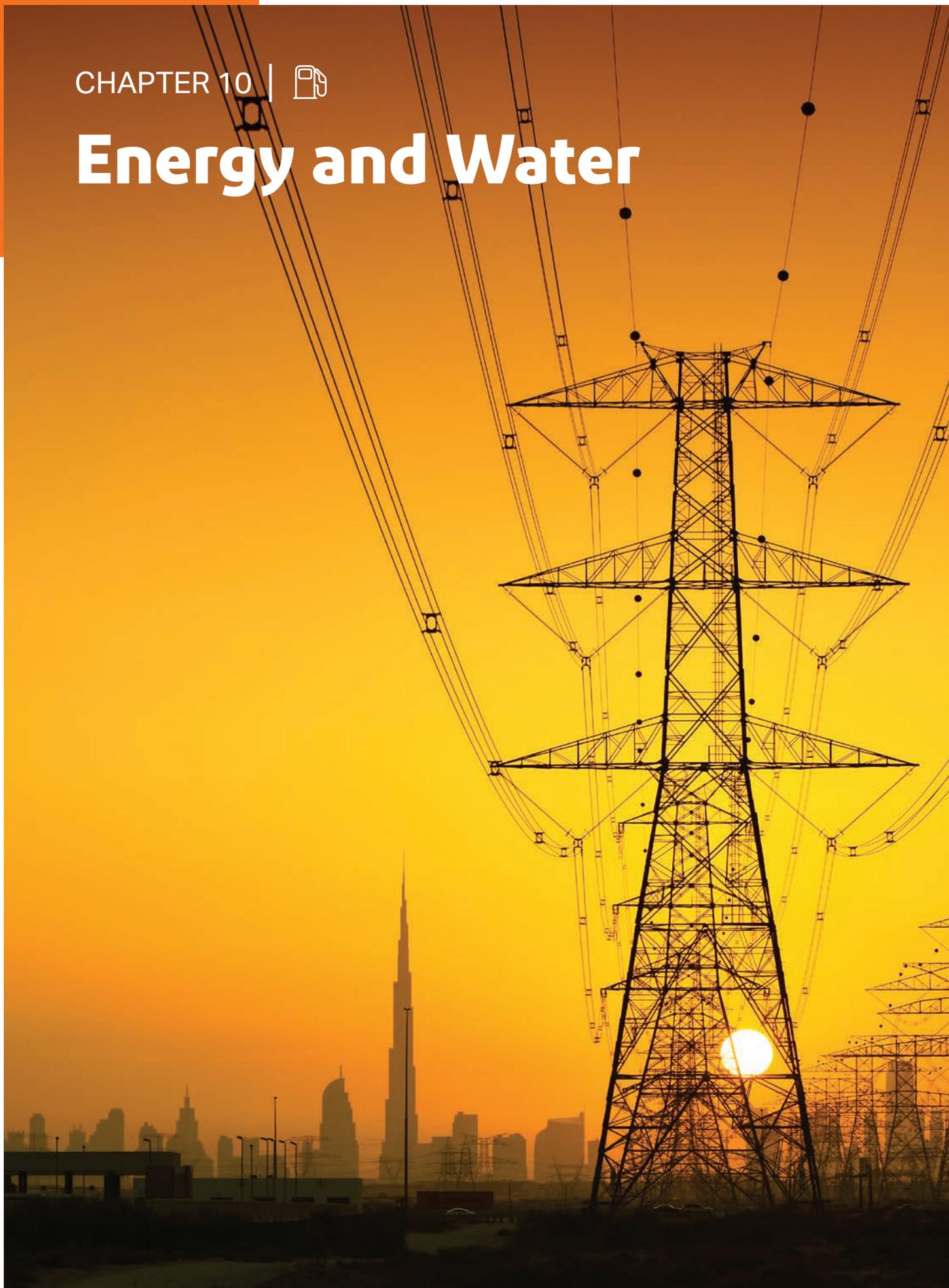


CHAPTER 10 | 

Energy and Water





The demand for electricity in Dubai is impacted by its desert climate and tied with economic growth and increased population in the emirate. The main energy issue is the widening gap between locally available resources in Dubai and the demand for different types of energy. The top challenge is securing investments in high-cost energy infrastructure to accommodate future expansions. The Government is proactively addressing these issues with initiatives such as the Dubai Clean Energy Strategy 2050, which has the goal of transforming Dubai into a global clean energy and green economy hub, and making it one of the world's ten least carbon footprint cities.

- New power plants have been built and existing ones expanded, which enables Dubai to cover 100 per cent of the electricity and water needs for the population and for manufacturing.
- Due to Dubai's desert climate, the average per capita water consumption there is one of the highest in the world. Desalination plants provide the bulk of water and are a major energy consumer.
- Dubai is exploring options to provide future energy for the sustainable growth of its economy, necessitating the adoption of policies for effective management of both production and consumption.
- The emirate intends to attract foreign investment in the energy sector by opening the way for the construction of reactors to generate electricity by nuclear power.
- The goal of Dubai Clean Energy Strategy 2050 is to transform Dubai into a global clean energy and green economy hub and make it one of the world's ten least carbon footprint cities.

Dubai Clean Energy Strategy 2050

Dubai plans to attract foreign investment and public-private partnerships to make its clean energy strategy a reality. Dubai Clean Energy Strategy 2050 aims at transforming Dubai into a global clean energy centre by 2050.

1 Aim:

To reduce carbon emissions by 16% by 2021 and transform Dubai into a city with the world's smallest carbon footprint by 2050.

