Chapter 3

Study of Selected Countries

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Chapter 3

Study of Selected Countries

This chapter analyses energy consumption, energy efficiency, CO_2 emissions, energy efficiency policies, and CO_2 emissions reduction policies in the four countries studied.

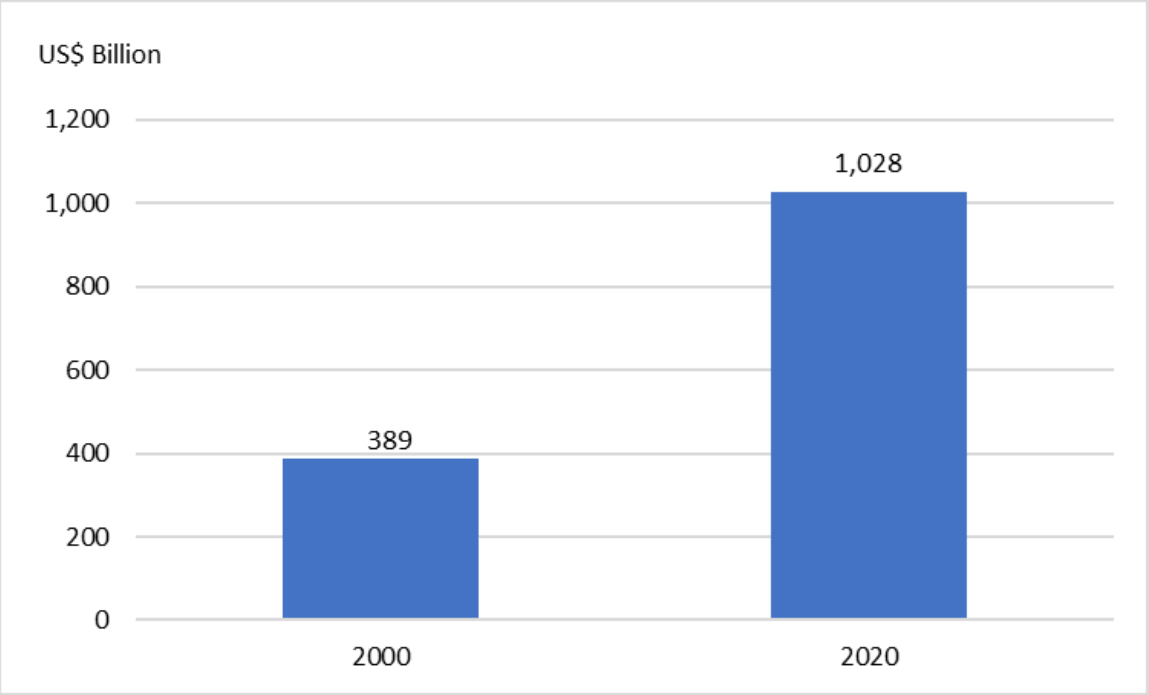
1. Indonesia

1.1. Indicators of Energy Consumption

1) Transition in GDP

Indonesia's GDP grew 2.6 times in 20 years, from $389 billion in 2000 to $1,028 billion in 2020 (Figure 3.1).

Figure 3.1. Indonesia GDP 2000 vs 2020 (2015 prices and ex rate)



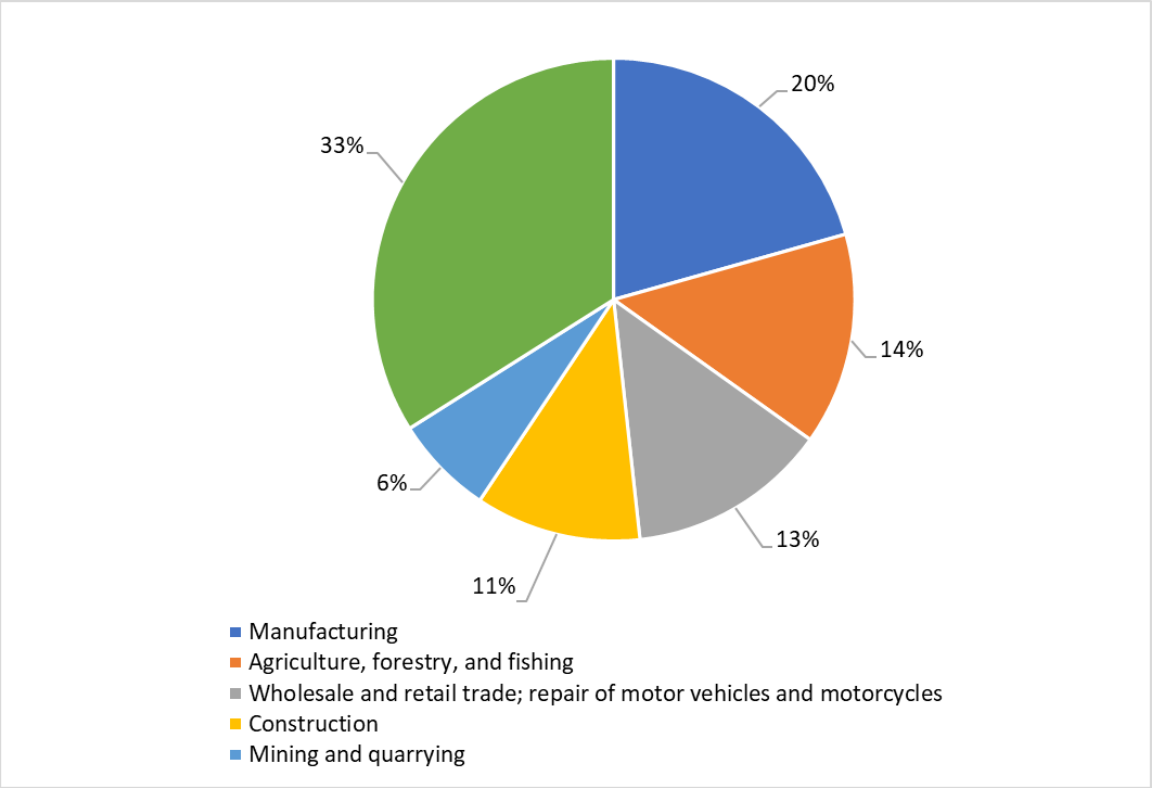
Source: IEA (2022).

2) GDP by sector and changes in industrial structure

In terms of the share of nominal GDP by sector in 2020, the manufacturing sector is in first place (20%), followed by agriculture, forestry, and fishing (14%), wholesale and retail trade (13%), construction (11%), and mining (6%) (Figure 3.2).

The Indonesian economy has shifted from its previous agricultural focus to manufacturing and services.

Figure 3.2. Indonesia GDP by Sector at Current Market Prices (2020)



GDP = gross domestic product
Source: ADB (2022).

3) Transition of TES by energy type

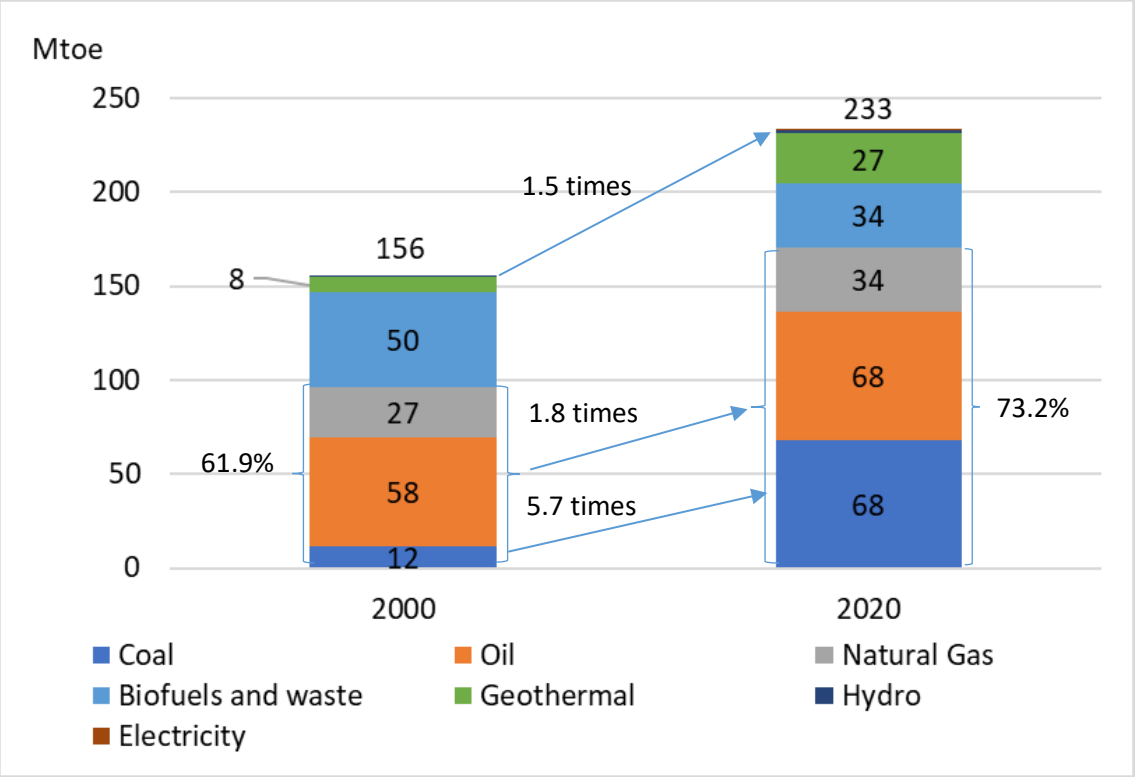
In 20 years, TES increased by 1.5 times from 156 Mtoe in 2000 to 233 Mtoe in 2020.

Of that amount, TES of fossil fuels (oil, coal, and natural gas) increased by 1.8 times from 96 Mtoe in 2000 to 171 Mtoe in 2020. If we focus on TES of fossil fuels by energy, TES of oil and natural gas increased 1.2 and 1.3 times, respectively, while TES of coal, which has a particularly high CO_2 emissions factor, increased significantly by 5.7 times, from 12 Mtoe in 2000 to 68 Mtoe in 2020.

Amongst non-fossil fuels, geothermal TES increased by a factor of 3.2 and hydro TES by a factor of 2.4. Conversely, TES of biofuels and waste decreased by a factor of 0.7.

Fossil fuel dependence (the percentage of oil, coal, and natural gas in the total) increased from 61.9% in 2000 to 73.2% in 2020 (Figure 3.3).

Figure 3.3. TES by Energy Type (Indonesia: 2000 vs 2020)

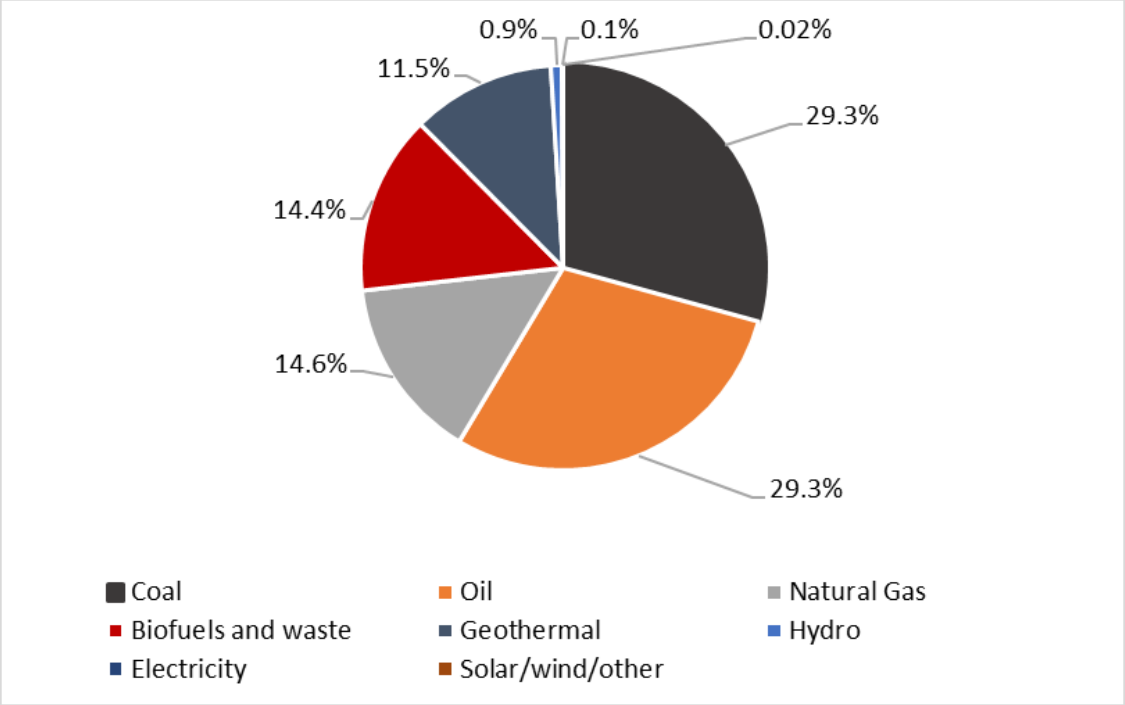


TES = total energy supply.
Source: IEA (2022).
Note: Totals may not match due to rounding.

Fossil fuels account for much of the TES, with a share of 73.2%. Coal, which has a particularly high CO_2 emissions factor, tops the list with a 29.3% TES share.

On the other hand, the TES share of non-fossil fuels (biofuels and waste, geothermal, hydro, and solar/wind/other) is 26.8%. Amongst them, biofuels and waste, and geothermal are the main sources, while TES of solar, wind and others is very small (Figure 3.4).

Figure 3.4. TES Share by Energy (Indonesia: 2020)

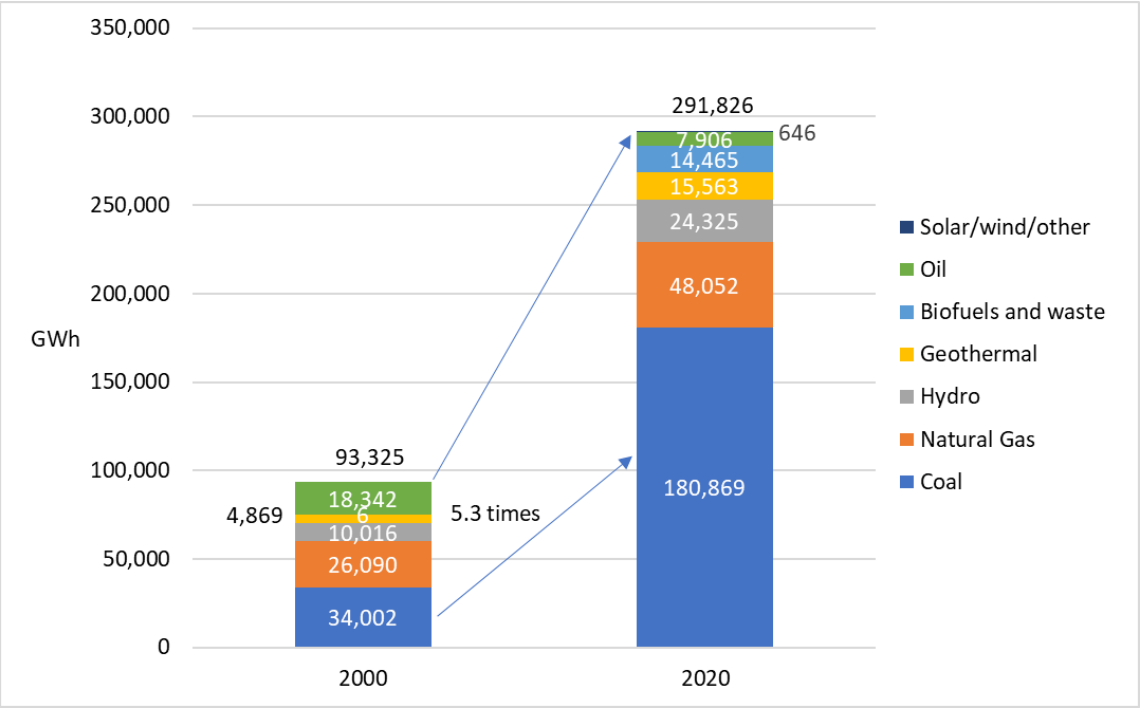


TES = total energy supply.
Source: IEA (2022).

4) Transition of power generation by fuel

Over the 20 years, power generation increased by 3.1 times from 93,325 GWh in 2000 to 291,826 GWh in 2020. In terms of power generation by fuel in 2020, coal ranks first (180,869 GWh), natural gas second (48,052 GWh), hydro third (24,325 GWh), followed by geothermal, biofuel and waste, and oil, solar power, wind power, and others. Over the 20 years, the amount of electricity generated by coal, which has the highest CO_2 emissions factor, increased markedly by 5.3 times (Figure 3.5).

Figure 3.5. Electricity Output by Fuel (Indonesia: 2000 vs 2020)



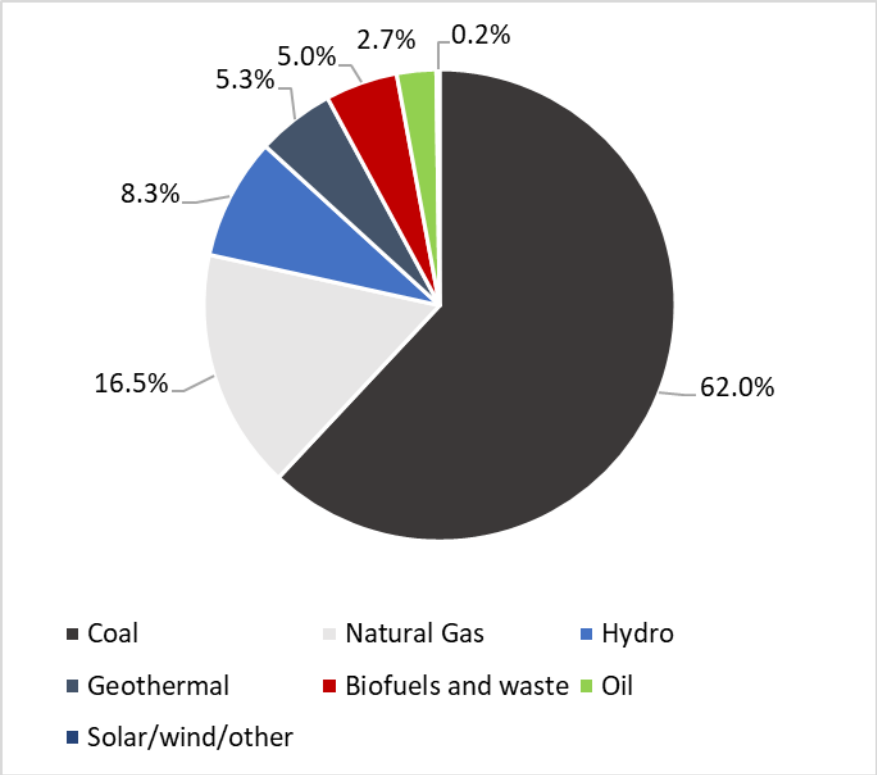
Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of share of power generation by fuel in 2020, coal comes in first (62.0%), natural gas second (16.5%), hydro third (8.3%), followed by geothermal, biofuel and waste, and solar/wind/other.

Fossil fuels account for most of the share of power generation, at 81.2%. Coal, which has a particularly high CO_2 emissions factor, tops the list with a 62.0% share.

On the other hand, the share of non-fossil fuels (biofuels and waste, geothermal, hydro, and solar/wind/other) is 18.8%. Amongst them, hydro (8.3%), geothermal (5.3%), and biofuels and waste (5.0%), which make use of Indonesia's nature and topography, are the main sources, while the power generation share of solar, wind, and others is very low, 0.2% (Figure 3.6).

Figure 3.6. Electricity Output Share by Fuel (Indonesia: 2020)



Source: IEA (2022).

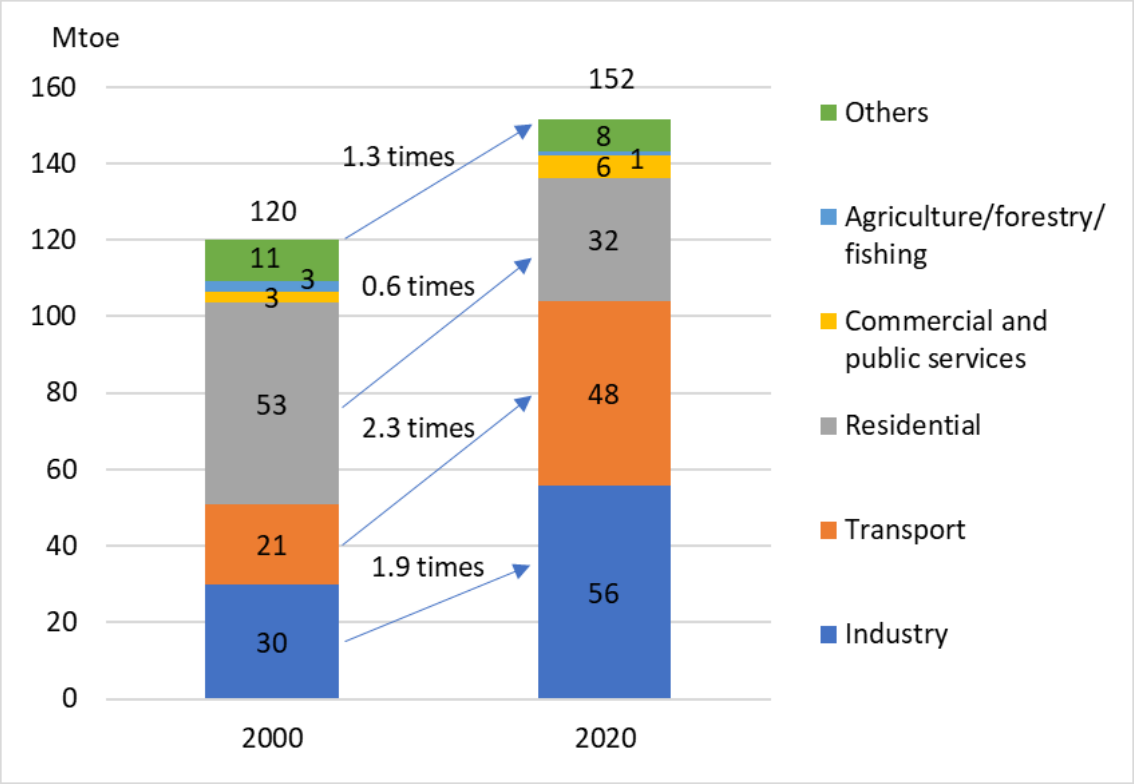
5) Transition of final energy consumption by sector

In 20 years, final energy consumption increased 1.3 times from 120 Mtoe in 2000 to 152 Mtoe in 2020. In terms of final energy consumption by sector in 2020, the manufacturing industries and construction sector (56 Mtoe) is in first place, the transport sector (48 Mtoe) is in second place, the residential sector (32 Mtoe) is in third place, followed by the commercial and public services sector (6 Mtoe), the agriculture/ forestry/fishing sector (1 Mtoe), and other sectors (8 Mtoe).

In 20 years, the final energy consumption in the industry sector increased 1.9 times from 30 Mtoe in 2000 to 56 Mtoe in 2020. In the transport sector, the final energy consumption increased 2.3 times from 21 Mtoe in 2000 to 48 Mtoe in 2020. On the other hand, the final energy consumption in the residential sector decreased by 0.6 times from 53 Mtoe in 2000 to 32 Mtoe in 2020 (Figure 3.7).

The shift in the industrial structure from being agriculture-based to being manufacturing- and services-based has led to the growth in the final energy consumption in the industry sector. The final energy consumption in the transport sector has also been growing with the development of motorisation.

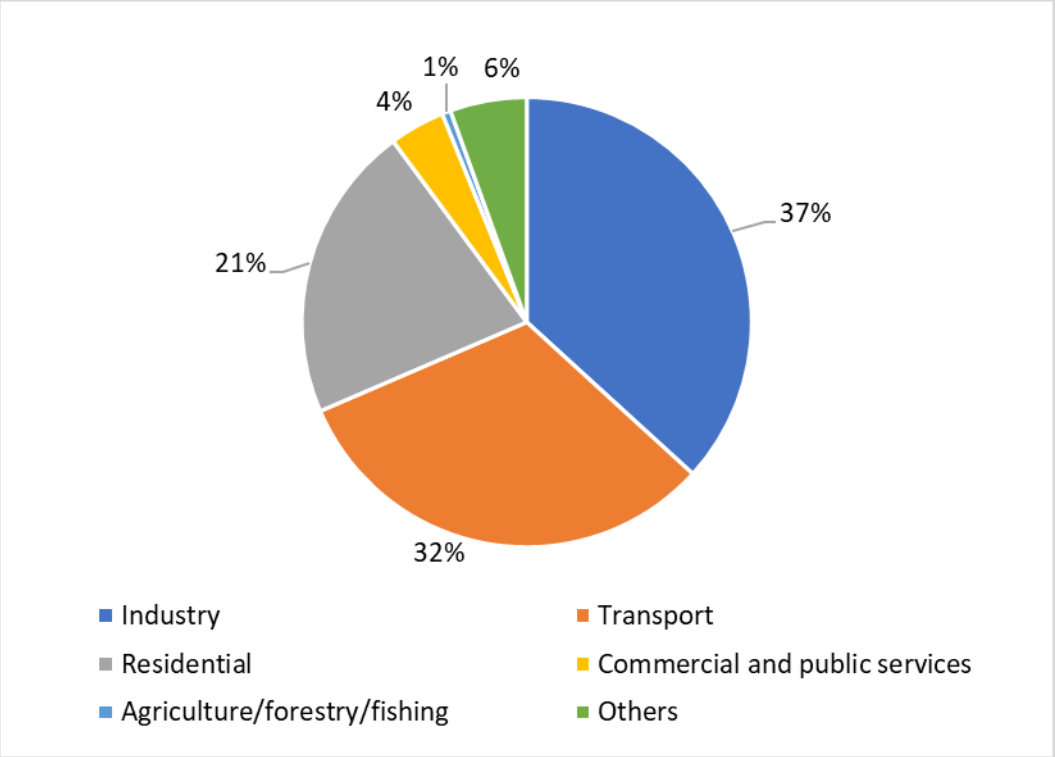
Figure 3.7. Final Energy Consumption (Indonesia: 2000 vs 2020)



Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of the share of final energy consumption by sector in 2020, the industry sector is in first place (37%), followed by the transport sector (32%), the residential sector (21%), the commercial and public services sector (4%), the agriculture/ forestry/ fishing sector (1%) and the others (6%) (Figure 3.8).

Figure 3.8. Final Energy Consumption Share by Sector (Indonesia: 2020)



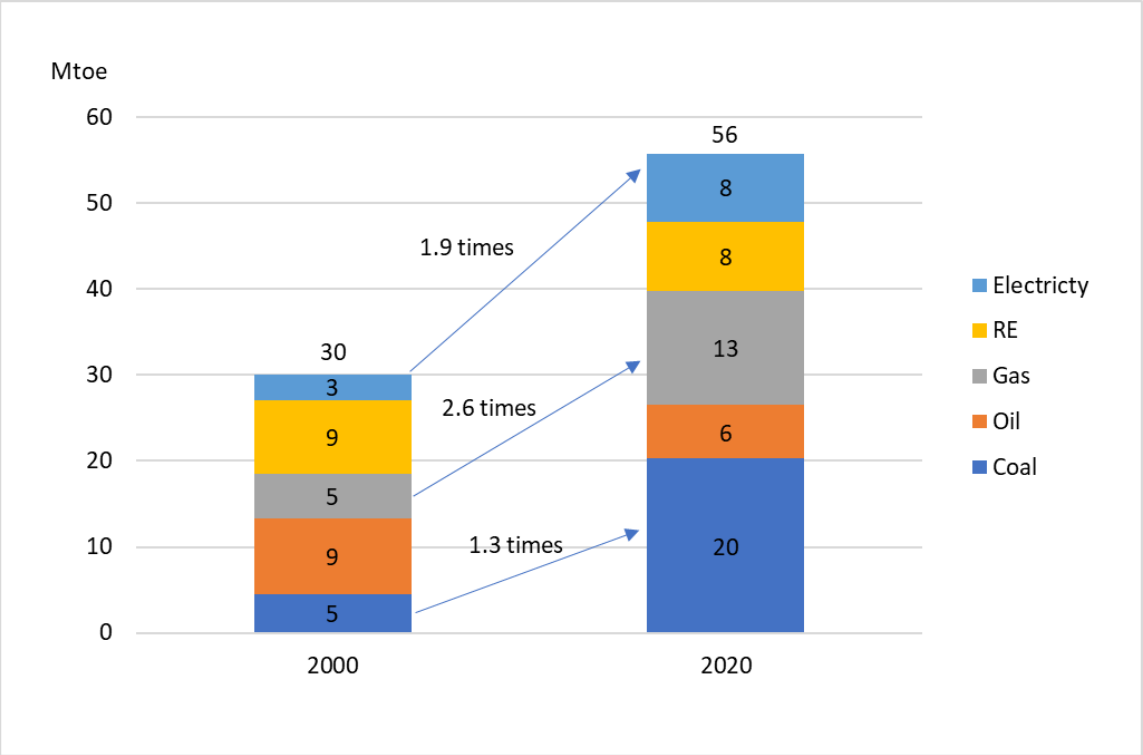
Source: IEA (2022).

6) Energy consumption and efficiency in the industry sector

The final energy consumption in the industry sector increased 1.9 times from 30 Mtoe in 2000 to 56 Mtoe in 2020.

In particular, the final energy consumption of coal increased 4.5 times from 5 Mtoe in 2000 to 20 Mtoe in 2020. The final energy consumption of natural gas also increased 2.6 times from 5 Mtoe in 2000 to 13 Mtoe in 2020 (Figure 3.9).

Figure 3.9. Final Energy Consumption Transition by Fuel (Indonesia: 2000 vs 2020)

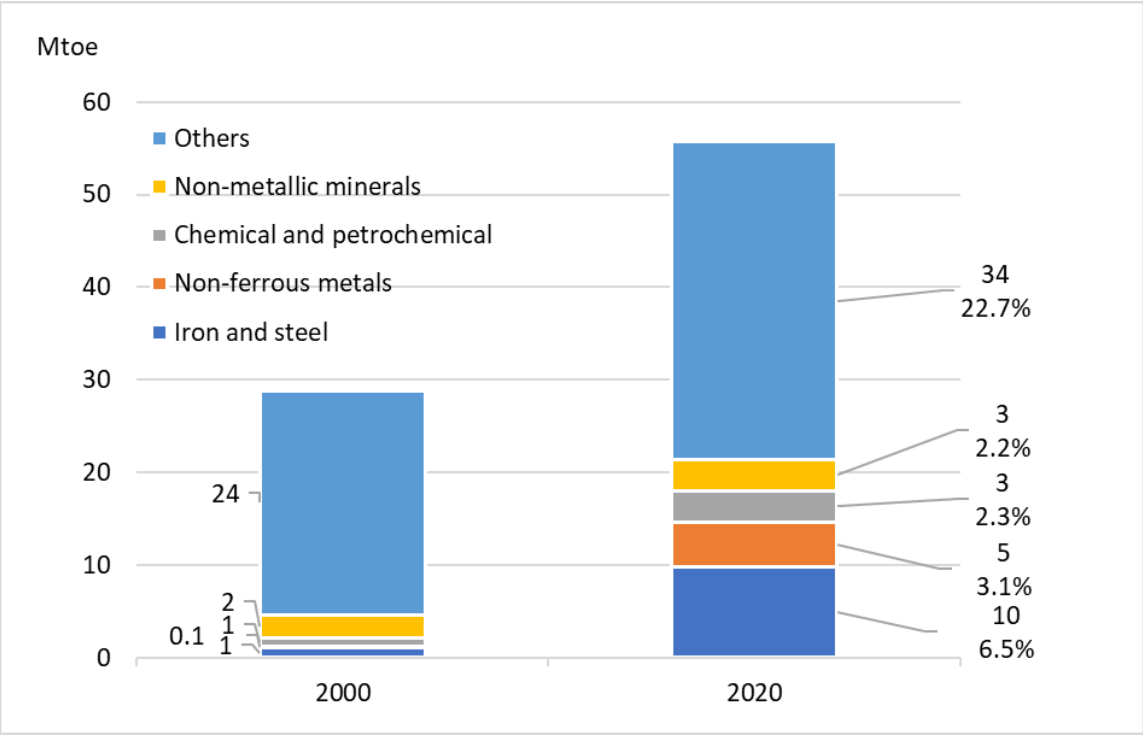


RE: renewable energy.
Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of final energy consumption by industry subsector, that of the iron and steel sector increased about 10 times from 1 Mtoe in 2000 to 10 Mtoe in 2020. In addition, the final energy consumption in the non-ferrous metals sector increased about 43 times from 0.1 Mtoe in 2000 to 5 Mtoe in 2020. In addition, the final energy consumption in the chemical and petrochemical sector increased about 3.0 times from 1 Mtoe in 2000 to 3 Mtoe in 2020. It should be noted that there is no detailed breakdown of final energy consumption by industry sector in Indonesia.

In the industry sector, the share by subsector in the final energy consumption in 2020 is 6.5% for the iron and steel sector. It is 3.1% for non-ferrous metals sector. It is 2.3% for chemical and petrochemical sector (Figure 3.10).

Figure 3.10. Final Energy Consumption Transition and Share by Industry Subsector (Indonesia: 2000 vs 2020)



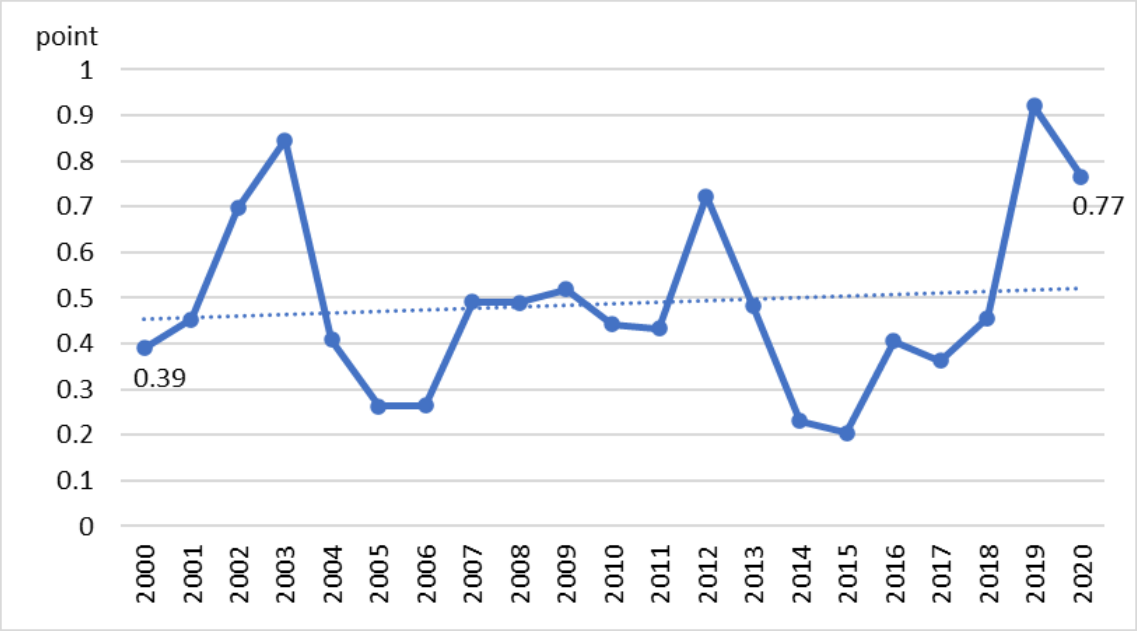
Source: IEA (2022).
Note: Totals may not match due to rounding.

