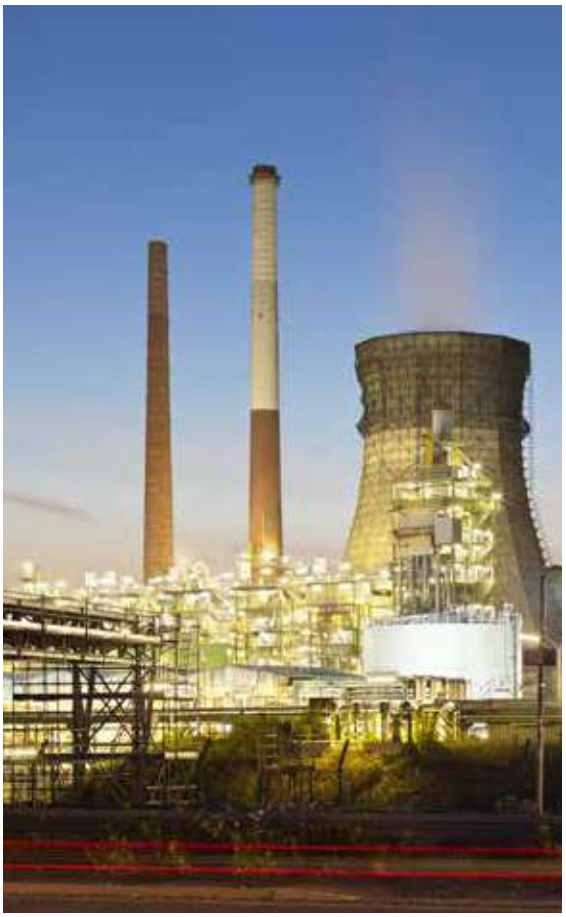
Gulf Research Center
Knowledge for All



GCC

ENERGY & POWER INDUSTRY

www.grc.net

ENERGY & POWER INDUSTRY

TABLE OF CONTENTS

1. Executive Summary

The GCC countries are promoting energy and power sector by taking initiatives for renewable energy targets such as by 2030, Saudi Arabia wants to use renewable energy to meet half of its energy needs, with gas covering the remaining half, and United Arab Emirates (UAE) Energy Strategy 2050 seeks to achieve the country's economic needs and environmental objectives by utilizing a combination of clean, nuclear, and renewable energy sources. The goal includes 44 percent clean energy, 38 percent gas, 12 percent clean coal and 6 percent nuclear energy by 2050.

The intergovernmental organization International Renewable Energy Agency (IREA) and partners planned workshop in GCC Interconnection Authority (GCCIA) targeting regional initiatives to develop renewable power. The workshop partners including GCCIA planning to launch a Clean Energy Initiative in the Region (Solar bridge Initiative) to integrate larger amounts of renewable electricity in the power systems, to support in achieving the 2030 target of the Pan-region Renewable Energy Strategy. The government initiatives and commercial partners collaboration promoting the growth of the energy and power industry in GCC.

GCC Climate Change Commitments:

KUWAIT

- Commits to reducing its emissions by 7.4% (142,290,7580MT C02eq) by 2035 compared to BAU (2015)
- Initiated formal produces to study the last of removal of subsides for gasoline from the beginning of 2016 and gradual removal of subsidies for electricity and water in commercial and industrial sectors.

QATAR

- Commits to reduce GHC emissions by 25% by 2030 compared to BAU
- Introduced a rapid mass transit system and upgraded its airport to level 3
- Introducing electric vehicle charging infrastructure and is gradually adopting Euro 6 emissions standards for regular vehicles.

OMAN

- Commits to reduce GHG Emissions by 4% (unconditional) and 7% (Conditional) by 2030 compared to the BAU scenario (predicted at about 125.254 MT C02eq)
- Vision 2040 includes a national energy strategy and carbon control target plan

SAUDAI RABIA

- Commits to reducing, avoiding, and removing GHG emissions by 278 million tons of C02eq annually by 2030, with the year 2019 designated as the base year for this NDC
- Net Zero Pledges: 2060
- Carbon Neutral goal by 2060
- Target of 50% renewables by 2030
- Commitment to advance low-carbon hydrogen development (green and blue)

UAE

- Commits to reduce GHC emissions by 23.5% for 2030 compared to BAU. (BAU scenario emissions about 310 million tons)
- Net Zero Pledges: 2050
- carbon Neutral goal by 2060
- Develop a Green growth strategy
- Target of 50% renewable by 2050
- Formed a hydrogen alliances
- Submitted a bid to hos COP28 in 2023

BAHRAIN

- Net Zero Pledges: 2060
- Carbon Neutral goal by 2060
- Target of 5% renewable of peak capacity by 2025 and 10% by 2035
- 6% reduction of energy consumption in the year 2025 (percentage of the average final energy consumption)

2. GCC

2.1 Initiatives to Promote Energy and Power

The Gulf Cooperation Council (GCC) aims for social and economic integration among six Middle Eastern countries—including Oman, Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, and Bahrain. The date 25th May 1981 marks the establishment of the GCC in Riyadh, Saudi Arabia. Also, the GCC aims to unite members based on common goals, political identities, and cultural values, .Also, these countries are counted among the top 25 countries recording the highest CO2 per capita emissions. Fossil fuels primarily cater to the regional domestic energy demands, and the charges for primary energy and electricity within the region are low.

Among the GCC countries, Saudi Arabia holds the largest oil reserves, (267.19 bbl) while Kuwait (101.50 bbl.) and the UAE (111.00 bbl.) follow. Additionally, Qatar is accredited with having one of the largest gas reserves (proved natural gas reserves – 843 trillion cubic feet (Tcf)). Due to the easy availability of fossil fuels in the Gulf countries, investment is on lower side in renewable energy sources.

2.1.1 Oman

Although not a member of the Organization of the Petroleum Exporting Countries (OPEC), Oman produces most of the oil and natural gas in the Middle East. The primary energy source in Oman is fossil fuels. Additionally, Oman exports its surplus energy supply to other countries. Besides, through domestically-produced energy, Oman can be self-sufficient.

Some of the developments relating to the energy sector in Oman include:

- Two large solar projects totaling 2.5 GW for increasing power consumption were commissioned in Oman in 2021.
- Oman has invested in various projects with targets including 30% generation of its electricity needs from renewable sources. Among these are Dhofar's wind farm project, the 11 solar-diesel hybrid facilities, and the two solar IPPs in Manah. In addition, the "Sahim" (Contribute) initiative involves installing small-scale solar panels on residential complexes and commercial buildings.
- A team of Saudi and Kuwaiti firms received financing for the 500-megawatt (MW) solar photovoltaic independent project at Ibri in Oman. Furthermore, In March 2019, the Oman Power and Water Procurement Company (OPWP) chose the Gulf firms as the favoured bidders. Thereafter, a Beijing-based bank extended a loan amounting to $60 million of the total $275 million project amount, which is the first renewable energy financing initiative in Oman.
- A group led by Japan's Marubeni and PDO Oman entered into a power purchase agreement (PPA) as part of a 100 MW PV solar project development at Amin in 2019.

2.1.2 Bahrain

Among the oil-producing countries in the Gulf region, Bahrain is the smallest oil and gas producer. However, the country's energy independence could increase due to recent discoveries in oil and gas. Besides, the Kingdom of Bahrain has two revenue-generating oil fields: the onshore Bahrain (Awali) field and the offshore Abu Safah field. Bahrain and Saudi Arabia are joint owners of the latter. Also, partnering with international companies, the Ministry of Oil and Gas of Bahrain is working to explore the large cache of gas from the deeper layers of the onshore field.

Listed below are some of the developments in Bahrain relating to energy sector:

- In 2022, Bahrain has launched tender for developing its first utility large-scale solar project. Once completed, the Solar PV Park will be equipped to generate 100 MW of electricity.
- Bahrain's scheduled renewable energy pipeline (encompassing waste, wind, solar, and energy technologies) proposes solar power capturing most of the country's renewable energy.
- A 50-megawatt plan for installing solar panels on the roofs of many government-owned buildings is one more SEA initiative.
- The cabinet approved the National Renewable Energy Action Plan in 2017, setting a target of 5% by 2025 and 10% by 2035 for national renewable energy sources—including solar, waste, and wind technologies.

2.1.3 Kuwait

Kuwait is among the top 10 producers and exporters of total petroleum liquids. Also, Kuwait adopts the practice of burning fossil fuels for its energy generation and water desalination requirements. Kuwait meets 90% of its water consumption with desalinated water. Moreover, Kuwait depends on oil and natural gas to meet its energy requirements. Each fuel accounts for ~50% of total primary energy consumption. Additionally, electricity, water, and oil products are available at heavily subsidized rates in Kuwait. For instance The government subsidizes around 95% of the electricity production cost

Although the country has new exploits, Kuwait's regulated oil sector is going slow in production and exploration. Moreover, Kuwait has taken steps to enhance oil recovery.

Some initiatives taken by Kuwait toward its energy sector growth include:

- Among downstream opportunities, Kuwait is currently working on two mega refinery projects: the Clean Fuels project and the Fourth Refinery. The Mina Abdulla and Mina Al-Ahmadi refinery complexes will be expanded as part of the former project. The costs of these projects are expected to go beyond $30 billion.
- In June 2023, Kuwait Oil Tanker Company (KOTC), a state-run company announced the commencement of construction on the two solar power plants, with an expected power output of 7 megawatts.

2.1.4 Qatar

Qatar—following the United States, Russia, Iran, China, and Canada—was found to have the world's sixth-largest reserves of dry natural gas in 2021. Also, Qatar was rated as the second-largest LNG exporter and the third-largest natural gas producer in 2021. Additionally, Qatar's high natural gas production volume leads to premium petroleum liquid byproducts—including hydrocarbon gas plant liquids (HGLs and lease condensates). Qatar is also the forerunner in gas-to-liquids (GTL) production while housing the world's most extensive GTL facility.

The major contributor to Qatar's economy is its energy industry. As per the data released by the International Monetary Fund, Qatar's earnings from its hydrocarbon sector touched 81% of the country's overall revenues in 2021, which rose from 77% in 2020. Also, hydrocarbon export revenues increased from $47 billion in 2020 to almost $77 billion in 2021.

Qatar is taking a range of initiatives for the progression of its energy sector, for instance:

- The Qatar Electricity & Water Company (QEWC) is working to increase its desalination capacity by 61.5 MIGD at the Umm Al Houl Power Plant, among the most prominent water desalination and power generation plants in the area.
- In late 2022, giant Solar Power Plant Al Kharsaah construction work was initiated with expected power capacity of 800 MWp, capable of serving approx. 10% of Qatar's peak electricity demand.
- In January 2022, QatarEnergy awarded a major Engineering, Procurement, Construction, and Installation (EPCI) Contract for the offshore scope of its LNG North Field Expansion Project to McDermott Middle East Inc.

2.1.5 Saudi Arabia

Saudi Arabia has around 15% of the world's proven oil reserves, being the biggest exporter of crude oil worldwide. Also, Saudi Arabia is adopting a series of measures to raise the capacity of its power sector to cater to the rising demand from residential and commercial consumers. More importantly, the country wants to diversify its domestic energy mix.

Herein are some initiatives of Saudi Arabia to advance its energy sector:

- Saudi Arabia plans to replace its 42% use of petroleum for generating 110-gigawatt daily electricity needs with an equal mix of natural gas and renewable energy by 2030. Also, the Ministry of Energy is slated to increase its spending on power and renewable energy projects to $293 billion by 2030.
- Saudi Arabia plans to spend $38 billion in energy distribution by 2030.
- Saudi Arabia established the Saudi Nuclear Energy Holding Company to focus on expanding its nuclear facilities.
- The 2021 Sudair Solar Plant Project is initiated by Saudi Arabia, which is expected to be largest solar plant in Saudi Arabia, and it will contribute to 70% of its total renewable energy by 2030.

2.1.6 United Arab Emirates

The UAE, with its 100 million barrels of proven oil resources in Abu Dhabi, is the sixth largest oil producer globally. Its daily output of petroleum and liquids touches 3.2 million barrels. Approximately 30 % of the UAE's GDP is directly based on its oil and gas output, which is contributing to almost 13 % of the value of its total exports.

More so, the UAE is introducing a host of schemes to meet the rising demand for utilities sustainably. It is investing in a balanced energy mix to cater to the increase in demand for energy resources.

Some of the UAE energy initiatives include:

- The UAE has been hosting the annual World Future Energy Summit (WFES) for clean energy and sustainability since 2008. Abu Dhabi sponsored the WFES 2023 from 16-18 Jan 2023 at the Abu Dhabi National Exhibition Centre (ANDEC).
- The Paris Agreement signed in 2016 to aid climate change efforts is another initiative by the UAE. Reducing greenhouse gas emissions and restricting the rise in global temperatures are some goals of this agreement.
- The United Arab Emirates also entered an MoC (Memorandum of Cooperation) on hydrogen with Japan in 2021.
- UAE and Russia partnership on hydrogen development in 2021, relating to the production, transportation, and storage of the fuel.
- The UAE initiated a Net Zero 2050 strategy aiming to achieve net zero emissions by 2050. As part of this initiative, the UAE authorities are drafting plans to lower emissions while ensuring economic growth via sustainable solutions.

2.2 Potential Future Outlook

2.2.1 Oman

Future Outlook

Oman produces more electric energy compared to its domestic consumption requirements. Also, as of 2021, the entire Oman population has access to electricity. Moreover, as per the 2020 data by IRENA for Oman, total electricity generation was 38,256 GWh, of which the share of non-renewable energy and renewable energy was 38,045 GWh and 211 GWh respectively. Solar energy and wind energy are Oman's primary renewable energy sources, holding 73% and 27% of the renewable capacity market share, respectively.

The future plans of Oman for further development of its energy sector are:

- Oman plans to increase its electricity-generation capacities via investments in renewable independent power projects (IPP) while aiming to generate up to 30% of its electricity production from renewables. The Oman IPPs will open up the market for US businesses relating to technology transfer services, the sale of equipment and services, and the privatization of government assets.
- Going by the Oman Vision 2040 and the National Energy Strategy, Oman is working to cover at least 30% of its electricity requirements from renewable sources by 2030.

2.2.2 Bahrain

Future Outlook

Bahrain produces around 2 billion cubic feet per day of gas which is used to generate electricity and power its refinery and industry. There are plans to import LPG via a floating receiving terminal to ensure supplies during peak hours for power generation and growth of the industry sector.

The total electricity generation in Bahrain was 33,799 GWh in 2020, with non-renewable energy production at 33,788 GWh and renewable energy production at 11 GWh. Solar energy (94%) and wind energy (6%) mainly comprise Bahrain's renewable energy market. Although Bahrain fully depends on natural gas for electricity generation, the country plans to invest more in renewable energy sources.

