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King Abdullah Petroleum Studies and Research Center

Electricity Demand Growth in Saudi Arabia: Cyclical Stagnation or Structural Adaptation?

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About KAPSARC

The King Abdullah Petroleum Studies and Research Center (KAPSARC) is a non-profit global institution dedicated to independent research into energy economics, policy, technology and the environment across all types of energy. KAPSARC's mandate is to advance the understanding of energy challenges and opportunities facing the world today and tomorrow, through unbiased, independent, and high-caliber research for the benefit of society. KAPSARC is located in Riyadh, Saudi Arabia.

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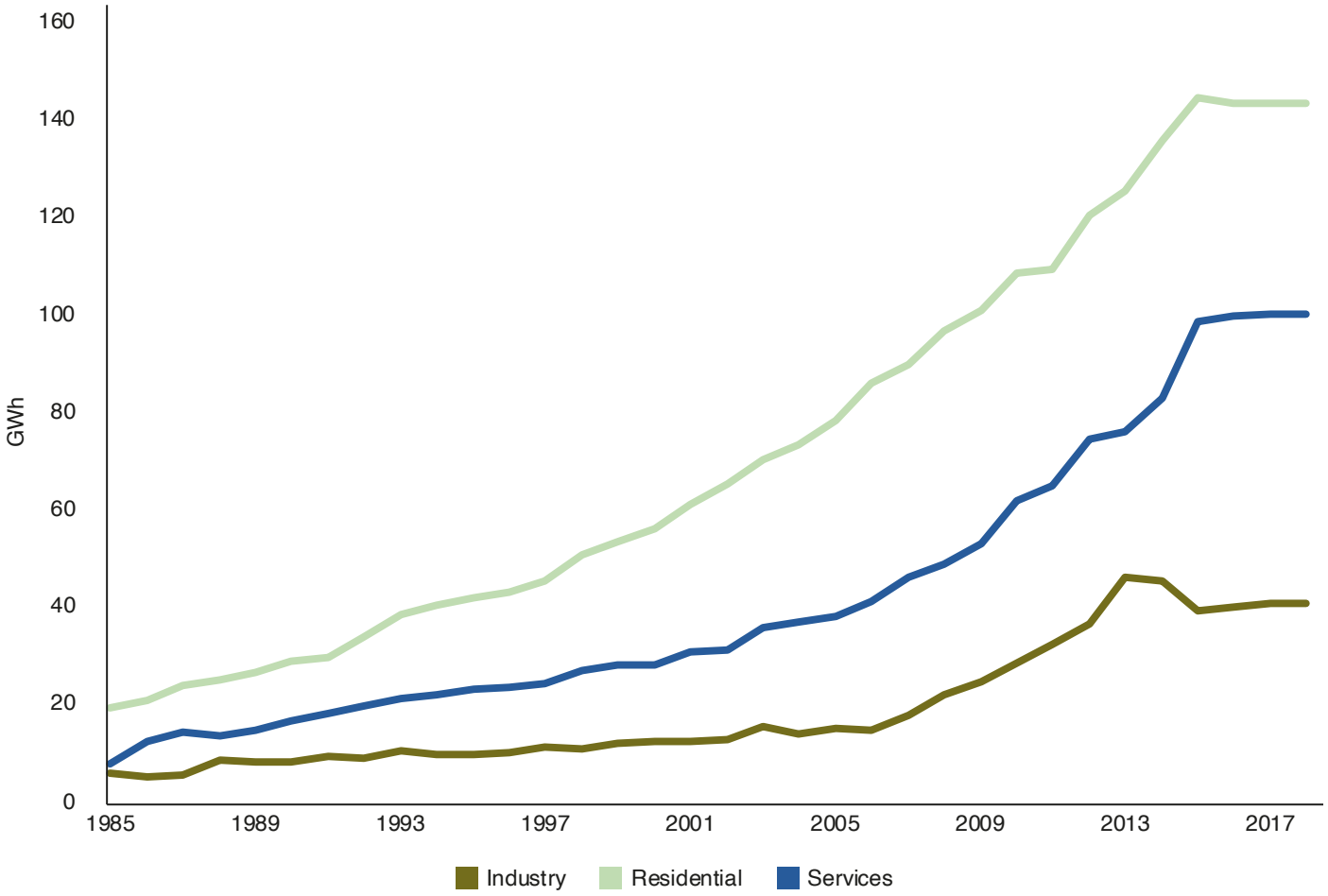
A recent International Monetary Fund report noted that in 2018, Saudi Arabia's energy price reforms generated 41.3 billion Saudi riyals (SAR) (11 billion US$) in new non-oil revenue for the government. The power sector contributed 25% of this revenue gain (10.1 billion SAR or 2.5 billion US$). The power sector's future non-oil fiscal revenue contributions will depend largely on the long-term demand for electricity in the Kingdom. Electricity demand has stagnated in the last three years. It is not yet clear whether this is due to short-term cyclical or long-term structural changes in the economy. This short note provides some insights into the long-term drivers of electricity demand.

