



Energy Industry in Kuwait



General State of the Economy

Kuwait, the official name – The State of Kuwait, is a country in the Middle East with its capital in El Kuwait.

The country has borders with Iraq (in the north and west), and Saudi Arabia (in the south), and is also washed by the waters of the Persian Gulf.

State of Kuwait / دولة الكويت

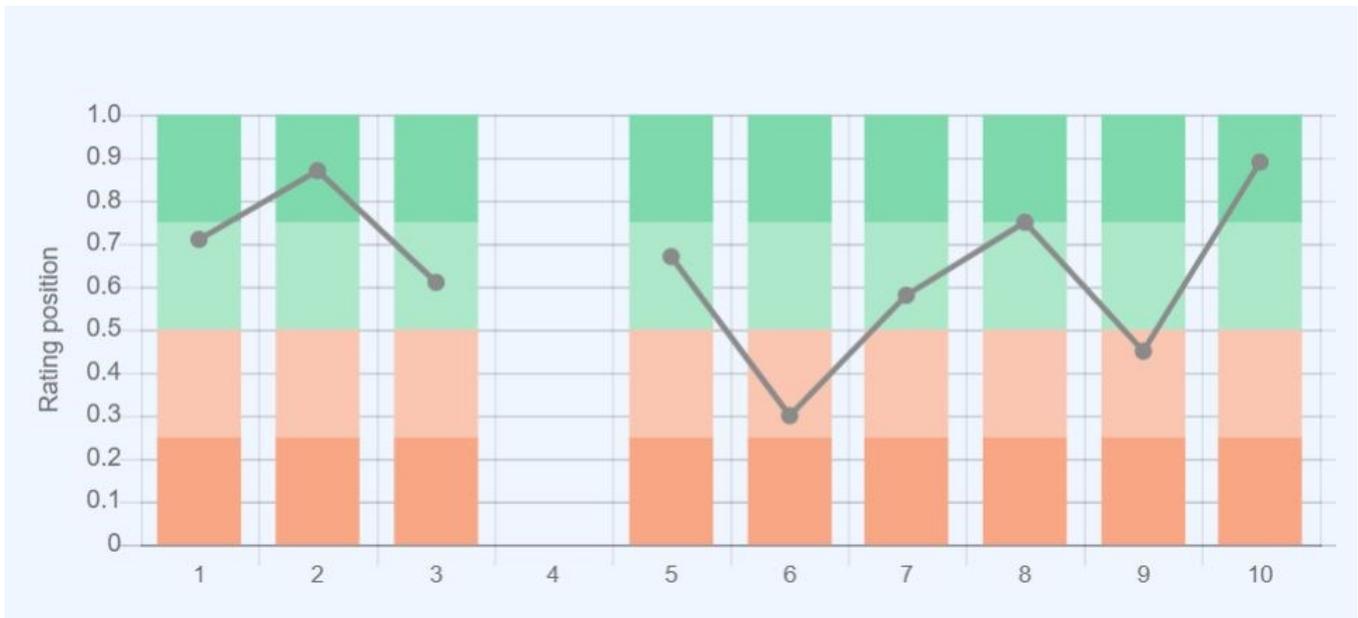
Capital: Kuwait City	Density: 277/km ²	Currency: Kuwaiti dinar (KWD)
Official languages: Arabic	Life expectancy at birth: 80.26 years	GDP (PPP): \$250.249 billion (2023)
National Day: 25 February	Land area: 17,820 km ²	GDP - per capita (PPP): \$51,561 (2023)
Population: 4,934,508 (2025)	Coastline: 499 km	Internet country code: .kw

Source: [1,2,3,4,5]



High-angle shot of The Green Island with a skyline of the city of Kuwait in the background. Envato Elements. JR43SMZXDT

According to 2025 statistics Kuwait, which in terms of size is placed 156th in the world, is home to around 5 million people. In terms of population density, the country is 50th in the world from 242 countries considered [1,2,3]. The length of the coastline is 499 km [3]. The political form of government is constitutional monarchy, however, in terms of high-technology exports and the annual GDP growth, the country is below the world average (figure 1).



Sources:

1. GDP (purchasing power parity), 2020 est. / The World Factbook/Library/Central Intelligence Agency *228
 2. GDP - per capita (PPP), 2020 / The World Factbook/Library/Central Intelligence Agency *229
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 6. High-technology exports (current US\$) 2019-2020 / United Nations, Comtrade database through the WITS platform / License: CCBY-4.0 / Data *134
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 9. Annual average GDP growth in %, for the last 10 years (2011-2020) / World Bank national accounts data, and OECD National Accounts data files / License: CC BY-4.0 *206
 10. Public debt (% of GDP), 2017 est. / The World Factbook / Library / Central Intelligence Agency (from smallest to largest) *210
- * Total number of countries participating in ranking

Figure 1. Economic indices of Kuwait

From the beginning of 2000, with a slight decline between 2008 and 2010, in 2017 and 2020, the country has experienced sustained GDP growth in purchasing power parity, which in 2023 reached the level of \$219.06 billion (73rd place in the world) [3,4]. GDP at purchasing power parity per capita showed stable growth from 2002 to 2007, then until 2010 there was a sharp fall and multidirectional movement until 2023, when it reached \$50,800 (39th place), falling from \$ 52,500 in 2022 [3,5]. The Global Competitiveness Report 2019 reflects the effectiveness of the use of the country's own resources for sustainable development. In addition to a number of economic indicators this index also takes into account such variables as education, health, level of innovation, etc.