Bahrain also promotes renewable energy technologies and energy efficiency policies supporting its long-term climate and environmental protection plans. More so, Bahrain is continuously making efforts to diversify its energy sources. Country is also introducing electric vehicle charging infrastructure and is gradually adopting Euro 6 emissions standards for regular vehicles.

The future plans of the Bahrain energy industry include:

- Bahrain's Sustainable Energy Authority (SEA) is planning various solar initiatives like a 50-megawatt initiative to install solar panels on the roofs off government-owned buildings as part of its energy development agenda. While conforming to the Economic Vision 2030 plan, Bahrain's SEA implements the country's renewable energy and energy efficiency programs. Reducing carbon emissions, protecting the natural environment, promoting sustainable energy, and minimizing pollution are some aspirations of Bahrain's Vision 2030.
- Along with deploying renewable energy, Bahrain is finding ways to reduce domestic energy consumption. The National Energy Efficiency Action Plan focuses on all economic sectors to achieve a 6% energy efficiency target by 2025.
- Furthermore, Bahrain plans to execute a heat waste recovery pilot program, whereby excess heat released by Aluminium Bahrain (Alba), the largest single-site smelter beyond mainland China, can be used for electricity generation.
- Waste generation in Bahrain goes up to 2.6 kg per person daily. Thus, as part of solid waste management, Bahrain's Ministry of Works studies the effects of a project implemented by an international consultancy firm. This project helps to analyse and determine waste materials for recycling, converting agricultural products, and producing electricity via incinerating measures at the Askar landfill.
- Bahrain seeks investments in plasma gasification, including converting waste into resalable by products. Among this list of by products are construction equipment, electricity, and hydrogen.

2.2.3 Kuwait

Future Outlook

Kuwait boasts of having the sixth-largest oil reserves globally. Besides, Kuwait's national oil company, Kuwait Petroleum Corporation, with its subsidiaries, regulates the entire manufacturing processes and export market of petroleum and other liquids industry.

Also, the total energy production in Kuwait in 2020 was 74,817 GWh, including non-renewable energy at 74,757 GWh and renewable energy at 60 GWh. More so, wind energy and solar energy comprise 88% and 12% of the renewable energy market in Kuwait, respectively. Kuwait plans to invest more in renewable energy projects to fulfill its requirements. Kuwait also plans to boost production capacity via foreign investment by providing incentives.

Kuwait's Ministry of Electricity and Water (MEW) estimates the country's demand for energy to triple by 2030. However, the energy generation sector will not be fully equipped to handle this demand load because of lack of infrastructure and inadequate fuel. Hence, Kuwait is diversifying its energy mix focusing more on natural gas, Solar and wind and setting goals to raise the share of renewable energy generation to 15% by 2030.

Furthermore, regarding upstream opportunities, the Kuwait Petroleum Corporation intends to raise oil and natural gas production to 4 million barrels per day and 4 billion cubic feet daily by 2030, respectively.

2.2.4 Qatar

Future Outlook

Qatar is one of the major hubs for international air travel and a prominent exporter of fertilizers, petrochemicals, natural gas, and oil. While natural gas and oil account for most of Qatar's total primary energy consumption, renewable energy occupies only a tiny part.

In Qatar, in 2020, the total electricity generation was 49,402 GWh, with renewable energy at 49,259 GWh and non-renewable energy at 143 GWh. In 2021, Bioenergy holds 79% share of the Qatar renewable energy capacity , and solar energy occupies 21% of its renewable energy capacity .

In 2021, Qatar's consumed an estimated 2.1 quadrillion British thermal units (quads) of primary energy (Natural gas, petroleum, Renewables) in which is down from a peak of 2.3 quads in 2019. Oil and Natural gas accounted for almost all of the Qatar's total primary energy consumption, with renewable energy only making up a small fraction of total primary energy consumption. Qatar Energy's Sustainability Strategy has three references: Qatar National Vision 2030, United Nation's Sustainable Development Goals, and the Paris Agreement. The main focus areas of the plan include reducing carbon emissions, setting up a low-carbon energy department, and holding the country's top position in the LNG sector.

2.2.5 Saudi Arabia

Future Outlook

Saudi Arabia is accredited with being the second-largest total petroleum liquids manufacturer globally, after the USA. Also, it has the world's highest crude oil production capacity, going up to almost 12 million barrels per day. Also, Saudi Arabia is recognized as the largest crude oil producer in the OPEC.

Saudi Arabia is taking steps to reduce the use of oil during power generation. Hence, it plans to develop its power generation, distribution, and transmission sector. There are plans to generate 58 GW of solar and wind power while phasing out all diesel and petroleum producing power stations. In addition, Saudi Arabia is directing its efforts to install smart grid technolo-

gy and boost international grid connectivity, replacing obsolete transmission and distribution infrastructure. Saudi Arabia is slated to double its power generation capacity to 160 GW by 2040, which would be a leap from 82 GW in 2018. To meet this objective, the government plans on investing about US$ 5 billion in generation and US$4 billion in distribution and transmission per year. Moreover, there are plans to meet its renewable energy goals, for which the National Renewable Energy Program (NREP) and Renewable Energy Project Development Office (REPDO), both of which are managed by the Ministry of Energy) will introduce many new initiatives such as goal of privatizing all electricity generation by 2025. Saudi Arabia aspires to privatize its power generation companies to achieve this goal. The new, privatized power generation companies will work towards meeting environmental standards, increasing efficiency, and replacing old power plants.

2.2.6 United Arab Emirates

Future Outlook

Regarding energy transition in the GCC region, the United Arab Emirates continues to be at the forefront because of the government's unwavering commitment. As a result, the UAE's investment in renewable energy sources is expected to increase. The UAE's renewable sector is expected to record a significant jump over the next decade. Also, the renewable energy production capacity of the country is expected to grow at a rate of 16.7% annually between 2021 and 2030, accounting for 11.3 percent of the energy mix by 2030. Besides, the UAE has plans to revisit its energy strategy with a greater focus on green hydrogen and solar energy over the next decade.

In line with its Net Zero by 2050 initiative, Abu Dhabi's upcoming renewable energy projects including the Barakah nuclear energy plant (5.6 GW) and the Al Dhafra Solar PV project (2-GW)) will produce a total clean power generation capacity of 8.8 GW by 2025.

The UAE is also directing its efforts towards making solar panels mandatory for all buildings in the UAE by 2030, aiding the expansion of solar industries in the country.

2.3 Introduction to Energy and Power Sector

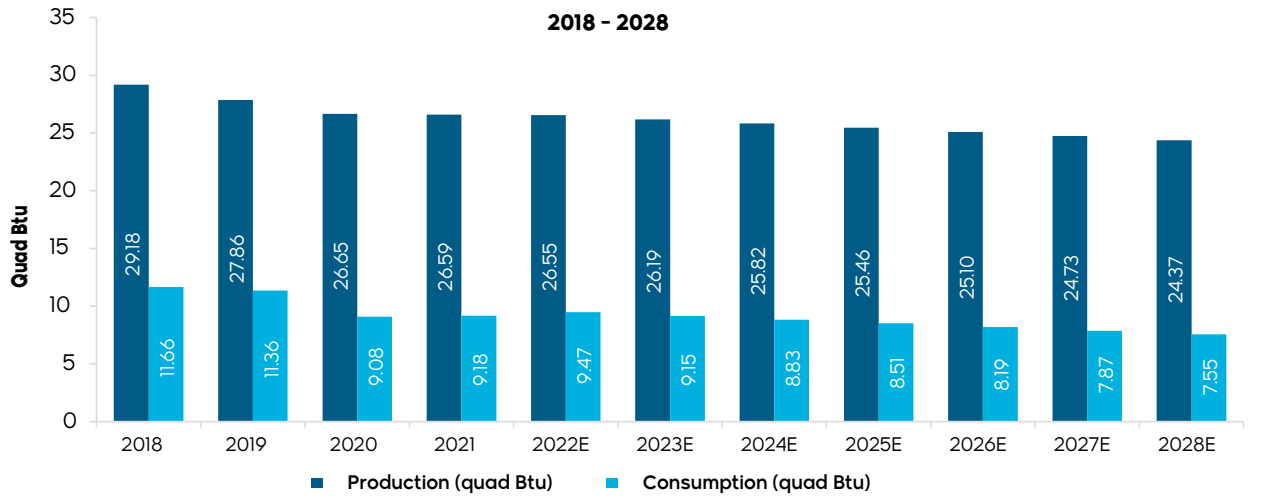
2.3.1 Overview and Key industry Trends

According to the World Bank Gulf Economic Update (GEU), the GCC countries are experiencing significant economic growth with the ease of pandemic restrictions in the post-pandemic scenario and positive developments in the hydrocarbon market. The economies of Gulf Cooperation Council (GCC) countries grew at a rate of more than 6% in 2022, and they are expected to moderate at 3.7% and 2.4% in 2023 and 2024, respectively. GCC countries are strengthening their focus on a green growth strategy to become low-carbon economies. Moreover, the oil & gas sector in the region continues to receive significant investments from the leading market players. For example, the International Energy Agency stated that Saudi Aramco and ADNOC have announced plans to increase their investments by 15%–30% in renewable energy sector. Similarly, national oil companies (NOCs) exhibited nearly 80% rise in upstream investments, specific to the Middle East, in 2021.

2.3.2 Energy and Power Market Size and Forecasts (2018 – 2028)

2.3.2.1 Saudi Arabia Market

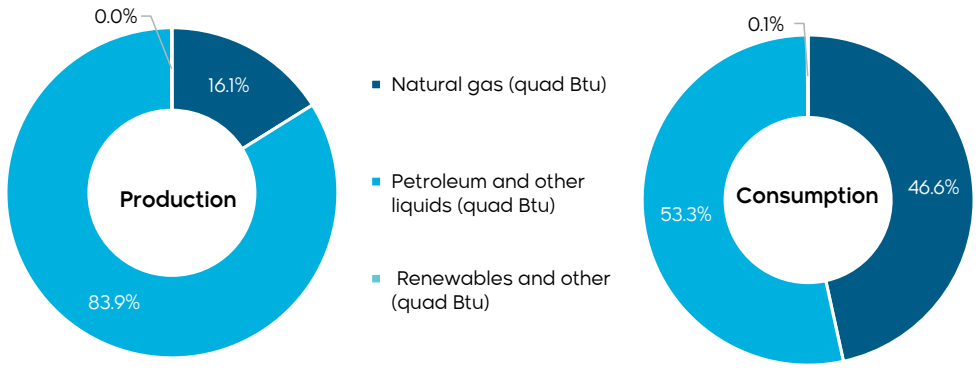
Figure 1. Saudi Arabia Primary Energy Supply Market and Forecast to 2028 (Quad BTU)



Source: Analyst Team, EIA
Note: Estimations are based on historical trends, current status, and government initiatives and investments

As showcased in the above figure, Saudi Arabia has been experiencing lower energy demand for the past few years, and it is expected to lower in the coming years. The country is one of the major energy exporters in the international market. Furthermore, the country witnessed a significant drop in production and consumption in 2020 due to COVID – 19 pandemic.

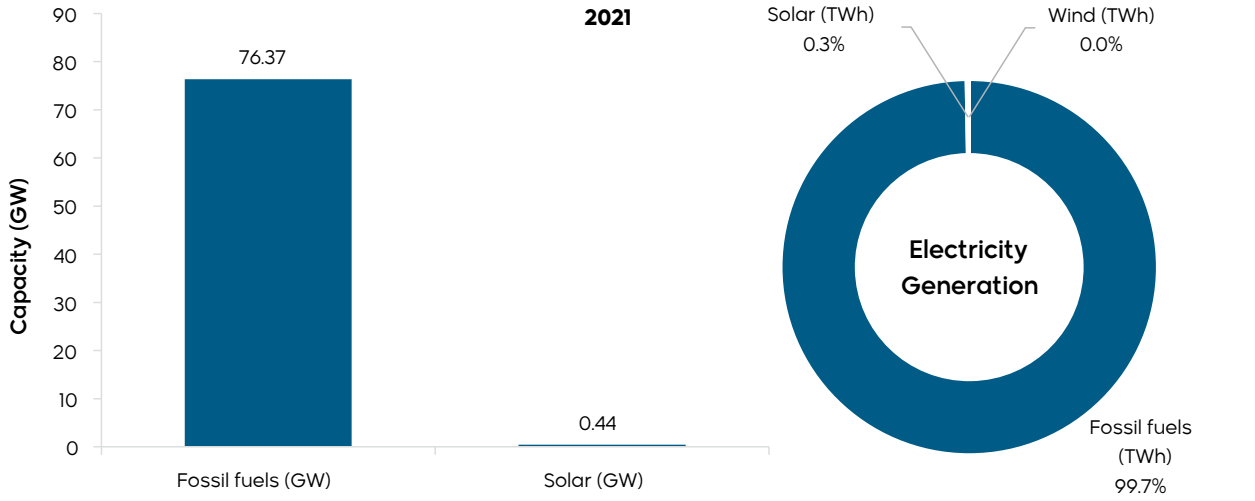
Figure 2. Saudi Arabia Primary Energy Supply Market – By Type (% Share) , 2021



Source: Analyst Team, EIA

As highlighted in the above figure, petroleum and other liquids has a significant market share in the energy sector at 83.9%, followed by natural gas at 16.1%. The country has limited focuses on renewable energy as the majority of the economy is dependent on non-renewable energy sources supply. However, the increasing focus on renewable energy projects will create lucrative opportunities for the market.

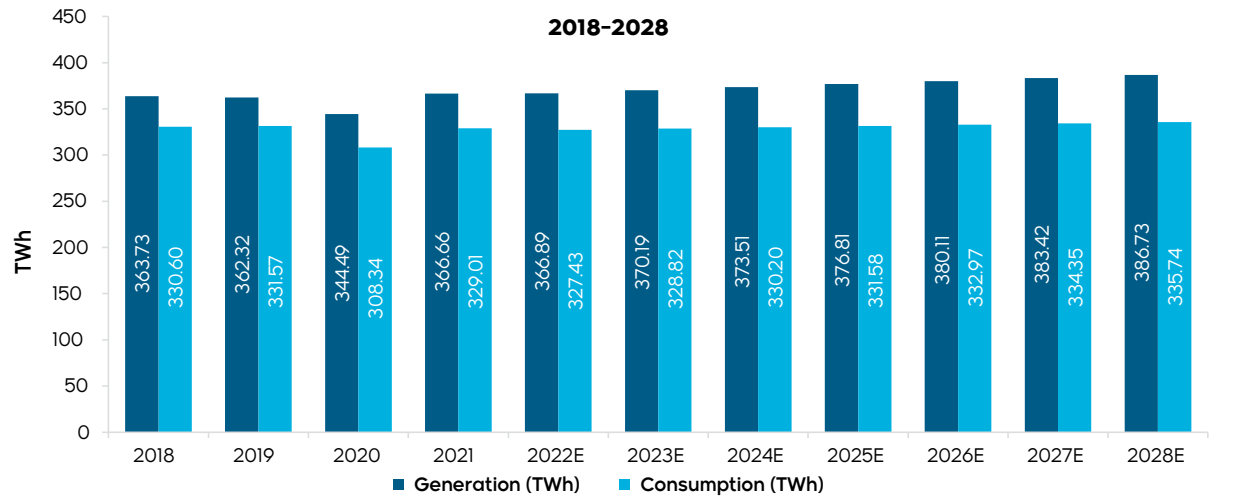
Figure 3. Saudi Arabia Electricity Market – By Type (GW and TWh % Share), 2021



Source: Analyst Team, EIA

As showcased in the above figure, fossil fuel has dominated the market in electricity generation, with 99.7%. The country also focuses on solar projects with 0.3% and wind energy projects for the electricity generation market share.

