



آفاق الطاقة في دولة الكويت
Kuwait Energy Outlook

2019

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Executive Summary

Sustaining Prosperity
Through Strategic Energy
Management



Energy Building and Research Center
Kuwait Institute for Scientific Research

Executive Summary

Kuwait is one of the world's top ten oil producers and holds the sixth largest proven oil reserves in the world. With its relatively small population, Kuwait has a very prosperous economy, but it is heavily dependent on oil-export revenues. The oil sector accounts for about 90% of export revenues, and net oil-export revenues are approximately 40% of GDP. Kuwait, like all oil-producing countries, is facing a changing energy world today. Shifting supply, demand and technology trends have ushered in an energy world where oil-price volatility and market uncertainty are the defining features. To ensure economic development and social prosperity in the years to come, Kuwait will require a new energy strategy, combined with a plan to foster economic diversification and reduce fossil fuel dependency.

Now is a particularly good time for an evaluation of Kuwait's current energy situation and how energy demand and supply might, and could, evolve over the next two decades. With valuable support from the General Secretariat of the Supreme Council for Planning and Development, Kuwait is releasing its first ever economy-wide, in-depth energy analysis and predictions. In the Business-as-Usual Case presented here, only current policies and plans are considered to have an impact on the projections. Under these assumptions, per capita greenhouse-gas emissions and energy demand per capita remain among the highest in the world, and carbon intensity of the economy is still persistently high. Viable options for public transport considerably lag behind other countries, and growth in renewable energy remains stymied by institutional and regulatory challenges. The final chapter of this report suggests a more sustainable path forward, but it will take a committed effort on the part of the government to come to fruition.

Today, Kuwait relies almost exclusively on oil products and natural gas to meet its energy needs, with each fuel accounting for about a half of total primary energy consumption. But while Kuwait is a major oil exporter, it is a net importer of liquefied natural gas, due to underdevelopment of its gas reserves. Kuwait plans to substitute natural gas for oil in the power generation sector in order to retain oil-export revenues for savings and investment. Government plans also encompass increasing the share of renewable energy in the power generation mix. Expanding natural gas and renewable energy use domestically are part of the government's plan to address the impacts from climate change. Renewable energy, however, satisfies less than 1% of energy demand today.

Consumption of oil products, electricity and water are all heavily subsidized in Kuwait. Due to lax energy efficiency regulations and codes in the past and its hot climate, demand for air-conditioning services in Kuwait accounts for some 70% of residential electricity demand. In addition, the share of personal passenger cars in the overall transport mix is quite substantial, about 80% in 2017. Motor gasoline and diesel prices are the lowest in the world. Vast potential exists for improvements in energy efficiency in both the buildings and transport sectors through actionable national energy efficiency plans, incentive/rebate programs and subsidy reduction.

In the Business-as-Usual Case, crude oil production in Kuwait is projected to be 3.5 million barrels per day in 2035, based on the country's plans to increase production capacity to 4 mb/d in the next decade. Like all producing countries, Kuwait will face increasing competition for its exports from unconventional oil supplies. The world's thirst for crude oil will also likely slowdown over the projection period, due to concerns over climate change impacts from burning fossil fuels and breakthroughs in cleaner and more cost-effective energy options. Natural gas production grows from 17.4 billion cubic meters in 2017 to 27.3 bcm in 2035. Domestic supply, however, will likely be unable to meet the expected increase in demand, and liquefied natural gas imports are expected to continue to be an important source of natural gas supply over the *Outlook* period.

In the period to 2035, energy demand in Kuwait is projected to increase by a third in the Business-as-Usual Case, growing at a much slower pace than over the past couple of decades, due to decelerating GDP and population growth. The share of oil in total primary energy demand steadily declines, to just over 40% in 2035, a result of the government's push to switch from oil to natural gas and solar energy for power generation. Natural gas demand is expected to grow at a fast clip, by 2.2% per year in 2015-2035. Despite some progress in adding renewables to the generation mix over the projection period, their share in total primary energy demand remains low in 2035, only 3% in the Business-as-Usual Case.

Kuwait faced recurring brownouts and blackouts throughout the 2010s, with reserve margins falling to alarmingly low levels. The Ministry of Electricity and Water is seeking to avoid these shortfalls in the future and plans to add 17.6 gigawatts of electricity generation capacity over the *Outlook* period. Total generating capacity is expected to be 32 GW in 2035, a 70% increase over capacity in 2018. Combined-cycle plants make up the lion's share of capacity expansions over the projection period, resulting in a more efficient and flexible fleet of power plants compared to today. These plants will use both oil and gas for generation, but Kuwait will favor the use of natural gas in combined-cycle and steam plants, and the share of oil products in total generation is likely to fall to about a quarter by 2035 in the Business-as-Usual Case. Renewable-energy capacity, mostly solar, will make up 16% of total generation capacity in 2035.

Keeping pace with rising demand for electricity will be critical to Kuwait's economic development, and reforms, such as opening up the power generation sector to independent power producers and independent water and power producers, are key to increasing the currently low share of private company involvement in the sector. Kuwait has several government institutions participating at varying levels in the power sector, all with different mandates. The Ministry of Electricity and Water oversees all aspects of generation, transmission and distribution of electricity. Kuwait Authority for Partnership Projects is tasked with negotiating power purchase agreements for independent water and power producers, and it negotiated the first such project in Kuwait, Az Zour North power station, on behalf of the government. Kuwait Foundation for the Advancement of Sciences sponsors distributed-photovoltaic projects, and the design and implementation of the first phase at the Shagaya renewable energy complex was overseen by Kuwait Institute for Scientific Research. Rigidities in the electricity sector's structure and the lack of coordination between the various institutions participating in the power sector are the main reasons for the lack of private sector involvement and the slow development and deployment of renewable energy technologies.

