MW**			
Expected Case	**85**	**89**	**93**	**98**	**103**	**108**	**113**
Low Case	**82**	**85**	**87**	**90**	**93**	**95**	**98**
High Case	**87**	**93**	**99**	**106**	**113**	**121**	**129**
Contracted Capacity							
Tanweer Plants	83	83	83	83	83	83	83
Musandam IPP [a]	123	123	123	123	123	123	123
Total Contract Capacity	**206**	**206**	**206**	**206**	**206**	**206**	**206**

[a] The MW figures are at 45°C

SECTION 2 FUEL

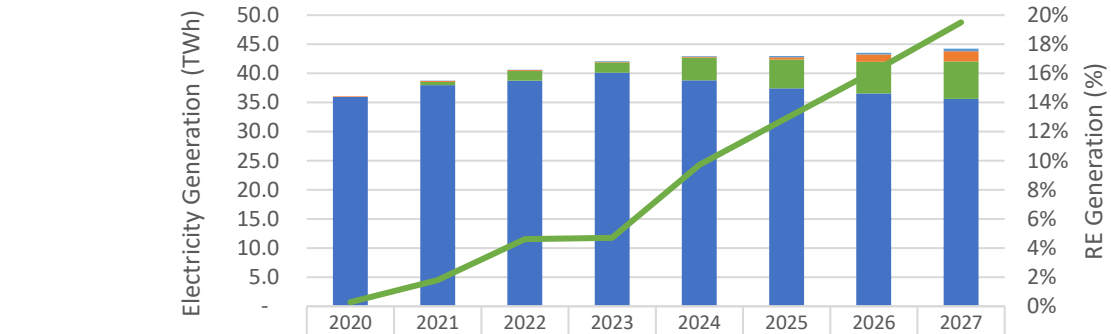
OVERVIEW

Fuel Diversification Policy

In 2018, OPWP began implementation of a Fuel Diversification Policy initiated by the Government, which included an objective that 10% (or more) of electricity generation is to be sourced from renewable resources by 2025. The favourable economic costs of wind and solar PV technologies are also driving development. As of Q1 2021, OPWP has contracted for 550 MW of RE capacity (Ibri II Solar IPP and Dhofar I Wind IPP) and plans to develop another 2,660 MW by 2027. Furthermore, OPWP continues to support improvements in efficient gas utilisation in the sector.

Figure 16 shows our projection of energy generation shares by fuel type among OPWP-contracted generators. By 2025, about 13% of generation will be provided by renewable energy sources, primarily solar energy. By 2027, the renewables share will reach 20%.

Figure 16 Fuel Shares in Electricity Generation



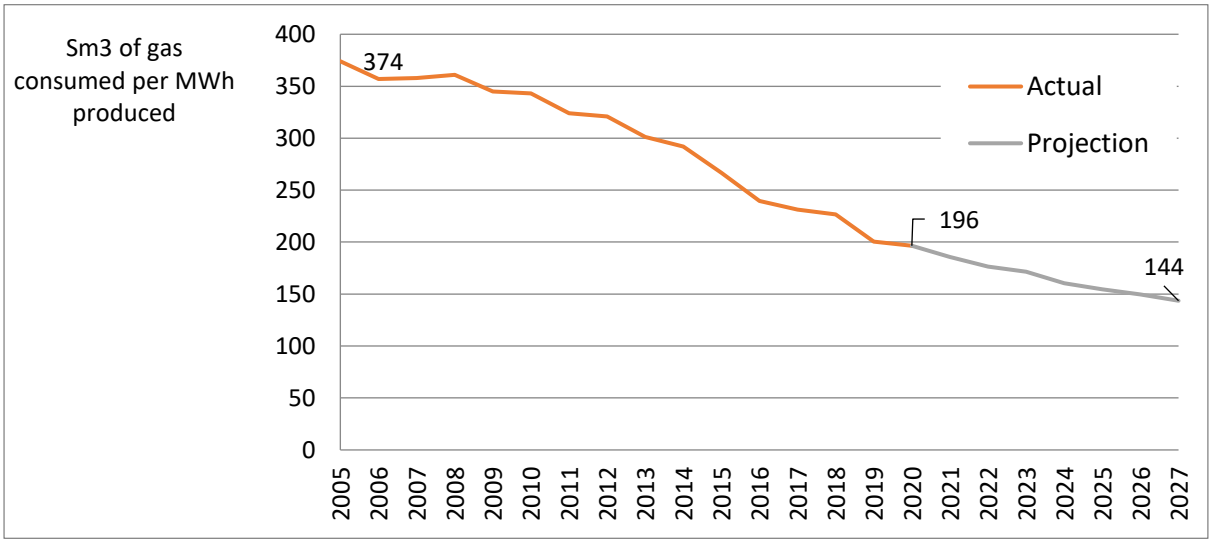
	2020	2021	2022	2023	2024	2025	2026	2027
Private Solar PV Initiatives	-	0.0	0.1	0.1	0.1	0.2	0.3	0.4
Wind	0.1	0.2	0.2	0.2	0.2	0.4	1.3	1.8
Solar PV	-	0.5	1.6	1.7	3.9	5.0	5.5	6.4
Gas-fired Plants	35.9	38.0	38.7	40.1	38.8	37.4	36.5	35.6
RE Generation (%)	0%	2%	5%	5%	10%	13%	16%	20%

Efficiency in Fuel Utilisation

Since 2005, through the introduction of progressively more efficient generation plants, OPWP has achieved a 47% reduction in the gas required per unit of electricity production, from 374 Sm^3/MWh in 2005 to 196 Sm^3/MWh in 2020. In 2020 alone, improvements in gas utilisation (when compared against gas utilisation rates in 2005) suggest savings in excess of OMR 280 million. This is the result of OPWP's procurement of new state-of-the-art CCGT plants in 2019, and new water desalination plants that shift water production from energy-intensive MSF technology to efficient RO technology.

After 2021, with the introduction of solar and wind plants, OPWP expects that the gas requirements for electricity generation will fall to around 144 Sm^3/MWh by 2027, or 61% less than that required in 2005.

Figure 17 Gas Required per Unit of Electricity Generation – MIS



2.1 MAIN INTERCONNECTED SYSTEM

a. 2020 Fuel Consumption

Total gas consumption at the main power and desalination plants in 2020 was about 6.37 billion Sm^3, equivalent to 17.4 million Sm^3/d, about 3% less than in 2019. This was due to the decrease in the energy demand of 2020 by 1.6% compared to 2019. In addition, Sohar III IPP, Ibri IPP and Sohar IV IWP were available full year in 2020.

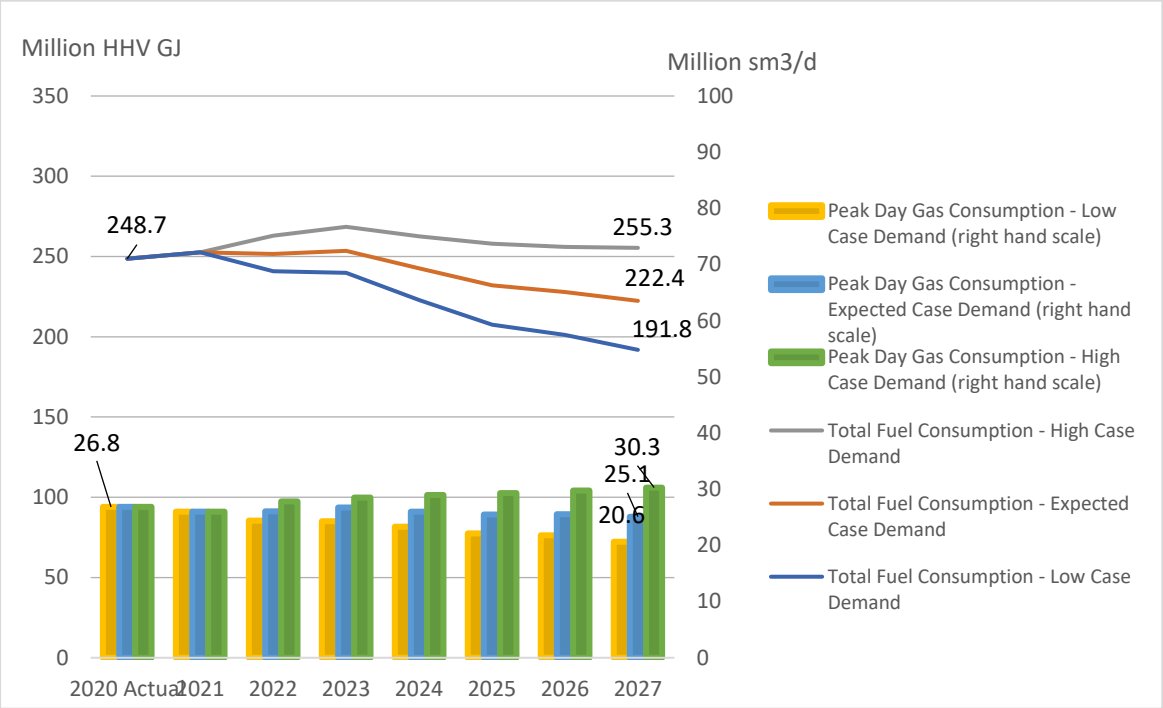
b. Projected Fuel Requirements

OPWP projects total annual fuel requirements to decrease by around 2% per year from 2020 to 2027 under the Expected Case. This scenario, in addition to the Low Case and High Case scenarios, are illustrated in Figure 18.

Under the Low Case demand scenario, total fuel consumption would decrease at an average of 4% per year. In the High Case demand scenario, total fuel consumption would increase slightly at an average rate of 0.4% per year. In each of the three scenarios, the rate of growth in fuel consumption is below that of electricity demand.

Figure 18 shows average gas consumption of 17.7 million Sm3/d in 2021, almost equal to 2020. This is due mainly to start of operation of Ibri II Solar IPP in Q3, 2021. A further drop can be noticed in 2022, the first full year of operation of the solar plant. In 2023 the average gas consumption increases due to demand growth in the MIS and the start of supply to Duqm from the MIS upon the connection of the North-South Interconnect. Further, the decline in gas requirements to continue from 2024 onwards in both the Expected and Low Cases as the planned new RE projects begin operation in 2024, 2025 and 2027. The High Case shows a more modest reduction during the same horizon.

