



Independent Statistics & Analysis

U.S. Energy Information
Administration

Country Analysis Brief: United Arab Emirates

Last Updated: March 21, 2017

Overview

The United Arab Emirates (UAE) is among the world's 10 largest oil producers and is a member of the Organization of the Petroleum Exporting Countries (OPEC) and the Gas Exporting Countries Forum (GECF).

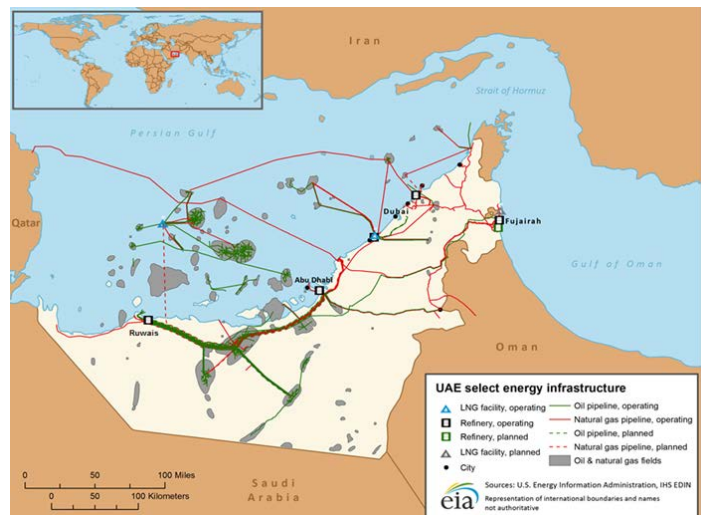
Since gaining independence from the [United Kingdom](#) and uniting in 1971, the United Arab Emirates (UAE)—a federation of the seven emirates of Abu Dhabi, Ajman, Al Fujairah, Dubai, Ras al Khaymah, Sharjah, and Umm al Qaywayn—has relied on its large oil and natural gas resources to support its economy. The UAE is currently the seventh-largest petroleum producer in the world, and hydrocarbon export revenues are projected to account for \$65 billion in 2017, roughly 20% of all export revenue. The share of hydrocarbon export revenues, which amounted to \$129 billion (35% of total export revenue), has fallen since 2013 according to the International Monetary Fund (IMF) as a result of the decline in oil prices.¹ Nonetheless, UAE's crude oil and other petroleum liquids production has grown over the same period.

In addition to the country's large hydrocarbon economy, the UAE is becoming one of the world's most important financial centers and a major trading center in the Middle East. Investments in nonenergy sectors, such as infrastructure and technology, continue to provide the UAE with long-term insurance against oil price declines and global economic stagnation. IMF data indicate the UAE's real gross domestic product slowed from 4.7% growth in 2013 to 4.0% in 2015 as a result of persistently low oil prices. The IMF expects UAE's economic growth to be largely limited to 3.5% over the medium term.²

A member of the Organization of the Petroleum Exporting Countries (OPEC) since 1967—when Abu Dhabi joined—the UAE is one of the most significant oil producers in the world. The likelihood of further major oil discoveries is low, but the UAE uses enhanced oil recovery (EOR) techniques to increase the extraction rates of the country's mature oil fields.

Natural gas use in the UAE is rising. Although the country is a member of the Gas Exporting Countries Forum (GECF), domestic demand is likely to draw heavily from the UAE's natural gas resources. Currently, the country both imports and exports liquefied natural gas (LNG) and shares international natural gas pipelines with [Qatar](#) and [Oman](#). The UAE is also one of the world leaders in the use of natural gas in EOR techniques. With natural gas demand rising, the UAE plans to expand domestic natural gas production by applying EOR techniques to gas wells.

The UAE is making notable progress in diversifying its economy through tourism, trade, and manufacturing. However, in the near term, oil, natural gas, and associated industries will continue to account for most of the economic activity in the seven emirates.



Sector Organization

Each of the seven emirates is responsible for regulating the oil industry within its borders, creating a mix of production-sharing arrangements and service contracts. In Abu Dhabi, the Supreme Petroleum Council (SPC) sets Abu Dhabi's petroleum-related objectives and policies. Given Abu Dhabi's dominance among the seven emirates in UAE's oil industry, the SPC is the most important entity in the country for establishing oil policy.