Next, we consider the iron and steel subsector and the non-metallic minerals subsector, for which statistical data are available. For the non-ferrous metals subsector, statistical data on copper and aluminum production are not available. For the chemical and petrochemical subsector, statistical data on ethylene and ammonia production are also not available.

a) Iron and Steel subsector

Figure 3.11 shows the index of final energy consumption in the iron and steel subsector divided by crude steel production. The index worsened from 0.39 in 2000 to 0.77 in 2020. The index has been deteriorating, although it fluctuates from year to year.

Figure 3.11. EE&C Indicator Transition of Iron and Steel Subsector (Indonesia)

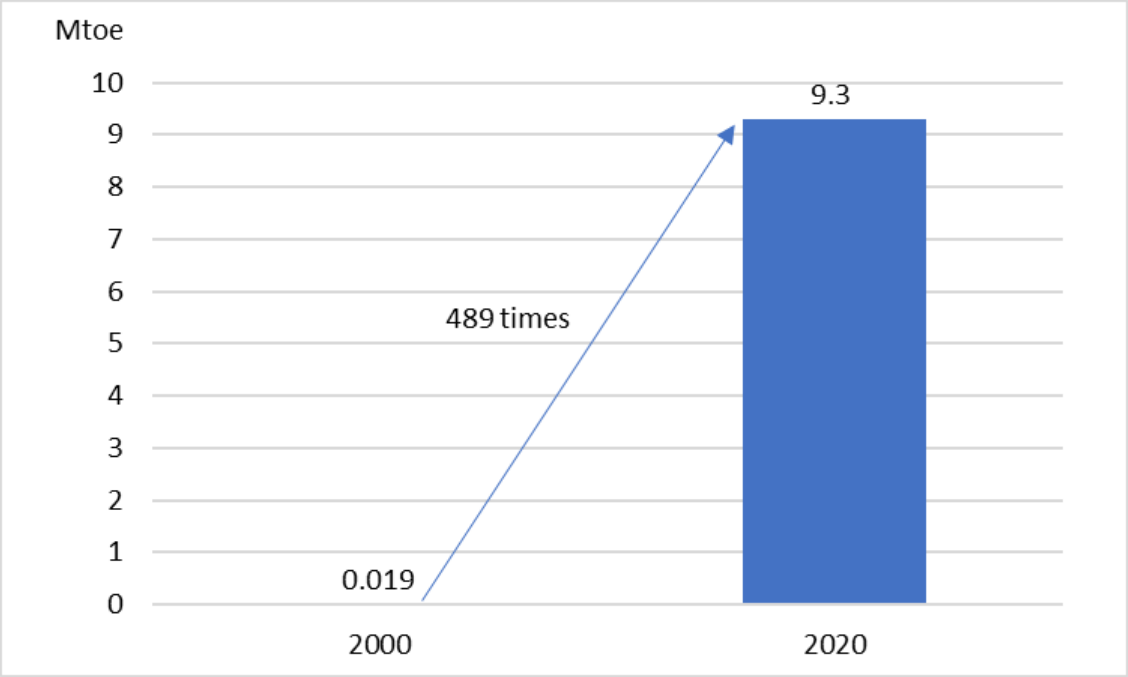


EE&C = energy efficiency and conservation.
Note: The dotted line in the graph is an approximate curve.
Source: IEA (2022) and World Steel Association.

The consumption of coal in the iron and steel subsector (6.5%), which has the largest share of energy consumption in the industry sector, increased by 489 times from 0.019 Mtoe in 2000 to 9.3 Mtoe in 2020 (Figure 3.12). This growth rate is first and prominent amongst all sectors.

One of the reasons for the sharp increase in final energy consumption in the iron and steel subsector may be related to the first blast furnace in Southeast Asia, which started operation in Java in 2013.

Figure 3.12. Final Energy Consumption Transition of Coal by Iron and Steel Subsector (Indonesia: 2000 vs 2020)

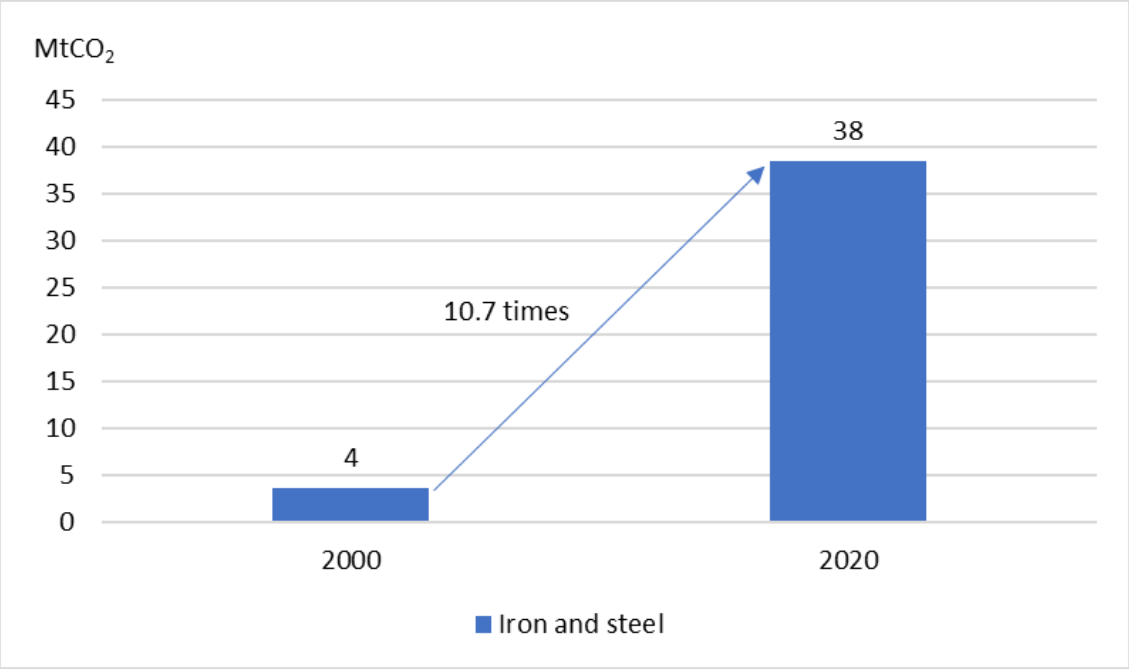


Source: IEA (2022).

In addition, the CO_2 emissions in the iron and steel subsector increased 10.7 times from 4 $MtCO_2$ in 2000 to 38 $MtCO_2$ in 2020 (Figure 3.13).

The iron and steel subsector is known for its high coal consumption. It is considered that a significant increase in the consumption of energy such as coal (by 489 times) in this subsector led to the increase of the CO_2 emissions (by 11 times).

Figure 3.13. CO_2 Emissions Transition by Iron and Steel Subsector (Indonesia: 2000 vs 2020)

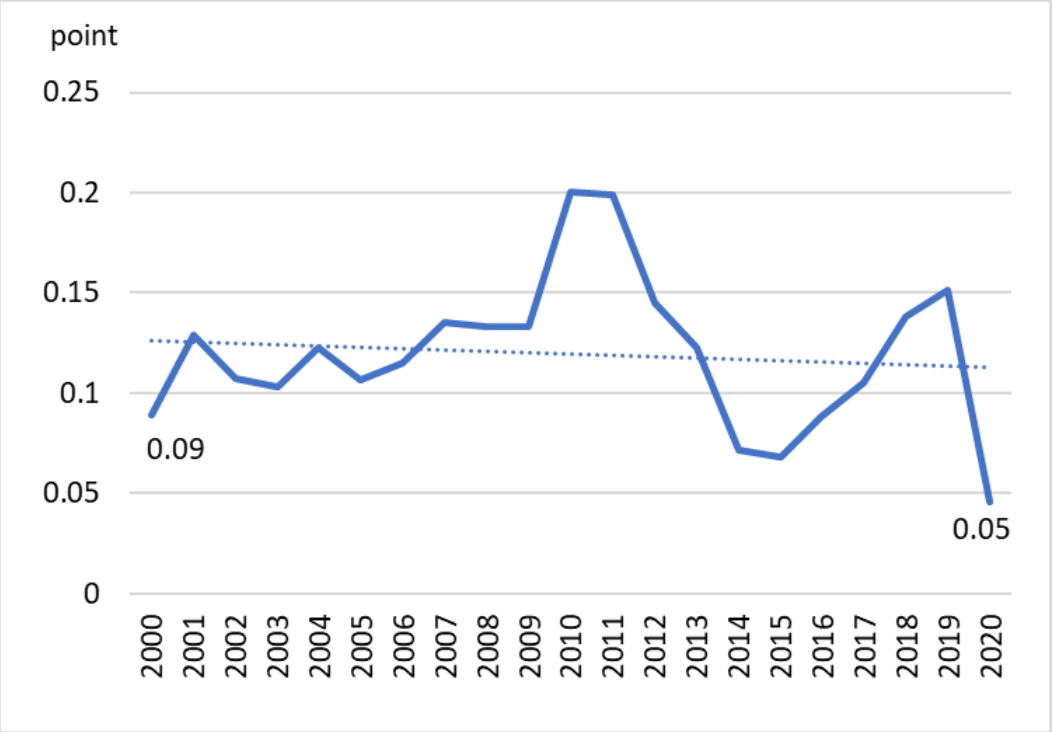


Source: IEA (2022).

b) Non-metallic minerals subsector

Figure 3.14 shows an index calculated by dividing the final energy consumption in the non-metallic minerals subsector by the cement production. The index improved from 0.09 in 2000 to 0.05 in 2020. The index has been improving, although it fluctuates from year to year.

Figure 3.14. EE&C Indicator Transition of Non-metallic Minerals Subsector (Indonesia)

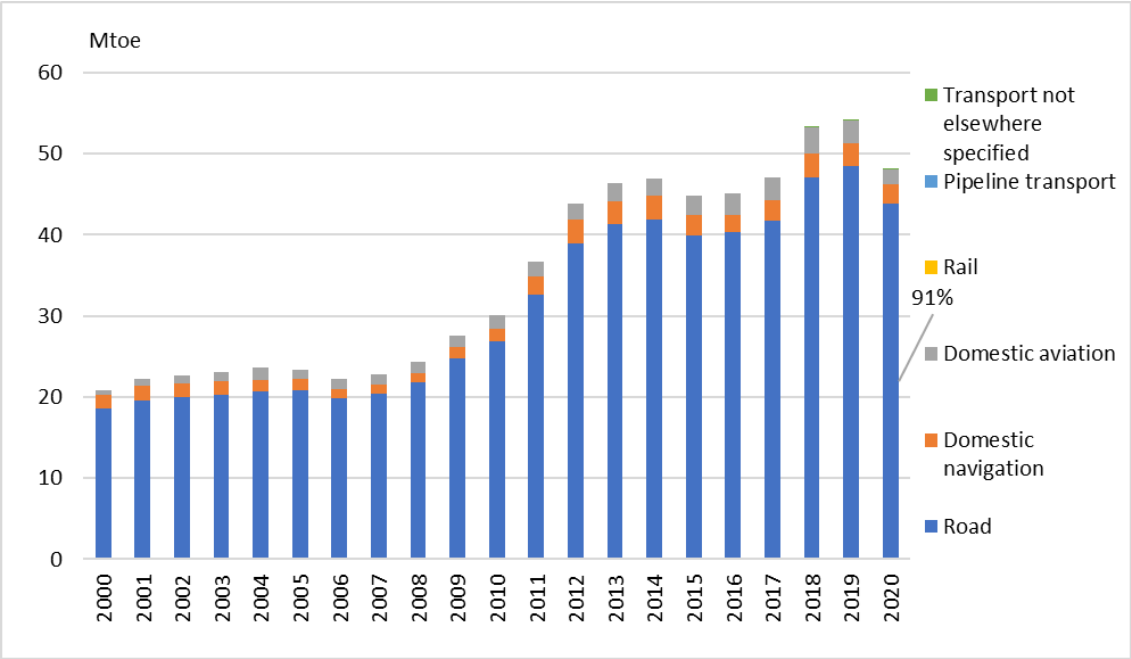


E&C = Energy efficiency and conservation.
Note: The dotted line in the graph is an approximate curve.
Source: IEA (2022) and USGS Cement Statistics and Information https://www.usgs.gov/centers/national-minerals-information-center/cement-statistics-and-information (accessed 23 May 2023).

7) Energy consumption and efficiency in the transport sector

91% of the energy consumption in the transport sector as of 2020 is represented by the road transport sector (Figure 3.15). The energy consumption in road transport rapidly increased from 2008 to 2014 and has slightly increased in recent years.

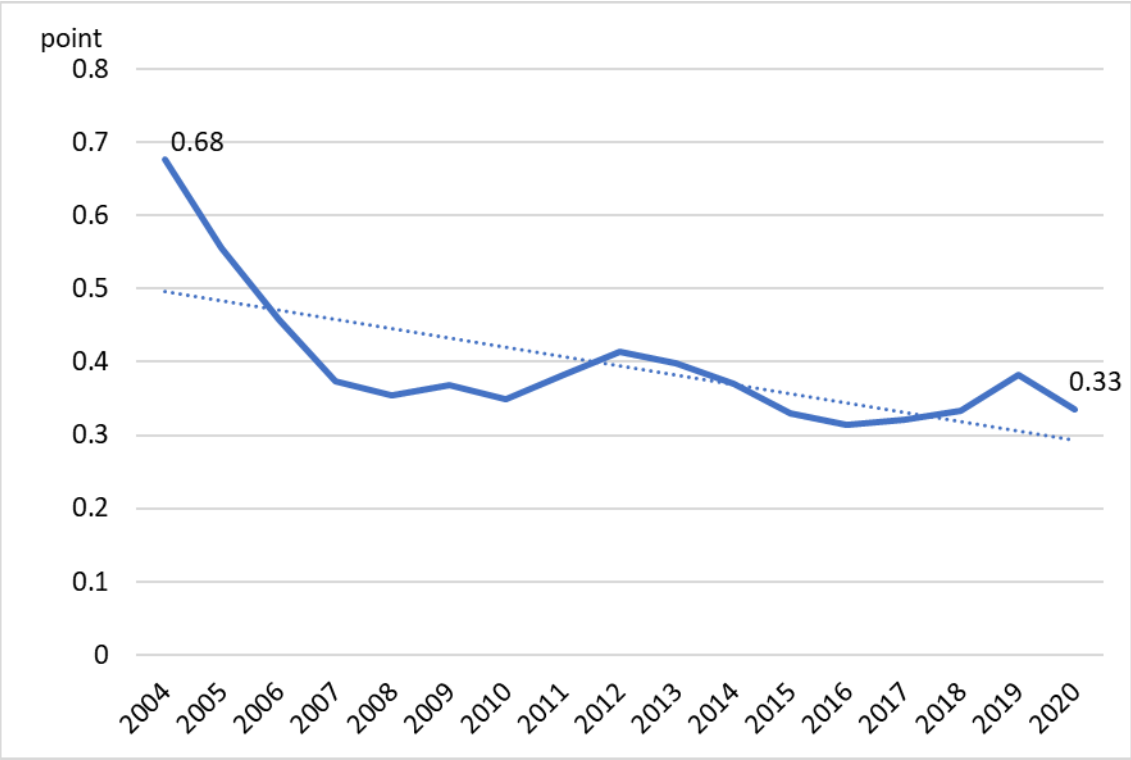
Figure 3.15. Final Energy Consumption Transition by Transport Sector (Indonesia)



Source: IEA (2022).

Next, we analyse the index obtained by dividing final energy consumption in the road transport sector by the number of registered vehicles owned. The index of 0.68 in 2000 improved to 0.33 in 2020 (Figure 3.16).

Figure 3.16. EE&C Indicator Transition of Road Sector (Indonesia)



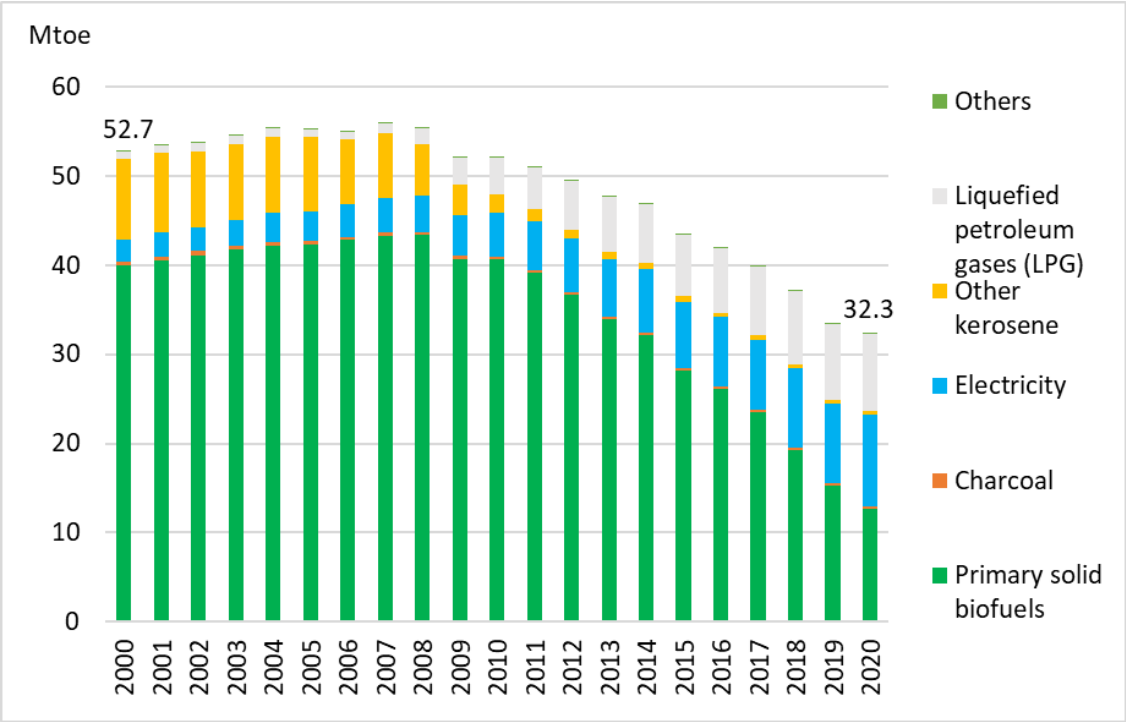
Source: IEA (2022) and ASEANStats, https://data.aseanstats.org/ (accessed 4 June 2023).

8) Energy consumption and efficiency in the residential sector

The final energy consumption in the residential sector decreased by 20.4 points from 52.7 Mtoe in 2000 to 32.3 Mtoe.

An analysis of this breakdown into traditional fuels, such as primary solid biofuels and charcoal, which are treated as carbon neutral, and modern fuels, such as liquefied petroleum gas (LPG), kerosene and electricity, shows that the traditional fuels have decreased, but the modern fuels have increased. Particularly since 2009, there has been a marked decrease in the final energy consumption of traditional fuel and a corresponding increase in that of modern fuel (Figure 3.17). It is considered that uses of electricity and LPG have increased due to improvement in living standards.

Figure 3.17. Final Energy Consumption Transition of Residential Sector (Indonesia)

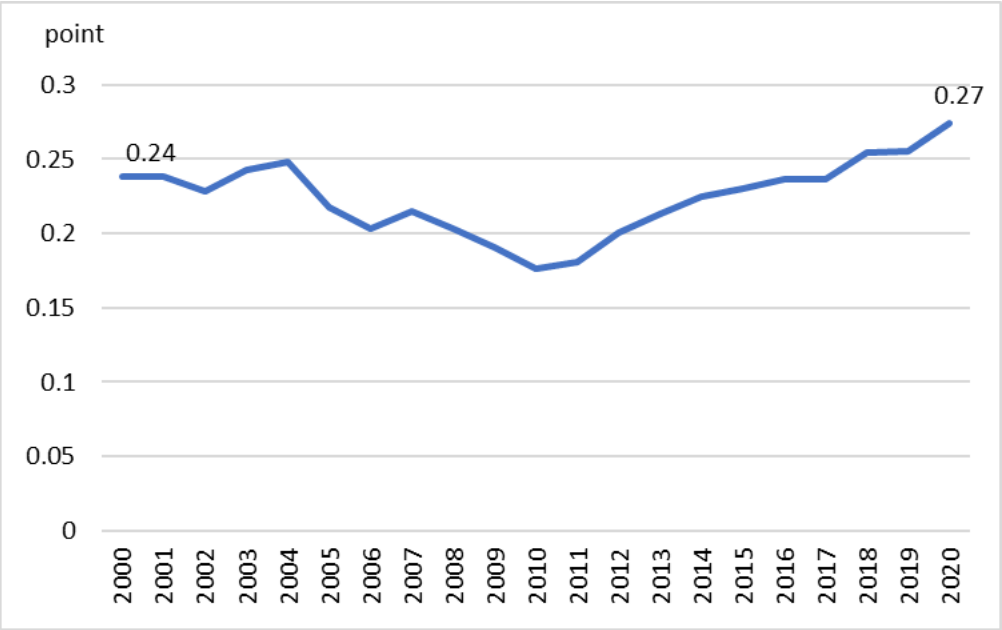


Source: IEA (2022).

Next, we analyse the index of final energy consumption of modern energy divided by the number of households. Since statistical data on the number of households in Indonesia are not confirmed, we use the deemed number of households, which is the population divided by the average number of persons per household.

Figure 3.18 shows that the indicator worsens from 0.24 in 2000 to 0.27 in 2022. The index improved from 2000 to 2010, but has deteriorated since 2011.

Figure 3.18. EE&C Indicator Transition of Residential Sector (Indonesia)



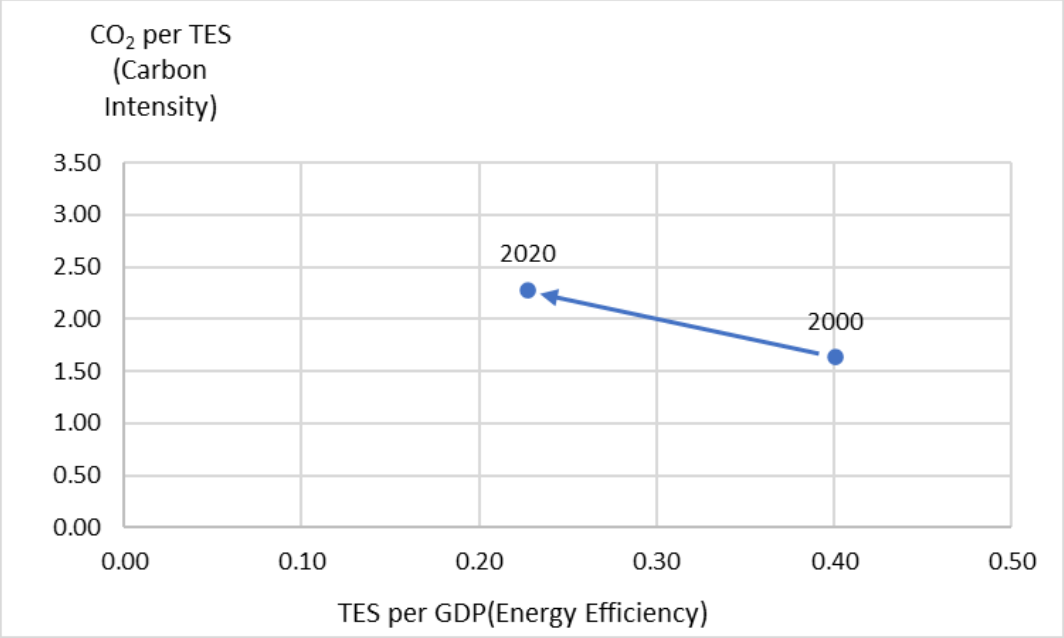
EE&C = energy efficiency and conservation.
Source: IEA (2022) and United Nations https://population.un.org/household/#/countries/ (accessed 23 May 2023).

1.2. Indicator of Energy Efficiency

1) Energy efficiency and carbon intensity

TES per GDP, a leading indicator of energy efficiency, decreased by 43% over 20 years, from 0.4 in 2000 to 0.23 in 2020. As shown in the graph below, energy conservation is making progress. On the other hand, CO_2 emissions per TES worsened from 1.64 in 2000 to 2.28 in 2020. Despite progress in energy conservation, the carbon intensity is deteriorating (Figure 3.19).

Figure 3.19. Energy Efficiency and Carbon Intensity Transition (Indonesia: 2000–20)



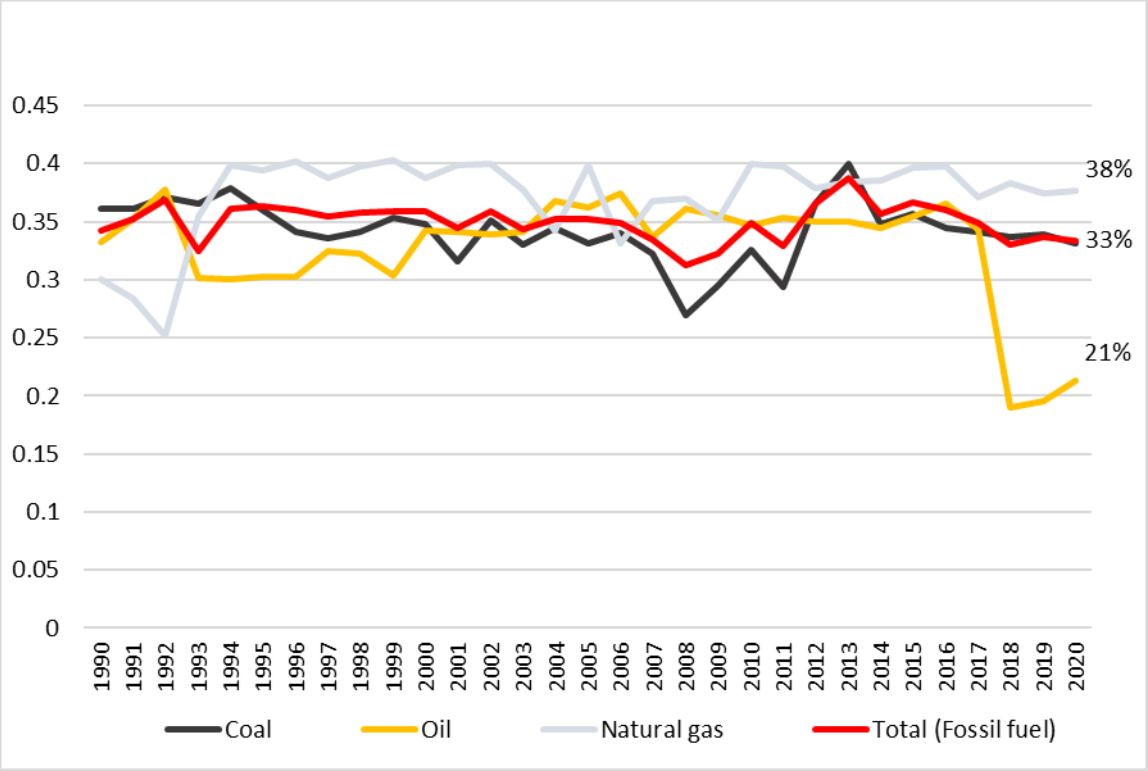
GDP = gross domestic product, TES = total energy supply.
Source: IEA (2022).

2) Power generation efficiency

Over the 20 years, the efficiency of thermal power generation (coal, oil, and natural gas) has generally remained around 35%. As of 2020, the efficiency of thermal power generation (average of coal, oil, and natural gas) is 33%.

The efficiency of coal-fired power generation over the 20-year period generally hovers around 33%, and the efficiency as of 2020 is 33% (Figure 3.20).

Figure 3.20. Thermal Efficiency Transition (Indonesia: 2000–20)



Source: IEA (2022).

1.3. Indicator of CO_2 Emissions

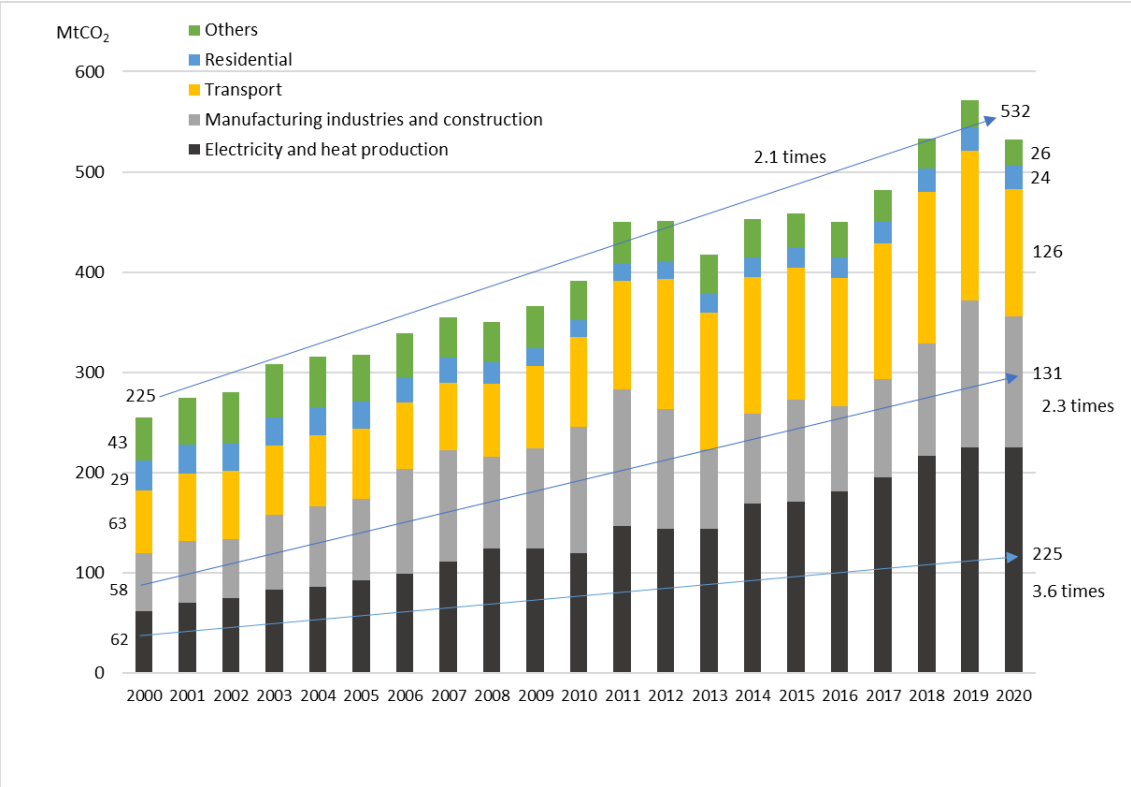
1) Transition in CO_2 emissions by sector

CO_2 emissions increased 2.1 times in 20 years, from 225 $MtCO_2$ in 2000 to 532 $MtCO_2$ in 2020.

CO_2 emissions by sector in 2020 are 225 $MtCO_2$ from the electricity and heat production sector, 131 $MtCO_2$ from the manufacturing industries and construction sector, 126 $MtCO_2$ from the transport sector, 24 $MtCO_2$ from the residential sector, and 26 $MtCO_2$ from other sectors.

Comparing CO_2 emissions over the 20-year period from 2000 to 2020, we find that the CO_2 emissions in the electricity and heat production sector increased 3.6 times from 62 $MtCO_2$ to 225 $MtCO_2$, that in the manufacturing industries and construction sector increased 2.3 times from 58 $MtCO_2$ to 131 $MtCO_2$, and that in the transport sector doubled from 63 $MtCO_2$ to 126 $MtCO_2$. The CO_2 emissions in the residential sector, on the other hand, decreased by 0.8 times, from 29 $MtCO_2$ to 24 $MtCO_2$ (Figure 3.21).

Figure 3.21. CO_2 Emissions Transition by Sector (Indonesia: 2000–20)



Source: IEA (2022).
Note: Totals may not match due to rounding.

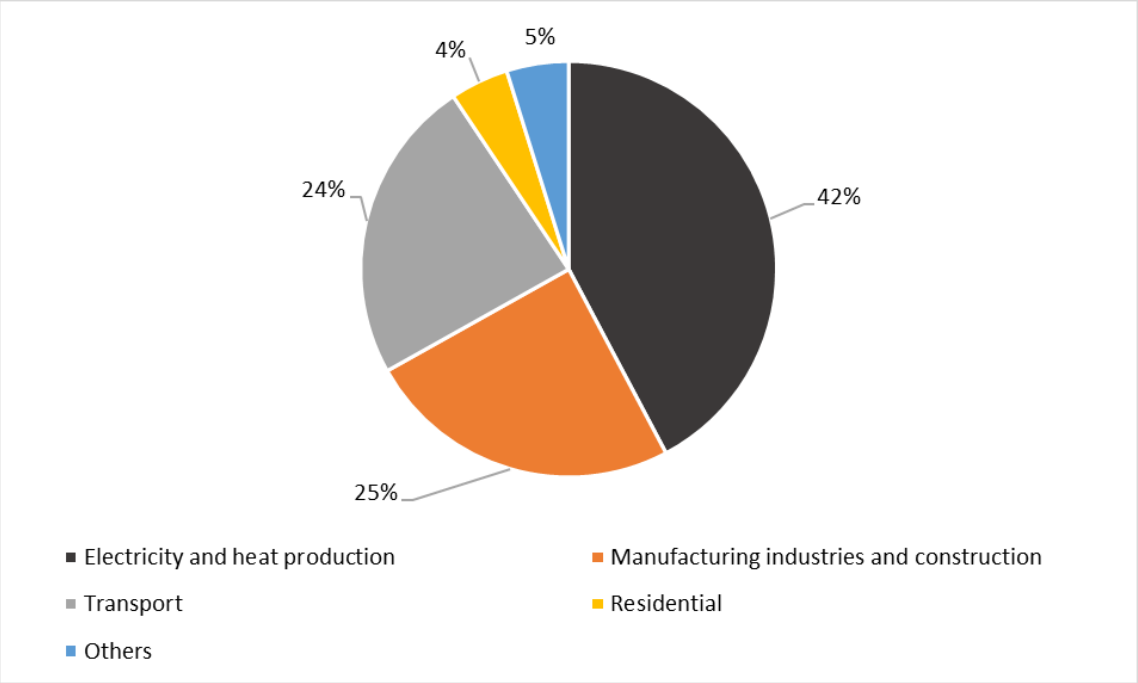
In terms of the share of CO_2 emissions by sector in 2020, the electricity and heat production sector are in first place (42%), followed by the manufacturing industries and construction sector (25%), the transport sector (24%), the residential sector (5%), and others (5%) (Figure 3.22).

In the electricity and heat production sector, the share of power generation from fossil fuels (oil, coal, and natural gas) is high, especially the share of coal-fired power generation (42%). In addition, coal-fired power generation efficiency (33%) is low compared to the OECD average (39%), suggesting that coal accounts for a large portion of CO_2 emissions from the electricity and heat production sector.