Figure 18 Projected Fuel Requirements – MIS



	2020 Actual	2021	2022	2023	2024	2025	2026	2027	Average Growth (%)
Expected Demand									
Gas Consumption (million Sm³/d)									
Annual Average	17.4	17.7	17.6	17.8	17.0	16.3	16.0	15.6	-2%
Peak Day	26.8	26.0	26.1	26.7	26.0	25.5	25.5	25.1	-1%
Total Fuel Consumption (million HHV GJ)[a]	**249**	**253**	**252**	**254**	**243**	**232**	**228**	**222**	**-2%**
Low Case Demand									
Gas Consumption (million Sm³/d)									
Annual Average	17.4	16.9	16.9	16.8	15.6	14.6	14.1	13.5	-4%
Peak Day	26.8	24.5	24.4	24.3	23.3	22.1	21.8	20.6	-4%
Total Fuel Consumption (million HHV GJ)[a]	**249**	**241**	**241**	**240**	**223**	**207**	**201**	**192**	**-4%**
High Case Demand									
Gas Consumption (million Sm³/d)									
Annual Average	17.4	18.5	18.4	18.8	18.4	18.1	18.0	17.9	0%
Peak Day	26.8	27.6	27.8	28.5	29.0	29.3	29.8	30.3	2%
Total Fuel Consumption (million HHV GJ)[a]	**249**	**264**	**263**	**268**	**263**	**258**	**256**	**255**	**0%**

[a] Based on natural gas HHV of 1,050 BTU/scf

2.2 Dhofar Power System

a. 2020 Fuel Consumption

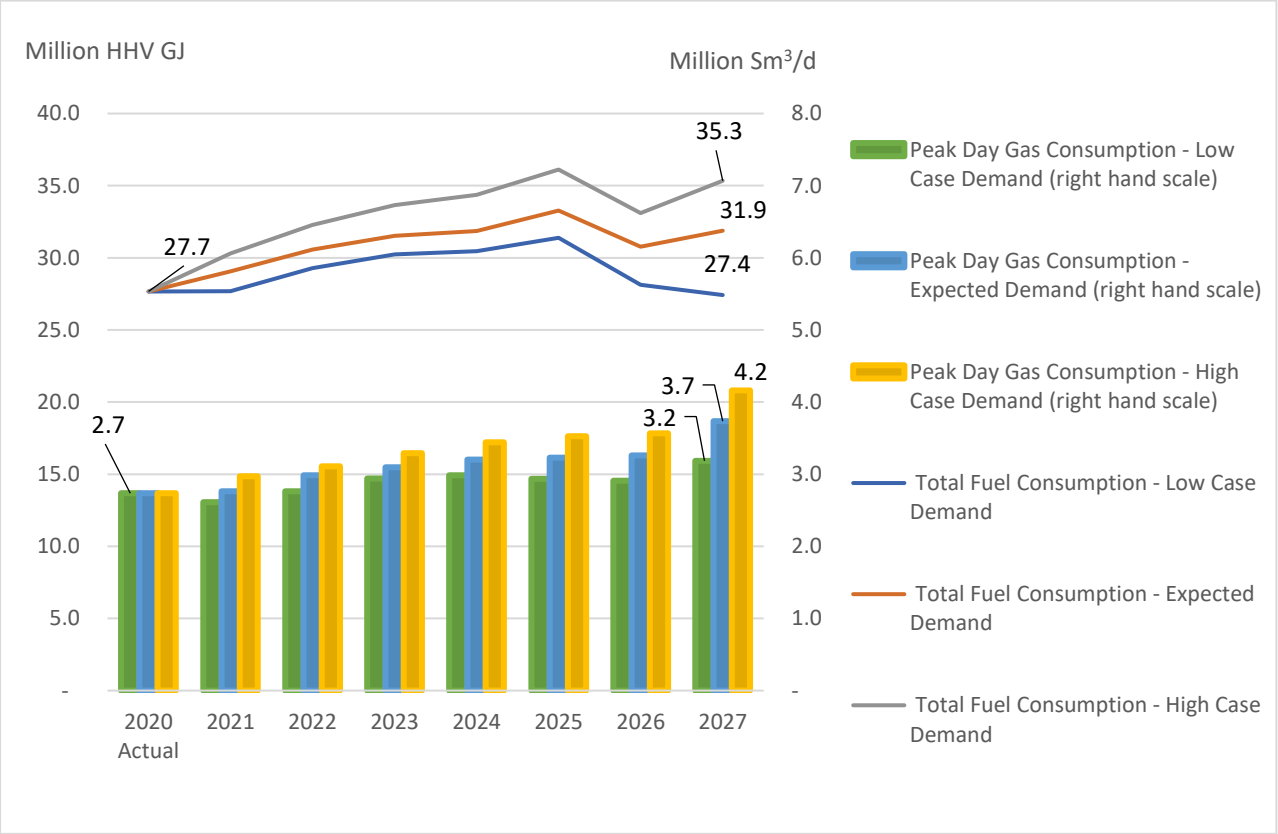
Gas consumption in 2020 was 710 million Sm3 (equivalent to 1.9 million Sm3/d), about 11% lower than in 2019, in line with a 5% decrease in electricity production. Peak daily natural gas consumption was 2.7 million Sm3 in 2020, which is lower than the 2019 peak.

b. Projected Fuel Requirements

Fuel requirements projections for each of the three demand scenarios are illustrated in Figure 19. The introduction of Dhofar Wind II IPP in the second quarter of 2026 leads to a decrease in gas consumption for all cases. In 2027 there is a slight increase in total gas consumption in the expected and high cases due to the expiration of Salalah IWPP.

For the 7-year period, total fuel consumption is expected to increase at an annual average of around 2% under the Expected Demand scenario, and by 4% in the High Case, and to decline by 0.1% under the Low Case scenario. These growth rates in fuel consumption compare to electricity demand growth of 3%, 2%, and 5%, respectively. OPWP is planning for additional wind IPP capacity in Dhofar beyond 2027, which may be subject to extension of the North-South Interconnect, and which would reduce the gas requirements.

Figure 19 Projected Fuel Requirements – DPS



	2020 Actual	2021	2022	2023	2024	2025	2026	2027	Average Growth (%)
Expected Demand									
Gas Consumption (million Sm^3/d)									
Annual Average	1.9	2.0	2.1	2.2	2.2	2.3	2.2	2.2	2%
Peak Day	2.7	2.8	3.0	3.1	3.2	3.2	3.3	3.7	5%
Total Fuel Consumption (million HHV GJ)[a]	**28**	**29**	**31**	**32**	**32**	**33**	**31**	**32**	**2%**
Low Case Demand									
Gas Consumption (million Sm^3/d)									
Annual Average	1.9	1.9	2.1	2.1	2.1	2.2	2.0	1.9	-0.1%
Peak Day	2.7	2.6	2.8	2.9	3.0	2.9	2.9	3.2	2%
Total Fuel Consumption (million HHV GJ)[a]	**28**	**28**	**29**	**30**	**30**	**31**	**28**	**27**	**-0.1%**
High Case Demand									
Gas Consumption (million Sm^3/d)									
Annual Average	1.9	2.1	2.3	2.4	2.4	2.5	2.3	2.5	4%
Peak Day	2.7	3.0	3.1	3.3	3.4	3.5	3.6	4.2	6%
Total Fuel Consumption (million HHV GJ)[a]	**28**	**30**	**32**	**34**	**34**	**36**	**33**	**35**	**4%**

[a] Based on natural gas HHV of 1,050 BTU/scf

2.3 Musandam Power System

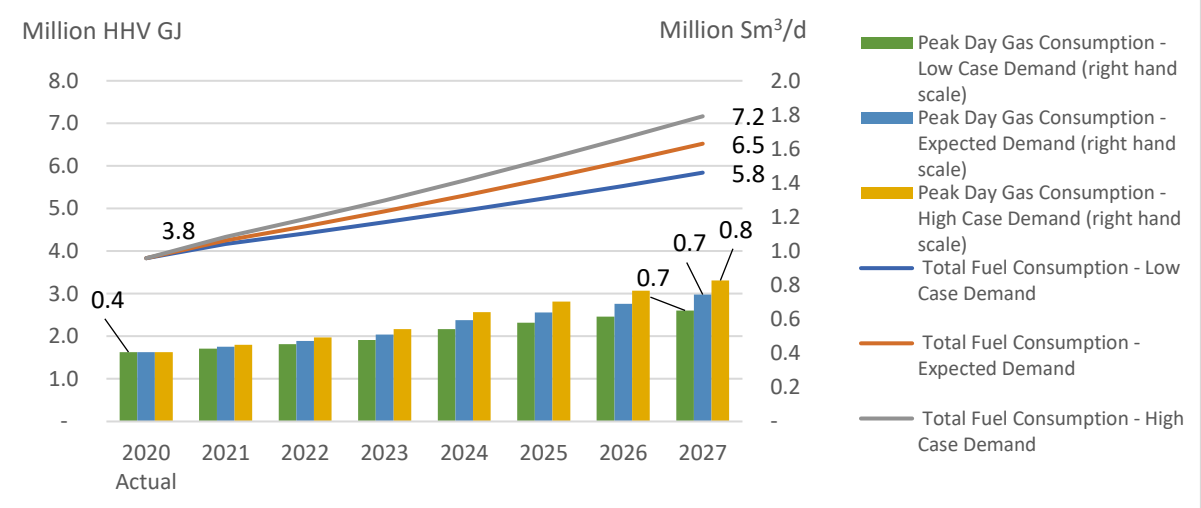
a. 2020 Fuel Consumption

Gas consumption in 2020 was 96.5 million Sm3 (equivalent to 0.26 million Sm3/d), about 1.6% lower than in 2019. Peak daily natural gas consumption was 0.41 million Sm3 in 2020, which is lower than the 2019 peak by 2%.

b. Projected Fuel Requirements

Fuel requirements projections for each of the three demand scenarios are illustrated in Figure 20. Total fuel consumption is expected to increase at an annual average of around 8% under the Expected Demand scenario, and by 9% and 6% under the High and Low Case scenarios, respectively. These growth rates in fuel consumption compare to energy demand growth of 5%, 7%, and 3%, respectively.