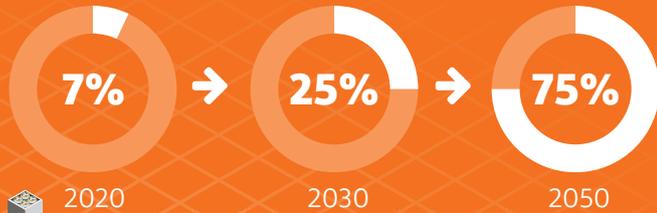
16%↓

in carbon emissions by 2021

2 Goals:

Reduce the share of natural gas in the energy mix to 61 per cent

Increase the portion of clean and renewable energy in Dubai from:



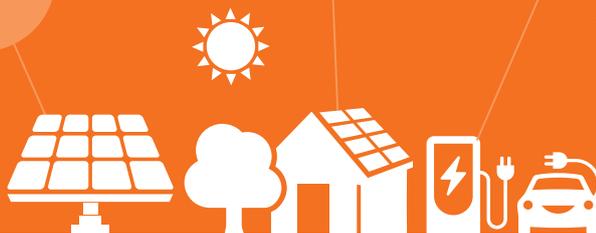
3 Dubai Electricity and Water Authority (DEWA)'s initiatives:

Mohammed bin Rashid Al Maktoum Solar Energy Park

Shams Dubai Initiative

Dubai Green Mobility Initiative

- To promote the use of electric and hybrid vehicles
- Reduce carbon emissions in the road transport sector
- In March 2017, DEWA announced an increase in the number of electric vehicle charging stations to over 200 stations throughout Dubai



Introduction

The Emirate of Dubai has a small share of the total conventional energy sources, oil and gas, available in the United Arab Emirates¹. Therefore, the Government of Dubai has sought to import sufficient quantities of energy to meet the growing demand for power generation and the needs of the industrial sector. It has also used natural gas to inject old oil wells in order to increase their production. Sharjah and Abu Dhabi have been the two traditional sources to meet the energy needs of Dubai, especially natural gas. As Dubai's

needs rose to unprecedented levels, it began importing LNG from Qatar. To address this issue, the Dubai Supreme Council of Energy (DSCE) developed the Dubai Integrated Energy Strategy 2030 at the end of 2010 and launched it in 2011. This initiative will determine the strategic direction of the emirate to ensure sustainable energy and enhance the efficiency and effectiveness of the electricity, water and fuel used to meet transportation demands.

Due to Dubai's desert climate, the average per capita water consumption there is one of the highest in the world. Desalination plants provide the bulk of water and are a major energy consumer.

¹ Dubai has 4 per cent of the UAE's oil reserves and 2 per cent of gas reserves, while Abu Dhabi has 94 per cent of oil and 92 per cent of gas. See Dubai Economic Report 2017, p. 61, http://www.dubaied.gov.ae/StudiesandResearchDocumentsinArabic/DubaiEconomicReport_AR_2017.pdf

Electricity, gas, steam and air conditioning Supply (Electricity sector)

The output of the electricity and gas sector rose from AED 9.861 billion in 2016 to AED 10.224 billion in 2017. The value added of this sector grew by 3.7 per cent between 2016 and 2017, which is higher than the economy's real GDP growth rate of 2.8 per cent. The contribution of the electricity sector to real GDP in 2012-2017 ranged from a minimum of 2.3 per cent in 2012 to a maximum of 2.6 per cent in 2017. (Figure 10.1)

The electricity sector employed 11,290 workers in 2016, accounting for less than 0.5 per cent of the total number of workers in Dubai, which stood at 2,649,069 workers in 2016. The productivity of workers in the electricity sector measured in the value of output per worker was AED 874,000 on average in 2016, down from AED 879,000 in 2015. (Table 10.1)

Figure 10.1: The Contribution of the Electricity sector to GDP (%)

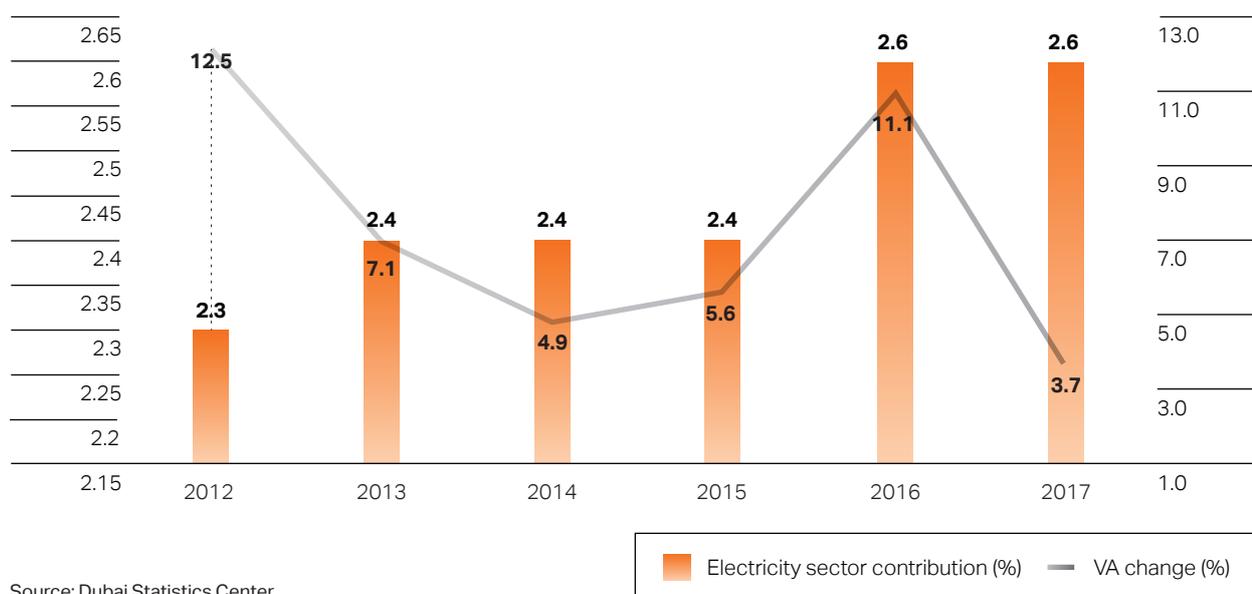


Table 10.1: Economic Indicators of the Electricity sector in Dubai (Thousand Dirhams)