Figure 4. Saudi Arabia Electricity Market and Forecast to 2028 (TWh)

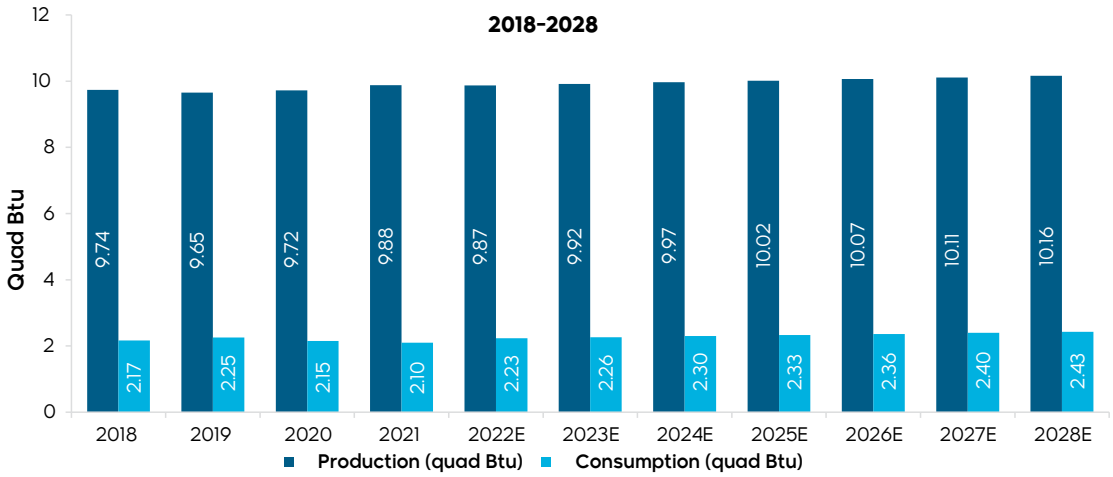


Source: Analyst Team, EIA
Note: Estimations are based on historical trends, current status, and government initiatives and investments

As showcased in the above figure, Saudi Arabia has been experiencing significant energy consumption for the past few years, and it is expected to rise in the coming years. Saudi Arabia is expected to consume ~331 TWh of electricity by 2025 due to rising industrialization

2.3.2.2 Qatar Market

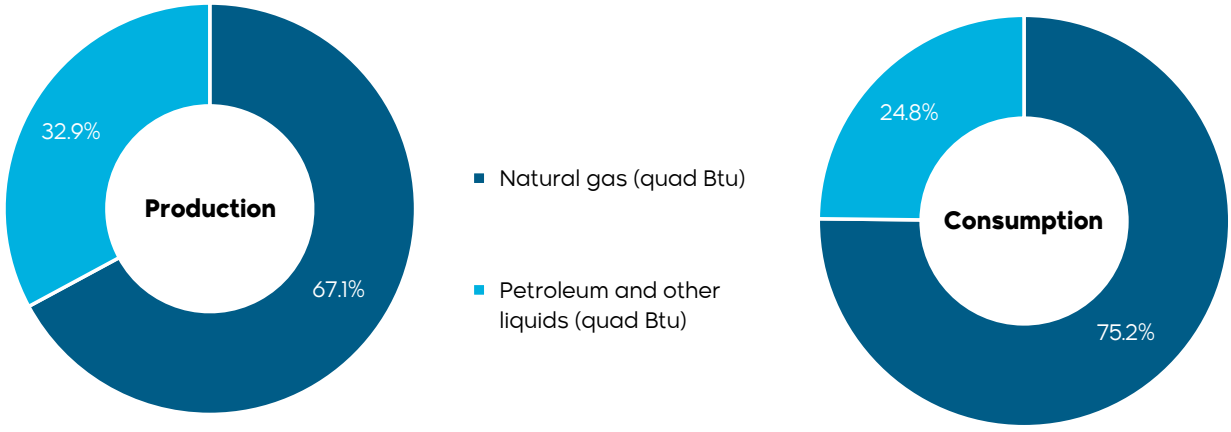
Figure 5. Qatar Primary Energy Supply Market and Forecast to 2028 (Quad BTU)



Source: Analyst Team, EIA
Note: Estimations are based on historical trends, current status, and government initiatives and investments

As depicted above, Qatar has been experiencing significant demand from the past few years, and it is expected to rise in the coming years., the 100.0% of the country's population (as of 2020) has access to electricity. Furthermore, the country witnessed a minimal impact of COVID – 19 pandemic as production continued to rise, while consumption experiences slight decline in 2020.

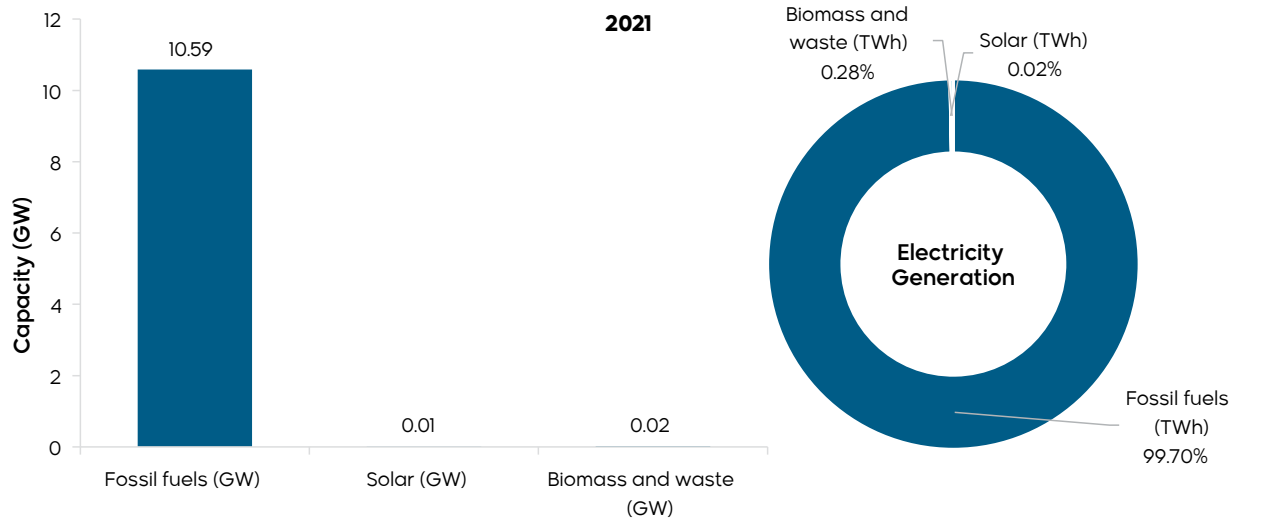
Figure 6. Qatar Primary Energy Supply Market – By Type (% Share) , 2021



Source: Analyst Team, EIA

As showcased in the above figure, natural gas has a significant market share in the energy sector at 67.1%, followed by petroleum and other liquids at 32.96%. The country has limited focuses on renewable energy as the majority of the economy is dependent on non-renewable energy sources supply. However, the increasing focus on renewable energy projects will create lucrative opportunities for the market.

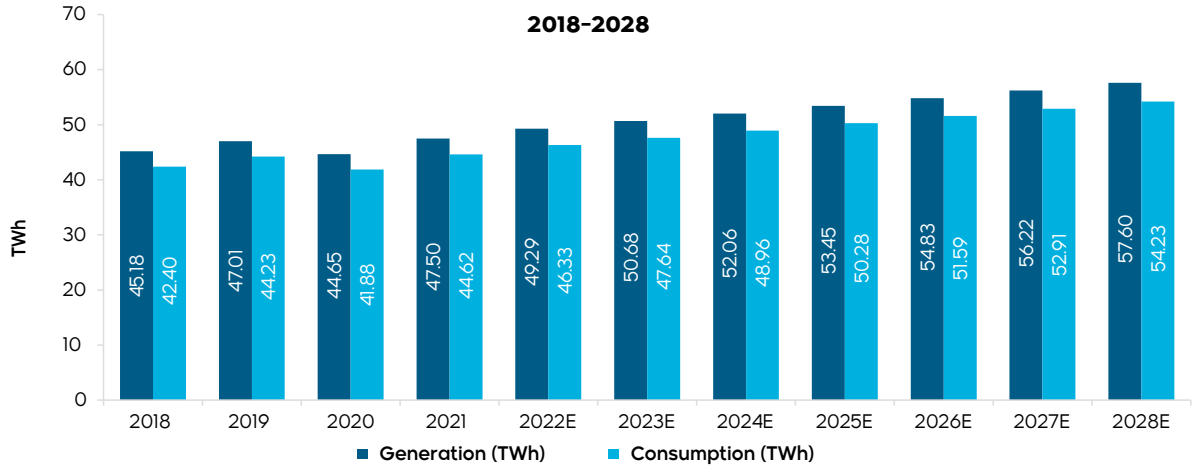
Figure 7. Qatar Electricity Market – By Type (GW and TWh % Share), 2021



Source: Analyst Team, EIA

As showcased in the above figure, fossil fuel has dominated the market in electricity generation, with 99.7%. The country has less focus on biomass and waste projects with 0.28% share and solar energy projects for the electricity generation

Figure 8. Qatar Electricity Market And Forecast to 2028 (TWh)

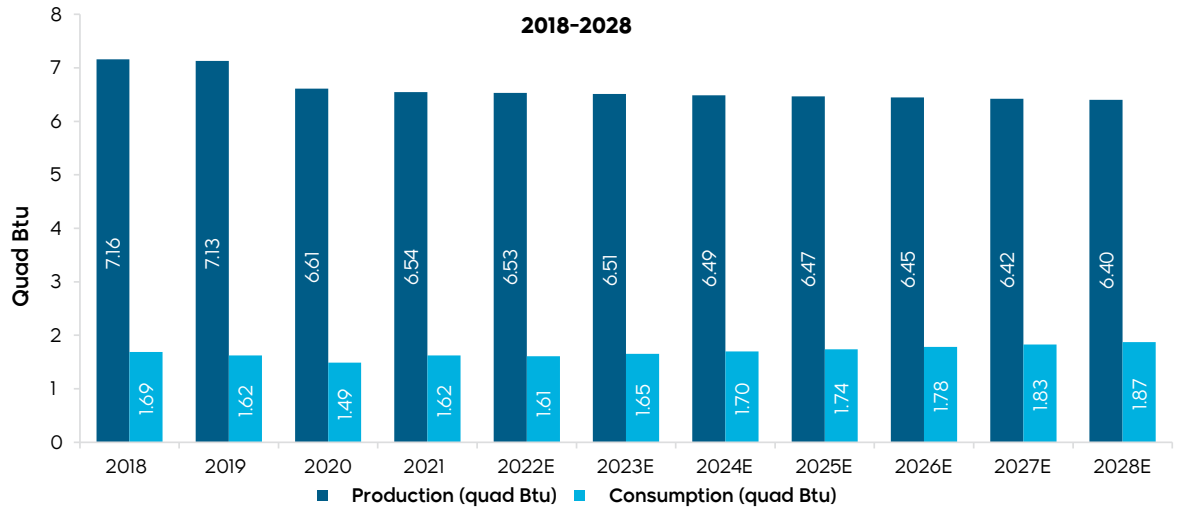


Source: Analyst Team, EIA
Note: Estimations are based on historical trends, current status, and government initiatives and investments

As showcased in the above figure, Qatar has been experiencing significant energy consumption for the past few years, and it is expected to rise in the coming years. Qatar is expected to consume ~50 TWh of electricity by 2025.

2.3.2.3 Kuwait Market

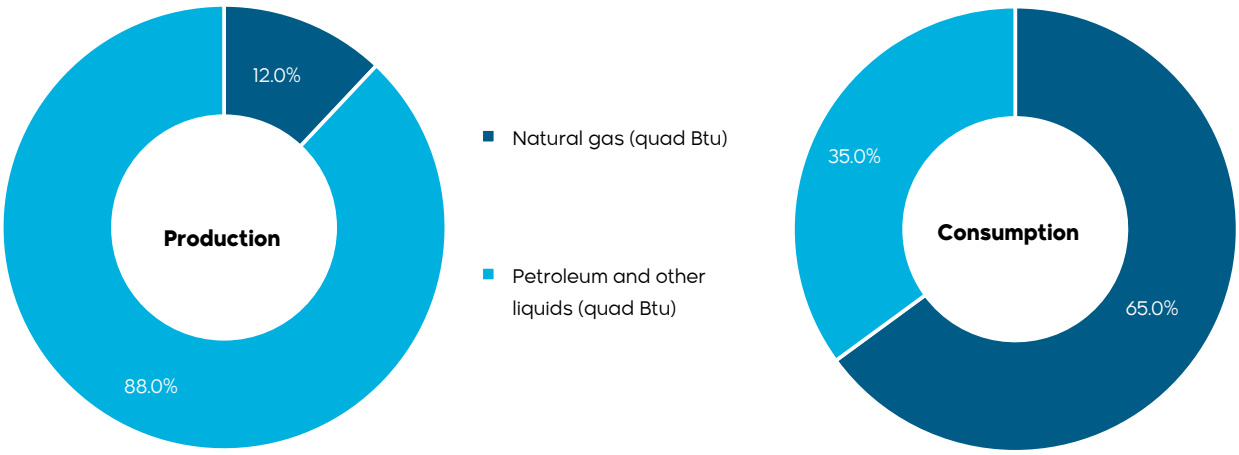
Figure 9. Kuwait Primary Energy Supply Market and Forecast to 2028 (Quad BTU)



Source: Analyst Team, EIA

As showcased in the above figure, Kuwait has been experiencing lower energy demand for the past few years, and it is expected to lower in the coming years. The country is one of the major energy exporters in the international market. Furthermore, the country witnessed a significant drop in production and consumption in 2020 due to COVID – 19 pandemic.