High-technology exports in 2021 was 1% of manufactured exports. According to the Index of Economic Freedom, which is based on freedom of business, freedom from government action, property protection, and freedom from corruption, the country was 90th in 2024.

Energy resources

Kuwait has significant reserves of fossil fuel resources (Table 1). According to proven reserves of oil and natural gas, the country is ranked 6th and 19th in the world, re-

spectively [3]. According to data for 2024, in terms of tons of oil equivalent, proved oil reserves amounted to 89.6 %, natural gas – 10.4% (Figure 5).

According to [3,6], in 2021 the proven oil reserves in Kuwait were estimated to be at 101.5 billion barrels.

Table 1. Fossil energy resources of Kuwait

Resource/explanations	Crude Oil*	Natural Gas*	Coal	Natural Bitumen	Tight Oil	Coal mine methane	Shale Oil
Value	101.5(5.96%)	63(0.09%)	no data	no data	no data	no data	no data
Unit	billion barrels	Tcf	-	-	-	-	-
Year	2021	2021	-	-	-	-	-
Source	[15]	[15]	[-]	[-]	[-]	[-]	[-]

*share of the country's reserves in world total is provided in brackets

In terms of this indicator Kuwait is second only to Saudi Arabia, Iraq and Iran in the region. At current production levels oil reserves in Kuwait could last for more than 100 years. Kuwait is an active participant in the organization of oil exporters (OPEC), where the share of its reserves is 8.4% of the total reserves of the participating countries [7]. Proven natural gas reserves in Kuwait in 2021 according to [3,6] were 1.784 - 1.7 Tcm, which at current production levels natural gas reserves in the country could last for approximately 106 years.

Kuwait's total primary energy supply (TPES) in 2024 was fully provided by fossil fuels - oil and gas, and the volume of oil supplies significantly exceeded the volume of gas supplies according to data from [8].

Due to its geographical position Kuwait has quite good reserves of such renewable energy sources as solar and wind. A selection of basic indicators of this type of resource is presented in Table 2.

Table 2. Renewable energy resources of Kuwait

Resource/explanations	Solar Potential (DNI)*	Wind Potential (50 m)*	Hydro energy Potential	Bio Potential (agricultural area)	Bio Potential (forest area)	Municipal Solid Waste
Value	5.0-5.5	6.5-7.0	no data	8.4	0.4	1.55
Unit	kWh/m ² /day	m/s	-	% of land area	% of land area	kg/capita day
Year	2022	2022	-	2022	2022	2016
Source	[9]	[10]	[-]	[11]	[12]	[13]

*for most of the territory of the country

The level of direct solar irradiation for the majority of the country is 5.0-5.5 kWh/m²/day [9].

The distribution of wind resources is as follows: for the majority of the country the wind speed is 6.5-7.0 m/s, and in the east of the country in the area of El-Kuwait it reaches a maximum mark of 7.5-8.9 m/s at an altitude of 50 metres [10]. About only 8.4% of the territory of Kuwait was covered by agricultural land in 2022 [11], and this

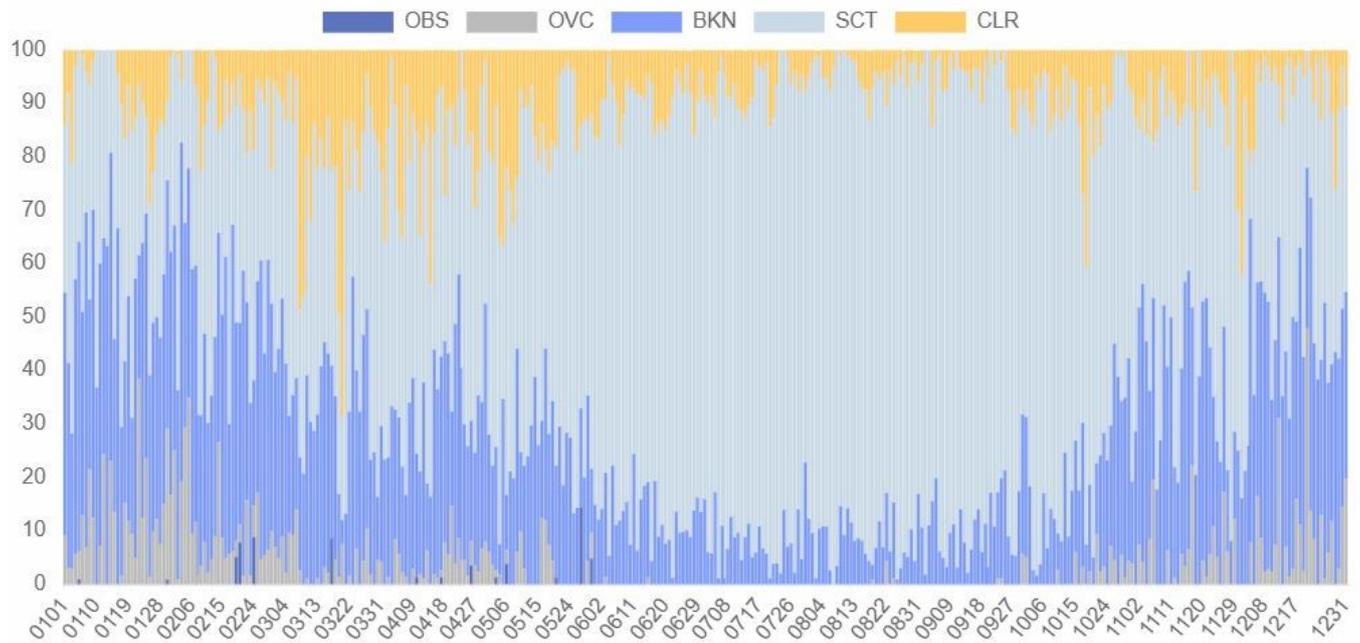
area has been increasing slightly over the last half century; while 0.4% is forested [12].

