

Chapter 4

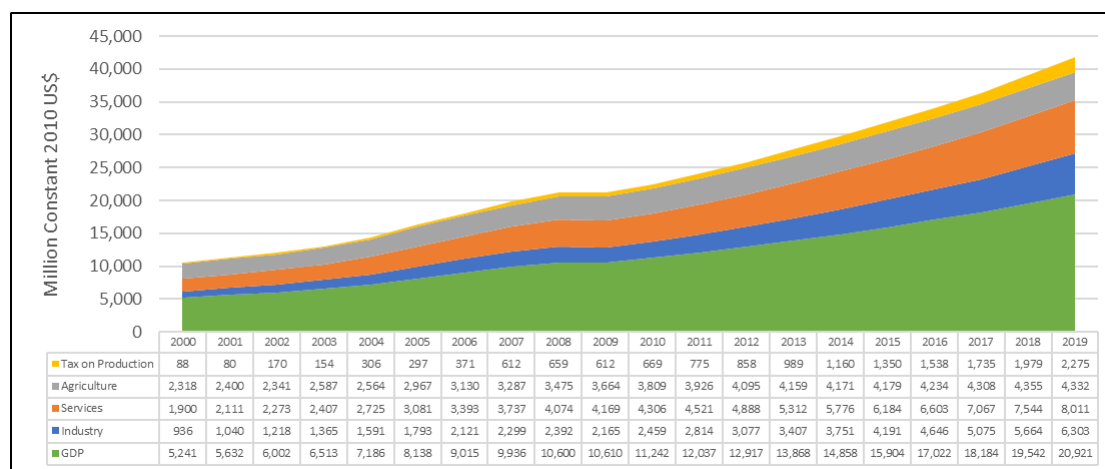
Energy Demand and Supply Analysis in 2000–2019

The final primary energy 2000–2019 data were used to produce Cambodia’s energy balance tables (EBTs). The EBT 2000–2019 is the basis for this chapter’s energy demand and supply analysis.

1. Socio-economic Situation

Cambodia’s GDP average annual growth rate (AAGR) was 7.6% from 2000 to 2019, with a share of around 38% in 2019. The services sector mainly contributed to the economy (Figure 4.1). Although the services sector constantly had the largest share, its AAGR was 8% between 2000 and 2019, lower than the industry sector (11%). This indicated that the industry sector’s growth significantly influences its GDP. The agriculture sector’s share was around 44% in 2000 and decreased to 21% in 2019, with an AAGR of around 1.7%.

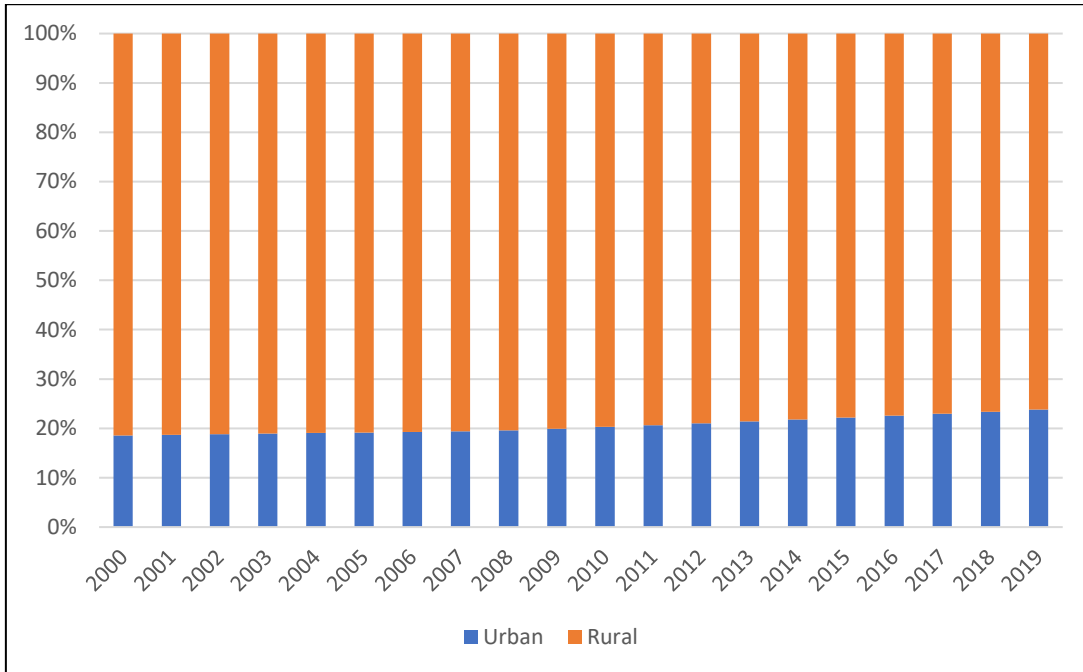
Figure 4.1. GDP in Constant 2010 US\$



Source: World Bank (2021).