	2012	2013	2014	2015	2016
Average worker productivity in the Economy	140	139	142	142	143
Average worker productivity in the electricity sector	829	852	863	879	874
Average compensation of workers in electricity sector	162	198	208	226	256
Average worker productivity in the water sector	54	51	75	94	109

Source: Dubai Statistics Center

Water supply, drainage and waste management and treatment (Water sector)

10.3 The output of the water sector in Dubai increased from AED 217 million in 2016 to AED 275 million in 2017, a growth of 26.7 per cent during this period. The contribution of the water sector to real GDP in 2012-2017 ranged from a minimum of 0.03 per cent in 2012 to a maximum of 0.07 per cent in 2017. (Figure 10.2)

10.4 The water sector employed 1,987 workers in 2016, representing a small percentage of Dubai's 2,649,069 workers in 2016. Average productivity per worker in the water sector was about AED 109,000 in 2016 with average compensation per worker at about AED 48,000 in 2016. (Table 10.2)

Figure 10.2: The Contribution of the Water sector to GDP (%)

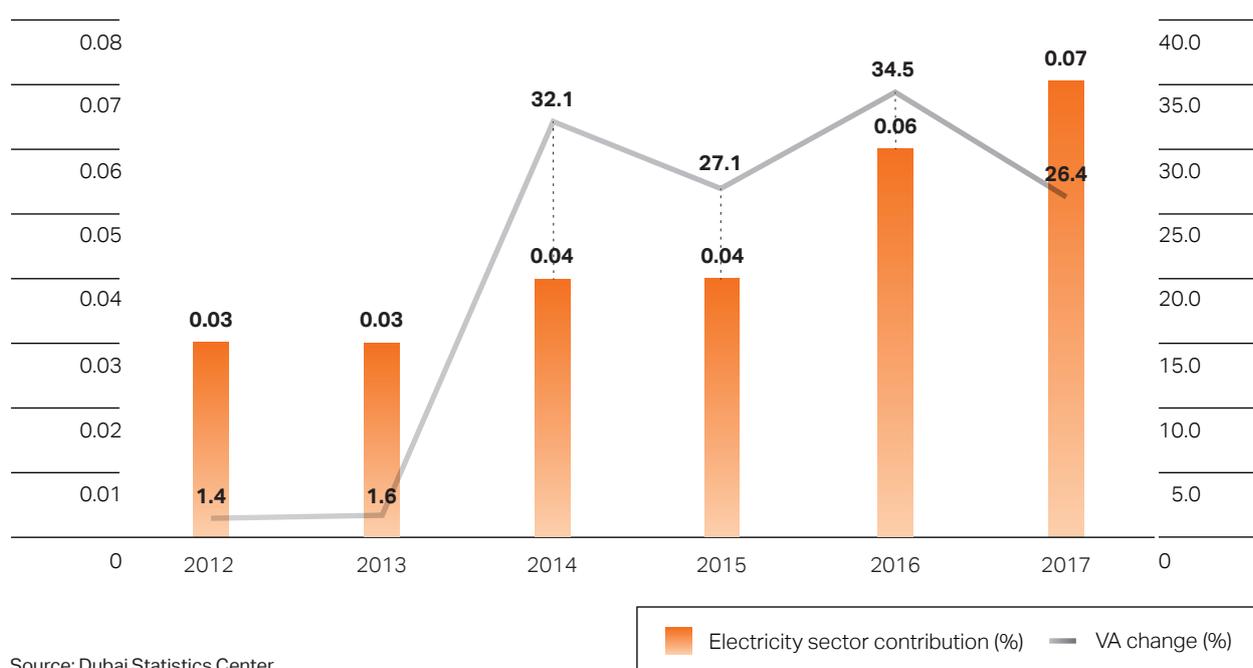


Table 10.2: Economic Indicators of the Water sector in Dubai (Thousand Dirhams)

	2012	2013	2014	2015	2016
Average productivity per worker in the economy	140	139	142	142	143
Average compensation per worker in Water sector	42	33	40	48	48
Average productivity per worker in the Water sector	54	51	75	94	109

Source: Dubai Statistics Center

Energy production and consumption

Petroleum products

10.5 Dubai has one oil refinery in Jebel Ali run by ENOC, with a capacity of 120,000 bpd. Built in 1999 and upgraded in 2010, the refinery supplies a large part of the domestic market needs of petroleum products. Oil derivatives are distributed in Dubai exclusively by three companies (Emarat, ENOC and EPPCO). Emarat is owned by the UAE Federal Government, while ENOC is owned by the Government of Dubai. EPPCO is owned by the Government of Dubai through ENOC (60 per cent) and by Chevron International (40 per cent).

Electricity

10.6 Overall energy needs in Dubai have increased dramatically in recent decades as a result of the rapid growth of the emirate's economy. In order to meet domestic electricity demand and efficiently cope with the increased consumption, the Government of Dubai has built new power plants and expanded existing ones, enabling it to cover 100 per cent of the electricity and water needs for the population and for manufacturing. DEWA² is the exclusive producer and distributor of electrical power in the emirate. Since its establishment, DEWA has built an integrated production and distribution system that matches the best international standards. It is expanding and developing that system to cope with the rapid growth in the emirate's electricity needs.