The manufacturing industries and construction sector, such as the iron and steel subsector, is energy-intensive and CO_2 emissions from coal-intensive sectors may be increasing.

In the transport sector, CO_2 emissions from automobiles are expected to increase due to the progress of motorisation.

Figure 3.22. CO_2 Emissions by Sector (Indonesia: 2020)



Source: IEA (2022).

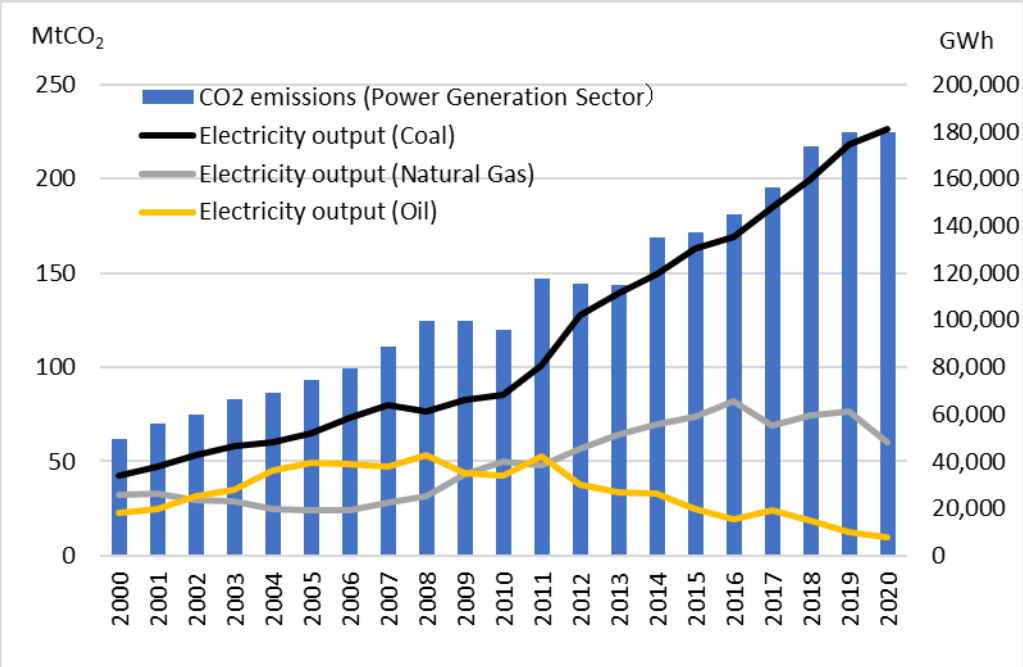
2) CO_2 emissions and coal-fired power generation

We analysed the relationship between the amount of thermal power generation of fossil fuels (oil, coal, and natural gas), which are closely related to CO_2 emissions, and CO_2 emissions from the electricity and heat production sector.

A graph of CO_2 emissions from the electricity and heat production sector versus oil-, coal-, and natural gas-fired power generation over a 20-year period is shown in Figure 3.23.

The graph indicates a strong correlation between CO_2 emissions and coal-fired power generation in the electricity and heat production sector in Indonesia.

Figure 3.23. Transition between CO_2 Emissions in Electricity Sector and Coal, Natural Gas, and Oil Electricity Output (Indonesia: 2000–20)



Source: IEA (2022).

1.4. Summary of Efficiency Indicators

Table 3.1 summarises Indonesia's energy efficiency indicator.

The major difference over the 20 years is that TES per GDP and the EE&C indicator of road transport have improved, but the EE&C indicator of the iron and steel subsector has worsened significantly.

Table 3.1. Summary of Energy Efficiency Indicator (Indonesia)

Energy Efficiency Indicator	Viet Nam		
	2000	2020	
TES per GDP	0.31	0.30	Improve
EE&C Indicator of Iron and Steel Sector	0.17	0.39	Worsen
EE&C Indicator of Non-metallic minerals Sector	0.09	0.12	Worsen
EE&C Indicator of Road Transport Sector	11.61	2.53	Improve
EE&C Indicator of Residential Sector	0.11	0.29	Worsen
Thermal Efficiency (Fossil fuel-fired)	0.29	0.34	Improve
Thermal Efficiency (Coal-fired)	0.23	0.31	Improve

EE&C = energy efficiency and conservation, GDP = gross domestic product, TES = total energy supply.
Source: Author.

1.5. Energy Efficiency Policy

Energy conservation policy in Indonesia started in 1982. Indonesia will reduce its energy elasticity below 1 by 2025 and reduce its final energy intensity by 1% annually by 2025. To achieve this goal, energy savings have been identified as follows: 15%–30% for industry, 25% for commercial buildings and 10%–30% for homes. The government will grant incentives to energy users and manufacturers of energy-saving equipment who consume more than 6,000 toe per year if they succeed in saving energy for a certain period. In addition, energy users with more than 6,000 toe per year have various obligations such as appointing an energy manager, formulating an energy conservation plan, and preparing an annual report on energy conservation.

1.6. CO_2 Emissions Reduction Policy

In its updated nationally determined contribution (NDC) and long-term strategy submitted to the United Nations Framework Convention on Climate Change in July 2021, Indonesia stated that it would reduce greenhouse gas (GHG) emissions to net zero by 2060.

The updated NDC aims to reduce GHG emissions by 29% (unconditional) and by 41% (conditional) using international assistance.

Indonesia will advance GHG reduction in the energy sector through promotion of renewable energy, energy efficiency, low-carbon emissions fuels, clean coal technology and gas-fired power generation.

Specifically, it will improve energy efficiency in the industrry, commercial, transport and residential sectors through the introduction of various devices including electric vehicles and their ecosystems, clean coal technology such as supercritical coal-fired power plants, renewable energy such as geothermal, hydro, solar, wind, biomass, and biofuels. In the transport sector, biofuels based on palm oil will be introduced.

Perusahaan Listrik Negara (PLN), Indonesia's state-owned power company, will not build any new coal-fired power plants in the future and will phase them out by 2056.

To promote the shift from coal-fired power generation to renewable and other clean energy sources, Indonesia entered into a partnership with the Asian Development Bank (ADB) in November 2021.

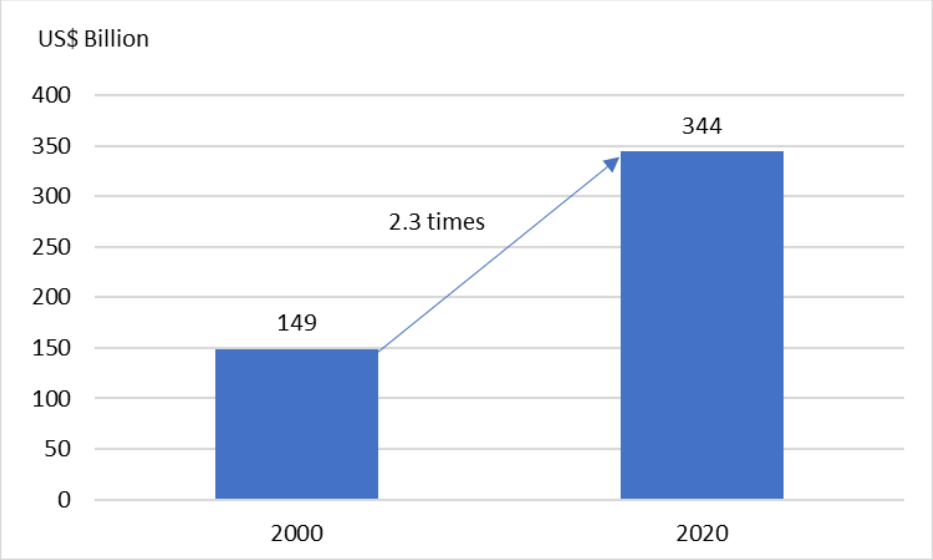
2. Malaysia

2.1. Indicators of Energy Consumption

1) Transition in GDP

Malaysia's GDP grew 2.3 times in 20 years, from $149 billion in 2000 to $344 billion in 2020 (Figure 3.24).

Figure 3.24. Malaysia GDP 2000 vs 2020 (2015 prices and ex rate)



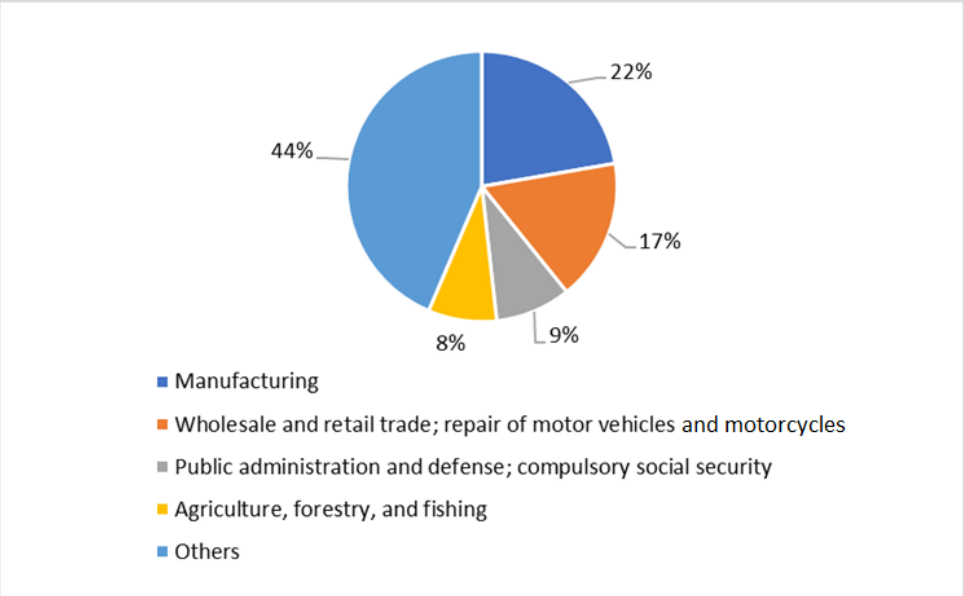
Source: IEA (2022).

2) GDP by sector and changes in industrial structure

In terms of the share of GDP by sector in 2020, the manufacturing sector is in first place (22%), followed by the wholesale and retail trade; repair of motor vehicles and motorcycles (17%), the public administration and defense; compulsory social security (9%), and agriculture, forestry, and fishing (8%) (Figure 3.25).

Malaysia's economy has shifted from its previous focus on agriculture, such as natural rubber and palm oil, to manufacturing (electrical equipment) and other high-tech industries.

Figure 3.25. Malaysia GDP by Sector at Current Market Prices (2020)



GDP = gross domestic product.
Source: ADB (2022).

3) Transition of TES by energy type

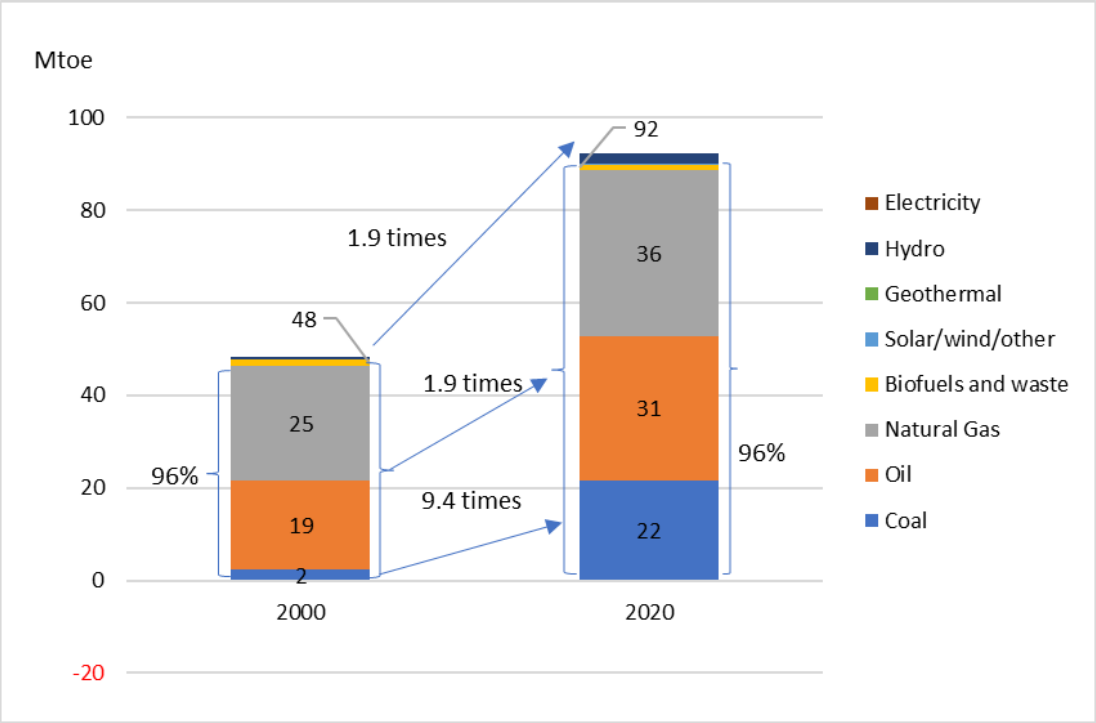
In 20 years, TES increased by 1.9 times from 48 Mtoe in 2000 to 92 Mtoe in 2020.

Of that amount, TES of fossil fuels (oil, coal, and natural gas) increased by 1.9 times from 46 Mtoe in 2000 to 89 Mtoe in 2020. Focusing on TES of fossil fuels by energy, TES of oil and natural gas increased 1.6 and 1.5 times, respectively, while TES of coal, which has a particularly high CO_2 emissions factor, increased significantly by 9.4 times, from 2 Mtoe in 2000 to 22 Mtoe in 2020.

For non-fossil fuels, hydro TES increased by 3.8 times, while biofuels and waste TES decreased by 0.9 times.

Fossil fuel dependence (the percentage of oil, coal, and natural gas in the total) remained high, remaining constant at 96% from 2000 to 2020 (Figure 3.26).

Figure 3.26. TES by Energy Type (Malaysia: 2000 vs 2020)



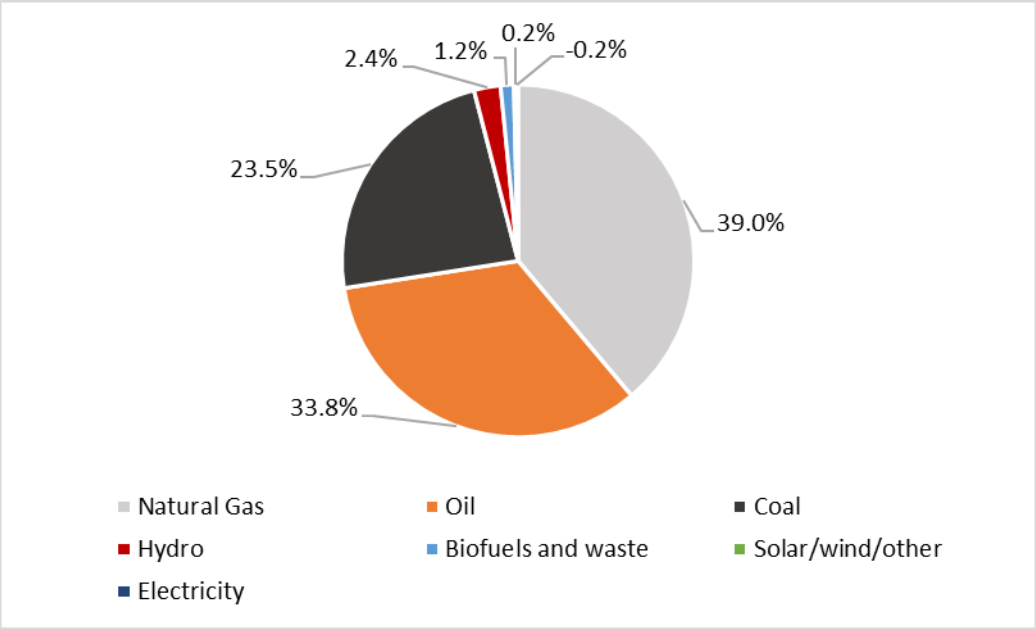
TES = total energy supply.
Note: Totals may not match due to rounding.
Source: IEA (2022).

The share of TES in 2020 by energy source is natural gas (39%) in first place, oil (33.8%) in second, coal (23.5%) in third, followed by hydropower (2.4%), biofuels and waste (1.2%), and solar, wind, and others (0.2%).

Fossil fuels, with a TES share of 96%, account for much of the TES. Natural gas has the highest share (39%), followed by oil (33.8%), and coal (29.3%), which has a high CO_2 emissions factor.

On the other hand, the TES share of non-fossil fuels (biofuels and waste, geothermal, hydro, and solar/wind/other) is about 4%. The share of solar, wind, and other is extremely small at 0.2% (Figure 3.27).

Figure 3.27. TES Share by Energy (Malaysia: 2020)

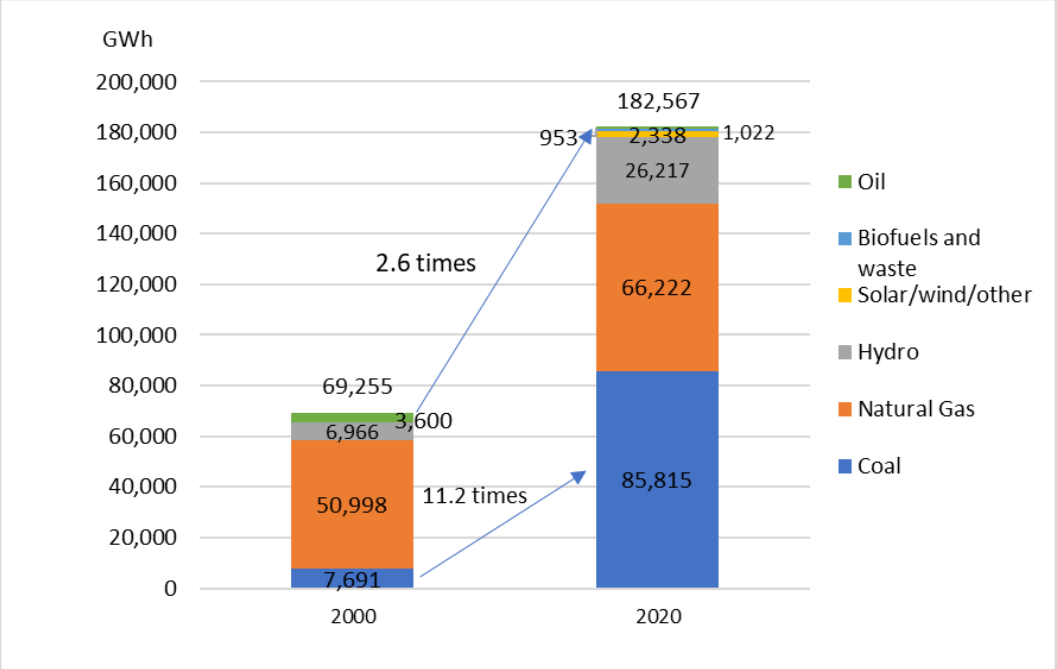


Source: IEA (2022).

4) Transition of power generation by fuel

Over a period of 20 years, power generation increased by 2.6 times from 69,255 GWh in 2000 to 182,567 GWh in 2020. In terms of power generation by fuel in 2020, coal comes in first (85,815 GWh), natural gas second (66,222 GWh), hydro third (26,217 GWh), followed by solar, wind and other (2,338 GWh), biofuels and waste (1,022 GWh) and oil (953 GWh). Power generation from coal, which has a high CO_2 emissions factor, increased 11.2 times from 7,691 GWh in 2000 to 85,815 GWh in 2020 (Figure 3.28).

Figure 3.28. Electricity Output by Fuel (Malaysia: 2000 vs 2020)



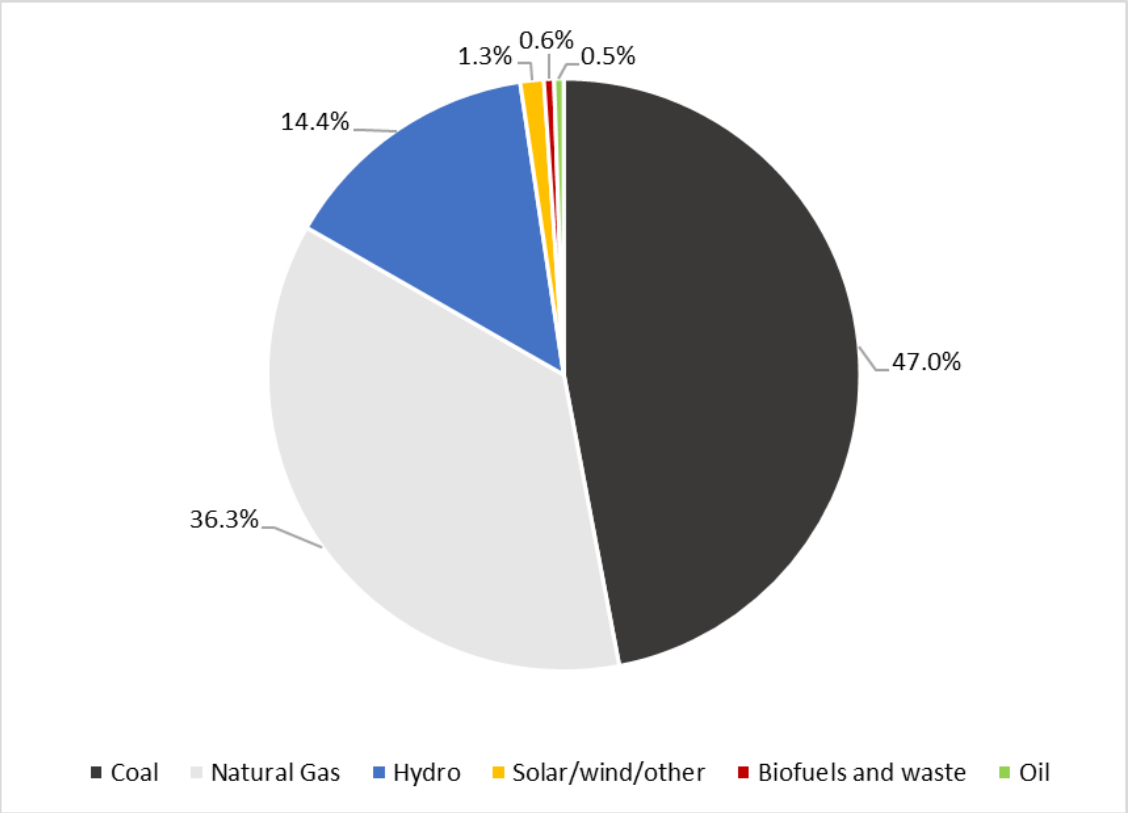
Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of share of power generation by fuel in 2020, coal ranks first (47.0%), natural gas second (36.3%), hydro third (14.4%), followed by solar, wind, and other (1.3%), biofuels and waste (0.6%), and oil (0.5%).

Fossil fuels account for most of the share of power generation, at 83.8%. Coal, which has a particularly high CO_2 emissions factor, tops the list with a 47% share.

On the other hand, the TES share of non-fossil fuels (biofuels and waste, geothermal, hydro, and solar/wind/other) is 16.2%. The breakdown is as follows: 14.4% for hydro, 1.3% for solar, wind, and other, and 0.6% for biofuels and waste (Figure 3.29).

Figure 3.29. Electricity Output Share by Fuel (Malaysia: 2020)



Source: IEA (2022).

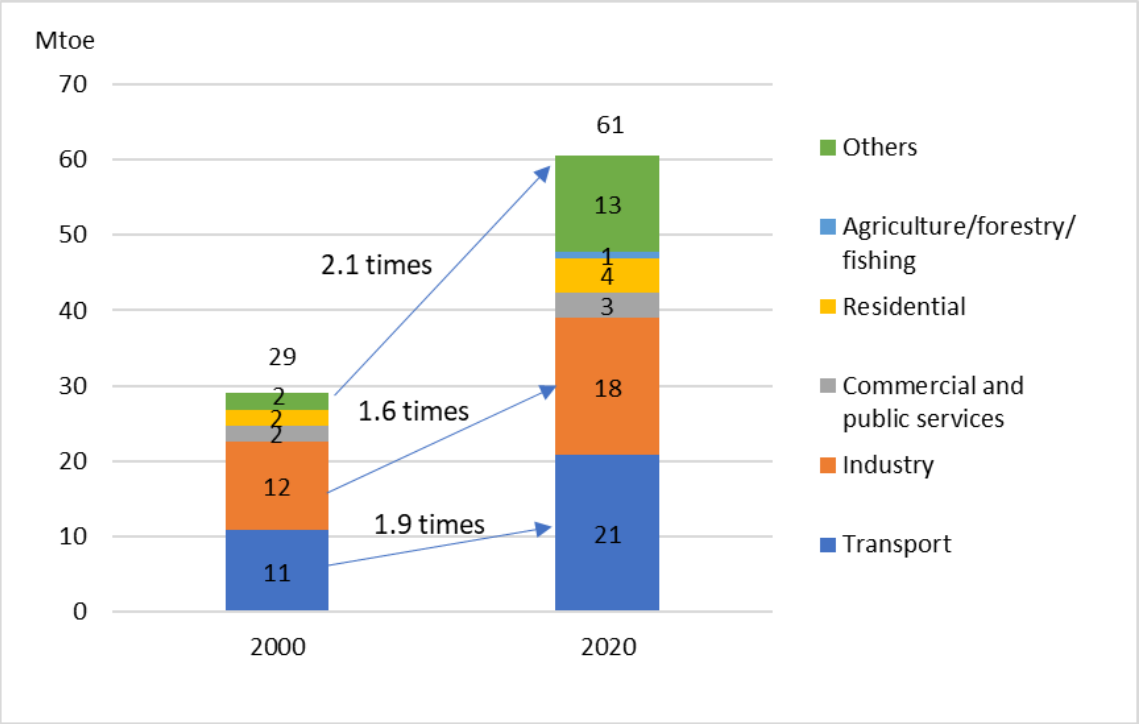
5) Transition of final energy consumption by sector

In 20 years, final energy consumption increased by 2.1 times from 29 Mtoe in 2000 to 61 Mtoe in 2020. In terms of final energy consumption by sector in 2020, the transport sector ranks first (21 Mtoe), followed by the manufacturing industries and construction sector (18 Mtoe), the residential sector (4 Mtoe), the commercial and public services sector (3 Mtoe), the agriculture, forestry, and fishing sector (1 Mtoe) and others (13 Mtoe).

The final energy consumption in the industry sector increased 1.6 times from 12 Mtoe in 2000 to 18 Mtoe in 2020. In the transport sector, the final energy consumption increased 1.9 times from 11 Mtoe in 2000 to 21 Mtoe in 2020. The final energy consumption in the residential sector increased 2.2 times from 2 Mtoe in 2000 to 4 Mtoe in 2020 (Figure 3.30).

The industry sector's final energy consumption has been growing with the progress of industrialisation. The final energy consumption in the transport sector has also been growing with the development of motorisation.

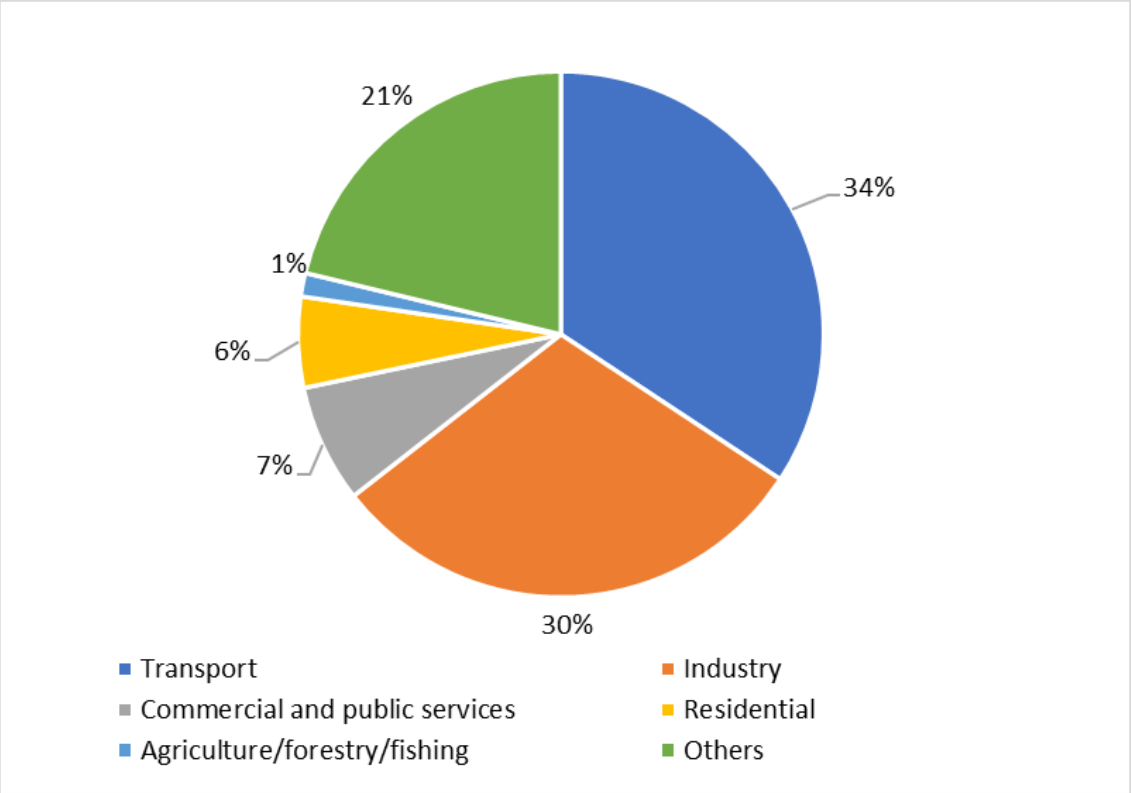
Figure 3.30. Final Energy Consumption (Malaysia: 2000 vs 2020)



Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of the share of final energy consumption by sector in 2020, the transport sector ranked first (34%), followed by the industry sector (30%), the commercial and public services sector (7%), the residential sector (6%), the agriculture, forestry, and fishing sector (1%), and others (21%) (Figure 3.31).

Figure 3.31. Final Energy Consumption Share by Sector (Malaysia: 2020)



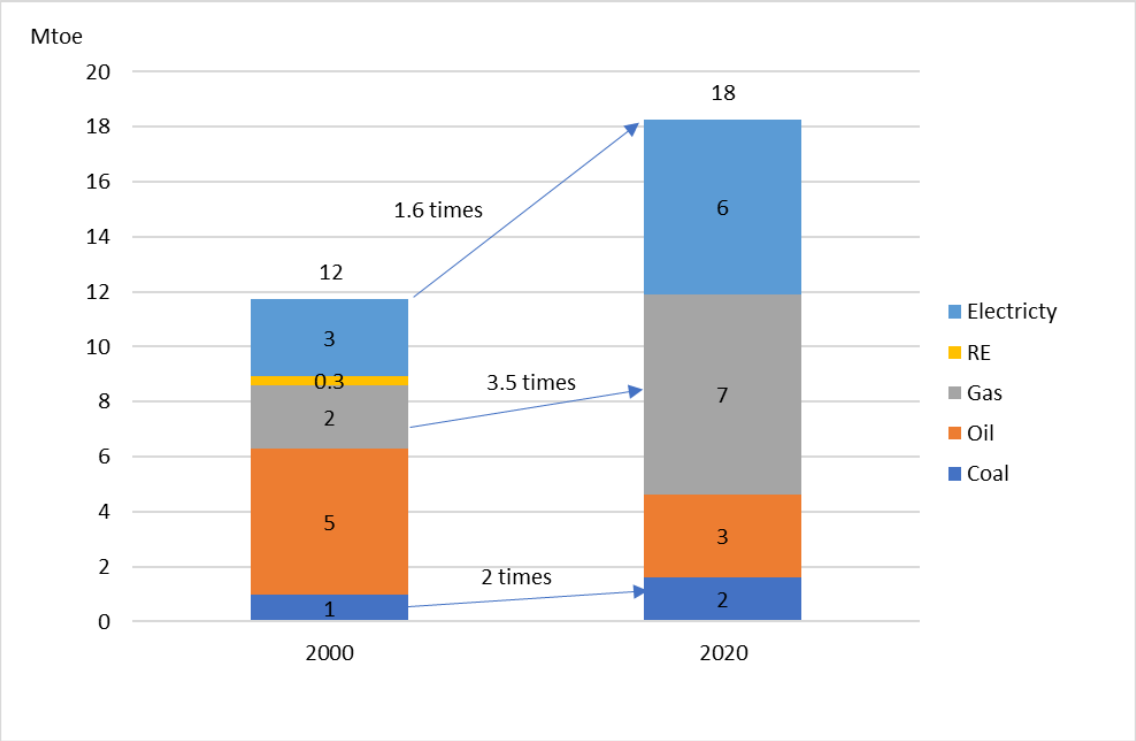
Source: IEA (2022).

6) Energy consumption and efficiency in the industry sector

The final energy consumption in the industry sector increased 1.6 times from 12 Mtoe in 2000 to 18 Mtoe in 2020.

In particular, the final energy consumption of coal doubled from 1 Mtoe in 2000 to 2 Mtoe in 2020. The final energy consumption of natural gas also increased 3.5 times from 2 Mtoe in 2000 to 7 Mtoe in 2020 (Figure 3.32).

Figure 3.32. Final Energy Consumption Transition by Energy (Malaysia: 2000 vs 2020)



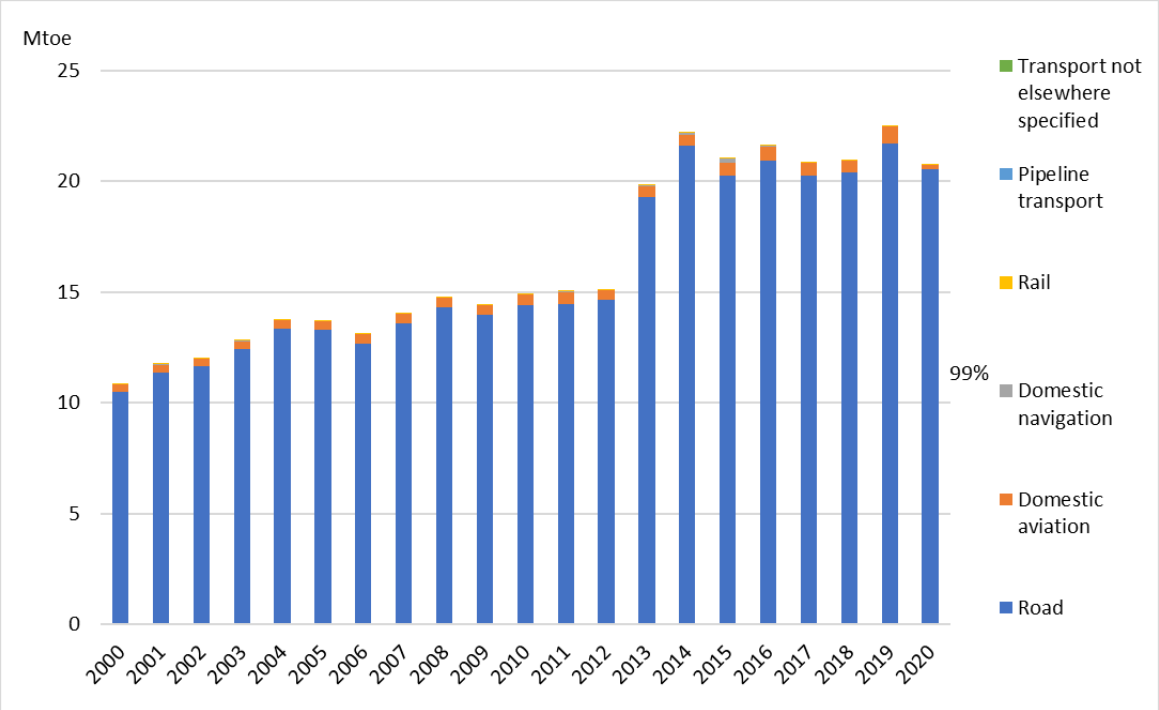
RE = renewables.
Source: IEA (2022).
Note: Totals may not match due to rounding.