Figure 20 Projected Fuel Requirements – Musandam Power System



	2020 Actual	2021	2022	2023	2024	2025	2026	2027	Average Growth (%)
Expected Demand									
Gas Consumption (million Sm³/d)									
Annual Average	0.27	0.30	0.32	0.35	0.37	0.40	0.43	0.46	8%
Peak Day	0.41	0.44	0.47	0.51	0.59	0.64	0.69	0.75	9%
Total Fuel Consumption (million HHV GJ)[a]	**3.83**	**4.25**	**4.58**	**4.94**	**5.31**	**5.69**	**6.10**	**6.52**	**8%**
Low Case Demand									
Gas Consumption (million Sm³/d)									
Annual Average	0.27	0.29	0.31	0.33	0.35	0.37	0.39	0.41	6%
Peak Day	0.41	0.43	0.45	0.48	0.54	0.58	0.62	0.65	7%
Total Fuel Consumption (million HHV GJ)[a]	**3.83**	**4.17**	**4.42**	**4.68**	**4.95**	**5.23**	**5.53**	**5.84**	**6%**
High Case Demand									
Gas Consumption (million Sm³/d)									
Annual Average	0.27	0.30	0.33	0.36	0.40	0.43	0.47	0.50	9%
Peak Day	0.41	0.45	0.49	0.54	0.64	0.70	0.77	0.83	11%
Total Fuel Consumption (million HHV GJ)[a]	**3.83**	**4.33**	**4.75**	**5.19**	**5.66**	**6.15**	**6.65**	**7.17**	**9%**

[a] Based on natural gas HHV of 1,050 BTU/scf

SECTION 3 Water

3.1 MAIN INTERCONNECTED SYSTEM

The Main Interconnected System (MIS) serves the largest population area and the greatest demand for potable water in the Sultanate of Oman. OPWP provides desalinated water to the Oman Water and Wastewater Services Company (OWWSC), the principal "water department." OWWSC is responsible for potable water supply to consumers. The MIS is an integrated network that currently serves the potable water requirements of the Governorates of Muscat, Batinah South, Batinah North, Ad Dakhiliyah, and Al Buraymi. The MIS will expand to include supply to the Governorate of Ad Dhahirah upon completion of a new transmission pipeline in 2021.[14]

The MIS consists of three supply zones, each of which has resources of desalinated water under contract to OPWP, well water supply that is operated by OWWSC, and transmission facilities that allow water transfer between zones under the management of OWWSC. The supply zones are as follows:

- **Muscat Zone** includes the potable water demands of the Governorate of Muscat. The current sources of desalinated water for this zone are Ghubrah II IWP, Qurayyat IWP, and transfers from the Barka Zone.
- **Barka Zone** includes the potable water demands of the Governorates of Batinah South and Ad Dakhiliyah. The current resources of desalinated water for this zone are Barka IWPP, Barka II IWPP, Barka IV IWP and transfers from the Sohar Zone.
- **Sohar Zone** includes the potable water demands of the Governorates of Batinah North and Al Buraymi, with the addition water demand from the Governorate of Ad Dhahirah from 2021 onwards. The current resources of desalinated water for this zone is Sohar IWPP, Sohar IV IWP and transfers from the Barka Zone. In addition, OWWSC has a long term contract with Majis Industrial Services Company MISC to supply OWWSC with a desalinated water capacity of about 11,000 m^3/d.

a. Demand for Water

OWWSC has provided OPWP with projections of average and peak water demand for the MIS, shown in Figure 20. Peak demand represents the average daily demand (including network losses) during the week of highest demand of the year.

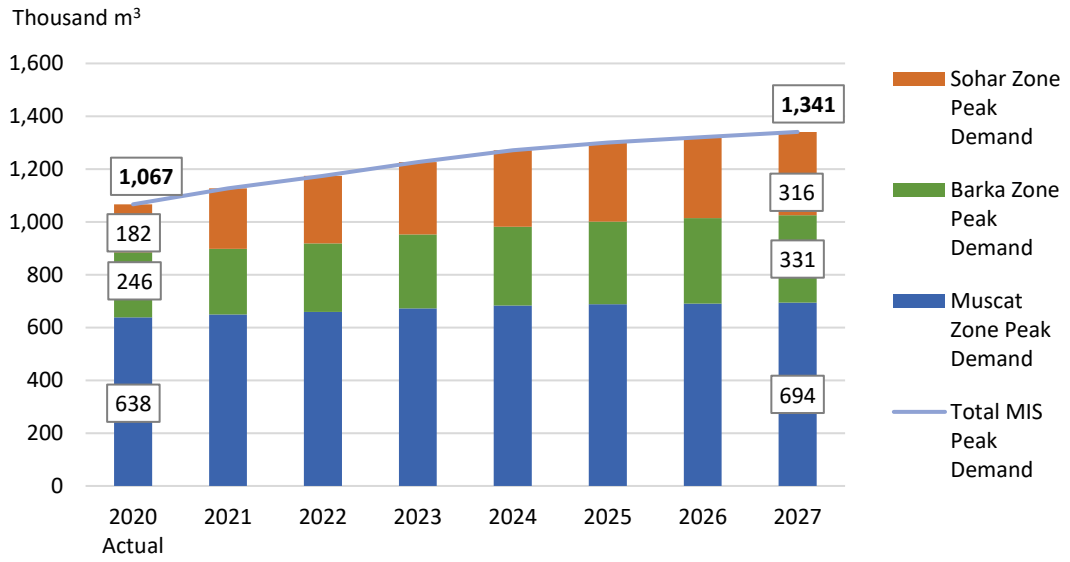
OWWSC has provided a Medium Case scenario only, which is driven fundamentally by population growth, distribution network expansion, and growth in per-capita water consumption. The OWWSC demand forecasts is based on the official NCSI population forecast for the Sultanate of Oman until 2040 as published in March 2017, together with NCSI 2019 mid-year data on the actual population[15].

The Medium Case scenario projects average annual growth of about 4% over the forecast horizon to 2027. This is much reduced from the previous year's OWWSC forecast, which presented 6% annual growth to 2026. Out-turn demand in 2020 was 39,000 m3/d less than the forecast demand. This may be attributed to the effect of the economic downturn and Covid-19 pandemic, which affected tourism and other sectors, and caused the departure of 15% of expatriate workers from the country in 2020 alone. The effects appear to persist through the forecast period, as the OWWSC forecast of peak demand in 2026 is less than the previous forecast by about 181,000 m3/d.

[14] The current scenario considers the MIS connection to Ad Dhahirah in 2021.

[15] National Centre for Statistics and Information, Population Projections in the Sultanate of Oman, March 2017, this scenario is based on the medium fertility rate 3.3 for the Omanis and the expatriate to Omani ratio is declining to 33% in 2040.

Figure 21 Water Demand Projections – MIS



	2020[a]	2021	2022	2023	2024	2025	2026	2027	Average Growth (%)
Medium Case Scenario				Thousand m³/d					
Muscat zone									
Peak Demand	638	649	659	673	683	688	691	694	1%
Average Demand	561	570	579	591	600	604	606	619	1%
Barka zone									
Peak Demand	246	249	260	280	299	313	324	331	4%
Average Demand	216	219	229	247	263	275	285	291	4%
Sohar zone									
Peak Demand	182	230	255	273	290	300	307	316	8%
Average Demand	157	199	221	237	251	260	266	274	8%
Total MIS									
Peak Demand	**1,067**	**1,127**	**1,174**	**1,226**	**1,271**	**1,300**	**1,321**	**1,341**	3%
Change from 2020-2026 Statement	*(66)*	*(91)*	*(119)*	*(133)*	*(145)*	*(161)*	*(181)*	-	
Average Demand	**935**	**988**	**1,029**	**1,075**	**1,115**	**1,139**	**1,157**	**1,184**	**3%**
Change from 2020-2026 Statement	*(39)*	*14*	*(17)*	*(34)*	*(49)*	*(71)*	*(89)*	-	

[a] The Average Demand is based on actual 2020 outturns (desalination and underground water supply) while the Peak Demand is estimated using peak factor.

b. Water Supply Resources

The resources of potable water supply include the existing water desalination plants, new desalination plants (under construction or development), and OWWSC resources. The water desalination resources that are under contract with OPWP in the MIS are summarized in Table 7.

OPWP's contracted resources of desalinated water in the MIS are classified by zones as follows:

Muscat Zone:

- **Ghubrah II IWP.** Owned by Muscat City Desalination Company and operated under a WPA with OPWP, the plant has contracted desalination capacity of 191,000 m^3/d (42 MIGD) using RO technology.
- **Qurayyat IWP.** Owned by Qurayyat Desalination Company and operated under a WPA with OPWP, Qurayyat IWP has contracted desalination capacity of 200,000 m^3/d (44 MIGD), using RO technology. Qurayyat IWP is currently operated as "pre-COD" water production of 180,000 m^3/d (40 MIGD), until it achieves its Commercial Operation Date COD, which is expected in 2024, and is then able to operate at full capacity.
- **Ghubrah III IWP**. Awarded in November 2020 to Capital Desalination Company, and to be operated under a WPA with OPWP. The plant is under construction, with contracted desalination capacity of 300,000 m3/d (66 MIGD) using RO technology. It is contracted to provide early water at 150,000 m3/d (33 MIGD) from Q4,2023 and to reach full capacity in Q2, 2024.

Barka Zone:

- **Barka IWPP**. Owned by ACWA Power Barka and operated under a PWPA with OPWP, the Barka IWPP was originally contracted with a desalination capacity of 91,200 m^3/d (20 MIGD) using MSF technology, and has added RO capacity of 45,000 m^3/d (10 MIGD) in 2014 and 57,000 m^3/d (12.5 MIGD) in 2016. The supply contracts for Barka IWPP are scheduled to expire in December 2021. The current agreement provides contracted desalinated capacity of the RO plants, while the MSF units are intended to remain on a standby mode, to be utilised as a contingency reserve.
- **Barka II IWPP.** Owned by SMN Power Barka and operated under a PWPA with OPWP, the Barka II IWPP has a capacity of 120,000 m^3/d (26 MIGD) using RO technology. The PWPA will expire in March 2024.
- **Barka IV IWP.** Owned by Barka Desalination Company and operated under a WPA with OPWP, Barka IV IWP utilises RO technology with a contracted capacity of 281,000 m^3/d (62 MIGD).
- **Barka V IWP.** Awarded in November 2020 to GS Inima Barka 5 Desalination Company and operated under a WPA with OPWP. The project is under construction, with contracted capacity of 100,000 m^3/d (22 MIGD), using RO technology. The SCOD is in September 2023.

Sohar Zone:

- **Sohar IWPP.** Owned by Sohar Power Company and operated under a PWPA with OPWP, Sohar IWPP has a desalination capacity of 150,000 m^3/d (33 MIGD), using MSF units. The PWPA will expire in March 2022.

- **Sohar IV IWP.** Owned by Myah Gulf Desalination Company and operated under a WPA with OPWP, Sohar IV IWP utilises RO technology with a contracted capacity of 250,000 m^3/d (55 MIGD).