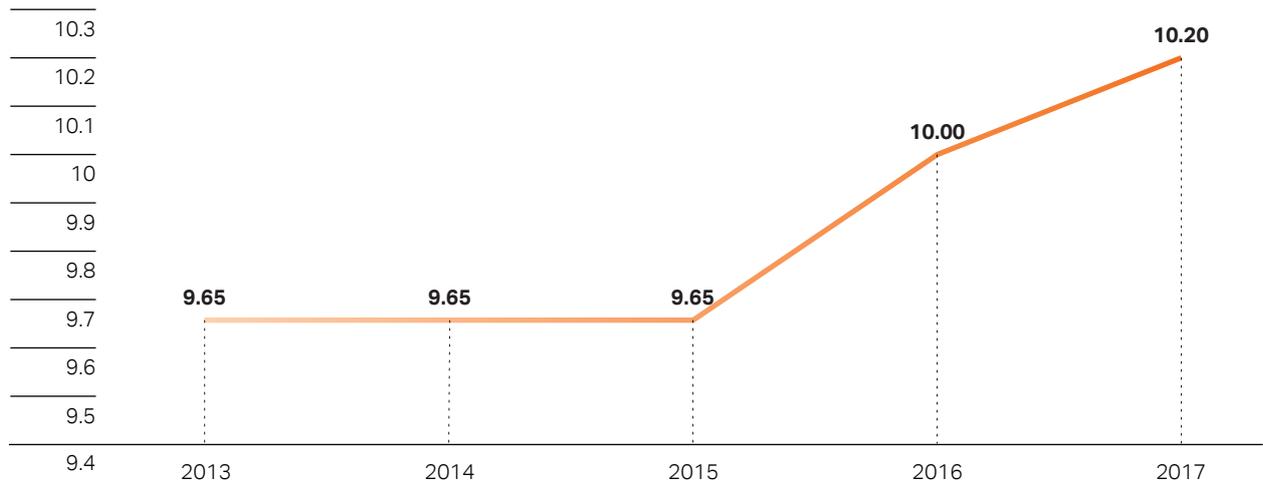
10.7 The electricity needs of Dubai are covered by 11 power plants in different areas. Power generation capacity in the emirate has increased from 10 gigawatts (one gigawatts is equal to one billion watts) in 2016 to 10.2 gigawatts in 2017. Electricity is generated in Dubai using gas turbines, which make up about 75 per cent of the installed capacity. In addition to domestic electricity sources, Dubai is connected to the UAE national grid and to the GCC interconnection grid. (Figure 10.3)

10.8 Dubai has gone through a period of rapid population growth that has led to similar growth in the emirate's energy needs, especially electricity. The number of DEWA customers increased from 752,505 residential, commercial, industrial and other consumers in 2016 to 796,764 in 2017, a growth rate of 5.9 per cent. The residential sector accounts for 74.5 per cent of the total number of customers. (Figure 10.4)

10.9 The emirate's electricity consumption increased from about 38.204 GWh in 2016 up to about 40.153 GWh in 2017, representing an annual growth rate of around 13 per cent. (Figure 10.5) The demand for electricity is expected to continue increasing in the near future as a result of the economic growth in the emirate. However, overall energy, and electricity efficiency in particular, is expected to be brought in line thanks to the Demand Side Management Strategy 2030 and the Dubai Integrated Energy Strategy 2030.

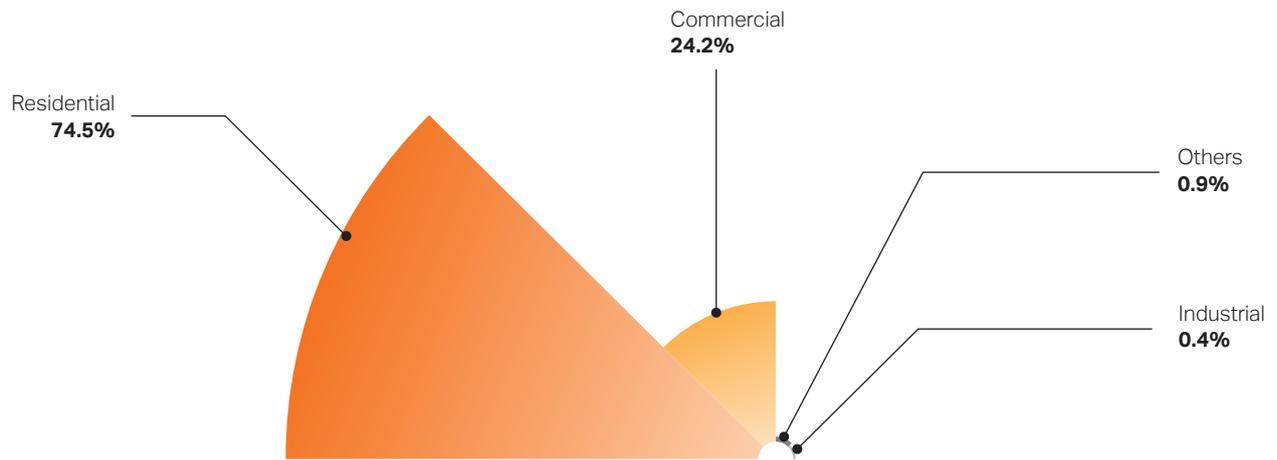
2 DEWA: Dubai Electricity and Water Authority

Figure 10.3: Power Installed Capacity in Dubai (GW)