Cambodia’s population increased steadily with an AAGR of 1.6% from 2000 to 2019. People in the urban areas grew by 3.4% per year, higher than the growth rate in the rural areas. Nevertheless, the share of the population in the rural areas was still bigger than in the urban areas. The share of the population living in rural areas was around 77% in 2019 (Figure 4.2).

Figure 4.2. Population of Cambodia, 2000–2019



Source: World Bank (2021).

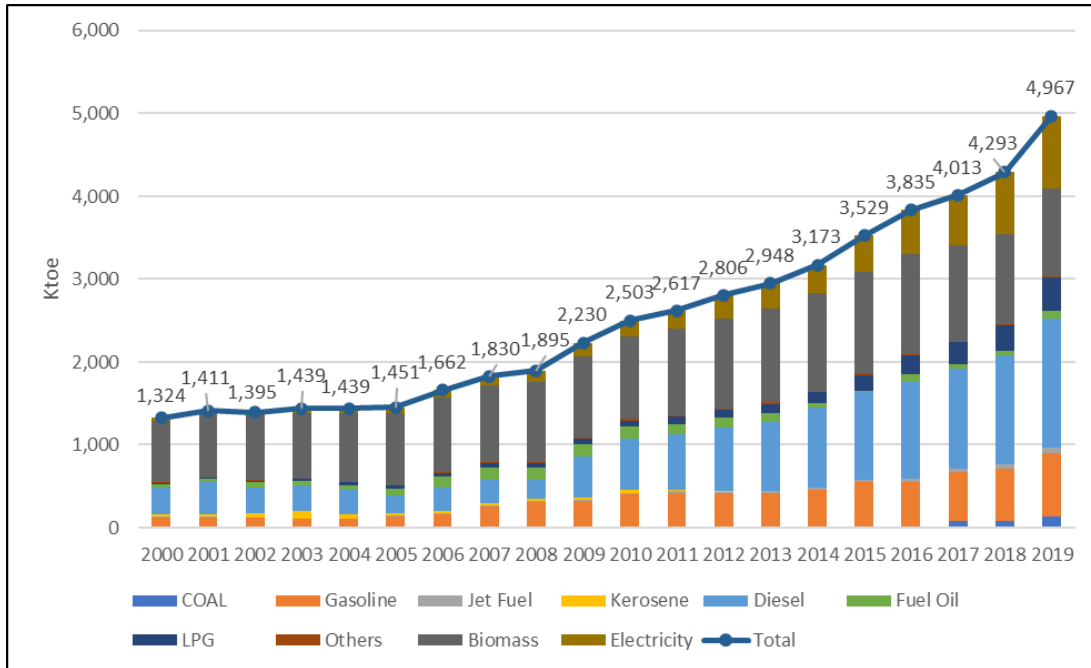
2. Final Energy Consumption

The final energy consumption of Cambodia increased steadily by 7.2% per year from 2000 to 2019 (Figure 4.3). Before 2009, biomass comprised most of the total final energy consumption (TFEC). The share, however, declined from 56% in 2000 to 44% in 2009 and reached 21% by 2019. As a result, biomass is being phased out of the country's energy market.

Oil consumption was also high in Cambodia, but its share was still lower than biomass in 2000–2008. Since 2009, the role of oil in the TFEC became dominant, and the share increased from 49% in 2009 to 58% in 2019. The AAGR of oil consumption was 9% from 2000 to 2019.

Electricity consumption grew the fastest over the 2000–2019 period, at an average annual rate of 18%. Although the fastest, electricity share in the TFEC was only 3% in 2000 and reached 18% in 2019 due to limited power supply capacity.