The level of municipal waste generation in Kuwait is 1.55 kg per capita per day; this is substantially higher than, for example, in Saudi Arabia (1.40 kg per capita per day), and Qatar (1.27 kg per capita per day).

KUWAIT, ALI AL SALEM

Latitude: 29.33 Longitude: 47.52

Average daily sky coverage over 10 years of observations, %



CLR - clear, SCT - scattered from 1/8 TO 4/8, BKN - broken from 5/8 TO 7/8, OVC - overcast, OBS - obscured, POB - partial obscuration

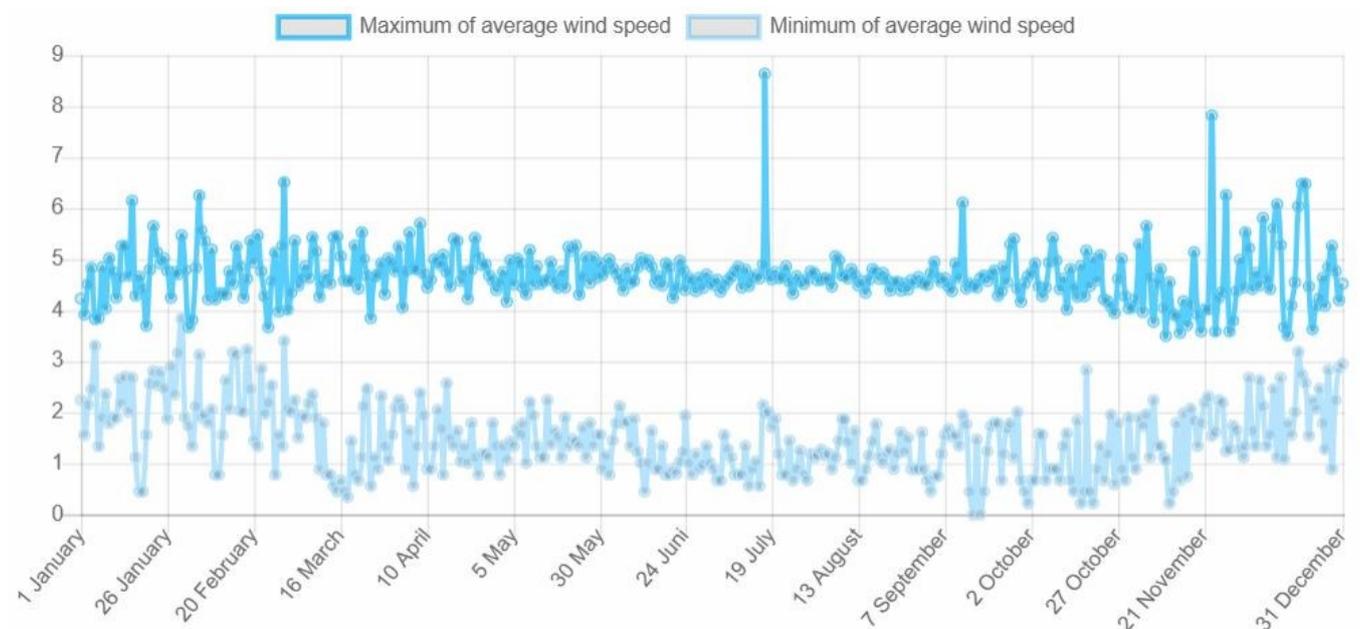
Source: based on NOAA U.S. Department of Commerce
 Detailed information: [Interactive map of solar resources](#)

KUWAIT, ALI AL SALEM

Latitude: 29.33 Longitude: 47.52

Average speed: 4.96 m/s, Operational share: 79%

Average daily wind speed for 10 years of observations, m/s, 10 m above the ground

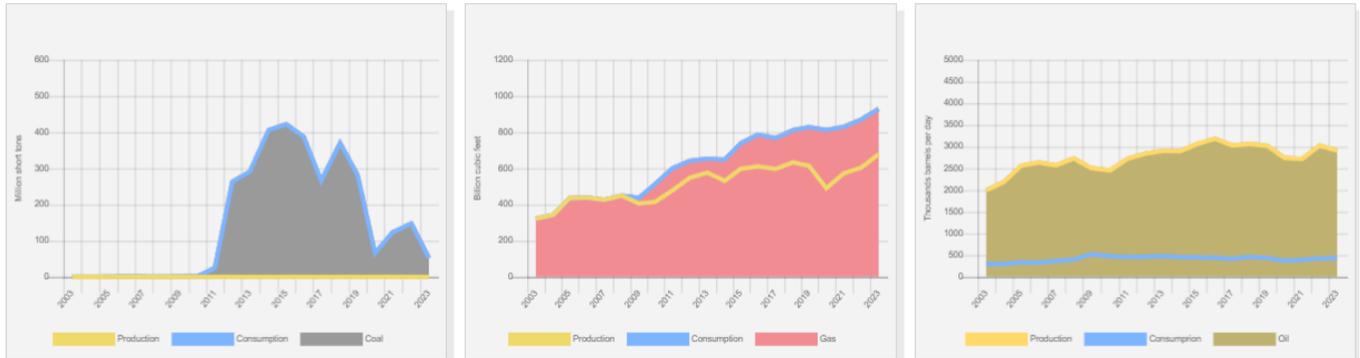


Source: based on NOAA U.S. Department of Commerce
 Detailed information: [Interactive map of wind resources](#)

Energy balance

According to the Statistical Review of World Energy 2024, primary energy consumption in Kuwait in 2023 was 1.58 Exajoule, and was dominated by oil - 51.3%,

followed by natural gas 48.1%, and coal - 0.6% [6]. According to [15], in 2023 in country, the total production of primary energy was 6.879 quadrillion Btu, while consumption was at the level of 1.886 quadrillion Btu.