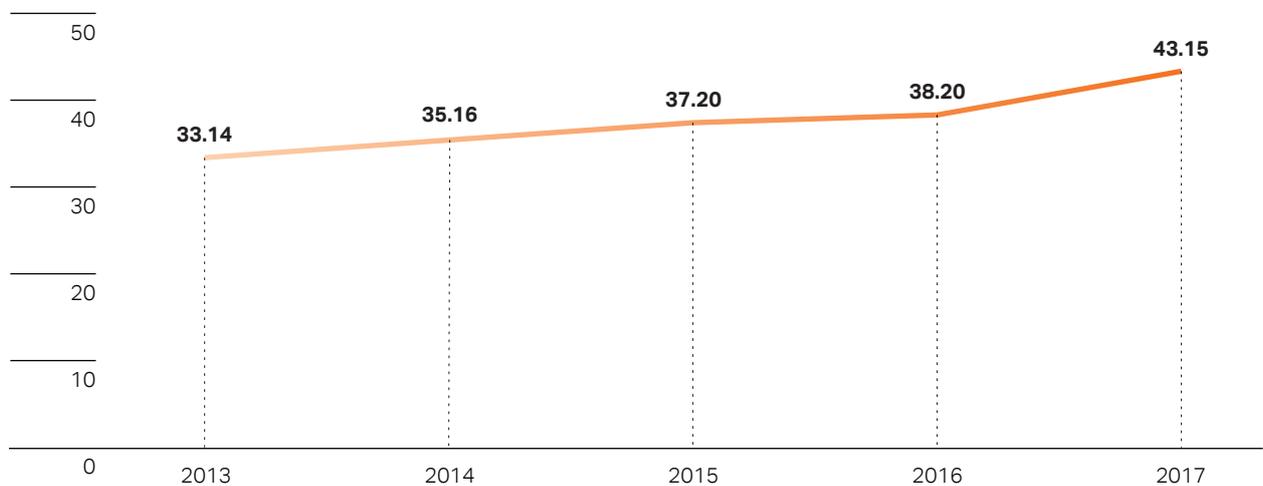
Source: Dubai Electricity & Water Authority

Figure 10.4: Electricity Consumption by sector in Dubai in 2017



Source: Dubai Electricity & Water Authority

Figure 10.5: Total Electricity consumption in Dubai (GW-hours)



Source: Dubai Electricity & Water Authority

10.10 The major development of urban centres in the emirate and the increased air conditioning requirements during Dubai's hot summers have made it one of the world's most energy-consuming regions. Average per capita electricity consumption is 15,110 kWh per year, compared to 9,660 kWh in Saudi Arabia, 12,080 kWh in the USA, 15,500 kWh in Canada and 7,480 kWh in Russia. (Figure 10.6)

It must be noted that Dubai's average per capita electricity consumption has dropped from about 15,110 kWh in 2014 to 13,900 kWh in 2017. This drop is in line with the directives of the Dubai Supreme Council of Energy and Dubai Integrated Energy Strategy 2030.

Water production and consumption

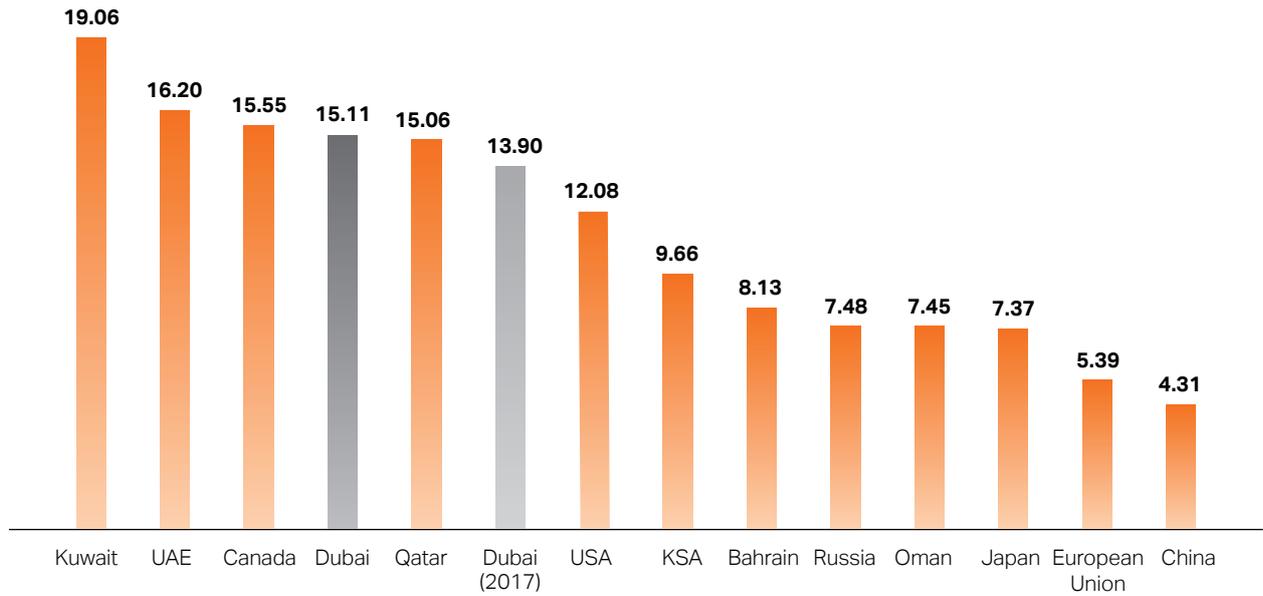
10.11 DEWA supplies the emirate's water needs and operates with high efficiency at 8 desalination plants located in Jebel Ali. In 2017, water desalination combined capacity remained at the same level as in 2016 (470 million gallons per day), while its groundwater production capacity was 32

million gallons of per day. DEWA has 11 power and water plants; 3 power plants in Al-Awir area, and eight power and water plants in Jebel Ali. Annual demand for desalinated water reached a peak of 362 million gallons per day in 2017, compared to 347 million gallons per day in 2016. (Figure 10.7)

10.12 Because of Dubai's desert climate, large quantities of water are needed and large amounts of energy are consumed to provide water for homes, facilities, irrigation and industry. In 2017, the total consumer demand for desalinated water reached 120.8 billion gallons, compared to 116.9 billion gallons in 2016, an increase of 3.4 per cent. This also means that average per capita water consumption in Dubai is one of the highest in the world: it reached 40.6 thousand gallons in 2017, down 6.2 per cent from its peak of 43.3 thousand gallons in 2016. Groundwater covers a small percentage of the emirate's needs, while desalination plants provide the bulk. As a result, these plants are a major energy consumer in Dubai. (Figure 10.8)