In the IEA World Energy Balance 2022, subsector data of final energy consumption in the industry sector is not available for Malaysia.

7) Energy consumption and efficiency in the transport sector

99% of the energy consumption in the transport sector as of 2020 is represented by the road transport sector (Figure 3.33). The energy consumption in the road transport sector has continued to rapidly increase since 2013 and has remained almost flat in recent years.

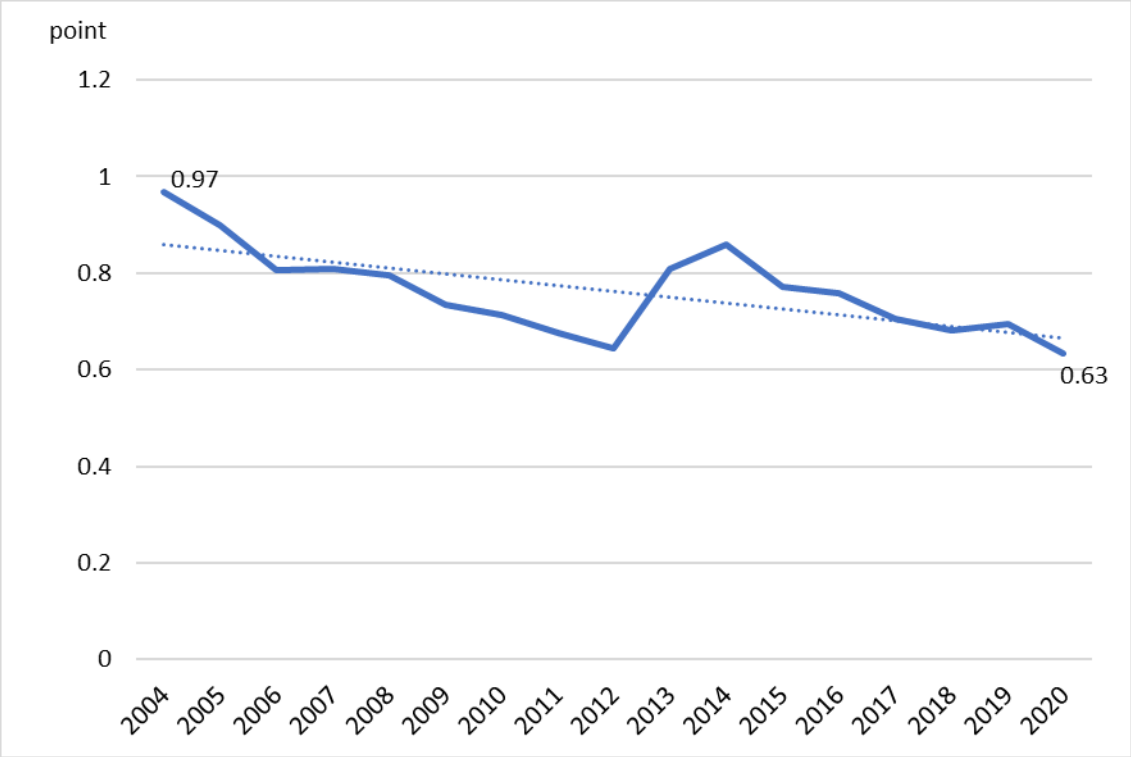
Figure 3.33. Final Energy Consumption Transition by Transport Sector (Malaysia)



Source: IEA (2022).

Next, we analyse the index obtained by dividing final energy consumption in the road transport sector by the number of registered vehicles owned. The indicator of 0.97 in 2000 improved to 0.63 in 2020 (Figure 3.34).

Figure 3.34. EE&C Indicator Transition of Road Sector (Malaysia)



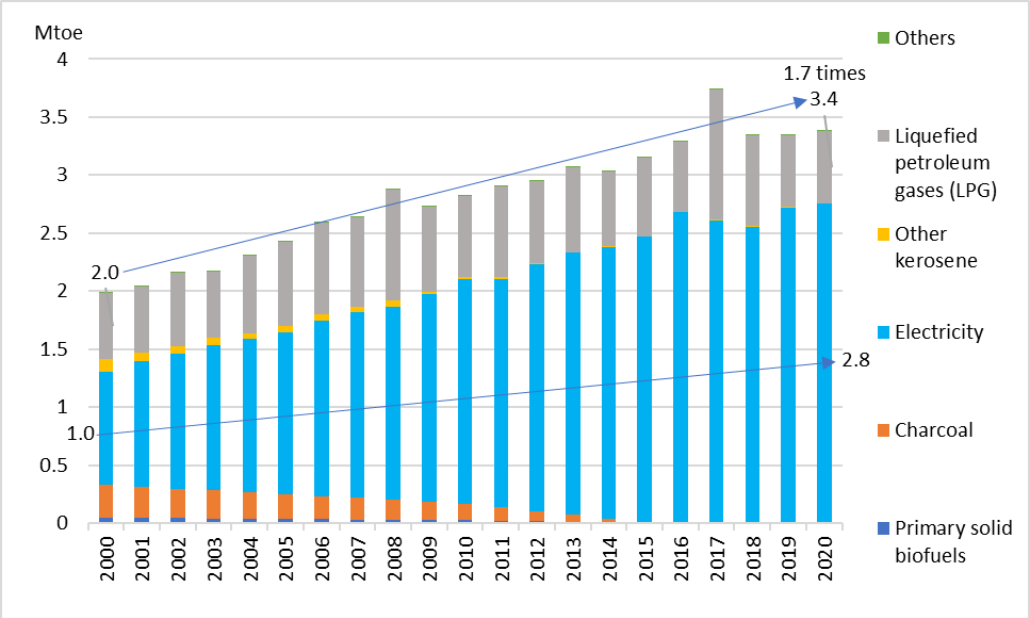
EE&C = energy efficiency and conservation.
Source: IEA (2022) and ASEANStats, https://data.aseanstats.org/ (accessed 4 June 2023).

8) Energy consumption and efficiency in the residential sector

The final energy consumption in the residential sector increased 1.7 times from 2.0 Mtoe in 2000 to 3.4 Mtoe.

The final energy consumption of traditional fuel such as charcoal has decreased and almost become zero, while that of modern fuel such as electricity and LPG has increased. In particular, the final energy consumption of electricity increased by 2.8 times in 20 years (Figure 3.35).

Figure 3.35. Final Energy Consumption Transition of Residential Sector (Malaysia)

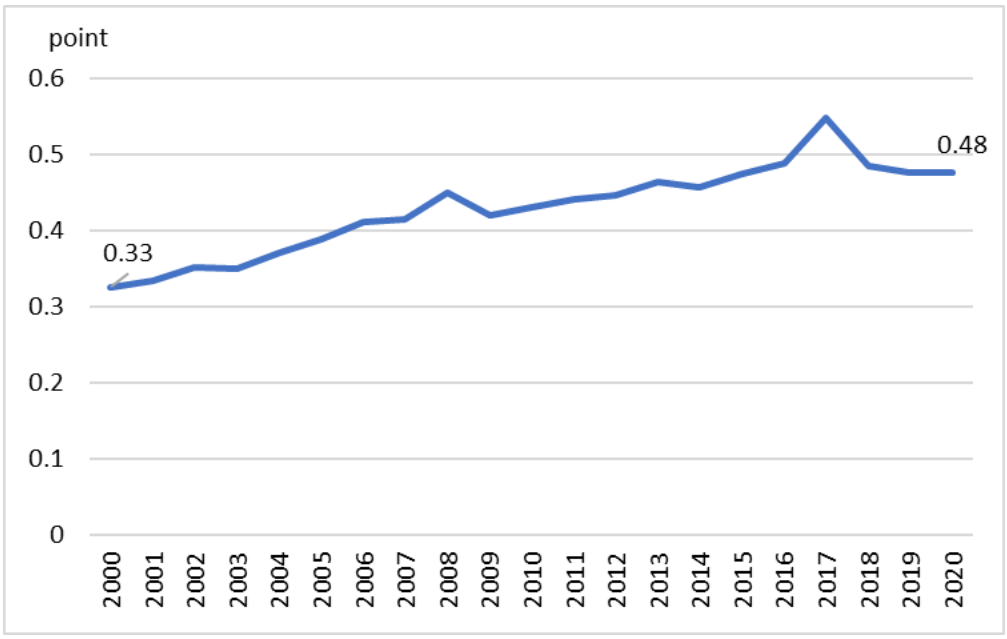


Source: IEA (2022).

Next, we analyse the indicator of final energy consumption of modern energy, such as electricity and LPG, divided by the number of households. Since statistical data on the number of households in Malaysia are not confirmed, we use the deemed number of households, which is the population divided by the average number of persons per household.

Figure 3.36 shows that the indicator worsens from 0.33 in 2000 to 0.48 in 2022.

Figure 3.36. EE&C Indicator Transition of Residential Sector (Malaysia)



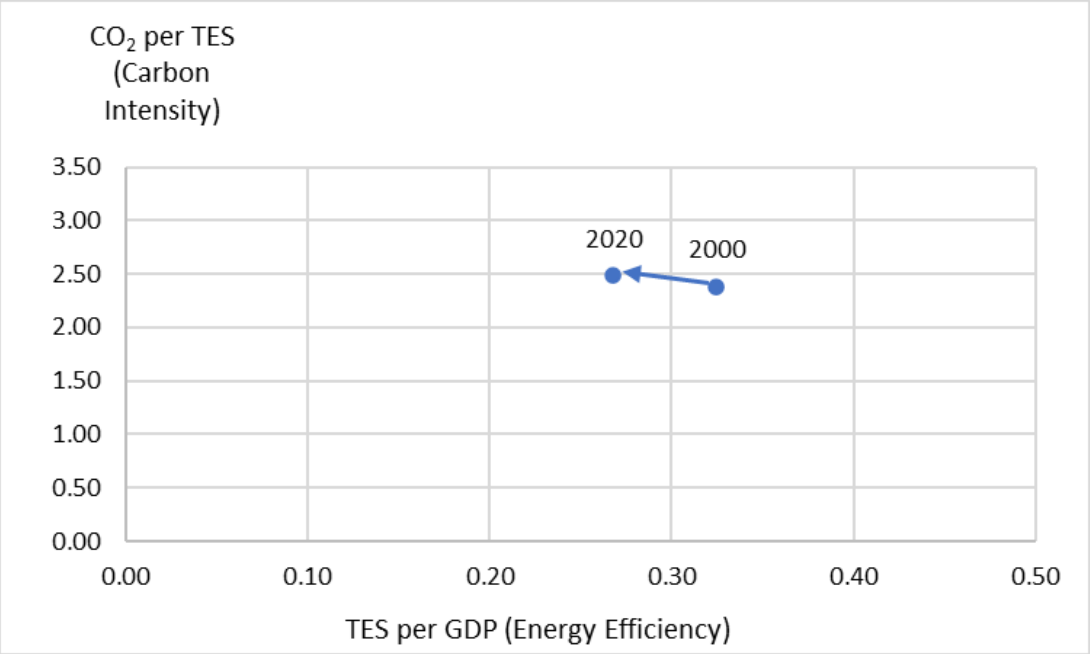
EE&C = energy efficiency and conservation.
Source: IEA (2022) and United Nations https://population.un.org/household/#/countries/ (accessed 23 May 2023).

2.2. Indicator of Energy Efficiency

1) Energy efficiency and carbon intensity

TES per GDP, a leading indicator of energy efficiency, decreased by 16% over 20 years, from 0.32 in 2000 to 0.27 in 2020. As shown in the graph below, energy conservation is making progress. On the other hand, CO_2 emissions per TES worsened from 2.38 in 2000 to 2.48 in 2020. Despite progress in energy conservation, the carbon intensity is deteriorating (Figure 3.37).

Figure 3.37. Energy Efficiency and Carbon Intensity Transition (Malaysia: 2000–20)



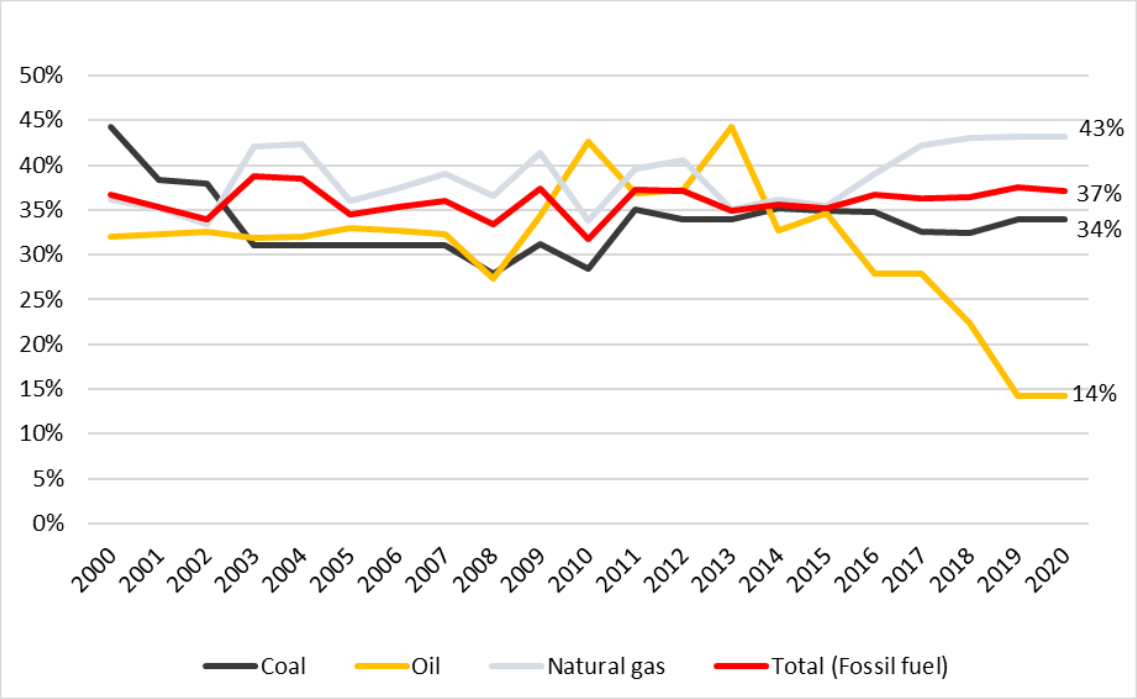
GDP = gross domestic product, TES = total energy supply.
Source: IEA (2022).

2) Power generation efficiency

Over the 20 years until 2020, the efficiency of thermal power generation (coal, oil, and natural gas) has generally remained around 36%. As of 2020, the efficiency of thermal power generation (average of coal, oil, and natural gas) is 37%.

The efficiency of coal-fired power generation over the 20-year period generally hovers around 34%, and the efficiency as of 2020 is 34% (Figure 3.38).

Figure 3.38. Thermal Efficiency Transition (Malaysia: 2000–20)



Source: IEA (2022).

2.3. Indicator of CO_2 Emissions

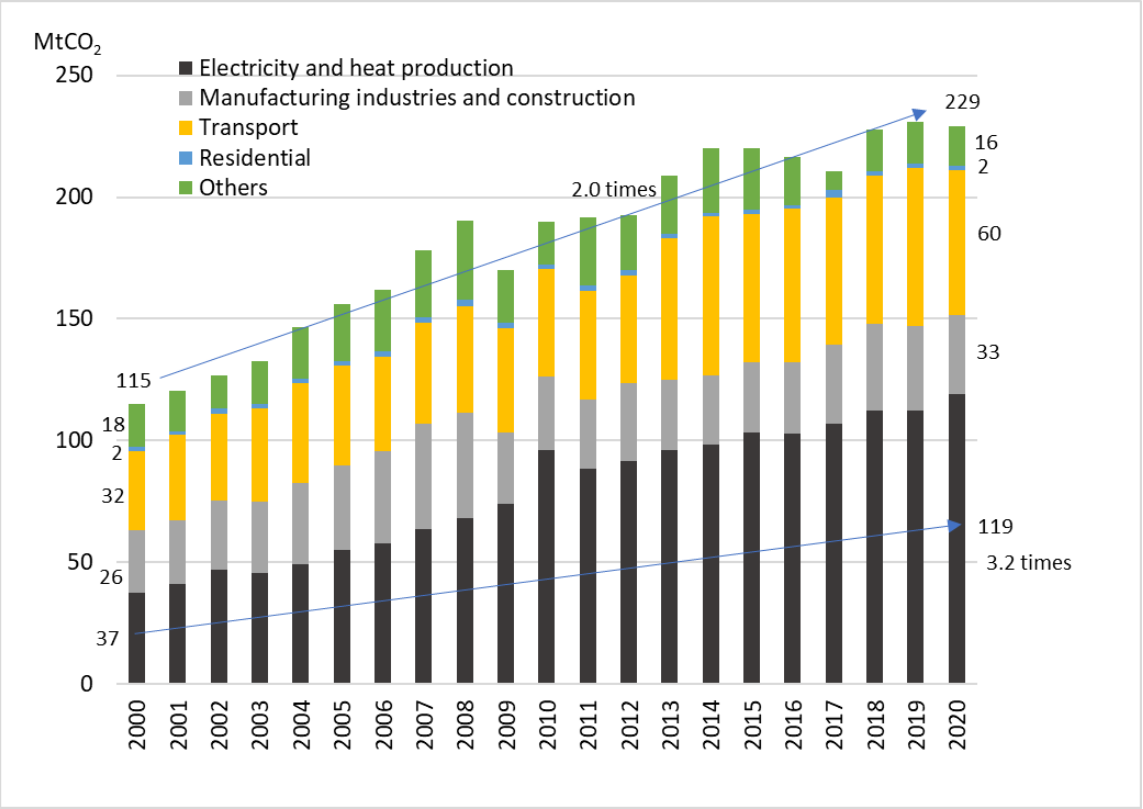
1) Transition in CO_2 emissions by sector

CO_2 emissions increased 2.0 times in 20 years, from 115 $MtCO_2$ in 2000 to 229 $MtCO_2$ in 2020.

CO_2 emissions by sector in 2020 are 119 $MtCO_2$ in the electricity and heat production sector, 60 $MtCO_2$ in the transport sector, 33 $MtCO_2$ in the manufacturing industries and construction sector, 2 $MtCO_2$ in the residential sector, and 16 $MtCO_2$ in the others.

Comparing CO_2 emissions over the 20-year period from 2000 to 2020, we find that the CO_2 emissions in the electricity and heat production sector increased 3.2 times from 37 $MtCO_2$ to 119 $MtCO_2$, that in the manufacturing industries and construction sector increased 1.3 times from 26 $MtCO_2$ to 33 $MtCO_2$, and that in the transport sector increased 1.8 times from 32 $MtCO_2$ to 60 $MtCO_2$. Meanwhile, CO_2 emissions from the residential sector decreased by 0.9 times rom 2 $MtCO_2$ in 2000 to 2 $MtCO_2$ in 2020 (Figure 3.39).

Figure 3.39. CO_2 Emissions Transition by Sector (Malaysia: 2000–20)



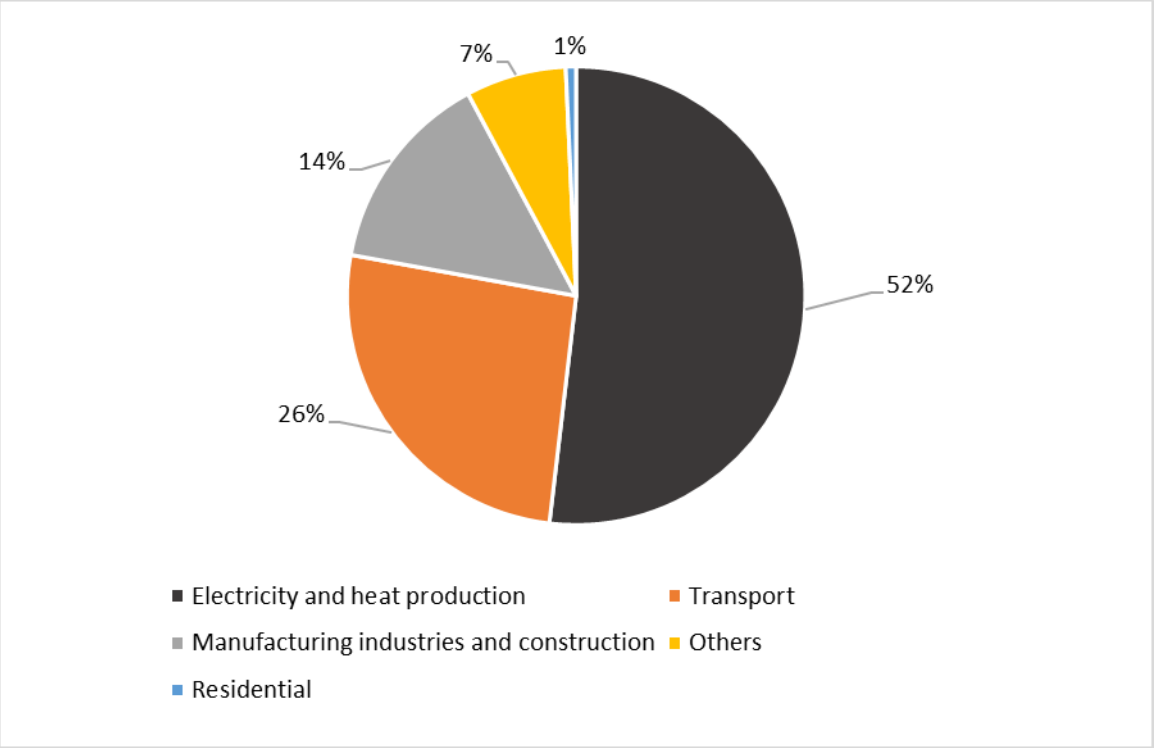
Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of the share of CO_2 emissions by sector in 2020, the electricity and heat production sector is in first place (52%), followed by the transport sector (26%), the manufacturing industries and construction sector (14%), the residential sector (1%), and the others (7%) (Figure 3.40).

In the electricity and heat production sector, the share of power generation from fossil fuels (oil, coal, and natural gas) is high, especially the share of coal-fired power generation (47%). In addition, coal-fired power generation efficiency (34%) is low compared to the OECD average (39%), suggesting that coal accounts for a large portion of CO_2 emissions from the electricity and heat production sector.

In the transport sector, CO_2 emissions from automobiles are expected to increase due to the progress of motorisation.

Figure 3.40. CO_2 Emissions by Sector (Malaysia: 2020)



Source: IEA (2022).

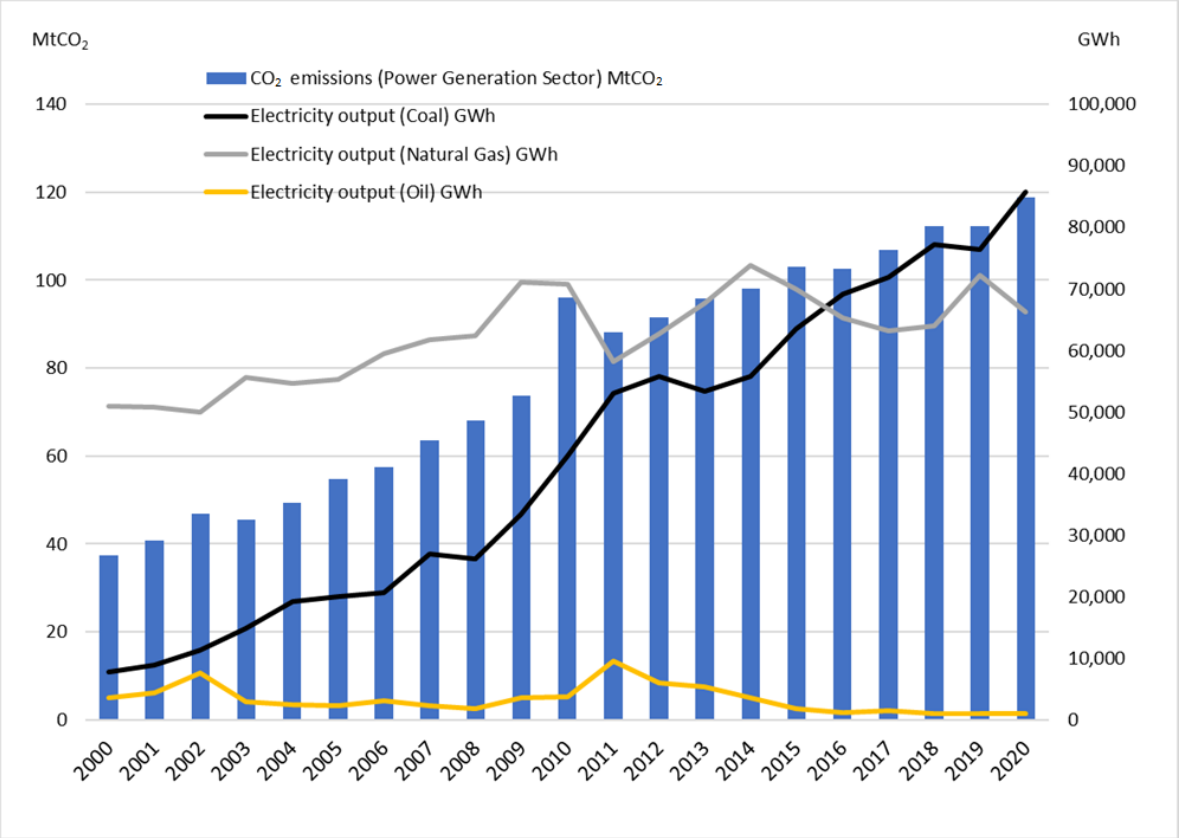
2) CO_2 emissions and coal-fired power generation

We analysed the relationship between the amount of thermal power generation of fossil fuels (oil, coal, and natural gas), which are closely related to CO_2 emissions, and CO_2 emissions from the electricity and heat production sector, in the period of 2000 through 2020.

A graph of CO_2 emissions from the electricity and heat production sector versus oil-, coal-, and natural gas-fired power generation over a 20-year period is shown in Figure 3.41.

The graph indicates a strong correlation between CO_2 emissions and coal-fired power generation in the electricity and heat production sector in Malaysia.

Figure 3.41. Transition between CO_2 Emissions in Electricity Sector and Coal, Natural Gas, and Oil Electricity Output (Malaysia: 2000–20)



Source: IEA (2022).

2.4. Summary of Efficiency Indicators

Table 3.2 summarises Malaysia's energy efficiency indicator.

The difference in 20 years is the improvement in TES per GDP and EE&C indicator of road transport and the deterioration in residential sector EE&C and thermal efficiency (coal-fired).

Table 3.2. Summary of Energy Efficiency Indicator (Malaysia)

Energy Efficiency Indicator	Malaysia		
	2000	2020	
TES per GDP	0.32	0.27	Improve
EE&C Indicator of Road Transport Sector	0.97	0.63	Improve
EE&C Indicator of Residential Sector	0.33	0.48	Worsen
Thermal Efficiency (Fossil fuel-fired)	0.37	0.37	No Change
Thermal Efficiency (Coal-fired)	0.44	0.34	Worsen

EE&C = energy efficiency and conservation, GDP = gross domestic product,
TES = total energy supply.
Source: Author.

2.5. Energy Efficiency Policy

1) History of energy efficiency policy

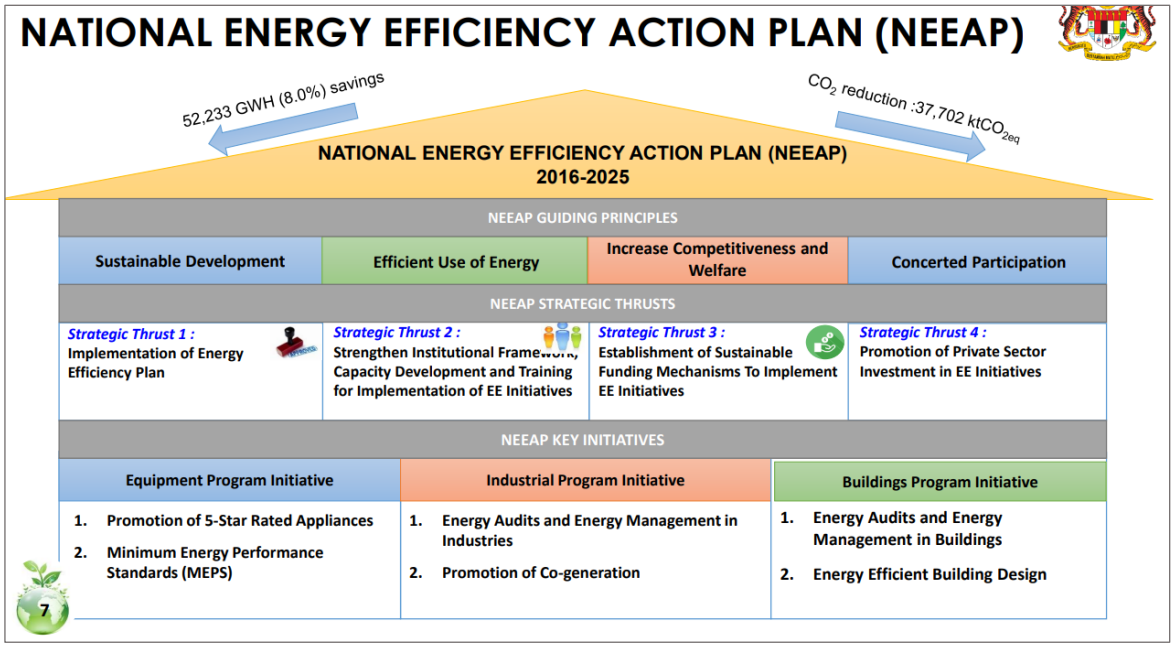
Malaysia's energy efficiency policy has been integrated with the country's energy policy from the Petroleum Development Act of 1974 to the current National Energy Policy 2022–40. Since the 2000s, energy audits and class curricula in universities on energy efficiency and renewable energy have been implemented. In 2016, the National Energy Efficiency Action Plan (NEEAP) 2016–25 was defined and the Energy Efficiency Project was implemented. The National Energy Policy 2022–40 also incorporates enhanced demand side management (DSM). Most recently, as of 2022, the Energy Efficiency and Conservation (EEC) Act has been drafted.

2) NEEAP 2016–25

NEEAP 2016–25 consists of four principles: Sustainable Development, Efficient Use of Energy, Increase Competitiveness, and Concerted Participation. Major initiatives include the Equipment Program Initiative, Industrial Program Initiative, and Building Program Initiative.

The Equipment Program Initiative has a five-star system for electrical products, Minimum Energy Performance Standards (MEPS). The Industrial Program Initiative promotes energy audit and co-generation in industry. The Building Program Initiative promotes energy audit of buildings and energy-efficient building design (Figure 3.42). NEEAP will reduce electricity demand growth by 8% from 2016 to 2025.

Figure 3.42. National Energy Efficiency Action Plan 2016–25 (Malaysia)



EE = energy efficiency.
Source: Ministry of Natural Resources, Environment and Climate Change, Malaysia.

3) Energy Service Company programme in Malaysia

The Energy Serice Company (ESCO) business in Malaysia involves the following: energy audit of government buildings, conversion to light-emitting diode lighting, highly energy-efficient buildings, zero-energy buildings, low-energy office buildings, energy committee headquarters building, elimination of incandescent lights by 2014, national energy conservation awareness campaigns, Japan-Malaysia cooperation on research for realising the green township vision in Malaysia, limiting the temperature of air conditioners in public offices to 24°C, energy-saving programmes in major public hospitals, and green procurement by the public sector.

2.6. CO_2 Emissions Reduction Policy

In September 2021, Prime Minister Ismail Sabri bin Yaakob announced the goal of achieving carbon neutrality by 2050. In line with this, the prime minister promised to halt the construction of new coal-fired power plants.

In July 2021, an updated NDC was submitted to the United Nations Framework Convention on Climate Change to reduce Greenhouse Gas emissions by 45% (Unconditional) from the 2005 baseline. Malaysia will continue its efforts to explore and optimise financing mechanisms, technology transfer, and capacity building to meet its NDCs.

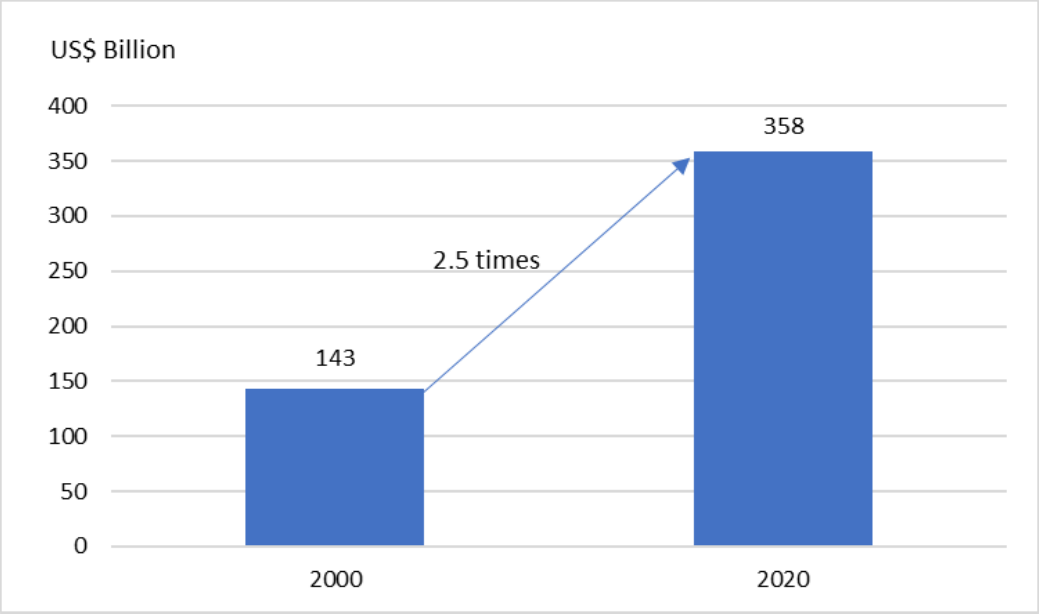
3. Philippines

3.1. Indicators of Energy Consumption

1) Transition in GDP

The Philippines' GDP grew 2.5 times in 20 years, from $143 billion in 2000 to $358 billion in 2020 (Figure 3.43).