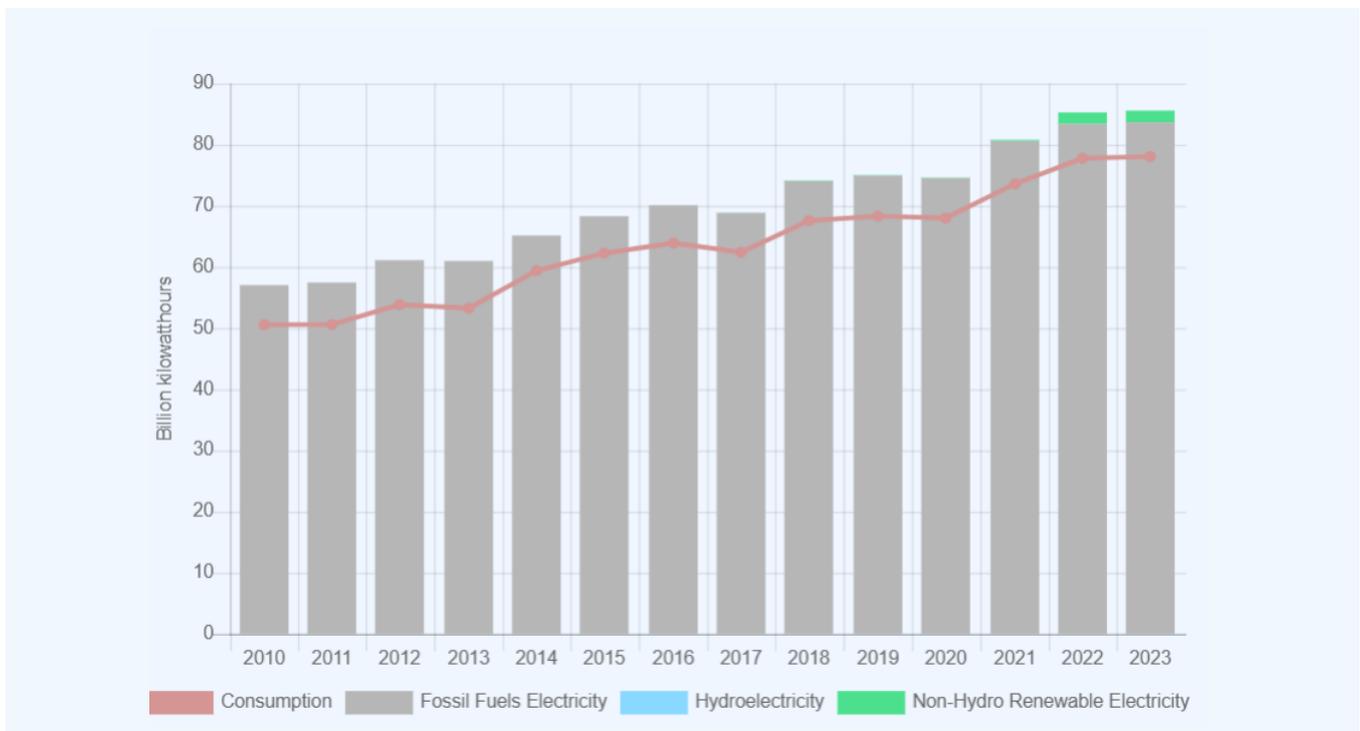


Source: U.S. Energy Information Administration (Sep 2024) / <https://www.eia.gov/>

Figure 2. Production and consumption of fossil fuels in Kuwait (left– coal, in the center– gas, right–oil)

Thus, the share of domestic consumption in primary energy production was 24,4%. This makes Kuwait a country independent of energy imports (without taking into account the structure of energy consumption). Kuwait is the 9th largest oil producer in the world [3]. Oil production between 2001 and 2019 grew, with annual fluctuations, and in 2023 amounted to 2,906 thousand barrels/day [15]. The volume of oil consumption in the country since 2001 has shown a steady growth (Fig. 2),

and in 2023 it was 430 thousand barrels/day [15]. The Energy Institute reported oil production in Kuwait in 2023 as being 2 908 thousand barrels/day with consumption was at 411 thousand barrels/day [6]. Oil exports from Kuwait in 2018 amounted to 1,838 million barrels/day, the main destination being Asia-Pacific (66%) [14,16]. Gas production in the country grew similarly to oil consumption, reaching 678 Bcf in 2023.