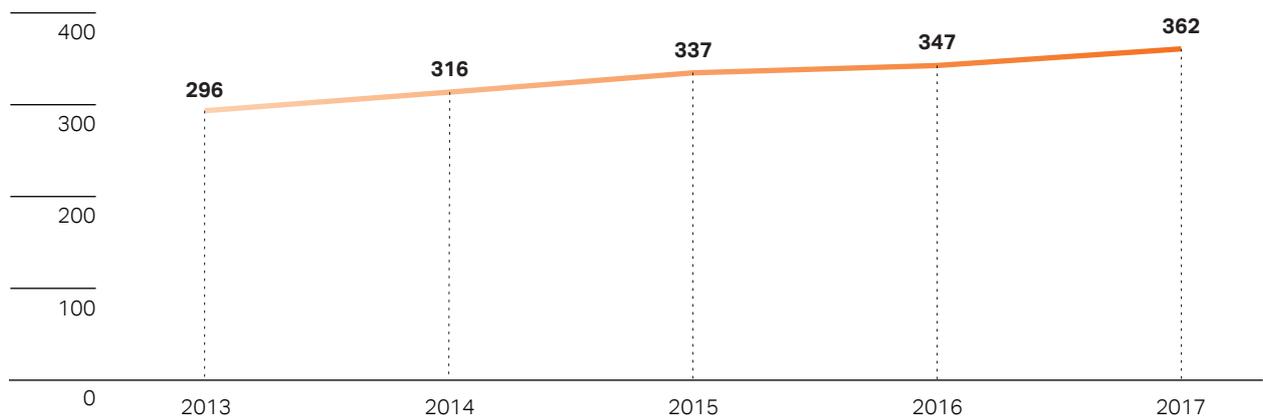


Figure 10.6: Average per capita electricity consumption (1000 KW/ hour a year)



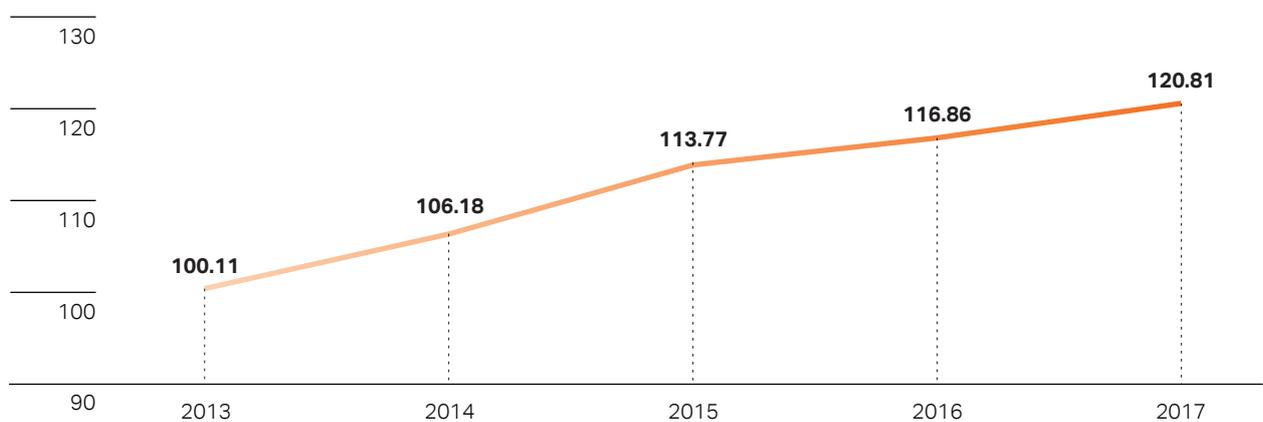
Source: http://en.wikipedia.org/wiki/list_of_countries_by_electricity_consumption

Figure 10.7: Peak demand for desalinated water in Dubai (Million Gallons/Day)



Source: Dubai Electricity & Water Authority

Figure 10.8: The demand for desalinated water in Dubai (Billion gallons)



Source: Dubai Electricity & Water Authority

Management of the Energy Sector in Dubai

Dubai Supreme Council of Energy (DSCE)

10.13 The Government of Dubai has entrusted the DSCE with the task of planning and coordinating with the concerned authorities and agencies to find new energy sources, following a balanced approach to environmental protection, the rationalization of consumption and cooperation with other emirates of the UAE. The DSCE has the following entities under its auspices: DEWA, Dubai Aluminium Company Limited (DUBAL), Emirates National Oil Company (ENOC), Dubai Supplies Authority (DUSUP), Dubai Petroleum Establishment (DPE), Dubai Nuclear Energy Committee (DNEC), Dubai Municipality (DM) and Roads and Transport Authority (RTA). The DSCE Board consists of a General Secretariat and an advisory committee of qualified and specialized staff. The DSCE Board has the full support of the Government of Dubai³.

Dubai Clean Energy Strategy 2050

10.14 Dubai is exploring options to provide future energy for the sustainable growth of its economy. This requires the adoption of policies that address effective management of both production and consumption. On the production side, these policies aim to select and provide the right mix of fuel to provide sufficient and reliable energy to meet growing economic needs. While power generation currently relies heavily on natural gas as a fuel, DEWA has announced its intention to diversify the energy sources it relies on to include clean coal and nuclear power in the future. In this context, the Authority intends to attract foreign investment in the energy sector by opening the way for the construction of reactors to generate electricity by nuclear power.