Figure 3.43. Philippines GDP 2000 vs 2020 (2015 prices and ex rate)

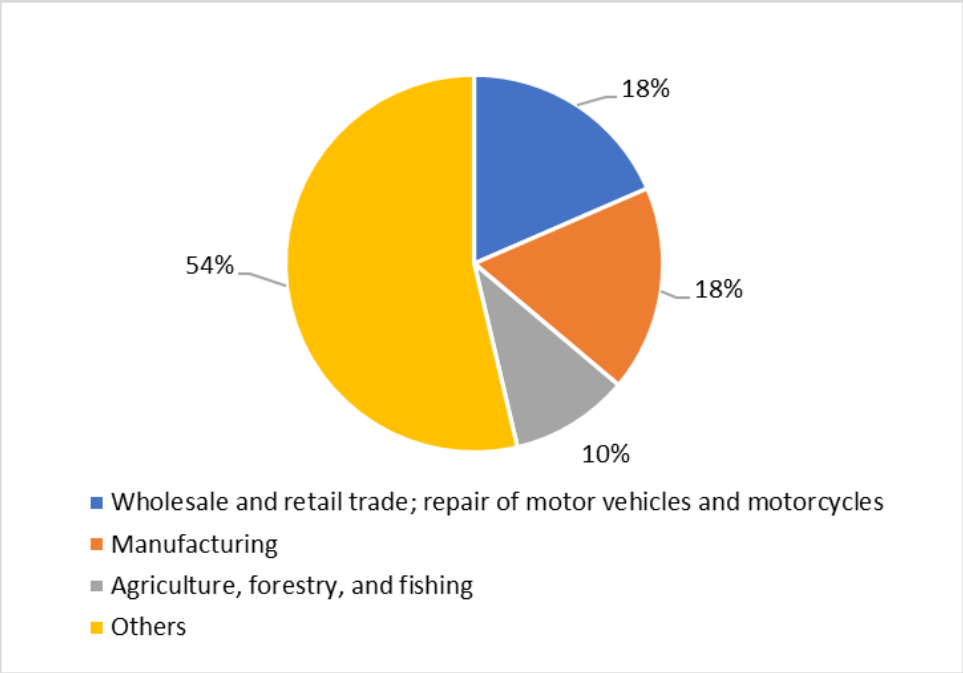


GDP = gross domestic product.
Source: IEA (2022).

2) GDP by Sector and Changes in Industrial Structure

In terms of the share of GDP by sector in 2020, the wholesale and retail trade sector is in first place (18%), followed by the manufacturing sector (18%) and agriculture, forestry and fishing sector (10%) (Figure 3.44). Wholesale and retail trade ranks first due to the country's economic pattern of importing goods and products and selling them at retail outlets. In second place, manufacturing includes automobile parts and electronic devices.

Figure 3.44. Philippines' Gross Domestic Product by Sector at Current Market Prices (2020)



Source: ADB (2022).

3) Transition of TES by energy type

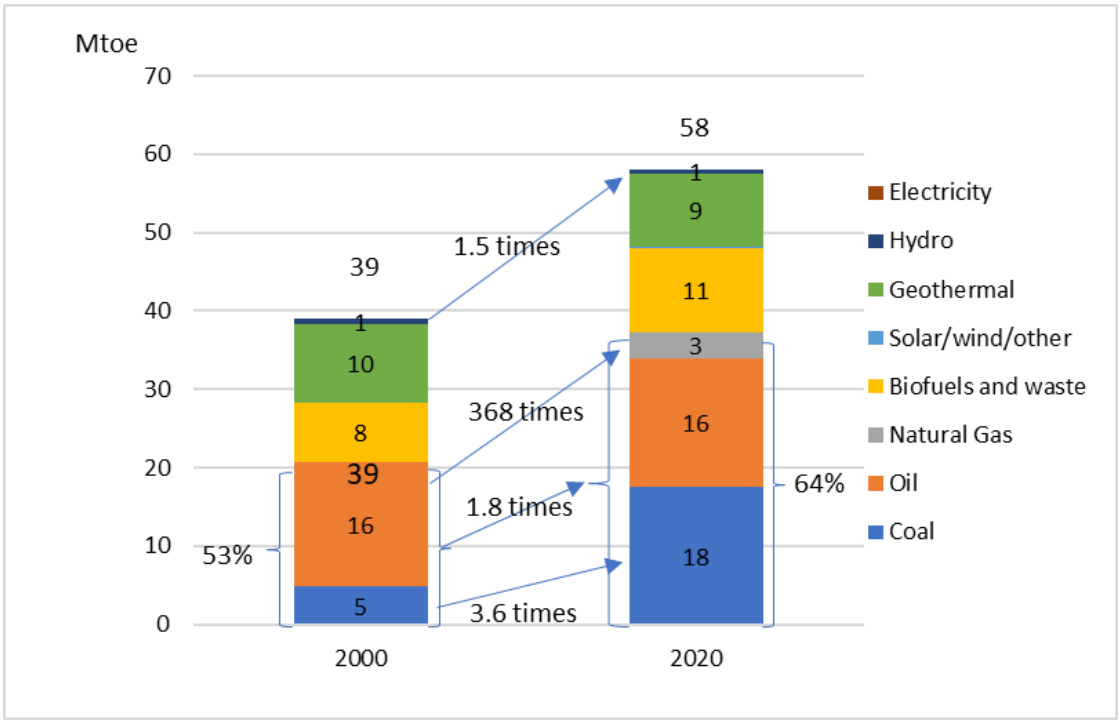
In 20 years, TES increased 1.5 times from 39 Mtoe in 2000 to 58 Mtoe in 2020.

Of that amount, TES of fossil fuels (oil, coal, and natural gas) increased by 1.8 times from 21 Mtoe in 2000 to 37 Mtoe in 2020. Focusing on TES of fossil fuels by energy, TES of oil and natural gas increased 1 and 368 times, respectively, due to development of the Malampaya gas field, while TES of coal, which has a particularly high CO_2 emissions factor, increased significantly by 3.6 times, from 5 Mtoe in 2000 to 18 Mtoe in 2020.

Amongst non-fossil fuels, geothermal TES decreased by 0.9 times and hydro TES by 0.9 times.

Fossil fuel dependence (the percentage of oil, coal, and natural gas in the total) increased from 53% in 2000 to 64% in 2020 (Figure 3.45).

Figure 3.45. Total Energy Supply by Energy Type (Philippines: 2000 vs 2020)



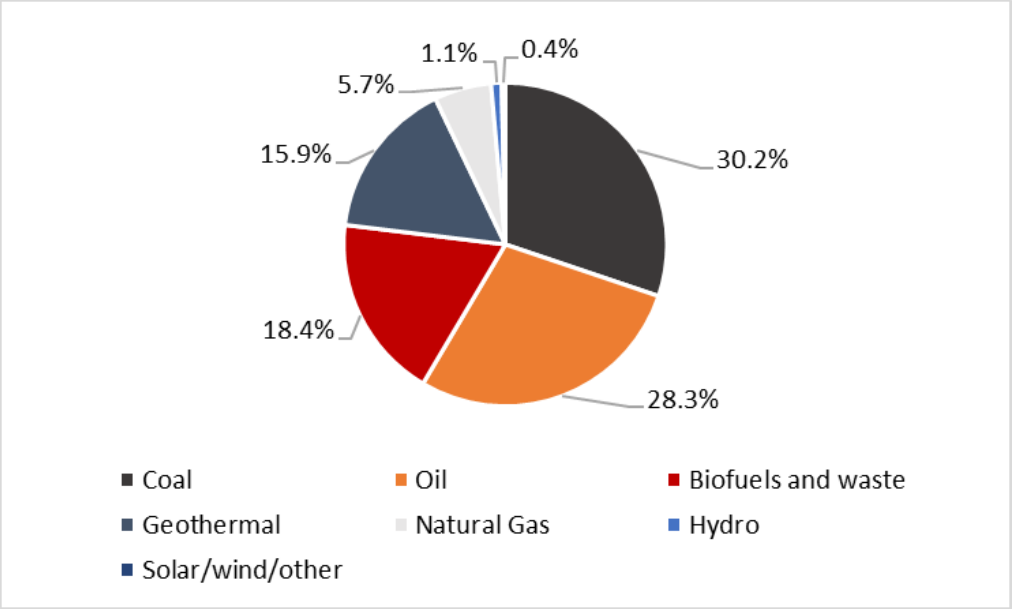
Source: IEA (2022).
Note: Totals may not match due to rounding.

The share of TES by energy source in 2020 is: coal (30.2%) in first place, oil (28.3%) in second place, biofuels and waste (18.4%) in third place, followed by geothermal (15.9%), natural gas (5.7%), hydro (1.1%), and solar, wind and other (0.4%).

Fossil fuels, with a TES share of 64.2%, account for much of TES. Coal, which has a particularly high CO_2 emissions factor, tops the list with a 30.2% TES share.

On the other hand, the TES share of non-fossil fuels (biofuels and waste, geothermal, hydro, and solar/wind/other) is 35.8%. Amongst them, biofuels and waste (18.4%) and geothermal (15.9%) are the main sources, while TES of solar/wind/others is very small, 0.4% (Figure 3.46).

Figure 3.46. Total Energy Supply Share by Type (Philippines: 2020)

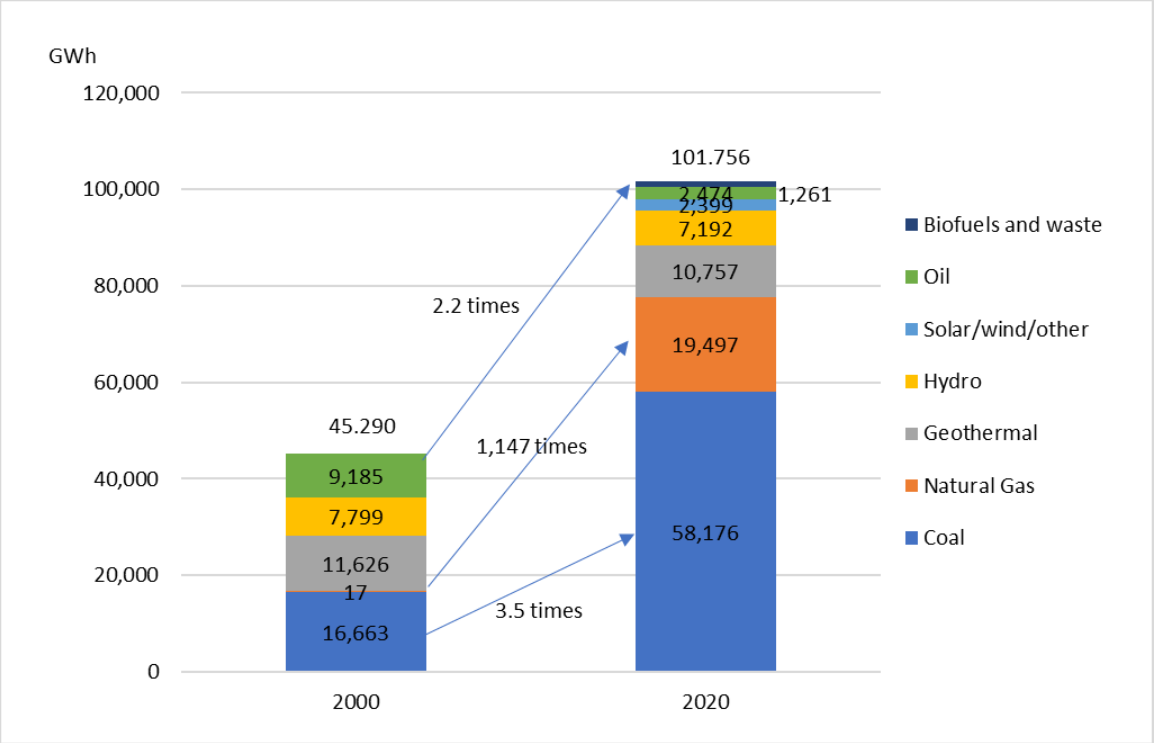


Source: IEA (2022).

4) Transition of power generation by fuel

Over the 20 years until 2020, power generation increased by 2.2 times from 45,290 GWh in 2000 to 101,756 GWh in 2020. In terms of power generation by fuel in 2020, coal comes in first (58,176 GWh), natural gas second (19,497 GWh), geothermal third (10,757 GWh), followed by hydro (7,192 GWh), solar/wind/other (2,399 GWh), oil (2,474 GWh), and biofuels and waste (1,261 GWh). The power generation from natural gas jumped 1,147 times from 17 GWh in 2000 to 19,497 GWh in 2020. Power generation from coal, which has a high CO_2 emissions factor, increased 3.5 times from 16,663 GWh in 2000 to 58,176 GWh in 2020 (Figure 3.47).

Figure 3.47. Electricity Output by Fuel (Philippines: 2000 vs 2020)



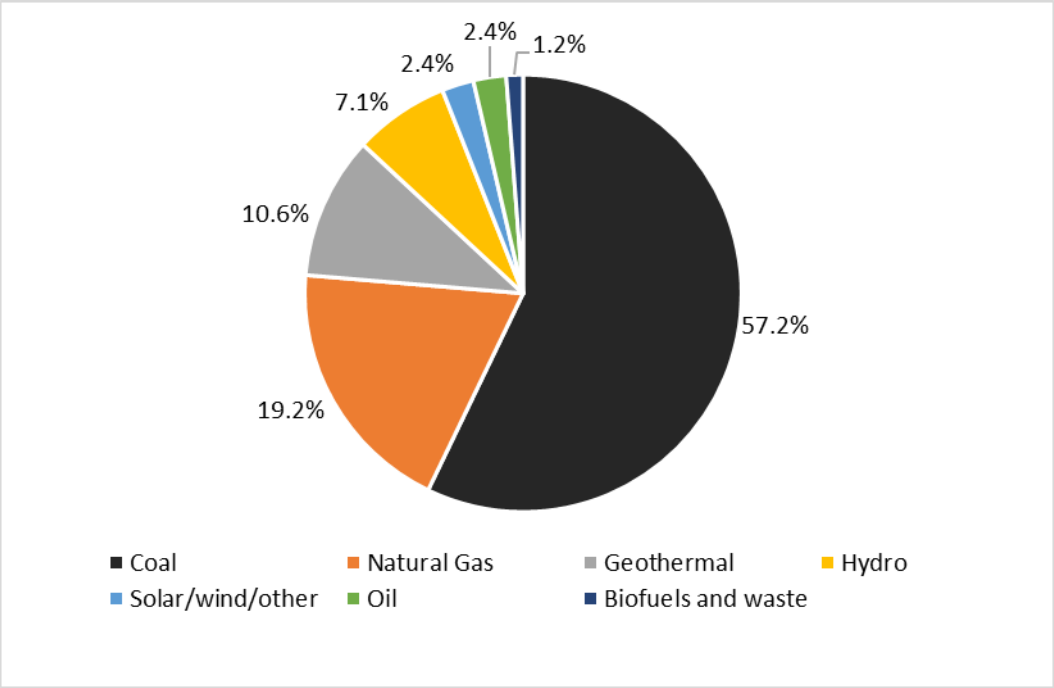
Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of share of power generation by fuel in 2020, coal comes in first (57.2%), natural gas second (19.2%), geothermal third (10.6%), followed by hydro (7.1%), solar/wind/other (2.4%), oil (2.4%), and biofuels and waste (1.2%).

Fossil fuels account for most of the share of power generation, at 78.8%. Coal, which has a particularly high CO_2 emissions factor, tops the list with a 57.2% share.

On the other hand, the TES share of non-fossil fuels (biofuels and waste, geothermal, hydro, and solar/wind/other) is 21.2%. The breakdown is as follows: geothermal (10.6%), hydropower (7.1%), solar, wind, and other (2.4%), and biofuels and waste (1.2%) (Figure 3.48).

Figure 3.48. Electricity Output Share by Fuel (Philippines: 2020)



Source: IEA (2022).

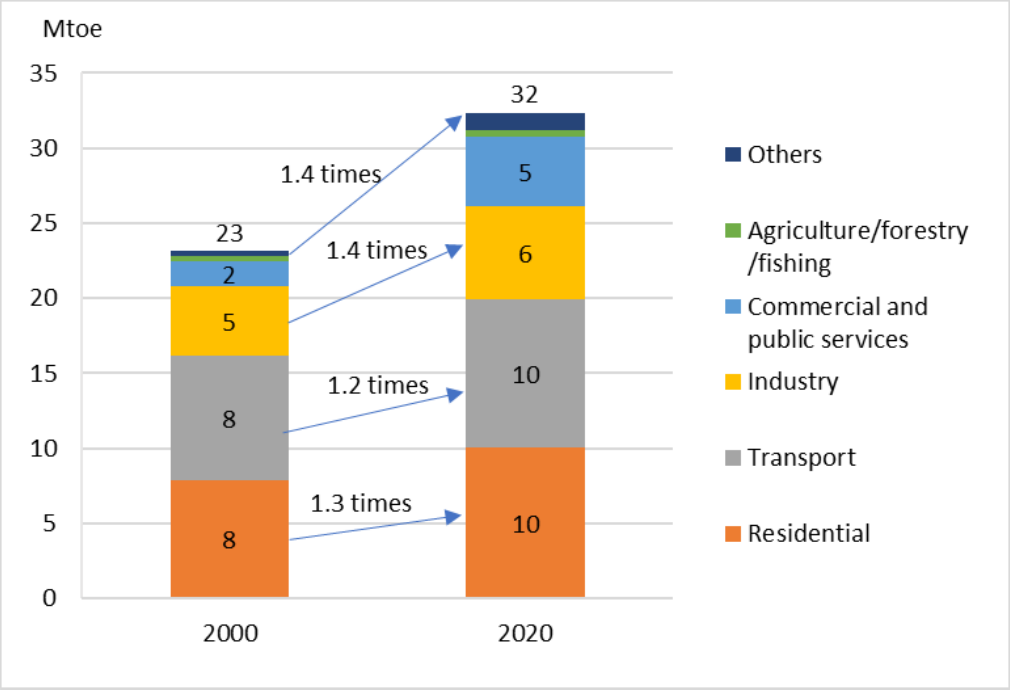
5) Transition of final energy consumption by sector

In 20 years, final energy consumption increased by 1.4 times from 23 Mtoe in 2000 to 32 Mtoe in 2020. In terms of final energy consumption by sector in 2020, the residential sector (10 Mtoe) is in first place, the transport sector (10 Mtoe) in second place, the manufacturing industries and construction sector (6 Mtoe) in third place, followed by the commercial and public services sector (5 Mtoe), the agriculture, forestry and fishing sector (0.4 Mtoe) and the others (1 Mtoe).

Comparing final energy consumption over the 20-year period from 2000 to 2020, we find that the final energy consumption in the industry sector increased 1.4 times from 5 Mtoe to 6 Mtoe, the final energy consumption in the transport sector increased 1.2 times from 8 Mtoe to 10 Mtoe, and the final energy consumption in the residential sector increased 1.3 times from 8 Mtoe to 10 Mtoe (Fig. 3.49).

The industry sector's final energy consumption has been growing with the progress of industrialisation. The final energy consumption in the transport sector has also been growing with the development of motorisation. Due to the improvement in living standards, the final energy consumption in the residential sector is also growing.

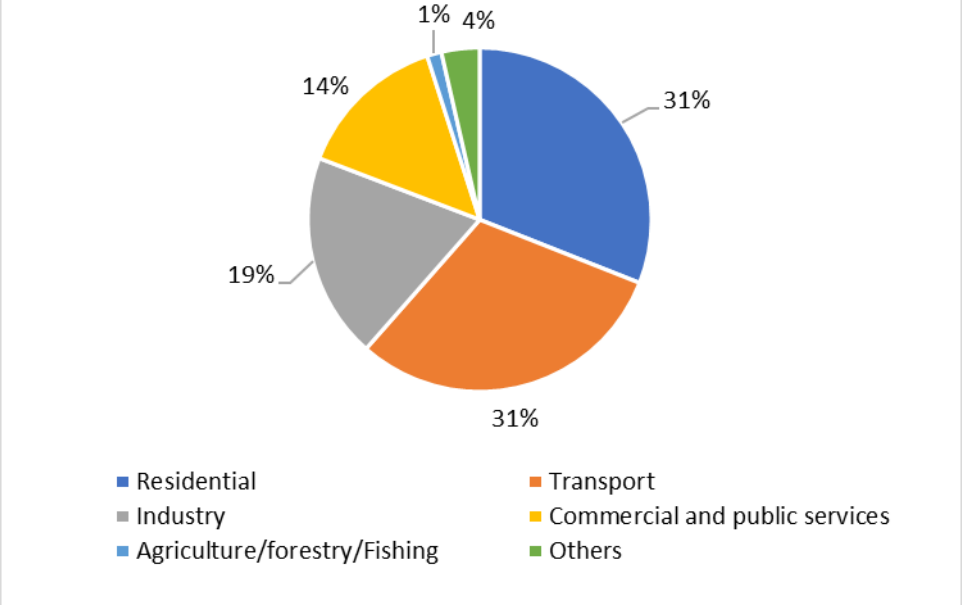
Figure 3.49. Final Energy Consumption (Philippines: 2000 vs 2020)



Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of the share of final energy consumption by sector in 2020, the residential sector (31%) and the transport sector (31%) are in first place, the industry sector (19%) in third place, followed by the commercial and public services sector (14%), the agriculture, forestry, and fishing sector (1%), and the others (4%) (Figure 3.50).

Figure 3.50. Final Energy Consumption Share by Sector (Philippines: 2020)



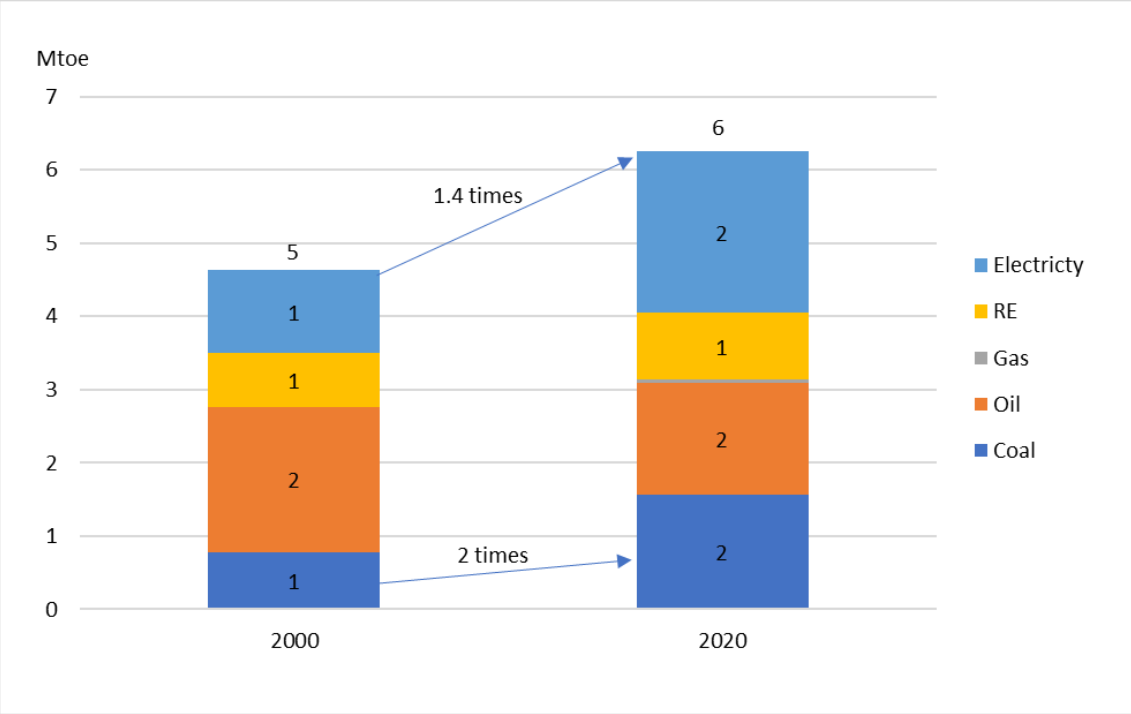
Source: IEA (2022).

6) Energy consumption and efficiency in the industry sector

The final energy consumption in the industry sector increased 1.4 times from 5 Mtoe in 2000 to 6 Mtoe in 2020.

In particular, the final energy consumption of coal doubled from 1 Mtoe in 2000 to 2 Mtoe in 2020 (Figure 3.51).

Figure 3.51. Final Energy Consumption Transition by Energy (Philippines: 2000 vs 2020)

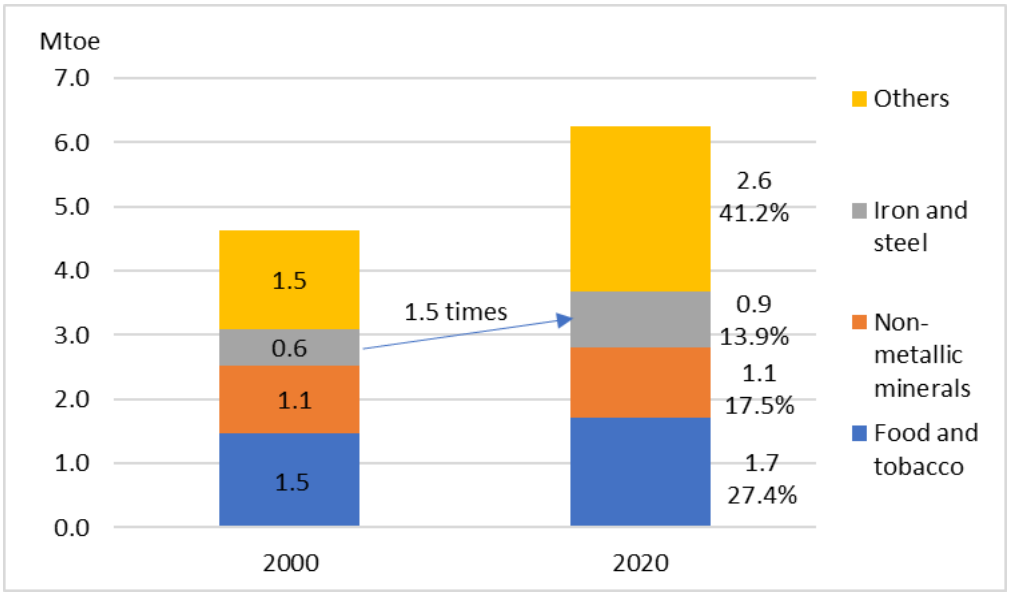


RE = renewable energy.
Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of final energy consumption by industry subsector, iron and steel increased about 1.5 times from 0.6 Mtoe in 2000 to 0.9 Mtoe in 2020. In the non-metallic minerals subsector, the final energy consumption remained unchanged from 1.1 Mtoe in 2000 to 1.1 Mtoe in 2020.

In the industry sector, the share by subsector in the final energy consumption in 2020 is 27.4% for the food and tobacco subsector. The share is 17.5% for the non-metallic minerals subsector. The share is 13.9% for the iron and steel subsector (Figure 3.52).

Figure 3.52. Final Energy Consumption Transition and Share by Industry Subsector (Philippines: 2000 vs 2020)



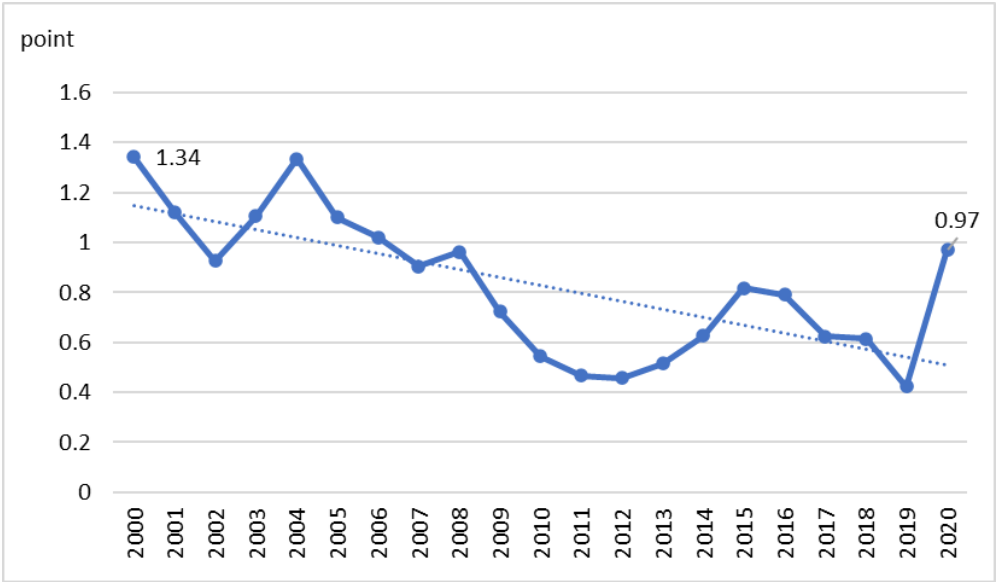
Source: IEA (2022).

Next, we consider the iron and steel subsector and the non-metallic minerals subsector, for which statistical data are available.

a) Iron and steel subsector

Figure 3.53 shows the indicator of final energy consumption in the iron and steel subsector divided by crude steel production. The indicator improved from 1.34 in 2000 to 0.97 in 2020.

Figure 3.53. EE&C Indicator Transition of the Iron and Steel Subsector (Philippines)



EE&C = energy efficiency and conversation.
Note: The dotted line in the graph is an approximate curve.
Source: IEA (2022) and World Steel Association.

b) Non-metallic minerals subsector

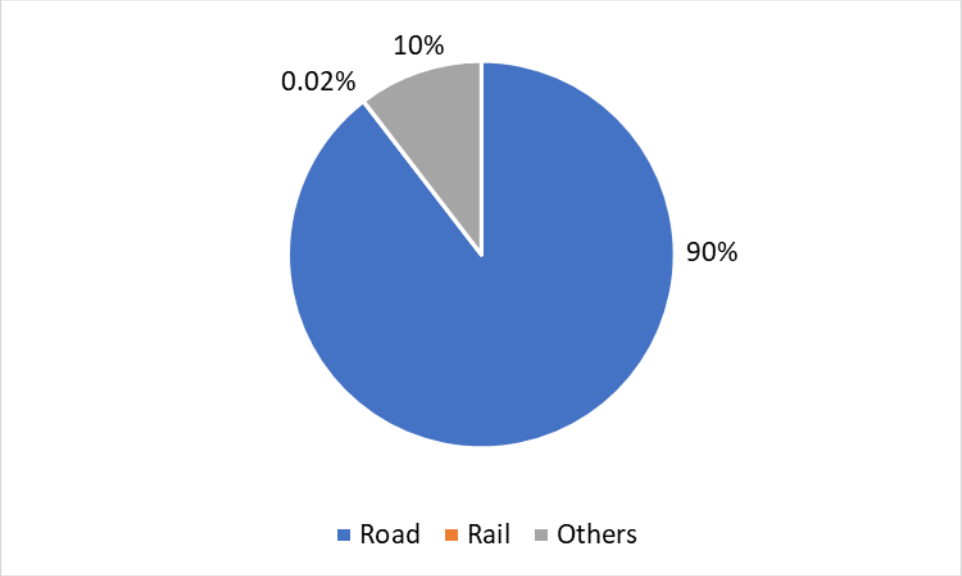
Statistical data on cement production in the Philippines are not available. Therefore, an efficiency analysis using indices such as those for the non-metallic minerals subsector could not be conducted.

7) Energy consumption and efficiency in the transport sector

In terms of the share of CO_2 emissions by sector in 2020, the transport sector (23%) has the largest CO_2 emissions share after the electricity and heat production sector (58%). Amongst the transport sectors, road transport accounts for 90% of the CO_2 emissions share (Figure 3.54).

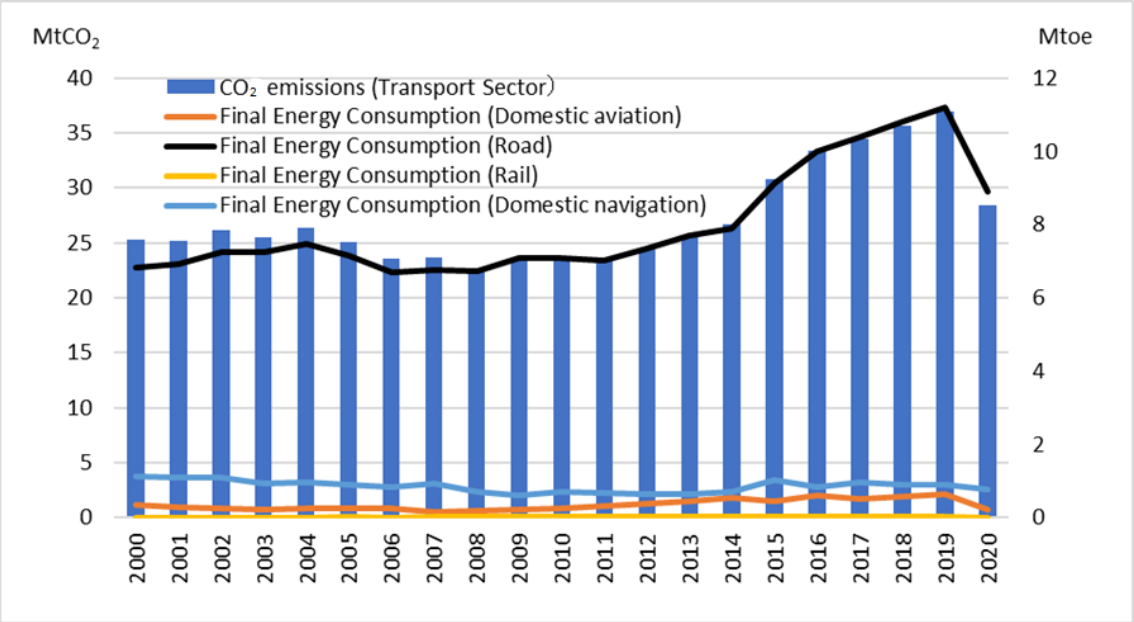
A graph of CO_2 emissions from the transport sector and final energy consumption by the road, domestic aviation, domestic navigation, and rail transport sectors over a 20-year period is shown in Figure 3.55. There is a strong relationship between CO_2 emissions in the transport sector and final energy consumption in road transport.

Figure 3.54. CO_2 Emissions Share by Transport Sector (Philippines: 2020)



Source: IEA (2022).

Figure 3.55. Transition between CO_2 Emissions in the Transport Sector and Final Energy Consumption in the Transport Sector (Philippines: 2000–20)

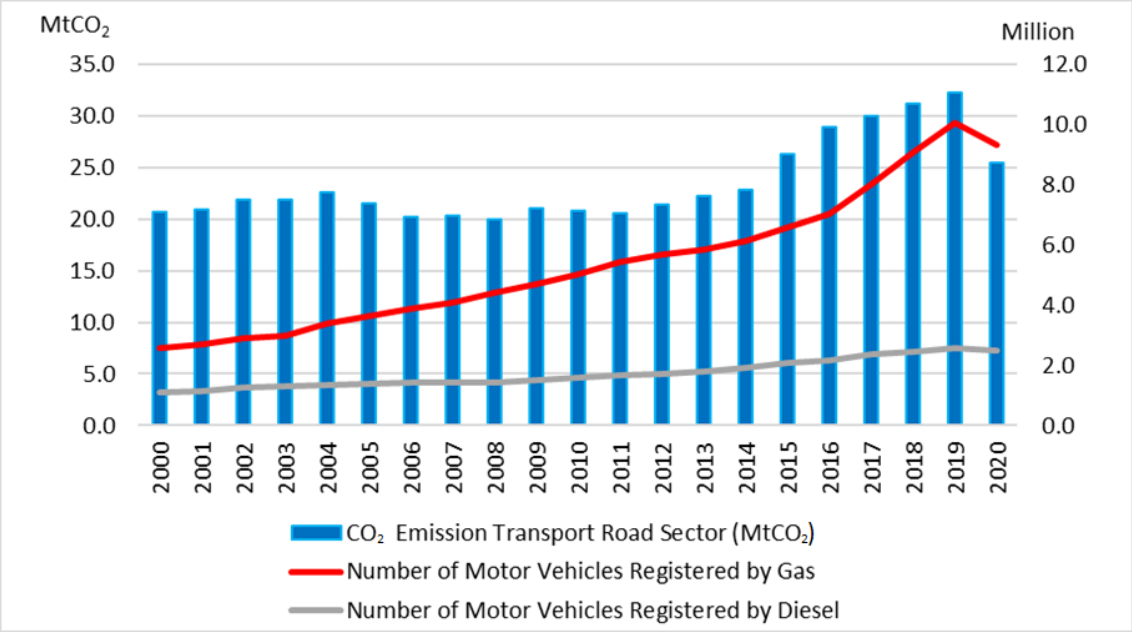


Source: IEA (2022).