Table 7 Water Desalination Plants – MIS

Project	Contracted Capacity	Contract Type	Plant Owner	Plant Status	Technology	Contract Expiry
Barka IWPP	91,200 m^3/d	PWPA	ACWA Power Barka (SAOG)	Operational	MSF	2021
	45,000 m^3/d	WPA		Operational	RO	2021
	57,000 m^3/d	WPA		Operational	RO	2021
Barka II IWPP	120,000 m^3/d	PWPA	SMN Barka Power Co. (SAOC)	Operational	RO	2024
Barka IV IWP	281,000 m^3/d	WPA	Barka Desalination Co. (SAOC)	Operational	RO	2038
Barka V IWP	100,000 m3/d	WPA	GS Inima Barka 5 Desalination Company	Under Construction	RO	2043
Ghubrah II IWP	191,000 m^3/d	WPA	Muscat City Desalination Co. (SAOG)	Operational	RO	2034
Qurayyat IWP	200,000 m^3/d	WPA	Qurayyat Desalination Co. (SAOC)	Under Construction	RO	2037
Ghubrah III IWP	300,000 m^3/d	WPA	Capital Desalination Company	Under Construction	RO	2044
Sohar IWPP	150,000 m^3/d	PWPA	Sohar Power Co. (SAOG)	Operational	MSF	2022
Sohar IV IWP	250,000 m^3/d	WPA	Myah Gulf Desalination Co. (SAOC)	Operational	RO	2038

In addition to the sources that are under contract to OPWP, OWWSC operates wellfields at several locations in the MIS that offset the need for water desalination capacity. The production capacity needed from these sources are shown in aggregate by year in Figures 22, 23, and 24. It was noticed that in 2020, the well extraction rate has grown significantly despite the availability of sufficient capacity from the desalination plants. The average daily well supply reached about 95,000 m3/d (21 MIGD) in 2020, compared to 86,000 m3/d (19 MIGD) in 2019. This level of wellfield production may not be sustainable for extended periods. The Government has a policy to limit water extraction from wellfields to allow natural replenishment of underground aquifers. Some wellfields are experiencing a decline in water quality due to encroaching salinity from over-use. Hence, wellfields are considered as emergency water resources, and the extent of their availability during the forecast period is somewhat uncertain.

c. Resource Adequacy and Development Plan

The expansion plan for water desalination capacity aims to meet peak demand plus a reserve margin for security of supply. In 2019 OWWSC re-assessed the margin required to meet the level of service target, considering uncertainty in the demand forecast and operational outages. The margin target is 8% for the first five-year period (2020 – 2024) followed by 9% for the remainder of the forecast period.

OPWP's assessment of resource adequacy and development plans is presented by supply zone. It shows the extent of transfers between zones, inter-zonal reserve sharing, and constraints that are otherwise not evident in a summary presentation of the MIS.

Muscat Zone

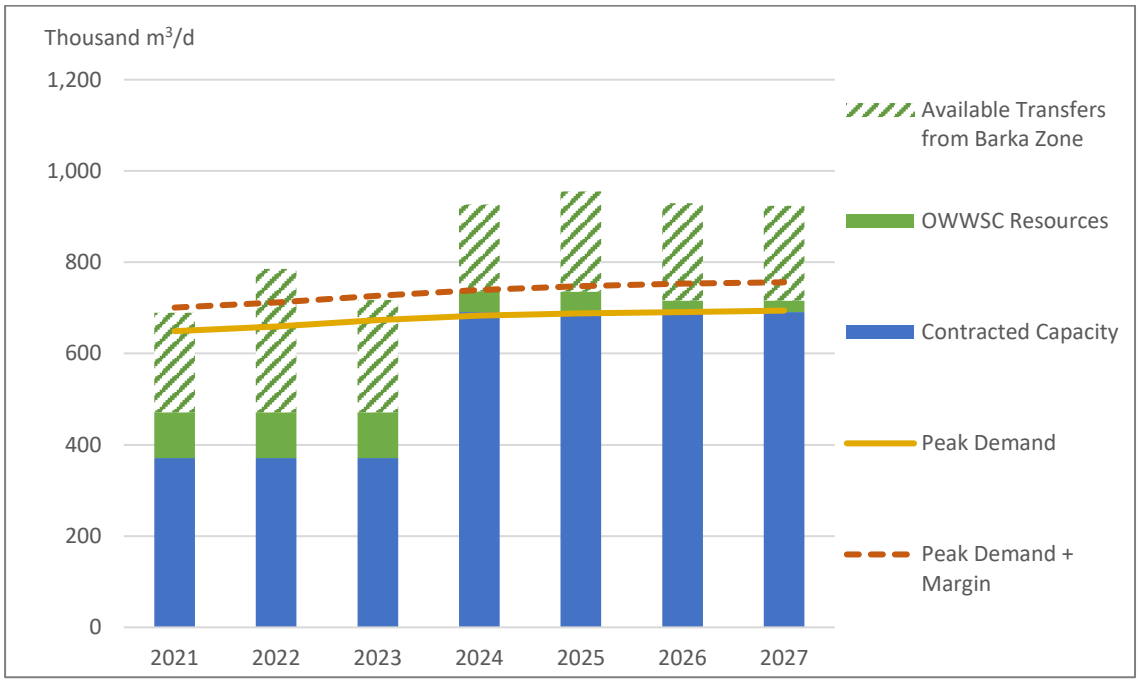
The Muscat Zone is currently supplied by the Ghubrah II IWP, Qurayyat IWP, Ghubrah temporary RO plant,[16] OWWSC wellfield resources, and transfers from Barka Zone. Qurayyat IWP is currently delivering commercial water as "pre-COD" until its Commercial Operation Date (COD) is achieved, which is expected in 2024. For the time being, local resources within the Muscat Zone are not sufficient to meet demand and therefore water transfers from Barka Zone are required to provide for the balance.

The transmission facilities relevant to transfers from Barka are currently undergoing a multi-year reinforcement and capacity expansion program. The existing transmission line capacity from Barka to Al Seeb and Ad Dakhiliyah is 320,000 m3/day. In 2022, reinforcement will increase total capacity from Barka to Seeb (in Muscat Zone) by 100,000 m3/day. Reinforcement of Al Khoud Main Pumping Station is scheduled for completion in 2023, increasing transfer capacity to Ad Dakhiliyah to 191,000 m3/d (42 MIGD). The resulting additional water flow to Ad Dakhiliyah in 2023 reduces the maximum available transfer capacity from Barka to Seeb to about 247,000 m3/d. This transfer capacity reduces steadily from 2024 onwards as water demand in Ad Dakhiliyah grows.

Figure 21A provides a summary of annual water supply requirements and supply sources in the Muscat Zone. For the Muscat Zone, the Barka transfers are required to meet the peak demand and contribute to reserves through 2023. In 2023, the constraints on transfer capacity cause a supply shortfall in Muscat zone of about 9,000 m3/d compared to peak demand plus margin. Ghubrah III IWP early water will be available in winter 2023 to provide capacity of 150,000 m3/d (33 MIGD). It will reach full capacity in Q2, 2024, contributing to 2024 peak demand requirements.

[16] The Ghubrah temporary RO plant is a OWWSC resource.

Figure 22 Resource Adequacy and Development Plan – Muscat Zone



	2021	2022	2023	2024	2025	2026	2027
Muscat Zone							
Average Demand	570	579	591	600	604	606	619
Peak Demand	649	659	673	683	688	691	694
Peak Demand + Margin	701	712	726	739	748	753	756
Contracted Capacity							
Ghubrah II IWP	191	191	191	191	191	191	191
Qurayyat IWP	180	180	180	200	200	200	200
Ghubrah III IWP	-	-	-	300	300	300	300
Prospective Capacity							
OWWSC **Resources**							
Wells Capacity[a]	80	80	80	25	25	25	25
Ghubrah Temp.	20	20	20	20	20		
Total Muscat Zone Capacity	**471**	**471**	**471**	**736**	**736**	**716**	**716**
Reserve over Peak Demand	-178	-188	-202	53	48	25	22
Reserve over Peak Demand + Margin	-230	-241	-255	-3	-12	-37	-40
Transfers							
Available Transfer Capacity from Barka to Muscat[b]	218	314	247	190	219	214	208
Required Transfers from Barka to Muscat[c]	178	188	202	0	0	0	0
Muscat Zone Capacity +/- available Transfers	**689**	**785**	**718**	**926**	**955**	**930**	**924**
Reserve over Peak Demand (shortfall)	40	126	45	243	267	239	230
Reserve over Peak Demand + Margin (shortfall)	-11	74	-9	187	207	177	167

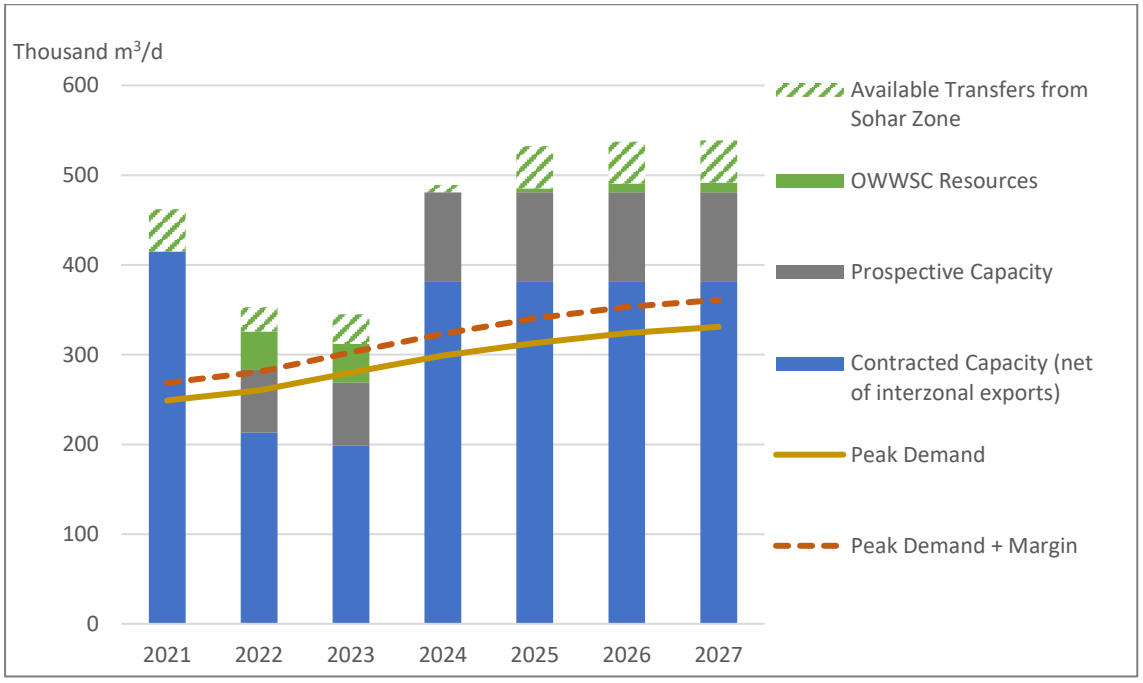
[a] The wells will be used up to the maximum capacity during peak demand periods when the desalination capacity is not sufficient to meet the demand. OWWSC is responsible of maintaining and operating these wells to overcome supply deficit.
b Available transfer capacity is the transmission capacity less the peak demand requirement of Ad Dakhiliyah, subject to the availability of Barka resources. there will be reinforcement of 100,000m3/d on the transmission line from Barka to Muscat starting in summer 2022.
[c] Transfer required to meet Muscat Peak Demand + Margin, subject to maximum available transfer capacity.