Overview of electricity demand in Saudi Arabia

Saudi Arabia's electricity demand grew by 10.7% per annum between 1979 and 1998, and by 5.9% between 1999 and 2018. Demand has been growing continuously year-on-year, although this growth has slowed sharply in the last three years, as shown in Figure 1. Electricity consumption in the residential sector increased by 158% between 2000 and 2018, driven largely by the use of air conditioning and electrical appliances. It reached a peak of 144 terawatthours (TWh) in 2015. Electricity consumption in the commercial and public sectors has risen by 256% since 2000, partly driven by the growing share of the non-oil service sector in the Kingdom's economy. By contrast, industrial electricity consumption has been steadily decreasing since 2013, partly due to increased energy efficiency measures introduced by the Saudi Arabian Energy Efficiency Center (SEEC).

Is this deceleration a cyclical phenomenon, i.e., a short-term effect that will dissipate in the near term? Or does it reflect a structural change in demand, i.e., a permanent effect of underlying changes in the country's economic structure and energy policy landscape? These are not straightforward questions to answer, partly because of the compound effects of a range of domestic fiscal reforms (a value-added tax, expat fees, gasoline price reforms, the Citizen's Account Program, and the cost of living allowance royal decree) that occurred during the country's economic contraction in 2017. We can, however, derive some useful insights by examining trends in the key drivers of long-term demand.

Figure 1. Final electricity consumption, Saudi Arabia (2000-2018).



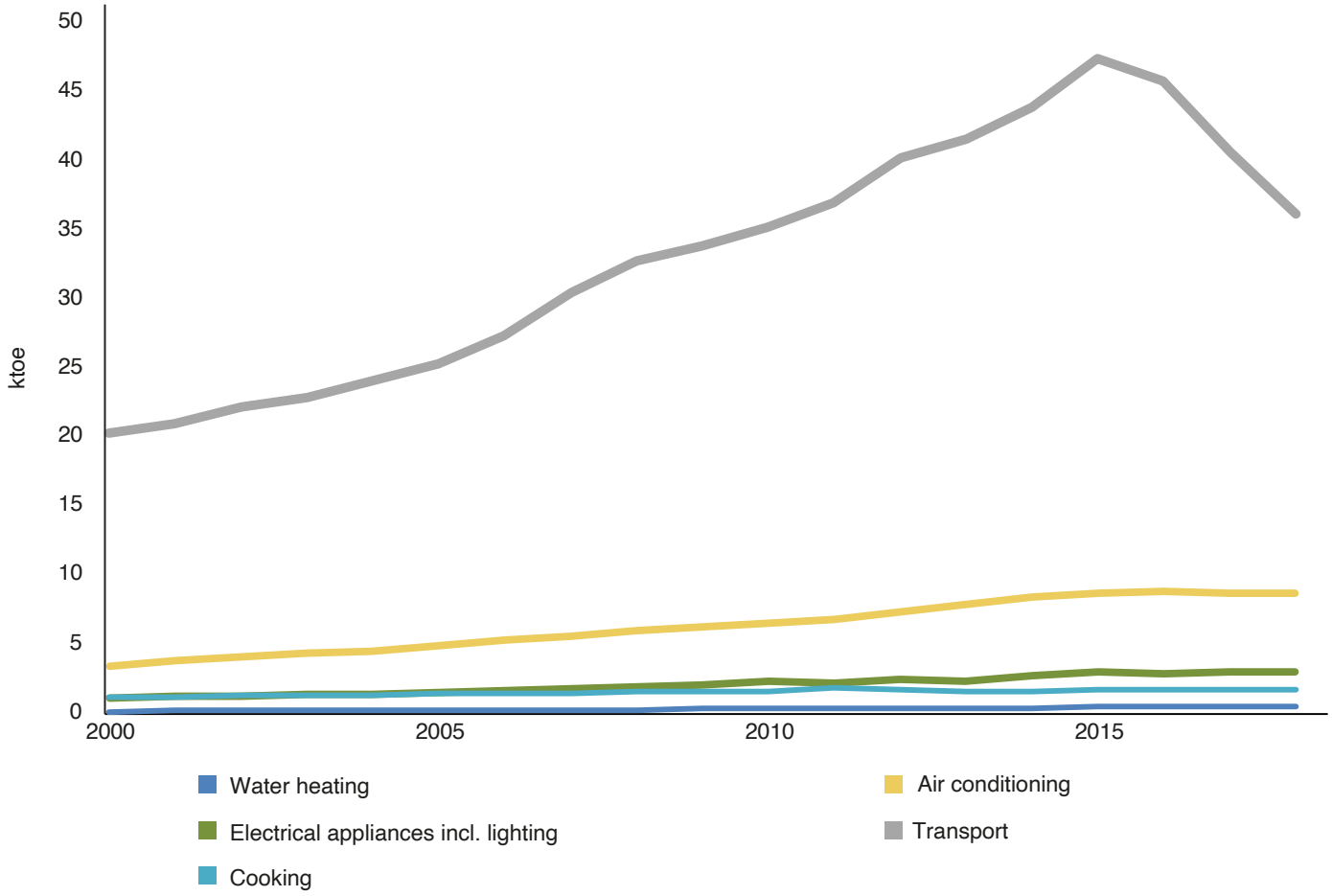
Source: Enerdata.