A 20-year trend of the number of cars owned and CO_2 emissions from the road transport sector shows that CO_2 emissions have increased with the growth in the number of cars owned (Figure 3.56).

As of 2020, 79% of cars were gasoline-powered and 21% were diesel-powered, with fossil fuels being the energy source for nearly all vehicles. This has led to an increase in the number of vehicles using fossil fuels, which in turn has led to an increase in CO_2 emissions in road transport.

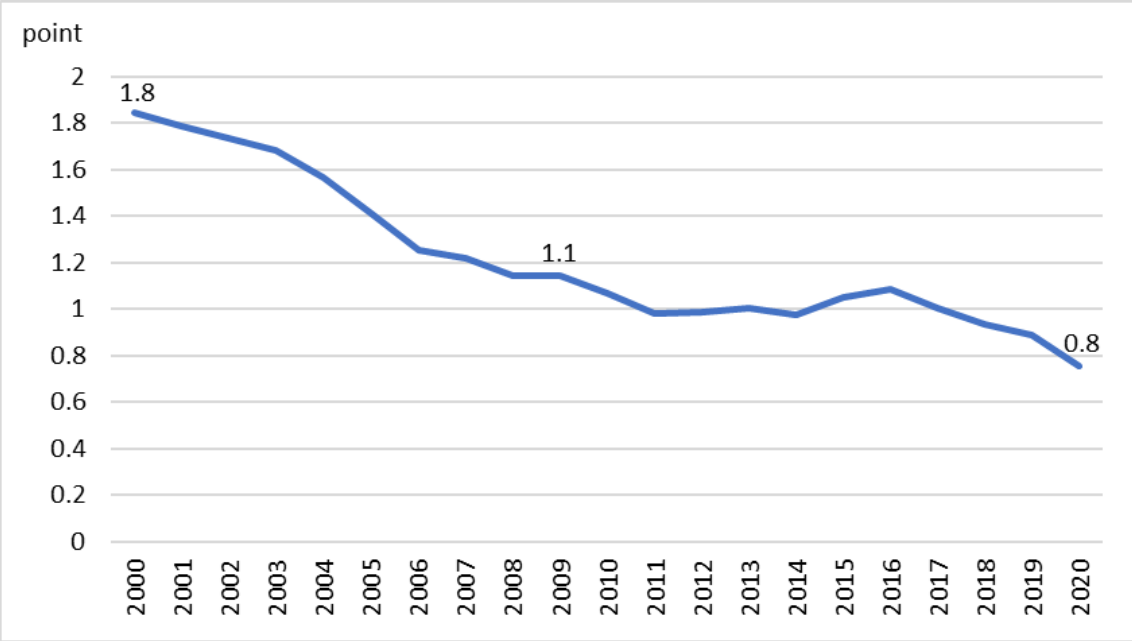
Figure 3.56. Transition between CO_2 Emissions in Road Transport and the Number of Motor Vehicles by Fuel Used (Philippines: 2000–20)



Source: IEA (2022) and Land Transportation Office.

Next, we analyse the indicator of final energy consumption in the road transport sector divided by the number of registered cars owned. The indicator of 1.8 in 2000 improved to 1.1 in 2009 and to 0.8 in 2020 (Figure 3.57).

Figure 3.57. EE&C Indicator Transition of Road Transport (Philippines)



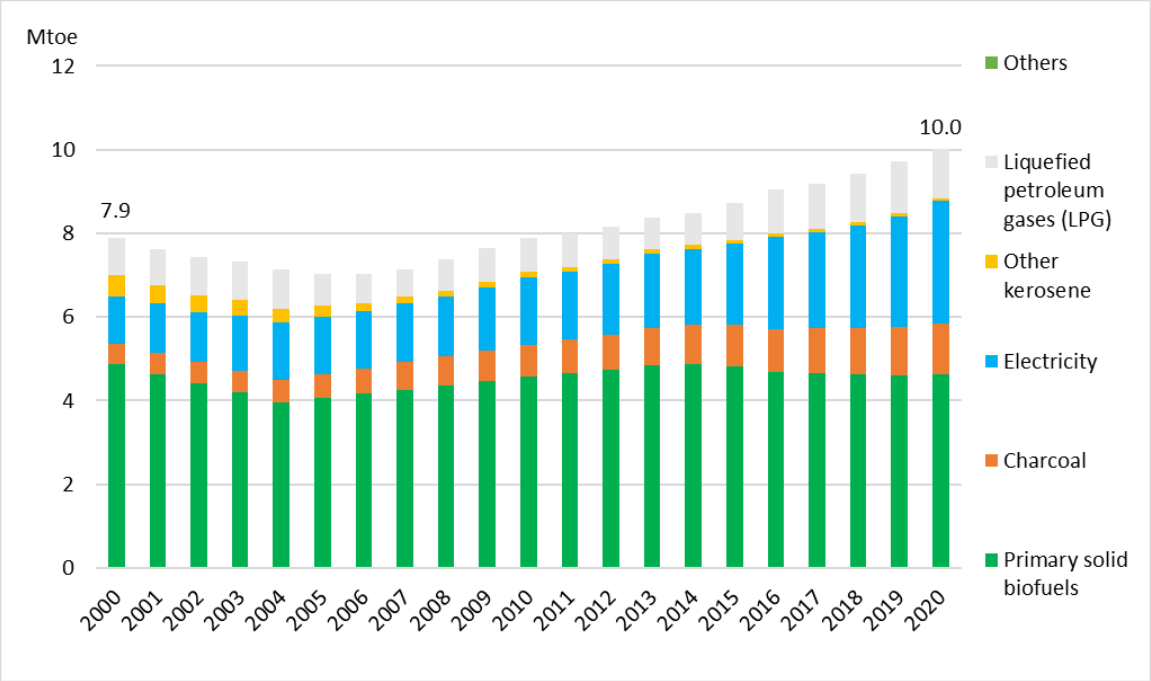
EE&C = energy efficiency and conservation.
Source: IEA (2022) and Land Transportation Office.

8) Energy consumption and efficiency in the residential sector

The final energy consumption in the residential sector increased by 27% from 7.9 Mtoe in 2000 to 10.0 Mtoe in 2020.

An analysis of this breakdown into traditional fuels, such as primary solid biofuels and charcoal, and modern fuels, such as LPG, kerosene and electricity, shows that the traditional fuels have increased, but the modern fuels have increased even more. The increase in electricity is particularly significant (Figure 3.58).

Figure 3.58. Final Energy Consumption Transition of Residential Sector (Philippines)

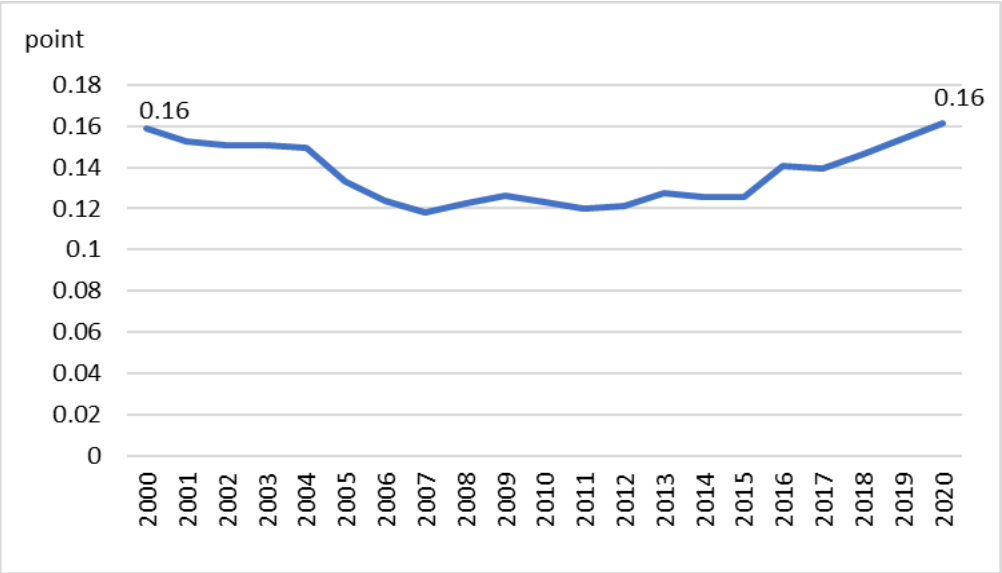


Source: IEA (2022).

Next, we analyse the indicator of final energy consumption of modern energy divided by the number of households. Since statistical data on the number of households in the Philippines are not confirmed, we use the deemed number of households, which is the population divided by the average number of persons per household.

Figure 3.59 shows that the indicator was 0.16 in 2000 and improved since then to around 2010, but has deteriorated since 2015, with the index at 0.16 in 2020.

Figure 3.59. EE&C Indicator Transition of Residential Sector (Philippines)



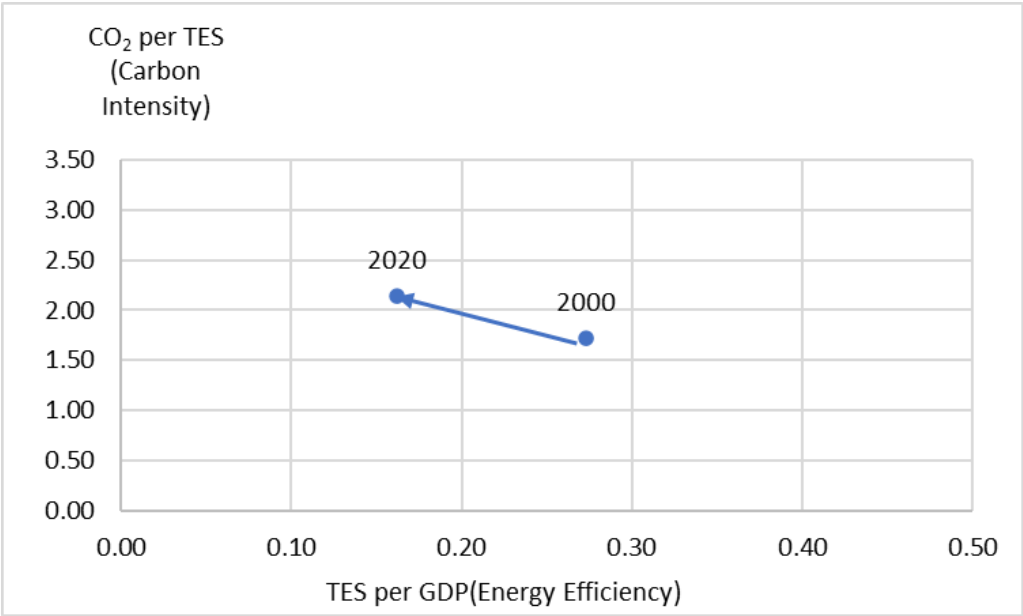
EE&C = energy efficiency and conservation.
Source: IEA (2022) and United Nations. https://population.un.org/household/#/countries/ (accessed 23 May 2023).

3.2. Indicator of Energy Efficiency

1) Energy efficiency and carbon intensity

As shown in the graph below, TES per GDP, a leading indicator of energy efficiency, has decreased by 41% over the 20 years, from 0.27 in 2000 to 0.16 in 2020, indicating progress in energy conservation. On the other hand, CO_2 emissions per TES worsened from 1.71 in 2000 to 2.15 in 2020. Despite progress in energy conservation, the carbon intensity is deteriorating (Figure 3.60).

Figure 3.60. Energy Efficiency and Carbon Intensity Transition (Philippines: 2000–20)



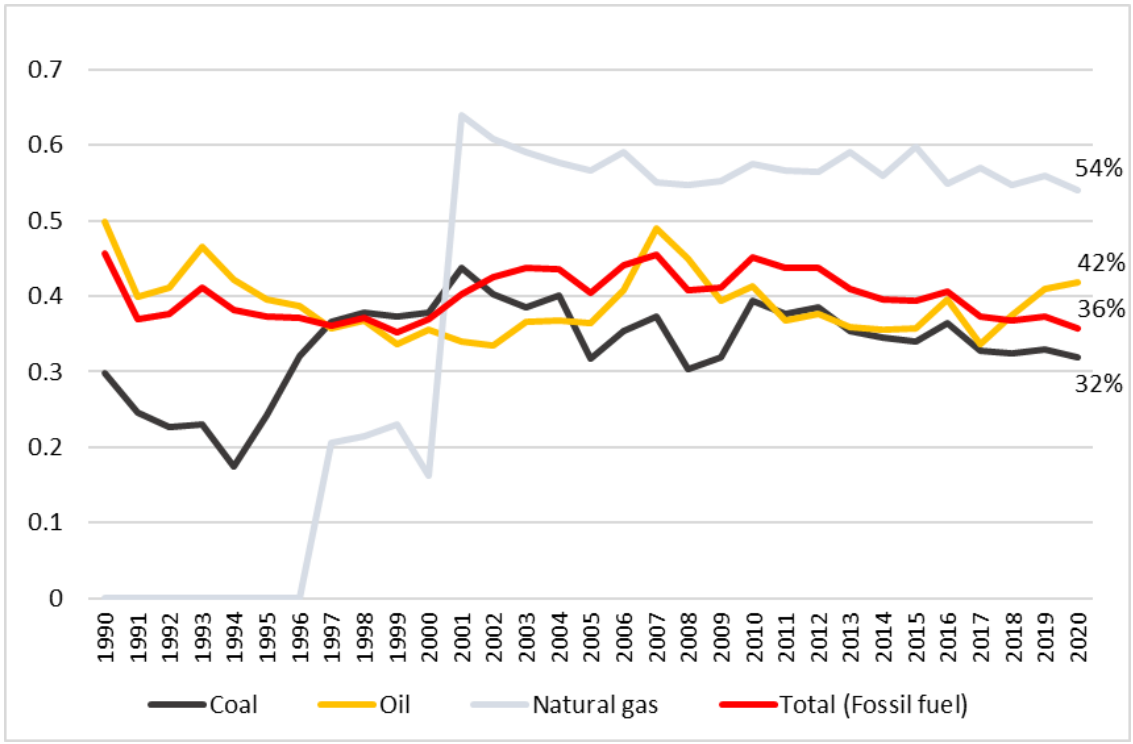
GDP = gross domestic product, TES = total energy supply.
Source: IEA (2022).

2) Power generation efficiency

Over the 20 years leading up to 2020, the efficiency of thermal power generation (coal, oil, and natural gas) has generally remained around 41%. As of 2020, the efficiency of thermal power generation (average of coal, oil, and natural gas) is 36%.

The efficiency of coal-fired power generation over the 20-year period generally hovers around 36%, and the efficiency as of 2020 is 32% (Figure 3.61).

Figure 3.61. Thermal Efficiency Transition (Philippines: 2000–20)



Source: IEA (2022).

3.3. Indicator of CO_2 emissions

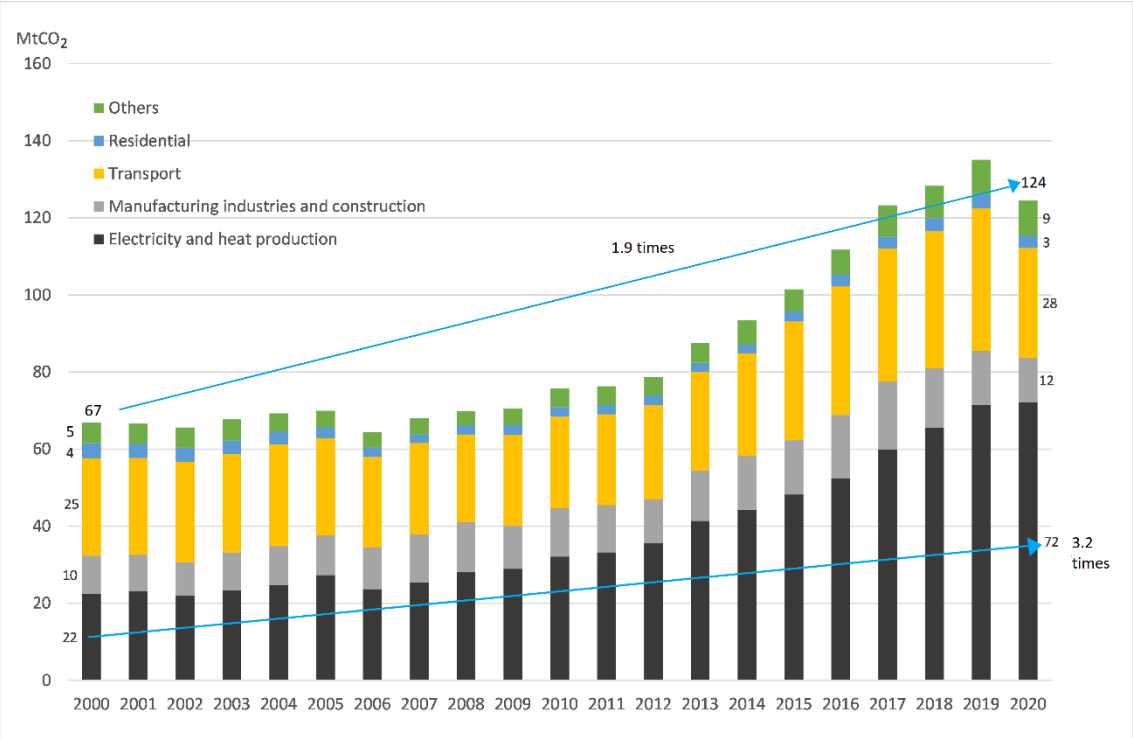
1) Transition in CO_2 emissions by sector

CO_2 emissions increased 1.9 times in 20 years, from 67 $MtCO_2$ in 2000 to 124 $MtCO_2$ in 2020.

CO_2 emissions by sector in 2020 are 72 $MtCO_2$ in the electricity and heat production sector, 28 $MtCO_2$ in the transport sector, 12 $MtCO_2$ in the manufacturing industries and construction sector, 3 $MtCO_2$ in the residential sector, and 9 $MtCO_2$ in the others.

Comparing CO_2 emissions over the 20-year period by sector from 2000 to 2020, we find that the CO_2 emissions in the electricity and heat production sector increased 3.2 times from 22 $MtCO_2$ to 72 $MtCO_2$, that in the manufacturing industries and construction sector increased 1.2 times from 10 $MtCO_2$ to 12 $MtCO_2$, and that in the transport sector increased 1.1 times from 25 $MtCO_2$ to 28 $MtCO_2$. On the other hand, CO_2 emissions from the residential sector decreased by 0.8 times from 4 $MtCO_2$ in 2000 to 3 $MtCO_2$ in 2020 (Figure 3.62).

Figure 3.62. CO_2 Emissions Transition by Sector (Philippines: 2000–20)

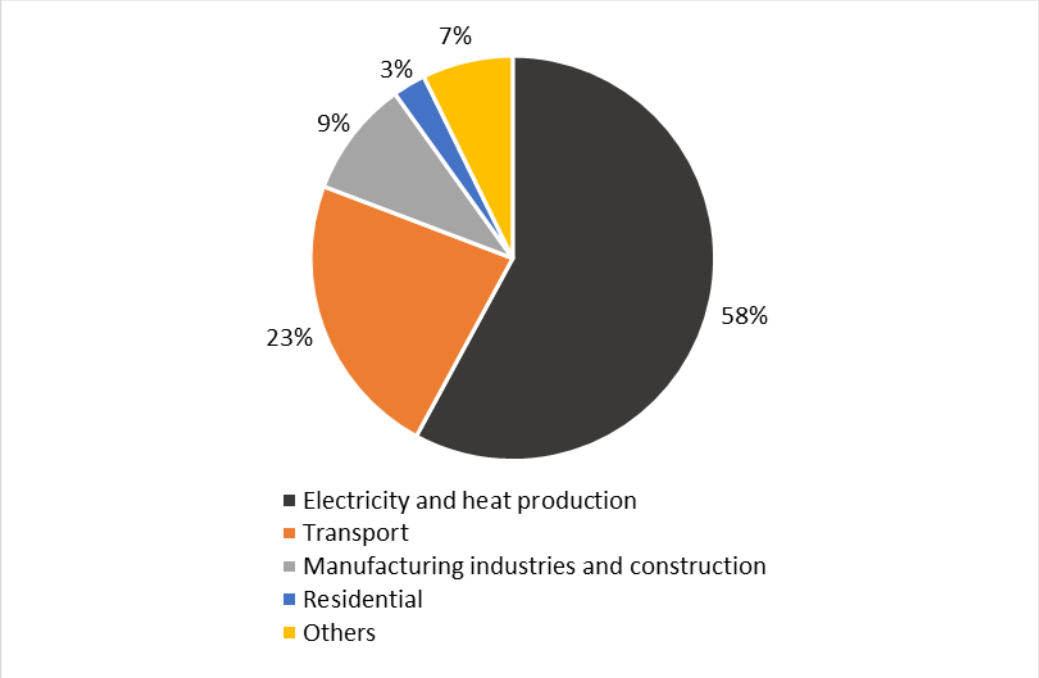


Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of the share of CO_2 emissions by sector in 2020, the electricity and heat production sector is in first place (58%), followed by the transport sector (23%), the manufacturing industries and construction sector (9%), the residential sector (3%), and the others (7%) (Figure 3.63).

In the electricity and heat production sector, the share of power generation from fossil fuels (oil, coal, and natural gas) is high, especially the share of coal-fired power generation (57.2%). In addition, coal-fired power generation efficiency (36%) is low compared to the OECD average (39%), suggesting that coal-fired power generation accounts for a large portion of CO_2 emissions from the electricity and heat production sector.

Figure 3.63. CO_2 Emissions by Sector (Philippines: 2020)



Source: IEA (2022).

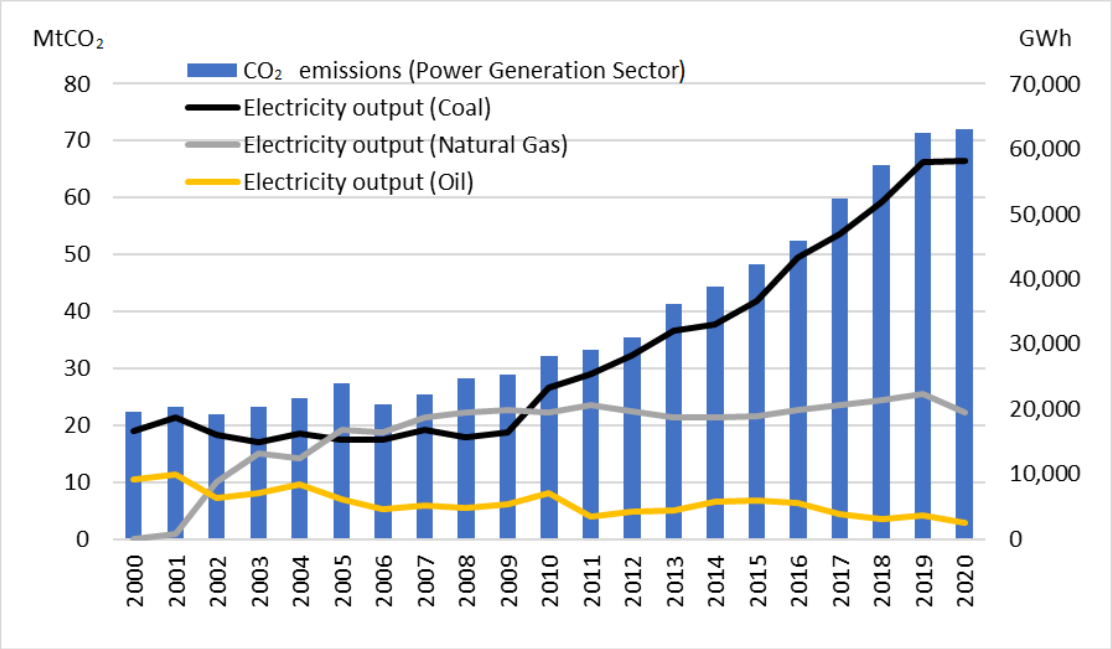
2) CO_2 emissions and coal-fired power generation

We analysed the relationship between the amount of thermal power generation of fossil fuels (oil, coal, and natural gas), which are closely related to CO_2 emissions, and CO_2 emissions from the electricity and heat production sector, in the period of 2000 through 2020.

A graph of CO_2 emissions from the electricity and heat production sector versus oil-, coal-, and natural gas-fired power generation over a 20-year period is shown in Figure 3.64.

The graph indicates a strong correlation between CO_2 emissions and coal-fired power generation in the electricity and heat production sector in the Philippines.

Figure 3.64. Transition between CO_2 Emissions in the Electricity Sector and Coal, Natural Gas, and Oil Electricity Output (Philippines: 2000–20)



Source: IEA (2022).

3.4. Summary of Efficiency Metrics

Table 3.3 summarises the Philippines' energy efficiency indicator.

The difference over 20 years is that TES per GDP and the EE&C indicator of iron and steel subsector have improved, while thermal efficiency (coal-fired plant) has deteriorated.

Table 3.3. Summary of Energy Efficiency Indicator (Philippines)

Energy Efficiency Indicator	Philippines		
	2000	2020	
TES per GDP	0.27	0.16	Improve
EE&C Indicator of Iron and Steel Sector	1.34	0.97	Improve
EE&C Indicator of Road Transport Sector	1.80	0.80	Improve
EE&C Indicator of Residential Sector	0.16	0.16	No Change
Thermal Efficiency (Fossil fuel-fired)	0.37	0.36	Worsen
Thermal Efficiency (Coal-fired)	0.38	0.32	Worsen

EE&C = energy efficiency and conservation, GDP = gross domestic product,
TES = total energy supply.
Source: Author.

3.5. Energy Efficiency Policy

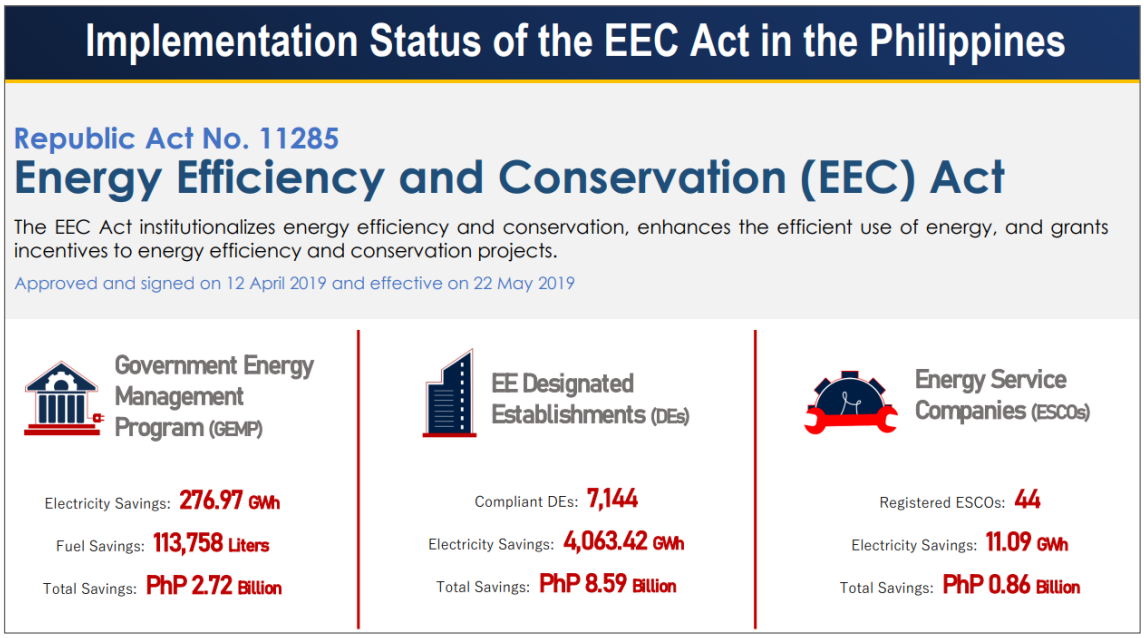
1) Energy Efficiency and Conservation Act

The Philippine EEC Act entered into force on 22 May 2019. The main pillars of this law are the Government Energy Management Program (GEMP), Energy Efficiency Designated Establishments (EEDEs), and ESCOs.

GEMP saved 276.97 GWh of electricity and EEDEs saved 4063.42 GWh of electricity. Forty-four companies registered for ESCOs, saving 11.09 GWh of electricity (Figure 3.65). The Philippines is a country with high energy prices in ASEAN, which may be a factor in the success of the ESCO project.

EEDEs were required to submit an annual energy consumption report for the duration of the project, and 23 of the 39 samples were able to submit an energy audit report during the 2022 compliance period.

Figure 3.65. Energy Efficiency and Conservation Act, Philippines



EE = energy efficiency.
Source: DOE, Philippines

2) Energy efficiency road map and Demand Side Managment programme

The Philippines has developed Energy Efficiency Roadmap 2014–2030. The target for 2030 is to reduce energy intensity by 40% compared to 2010, reduce annual energy consumption by 1.6% compared to business as usual (BAU), and reduce annual energy demand by 10,665 ktoe, which correspond to one-third of the current energy demand.

In addition, to deal with tight supply and demand, Philippines has introduced DSM to all electricity consumers (especially households, industries, and commercial organisations), excluding important facilities such as hospitals, military facilities, and airport-related facilities.

The introduction of DSM was required not only for consumers, but also for power suppliers.

In the industry sector, regulations based on the ministerial decree on the DSM programme have been in force since 2014. The industry sector voluntarily submits an energy consumption status report to the Department of Energy (DOE) based on the energy management system. These include energy audits and certification programmes in which the DOE provides advisory services to the industry and commercial sectors.

In the commercial and residential sector, there is an obligation to report energy consumption based on the energy management system. Incandescent light bulbs were phased out in 2008, and the ESCO certification system was launched.

In the transport sector, various fuel efficiency improvement programmes are being promoted.

3) ESCOs programme in Philippines

Government-affiliated and other financial institutions in the Philippines provide financial packages for renewable energy and energy efficiency projects promoted by ESCOs. Examples of ESCO initiatives include efficiency lighting systems, employing efficient heating and air conditioning solutions, and implementing centralised energy management systems, all of which are given financial incentives.

DOE has established policies and regulations such as evaluation, approval procedures, and standards for energy efficiency projects to promote ESCOs. ESCO-led project types such as Third-Party Project Developer, Project Special Purpose Vehicle, or Self-Financed will be given financial incentives and eligible facilities will be certified by an energy auditor or certified ESCO within 3 years. Energy audits are mandatory.

Registered and accredited ESCOs include private, government-owned, and managed companies that provide energy efficiency project development, design, energy savings realisation and assurance, and cost-effective services and products. As of 5 June 2023, there are 49 registered ESCOs.

3.6. CO_2 Emissions Reduction Policy

As of May 2023, the Philippines' carbon neutrality declaration cannot be confirmed.

In April 2021, the Philippines submitted a new NDC that calls for a 75% GHG reduction relative to the BAU case in 2030 (2.71% without conditions, 72.29% with conditions of international support). The Philippines aims to reduce GHGs through climate finance, enhanced access to technology, circular economy, and sustainable consumption.

In October 2020, the Philippines suspended the approval of new coal-fired power generation. In November 2021, the Philippines entered into a partnership with ADB to promote the shift from coal-fired power generation to renewable and other clean energy sources.

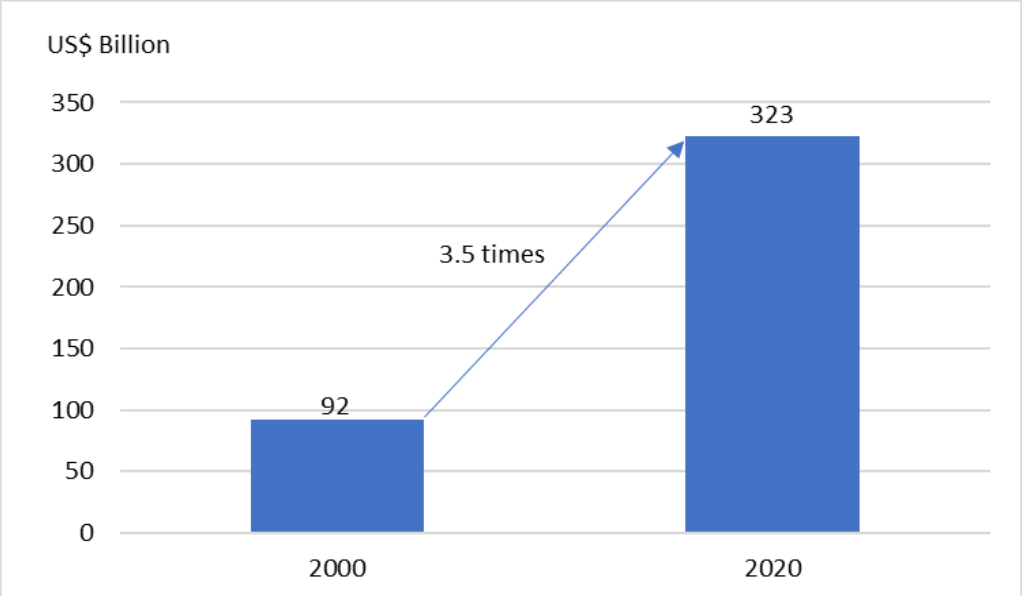
4. Viet Nam

4.1. Indicators of Energy Consumption

1) Transition in GDP

Viet Nam's GDP has grown 3.5 times in 20 years, from $92 billion in 2000 to $323 billion in 2020 (Figure 3.66).