The Abu Dhabi National Oil Company (ADNOC)—which operates more than two dozen subsidiaries and institutions throughout the oil, natural gas, and petrochemical sectors—leads the day-to-day operations and implementation of SPC directives, and it is the key shareholder in nearly all upstream activity in Abu Dhabi.³ ADNOC's subsidiaries engage in oil and natural gas exploration, processing, and distribution, among other activities. Some of the most notable subsidiaries are the Abu Dhabi Company for Onshore Oil Operations (ADCO), the Abu Dhabi Marine Operating Company (ADMA-OPCO), the Zakum Development Company (ZADCO), and the Abu Dhabi National Tanker Company (ADNATCO), which operates under the same management team as the National Gas Shipping Company (NGSCO).

The Dubai Supreme Council of Energy (DSCE) oversees Dubai's energy policy development and coordination. The DSCE includes representatives from several key entities, including the Emirates National Oil Company (ENOC), the Dubai Petroleum Establishment (DPE), the Dubai Nuclear Energy Committee (DNEC), and the Dubai Electricity and Water Authority (DEWA). The DSCE works to ensure that Dubai has adequate access to energy resources by investing in renewable energy projects and developing efficiency measures.⁴

Sharjah, which is a minor producer of condensate and natural gas, established a national oil company in 2010, with the Sharjah National Oil Company (SNOC) and its subsidiary, the Sharjah Liquefaction Gas Company. SNOC is a wholly state-owned company and is overseen by the Sharjah Oil Council. The other four Emirates have small oil and natural gas sectors, but details on their structures are limited.⁵

Natural gas production and regulation are the responsibilities of the individual Emirates and are often carried out under the same leadership as their oil sectors. ADNOC leads Abu Dhabi's natural gas sector through its subsidiaries, and the exploration and production of natural gas resources, as is true for its oil, is carried out by ADCO and ADMA-OPCO. The Abu Dhabi Gas Industries Limited Company (GASCO), created as a joint venture between ADNOC, Shell, Total, and Partex, oversees processing of Abu Dhabi's natural gas liquids (NGL), and the associated gas recovered from onshore oil operations. Another important company in Abu Dhabi's natural gas sector is Abu Dhabi Gas Liquefaction Limited (ADGAS), which controls the production and export of Abu Dhabi's LNG and liquefied petroleum gas (LPG). The third major participant in Abu Dhabi's natural gas industry is the Abu Dhabi Gas Development Company Limited (Al Hosn Gas), which develops the sour gas reservoirs in the Emirate's large Shah field. Al Hosn Gas is a joint venture between ADNOC and Occidental Petroleum Company.

The DSCE is also the central figure in Dubai's natural gas sector. Led by the ENOC group—a state-owned entity made up of dozens of subsidiaries—Dubai's natural gas sector operates similarly to its counterpart in Abu Dhabi. The Dubai Natural Gas Company Limited (DUGAS) oversees engineering, construction, management, and operation of Dubai's natural gas infrastructure.

Contracts

Abu Dhabi bases contract structures on long-term, production-sharing agreements (PSAs) between the state-run ADNOC and private actors (primarily large international oil companies), with the state holding a majority share in all projects. With the exceptions of Dubai and Sharjah—which have service contracts to manage their declining reserves—the smaller Emirates all use PSAs similar to those found in Abu Dhabi.

Major international oil companies involved in the UAE oil and natural gas sector include BP, Shell, Total, ExxonMobil, and Occidental Petroleum. International oil companies involved in the UAE's upstream oil sector received just \$1 per barrel (/b) of oil produced under the decades-old ADCO concession. After the legacy onshore concession expired in January 2014, nine companies submitted bids for 5% and 10% stakes in a new 40-year concession.⁶ In January 2015, Total was the first company to sign a new contract, agreeing to a 10% participating interest in the onshore concession for 40 years. BP also signed up for a 10% stake in the 1.66 million b/d onshore ADCO concession in December 2016. Japan's Inpex and [South Korea's](#) GS Energy have been awarded a 5% and a 3% concession, respectively. In February 2017, Abu Dhabi awarded the final 12% of the planned 40% IOC allocation, with CNPC and CEFC signing up for 8% and 4%, respectively. The new contract terms offer a \$2.85/b fee.^{7 8 9 10 11}

[Japan's](#) Inpex has also extended its contract to jointly develop the Satah and Umm Al Dalkh fields offshore Abu Dhabi. The contract gives Inpex a 40% participating interest in both fields, with the contract running until the end of 2042.¹²

Petroleum and other liquids

The UAE is a major oil producer and exporter. In 2016, the country produced an average of nearly 3.7 million barrels per day of petroleum and other liquids, the seventh-highest total in the world.