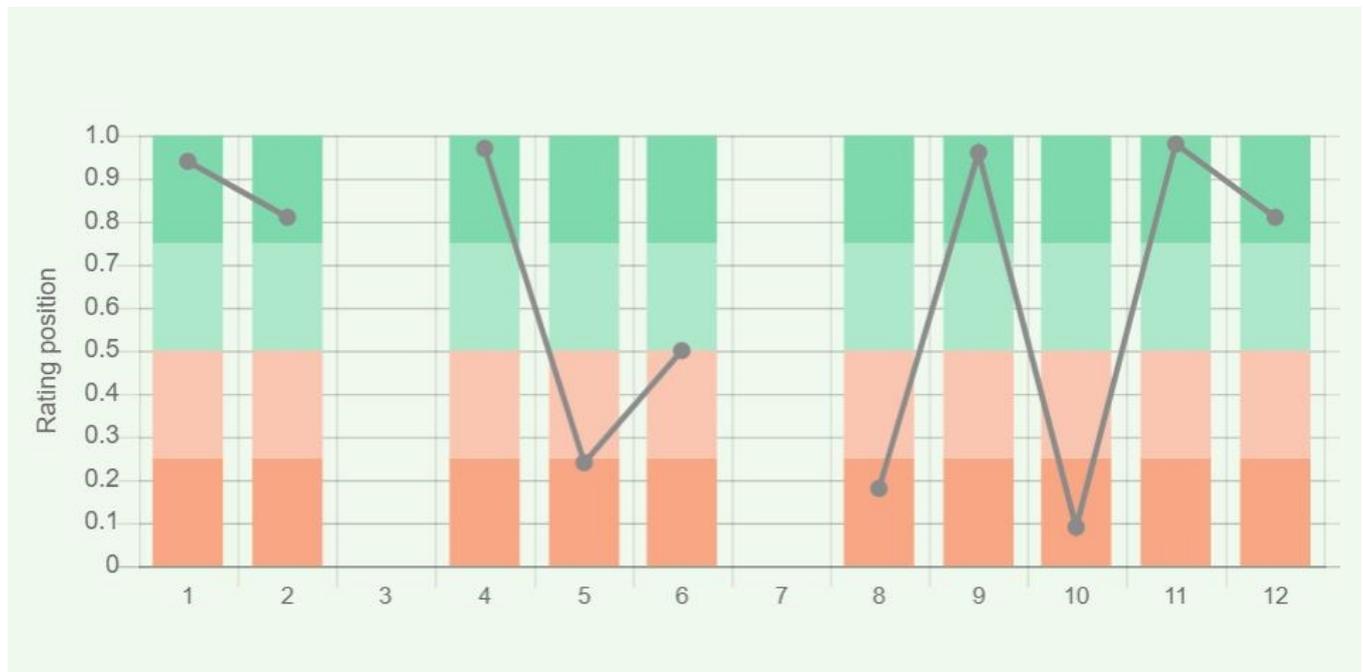


Source: U.S. Energy Information Administration (Sep 2024) / <https://www.eia.gov/>

Figure 3. Electricity production in Kuwait

Gas consumption in the period from 2001 also showed an increase, and by 2023 it reached 928 Bcf [15]. According to the Statistical Review of World Energy 204 [6], gas production in 2023 was 13.5 Bcm, while consumption was 22.5 Bcm. Kuwait imports LNG mainly from Qatar and Nigeria [14]. Between 2010 and 2020, coal consumption rose sharply from a level of 0.10 to 281 thousand short tons in 2019,

falling again to 52 thousand short tons in 2023 [15]. For electricity production Kuwait almost completely relies on fossil fuel resources (Fig.3). According to the U.S. Energy Information Administration the country produced 85.56 TWh of electricity in 2023, where fossil fuels accounted for 97.8%, non-hydro renewable 2.2% (Fig.6). Kuwait's position in the comparative diagram of energy index is shown in Fig. 4.



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 11. Electric power consumption (kWh per capita), 2016 *217
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 12. Combination of electricity production-consumption (kWh)/The World Factbook/Library/Central Intelligence Agency *216
- * Total number of countries participating in ranking

Figure 4. Energy indices of Kuwait

Kuwait is at the top of the list of countries in terms of production/consumption of oil, however, having significant gas resources, in terms of its production/consumption ratio, the country is below the world average. In terms of electricity consumption per capita, the country was 5th in the world, however, for the indicator

of combination of electricity production-consumption, Kuwait is 40th in the world.

It should also be noted that Kuwait has a significant excess in the volume of electricity production compared to its consumption.

Energy Infrastructure

A territorial map of the distribution of the largest infrastructure projects of the fossil-fuel sector in Kuwait is shown in Figure 5. In the total potential of fossil energy

resources, oil plays the predominant role – 89.6%, gas amounts to 10.4%. The main gas fields are concentrated in the North of Kuwait, and the country also plans to develop the Dorra offshore field, which could bring the country an additional 500-800 MMcf/day (Figure 5) [14].



Oil tanker in the sea. Envato Elements. RXKQG679WZ

Gas is imported into the country via the Mina Al-Ahmadi LNG terminal, managed by KNPC, which has a capacity of 5.8 Mtpa [17]. Transportation of gas, condensate and gas condensate within the country is carried via a network of pipelines with a total length of 261 km (Figure

5). Greater Burgan is considered to be one of the leading oil fields in the country and in the world, the production of which can reach about 1.7 million bbl/day, according to [14]. In 2023, Kuwait refineries had a total installed capacity of 1415 thousand barrels/day [18].