Note: All major sectors of the electricity market have seen demand growth contract in the last three years.

Residential end use consumption

Figure 2 shows energy consumption by end use for the residential sector. The orange line shows increasing air conditioner (AC) use, which is powered entirely by electricity. A flattening of AC demand is discernible from 2014-2018. Energy efficiency regulations and standards introduced by SEEC have helped to improve AC efficiency by 57% since 2012. Energy consumption from transport – represented by the grey line – had been increasing steadily until 2015, when SEEC regulations and higher gasoline prices placed downward pressure on demand. It is noteworthy that transport energy use is roughly four times the energy use for AC. Passenger transport electrification could have a large impact on future residential electricity demand. Figure 2 indicates flattening electricity consumption for water heating, cooking, electrical appliances and lighting. This is in part attributable to SEEC's energy efficiency initiatives.

Figure 2. Residential end use consumption, Saudi Arabia (2000-2018).



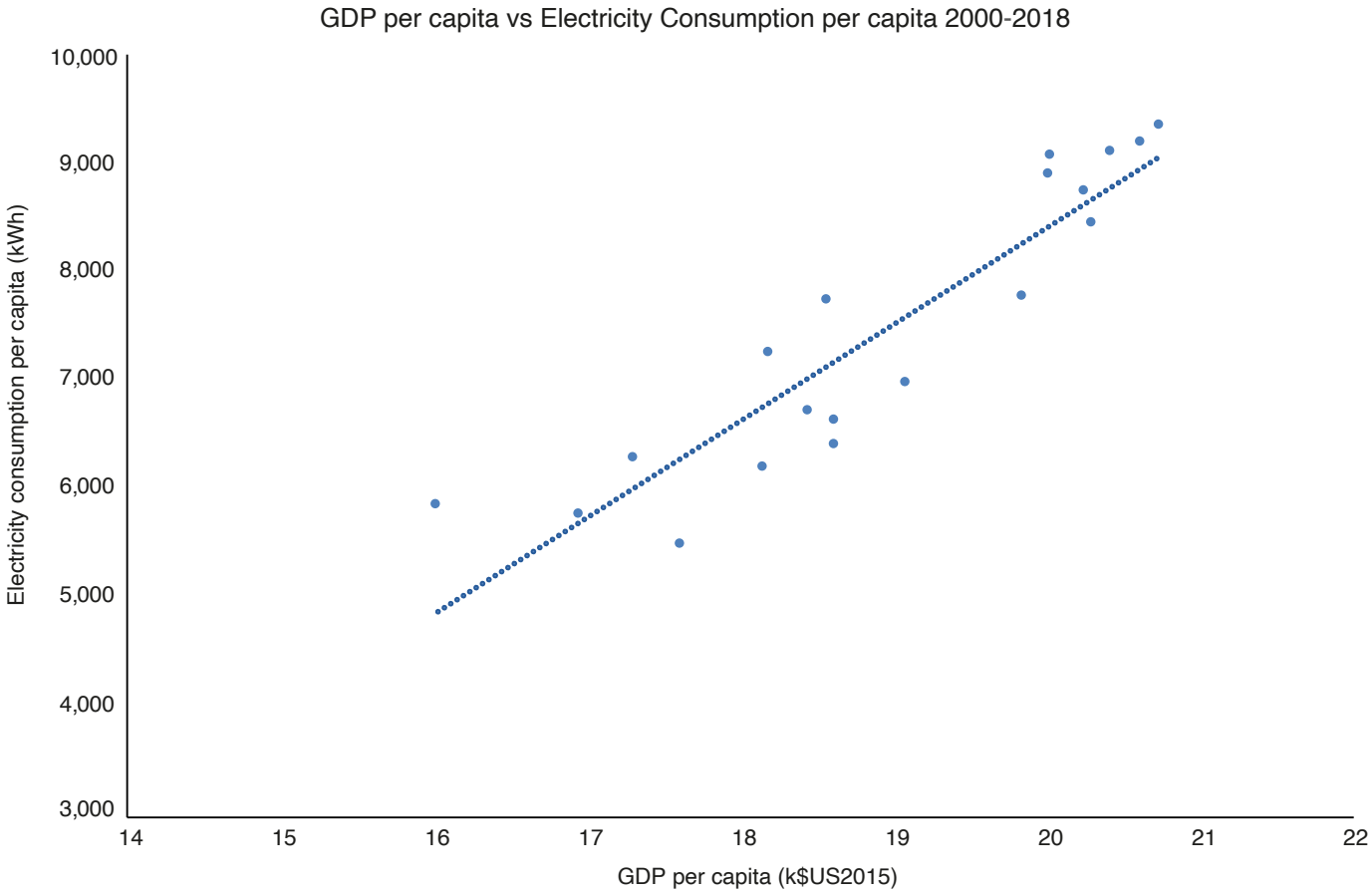
Source: Enerdata.