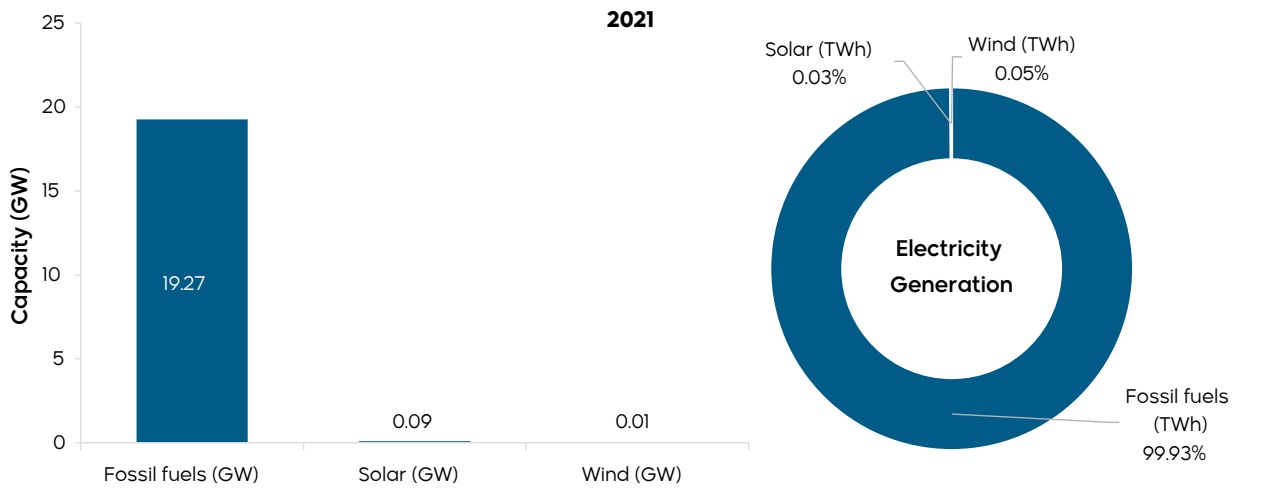
Figure 10. Kuwait Primary Energy Supply Market – By Type (% Share) , 2021



Source: Analyst Team, EIA

As Highlighted above figure, petroleum and other liquids has a significant market share in the energy sector at 88.0%, followed by natural gas at 12.0%. The country has limited focuses on renewable energy as the majority of the economy is dependent on non-renewable energy sources supply. However, the increasing focus on renewable energy projects will create lucrative opportunities for the market in coming years.

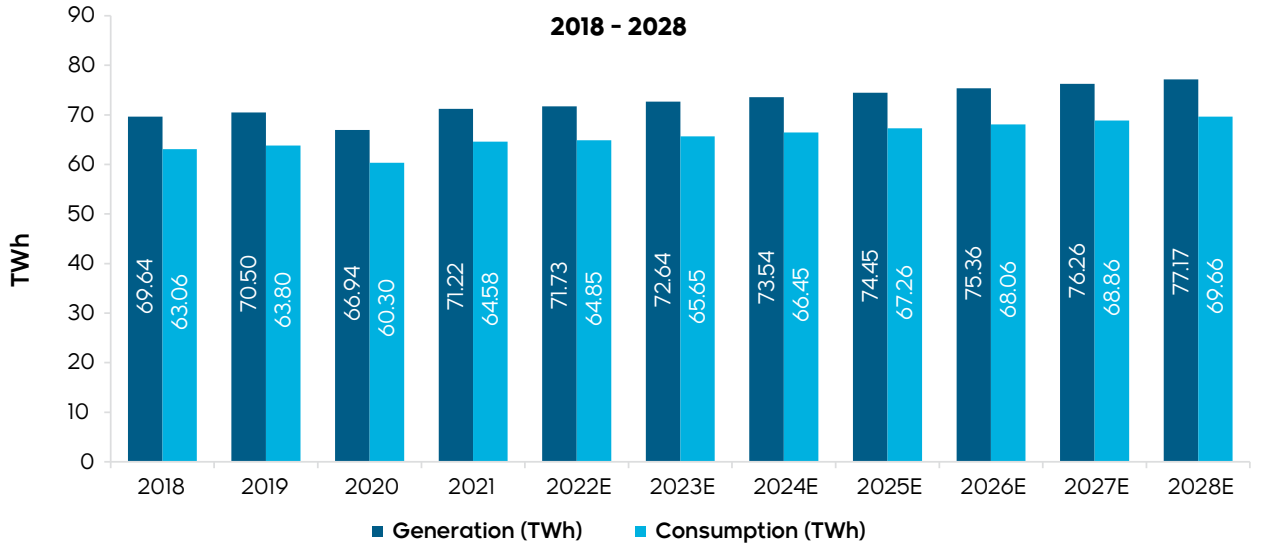
Figure 11. Kuwait Electricity Market – By Type (GW and TWh % Share), 2021



Source: Analyst Team, EIA

As showcased in the above figure, fossil fuel has dominated the market in electricity generation, with 99.93%., while wind projects hold 0.05% and solar energy projects holds 0.03% for the electricity generation market share.

Figure 12. Kuwait Electricity Market And Forecast to 2028 (TWh)

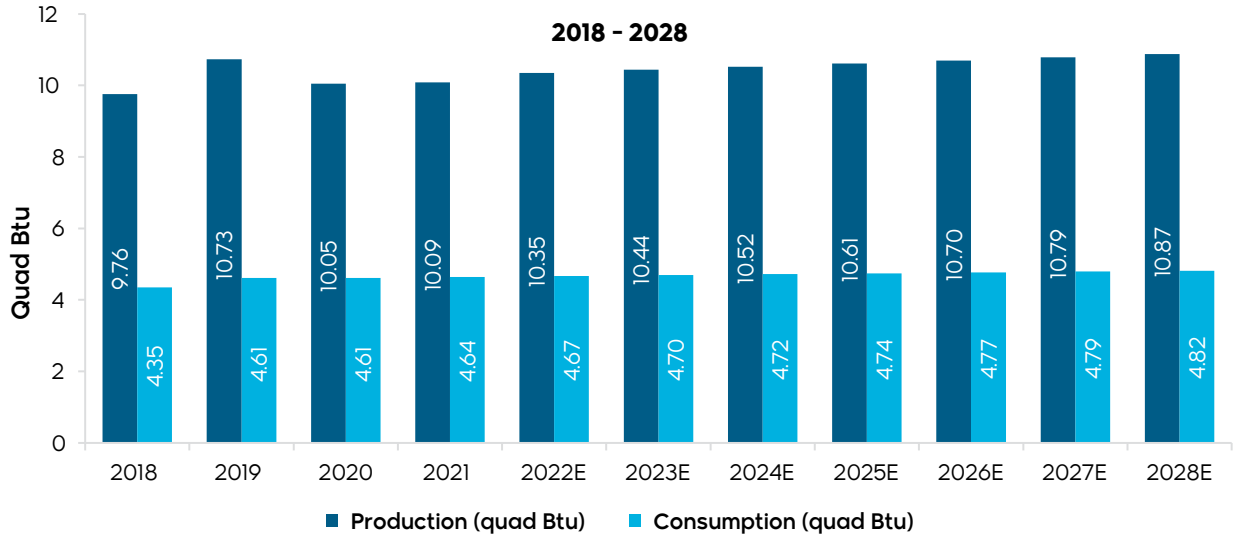


Source: Analyst Team, EIA
Note: Estimations are based on historical trends, current status, and government initiatives and investments

As showcased in the above figure, Kuwait has been experiencing significant energy consumption for the past few years, and it is expected to rise in the coming years. Kuwait is expected to consume ~77 TWh of electricity by 2028.

2.3.2.4 United Arab Emirates Market

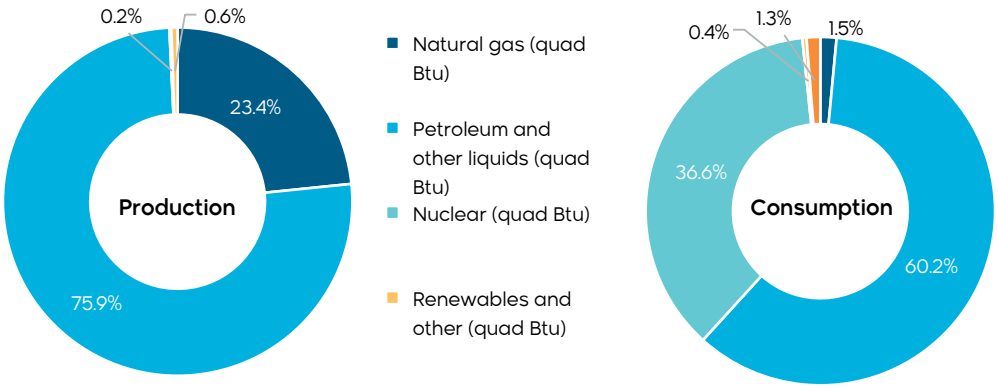
Figure 13. United Arab Emirates Primary Energy Supply Market and Forecast to 2028 (Quad BTU)



Source: Analyst Team, EIA
Note: Estimations are based on historical trends, current status, and government initiatives and investments

As showcased in the above figure, UAE has been experiencing significant demand from the past few years, and it is expected to rise in the coming years. The country is one of the major exporters of the natural and petroleum products in the international market. However, the country witnessed a significant drop in production in 2020 due to COVID – 19 pandemic.

Figure 14. United Arab Emirates Primary Energy Supply Market – By Type (% Share) , 2021

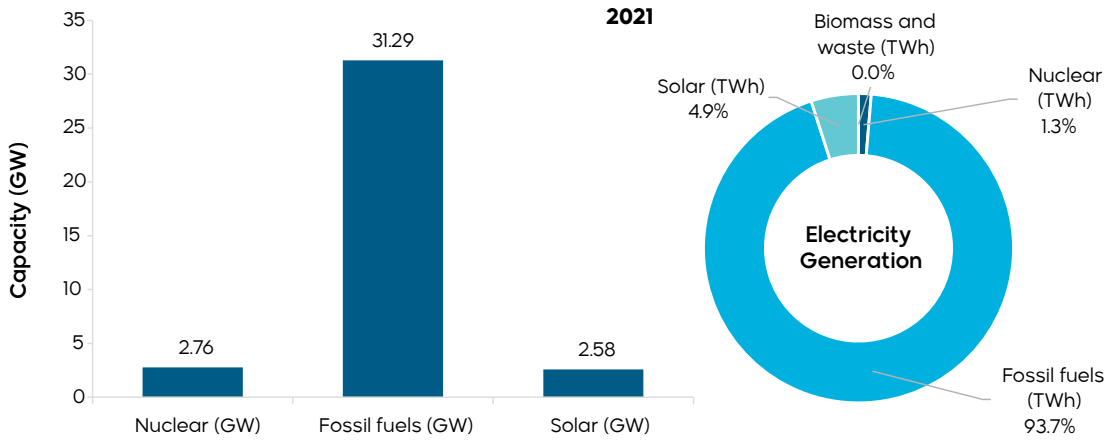


Source: Analyst Team, EIA

As highlighted in the above figure, petroleum and other liquids has a significant market share in the energy sector at 75.9%, followed by natural gas at 23.4%. The country currently has limited share of renewable energy, as the majority of the economy is dependent on non-renewable

energy sources supply. However, the county is planning to enhance renewable energy projects under the UAE Governments Net Zero 2050 Charter, which will create lucrative opportunities for the market.

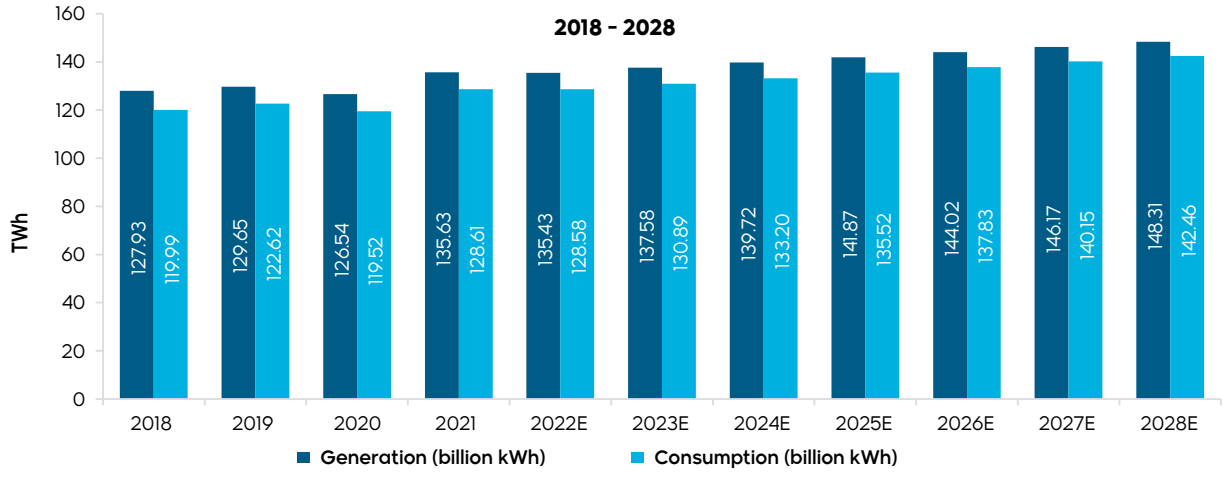
Figure 15. United Arab Emirates Electricity Market – By Type (GW and TWh % share), 2021



Source: Analyst Team, EIA

As showcased in the above figure, fossil fuel has dominated the market in electricity generation, with 93.7%. Whereas the solar projects at 4.9% and nuclear energy projects at 1.3% for the electricity generation market share.