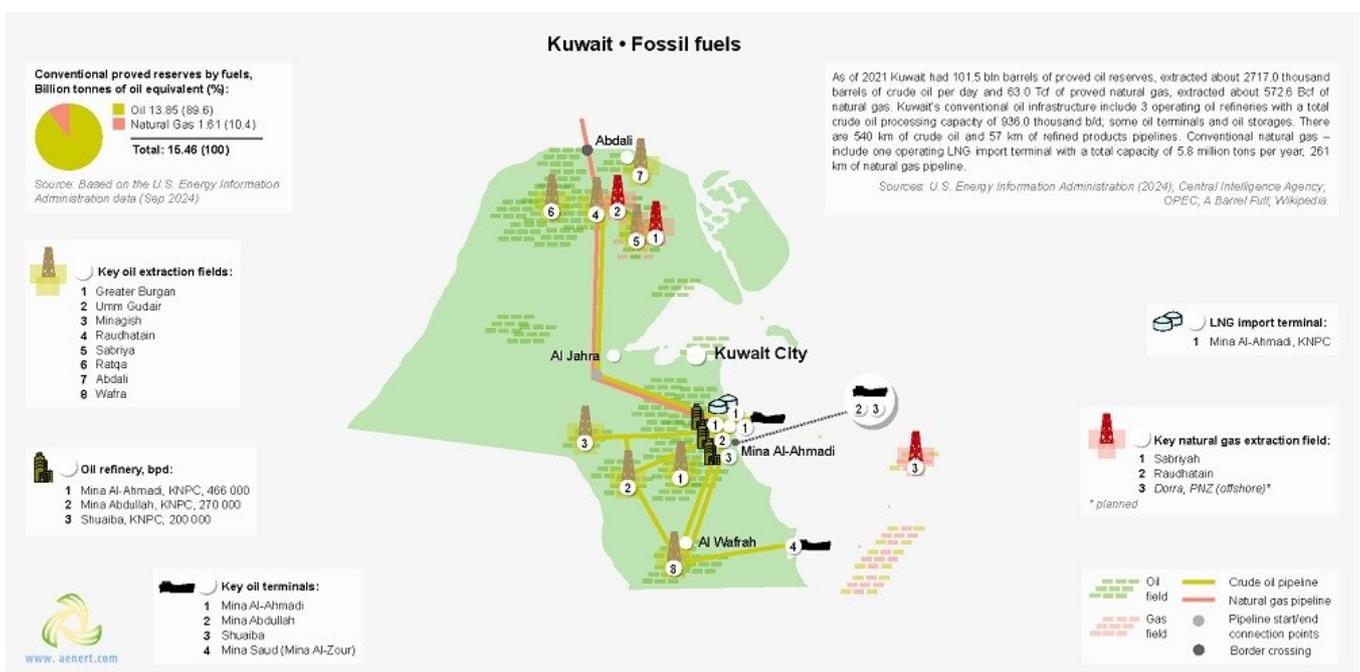


Figure 5. Basic Infrastructure facilities of the fossil fuel sector in Kuwait

The largest being Mina Al-Ahmadi, KNPC with an installed capacity of 466 000 bbl/day [14] (Fig.5). Oil and petroleum products are exported via 4 oil terminals, and crude oil and petroleum products are transported via pipelines with a total length of 540 km and 57 km, respectively (Fig. 5). A map of the territorial distribution of Kuwait's largest infrastructure facilities for electricity generation is presented in Figure 6.

According to the U.S. Energy Information Administration, the share of fossil fuels in energy production in Kuwait in 2023 was about 98% (Fig.6).

The country has a significant number of power plants for the production of electricity from fossil fuels, including power plants with a capacity of over 100 MW, one oil power plant, four power plants, and three combined type power plant (Fig. 6).