Barka Zone

The Barka zone is currently supplied by Barka IWPP (RO, MSF-standby), Barka II IWPP, Barka IV IWP, and OWWSC -operated wellfield resources. These resources currently exceed the demand requirements within the Barka Zone and enable transfers to support the needs of the Muscat Zone.

Figure 22 provides a summary of annual water supply requirements and supply sources in the Barka Zone. OPWP will procure additional water desalination capacity within the Barka zone: Barka Water 2024 IWP. This procurement is expected to secure sufficient capacity to meet targets at a reasonable cost and provide for demand growth in this supply zone. OWWSC has also requested OPWP to procure 70,000 m^3/ to cover a shortfall in Muscat zone until COD of Barka V IWP is achieved.

Figure 23 Resource Adequacy and Development Plan – Barka Zone



	2021	2022	2023	2024	2025	2026	2027
Barka Zone							
Average Demand	219	229	247	263	275	285	291
Peak Demand	249	260	280	299	313	324	331
Peak Demand + Margin	269	281	303	323	341	353	361
Contracted Capacity							
Barka I IWPP (RO) [a]	101	-	-	-	-	-	-
Barka I IWPP (MSF- Standby) [a]	91	-	-	-	-	-	-
Barka II IWPP [b]	120	120	120	-	-	-	-
Barka IV IWP	281	281	281	281	281	281	281
Barka V IWP	-	-	-	100	100	100	100
Prospective Capacity							
Barka 2022-2023 IWP	-	70	70	-	-	-	-
Barka 2024 IWP	-	-	-	100	100	100	100
OWWSC Resources							
Wells Capacity [d]	-	43	43	-	4	10	11
Total Barka Zone Capacity	**502**	**514**	**514**	**481**	**485**	**491**	**492**

Total Supply to Barka Zone [e]	**199**	**206**	**280**	**299**	**313**	**324**	**331**
Reserve over Supply to Barka Zone	303	308	234	182	172	167	161
Reserve over Supply to Barka Zone+Margin	287	291	211	159	144	137	131
Transfers							
Available Transfer Capacity From Sohar to Barka [f]	31	27	33	8	47	47	47
Required Transfer from Sohar to Barka	0	0	0	0	0	0	0
Required Transfer from Barka to Sohar	0	0	0	0	0	0	0
Max. Transfer Capacity from Barka to Muscat	218	314	247	236	230	225	221
Available Transfer Capacity from Barka to Muscat	218	314	247	190	219	214	208
Required Transfer from Barka to Muscat	-178	-188	-202	0	0	0	0
Barka Zone Capacity +/- Transfers	**355**	**353**	**345**	**489**	**532**	**538**	**539**
Reserve over Supply (shortfall)	156	146	65	190	219	214	208
Reserve over Peak Demand + Margin (shortfall)	87	72	42	166	192	184	178

[a] Barka I will be expired on 31st Dec. 2021, Barka I IWPP (MSF) since it is in a Standby mode it is excluded from the total capacity.
[b] Barka II will be expired on 31st March. 2024.
[c] As per OWWSC request.
[d] The wells will be used up to the maximum capacity during peak demand periods when the desalination capacity is not sufficient to meet the demand. OWWSC is responsible of maintaining and operating these wells to overcome supply deficit.
[e] Due to transmission network constraints, Dakhiliyah peak demand will not be fully met until the network reinforcement project is completed in 2023. The expected shortfall in Dakhiliyah in 2021 & 2022 are 49 m^3/day & 54 m^3/day respectively.
[f] Subject to reserves available in Sohar Zone.

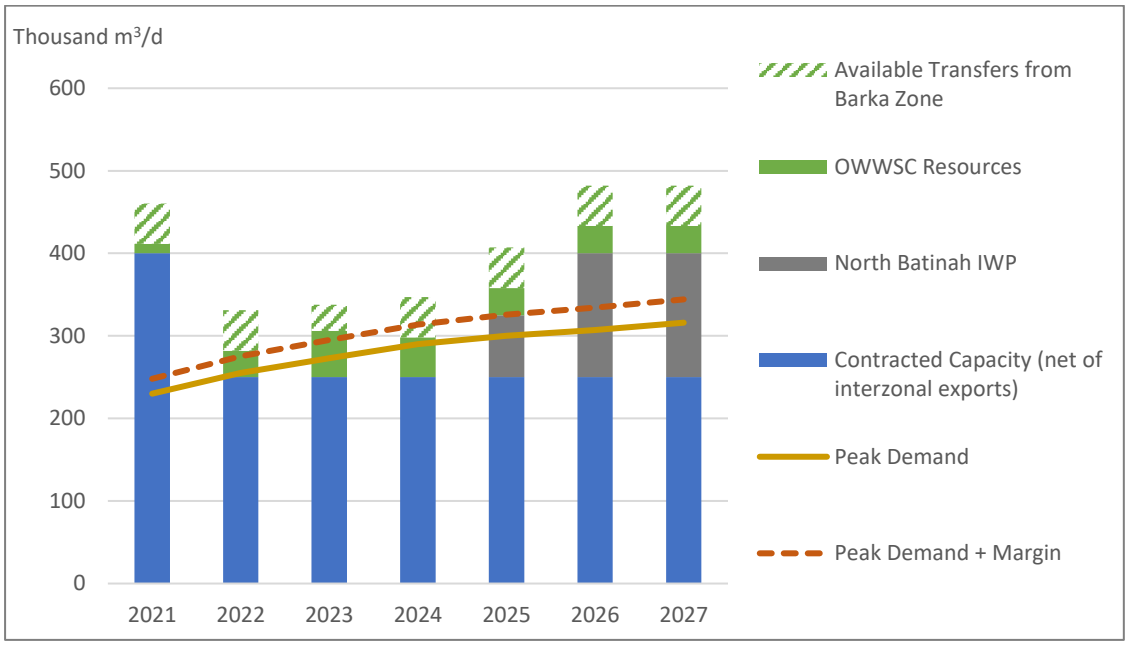
Sohar Zone

The Sohar zone is currently supplied by the existing Sohar IWPP, Sohar IV IWP and OWWSC resources which include wellfield supply and an RO plant operated by MISC under contract to OWWSC.

The Sohar IWPP PWPA expires in March 2022. The remaining resources have sufficient capacity to meet water requirements until 2025. OPWP will procure North Batinah IWP with early water capacity of 75,000 m^3/d in Q2, 2025 and full capacity of 150,000 m^3/d (33 MIGD) in Q2,2026. However, the respective site is not yet confirmed which might affect the timeline of the project. OWWSC wells capacities are needed in 2022, 2023 and 2024 to meet the peak demand due to the retirement of Sohar IWPP and before the completion of North Batinah IWP. These well extraction rates are significantly higher than in any previous period and may not be sustainable for extended periods. Hence supply adequacy is vulnerable to unplanned outages or red tide events from 2022 until water supply is available from the new North Batinah IWP.

While initially planned with a COD in 2023, the North Batinah IWP was at OWWSC 's request to achieve COD in Q2, 2026. This delay is anticipated to lead to some deficit in 2025, but OWWSC expects to cover the deficit via other mitigations. Data further indicates that a surplus in the Barka Zone of up to 49,000 m^3/d can be transferred to Sohar Zone, subject to the interconnection capacity between the two zones. Figure 23 indicates the development of the supply balance and resource adequacy. In 2024 there will be a lack of reserve over peak demand plus margin until the completion of the North Batinah IWP. Then reserves meet the planning target for the remainder of the forecast period.

Figure 24 Resource Adequacy and Development Plan – Sohar Zone



	2021	2022	2023	2024	2025	2026	2027
Sohar Zone							
Average Demand	199	221	237	251	260	266	274
Peak Demand	230	255	273	290	300	307	316
Peak Demand + Margin	248	275	295	314	326	334	344
Contracted Capacity							
Sohar I IWPP (Standby Only) [a]	150	-	-	-	-	-	-
Sohar IV IWP	250	250	250	250	250	250	250
Prospective Capacity							
North Batinah IWP [b]	-	-	-	-	75	150	150
OWWSC Resources							
Wells Capacity [c]	0	21	45	37	22	22	22
Sohar RO MISC	11	11	11	11	11	11	11
Total Sohar Zone Capacity	**261**	**282**	**306**	**298**	**358**	**433**	**433**
Reserve over Peak Demand	31	27	33	8	58	126	117
Reserve over Peak Demand + Margin	13	7	11	-16	32	99	89
Transfers							
Required Transfer from Sohar to Barka	0	0	0	0	0	0	0
Available Reserve from Barka	125	119	32	182	172	167	161
Available Transfer Capacity from Barka	49	49	32	49	49	49	49
Required Transfer from Barka to Sohar	0	0	0	0	0	0	0
Sohar Zone Capacity +/- Required Transfers	**310**	**331**	**338**	**347**	**407**	**482**	**482**
Reserve over Peak Demand (shortfall)	80	76	65	57	107	175	166
Reserve over Peak Demand + Margin (shortfall)	62	56	43	33	81	148	138

[a] Sohar I IWPP will be expired on 31 March 2022 and since it is in a standby mode it is excluded from the total capacity
[b] North Batinah IWP with early water capacity of 75,000 m³/d on Q2, 2025 and full capacity of 150,000 m³/d on Q2,2026.
[c] In 2022, 2023 and 2024, OWWSC expected maximum output of the wells capacity includes Batinah North wells, Buraymi wells, and Dhahirah wells.

Summary

In summary, the supply plan meets peak demand and margin requirements in the MIS across the forecast period, except for a shortfall against the margin target in Muscat Zone in 2021 and 2023. The Muscat Zone depends on transfers from Barka Zone to meet peak demand until the Early Water capacity of Ghubrah III IWP becomes available in Q4 2023. Margins in certain years may be vulnerable delay in the development of planned projects, such that contingency plans need to be available.