According to the *Oil & Gas Journal* estimates as of January 2017, the UAE holds the seventh-largest proved reserves of oil in the world at 97.8 billion barrels (Table 1),¹³ with most of the reserves located in Abu Dhabi (approximately 96% of the UAE's total). The other six Emirates account for just 4% of the UAE's crude oil reserves, led by Dubai with approximately 2 billion barrels.¹⁴ The UAE holds approximately 6% of the world's proved oil reserves.¹⁵

Recent exploration in the UAE has not yielded any significant discoveries of crude oil. What the UAE lacks in new discoveries, it makes up for with an emphasis on EOR techniques designed to extend the lifespan of the Emirates' existing oil fields. By improving the recovery rates at the existing fields, such techniques helped the UAE to nearly double the proved reserves in Abu Dhabi over the past decade.

The UAE has several crude oil streams, including the Murban—a light and sweet (low sulfur) crude oil that is the country's primary export stream. In July 2014, Abu Dhabi began offering a new crude oil stream called Das, which is a blend of two existing streams—the Umm Shaif and Lower Zakum crude oil streams.¹⁶

Table 1. Top 10 countries for proved oil reserves, January 2017

Country	Billion barrels
Venezuela	300.9
Saudi Arabia	266.5
Canada	169.7
Iran	158.4
Iraq	142.5
Kuwait	101.5
United Arab Emirates	97.8
Russia	80.0
Libya	48.4
Nigeria	35.3

Source: U.S. Energy Information Administration, Oil and Gas Journal

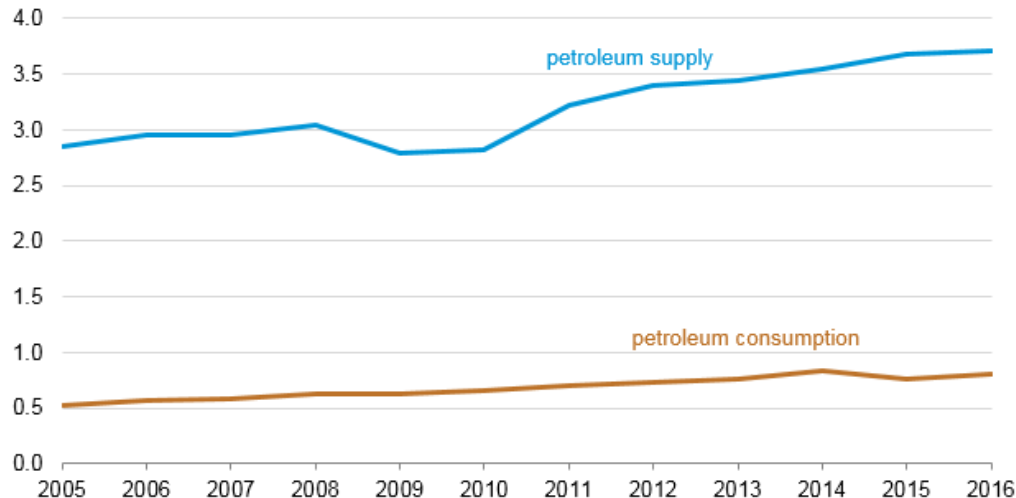
Exploration and production

The UAE was the fourth-largest producer of petroleum and other liquids among OPEC members in 2015. The country has an ambitious target of increasing crude oil production to 3.5 million b/d by 2020, despite lower oil prices.

The UAE produced 3.7 million barrels per day (b/d) of petroleum and other liquids in 2016, of which 2.9 million b/d was crude oil and the remainder was non-crude liquids (condensate, natural gas plant liquids, and refinery processing gain). The UAE has the fourth-highest petroleum production in OPEC behind [Saudi Arabia](#), [Iraq](#), and [Iran](#) (Figure 1). The UAE plans to increase crude oil production to 3.5 million b/d in 2020,¹⁷ but with limited prospects for major discoveries, production increases in the UAE will come almost exclusively by using EOR techniques in Abu Dhabi's existing oil fields.