Kuwait uses desalinated water to meet about 90% of its water consumption. Despite its relatively small population, it produces the third greatest amount of desalinated water in Gulf Cooperation Countries, after Saudi Arabia and the United Arab Emirates. Multi-stage flash desalination technology dominates the water production sector but its share is expected to fall to less than 40% by 2035 in the Business-as-Usual Case. The more efficient and cost-effective multi-effect desalination technology will make considerable inroads, with its share in total desalination production accounting for nearly half by the end of the projection period. Despite being the preferred technology in most of the world, reverse osmosis is projected to account for only 13% of total production capacity in 2035 in Kuwait.

Improving energy efficiency in the buildings sector in Kuwait will require a clear long-term government commitment, combined with well-designed packages of efficiency policies reinforced by adequate capacity for implementation and sufficient enforcement. The energy conservation code put in force in 1983 in Kuwait lacked effective monitoring, verification and enforcement. The 1983 code was not revised for 27 years, and the buildings sector is a major source of inefficient energy consumption, with a very large stock of energy-inefficient buildings. Nearly three decades later, a revised version of the code was developed with more stringent requirements for energy efficiency measures in new buildings. This 2010 energy conservation code was again updated in 2014 with even more rigorous standards for the minimum requirements for energy-efficient design of new buildings in Kuwait. A 2017 code for government and commercial buildings, which sets minimum requirements in terms of power densities, material properties and the use of efficient air-conditioning systems, is under final approval.

Stricter enforcement of regulations and codes in the buildings sector are expected to play a major role in the significant deceleration in energy demand growth in the residential sector over the projection period. A slowdown in population and economic growth will also contribute. In the Business-as-Usual Case, residential electricity demand grows by 1.2% per year over the *Outlook* period, considerably slower than average annual growth of 5% in 2000-2015. Growth in energy demand for space cooling and heating, which will account for about 70% of total residential energy consumption, will be driven, in large part, by increases in the average annual temperature, estimated to be nearly 0.1° Celsius per year over the projection period. Kuwait has plans to construct 128,000 new houses over the *Outlook* period, all subject to the more rigorous standards of the recent energy conservation codes and regulations. Three government entities will be responsible for enforcing the building codes.

In the Business-as-Usual Case, oil demand in the transport sector grows by 3% per year, much faster than the growth rate worldwide. In most countries, the introduction of fuel efficiency standards for passenger vehicles has been the most effective way of cutting oil consumption in the transport sector. Providing citizens with a modern, efficient, mass public transportation system, including metro lines, trams and buses, have also proven to be a very successful way to better manage growth in demand for transport. But, in Kuwait, there are very few incentives to switch from current modal transport choices. Motor gasoline and diesel prices are low, and plans to build a metro have been stalled. The transport sector is projected to account for nearly a third of total final energy consumption in 2035 and for all of the increase in greenhouse-gas emissions from oil and oil product use.

Greenhouse-gas emissions increase from 83 million tonnes of CO₂-equivalent in 2015 to 103.4 Mt of CO₂-eq in 2035 - at an annual rate of 1.1% - twice the global average. Greenhouse gas emissions in Kuwait increased at a much more rapid clip in 2005-2015, due to a construction boom, high oil prices and heavy reliance on oil for power generation. The projected slowdown over the next couple of decades reflects the government efforts to decarbonize the economy by expanding the role of natural gas and renewables in the energy mix. In 2015, CO₂ emissions per capita were 21.1 tonnes of CO₂ per capita, among the highest in the world. Per capita emissions inch down over the projection period to about 20 tonnes of CO₂ per capita in 2035, in the Business-as-Usual Case, moving in the right direction, but clearly more work needs to be done.

Kuwait released the *White Paper on a Sustainable National Energy Strategy in 2017*, which recommended the establishment of a national champion to implement the strategy and coordinate its multiple dimensions. In those countries where a national champion was established over the past few decades, the most successful champions were those who were given the necessary power to carry out their tasks. In a promising first step, the Kuwait Council of Ministers set up the Higher Energy Committee in 2018 to improve coordination between ministries, regulatory agencies and infrastructure operators and service providers. The Committee also is tasked with strengthening Kuwait's participation in international decision-making forums and enhancing coordination between central, regional and local government agencies and stakeholders. As in other countries, successful implementation of the national energy strategy will require the separation of policy-making institutions from regulatory institutions, combined with a clear demarcation of their remit and procedures for improving coordination.

Price reform and energy efficiency offer major opportunities to rationalize consumption and encourage more diversified growth, without foregoing the economic opportunities to capitalize on abundant energy resources. The pace of energy subsidy removal in Kuwait has been slow compared to some other resource-rich countries. Energy efficiency measures offer the least-cost pathway to energy and greenhouse gas emission reductions and to an increase in energy supply security. The effectiveness of energy efficiency measures and price adjustments should be underpinned with measurable targets and objectives, which could be selected and monitored by the Higher Energy Committee.

Reliable data and robust projections will serve as the essential foundation for Kuwait's policy choices as it prepares for a more sustainable energy future. There is a pressing need to improve data collection efforts in Kuwait. This could be facilitated through more coordination and collaboration between energy players within Kuwait and improving the institutional capacity for data collection. The lack of collaboration and expertise contribute to long delays in receiving feedback and data from energy entities. The paucity of energy statistics was challenging for the production of this energy outlook. Addressing these challenges will certainly improve future energy outlooks and their capacity to guide meaningful reform of Kuwait's energy sector.



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