Figure 4.3. Total Final Energy Consumption by Fuel

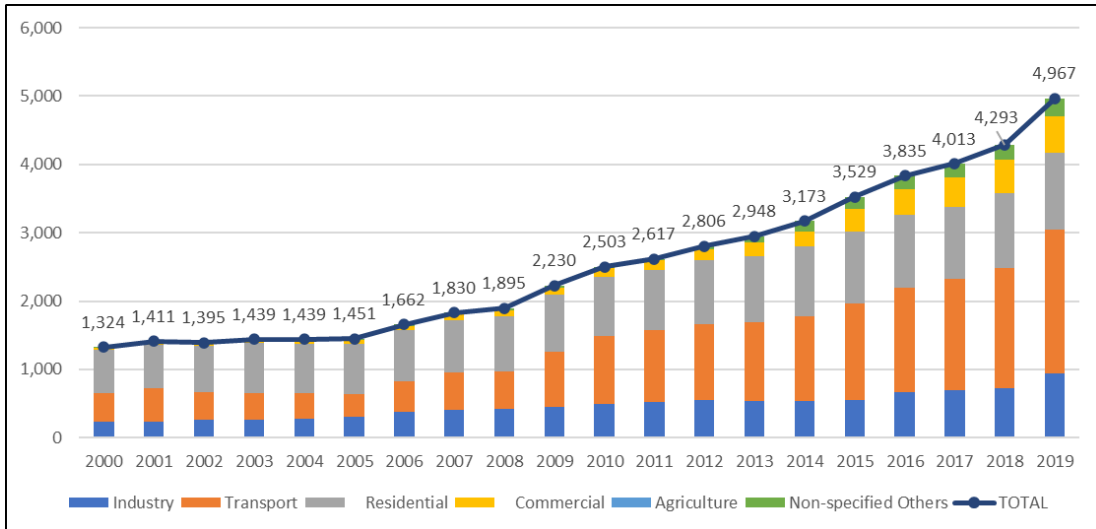


Source: GDE-MME in-house data (2021).

The transport and residential sectors had the largest share in the TFEC (Figure 4.4). Transport is the major oil consumer, while the residential sector mainly consumes biomass. The commercial sector has a smaller share but has high consumption growth rates over the 2000–2019 period, at 16% per year, compared to the transport and residential sectors at 9% and 3% per year, respectively. The industry sector showed an increase of 8% per year, slightly slower than the transport sector.

The high growth of the commercial, transport, and industry sectors was due to significant economic development, as reflected by the remarkable foreign direct investment in the construction of commercial buildings, infrastructure, and economic zones. The country’s GDP increased by 7.6% per year in 2000–2019, so the energy elasticity of GDP towards the TFEC (2000–2019) was 0.95. If biomass is excluded from the TFEC, the energy elasticity will be around 1.4, since the TFEC without biomass has been growing at 10.5% faster than the GDP. In this regard, an aggressive energy efficiency and conservation programme must be in place to improve elasticity in the future.

Figure 4.4. Total Final Energy Consumption by Sector

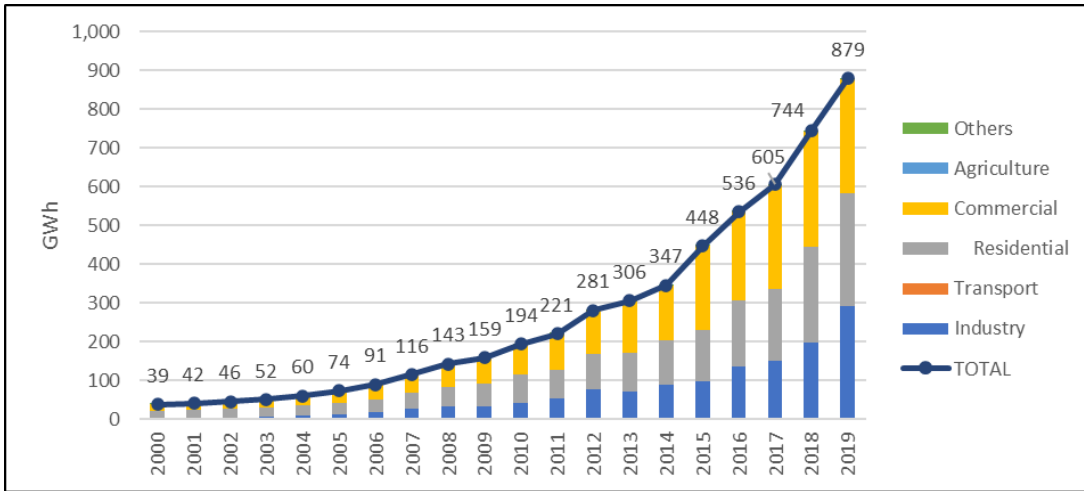


Source: GDE-MME In-house data, (2021).

3. Power Generation

Electricity consumption grew at an AAGR of 18% over the 2000–2019 period (Figure 4.5). By 2019, electricity consumption reached almost 900 GWh. An increase in income and expansion of the electricity distribution network contributed to this significant increase in electricity demand between 2000 and 2019. Although growing slower, the residential and commercial sectors still dominated electricity demand in Cambodia, from 94% in 2000 to 67% in 2019. Although the industry sector had a lower share, it grew the fastest by 29% over the 2000–2019 period. As a result, the share of electricity consumption in industries increased from 6% in 2000 to 33% in 2019. Saving electricity through highly efficient appliances and machines is essential with the strong leadership of the MME.