One potential source of output growth is the Zakum petroleum system. ZADCO—owned jointly by ADNOC (60%), ExxonMobil, (28%) and the Japan Oil Development Company (12%)—manages production from UAE's Upper Zakum field, which currently produces about 670,000 b/d.¹⁸ In July 2012, ZADCO awarded an \$800 million engineering, procurement, and construction contract to Abu Dhabi's National Petroleum Construction Company—along with the French firm, Technip to expand oil production at the Upper Zakum field to 750,000 b/d by 2018 and to 1 million b/d by 2024.¹⁹ To meet this target, ZADCO shareholders have employed an artificial island concept with extended-reach drilling (ERD) and maximum reservoir contact (MRC) technology.²⁰ Production from the Lower Zakum field—operated by the Abu Dhabi Marine Operating Company (ADMA-OPCO)—should also increase to 425,000 b/d from the 345,000 b/d it currently produces.

Figure 1. UAE petroleum and other liquids supply and consumption
million barrels per day



eia Source: U.S. Energy Information Administration

Imports, exports, and consumption

The UAE has one of the highest rates of per capita petroleum consumption in the world.

The UAE is both a major exporter and a consumer of petroleum liquids. The U.S. Energy Information Administration (EIA) estimates that the UAE exported more than 2.5 million b/d of crude oil in 2016, with most of it going to markets in Asia (Table 2). In addition to being a major global petroleum exporter, the UAE domestic market relies heavily on petroleum product imports to meet energy demand. Most of the UAE’s petroleum imports are residual fuel oil, with limited imports of motor gasoline and diesel fuel.

Table 2. UAE crude oil exports by region, 2016

Region	Share
Asia	96%
Africa	2%
Other	2%

Source: U.S. Energy Information Administration, Lloyd's List Intelligence

The UAE has a well-developed domestic pipeline network that links oil fields with processing plants and export terminals. The newest export pipeline, the Abu Dhabi Crude Oil Pipeline (ADCOP), runs 236 miles from Habshan to Fujairah and began operations in June 2012. This pipeline gives the UAE a direct link from the rich fields of its western desert to the Gulf of Oman and from there to global markets. With a capacity of 1.5 million b/d—and a potential capacity of 1.8 million b/d—this pipeline allows the UAE to export a significant portion of its daily production without passing through the Strait of Hormuz. The Strait of Hormuz is the world’s busiest energy chokepoint (*link to Chokepoints CAB*), accounting for 30% of all seaborne-traded oil.

Already the world’s second-largest bunkering port, the export terminal in Fujairah will expand its storage capabilities significantly over the coming years. Plans to expand the terminal include several new private tank storage units, with an anticipated capacity of 88 million barrels by 2020. The Fujairah port also opened the country’s first very large crude carrier (VLCC) in September 2016, bringing total port loading and unloading capacity to 2 million b/d.²¹ Refining and storage capacity are growing as a result of ongoing expansion projects, and Fujairah is quickly becoming a critical node in a well-developed refining and export network.

Refining

The UAE has four refining facilities, the largest of which is the Ruwais facility. A major expansion at the Ruwais refinery in 2015 doubled the facility's capacity from 400,000 b/d to 817,000 b/d, bringing total refining capacity in the UAE to 1.1 million b/d (Table 3).²² In addition, the UAE has tentative plans to invest in a new 200,000 b/d Fujairah refining complex, although the project timeline remains uncertain.²³

The UAE and neighboring Oman plan to build a jointly-operated refinery in the Duqum special economic zone that would have a capacity of 230,000 bbl/d by 2018. DSCE also signed a memorandum of understanding (MOU) with China Sonangol to build a refinery in Dubai, but capacity and schedules have not been released.

Table 3. UAE's Refineries

Refinery	Capacity (thousand b/d)
Ruwais	817
Jebel Ali	140
Umm Al-Narr	85
Fujairah	82

Source: OPEC Annual Statistical Bulletin 2016

Natural gas

The UAE plans to boost domestic natural gas production over the next several years to help meet growing internal demand. Much of the growth could come from the country's large sour (high-sulfur) gas deposits.