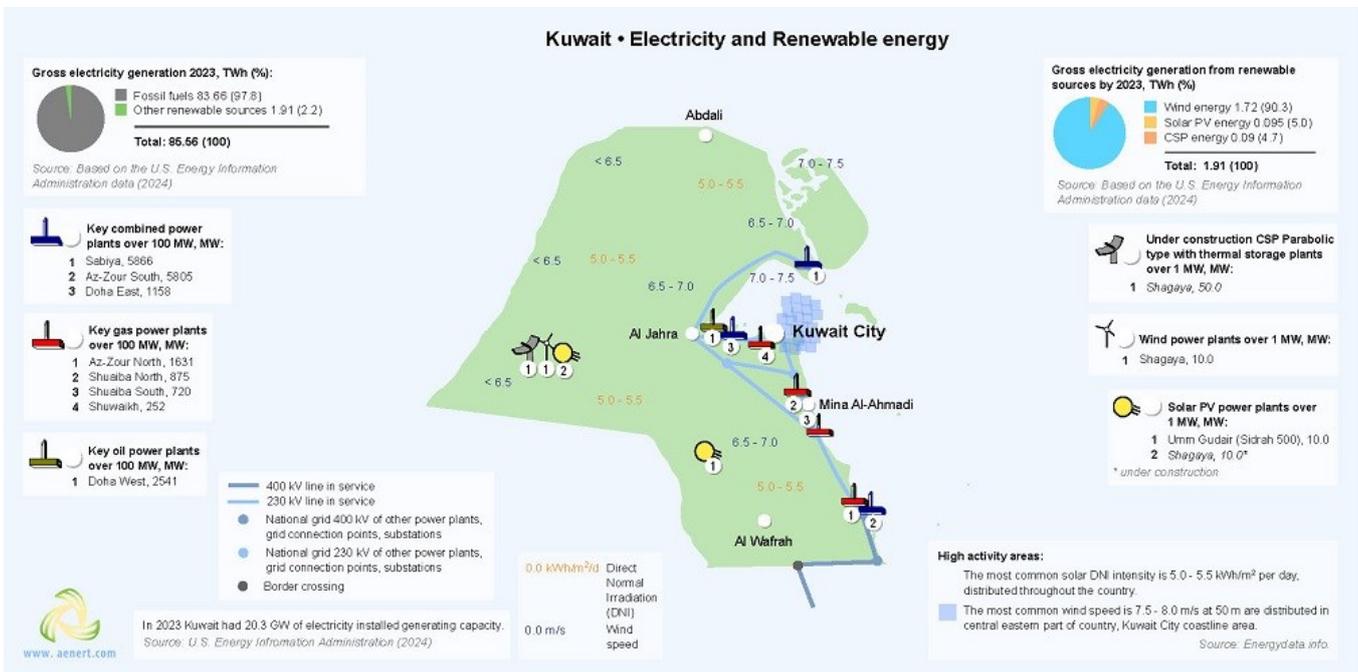


Figure 6. Electricity production and renewable energy in Kuwait

The largest power plants in Kuwait are: Az-Zour North gas power plant, with a capacity of 1,631 MW, Doha West oil power plant, with an installed capacity of 2541 MW, and Sabiya combined type power plant with an installed capacity of 5866 MW [19].

As already noted above, the country has sufficient potential for generating electricity by means of photovoltaics – the level of direct solar radiation in certain parts of the country can reach 5.5 kWh/m²/day[9]. This technology has not yet received visible development. However, since 2016, a PV power plant with an installed capacity

of 10 MW has been operating not far from the Umm Gudair oil field [20]. Kuwait has developed a new strategy aimed at including renewable energy in its energy mix and installing 22 gigawatts of renewable energy by 2030. In addition to large-scale projects, the strategy will allow Kuwaiti citizens to install solar panels on their roofs and sell surplus energy to the state [21].

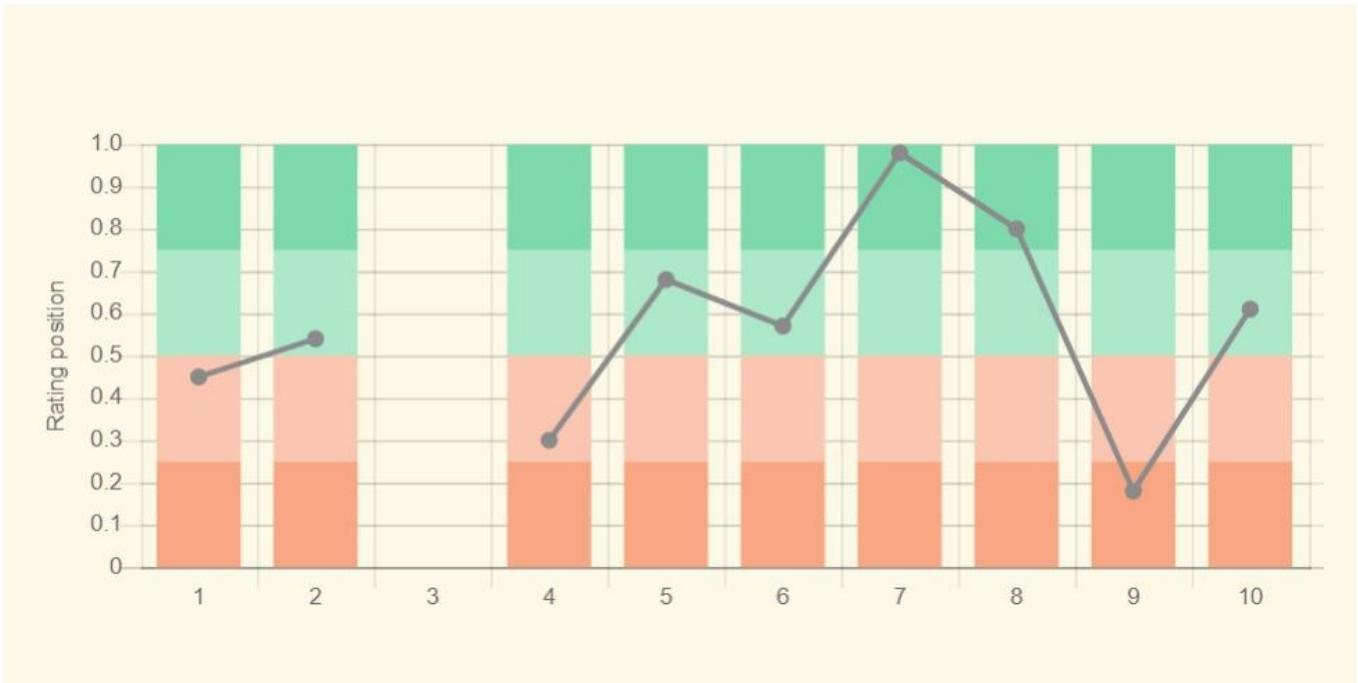
Education and Innovation

The set of indices reflecting the position of Kuwait among other countries in the field of education and innovation can be seen in Figure 7.

Kuwait is 71st out of 133 countries considered in the ranking of countries of the Global Innovation Index 2024 (see diagram). According to the indicator for the number of patents granted (2011-2020) to Kuwait residents, both

inside the country and abroad, the country is ranked 85th out of 185 countries considered.

In terms of government expenditure on education as a percentage of the country's GDP, the country demonstrates a result above the world average – 36th out of 177 countries considered. As a result, a number of universities of Kuwait were included in the 2025 QS University Rating.