Figure 16. United Arab Emirates Electricity Market And Forecast to 2028 (TWh)

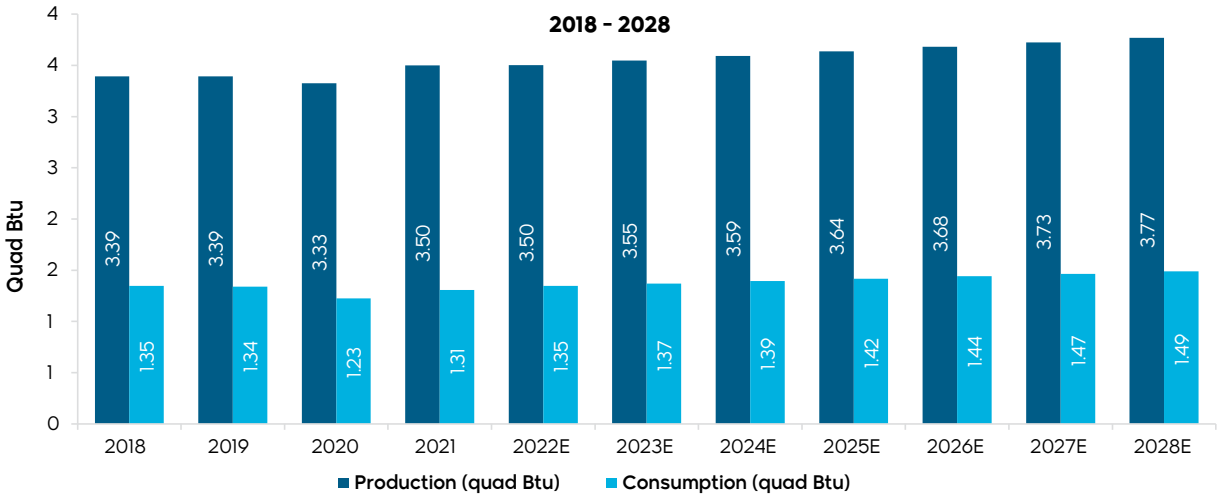


Source: Analyst Team, EIA
Note: Estimations are based on historical trends, current status, and government initiatives and investments

As showcased in the above figure, UAE has been experiencing significant growth in energy consumption from the past few years, and it is expected to rise in the coming years. UAE is expected to consume ~135 TWh of electricity by 2025 due to rising industrialization

2.3.2.5 Oman Market

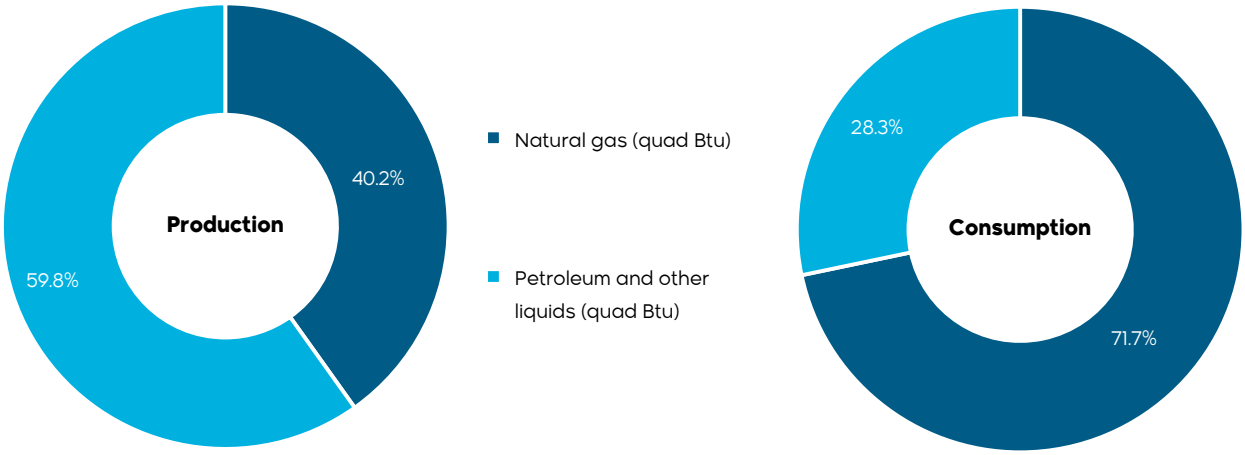
Figure 17. Oman Primary Energy Supply Market and Forecast to 2028 (Quad BTU)



Source: Analyst Team, EIA
Note: Estimations are based on historical trends, status, and government initiatives and investments

As showcased in the above figure, Oman has been experiencing significant demand from the past few years, and it is expected to rise in the coming years. The country is one of the major exporters of the oil and gas in the international market. However, the country witnessed a significant drop in production in 2020 due to COVID – 19 pandemic

Figure 18. Oman Primary Energy Supply Market – By Type (% Share), 2021

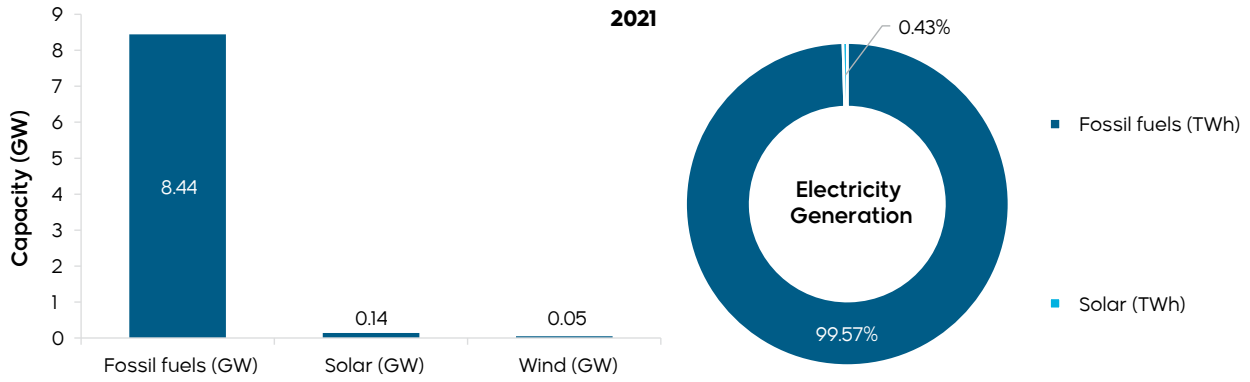


Source: Analyst Team, EIA

As showcased in the above figure, petroleum and other liquids has a significant market share in the energy sector at 59.8%, followed by natural gas at 40.2%. The country has limited focuses on renewable energy as the majority of the economy is dependent on export of oil and gas prod-

ucts. However, the increasing focus on renewable hydrogen projects will create lucrative opportunities for the market, as per the IEA, Oman is targeting to produce 1 million tons of renewable hydrogen per year by 2030 and 3.75 million tonnes by 2040

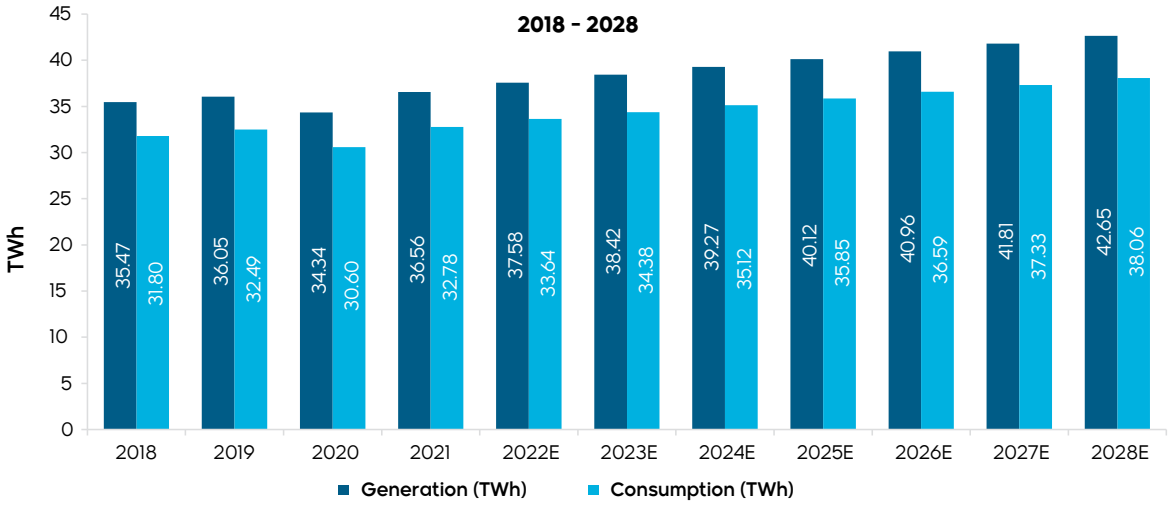
Figure 19. Oman Electricity Market – By Type (GW and TWh % share), 2021



Source: Analyst Team, EIA

As showcased in the above figure, fossil fuel has dominated the market in electricity generation, with 99.57% share in 2021.

Figure 20. Oman Electricity Market And Forecast to 2028 (TWh)

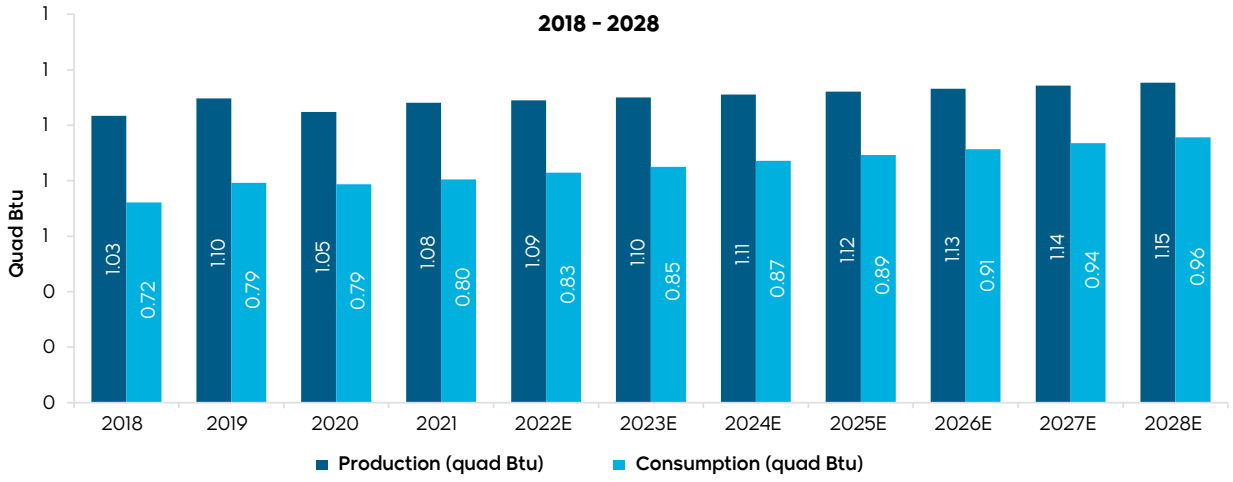


Source: Analyst Team, EIA
Note: Estimations are based on historical trends, current status, and government initiatives and investments

As showcased in the above figure, Oman has been experiencing significant growth in energy consumption from the past few years, and it is expected to rise in the coming years. Oman is expected to consume ~36 TWh of electricity by 2025

2.3.2.6 Bahrain Market

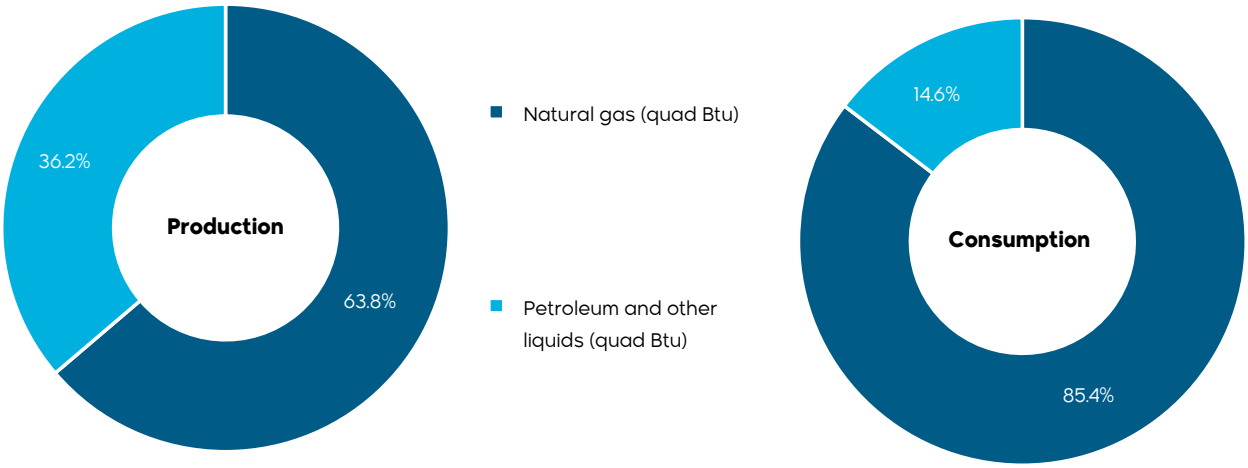
Figure 21. Bahrain Primary Energy Supply Market and Forecast to 2028 (Quad BTU)



Source: Analyst Team, EIA
Note: Estimations are based on historical trends, current status, and government initiatives and investments

As highlighted in the above figure, Bahrain has been experiencing significant demand from the past few years, and it is expected to rise in the coming years, the country witnessed a significant drop in production in 2020 due to COVID – 19 pandemic.

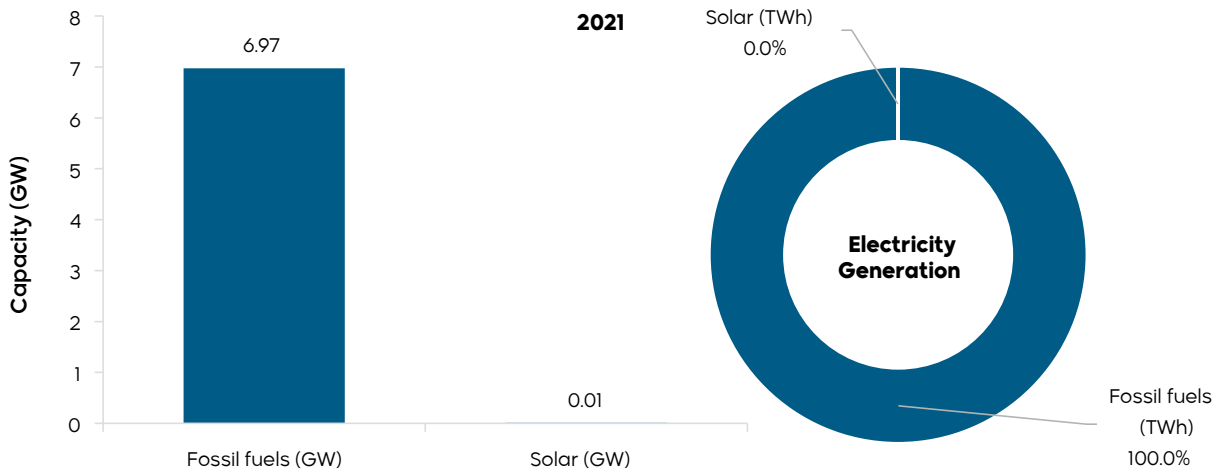
Figure 22. Bahrain Primary Energy Supply Market – By Type (% Share) , 2021



Source: Analyst Team, EIA

As showcased in the above figure, natural gas has a significant market share in the energy sector at 63.8%, followed by petroleum and other liquids at 36.2%. Furthermore, the increasing focus on renewable energy projects under the Bahrain's Sustainable Energy Authority (SEA) the country is targeting production of 280 megawatts of electricity from renewables by 2025 and 710 megawatts by 2035.