The UAE holds the seventh-largest proved reserves of natural gas in the world, at slightly more than 215 trillion cubic feet (Tcf) (Table 4). Despite its large endowment, the UAE became a net importer of natural gas in 2008. This phenomenon is a result of two things: (1) the UAE reinjected approximately 26% of gross natural gas production in 2015²⁴ into its oil fields as part of EOR techniques and (2) the country's rapidly-expanding electricity grid—already strained by the swift economic and demographic growth of recent decades—relies on electricity from natural gas-fired facilities.

Table 4. Top 10 natural gas reserve holders in the world, January 2017

Country	Trillion cubic feet
Russia	1,688
Iran	1,183
Qatar	858
United States	324
Saudi Arabia	303
Turkmenistan	265
United Arab Emirates	215
Venezuela	201
Nigeria	187
China	183

Source: U.S. Energy Information Administration, Oil & Gas Journal

To help meet the growing demand for natural gas, the UAE boosted imports from neighboring Qatar via the Dolphin Gas Project's pipeline over the past several years. The pipeline runs from Qatar to Oman via the UAE and is one of the principal points of entry for the UAE's natural gas imports. In addition to the imports from Qatar, Dubai (an importer) and Abu Dhabi (an exporter), both engage in liquefied natural gas (LNG) trade.²⁵

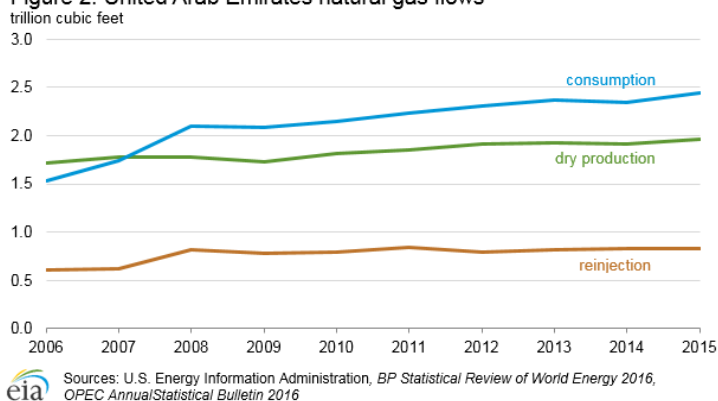
The UAE's natural gas has a relatively high sulfur content that makes it highly corrosive and difficult to process. For decades, the country simply flared the natural gas from its oil fields rather than undertake the extensive—and expensive—processes associated with separating the sulfur from the natural gas. The technical difficulties of producing the country's sulfur-rich (sour) natural gas once posed a great impediment to the development of the UAE's reserves, but advances in technology and the growing domestic demand for natural gas make the country's vast reserves an enticing alternative to Qatari imports.

Exploration and production

Already a natural gas producer, the UAE has several ongoing projects that could bring additional natural gas supplies online to help satisfy rapidly growing demand. However, developing additional gas resources is costly.

Natural gas production in the UAE rose to roughly 2 trillion cubic feet (Tcf) in 2015, continuing the upward trend that began in the late 1970s (Figure 2).²⁶ Despite the challenges of producing natural gas domestically, the UAE hopes to further boost production to help meet the country's growing demand.

Figure 2. United Arab Emirates natural gas flows



Several ongoing projects—the Onshore Gas Development (OGD), Integrated Gas Development (IGD), and Offshore Associated Gas (OAG) projects—may increase production of the country's natural gas reserves and could help meet UAE's rapidly growing demand for natural gas. ADNOC is pursuing a large-scale sour-gas development at the Shah field. One of the project's challenges is that producing the ultra-sour natural gas yields relatively small quantities of marketable natural gas; in this case, just 504 cubic feet per 1,000 cubic feet of marketable gas is produced, even after extensive treatment. The Shah natural gas field production project came online in January 2015 and reached full capacity in October 2015. It produced 504 million cubic feet per day (MMcf/d) of dry natural