Figure 3.66. Viet Nam Gross Domestic Product, 2000 vs 2020 (2015 prices and ex rate)

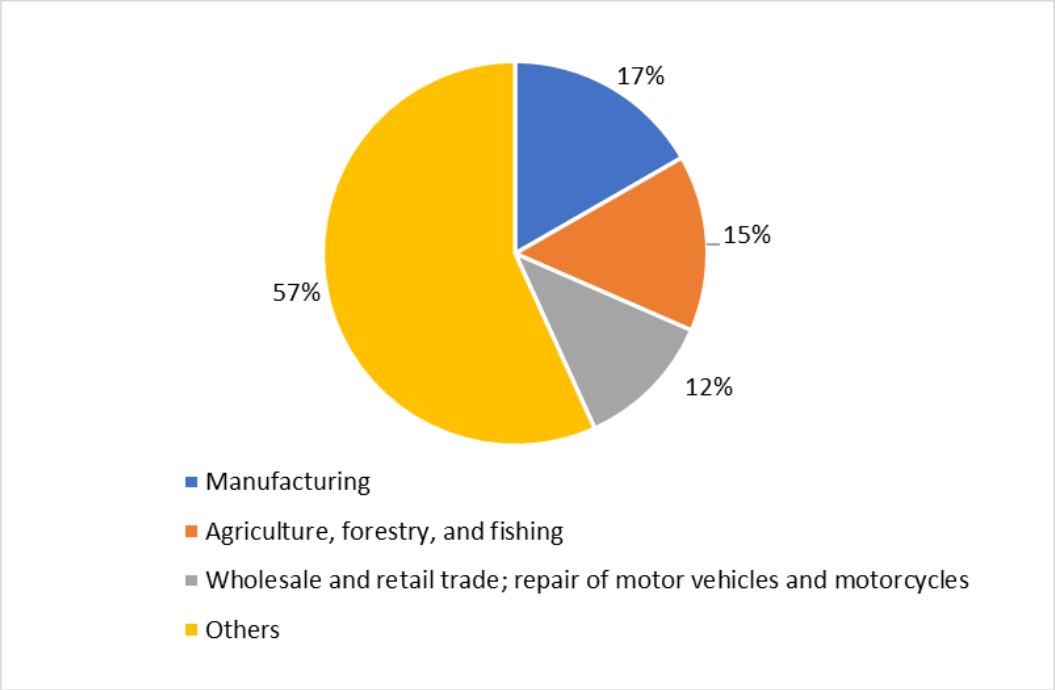


Source: IEA (2022).

2) GDP by sector and changes in industrial structure

In terms of the share of nominal GDP by sector in 2020, manufacturing is in first place (17%), followed by agriculture, forestry, and fishing (15%), and wholesale and retail trade (12%) (Figure 3.67). Viet Nam's 10-year Socio-Economic Development Strategy set the goal of 'becoming an industrialized country by 2020.' and the industrial development strategy for Viet Nam until 2025 identified three major industries, including manufacturing.

Figure 3.67. Viet Nam Gross Domestic Product by Sector at Current Market Prices (2020)



Source: ADB (2022).

3) Transition of TES by energy type

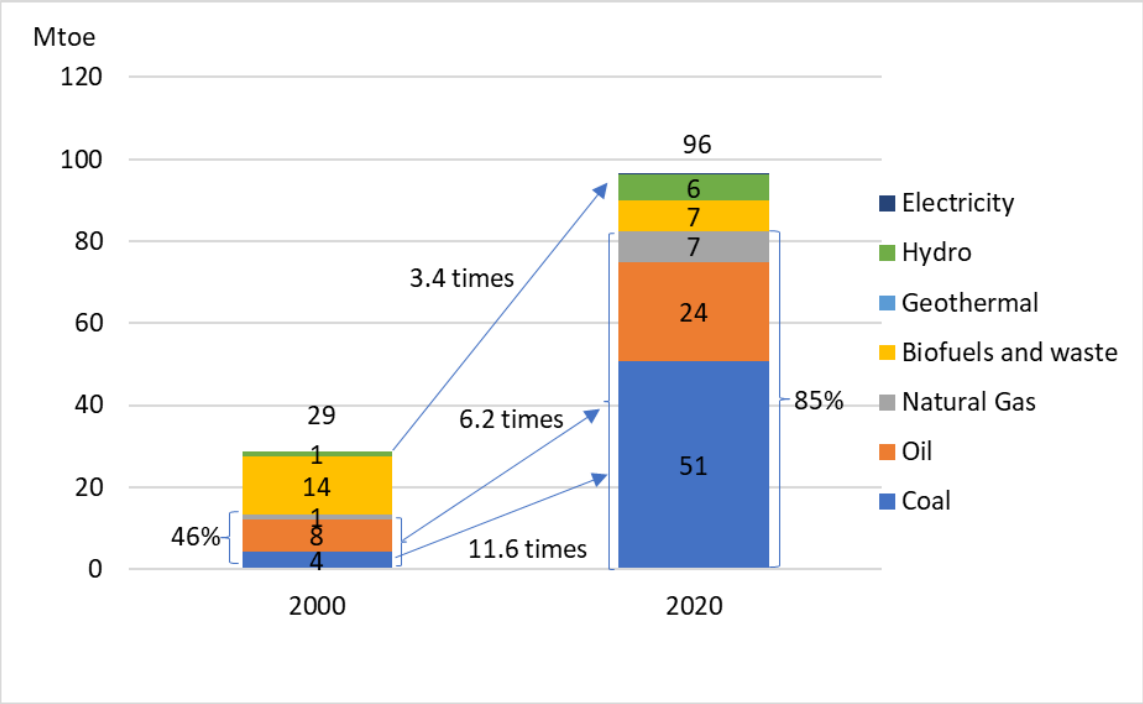
In 20 years, TES increased by 3.4 times from 29 Mtoe in 2000 to 96 Mtoe in 2020.

Of that amount, TES of fossil fuels (oil, coal, and natural gas) increased by 6.2 times from 13 Mtoe in 2000 to 82 Mtoe in 2020. Focusing on TES of fossil fuels by energy, TES of oil and natural gas increased 3.6 and 6.6 times, respectively, while TES of coal, which has a particularly high CO_2 emissions factor, increased significantly by 11.6 times, from 4 Mtoe in 2000 to 51 Mtoe in 2020.

For non-fossil fuels, hydro TES increased by 5.0 times, while biofuels and waste TES decreased by 0.5 times.

Fossil fuel dependence (the percentage of oil, coal, and natural gas in the total) increased from 46% in 2000 to 86% in 2020 (Figure 3.68).

Figure 3.68. Total Energy Supply by Energy Type (Viet Nam: 2000 vs 2020)



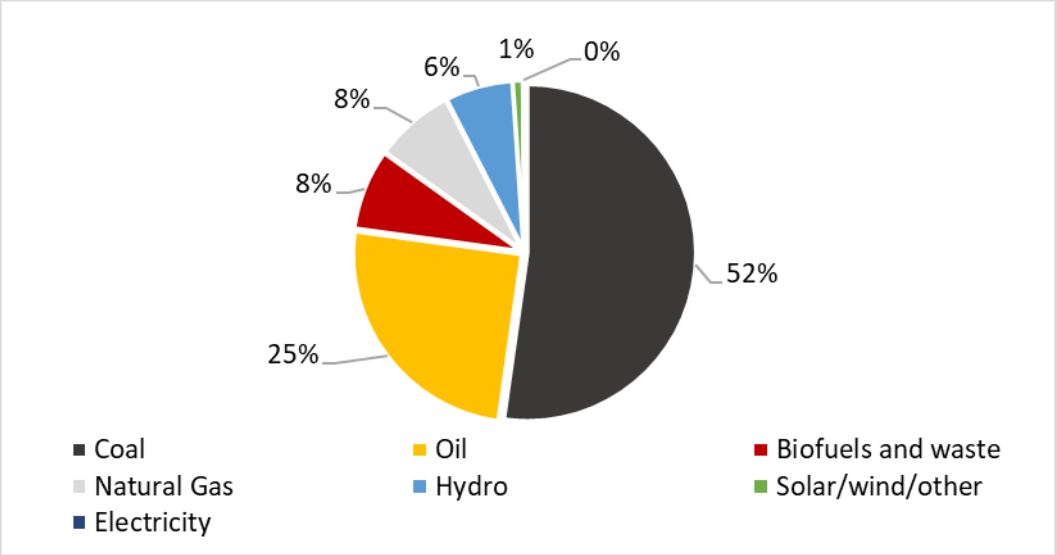
Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of TES share by energy source in 2020, coal ranks first (52.2%), oil second (24.9%), biofuels and waste third (7.7%), followed by natural gas (7.6%), hydro (6.4%), and solar/wind/other (0.9%).

Fossil fuels, with a TES share of 85%, account for much of the TES. Coal, which has a particularly high CO_2 emissions factor, tops the list with a 52% TES share.

On the other hand, the TES share of non-fossil fuels (biofuels and waste, geothermal, hydro, and solar/wind/other) is 15%. The breakdown is dominated by biofuels and waste (8%) and hydro (6%), with solar/wind/others at a very low 1% (Figure 3.69).

Figure 3.69. Total Energy Supply Share by Energy (Viet Nam: 2020)

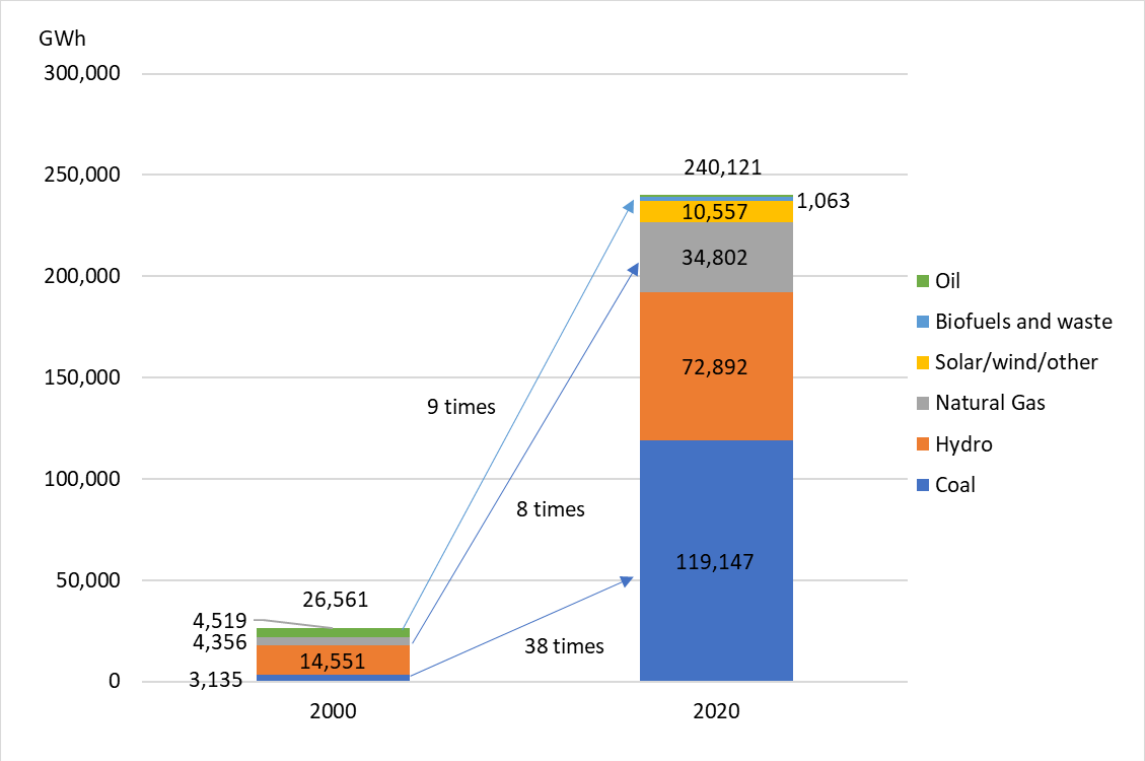


Source: IEA (2022).

4) Transition of power generation by fuel

In 20 years, power generation increased 9.0 times from 26,561 GWh in 2000 to 240,121 GWh in 2020. In terms of power generation by fuel in 2020, coal ranks first (119,147 GWh), followed by hydro (72,892 GWh), natural gas (34,802 GWh), solar/wind /other (10,557 GWh), biofuels and waste (1,660 GWh) and oil (1,063 GWh). Natural gas has increased 8.0 times from 4,356 GWh in 2000 to 34,802 GWh in 2020, mainly due to the Rang Dong oil field associated gas recovery and utilisation project. Power generation from coal, which has a high CO_2 emissions factor, jumped 38 times from 3,135 GWh in 2000 to 119,147 GWh in 2020 (Figure 3.70).

Figure 3.70. Electricity Output by Fuel (Viet Nam: 2000 vs 2020)



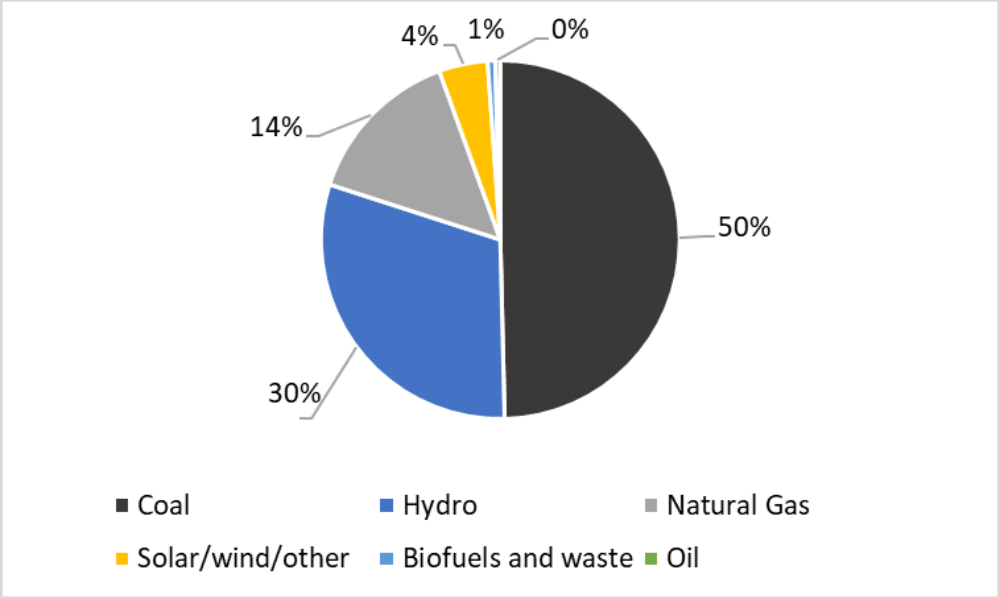
Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of share of power generation by fuel in 2020, coal ranks first (50%), hydro second (30%), natural gas third (14%), followed by solar, wind, and other (4%), and biofuels and waste (1%).

Fossil fuels account for most of the share of power generation, at 65%. Coal, which has a particularly high CO_2 emissions factor, tops the list with a 50% share.

On the other hand, the TES share of non-fossil fuels (biofuels and waste, geothermal, hydro, and solar/wind/other) is 35%. The breakdown is as follows: 30% for hydro, 4% for solar/wind/other, and 1% for biofuels and waste (Figure 3.71).

Figure 3.71. Electricity Output Share by Fuel (Viet Nam: 2020)



Source: IEA (2022).

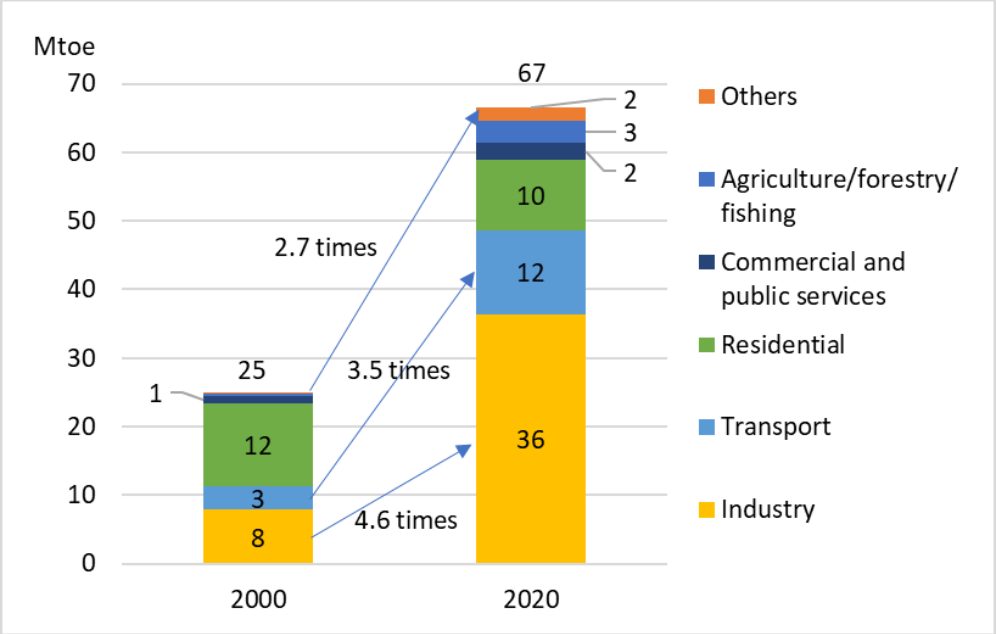
5) Transition of final energy consumption by sector

In 20 years, final energy consumption increased by 2.7 times from 25 Mtoe in 2000 to 67 Mtoe in 2020. In terms of final energy consumption by sector in 2020, the industry sector is in first place (36 Mtoe), followed by the transport sector (12 Mtoe), the residential sector (10 Mtoe), the agriculture, forestry, and fishing sector (3 Mtoe), the commercial and public service sector (2 Mtoe) and the others (2 Mtoe).

Comparing final energy consumption over the 20-year period from 2000 to 2020, we find that the final energy consumption in the industry sector increased 4.6 times from 8 Mtoe to 36 Mtoe, the transport sector increased 3.5 times from 3 Mtoe to 12 Mtoe, while the final energy consumption in the residential sector decreased 0.9 times from 12 Mtoe to 10 Mtoe (Figure 3.72).

The industry sector's final energy consumption has been growing with the progress of industrialisation. The final energy consumption in the transport sector has also been growing with the development of motorisation.

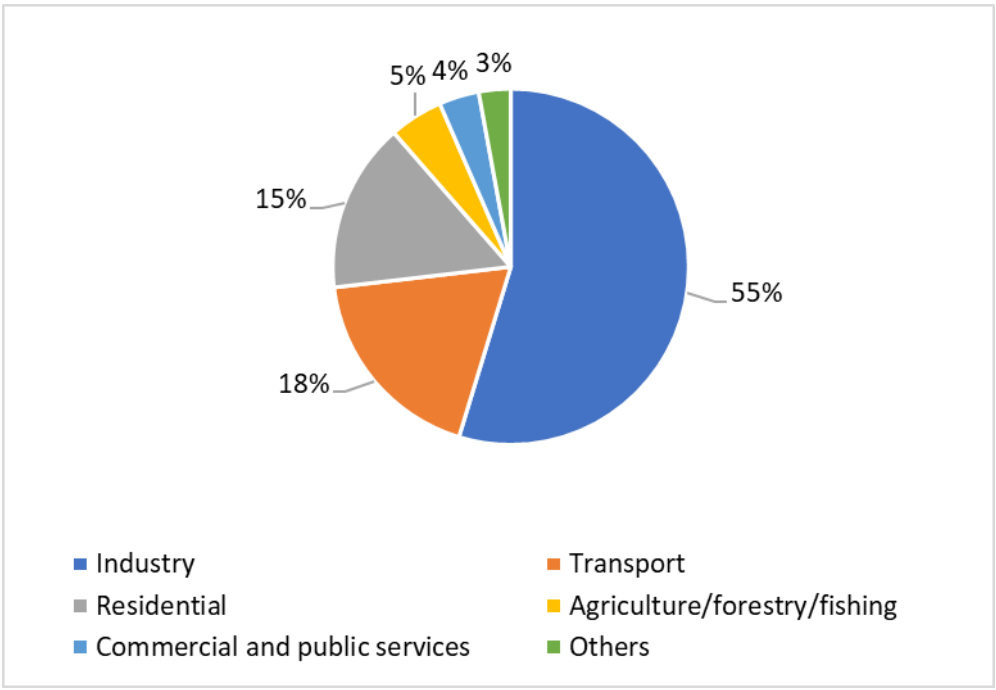
Figure 3.72. Final Energy Consumption (Viet Nam: 2000 vs 2020)



Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of the share of final energy consumption by sector in 2020, the manufacturing industries and construction sector ranked first (55%), followed by the transport sector (18%), the residential sector (15%), the agriculture, forestry and fishing sector (5%), the commercial and public services sector (4%) and others (3%) (Figure 3.73).

Figure 3.73. Final Energy Consumption Share by Sector (Viet Nam: 2020)



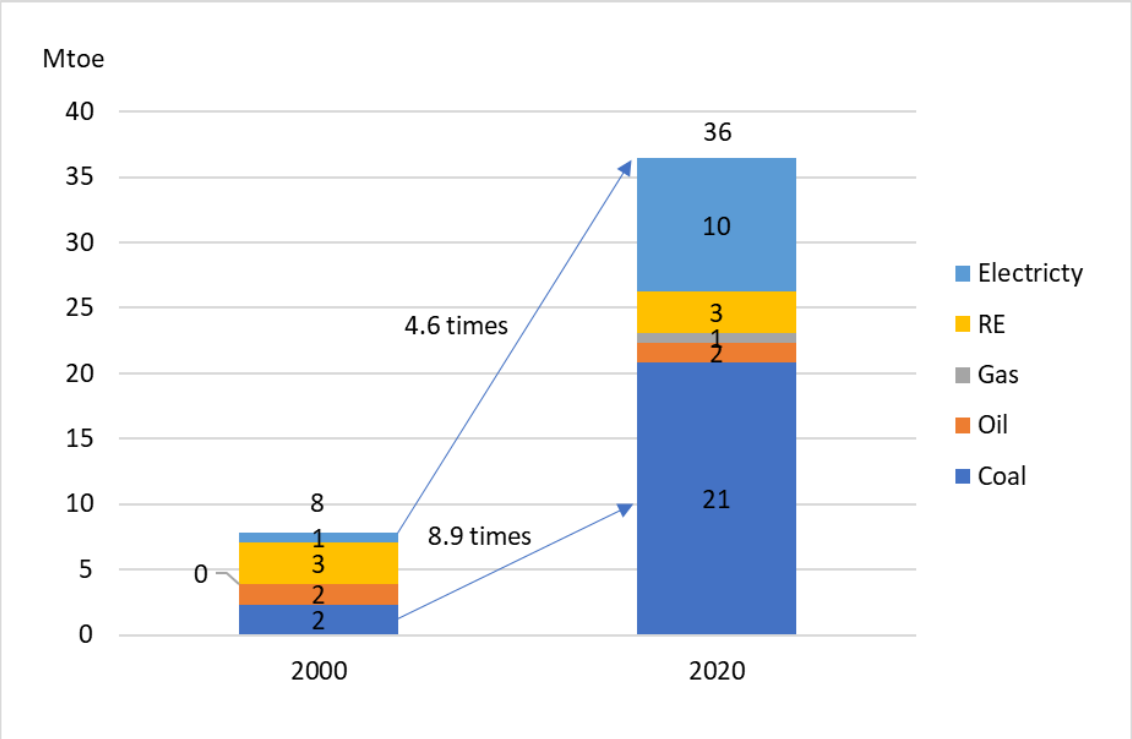
Source: IEA (2022).

6) Energy consumption and efficiency in the industry sector

The final energy consumption in the manufacturing industries and construction sector increased 4.6 times from 8 Mtoe in 2000 to 36 Mtoe in 2020.

In particular, the final energy consumption of coal increased 8.9 times from 2 Mtoe in 2000 to 21 Mtoe in 2020 (Figure 3.74).

Figure 3.74. Final Energy Consumption Transition by Fuel (Viet Nam: 2000 vs 2020)



RE = renewable energy.
Source: IEA (2022).
Note: Totals may not match due to rounding.

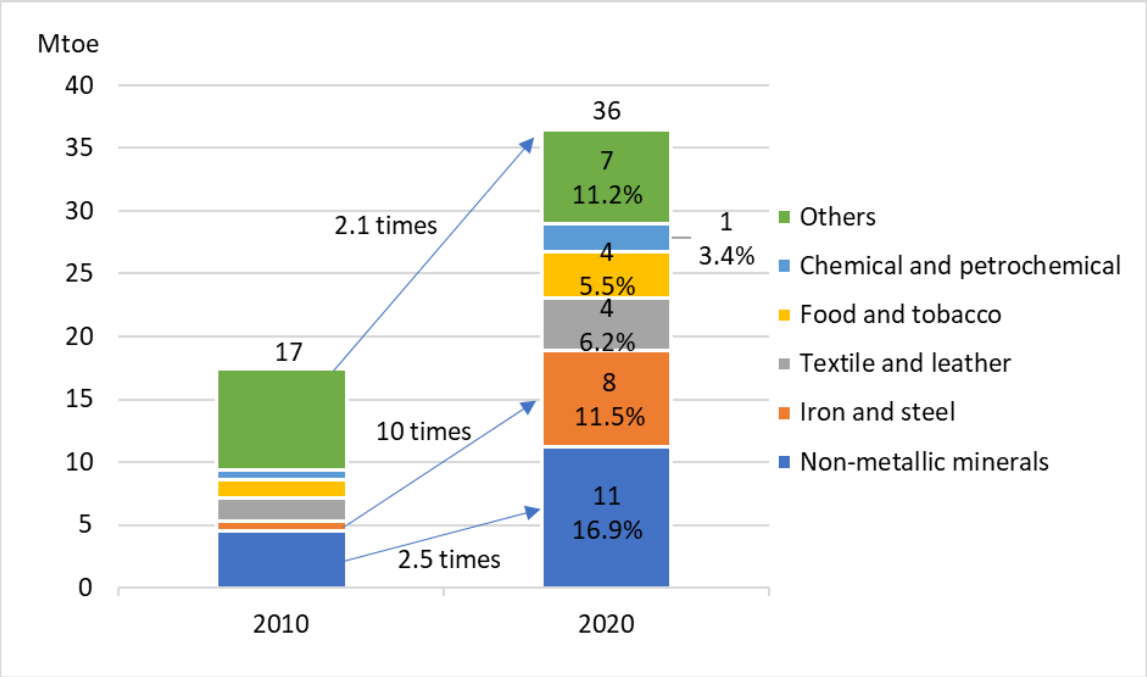
In the IEA World Energy Balance, final energy consumption data for subsectors of the industry sector in Viet Nam are available since 2010.

The final energy consumption in the industry sector increased 2.1 times from 17 Mtoe in 2010 to 36 Mtoe in 2020.

In terms of final energy consumption by subsector in the industry sector, the final energy consumption in the non-metallic minerals subsector increased about 2.5 times from 4.5 Mtoe in 2010 to 11.2 Mtoe in 2020, while the final energy consumption in the iron and steel subsector increased about 10 times from 0.7 Mtoe in 2010 to 7.7 Mtoe in 2020.

In the industry sector, the share by subsector in the final energy consumption in 2020 is 16.9% for the non-metallic minerals subsector and 11.5% for the iron and steel subsector (Figure 3.75).

Figure 3.75. Final Energy Consumption Transition and Share by Industry Subsector (Viet Nam: 2010 vs 2020)



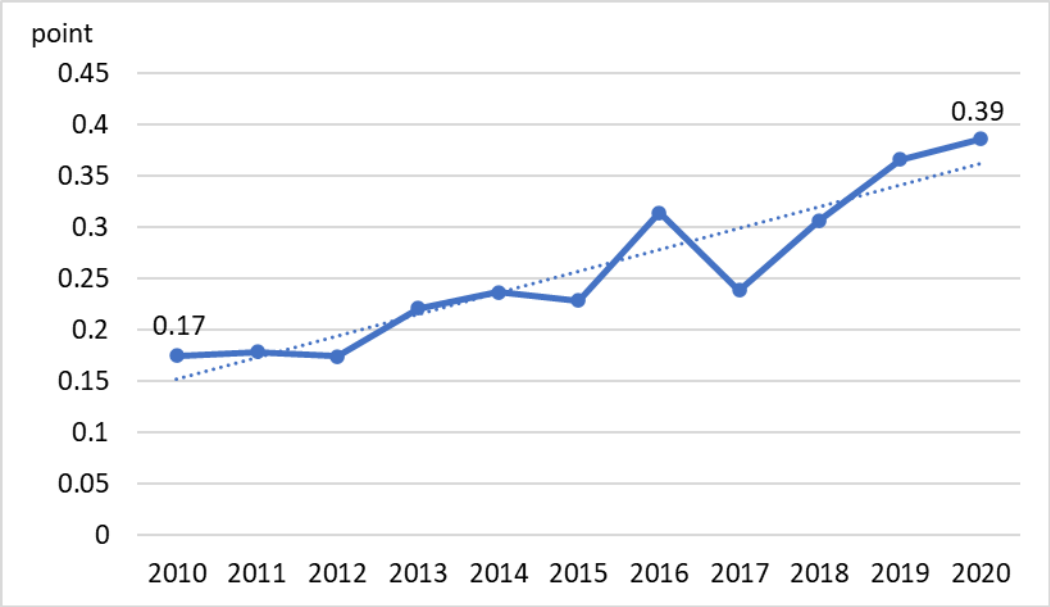
Source: IEA (2022).
Note: Totals may not match due to rounding.

Next, we consider the iron and steel subsector and the non-metallic minerals subsector, for which statistical data are available.

a) Iron and steel subsector

Figure 3.76 shows the indicator of final energy consumption in the iron and steel subsector divided by crude steel production. The indicator worsened from 0.17 in 2010 to 0.39 in 2020.

Figure 3.76. EE&C Indicator Transition of Iron and Steel Subsector (Viet Nam)

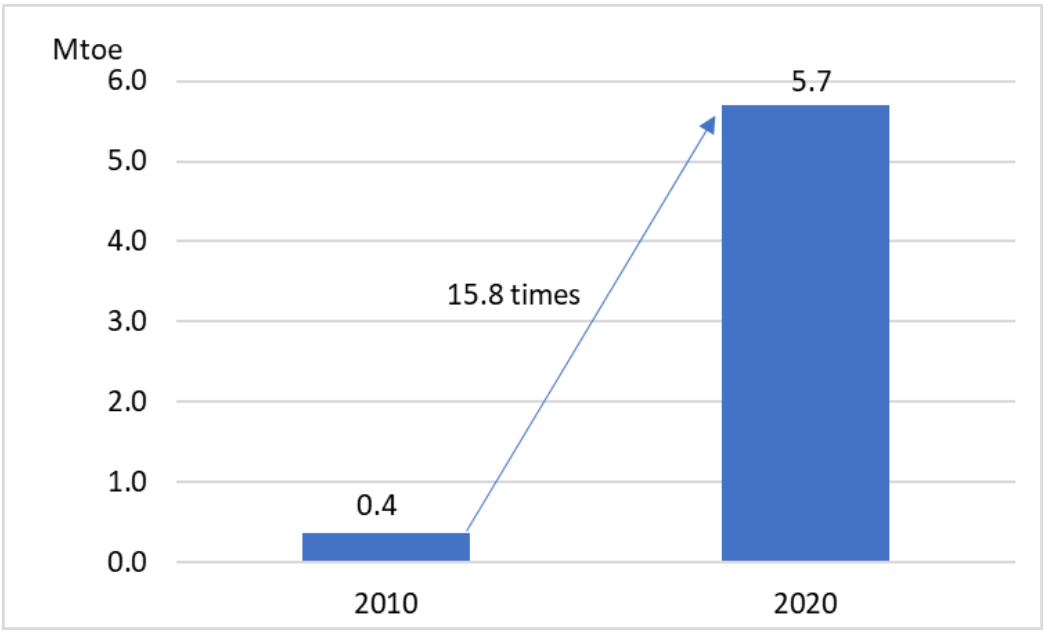


EE&C = energy efficiency and conservation.
Source: IEA (2022) and World Steel Association
Note: The dotted line in the graph is an approximate curve.

In the manufacturing industries of Viet Nam, the energy consumption in the iron and steel subsector steeply increased. In particular, the final energy consumption of coal in the iron and steel subsector increased by 15.8 times from 0.4 Mtoe in 2010 to 5.7 Mtoe in 2020 (Figure 3.77). This growth rate is first and prominent amongst all sectors.

The crude steel production in Viet Nam rose by approximately 5.7 times from 2.7 million tonnes in 2009 to 15.47 million tonnes in 2018, indicating rapid growth in the past 10 years. In 2017, the nation's first integrated blast-furnace steelworks began operation in Hà Tĩnh, which is in the in the middle region of Viet Nam. These circumstances are considered as a factor for the increase of the final energy consumption in the iron and steel subsector.

Figure 3.77. Final Energy Consumption Transition of Coal by Iron and Steel Subsector (Viet Nam: 2010 vs 2020)

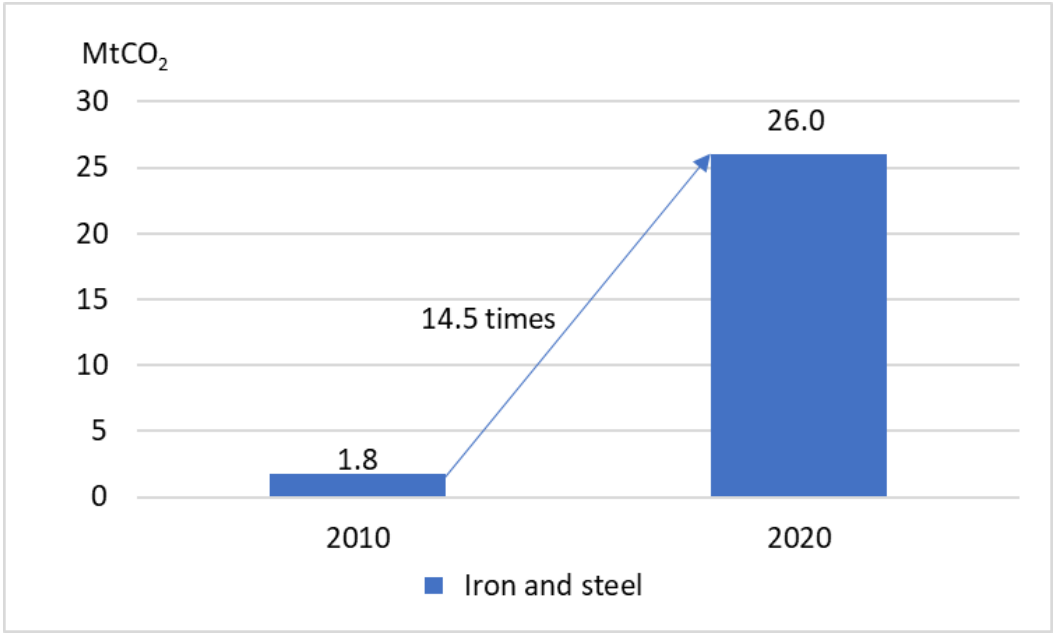


Source: IEA (2022).

In addition, the CO_2 emissions in the iron and steel subsector showed 14.5 times increase from 1.8 $MtCO_2$ in 2010 to 26 $MtCO_2$ in 2020 (Figure 3.78).

The iron and steel subsector is known for its high coal consumption. It is considered that an increase in the consumption of energy such as coal (by 15.8 times) in this sub- sector led to the increase of the CO_2 emissions (by 14.5 times).