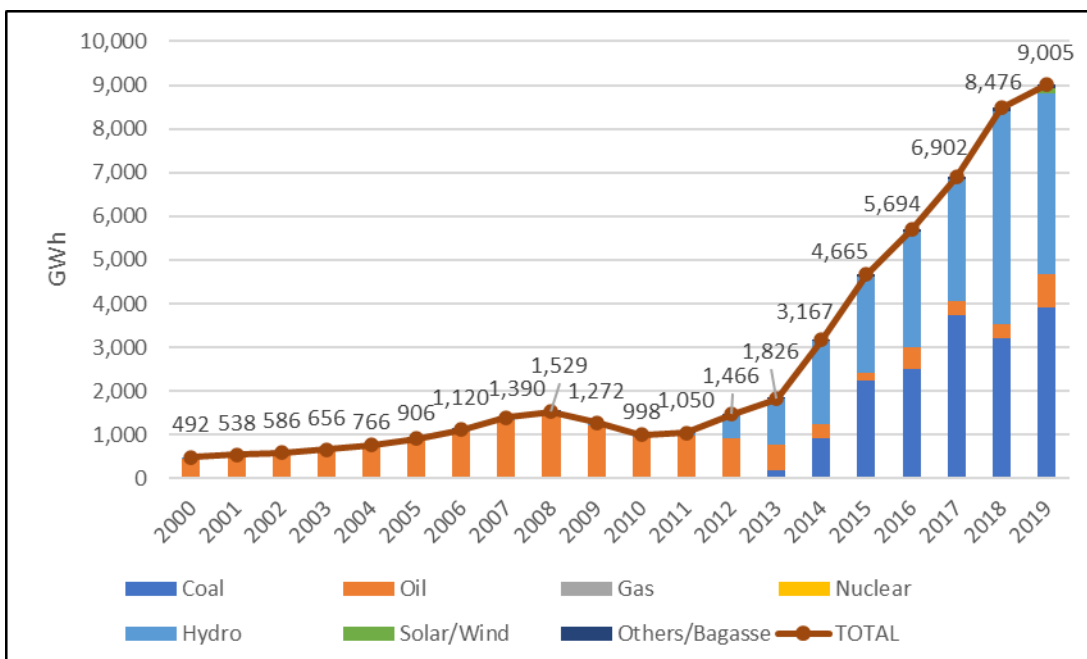
Figure 4.5. Electricity Demand by Sector



Source: GDE-MME in-house data (2021).

The total electricity generation increased from 492 GWh in 2000 to 998 GWh in 2010. Since then, electricity generation has increased significantly ninefold, reaching 9,000 GWh by 2019 at an AAGR of 17% (Figure 4.6). Oil was the primary power source of generation until 2013. However, the share of oil decreased as hydro-based electricity generation started to operate in 2012 and coal in 2015. By 2019, oil share declined to 8%, while coal and hydro increased to 44% and 46%, respectively.

Figure 4.6. Electricity Generation by Fuel



Source: GDE-MME in-house data (2021).

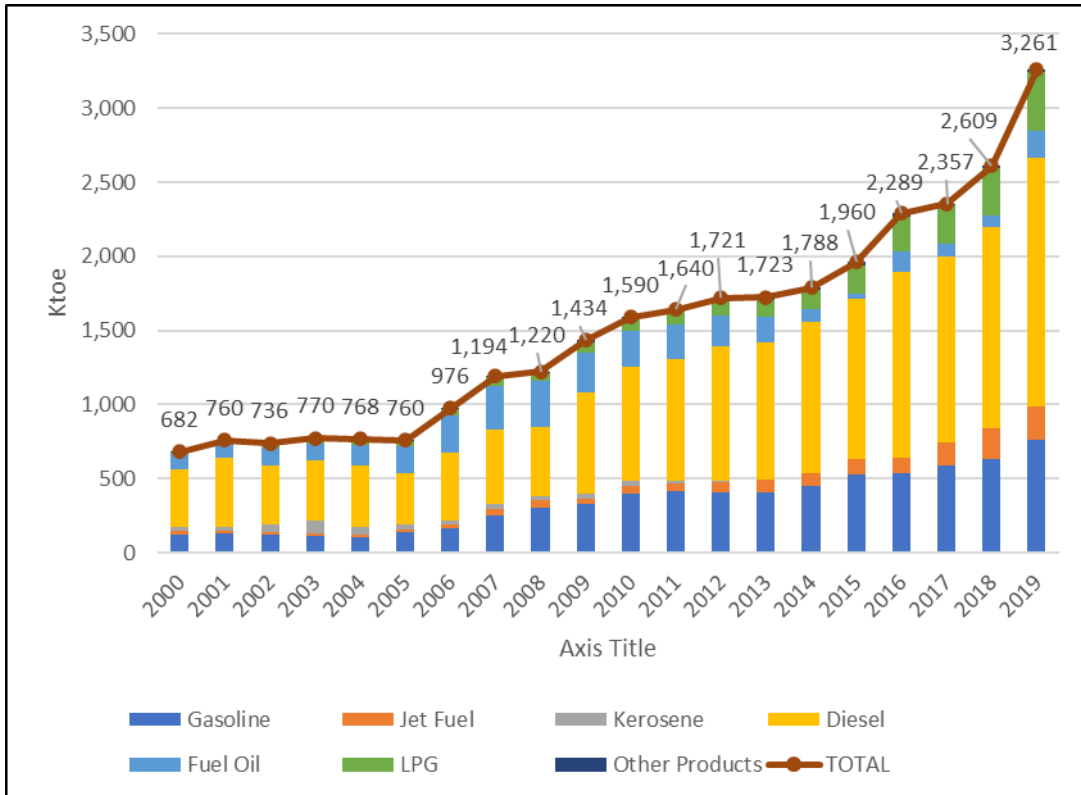
Cambodia imported electricity mainly during the dry season. Electricity imports grew at an AAGR of 25% from 2000 to 2019. The increase in electricity consumption, especially in commercials and industries, including special economic zones, as well as the insufficient power supply system in Cambodia contributed to the rapid growth of electricity imports in the country.