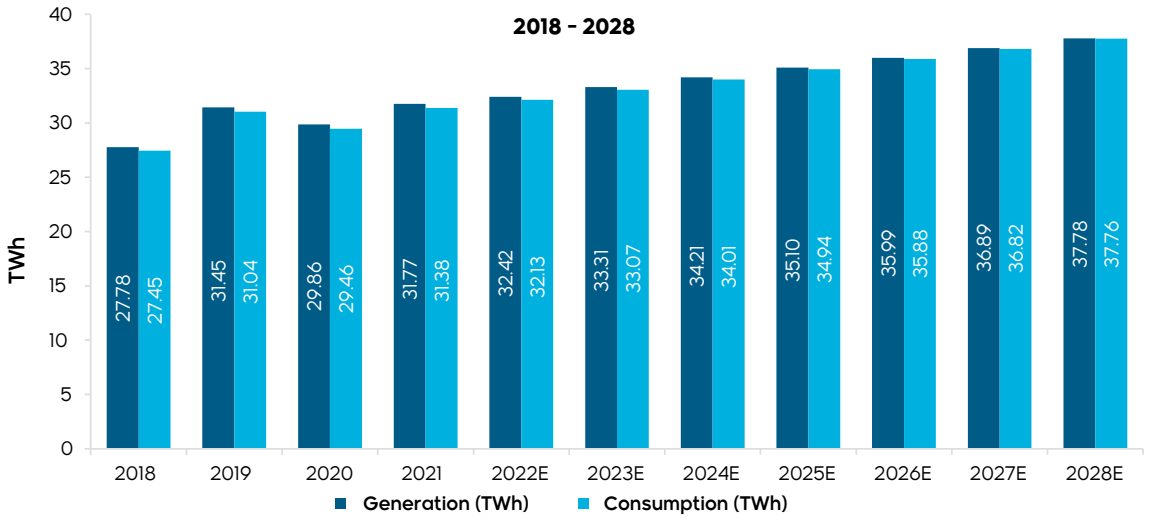
Figure 23. Bahrain Electricity Market – By Type (GW and TWh % Share), 2021



Source: Analyst Team, EIA

As showcased in the above figure, fossil fuel has dominated the market in electricity generation, with 100.0%. The country has very few initiatives in the past years towards the solar projects for generating electricity.

Figure 24. Bahrain Electricity Market And Forecast to 2028 (TWh)



Source: Analyst Team, EIA
Note: Estimations are based on historical trends, current status, and government initiatives and investments

As showcased in the above figure, Bahrain has been experiencing significant growth in energy consumption from the past few years, and it is expected to rise in the coming years. Bahrain is expected to consume ~38 TWh of electricity by 2028.

2.4 Country-Level COVID-19 Impact on Energy and Power Sector

2.4.1 Oman

The oil industry in Oman heavily supports country's infrastructure, which includes medical services, public education, roads, and electric utilities. Oman's energy sector, like those of the rest of the world, has been severely affected by COVID-19. It has experienced a decrease in energy demand after the reduction of commercial and industrial activities and the closure of institutes and schools. The reduction in the industrial load has also impacted the country. The government had also taken steps such as to support individuals who cannot pay their energy bills due to financial crisis.

The Covid-19 pandemic also caused an oil price crash, causing a dent in the oil industry. However, oil prices have bounced back to pre-pandemic levels. Also, Oman's natural gas reserves are expected to boost industrial growth in the country. Additionally, when it comes to downstream, Oman is investing in manufacturing and value-added processing via refining and petrochemical projects. In March 2022, the Ministry of Energy and Minerals (MEM) declared its plans to award three oil and gas blocks to boost the Oman's oil and gas exploration and production.

2.4.2 Bahrain

The Covid-19 epidemic led to increase in unemployment, and economical challenges . However, the Government of Bahrain is playing an important role in helping people to overcome the stress of the Covid-19 pandemic. Offering financial aids, and providing electricity subsidies are some measures taken by the Kingdom of Bahrain.

The closure of factories, commercial spaces and institutes, and the suspension of international trade has also impacted the demand for energy. Like the other Arab countries during the pandemic Bahrain has also witnessed fall in oil demand, leading to falling oil prices. The country has intensified the efforts to diversify and to increase revenue modes beyond oil while focusing on low-carbon emitting projects.

Covid-19 also affected Bahrain's upstream and downstream oil and gas projects, including the development of the Khalij Al Bahrain field, and the BAPCO refinery modernization. However, significantly less dependent on oil than its neighbors in the region, and past diversification investment in Banking, Tourism and manufacturing sectors has lowered the impact of collapsed oil prices during the pandemic.

2.4.3 Kuwait

Like other countries, the Covid-19 epidemic impacted various sectors differently in Kuwait. While the energy industry came under tremendous pressure, the educational and commercial sectors changed their way of doing business. Also, lockdown restrictions led to fluctuations in electricity demand, during the pandemic the residential sector electric consumption went up, the non-residential sector electric consumption fell. The rise in electricity consumption in the residential sec-

tor was not fully compensated by a reduction in electricity demand in the remaining sectors, including the commercial and governmental sectors, resulted in the reduction in total power generation compared to previous year.

Restrictions on movement during the lockdown period have also drastically reduced the usage of transportation, automobiles, industrial activity, and shipping. This impact was immediately felt on the of the Kuwait oil and gas demand and prices. Lowering oil and gas prices has further impacted the fiscal deficit of the country and presented a challenge for the government to spend on planned projects and to make measures to prop up the country's economy.

2.4.4 Qatar

The Covid-19 pandemic hit all aspects of life in Qatar, including electricity demand. There was a decline in industrial demand because of low global demand for several products and commodities, such as gas and oil. Going by the severity of restrictions imposed, the domestic demand in different regions of country fluctuated during the lockdown phase. Also, in Qatar, academic classroom learning sessions were shifted to online learning modes during the pandemic era. Moreover, public transport services to schools and universities were suspended. Further, the strength of employees in government and private workplaces was cut down to approx. 20% of the total workforce, with the rest of the employees embarking on a work-from-home model. Consequently, residential and non-residential electricity demand fluctuated in the different cities of the country.

The electricity consumption has increased in the residential and governmental sectors, and industrial and commercial sectors experienced decline in electricity consumption. During the pandemic, the transportation sector including aviation came to almost standstill, and movement of people drooped to almost dropped to half around public transport hubs, which has severely impacted the fuel demand and consumption.

2.4.5 Saudi Arabia

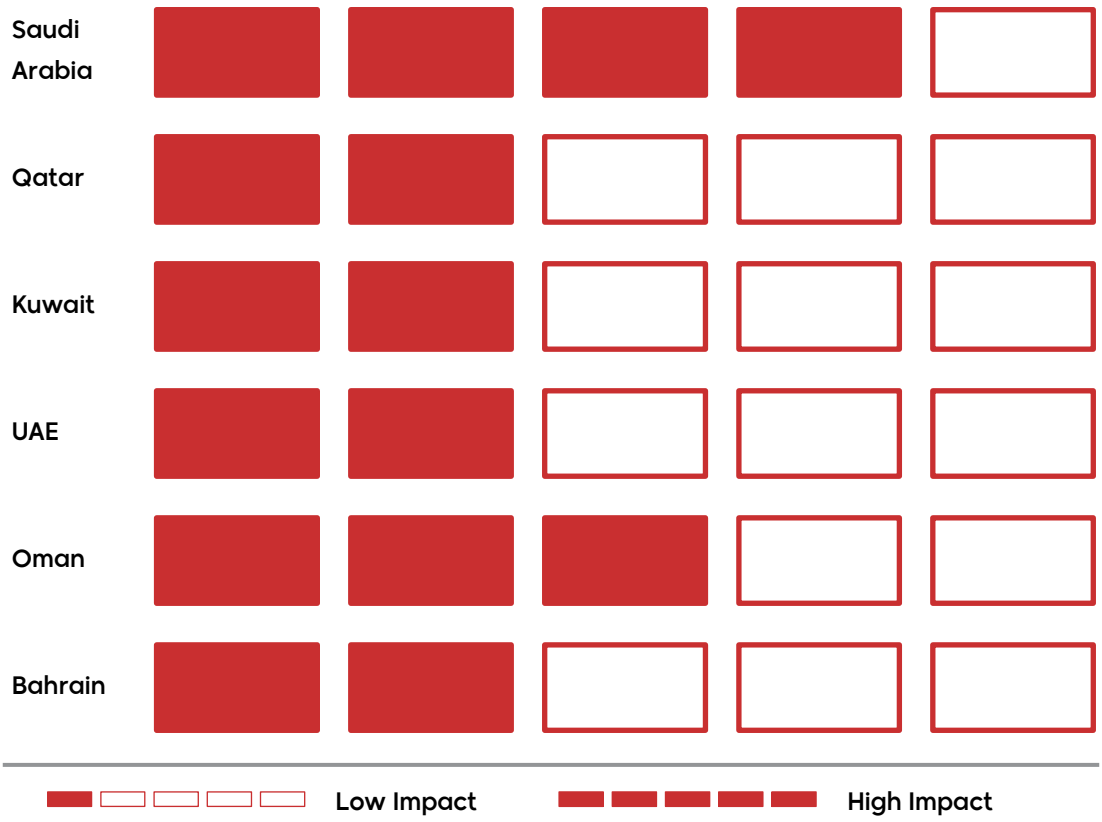
Saudi Arabia is one of the major global oil producers, and the pandemic has severely impacted the energy sector of the country. Saudi Arabia started the lockdown measures in February 2020, which includes temporary suspension of travel to prevent people from going to workplaces in the public and private sectors, halting domestic and international flights. This measure has heavily influenced the volume of demand for oil and its derivatives and electricity consumption. The impact on the demand for oil is also mainly because oil is still one of the major sources for petrochemical sectors and for generating electricity in various electricity and water stations.

On March 31, 2020, the Council of Ministers announced the formation of a special committee concerned with the energy mix for electricity production. In particular, the committee emphasis on the renewable energy sector to produce and manufacture. On November 17, 2020, the Minister of Energy announced further restructuring and reforms pertaining to the electricity sector which include· canceling the government fee imposed on the Saudi Electricity Company.

2.4.6 The United Arab Emirates

The Covid-19 infectivity impacted not only the daily lives of people in UAE but also businesses across the country. Besides health, the pandemic affected water use, carbon emissions, and energy usage. Lockdowns and suspension of services altered working style, and several people have started working remotely, because of which there has been a shift in water and energy demand levels. More so, there was a steep decline in commercial energy use because of closures and curfews. With each state responding differently to the lockdown, there has been an impact on general energy consumption. UAE saw its first Covid-19 lockdown in March 2020. Once lockdown was implemented, the electricity sector evolved in different ways, for instance in Sharjah City electric power demand was reduced in commercial, industrial, and agricultural sectors, while residential and government sectors witnessed a higher power demand. Lockdown across the country industrial and commercial establishments has also led to the fluctuation in demand for electricity which has severely impacted the utility revenues. Contracting foreign exchanges and the decrease in oil demand has also resulted in the different industry project profitability and project delays.

Figure 25. Assessment of COIVD-19 Impact on GCC Region

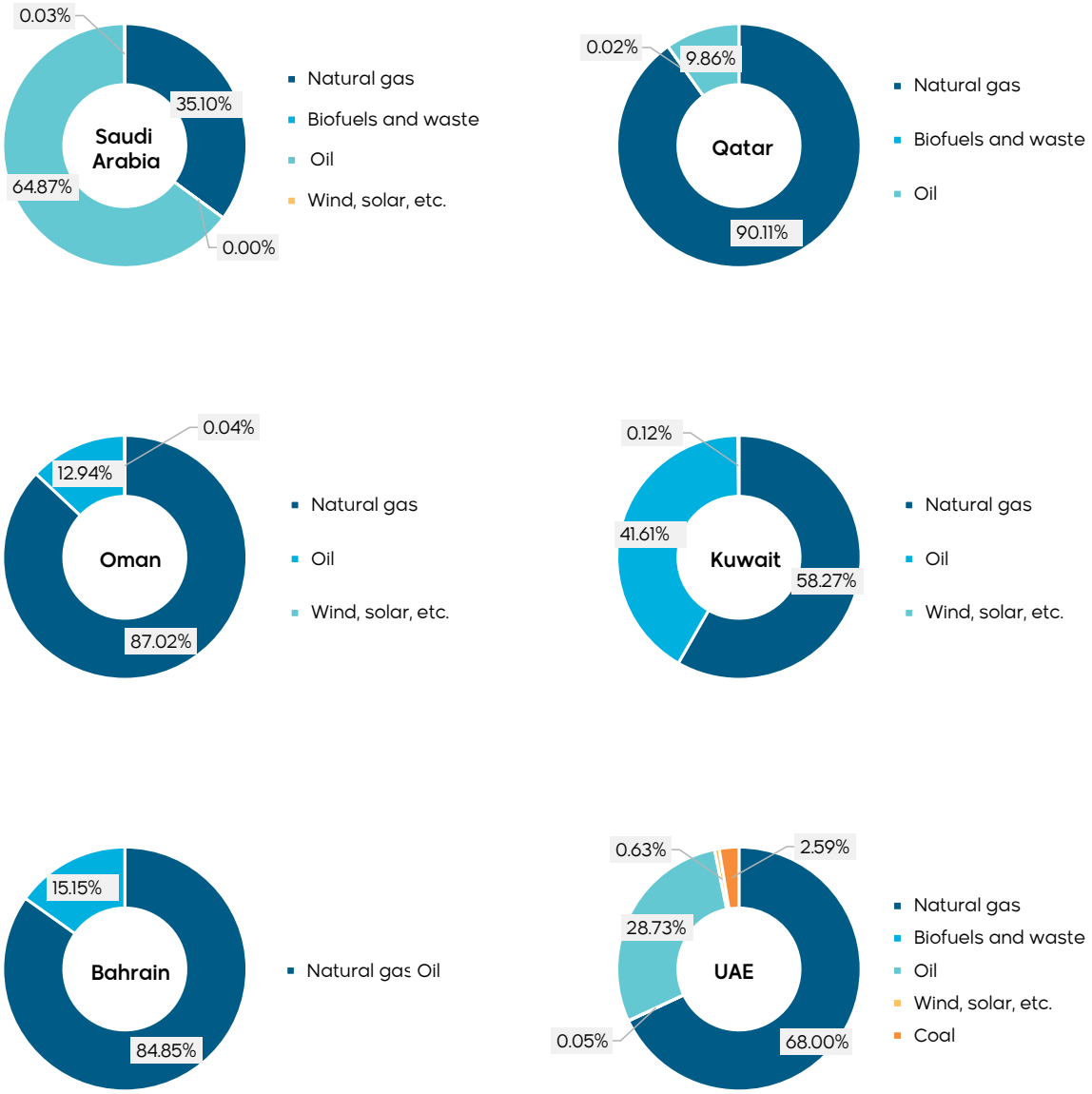


Note – Impact has been analyzed based on the industry performance during COVID

2.5 Type of Energy and Power

2.5.1 GCC

The below figure highlights the breakup on primary energy supply in Saudi Arabia, Qatar, Oman, Kuwait, Bahrain and UAE. The energy mix is mainly dominated by natural gas and oil products, as most countries are leading energy exporters in the international market. UAE holds diversified energy supply sources such as natural gas, biofuels & waste, oil, wind, solar, and coal. Furthermore, Natural gas is one of the primary energy supply markets in GCC countries, except Saudi Arabia, as oil is a major shareholder in the country.