10.15 In terms of renewable energy, DEWA is implementing the Dubai Clean Energy Strategy 2050, which aims at transforming Dubai into a global clean energy centre by 2050. The share of clean and renewable energy in the total energy output in Dubai is planned to increase from 7 per cent in 2020 to 25 per cent in 2030 and to 75 per cent by 2050⁴. By 2030, DEWA expects the share of natural gas in the energy mix to be reduced to 61 per cent. The main focus of Dubai Clean Energy Strategy 2050 is to significantly increase the use of solar energy to reach 25 per cent of Dubai energy mix by 2030. DEWA is currently undertaking two solar initiatives: Mohammed bin Rashid Al Maktoum Solar Park and the Shams Dubai project. The emirate has also launched a number of other initiatives aimed at diversifying its energy mix to both meet the growing demand in Dubai while minimizing its impact on environment.

Mohammed bin Rashid Solar Energy Park

10.16 With the launch of the first phase of the project with a capacity of 13 MW generated using photovoltaic technologies⁵. The second phase of the solar park was inaugurated in April 2017 with a total capacity of 200 MW. Two other phases are planned. The third phase will be launched in stages up to 2020 with a capacity of 800 MW. The fourth phase, a concentrated solar power (CSP) plant,⁶ with a capacity of 700 MW, will be executed in cooperation with a consortium consisting of Saudi Arabia's ACWA Power, The Silk Road Fund and China's Shanghai Electric as the main contractor for engineering, procurement and construction. This phase will be completed in 2030.

³ <https://www.dubaisce.gov.ae/ar-AE>

⁴ DEWA 2017 Sustainability Report

⁵ Photovoltaic technology (PV)

⁶ Concentrated Solar Power (CSP)

Shams Dubai Initiative

10.17 As part of Smart Dubai Initiative to make Dubai the smartest and happiest city in the world, DEWA launched the Shams Dubai initiative to connect solar energy to buildings and households.

Shams Dubai encourages owners of houses and buildings to install solar panels for power generation and connect them to DEWA network. These owners consume the solar-generated electricity in their properties and then export the surplus to the DEWA network, with its price deducted from their next bill. As of January 2018, 40 MW peak capacity has been installed through solar systems in 613 buildings which are connected to DEWA network.

Dubai Green Mobility Initiative

10.18 Within the framework of the UAE's policy aimed at reducing carbon emissions and maintaining a healthy environment, the DSCE issued Circular No. 1/2017 dated 1 March 2017 concerning the establishment and installation of electric vehicle charging stations in the Emirate of Dubai. The circular aims at achieving sustainability and meeting the technical requirements of DEWA and is part of the efforts to implement Dubai Green Mobility Initiative. This directive will promote the use of electric and

hybrid vehicles and reduce carbon emissions in the road transport sector in line with Dubai Plan 2021 and Dubai Clean Energy Strategy 2050. The aim of the latter is to make Dubai the world's least carbon footprint city by 2050, as well reduce carbon emissions by 16% by 2021. In March 2017, DEWA announced an increase in the number of electric vehicle charging stations to over 200 stations across the Emirate of Dubai.

Green Charger Initiative

10.19 Through its Green Charger Initiative, DEWA aims to encourage residents to use sustainable means of transportation such as hybrid and electric vehicles to help reduce carbon emissions in the land transport sector, which is the second largest producer of greenhouse gas emissions in the Emirate of Dubai. This initiative will effectively contribute to the realization of the UAE Vision 2021 and the Dubai Plan 2021 to make Dubai a smart, integrated and connected city that is sustainable with its resources and has clean and healthy environmental practices. DEWA has stressed that the Green Charger Initiative is in line with Dubai Clean Energy Strategy 2050's goal of transforming Dubai into a global clean energy and green economy hub and making it one of the world's ten least carbon footprint cities.

The goal of Dubai Clean Energy Strategy 2050 is to transform Dubai into a global clean energy and green economy hub and make it one of the world's ten least carbon footprint cities.

Challenges to Energy Management in Dubai

10.20 The management of the energy sector in Dubai is of great importance due to its impact on the sector's efficiency and sustainability. The Government of Dubai has adopted effective policies in the management of the energy sector that rely exclusively on public sector institutions in both production and distribution. As mentioned above, DEWA produces and distributes electricity and water, and a limited number of state-owned companies produce and distribute petroleum products and domestic gas. The provision of various sources of energy by the Government of Dubai, as represented by public sector companies, has been successful. However, case studies from around the world show that the public sector is capable of meeting energy needs, but less efficiently than the private sector.

10.21 The authorities in charge of energy in Dubai have been successful in providing the energy sources needed today to preserve economic growth and sustainable development in the emirate by providing operational infrastructure for the production and distribution of energy with the highest quality. However there are future challenges facing the energy sector in Dubai. Further studies and analyses are in order to modernize the mechanisms for providing energy and managing the demand for it. In general, the main energy issue is the widening gap between locally available resources in Dubai and the demand for different types of energy. The top challenge is securing investments in high-cost energy infrastructure to accommodate future expansions.

Public-Private Partnerships

10.22 The Government of Dubai plans to ease some of the pressure on the public sector by providing necessary investments through partnerships with the private sector, especially by encouraging private sector investments in electricity generation using public-private partnership standards. These partnership projects require changing existing laws and regulations to incentivize the private sector to invest in energy projects. Recognizing this fact, the

DSCE is considering a restructuring of the energy sector to involve the private sector in some limited activities within the sector. In this context, Decree No. 1 of 1992 establishing the DEWA was amended to facilitate private sector participation in power generation and in desalination. In addition, Decree No. 9 and Law No. 6 of 2011 were issued, amending some provisions under which DEWA was established and regulating the private sector participation in the production of electricity and water in the Emirate of Dubai. This allows the private sector to participate in power generation alongside DEWA, while the distribution and sale of electricity and water to the final consumer is still limited to DEWA.