Figure 3.78. CO_2 Emissions Transition by Iron and Steel Subsector (Viet Nam: 2010 vs 2020)

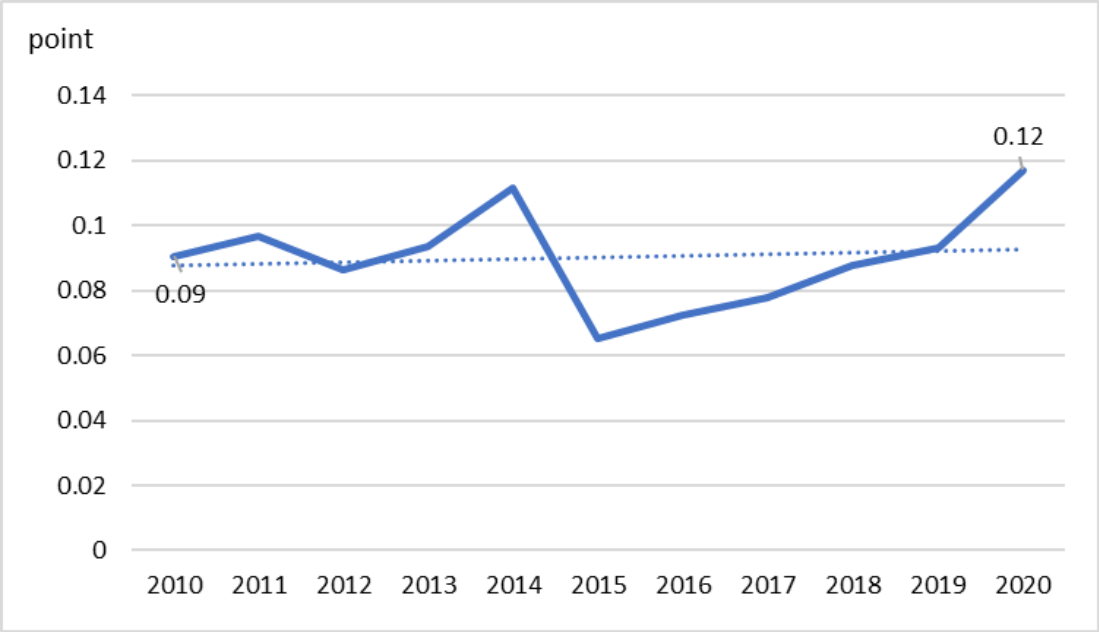


Source: IEA (2022).

b) Non-metallic minerals subsector

Figure 3.79 shows an indicator calculated by dividing the final energy consumption in the non-metallic minerals subsector by the cement production. The indicator improved from 0.09 in 2000 to 0.12 in 2020.

Figure 3.79. EE&C Indicator Transition of Non-Metallic Minerals Subsector (Viet Nam)



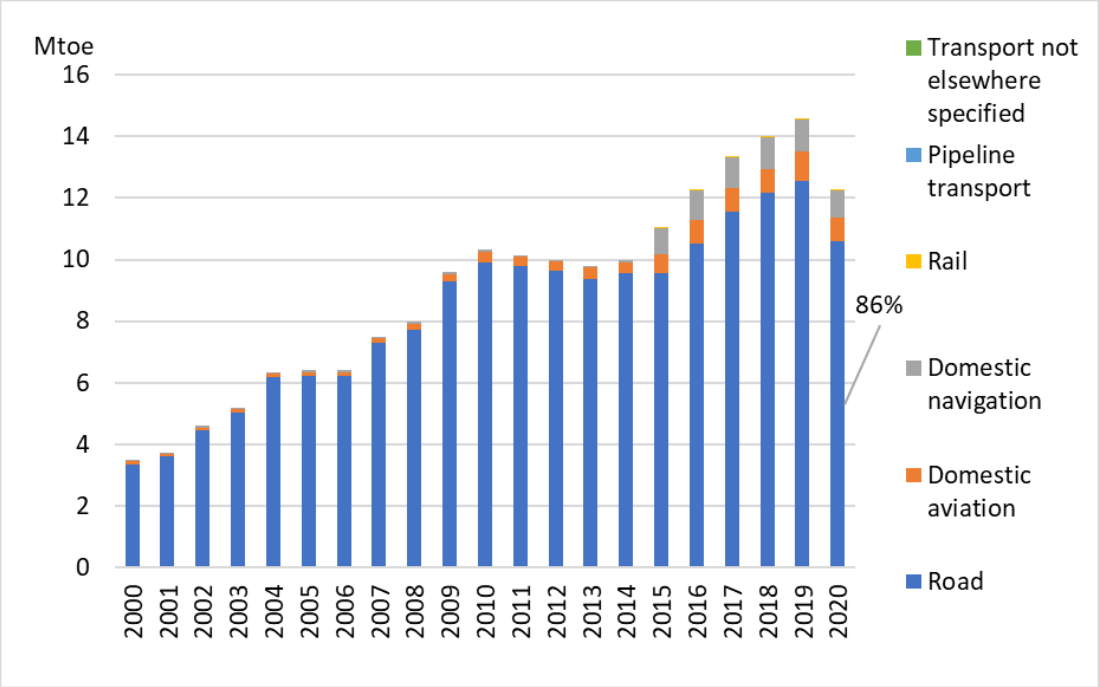
EE&C = energy efficiency and conservation.
Source: IEA (2022) and USGS Cement Statistics and Information https://www.usgs.gov/centers/national-minerals-information-center/cement-statistics-and-information (accessed 23 May 2023).
Note: The dotted line in the graph is an approximate curve.

7) Energy consumption and efficiency in the transport sector

86% of the energy consumption in the transport sector as of 2020 is represented by the road transport (Figure 3.80).

The energy consumption in the road transport sector has continued to rapidly increase over the past 20 years.

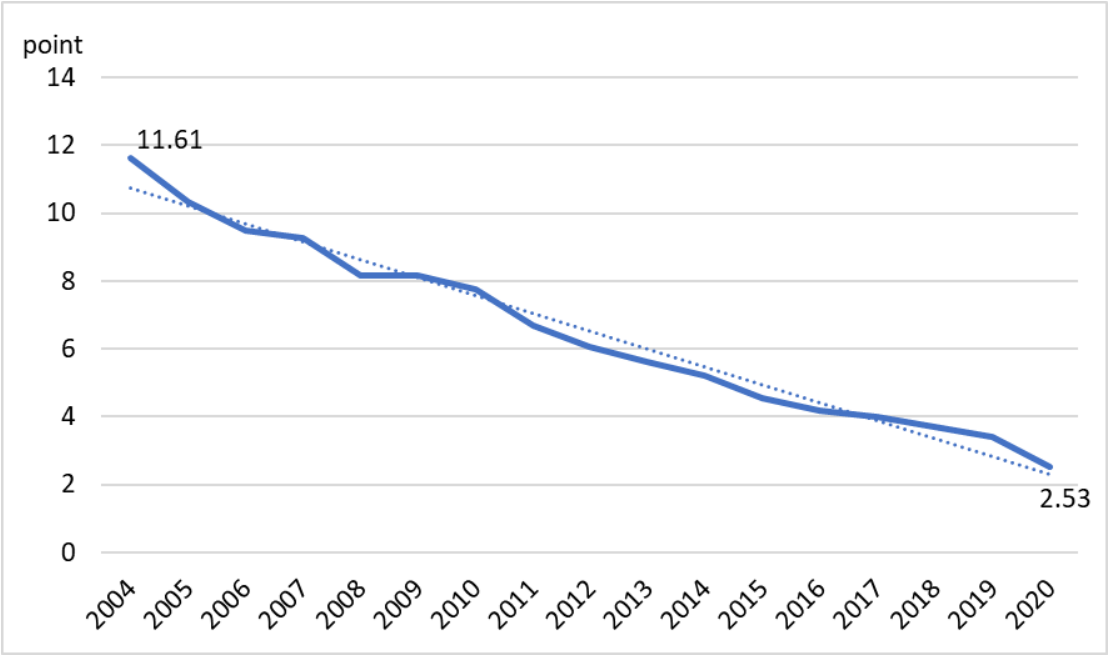
Figure 3.80. Final Energy Consumption Transition by Transport Sector (Viet Nam)



Source: IEA (2022).

Next, we analyse the indicator obtained by dividing final energy consumption in the road transport sector by the number of registered vehicles owned. The indicator of 11.61 in 2000 improved to 2.53 in 2020 (Figure 3.81).

Figure 3.81. EE&C Indicator Transition of Road Transport (Viet Nam)



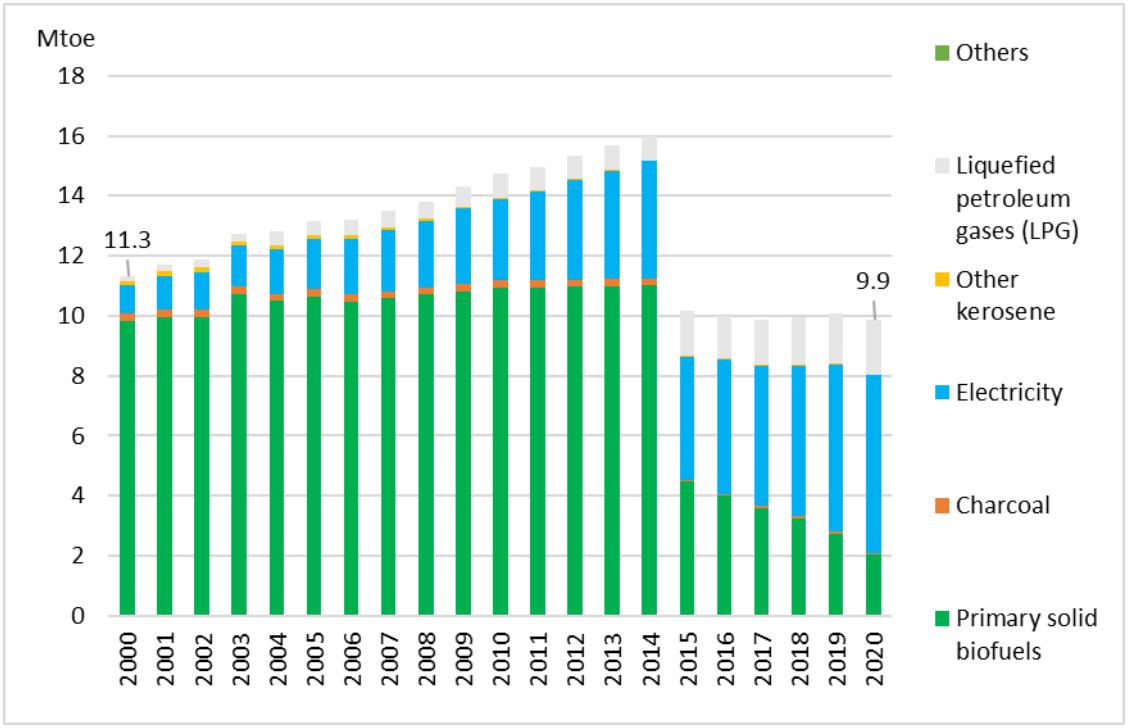
EE&C = energy efficiency and conservation.
Source: IEA (2022) and ASEANStats, https://data.aseanstats.org/ (accessed 4 June 2023).

8) Energy consumption and efficiency in the residential sector

The final energy consumption in the residential sector decreased from 11.3 Mtoe in 2000 to 9.9 Mtoe. However, the consumption of biofuels began to steeply decline in 2015, as shown in the graph. The cause of this is unknown.

An analysis of this breakdown into traditional fuels, such as primary solid biofuels and charcoal, and modern fuels, such as LPG, kerosene, and electricity, shows that the traditional fuels have decreased, but the modern fuels have increased. It is considered that uses of electricity and LPG have increased due to improvement in living standards (Figure 3.82).

Figure 3.82. Final Energy Consumption Transition of Residential Sector (Viet Nam)

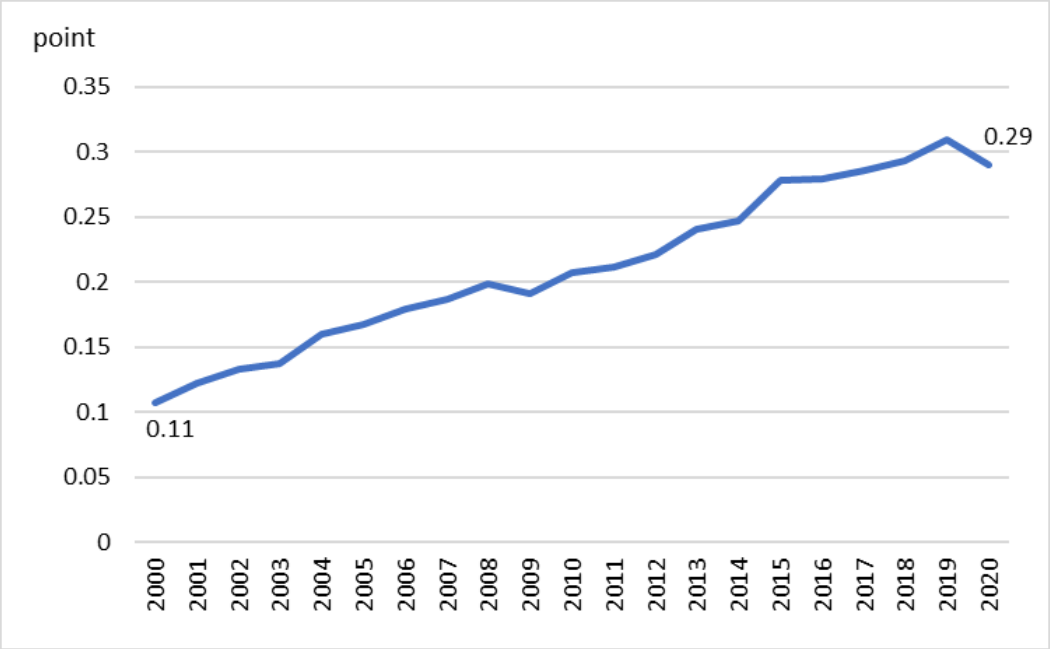


Source: IEA (2022).

Next, we analyse the indicator of final energy consumption of modern energy divided by the number of households. Since statistical data showing the number of households in Viet Nam are not confirmed, a deemed number of households calculated by dividing the population by the average number of people per household is used.

Figure 3.83 shows that the indicator worsens from 0.11 in 2000 to 0.29 in 2022.

Figure 3.83. EE&C Indicator Transition of Residential Sector (Viet Nam)



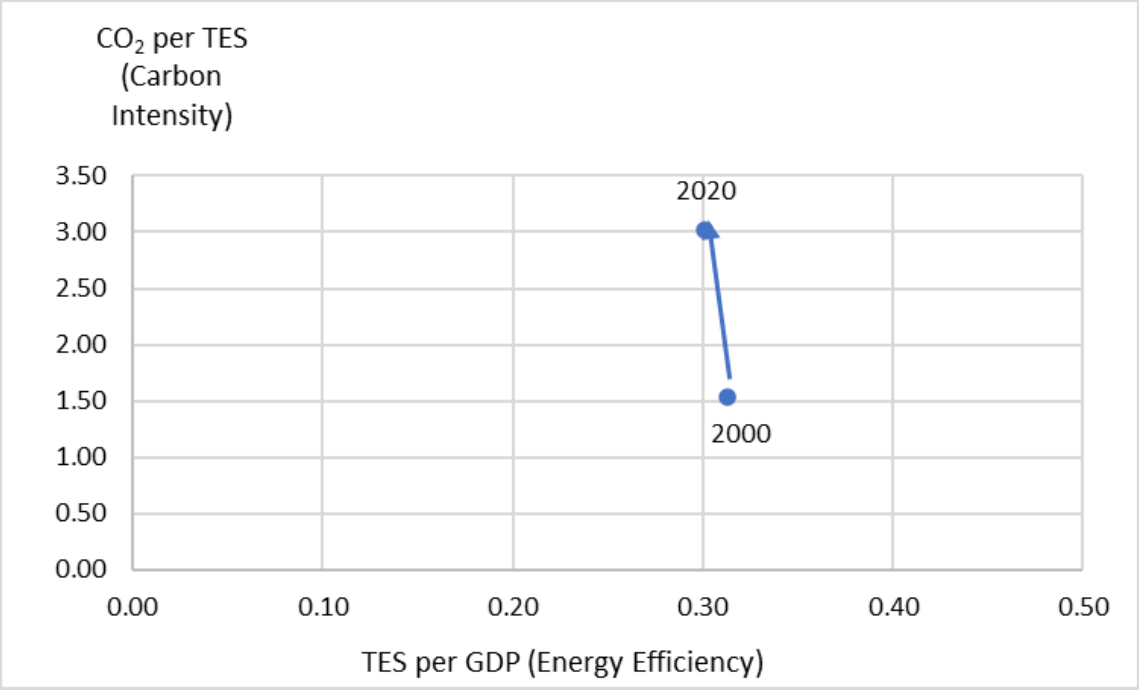
EE&C = energy efficiency and conservation.
Source: IEA (2022) and United Nations.
https://population.un.org/household/#/countries/ (accessed 23 May 2023).

4.2. Indicator of Energy Efficiency

1) Energy efficiency and carbon intensity

As shown in the graph below, TES per GDP, a leading indicator of energy efficiency, changed only slightly over 20 years from 0.31 in 2000 to 0.3 in 2020, indicating that energy conservation has not advanced. On the other hand, CO_2 emissions per TES worsened from 1.54 in 2000 to 3.02 in 2020. In other words, energy conservation has not progressed, and the carbon intensity is deteriorating (Figure 3.84).

Figure 3.84. Energy Efficiency and Carbon Intensity Transition (Viet Nam: 2000–20)



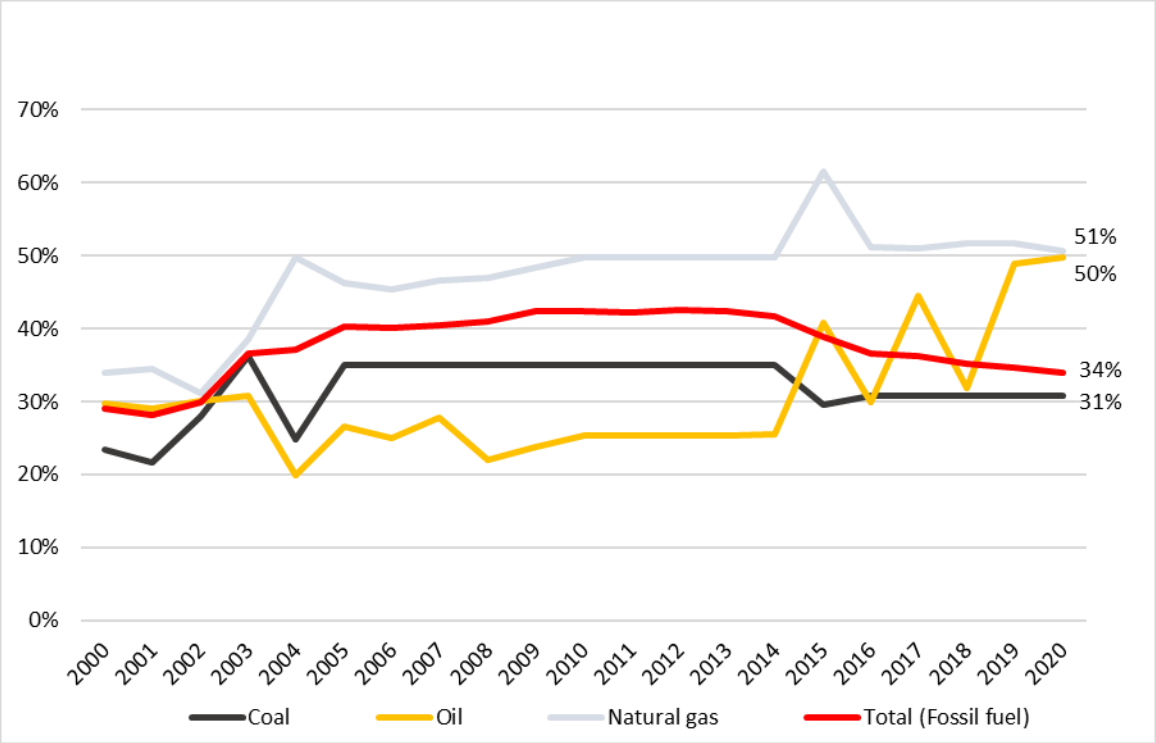
GDP = gross domestic product, TES = total energy supply.
Source: IEA (2022).

2) Power generation efficiency

Over the 20 years, the efficiency of thermal power generation (coal, oil, and natural gas) has generally remained around 38%. As of 2020, the efficiency of thermal power generation (average of coal, oil, and natural gas) is 34%.

The efficiency of coal-fired power generation over the 20-year period generally hovers around 32%, and the efficiency as of 2020 is 31% (Figure 3.85).

Figure 3.85. Thermal Efficiency Transition (Viet Nam:2000–20)



Source: IEA (2022).

4.3. Indicator of CO_2 emissions

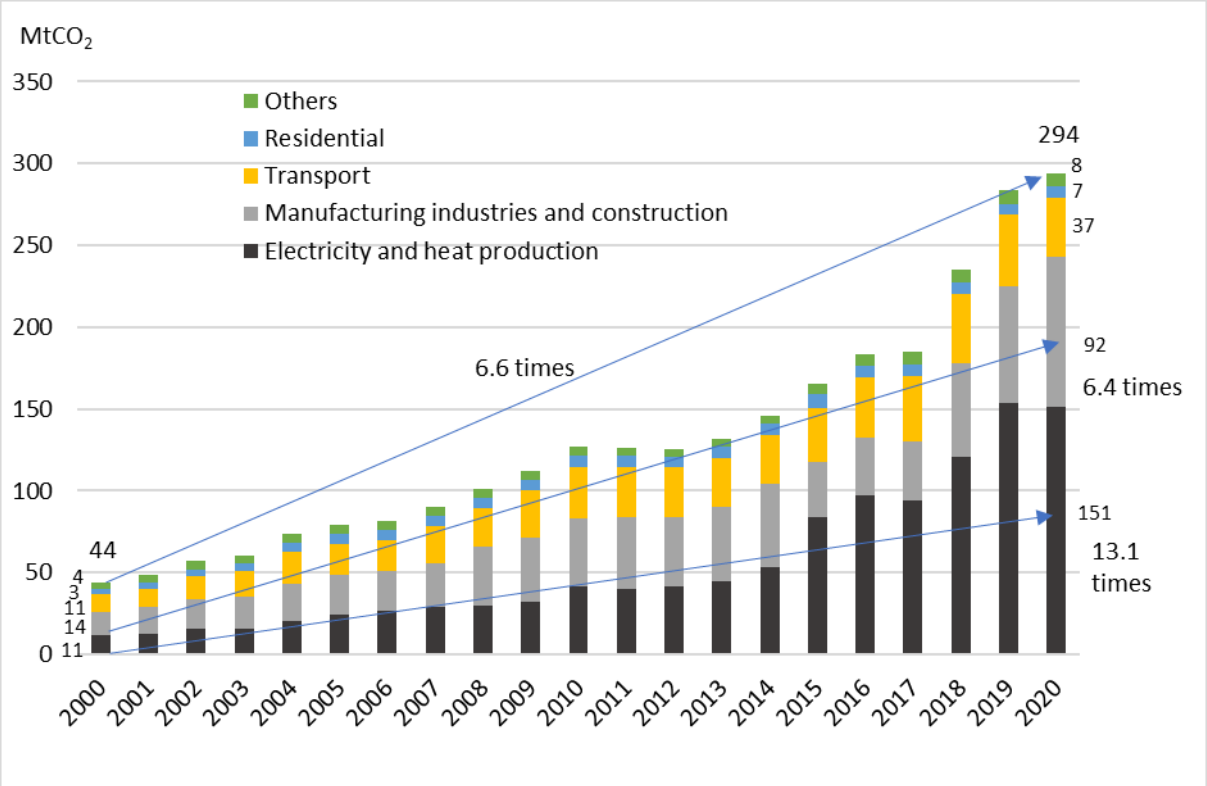
1) Transition in CO_2 emissions by sector

CO_2 emissions increased 6.6 times in 20 years, from 44 $MtCO_2$ in 2000 to 294 $MtCO_2$ in 2020.

CO_2 emissions by sector in 2020 are 151 $MtCO_2$ in the electricity and heat production sector, 92 $MtCO_2$ in the manufacturing industries, 37 $MtCO_2$ in the transport sector, 7 $MtCO_2$ in the residential sector, and 8 $MtCO_2$ in the others.

Comparing CO_2 emissions by sector from 2000 to 2020, we find that the CO_2 emissions in the electricity and heat production sector increased 13.1 times from 11 $MtCO_2$ to 151 $MtCO_2$, that in the manufacturing industries increased 6.4 times from 14 $MtCO_2$ to 92 $MtCO_2$, that in the transport sector increased 3.5 times from 11 $MtCO_2$ to 37 $MtCO_2$, and that in the residential sector doubled from 3 $MtCO_2$ to 7 $MtCO_2$ (Figure 3.86).

Figure 3.86. CO_2 Emissions Transition by Sector (Viet Nam:2000–20)

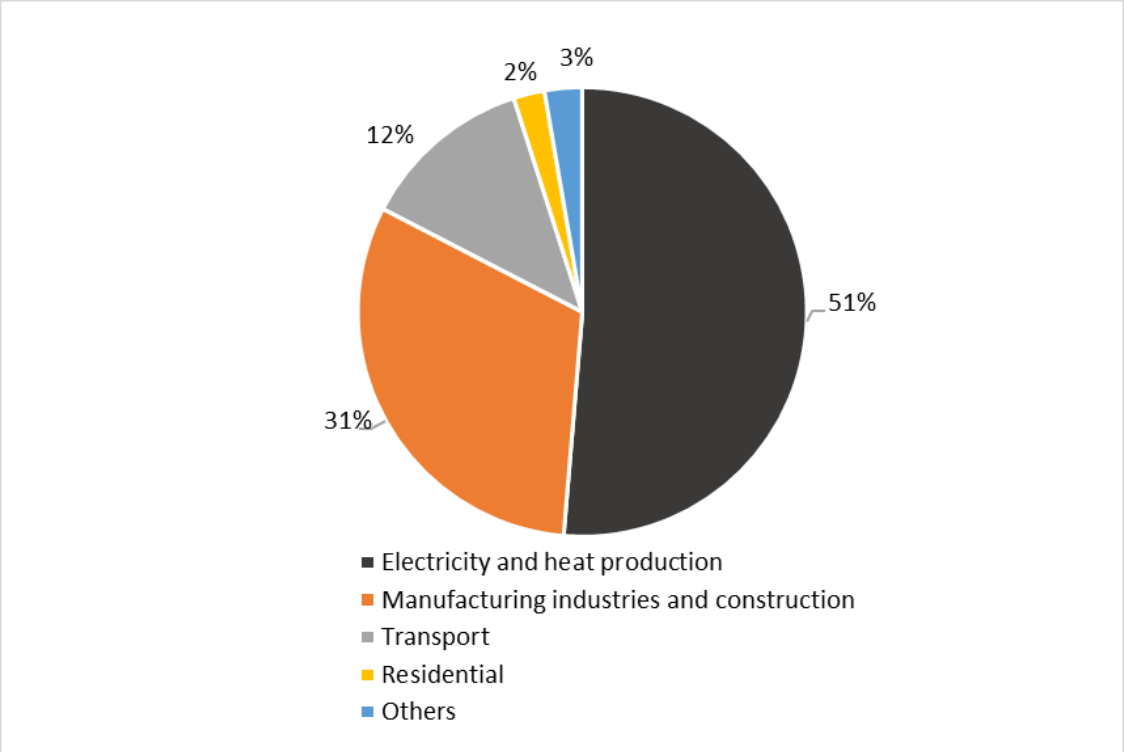


Source: IEA (2022).
Note: Totals may not match due to rounding.

In terms of the share of CO_2 emissions by sector in 2020, the electricity and heat production sector is in first place (51%), followed by the manufacturing industries and construction sector (31%), the transport sector (12%), the residential sector (2%), and others (3%) (Figure 3.87).

In the electricity and heat production sector, the share of power generation from fossil fuels (oil, coal, and natural gas) is high, especially the share of coal-fired power generation (50%). In addition, coal-fired power generation efficiency (31%) is low compared to the OECD average (39%), suggesting that the CO_2 emissions from coal is a major factor for increasing the CO_2 emissions from the electricity and heat production sector.

Figure 3.87. CO_2 Emissions by Sector (Viet Nam: 2020)



Source: IEA (2022).

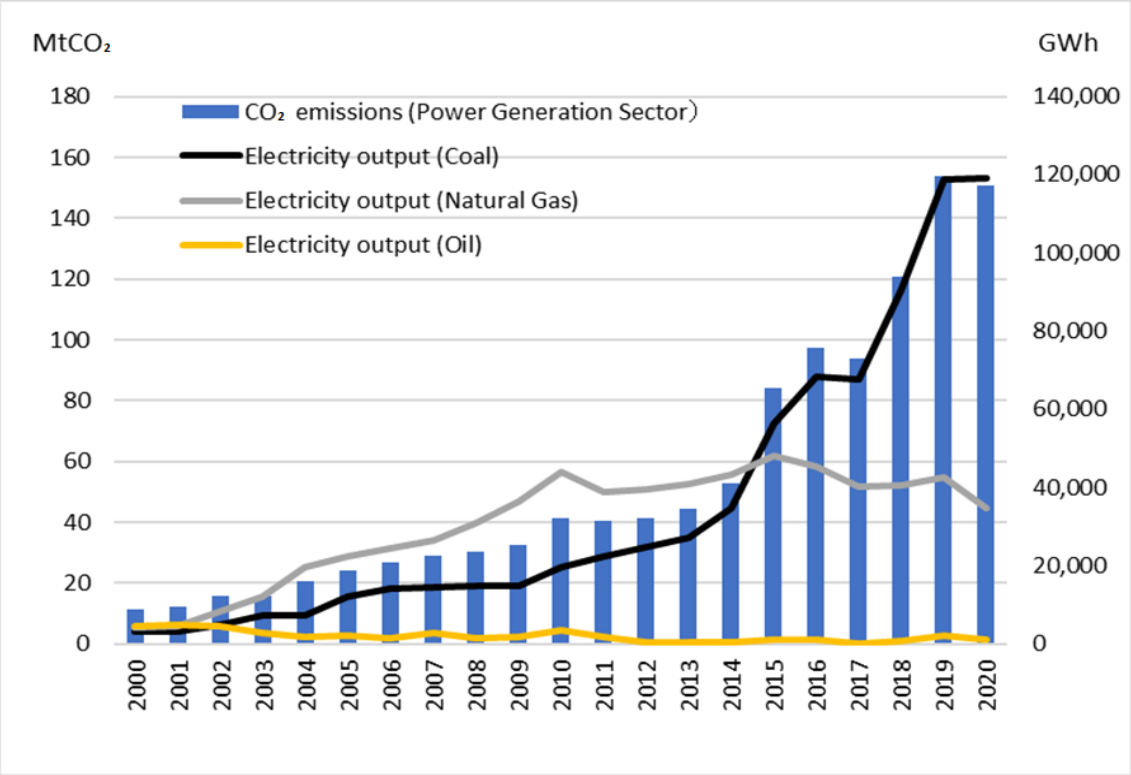
2) CO_2 emissions and coal-fired power generation

We analysed the relationship between the amount of thermal power generation of fossil fuels (oil, coal, and natural gas), which are closely related to CO_2 emissions, and CO_2 emissions from the electricity and heat production sector, in the period of 2000 through 2020.

A graph of CO_2 emissions from the electricity and heat production sector versus oil-, coal-, and natural gas-fired power generation over a 20-year period is shown in Figure 3.88.

The graph indicates a strong correlation between CO_2 emissions and coal-fired power generation in the electricity and heat production sector in Viet Nam.

Figure 3.88. Transition between CO_2 Emissions in Electricity Sector and Coal, Natural Gas, and Oil Electricity Output (Viet Nam: 2000–20)



Source: IEA (2022).

4.4. Summary of Efficiency Metrics

Table 3.4 summarises Viet Nam's energy efficiency indicator.

The difference over the 20 years is that TES per GDP remained unchanged while the EE&C indicator of the iron and steel subsector and that of the residential sector deteriorated. The EE&C indicator of road transport improved significantly. Thermal efficiency (coal-fired) has improved, but efficiency is still low compared to the OECD average.

Table 3.4. Summary of Energy Efficiency Indicator (Viet Nam)

Energy Efficiency Indicator	Viet Nam		
	2000	2020	
TES per GDP	0.31	0.30	Improve
EE&C Indicator of Iron and Steel Sector	0.17	0.39	Worsen
EE&C Indicator of Non-metallic minerals Sector	0.09	0.12	Worsen
EE&C Indicator of Road Transport Sector	11.61	2.53	Improve
EE&C Indicator of Residential Sector	0.11	0.29	Worsen
Thermal Efficiency (Fossil fuel-fired)	0.29	0.34	Improve
Thermal Efficiency (Coal-fired)	0.23	0.31	Improve

EE&C = energy efficiency and conservation, GDP = gross domestic product,
TES = total energy supply.
Source: Author.

4.5. Energy Efficiency Policy

In January 2011, The Law on Energy Efficiency and Conservation (Energy Conservation Law) came into force. The law requires plants and business operators designated for energy management to prepare and submit an energy-conservation annual plan and Five-Year Plan, and report regularly, appoint an energy manager, and conduct an energy audit once every 3 years.

General energy conservation measures in Viet Nam include financial support, labeling systems, formulation of energy conservation plans and establishment of business responsibilities and obligations, designation of 'major energy users' with high annual energy consumption by the Ministry of Commerce and Industry, formulation of annual plans and Five-Year Plans for the rationalisation of energy use, establishment of 'major operations such as energy use' including designation of energy managers, etc. other measures include the obligation to affix energy labels to devices subject to energy labeling, exemption from tariffs on equipment used for energy-saving technology development and energy-related research, and tax incentives to produce energy-saving products.

Industry sector

- Formulation of an annual energy-saving plan
- Introduction of highly energy-efficient equipment
- Implementation of production line maintenance regulations aimed at preventing energy loss, and the use of old technology
- Sequential dismantling of energy-consuming facilities

Commercial and residential sector

- Designing buildings that make use of nature to reduce energy consumption through lighting, ventilation, and air conditioning.
- Prioritising the use of renewable energy and the installation of high efficiency equipment
- The use of natural lighting, ventilation, heat insulation, and energy-saving electrical equipment
- The promotion of restraints on the use of large-capacity facilities during peak hours

Transport sector

- Use LPG, natural gas, electric power, hybrid fuels, and biogas as petroleum substitutes
- Select routes and transportation methods that optimise fuel use
- Develop maintenance and repair regulations from the perspective of fuel reduction
- Introduction, research on fuel-efficient equipment, and introduction of advanced technologies such as the use of alternative fuels such as clean fuels and renewable energy

4.6. CO_2 Emissions Reduction Policy

Viet Nam announced at COP26, which was held in the United Kingdom (UK) in November 2021, that it would aim to achieve carbon neutrality by 2050.

Viet Nam joined a coalition of 190 countries at COP26 that pledged to phase out coal-fired power

generation and stop construction of new plants.

Viet Nam revised its NDC in July 2020. In the revised NDC, the GHG reduction target was revised upward to 9%, with domestic self-help efforts by 2030 was set. This is equivalent to a GHG reduction of 83.90 million tonnes. With an international aid added, the reduction rate is 27%, meaning that the country aims at a reduction of 250.80 million tonnes.

Viet Nam will reduce GHG emissions by reducing energy consumption, improving energy efficiency, changing the fuel and energy structure in the industry and transport sectors, promoting renewable energy, and improving cement and chemical production processes.

Specifically, Viet Nam will invest in the renovation of equipment production lines, energy conservation and energy efficiency improvement in public facilities, schools, and hospitals, and promote the shift from conventional fuels to biofuels, natural gas, and electricity. It will also improve the energy efficiency of vehicles.

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