Source: IEA, 2020

2.6 Economic Contribution

2.6.1 Government Initiatives and Programs

2.6.1.1 GCC

Government Initiatives and Programs

As per its renewable energy goal to diversify the energy mix, Kuwait plans to increase the share of renewables in total power generation to 15% by 2030. According to the Ministry of Electricity and Water (MEW), energy demand in Kuwait would triple by 2030, which is likely to pose a significant challenge to the capacity of its energy generation sector in terms of fuel and infrastructure. The diversification of the energy mix is expected to help Kuwait overcome this challenge.

Kuwait has developed GHG policies and measures to mitigate fugitive emissions from the oil and gas sector and combustion-related emissions of the power generation industry. The corresponding report mentioned two projects—Mina Al Ahmadi Refinery and Mina Abdullah Refinery.

The government of Qatar has implemented petrol subsidies keeping the prices capped at October 2021 levels.

Qatar initiated the implementation of the United Nations Sustainable Development Goals (SDGs) and Qatar National Vision 2030 strategy to facilitate a transition toward a low-carbon industrial landscape. Under this strategy, Qatar has set a target of increasing the production of LNG to 126 million tons per annum (MTPA) by 2027 and adding 2–4 gigawatts (GW) solar projects by 2030, along with emission reduction targets.

The UAE plans to revisit its energy strategy by encouraging investments in solar energy and green hydrogen projects. Its renewables sector plans to increase its capacity at an annual average of 16.7% during 2021–2030, thus accounting for ~11.3% of the power mix by 2030.

Bahrain's Vision 2030 outlines measures to reduce carbon emissions, minimize pollution, protect the natural environment, and promote sustainable energy. Endorsed by Bahrain's Cabinet, the National Energy Efficiency Action Plan (NEEAP) and the National Renewable Energy Action Plan (NREAP) sets the national energy efficiency and national renewable energy 2025 targets of 6 and 5 percent, respectively, with the NREAP target increasing to 10 percent by 2035.

By 2030 Saudi Arabia plans to generate around 50 percent of its electricity from renewables and the other half from gas. The Kingdom is working with ACWA Power to achieve its Vision 2030 renewable energy goal to provide 70 percent of the Kingdom's RE-generated power needs.

As a part of Vision 2030 Saudi Arabia, through National Renewable Energy Program (NREP) initiative country is aiming to strategically increase the renewable energy production share, in line with Kingdom's commitment towards reducing carbon dioxide emissions.

Oman with its National Energy Strategy is aiming to derive 30 percent of electricity from renewable sources by 2030.The country has also pledged to lower down its greenhouse gas emissions by 7% compared to the business-as-usual scenario by 2030.

Oman is aiming to produce at least 1 million tons of renewable hydrogen a year by 2030, up to 3.75 million tonnes by 2040 – and up to 8.5 million tonnes by 2050 and is working towards the goal of becoming a net-zero economy by 2050.

2.7 Energy Mix – Detailed Analysis

2.7.1 Renewable and Non-Renewable Energy Production

2.7.1.1 GCC

Figure 26. Energy Mix Share, By Type, % in 2021

As shown in the above figure, the GCC country's renewable energy sector holds less than 1% of the market share, as GCC countries hold substantial production and export share of oil & gas in the international market. However, these countries are planning to invest in solar and wind projects for electricity generation and Greenhouse gas emissions reduction targets. The renewable energy target set by the GCC countries will create considerable opportunities for the energy market.

2.7.2 Regulations, Policies and Developments

- The UAE and Japan signed a memorandum of cooperation (MoC) to exchange a hydrogen policy and develop standards. Both countries would form an international supply chain, including the production and transportation of hydrogen to Japan.
- UAE and Russia collaborated by signing an MoU for hydrogen development. Under the collaboration, both countries are working on manufacturing equipment for hydrogen production and liquefaction.
- The Ministry of Energy and Infrastructure (MOEI) in the UAE introduced the Hydrogen Leadership Roadmap. The country has set a target of attaining a 25% share of low-carbon hydrogen in the key export markets, including Japan, South Korea, Germany, India, and Europe, by 2030.
- Qatar has initiated Qatar Energy's Sustainability Strategy, which is governed by Paris Agreement, United Nations' Sustainable Development Goals, and Qatar National Vision 2030. Under the strategy, the government aims to meet targets such as lowering methane intensity to 0.2% by 2025, reducing carbon intensity by 15% from upstream and 25% from LNG facilities by 2025, and expanding renewable energy capacity by adding 2–4 GW by 2030.
- Oman has signed an MoU with Belgium to build a green hydrogen project providing 250–500 MW green hydrogen in Oman. The project is aimed to resume operations in 2026, alongside promoting green hydrogen.
- Saudi Arabia encourages renewable investments under its Saudi Green Initiative, offering seven contracts for solar projects with a combined ~3.7 GW capacity. Under the initiative, the country has partnered with five consortia, and ACWA Power (Saudi Arabia) has partnered with 12 domestic and international firms.
- Bahrain is highly committed in designing energy efficiency policies and promoting renewable energy technologies that support country's environmental protection ambitions and long-term climate action, in line with its Vision 2030.
- Bahrain's target renewable energy mix includes solar, wind and waste to energy technologies. Some of the country's key initiative includes, delivering 100 megawatts of renewable power through solar farm project on the Askar landfill, a 50-megawatt initiative to install solar panels on the roofs of hundreds of government-owned buildings, The country is also planning a heat waste recovery pilot program to capture the excess heat generated by Aluminum Bahrain (Alba) and convert into electricity.
- Kuwait is planning to reduce 7.4% of national greenhouse gas (GHG) emission by 2035, which includes carbon dioxide, methane, and nitrous oxide emissions.
- In the fiscal year 2023-2024 budget Kuwait has announced subsidies for fuel and petroleum products of ~ US$ 3.77 billion
- The Oman government created Hydrogen Oman (HYDROM) a separate entity in 2022 to oversee and manage its hydrogen plan, total of 1,500 square kilometers of land will be used for construction by 2030.
- Oman has started numerous projects with targets for the year 2030. The projects include a wind farm in Dhofar, two solar Independent Power Projects (IPPs) in Manah, and 11 solar-diesel hybrid facilities.
- Kuwait intends to build a 2 GW renewable energy project to help diversify its energy mix by the introduction of solar and wind project in the country.

2.8 Projects & Investments

Locations	Project Details/Investment & Investor
Saudi Arabia	Jada Fund of Funds, has made major investment in the Energy Capital Group (ECG) targeting the Saudi's Vision 2030 and Aramco's IKTVA program. Through this both the companies are acquiring the local companies to develop local content and bolt-on innovative technologies.
UAE	Yellow Door Energy, a UAE based company had raised funding of US$400 million from Actis, British private equity company. The company is focusing to invest more into the sustainable energy projects in the Middle East and Africa.
Bahrain	Energy Capital Group (ECG) and NEOS GeoSolutions, had co-invested the US$ 60 million for the development of NeoSphere, an advanced technology for oil & gas exploration activities
Qatar	TotalEnergies has invested US$ 1.5 billion into the Qatar gas expansion project. The project is aimed to raise Qatar's LNG capacity to 126 million tonnes.
Oman	ADQ, an Abu Dhabi-based investment and holding company and Oman Investment Authority (OIA) announced plan to invest US$ 8.17 billion in new project within Oman. The companies are planning the investment in the energy sector such as solar and wind energy.
Oman	OQ Alternative Energy announced the plan to invest significant capital to build 2 GW of solar energy project the Sultanate of Oman.

2.9 Upcoming Energy and Power Projects

2.9.1 GCC Countries

Large, under-construction power plants across the Gulf Cooperation Council (GCC) aim to reduce carbon emissions while guaranteeing future water and power supply. Gulf countries strive to develop sustainable solutions for harnessing natural gas and solar energy, and lowering CO_2 emissions in the seawater recovery process for potable use. Overall, GCC states are safeguarding their power and water supplies for future use by investing in sustainable projects. Although desalination and solar energy projects are gaining greater importance than earlier.

Solar photovoltaics (PV) is economical, which adds to its popularity in developing new projects in the GCC countries. As a result, Saudi Arabia, the UAE, Kuwait, Qatar, Oman, and Bahrain are expected to have 40 GW utility-scale PV projects by 2030, creating 124,000 solar PV jobs. A gigantic 5,000 MW Mohammad Bin Rashid Al Maktoum Solar Park is being developed in Dubai, and Abu Dhabi plans to add 3,500 MW of capacity across two sites. In addition, Saudi Arabia plans to set up projects to generate 10 GW of renewable energy. Qatar and Oman are also making investments in renewable energy projects.

- **Floating Solar PVs**

GCC considers floating solar installations (FPVs) on artificial water reservoirs and offshore FPVs as notable ways of raising the share of renewables in the energy mix, in addition to land-based solar projects. As per the Middle East Solar Industry Association (MESIA), FPVs have greater energy output, with an added 10% yield owing to the cooling effect of the nearby water, leading to less dust gathering on the panels.

- **Projects in UAE**

The UAE is taking measures to increase the use of renewable energy while planning to meet 50% of its electricity requirements via clean energy sources by 2050. It intends to invest ~AED 600 billion (~US$ 163 billion) in renewable energy sources. Thus, the UAE plans to be the first MENA country to reach its zero emissions target by 2050.

Dubai's Mohammed Bin Rashid Al Maktoum Solar Park is among the large-scale renewable ongoing projects, targeting electricity generation of up to 5,000 MW by 2030. The colossal solar park, with investments amounting to AED 50 billion (US$ 13.6 billion), would help save more than 6.5 million tonnes of carbon emissions per year post-completion.

In addition to large-scale and government-funded projects, Dubai plans to set up the Dubai Green Zone for clean energy projects. Also, the government is launching the Dubai Green Economy Partnership program to drive public-private partnerships for new generating business opportunities in the sector. Further, the Al Dhafra Solar PV project in Abu Dhabi is the world's largest solar site, producing 2,000 MW of energy. After being connected to the grid in mid-2023, the park will be enabled to provide clean energy to a significant number of households.

- **Green Initiatives by Saudi Arabia, Qatar, and Oman**

Saudi Arabia is also making its foray into the green revolution. As stated by the MESIA, the country plans to add 10 GW of renewable capacity, primarily solar PVs, during 2022–2027. Also, to meet its target of becoming carbon-neutral by 2060, the Kingdom of Saudi Arabia intends to boost its installed renewable energy capacity to 58.7 GW by 2030. Solar energy would account for 68.1% of the Saudi Arabia 2030 Vision.

The Saudi Energy Procurement Company has installed two new solar projects in Saudi Arabia having total capacity of ~1,500 MW. Additionally, ACWA Power has partnered with Badeel, a Public Investment Fund subsidiary, to set up its second Shuaiba solar power station with a 2,060 MW capacity. Moreover, the Saudi Ministry of Energy has approved two solar energy projects with a collective capacity of 1,000 MW in Riyadh.

Smaller GCC countries are also venturing into solar projects to offset the high costs of fossil fuels. Qatar, which plans to produce 20% of its energy from solar power by 2030, launched its 800 MWp Al Kharsaah Solar PV Independent Power Producer, the country's first large-scale solar project, in 2022.

In Oman, the government launched a 500 MW Ibri Solar Power Plant, its largest clean energy production facility, in 2020. Per MESIA, this project can help the country lower greenhouse gas emissions by up to 340,000 tonnes annually. Further, the Oman Power and Water Procurement Company (OPWP) plans to launch two solar energy projects, the Manah Independent Power Stations 1 and 2, with a combined capacity of 500 MW, in the private sector. Commercial operations at Plant 1 and Plant 2 will begin by late 2023 and early 2024, respectively.

2.10 Energy and Power Industry Dynamics

2.10.1 Key Industry Driver

2.10.1.1 Ample High-Yield Renewable Resources

The GCC countries receive some of the highest solar energy levels in the world as they are situated directly under the sun's belt. A solar photovoltaic (PV) panel in a GCC country generates twice as much energy as in a comparable European country. The daily and seasonal changes in demand

modulate the output of a solar power plant in the GCC. The peak electricity demand in GCC nations is dominated by air conditioning requirements, which increase and decrease in lockstep with solar power plant output. In contrast, the power demand is often at its peak in countries with colder climates during the dark, gloomy winter days when solar plant outputs are at their lowest. Thus, renewable energy sources can potentially increase the general efficiency of GCC power systems.

Considering the need and potential of renewables, GCC member countries have begun launching more energy plants. The UAE, home to a few of the world's largest solar plants, has plans to invest US$ 163.39 in sustainable energy programs over the next 30 years to attain net-zero emissions by 2050. It intends to construct the Mohammed bin Rashid Solar Park in Dubai with 5 gigawatts capacity. Abu Dhabi aims to achieve 5.6 gigawatts of solar PV capacity by 2026 and is now building a 2-gigawatt solar facility in the Al Dhafra region. Saudi Arabia, the world's largest exporter of petroleum, is also working on several new renewable energy projects to increase its clean energy capacity and achieve carbon neutrality by 2060. According to the International Renewable Energy Agency, solar energy comprised 97% of the GCC's installed renewable energy capacity as of 2021. Thus, the energy and power sector are growing with such initiatives due to the availability of high-yield renewable resources in the GCC countries.

2.10.1.2 Ambitious Energy and Power Production Targets

The ambitious energy and power production of the Gulf Cooperation Council (GCC) countries is a major driver for the energy and power industry in the region. The GCC countries have some of the world's largest oil and gas reserves, and they are major exporters of these commodities. This has led to a significant investment in the energy and power sector in the GCC, as these countries seek to develop their production and export capabilities.

According to the ITA, by 2040, the Kuwait Petroleum Corporation (KPC) plans to boost its capacity for oil production to 4.75 million barrels per day (mmb/d). Additionally, KPC has declared plans to boost natural gas output to 4 billion cubic feet per day by 2030. Also, as on January 2023 the UAE and US commit $20 billion to 15 GW of renewable energy projects. By 2035, the 20 gigawatts (GW) of new renewable energy projects will be funded with the first $20 billion of their $100 billion clean energy collaboration. Other GCC countries are also investing in various energy and power projects to seek future energy and power needs. UAE and Saudi Arabia also has ambitious Nuclear-Energy plans, in their energy diversification mix. The UAE is targeting to meet 1/4th of domestic electricity energy needs by its Barakah nuclear plant. Saudi Arabia is also working on developing nuclear energy plans, and is currently working on developing two 1.4 gigawatt-electric nuclear reactors. Saudi Arabia is currently working with US to develop joint US-Saudi domestic project on nuclear energy. Such ambitious energy and power production by the GCC countries drive the overall energy and power industry in the GCC.