Due to the many housing development projects underway to help meet the needs of a rising population, long-term residential demand is expected to increase again. Furthermore, policies that incentivize purchases of electric vehicles and increase passenger vehicle electrification would create additional residential electricity demand.

Economic growth and electricity demand

Figure 3 shows a strong positive relationship between gross domestic product (GDP) per capita and electricity consumption per capita. This means that high levels of income are expected to lead to high levels of electricity consumption. As incomes rise, people can afford more electrical appliances such as air conditioners, smartphones, tablets, laundry machines, refrigerators and clothes dryers. This, in turn, can lead to increased consumption of electricity.

Figure 3. GDP and electricity consumption, Saudi Arabia (2000-2018).



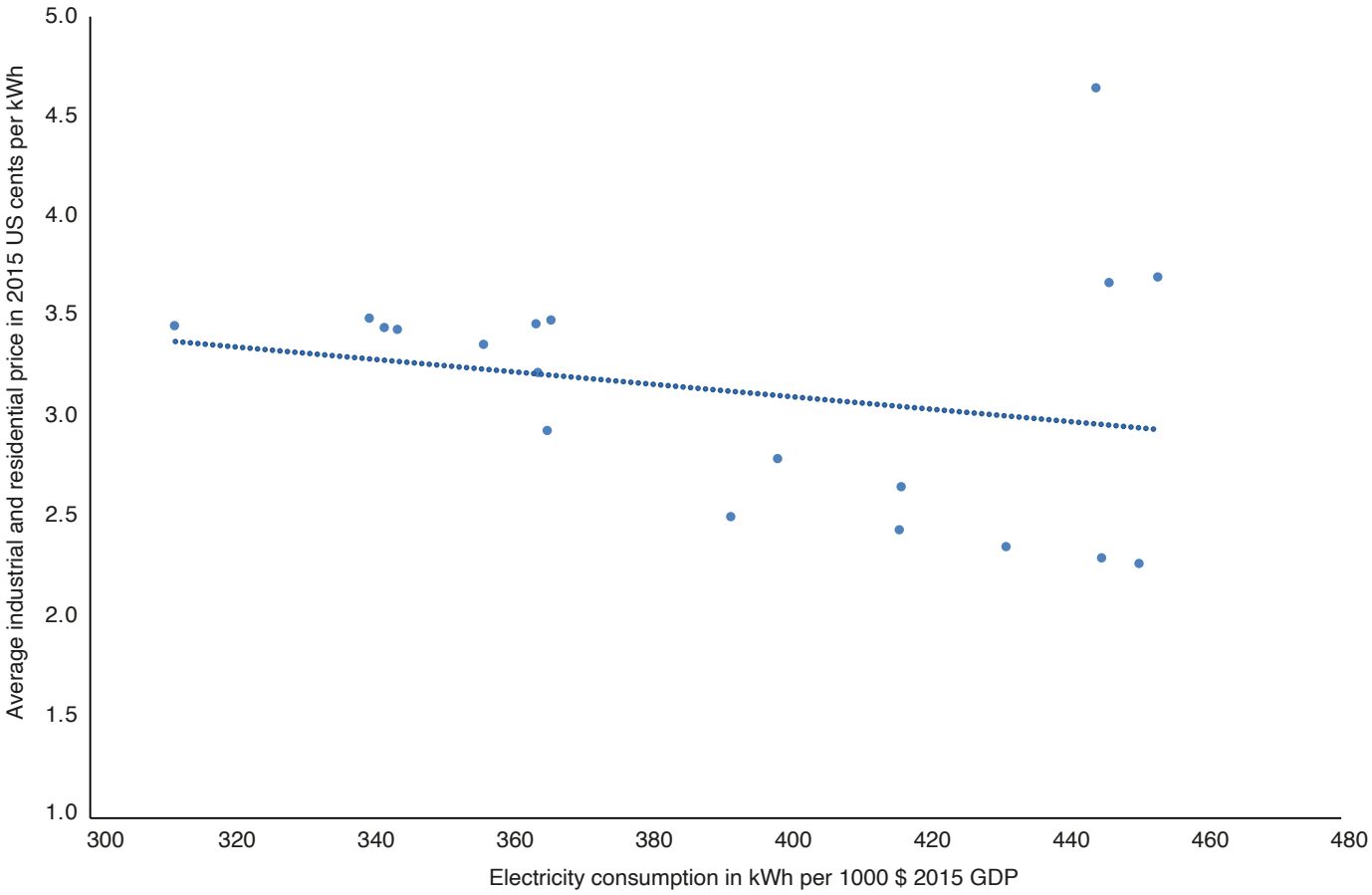
Sources: Enerdata, CEIC.