Sources:

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 3. Patents in Force 2020 / Statistical country profiles / World Intellectual Property Organization *109
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 8. Government expenditure on education, total (% of GDP), 2019 / United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics. License: CCBY-4.0 / Data as of September 2021 *177
 9. Research and development expenditure (% of GDP), 2018 / UNESCO Institute for Statistics. License: CCBY-4.0 / Data *119
 10. Scientific and technical journal articles, 2018 / National Science Foundation, Science and Engineering Indicators. License: CCBY-4.0 / Data *197
- * Total number of countries participating in ranking

Figure 7. The indices of education and innovation in Kuwait

In terms of government expenditure on research and development as a percentage of the country's GDP, Kuwait is 97th behind a number of European countries, Oman and Algeria. However, Kuwait is well positioned when considering the number of publications of specialists in scientific and technological journal and patent activities. The country is also among the leaders in the region in terms of the number of Internet users.

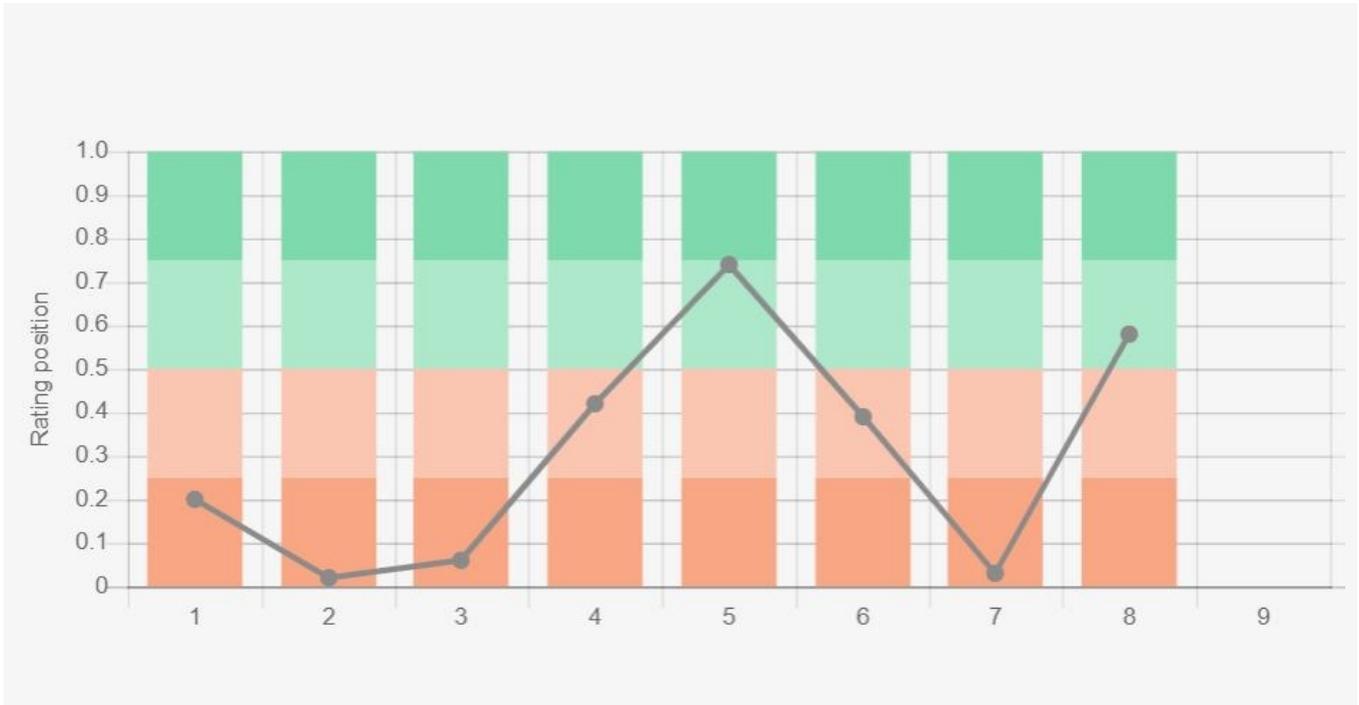
Universities of Kuwait, such as the American University of the Middle East, the Australian College of Kuwait, and Kuwait University train specialists in various fields of energy, including Civil Engineering, Electrical Engineering and Petroleum, etc. Kuwait University is actively engaged in research in the field of synthetic fuel production and coalbed methane. Kuwait Oil Company publishes scientific papers in the field of associated petroleum gas. Research of unconventional oil is carried out at Kuwait Oil Company, Kuwait University, and the Kuwait Institute for Scientific Research.

A large number of research institutes conduct research in the field of technologies for the production of energy from renewable sources. In the field of solar power – the American University of the Middle East, the Kuwait Institute for Scientific Research, and in the field of wind power – Kuwait University, the American University of the Middle East, and the Australian College of Kuwait.

Ecology and Environment Protection

the country, which in the case of Kuwait is extremely negative.

The diagram of environmental indices presented in Figure 8 to some extent reflects the ecological situation in



Sources:

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* Total number of countries participating in ranking

Figure 8. Environmental Indices of the Kuwait

First of all, the country demonstrates a relatively high level of CO₂ emissions in general and per capita. It is also necessary to note the high level of methane emissions in the country. Of course, this is a consequence of the intensive extraction and use of oil and natural gas, but it is also evident that the degree of utilization of associated petroleum gas or the degree of purification of harmful emissions at industrial enterprises is insufficient.

According to the Environmental Performance Index (EPI) 2024, which is focused primarily on the environ-

mental activities of national governments, aimed at reducing the negative impact of the environment and rational use of natural resources, the country is 95th out of 180 participating countries.

Finally, it is worth mentioning that according to the Ecological Footprint Atlas rating Kuwait is among a number of ecological debtors.



Camel caravan in the desert. Envato Elements. DWZBEMVNTNTR

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The sources of charts and curves are specified under the images.

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