2.10.2 Key Industry Challenges and Sustainability Issues

2.10.2.1 Extreme Reliance on Energy Exports

Changes in energy prices and emissions pricing may impact financial markets in GCC countries as these economies are heavily dependent on energy exports. The economic expansion of any country depends on the use of clean energy. The GCC economies are highly susceptible to the effects of climate change as they are likely to face up to 1% loss of GDP per year due to these changes. Kuwait is one of the top 10 oil producers in the world and is home to the sixth-largest

proven oil reserves. The economy of Kuwait is highly dependent on oil exports; ~90% of its export income comes from the oil industry, and the net oil export income makes up ~40% of its GDP.

GCC nations are prone to problems such as harsh environments. Moreover, significantly subsidized domestic consumption rates aggravate the difficulties associated with a heavy reliance on oil & gas exports. Natural gas makes up 75% of the energy mix used to generate power in GCC, while crude oil makes up the remaining 25%. The region is anticipated to boost its hydrocarbon export capacity by 437 million barrels by 2025. Despite relative financial stability and political & economic stability in a majority of GCC nations, the structural weaknesses of the Gulf economies due to their disproportionate reliance on oil and gas exports unveil a notable economic slump.

2.10.2.2 Challenges of Energy Transition

The Gulf Cooperation Council (GCC) countries face several challenges as they transition to a more sustainable energy future. The renewable energy projects are more expensive to build than traditional fossil fuel-fired power plants. This is a major barrier for GCC countries, resulting in high levels of debt.

The Gulf states are particularly vulnerable to the effects of the energy transition as both big producers and consumers of hydrocarbons. The reducing share of the carbon-based energy in the global energy mix is irreversible, and demand for hydrocarbons is expected to decline by 2050. The Gulf economies' present recovery, is fueled by a surge in hydrocarbon prices, demonstrates the continued structural importance of oil and gas earnings. Thus, energy transition acts as challenge for the gulf countries due to their rely on fossil fuel and oil for the energy and power.

2.10.3 Key Industry Opportunities

2.10.3.1 Use of Renewable Energy for Water Resources Management

Water availability has historically presented opportunities for the GCC nations. The Gulf and Red Sea are inherently saltier than other seas in the world due to higher evaporation rates and lower freshwater inputs. In shallow coastal zones, hundreds of desalination units discharge hypersaline effluent, and many GCC nations plan to further scale up these desalination operations. Desalination is an energy-intensive process, and it currently relies on fossil fuels. After desalination, removing the salts from waste dumped in the vicinity to source intakes requires more energy. This necessitates actions on various fronts to increase the use of renewable energy sources in seawater desalination, in turn, reducing GHG emissions. These actions include enacting laws and tariffs to encourage more efficient and sustainable water usage, promoting research topics to spur innovation in water management, making efforts to replenish marine habitats, and using wastewater (as a resource) to enhance water security. Rising temperature levels, declining precipitation, excessive evaporation, increased demand, and protracted drought are the key factors threatening water security. Through the water–energy nexus, climate change can be perceived as an opportunity to increase resilience. Thus, the use of renewable energy to manage water resources is emerging as a significant opportunity in GCC countries.

2.10.3.2 Sustainable Development In Renewable Energy

The GCC countries are facing a number of challenges in the energy and power sector, including, depleting oil and gas reserves, rising demand for electricity, increasing environmental concerns to tackle these challenges the adoption and sustainable investment in renewable energy can be the better alternative for the GCC countries. The GCC's primary energy consumption is still dominated by fossil fuels and the share of renewable energy still does not exceed 1% as of 2022.

The supportive government regulations have contributing to a significant rise in renewable power generation capacities by various commercial projects. The commercial project such as NEON, world's largest green hydrogen production facility at a total investment value of USD 8.4 billion. The plant is currently being built at Oxagon, in Saudi Arabia's region of NEOM. In addition, Al Ajban Solar PV project in Abu Dhabi, UAE to generating 1,500 MW of electricity, it is crucial in advancing the UAE's environmental objectives set by the government of UAE. Such renewable projects in GCC countries create an opportunity for the further flourishment for energy and power industry in GCC countries.

2.11 Macro-Economic Factors Impacting The Sector

GOVERNMENT		GCC member countries such as Saudi Arabia, the UAE, Qatar, and Kuwait have taken initiatives to diversify their energy sources by investing in renewable resources, such as solar, wind, and hydropower. This helps reduce fossil fuel dependency and carbon footprint. Several GCC countries have set particular targets to raise the share of renewable energy in their energy mix. The UAE introduced "Energy Strategy 2050" in 2017 as the nation's first comprehensive supply-and-demand-driven energy policy. With this strategy, the country intends to save AED 700 billion by boosting the share of renewable energy in the whole energy mix from 25% to 50% by 2050 and lowering the carbon footprint of power generation by 70%. Additionally, it aims to improve corporate and individual consumption efficiency by 40%. In 2016, Saudi Arabia, a leading oil exporter, announced reforms in its Vision 2030 plan, which included the goal of installing capacities to generate 9.5 gigawatts of renewable energy by 2030. Some GCC countries have invested in carbon capture and storage (CCS) technology to reduce carbon emissions from the energy industry. The CCS involves capturing carbon dioxide emissions from power stations and storing them deep underground to lessen their environmental impact. GCC nations have significantly contributed to the global supply of CCS capacity. Merely three facilities in Saudi Arabia and the UAE can absorb ~3.7 million tonnes of CO2, i.e., 10% of the CO2 that has ever been captured globally. In contrast, all European CCS projects, collectively, account for only 4%.
ECONOMICAL		Historically, oil and gas exports have been a major source of income for GCC nations. However, in recent years, these countries have realized the necessity of diversifying their economies and lowering their reliance on fossil fuels. With the world moving toward cleaner energy sources, renewable resources have become vulnerable to changes in energy prices worldwide. Additionally, investments by GCC nations in infrastructure for renewable energy have strengthened economic prospects and created new jobs. Despite the efforts made for the rapid expansion of renewable energy, the economic well-being of GCC countries is still heavily reliant on the energy sector, as they continue to be prime producers and exporters of oil and gas. For instance, the energy industry plays a significant role in Qatar's economy. According to the International Monetary Fund, Qatar's earnings from its hydrocarbon sector accounted for 81% of its total government revenues in 2021, up from 77% in 2020. Its hydrocarbon export revenues rose from US$ 47 billion in 2020 to US$ 77 billion in 2021. Oil consumption in Qatar reached ~292,000 b/d in 2022 from ~260,000 b/d in 2020.
ENVIRONMENTAL		Before the Paris Agreement 2015 (a legally binding international treaty on climate change) and the UN Climate Change Conference in Glasgow (COP26), held in 2021, the governments of GCC countries lacked the resources required to wheel up their commitments to more environmentally friendly climate policies. Nevertheless, the governments of GCC countries succeeded in developing their climate change strategies to address current economic and energy security problems. Every GCC state has taken initiatives, enacted regulations, and designed programs to address climate change and achieve the objectives set in its national development strategies. Moreover, the newly developed institutional architecture in GCC countries has helped mitigate the effects of climate change and adapt to the changing environment. Except for Qatar, every GCC nation has committed to achieving a net-zero emissions goal by 2025. Each GCC country has agreed to reduce emissions as part of its unique Nationally Determined Contributions (NDCs). The entire installed renewable energy capacity of the GCC has increased nearly seven times, reaching 3,498 MW in 2021. The UAE contributes more than 75% to the total renewable energy capacity of the region.

LEGAL		Oil and gas revenues continue to be of signific important for the GCC country economies. Nonetheless, governments have started to take measures to reduce their degree of dependence on the oil market. The UAE introduced the Energy Strategy 2050 in 2017, its first unified energy plan based on the supply and demand of clean, safe, affordable energy while lowering greenhouse gas emissions. The Electricity and Water Authority (FEWA) and the Ministry of Energy and Infrastructure are the key government bodies in the renewable energy industry in the UAE. The Ministry of Energy and Infrastructure is responsible for formulating regulations for the electrical industry and ensuring compliance with the same. Kuwait has also developed Greenhouse gas emission policies and measures to mitigate fugitive emissions from the oil and gas sector and combustion-related emissions of the power generation industry. Bahrain under its Vision 2030 chalked out measures to reduce carbon emissions, protect the natural environment minimize pollution, and promote sustainable energy. The country is committed to designing energy efficiency policies and promoting renewable energy technologies that support Bahrain's long-term climate action and environmental protection ambitions. Bahrain's National Energy Efficiency Action Plan (NEEAP) and the National Renewable Energy Action Plan (NREAP) sets the national energy efficiency and national renewable energy 2025 targets of 6 and 5 percent. Through National Renewable Energy Program (NREP) initiative Saudi Arabia is aiming to strategically increase the renewable energy production share, in line with country's Vision 2030 and commitment towards reducing CO2 emissions. The country is also promoting the concept of a Circular Carbon Economy (CCE) to reduce emissions from oil and gas productions. Oman's Ministry of Energy and Minerals (MEM) is responsible for implementing policies and regulating the country's energy sector. Oman with its National Energy Strategy is aiming to derive 30 percent of electricity from renewable sources by 2030. Country has opportunities in renewable energy sector as Oman pursues economic diversification and explores alternatives to hydrocarbons for its power generation. The country has also pledged to lower down its greenhouse gas emissions by 7% compared to the business-as-usual scenario by 2030. Oman's other noble notable initiatives also include country's goal of becoming a net-zero economy by 2050. QatarEnergy (QE), formerly Qatar Petroleum (QP), is the state-owned company that operates all oil and gas activities, including exploration, extraction, production, refining, transport, and storage in Qatar. In 2021, QE announced to reduce its Green House Gas (GHG) emissions by 25 percent by 2030 and had allocated $170 million to this effort. The Qatar Energy's Sustainability Strategy also aims to keep the Carbon Reduction intensity of 15% from upstream and 25% from the LNG facilities by 2030, while adding 2 to 4 GW of renewable by 2030.
TECHNOLOGICAL		GCC countries are adopting various new technologies in their energy and power sectors. Owing to a wealth of solar energy resources and the need to efficiently meet the growing energy demands, nations such as Saudi Arabia and the UAE have set high renewable energy goals and are making significant investments in solar power technologies. For example, Oman intends to establish a hydrogen-based economy by attaining ~30 GW of annual green and blue hydrogen production by 2040. The government has announced several gigawatt-scale green hydrogen projects, including a 14 GW facility fueled by 25 GW of wind and solar energy. According to MEED, Oman is planning to invest ~US$ 45 billion in green hydrogen and green ammonia projects. Further, many GCC nations intend to explore nuclear energy as a power source. For instance, the Barakah Nuclear Power Plant, the first nuclear power plant in the GCC is already operational in the UAE. By 2030, Saudi Arabia intends to construct 16 nuclear reactors. GCC countries, whose energy mix is still dominated by fossil fuels, increasingly emphasize carbon capture, utilization, and storage (CCUS) technologies. The technology entails storing or exploiting carbon dioxide emissions from power plants to create other products. For instance, a white paper study commissioned by the Oil and Gas Climate Initiative (OGCI) demonstrates that CCUS deployment in GCC countries might significantly increase the region's economic potential.

3. Appendix

3.1 Word Index

Table 1. List of Abbreviation

Abbreviation	Expansion
BOT	Build-operate-transfer bases.
BOO	Build-own-operate
CCUS	Carbon capture, utilization, and storage
CEPA	Comprehensive Economic Partnership Agreement
EDB	Economic Development Board
EUAS	Electricity Generation Company
EMRA	Energy Market Regulatory Authority
EPCI	Engineering, Procurement, Construction, and Installation
SMR	Eurasia Small Modular Reactor
FPVs	Floating solar installations
FSRU	Floating Storage and Regasification Unit
GCCIA	GCC Interconnection Authority
GW	Gigawatts
GCC	Gulf Cooperation Council
HYDROM	Hydrogen Oman
IPPs	Independent Power Projects
IREA	International Renewable Energy Agency
KPC	Kuwait Petroleum Corporation
LNG	liquified natural gas
LTS	Long-Term Strategy
MW	Megawatts
MoC	Memorandum of Cooperation
MEW	Ministry of Electricity and Water
MOEI	Ministry of Energy and Infrastructure
MENR	Ministry of Energy and Natural Resources
NEEAP	National Energy Efficiency Action Plan
GHG	National greenhouse gas

Abbreviation	Expansion
NOCs	National oil companies
NREP	National Renewable Energy Program
NDCs	Nationally determined contributions
NPPs	nuclear power plants
OGCI	Oil and Gas Climate Initiative
OECD	Organisation for Economic Cooperation and Development
PPA	power purchase agreement
QEWC	Qatar Electricity & Water Company
REPDO	Renewable Energy Project Development Office
YEKDEM	Renewable Energy Support Mechanism
PV	Solar photovoltaics
SEA	Sustainable Energy Authority
TANAP	Trans-Anatolian Natural Gas Pipeline
Tcf	Trillion cubic feet
GEU	World Bank Gulf Economic

Gulf Research Center
Knowledge for All

About the Gulf Research Center

The Gulf Research Center is an independent research institution, whose motto is "Knowledge for All." Its work serves the issues and goals of the peoples and countries of the Gulf region. The center was established in July 2000, and its headquarters are in Jeddah, Saudi Arabia. It has branches in Riyadh, Saudi Arabia, Cambridge University, United Kingdom, and Geneva, Switzerland.

Since its establishment, the Center has been committed to actively contributing to issues in the Gulf region, through all its activities, which include: conducting research and studies, organizing conferences, forums and workshops, media dissemination on security issues, politics, economy, military affairs, education and environment, media and others. The Center has also translated and published more than 500 major books, dictionaries and dictionaries specialized in politics, security, economics, international relations, strategic thought, environment, media, regional and international balance...etc.

For the twelfth consecutive year, the Gulf Research Center maintained its presence among the most prominent think tanks and civil society organizations in the world, and as one of the major independent think tanks in the Middle East and out of 8,162 organizations from all continents of the world, according to what was announced by the International Relations Program at the University of Pennsylvania on 30 January 2020, as a part of the program's annual classification of think tanks in the world. In addition, the Gulf Research Center was cited as one of the most prominent think tanks interested in foreign political and international affairs, and among the best institutions within the classification of institutional cooperation.

Gulf Research Center
Knowledge for All

www.grc.net