OPWP and OWWSC will continue to work together to anticipate potential difficulties and to develop supply mitigation plans as necessary.

3.2 SHARQIYAH WATER NETWORK

The Sharqiyah Water Network is developed and operated by OWWSC, serving Ash Sharqiyah North and Ash Sharqiyah South Governorates, noting that this network is not connected with the MIS. OPWP provides desalinated water to OWWSC from the Sur II IWP and Asselah IWP[17]. OWWSC provides water to other communities of the Governorate of Ash Sharqiyah South from its own resources, including wells and RO plants.

a. Demand for Water

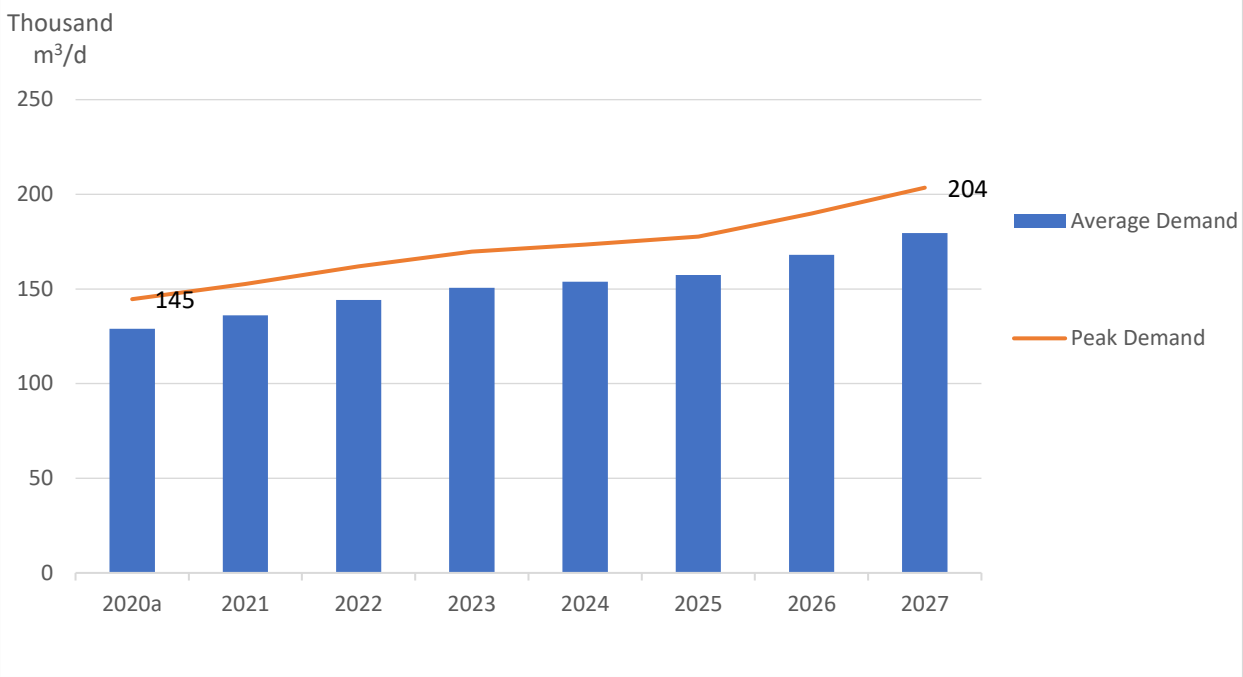
The OWWSC water demand forecast for the Sharqiyah Zone is shown in Figure 24. Sharqiyah Zone refers to the area served by the Sharqiyah Water Network that is or will be connected to water desalination plants under contract with OPWP.

The average actual water consumption in Sharqiyah Zone for 2020 has increased by 9,000 m^3/d compared with the last 7 Year Statement, bringing the average consumption to about 180,000 m^3/d and the peak consumption to 204,000 m^3/d.

OWWSC projects average growth for peak and annual average demand at 5% over the 7-year horizon, which is higher than the forecast provided for the previous 7-Year Statement, Issue 14. As for the annual growth, it is not constant, as it varies from year to year. In pace with the network developments, the peak demand increases by about 6% in 2021, while it increases by only 2% in the years 2024 and 2025.

[17] The SCOD of Aseelah IWP is on 1st April 2021.

Figure 25 Water Demand Projections – Sharqiyah Water Network



	2020[a]	2021	2022	2023	2024	2025	2026	2027	Average Growth (%)
					Thousand m³/d				
Peak Demand	**145**	**153**	**162**	**170**	**173**	**178**	**190**	**204**	**5%**
Change from 2020-2026 Statement	*13*	*11*	*11*	*9*	*6*	*5*	*7*	-	
Average Demand	**129**	**136**	**144**	**151**	**154**	**157**	**168**	**180**	**5%**
Change from 2020-2026 Statement	*9*	*8*	*8*	*7*	*5*	*4*	*7*	-	

[a] The Average Demand is based on actual 2020 outturns (desalination and underground water supply) while the Peak Demand is estimated using peak factor.

b. Water Supply Resources

The supply sources available to meet water demand include existing water desalination plants and OWWSC sources. The resources that are under contract with OPWP in the Sharqiyah Zone are summarized in Table 8 and described as follows:

- **Sur II IWP**. Owned and operated by Sharqiyah Desalination Company under a WPA with OPWP, Sur II IWP has contracted capacity of 131,837 m³/d (29 MIGD), using RO technology.
- **Aseelah IWP.** Awarded in December 2017 to Al Asilah Desalination Company, to be operated under a WPA with OPWP with contracted capacity of 80,000 m³/d (17 MIGD), using RO technology. Aseelah IWP is expected to be available for commercial operation in June 2021.

In addition to the capacity under contract to OPWP, OWWSC has wells at several locations with a maximum aggregate capacity of 21,000 m³/d. They may be utilised, to a limited degree, for water supply when desalinated water capacity is not sufficient to meet the demand in the Sharqiyah Zone.

Table 8 Water Desalination Plants – Sharqiyah Water Network

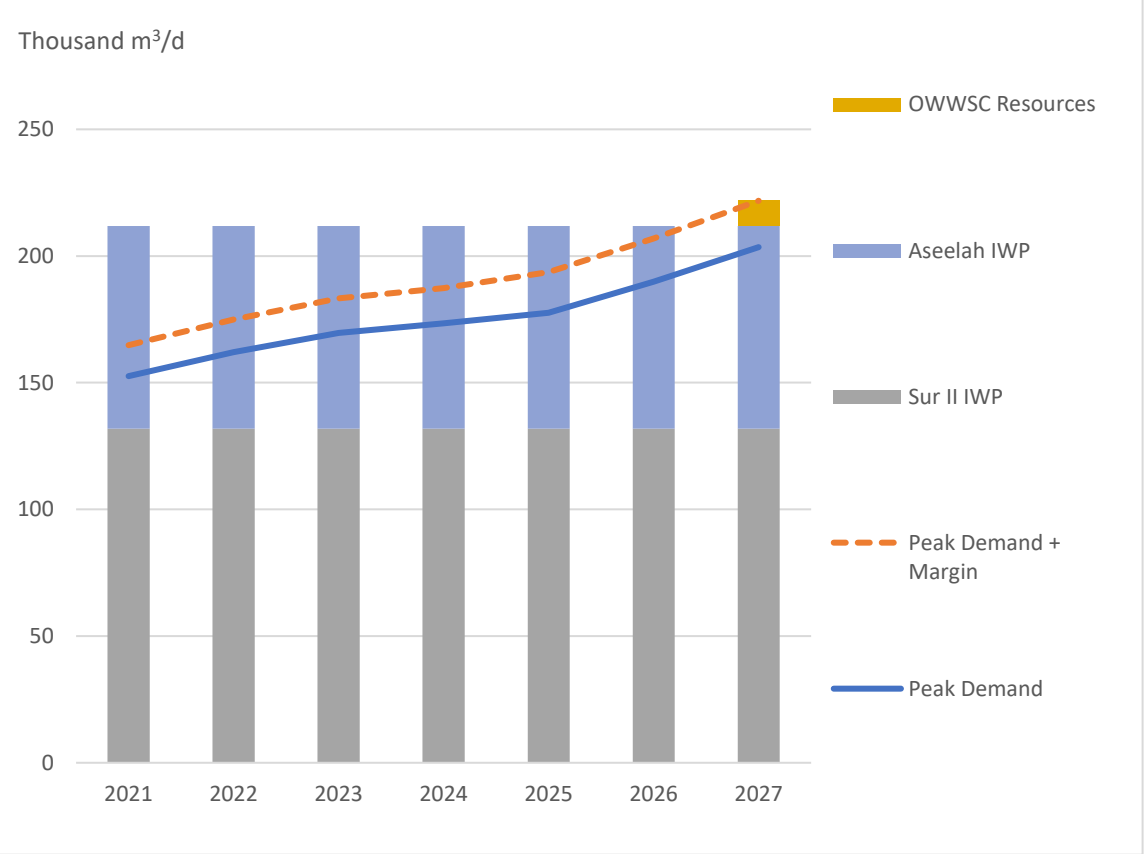
Project Name	Contracted Capacity	Contract Type	Project Company	Project Status	Technology	Contract Expiry
Sur II IWP	131,000 m^3/d	WPA	Sharqiyah Desalination Company (SAOG)	Operational	RO	2029
Aseelah IWP	80,000 m^3/d	WPA	Al Asilah Desalination Company (SAOC)	Under construction	RO	2041

c. Resource Adequacy and Development Plan

The capacity target for the Sharqiyah Zone is set at an 8% margin above forecasted peak demand up to 2024, and with a margin of 9% from 2025 to 2027, the same as the capacity target for MIS. Figure 25 compares the capacity target to the supply plan.

The figure shows that the contracted capacity is sufficient to meet the capacity target until 2026. However, it is important to note that OWWSC is currently working on the development of its transmission and distribution networks in Sharqiyah zone. OWWSC progress on the water connection to Aseelah IWP has been delayed, such that evacuation of Aseelah IWP capacity may not be possible before the end of 2021. OWWSC plans to use wells to meet the demand shortfall until the water network connection is completed.

Figure 26 Resource Adequacy and Development Plan – Sharqiyah Water Network



	2021	2022	2023	2024	2025	2026	2027
Supply Requirements							
Peak Demand	153	162	170	173	178	190	204
Peak Demand + Margin	165	175	183	187	194	207	222
Contracted Capacity							
Sur II IWP [a]	132	132	132	132	132	132	132
Aseelah IWP [b]	80	80	80	80	80	80	80
Total Contracted Capacity	**212**	**212**	**212**	**212**	**212**	**212**	**212**
Reserve over Peak Demand (Shortfall)	**59**	**50**	**42**	**38**	**34**	**22**	**8**
Reserve over Peak Demand + Margin (Shortfall)	**47**	**37**	**29**	**25**	**18**	**5**	**-10**
OWWSC Resources Supply [c]	0	0	0	0	0	0	10

[a] Including Sur capacity addition of 48,000 m³/d.