Efficiency and Energy and Water Pricing Policies

10.23 The UAE subsidizes energy and water prices at relatively low levels. The subsidy was primarily intended to provide all types of energy and water to low-income groups, to increase the competitiveness of local producers in international markets and to stabilize local energy prices to help reduce volatility in prices of goods and services in general. Another objective of the subsidy was to help distribute oil and gas revenues to UAE nationals so that they benefited from their country's wealth. However, experience has shown that subsidizing energy and water consumption does not help the economy because it does not benefit the target groups of the population. On the contrary, the benefits of subsidy are usually reaped by high-income non-target groups.

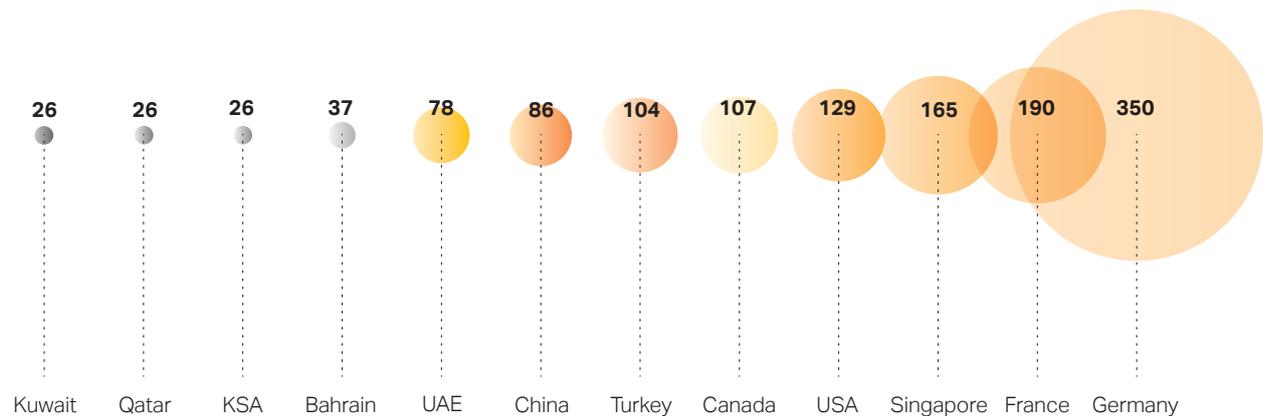
10.24 The GCC region in general suffers from low energy efficiency, with average energy density⁷ in Dubai being over 480 tonnes of oil equivalent (TOE) per a million dollars of GDP, which is high by global standards. The high energy density is likely to be due to several factors, most prominently the climate in Dubai: the hot dry climate results in high levels of consumption and density, thus increasing the emirate's energy needs. The second factor is a low efficiency in the use of energy. Effective policies

⁷ The term "energy density" refers to the volume of energy required to produce one unit of GDP.

are needed to improve efficiency in consumption, such as correcting the pricing system used for all kinds of energy. Therefore, the Government of Dubai, through its various institutions, has recently adopted programs aimed at promoting more efficient and effective consumption, including some programs to manage the demand for electricity and water and measures that increase the effectiveness of the end user. These include awareness campaigns aimed at educating individuals about the importance of prudent consumption of electricity and water. Campaigns are complemented by more comprehensive policies to increase the efficiency of the final consumption of electricity, known as demand side management programs. The programs include a set of consumer-focused measures aimed at influencing the time and amount of energy use by residents to increase efficiency, including the pricing structure for power and water.

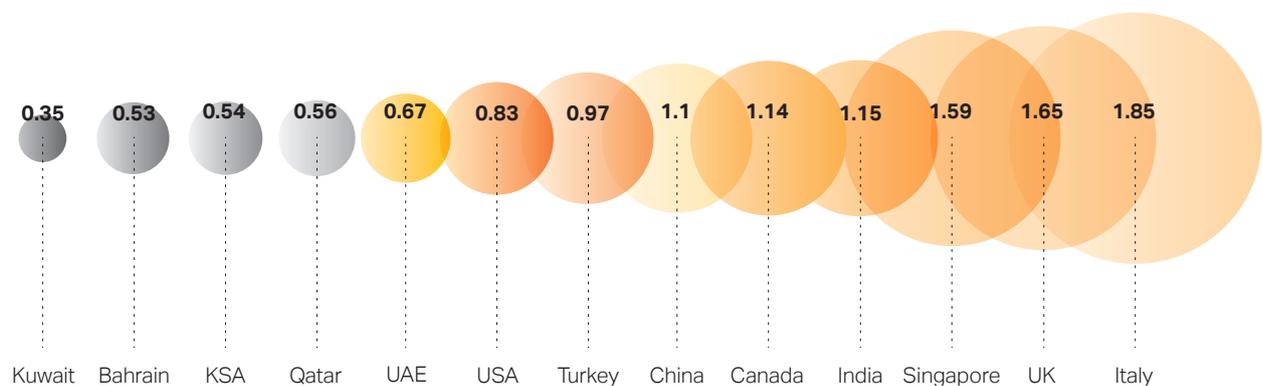
10.25 Energy demand management policy involves the use of pricing to reduce consumption by phasing out consumer subsidies under which energy sources are available for final consumption at a much lower price than in most other countries, and sometimes at a price lower than cost. The Government of Dubai, through DEWA, has recently adopted a new system for electricity and water tariffs called the segment system. This system is specifically designed to charge higher when the customer exceeds certain levels in the consumption of electricity or water. In addition, since January 2011, DEWA has introduced a new pricing system that includes a 15 per cent increase in the price of electricity and water consumed by residents. The new tariff system partially corrects the low prices and encourages a more efficient use of resources. However, the current tariff does not reflect the total cost to the community, including the environmental cost. It is still lower than prevailing levels in most countries of the world although the tariff is the highest among the GCC countries. Figures (10.9) and (10.10)

Figure 10.9: Electricity tariff in UAE and selected countries (\$ per thousand KWh)



Source: Global Energy prices.com, (June 2018)

Figure 10.10: Gasoline prices in UAE and selected countries (August 2018, US\$ per litre)



Source: Global Energy Prices.com