4. Petroleum Products

Cambodia imported 100% of its petroleum products from Singapore, Thailand, and Viet Nam to supply domestic petroleum consumption. The AAGR of imported petroleum products was 9% from 2000 to 2019. The major contributor to the growth of imported petroleum products was LPG (19%), jet fuel (14%), and gasoline (10%). This is in line with the increase in domestic air traffic volume, residential, commercial, and road transport (Figure 4.7). Consumption of jet fuel for international air traffic is larger than domestic air traffic, but the growth in the 2000–2019 period was slower at 9% per year.

Diesel imports grew at an average of 9% per year in 2000–2019. The road transport sector consumed most of the imported diesel (73% in 2019), and consumption has been growing at an average of 9% per year. Other diesel consumers are manufacturing, agriculture, mining, construction, and power generation. Diesel consumption for power generation declined due to the increase of other sources, such as hydro and coal. Diesel consumption for power generation decreased at an average rate of 1% per year over the 2000–2019 period. However, Cambodia needs oil power plants to meet the power supply shortage in the dry season.

Figure 4.7. Import of Petroleum Products

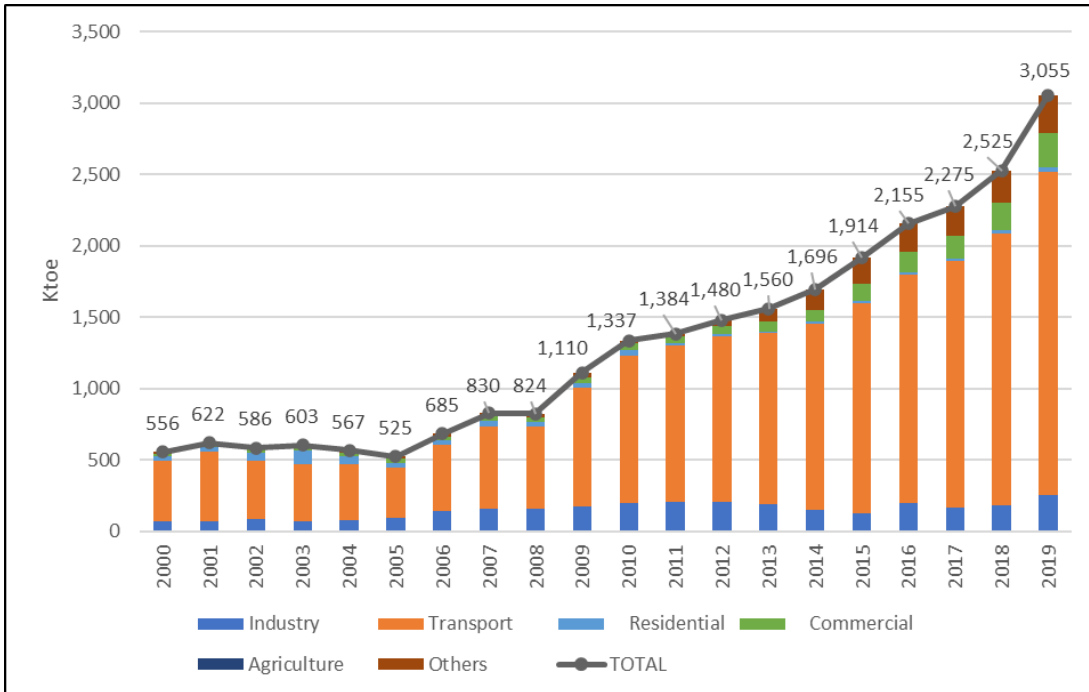


Source: GDE-MME in-house data (2021).

The main consumer of petroleum products in 2019 was the transport sector, at 73% share of total consumption. Other consumers of petroleum products were the industry (9%), residential and commercial sectors (9%), and the agriculture sector with others (9%) (Figure 4.8).

Cambodia’s petroleum products demand in the final sector (industry, transport, commercial, residential, and others) increased from around 556 ktoe in 2000 to 3,055 ktoe in 2019, a more-than-fivefold increase over the 2000–2019 period. As mentioned, the AAGR of petroleum products’ consumption was 9% (Figure 4.8).