[b] Expected COD for Aseelah IWP is in Q2 2021, expected delay in OWWSC transmission lines.

[c] OWWSC wells or tankers supply are considered only as an emergency supply in the near term

3.3 DHOFAR WATER NETWORK

The Dhofar Integrated Services Company (DISC) is the principal "water department" responsible for potable water supply to consumers, and for the development, operation and maintenance of the Dhofar Water Network. OPWP provides desalinated water to DISC.

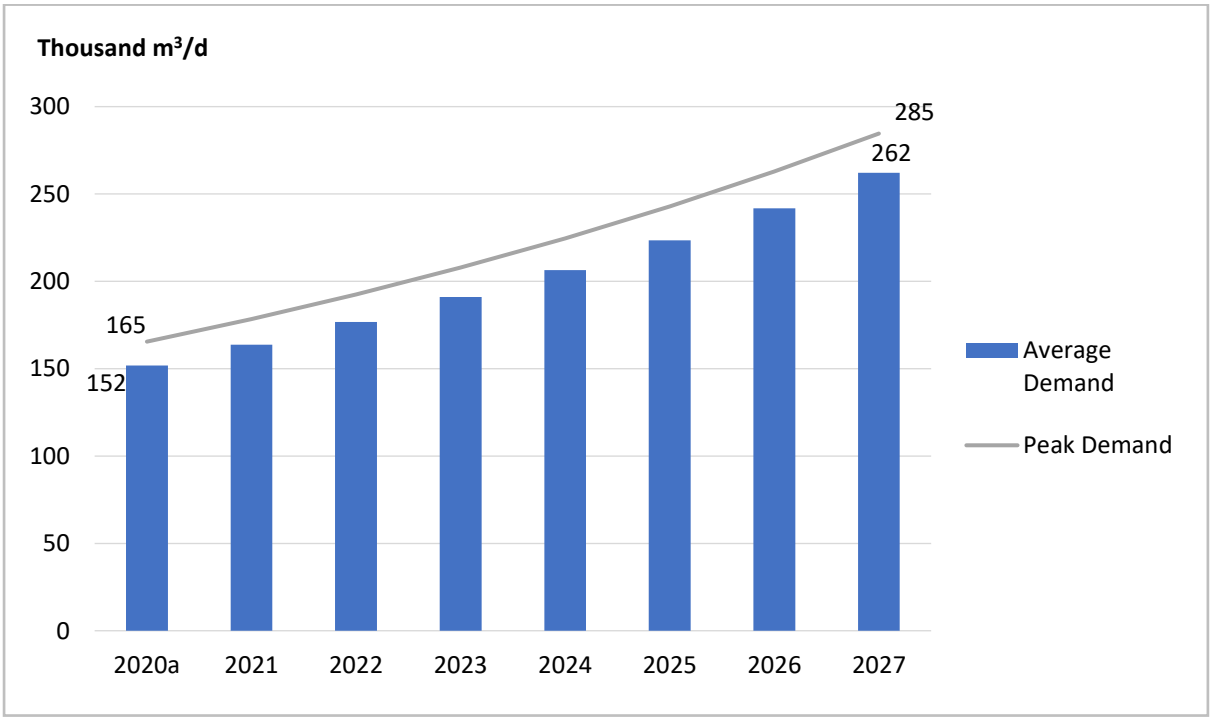
a. Demand for Water

DISC has provided OPWP with the water demand projection for the Governorate of Dhofar, shown in Figure 26. It includes the aggregated potable water demands of the wilayats of Salalah, Taqah and Mirbat.

DISC has differentiated the forecast into two demand groups: (1) Cities of Salalah, Taqah, and Mirbat, which comprise demand served by the existing water distribution network; and (2) Jabal, which represents the demand in Jabal areas that are partially connected to the network. Currently, the Jabal demand is mainly served by local wells and by tankers. DISC plans to expand its network to supply the Jabal communities during the forecast period. The expansion plans are under approval process by the Government. However, the water supply plan considers a scenario in which the expansion occurs.

Due to the change on the forecasting methodology, DISC has updated the water demand forecast considering the reduction in actual 2020 water demand compared to the projections provided for the previous 7 Year statement, Issue 14. The accumulated reduction in average demand for 2026 is about 82,000 m^3/d and 116,000 m^3/d in peak demand.

Figure 27 Water Demand Projections – Dhofar Water Network



	2020[a]	2021	2022	2023	2024	2025	2026	2027	Average Growth (%)
Peak Demand				Thousand m^3/d					
Cities	120	127	135	143	152	161	171	181	6%
Jabal	46	52	58	65	73	82	92	103	12%
Total	**165**	**178**	**192**	**208**	**225**	**243**	**263**	**285**	**8%**
Change from 2020-2026 Statement	(28)	(37)	(49)	(62)	(77)	(95)	(116)	-	
Average Demand									
Cities	109	115	122	130	138	146	155	165	6%
Jabal	43	49	55	61	69	77	87	97	12%
Total	**152**	**164**	**177**	**191**	**206**	**223**	**242**	**262**	**8%**
Change from 2020-2026 Statement	(12)	(20)	(29)	(39)	(51)	(65)	(82)	-	

[a] The Average Demand is based on actual 2020 outturns (desalination and underground water supply) while the Peak Demand is estimated using peak factor.

b. Water Supply Resources

The sources of water supply include water desalination plants under contract to OPWP and groundwater resources operated by DISC. OPWP has two water desalination plants under contract for water supply to DISC. They are described in Table 9 and as follows:

- **Salalah IWPP.** Owned and operated by Sembcorp Salalah Power and Water Company under a PWPA with OPWP, Salalah IWPP has a capacity of 68,190 m^3/d (15 MIGD), using RO technology, and was commissioned in 2012.

- **Salalah III IWP.** Owned by Dhofar Desalination Company under a WPA with OPWP, Salalah IWP has a capacity of 113,650 m^3/d (25 MIGD), using RO technology, and was commissioned on 12th March 2021[18].

In addition to this desalination capacity, DISC uses a network of groundwater sources to meet the balance of water demand. DISC estimates that the groundwater supplies have a total capacity of around 100,000 m^3/d (22 MIGD) to 110,000 m^3/d (24 MIGD) (which includes 70,000 m^3/d in the cities). DISC plans to utilise desalinated water to meet average and peak demand requirements, and to utilise groundwater from wells only as a reserve for emergency supply. This is also consistent with national policy to limit ground well production to replenish aquifers.

Table 9 Water Desalination Plants – Dhofar Water Network

Project Name	Contracted Capacity	Contract Type	Project Company	Project Status	Technology	Contract Expiry
Salalah IWPP	68,000 m^3/d	PWPA	Sembcorp Salalah Power & Water Company (SAOC)	Operational	RO	2027[a]
Salalah III IWP	113,650 m^3/d	WPA	Dhofar Desalination Company (SAOC)	Under Construction	RO	2040

[a] The contract expiry date for Salalah IWPP is on 1st April 2027.

[18] The pre-COD water production started on January 2021.

c. Resource Adequacy and Development Plan

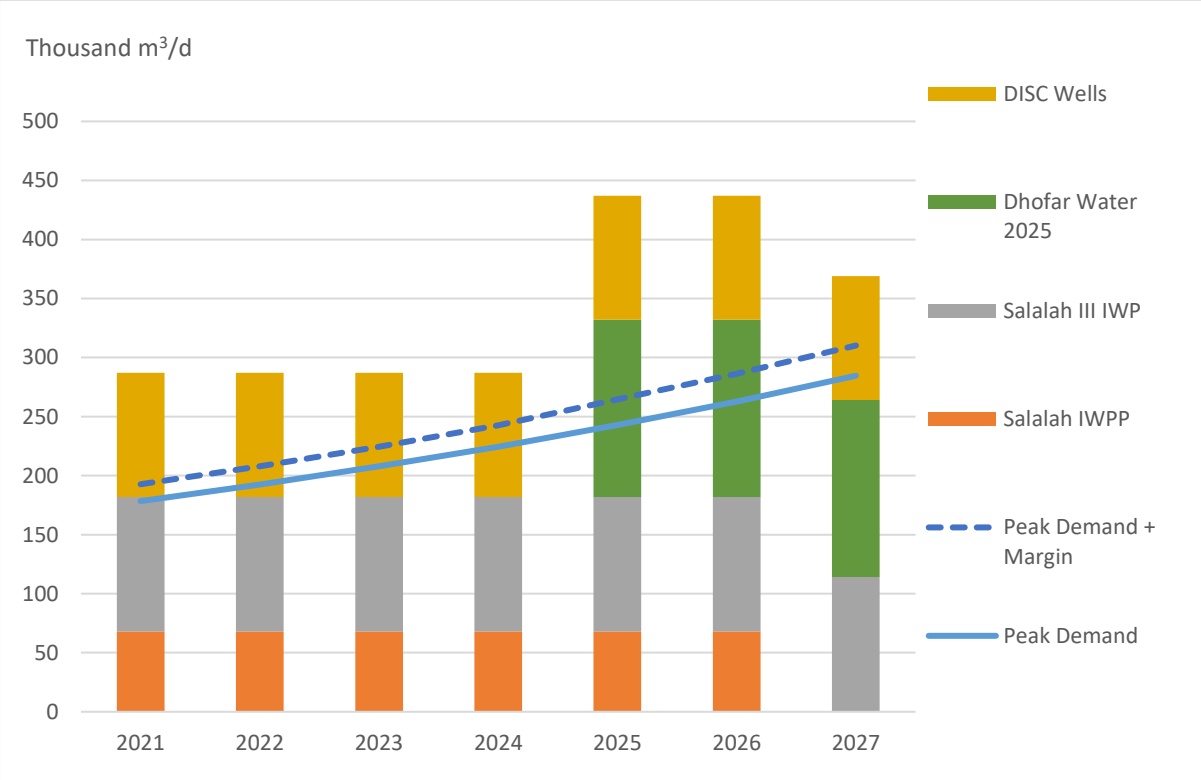
The resource adequacy presentation addresses Dhofar Cities' and Jabal demand, which corresponds to DISC's proposed network expansion plan. The capacity target assumes the same reserve margin standard as the MIS and Sharqiyah Zone in the northern regions of the Sultanate. Figure 27 shows the demand-supply balance, considering network expansion to include water demand in the Jabal areas. It illustrates that from 2022, groundwater supply would be required in every year to supplement desalinated water supply, unless additional desalination capacity becomes available.