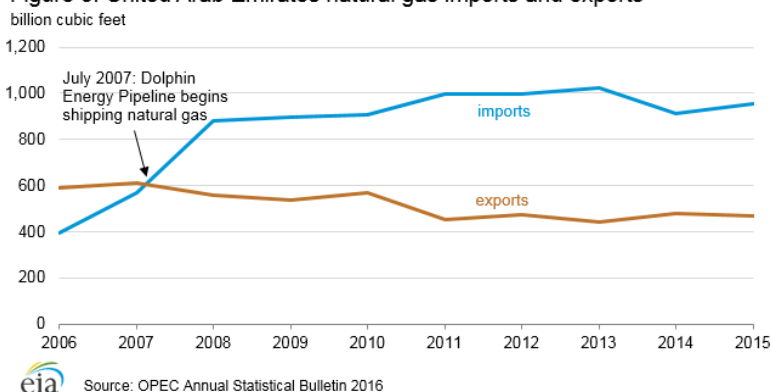
gas and 50,000 b/d of natural gas liquids from 1 Bcf of gross production.

Imports, exports, and consumption

The UAE was the first country in the Middle East to export liquefied natural gas (LNG) and has exported more than 268 billion cubic feet of LNG annually, almost exclusively to Asia, in 2015.

The UAE became a net importer of natural gas in 2008 as UAE consumption grew by an average of 5% per year between 2005 and 2015 to roughly 2.5 Tcf.²⁷ Natural gas consumption in the electric power sector grew at an even faster pace over this period, according to IHS Energy. While UAE continues to produce and increase domestic natural gas output, domestic demand growth has far outpaced production growth during this period. The UAE has had to increase natural gas imports to meet the country's rising demand. Natural gas imports grew from 7 Bcf in 2003 to 957 Bcf in 2015, while exports remained relatively flat at roughly 466 Bcf (Figure 3).²⁸

Figure 3. United Arab Emirates natural gas imports and exports



Imports

Most of the UAE natural gas imports come from Qatar via the Dolphin Energy pipeline project. The Dolphin project was the first major international pipeline project of its kind in the Persian Gulf, sending Qatari gas from its vast North Field to the UAE and

Oman. The pipeline, which began shipping natural gas in 2007, runs from Qatar's North Field to Abu Dhabi's Taweelah power stations. Dolphin is a 3.2 Bcf per day, 226-mile subsea pipeline, which also connects to the other Emirates and Oman.²⁹ However, flows through the Dolphin pipeline have remained relatively constant at about 2 Bcf per day as Qatar's compression facilities and contracted export volume limits the flows.³⁰ The pipeline imports help free up Abu Dhabi's natural gas for oil recovery and exports, levels that the Emirate must meet under contract. The pipeline supplies all seven Emirates and meets roughly 26% of the country's natural gas demand.³¹

The UAE imports LNG via two floating storage and regasification units (FSRUs), which helps to offset the risk of gas supply shortages while taking advantage of low LNG prices. The Explorer FSRU has imported LNG at the Jebel Ali terminal off the coast of Dubai since 2010. A second FSRU located near Ruwais was delivered in August 2016 and began imports of LNG that month.³²

Exports

In 1977, the UAE became the first country in the Middle East to export LNG, sending its first load to the Tokyo Power Company (TEPCO) as part of a long-term supply agreement. The UAE signed a second contract in 1990 to double LNG exports to Japan, and in 1994, a third LNG train at Das Island began operations to help fulfill the terms of the agreement.

In 2015, the UAE exported 466 Bcf of natural gas, mostly in the form of LNG. Nearly all of UAE's LNG exports that were destined for Japan in 2015, with smaller amounts exported to [India](#) and [Brazil](#).³³ Though UAE plans to expand development of domestic natural gas reserves, low LNG spot prices have reduced economic incentives to bring costly, high-sulfur fields online.³⁴

Consumption

Natural gas consumption in the UAE reached a record high of more than 6.7 Bcf per day 2015.³⁵ Solid economic growth and the resulting energy demand over the past few years are straining the country's natural gas supplies. The UAE uses a large amount of natural gas in its extensive EOR operations and to operate its many power plants and desalinization plants. Meeting domestic demand will require large import volumes for the foreseeable future. Advances in EOR techniques and carbon capture and storage (CCS) could free up additional volumes for domestic consumption.