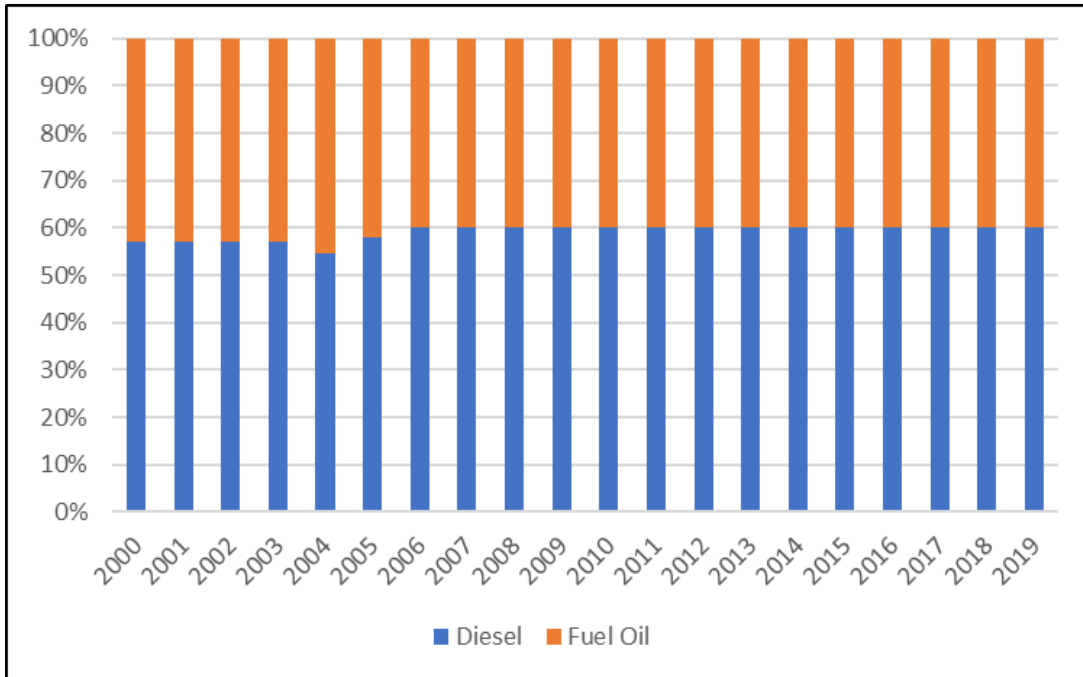
Figure 4.8. Petroleum Demand in the Final Sector



Source: GDE-MME in-house data (2021).

The consumption of petroleum products for power generation consisted of diesel and fuel oil. Total consumption was 126 ktoe in 2000 and increased to 206 ktoe in 2019 at an average rate of 3% per year (Figure 4.9).

Figure 4.9. Petroleum Consumption for Power Generation



Source: GDE-MME in-house data (2021).

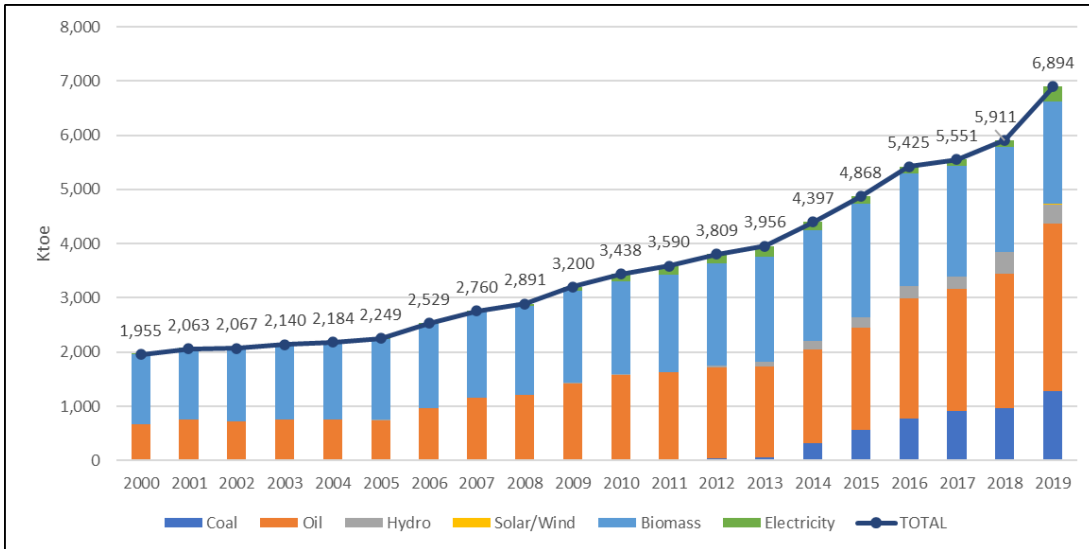
Primary Energy Supply

Primary energy supply is the sum of the transformation and the final energy consumption sectors. Another definition is shown in the equation below:

$$\text{Primary Energy Supply} = \text{indigenous production} + (\text{import} - \text{export}) + \text{stock change} \\
 (\text{beginning} - \text{ending}) - \text{international marine and aviation bunkers}$$

Cambodia imported coal, oil (petroleum products), and electricity. Domestic energy comprises hydropower and biomass only. Total primary energy supply (TPES) grew at an AAGR of 7% over the 2000–2019 period (Figure 4.10).