Whether this relationship will persist depends on many factors. Energy efficiency has the potential to suppress electricity demand and is worthy of attention, as a less energy-intensive Saudi economy could lead to a decoupling of economic and electricity demand growth. In addition, changes in consumer preferences and behavior could also lead to more efficient electricity usage. In absolute terms, we would expect electricity demand to grow with the economy. However, it is unclear whether the rate of growth in electricity demand will be lower than the growth rate of GDP and requires further research.

Electricity prices and consumption

Figure 4 suggests a negative relationship between average electricity prices and electricity consumption in the Kingdom. As electricity prices fall, electricity consumption increases, in line with economic theory. Previous studies have established this negative relationship between electricity prices and electricity demand in Saudi Arabia. The size of the response of consumers to price changes – price elasticity – is important for policymakers and is extremely difficult to estimate precisely. Most studies find low price responses from consumers in the short term unless the price changes are very large. In the long term, there is more time to adjust to price changes, and often the price elasticity is larger than in the short term.

Figure 4. Prices and electricity consumption, Saudi Arabia (2000-2018).



Sources: Enerdata, CEIC.

Note: It is not yet clear whether the recent stagnation in electricity demand growth is a cyclical or a structural phenomenon.

Figures 3 and 4 provide evidence that income and prices are important determinants of long-term electricity demand. However, income and prices have opposite effects on electricity demand growth. Higher income growth increases electricity demand, while higher prices reduce electricity demand. Technological innovations and strict energy efficiency standards also play critical roles in mitigating demand growth. Since 2012, SEEC has introduced a plethora of energy efficiency standards across the industrial, buildings and transportation sectors, covering air conditioners, insulation materials, washing machines, refrigerators, electric motors, lighting products and cars. These measures would have contributed to the deceleration in Saudi Arabia's electricity demand growth seen in the last few years.

Climate variables such as temperature and humidity can significantly influence electricity demand. If cities in Saudi Arabia are getting warmer over time (see our earlier Commentary, "Temperature Trends Across Cities in Saudi Arabia"), we would expect electricity demand from space cooling to increase after controlling for the marginal effects of economic and population growth.

Implications for future electricity demand

In summary, we expect long-term electricity demand in Saudi Arabia to rise as a result of increases in income, population and temperature. The rate of growth will, however, be mitigated by a range of factors including electricity prices, energy efficiency measures, consumer preferences and technological innovation. We do not yet know whether the current demand contraction is cyclical or structural. However, ongoing research at KAPSARC assessing the impact of these factors on long-term electricity demand should prove to be of benefit in the Kingdom's long-term energy, electricity and fiscal expenditure planning.

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