Electricity

*The UAE is planning to add nuclear, renewable, and coal-fired electricity generating capacity to accommodate rising demand, but the country currently relies primarily on natural gas.*³⁶

Rapid economic and demographic growth over the past decade pushed the UAE's electricity grid to its limits. Installed generation capacity continues to rise, reaching 28.6 gigawatts (GW) in 2015. The UAE generated over 87% of its electricity in 2015 using natural gas-fired generation.³⁷ Electricity consumption in the UAE reached nearly 112,000 gigawatthours (GWh) in 2014, placing the UAE among the highest electricity consumers per capita in the world.³⁸ The UAE's State of Energy 2016 Report states that electricity peak demand has almost doubled over the past 10 years.³⁹

Electricity sectors in all Emirates, with the exception of Abu Dhabi, are regulated by state agencies, and Abu Dhabi plans to further privatize its distribution sector. In Abu Dhabi, independent power producers (IPPs) and independent water and power producers (IWPPs) are joint ventures between the Abu Dhabi Water and Electricity Authority (ADWEA) holding companies and private investors, which hold 60% and 40%, respectively. All IWPPs sell water and electricity to the single state-owned buyer, Abu Dhabi Water & Electricity Company (ADWEC), under 20-year power and water purchase agreements.⁴⁰

The Dubai Electricity and Water Authority (DEWA) owns and operates all power production and water desalination plants in Dubai and all of the Emirate's transmission and distribution networks.⁴¹ DEWA has allowed for private sector participation in energy generation and water production by adopting the IWPP model, and these IWPPs would, in turn, sell their capacity and output to the single buyer, DEWA.⁴²

The UAE plans to increase its power generation capacity by around 21 GW by 2030 through various projects. These projects, both planned and under development, are comprised of 26.8% nuclear, 24.3% coal-fired, and 22.5% gas-fired. Solar capacity is expected to contribute 26.1% of the total additional generation capacity. These plans include a 2.4 GW Dewa clean-coal facility and the 5.6 GW 4-reactor Barakah nuclear facility.⁴³

In 2010, the state-run Emirates Nuclear Energy Corporation (ENEC) contracted South Korea's Kepco to construct four 1.4 GW nuclear power reactors at the Barakah site. The first reactor is scheduled to come fully online in 2017, making the UAE the region's second country (along with Iran) to have a domestic nuclear program.⁴⁴ All four Barakah reactors are expected to add at least 5.6 GW of capacity, or 25% of the country's energy needs, when construction is complete in 2020.⁴⁵ The overall construction completion rate for the four units at the Barakah nuclear plant was 76% complete at the end of 2016, with Unit 1 more than 93% complete.⁴⁶

The UAE sought and received International Atomic Energy Agency (IAEA) approval for the nuclear project, and committed to forgoing the domestic enrichment and reprocessing of nuclear fuel within the country. Since 2014, the UAE has reached agreements with several countries ([Argentina](#), Japan, South Korea, the United Kingdom, [France](#), [Australia](#), [Canada](#), and [Russia](#)) on cooperation in the nuclear power sector.⁴⁷

The UAE is also investing in renewable energy technologies and has committed to producing at least 7% of its total power generation from renewable sources by 2020.⁴⁸ New solar capacity will also generate a significant share of new power generation within the UAE, and the country has 5.45 GW of new solar projects in development. Dubai has set targets for increasing electricity from renewables, with renewables expected to generate at least 25% of all electricity by 2030. Key to meeting this goal is the Muhammad bin Rashid Al Maktoum Solar Park, which will be the largest such facility in the world when completed in 2030. Of the plant's planned 5GW capacity, 13 MW came online in 2013, with a 200MW addition planned for 2017.⁴⁹ Smaller solar plants are also under construction elsewhere in the country. Abu Dhabi expects the 350 MW Shweihan solar plant to begin operations in 2019, while the Federal Electricity and Water Authority (FEWA), which covers several northern Emirates, anticipates an additional 200MW of planned solar projects.⁵⁰

State-led entities manage the domestic electricity grid in each of the seven emirates, but the UAE is working to integrate the Emirates into a more efficient national grid. This integration coincides with developing the Gulf Cooperation Council (GCC) Interconnection Grid that will link Bahrain, [Kuwait](#), Oman, Qatar, Saudi Arabia, and the UAE under one regional grid.

Notes

- Data presented in the text are the most recent available as of March 21, 2017.
- Data are EIA estimates unless otherwise noted.

Endnotes

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