Figure 4.10. Primary Energy Supply



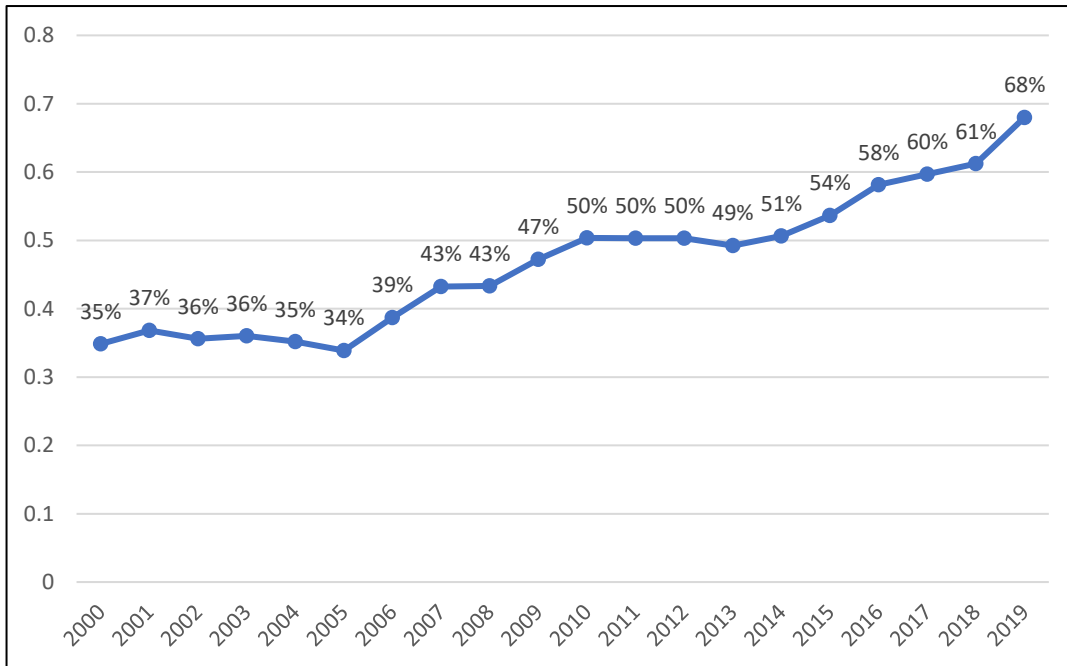
Source: GDE-MME in-house data (2021).

Coal supply grew the fastest at 51% per annum in 2008–2019 due to the rapid increase of its power generation, followed by hydropower supply at 28% yearly from 2000 to 2019, while petroleum products supply increased by 8% per year. On the other hand, traditional biomass supply slightly increased by 2% yearly during 2000–2019 as Cambodia shifted from non-commercial energy to commercial energy (coal, oil, and electricity).

5. Energy Indicator

The import dependency ratio of Cambodia, defined as energy imports divided by the sum of energy production and energy imports, increased from 35% in 2000 to 68% in 2019. This indicates that the country still depended on outside sources for oil supply, making its energy supply security vulnerable. Thus, emergency response and preparedness at the national level, including strategic oil stockpiling, will be needed. (Figure 4.11).