DISC has requested OPWP to procure new desalination capacity of 150,000 m^3/d (33 MIGD) to begin operation in 2025. To provide greater supply security via geographical diversity, it was proposed to establish this new plant on the western side of Salalah (Raysut area).

The desalinated water from Salalah IWPP, Salalah III IWP, and the prospective Dhofar Water 2025 IWP would be sufficient to meet the network's total water supply needs through to the year 2027, as shown in Figure 27. As noted above, DISC plans to use wells only as reserve for emergency supply. This is achieved in 2025 with the addition of Dhofar Water 2025 IWP.

Due to the expiry of the Salalah IWPP contract at the end of March 2027, DISC is expected to review its water demand forecasts and verify the need to replace this capacity. OPWP will work together with DISC to develop procurement plan either by extending the current contract or replacing it with another desalination plant.

Figure 28 Resource Adequacy and Development Plan – Dhofar Cities and Jabal



	2021	2022	2023	2024	2025	2026	2027
Supply Requirements							
Peak Demand - Cities	127	135	143	152	161	171	181
Peak Demand - Jabal	52	58	65	73	82	92	103
Total Peak Demand	**178**	**192**	**208**	**225**	**243**	**263**	**285**
Total Peak Demand + Margin	**193**	**208**	**224**	**243**	**265**	**286**	**310**
Contracted Capacity							
Salalah IWPP	68	68	68	68	68	68	
Salalah III IWP	114	114	114	114	114	114	114
Total Contracted Capacity	**182**	**182**	**182**	**182**	**182**	**182**	**114**
Prospective Capacity							
Dhofar Water 2025	-	-	-	-	150	150	150
Total Water Desalination Resources	**182**	**182**	**182**	**182**	**332**	**332**	**264**
Reserve over Peak Demand (Shortfall)	4	-10	-26	-43	89	69	-21
Reserve over Peak Demand + Margin (Shortfall)	-11	-26	-42	-61	67	46	-46
DISC Resources							
DISC Capacity[a]	105	105	105	105	105	105	105
DISC Groundwater Supply Requirements	**0**	**10**	**26**	**43**	**0**	**0**	**21**
Reserve over Peak Demand (Shortfall)	109	95	79	62	194	174	84
Reserve over Peak Demand + Margin (Shortfall)	94	79	63	44	172	151	59

[a] Total wells supply is shown as 105,000 m^3/d, considering an approximate capacity range of 100,000 m^3/d to 110,000 m^3/d. This range includes wells capacity within the cities (70,000 m^3/d) and supply outside the cities.

SECTION 4 Procurement Activities

4.1 POWER PROJECTS

OPWP's current and near-term procurement activities for power projects include the following, and are summarized in Table 10:

- **Manah I and II Solar IPPs.** OPWP is procuring two solar PV projects at a site in Manah via a single RFP process. Both projects will have installed capacity of 1000 MW. The RFQ was issued in Q3 2019, and the RFP was released in Q3 2020. The projects will have successive scheduled CODs: in Q4 2023 for Manah I Solar IPP, and in Q1 2024 for Manah II Solar IPP.

- **Wind IPPs 2025.** OPWP plans to commence the procurement of two wind IPPs in different locations in the beginning of 2022 (RFQ to be released in Q1), to achieve commercial operation in 2025. The expected locations for these two projects are in Duqm and in Jalaan Bani Bu Ali (MIS). Both IPPs are expected to have a combined installed capacity of 300 MW.

- **Solar IPP 2025.** OPWP plans to launch the RFQ process for the third of the series of solar IPP procurements in Q4 2021, to achieve commercial operation in 2025. This project may also have installed capacity of 500 MW or more, subject to site and market evaluations.

- **Power 2024.** OPWP currently plans to initiate a procurement round for new PPAs that would begin operating in 2024. Existing generators with expiring or expired P(W)PAs and participants in the Spot Market may be eligible to participate in this competition, subject to qualification. The total capacity requirement in 2024 and procurement timeline will be determined following the outcome of the review of the capacity procurement framework, demand developments, and considerations for supply via the Spot Market.

- **Power 2026.** In-line with assessing the procurement needs for long-term contracts every two years, OPWP has identified the possibility to initiate a procurement round for new PPAs that would begin operating in 2026. Similar to Power 2024, existing generators with expiring or expired P(W)PAs and participants in the Spot Market may be eligible to participate in this competition, subject to qualifications. The overall capacity need for this procurement round will only be determined at a later point in time and following the outcome of the capacity procurement framework review, the possible Power 2024, demand developments, and considerations for supply via the Spot Market.

- **Dhofar II Wind IPP.** OPWP plans to procure a wind project of about 100 MW in Harweel, adjacent to the existing Dhofar Wind IPP in the DPS. The RFP expected to be released by Q1 2023, to achieve commercial operation in 2026.

OPWP also considers solar CSP with energy storage to be a promising technology solution. Ground-source data collection is currently being planned to commence in 2021, to support a feasibility assessment to be completed in 2022. The previous 7-Year Statement included a solar CSP project, Duqm Solar IPP 2026, which this feasibility assessment would support. Once the project has been deemed viable, OPWP will revise its incorporation into the development plan and the 7 Year Statement.

Upon request from the APSR, OPWP initiated a revision of the existing pre-feasibility study for the procurement of the Barka WTE IPP in 2021. The outcome of this feasibility is not expected until the after the publication of this 7 Year Statement. The outcome and implications on the development plan will be included in the upcoming version of the 7 Year Statement.

Table 10 Procurement Activities in 2021-2022 – Power Projects

	System	Capacity	RFQ	RFP	Bids Due	Award Anticipated	SCOD
Dhofar II Wind IPP 2026	Dhofar	100 MW	Q4, 2022	Q1, 2023	Q3, 2023	Q1, 2024	Q1, 2026
Duqm Wind IPP 2025[a]	Duqm	200 MW	Q1, 2022	Q3, 2022	Q1, 2023	Q3, 2023	Q3, 2025
Jalaan Bani bu Ali Wind IPP 2025[a]	MIS	100 MW	Q1, 2022	Q3, 2022	Q1, 2023	Q3, 2023	Q3, 2025
Manah I Solar IPP	MIS	500 MW	Completed	Completed	Q4, 2021	Q2, 2022	Q2, 2024
Manah II Solar IPP	MIS	500 MW	Completed	Completed	Q4, 2021	Q2, 2022	Q3, 2024
MIS Solar IPP 2025	MIS	500 MW	Q4, 2021	Q1, 2022	Q3, 2022	Q4, 2022	Q2, 2025
Power 2024[b]	MIS	TBD	TBD	TBD	TBD	TBD	TBD
Power 2026[b]	MIS	TBD	TBD	TBD	TBD	TBD	TBD

[a] Project procurement is subject to the outcomes of a feasibility study to be undertaken in Q3, 2021 for Wind Projects.

[b] Capacity requirement and procurement timeline is likely to identified/confirmed at a later point, depending upon outturn of demand growth and demand forecast updates, conclusions following the capacity procurement framework review, and assessments of capacity contributions from other resources, such as the spot market (and the outturn of Power 2024, in the case of the Power 2026 procurement round).

Future Procurement Activities

From 2023 to 2027, OPWP plans to continue to procure new solar and/or wind IPPs on an annual basis. The RE development plan includes Solar PV 2027, for which the procurement process may begin in 2023. Depending upon demand growth and other factors, a third procurement round for existing generator contract renewals or new-build thermal projects may be initiated for operational start in 2026 or 2027 (Power 2026/27).

If the need for additional capacity should arise, or according to opportunity, OPWP may also procure short-term capacity or energy via transactions with neighbouring power systems, or initiate development of a Demand Response program in which demand reductions will be contracted with participating electricity customers.

4.2 WATER PROJECTS

Current/Near-Term Procurement Activities

OPWP's current and near-term procurement activities for water projects include the following, and are summarized in Table 11:

- **Barka 2022-2023 IWP.** With a capacity 70,000 m^3/d , which requested from OWWSC to OPWP to cover a shortfall in Muscat zone until COD of Barka V IWP is achieved.

- **North Batinah IWP.** OPWP initiated the procurement process in 2018 for new IWP capacity of 150,000 m^3/d (33 MIGD). The prequalification process for the project was completed in April 2019. The RFP is planned to be released in Q3 2021, subject to confirmation of site allocation. The early water requirement for the project is Q2 2025 while the SCOD for the full capacity is planned for Q2 2026.

- **Dhofar Water 2025.** OPWP initiated the procurement process for this project in Q3 2019 for a capacity of 150,000 m^3/d (33 MIGD). Release of the RFP is planned for Q3 2021 and is subject to confirmation of land allocation and availability of transmission infrastructure.

- **Barka Water 2024.** Following the expiration of Barka II PWPA in 2024, OPWP notes that additional capacity will be required to cover the resulting deficit. Accordingly, OPWP will follow the approved procurement strategy by the Authority to procure a capacity of 100,000 m^3/d for COD in Q2 2024.

The Wadi Dayqah IWP and Masirah IWP projects were included in the list of current and near-term procurement activities in the 7-Year Statement Issue 13. The procurement process of Wadi Dayqah IWP has been put on indefinite hold pending final approval by OWWSC, and Masirah IWP is suspended pending further assessments. OWWSC will operate Tanweer existing plant and build a new desalination plant with a capacity of 2,200 m^3/d to supply the demand in Masirah Zone.

Table 11 Procurement Activities in 2021-2022 – Water Projects

	System	Capacity	RFQ	RFP	Bids Due	Award Anticipated	SCOD
North Batinah IWP [a]	MIS	33 MIGD	1st Round Completed	Q3, 2021	Q1, 2022	Q3, 2022	Q2, 2026
Dhofar Water 2025[b]	Dhofar Water Network	33 MIGD	Q1, 2021	Q2, 2021	Q3, 2021	Q1, 2022	Q1, 2025
[a] North Batinah IWP Early Water is scheduled for Q2, 2025 and full SCOD is planned for Q2, 2026.							
[b] Subject to confirmation of site allocation and other approvals.							

Future Procurement Activities

From 2023 to 2027, OPWP may procure additional water desalination capacity projects. The analysis in section 3.1.C, Resource Adequacy and Development Plan, suggests there may be a need for additional capacity in the Muscat Zone and Sharqiyah Zone around 2027. This will be reassessed in the coming years, as the procurement process would not need to begin until 2023 for a 2027 COD.