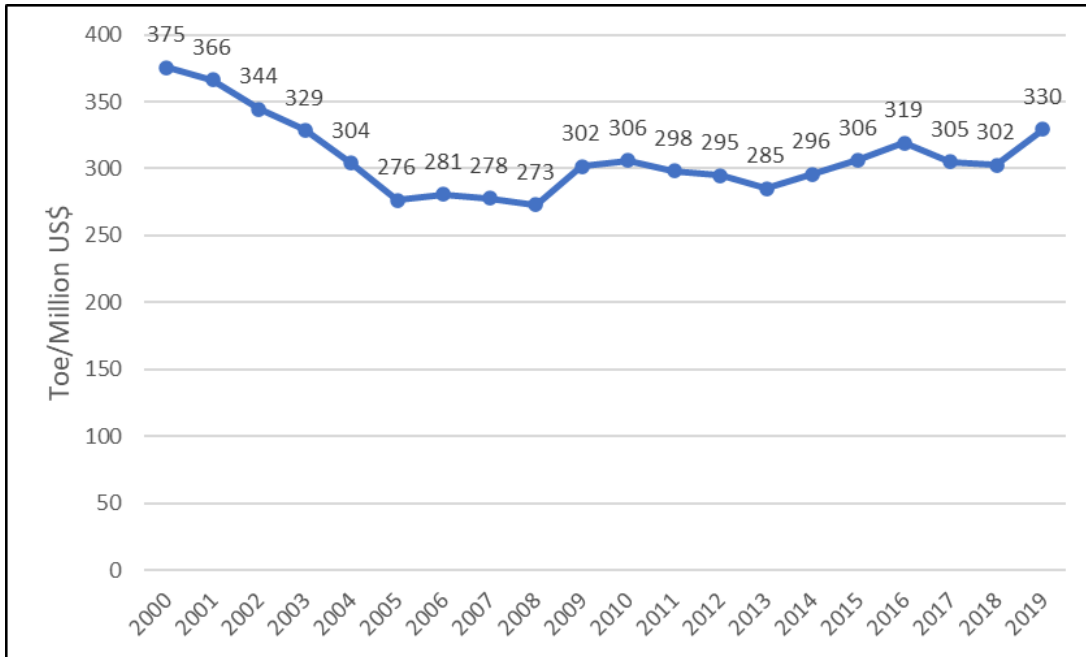
Figure 4.11. Import Dependency Ratio



Source: GDE-MME in-house data (2021).

Energy intensity (Figure 4.12) is defined as the TPES divided by the GDP. Cambodia's energy intensity slightly decreased at an average rate of 1% per year from 2000 to 2019. The growth rate decreased by 6% from 2000 to 2005 due to oil-based electricity generation reduction. However, the energy intensity rose 4% from 2013 to 2016 as coal power plants increased significantly. Overall, 2000–2008 showed its downtrend, but gradually trended upwards after 2009 until 2019. Thus, effective energy efficiency and conservation measures will be needed to change this trend.

Figure 4.12. Energy Intensity

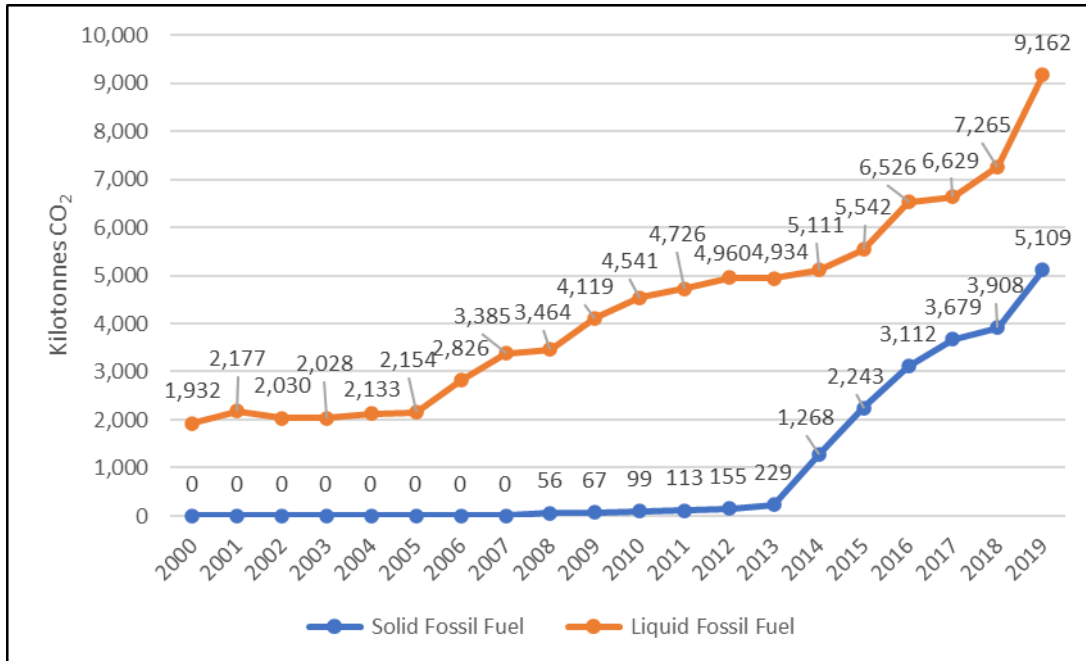


Source: GDE-MME in-house data (2021).

5.1. CO₂ emissions

Cambodia's CO₂ emissions have been increasing at an AAGR of 11% over the 2000–2019 period. CO₂ emissions in 2019 totaled 14,271 Kt-CO₂. CO₂ emissions from liquid fossil fuels grew at an AAGR of 8.5% from 2000 to 2019 because of the rapid increase in petroleum demand for transport activities. CO₂ emissions of solid fossil fuels totaled 56 Kt-CO₂ in 2008 and reached 1,268 Kt-CO₂ in 2014 as the capacity of coal power plants increased significantly (Figure 4.13). CO₂ emissions continued to rise to 5,109 Kt by 2019, increasing at an average rate of 32% between 2014 and 2019 due to the significant electricity demand growth in the same period.

Figure 4.13. CO₂ Emissions in Cambodia



Source: GDE-MME in-house data (2021).