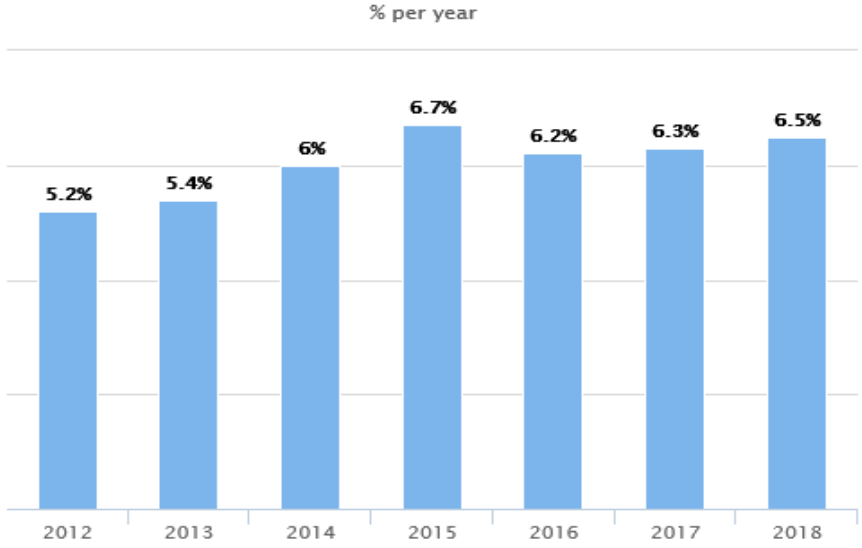
1.4 Viet Nam

Viet Nam is a country with a population of 92.7 million (2016). The United Nations (UN) estimates that by July 2018 the country's population will be 96.49 million (World Population Review, 2018). The actual gross domestic product (GDP) growth rate in 2017 was 6.81%, which is more than the expected rate of 6.3% projected by the Asian Development Bank (ADB), as shown in Figure 2.1.4-1. It is the highest growth rate in the past 6 years. With this growth rate, the GDP per capita is US$2,385, an increase of US$170 compared to 2016.

Figure 2.1.4-1 Gross Domestic Product Growth of Viet Nam, 2012–2018



Note: 2018 figure is projected.
Source: ADB (2017).

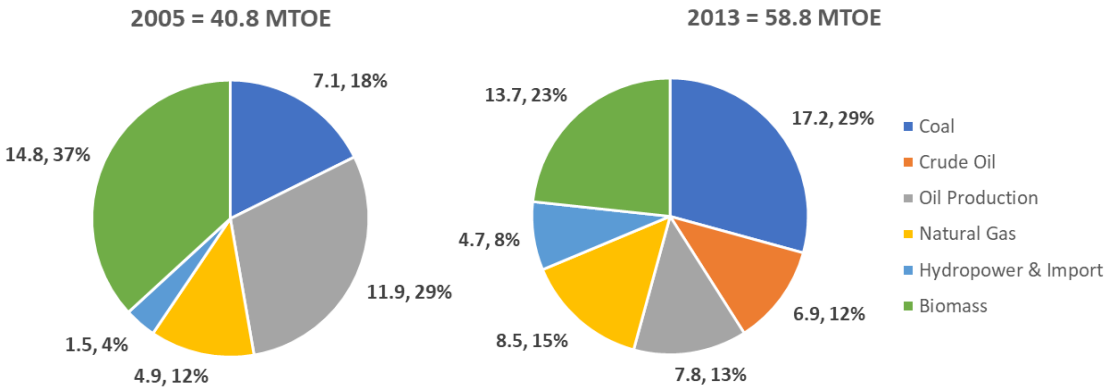
As a growing country, the government has released many policies that relate to energy saving and energy efficiency, power development planning, CO_2 reduction strategies, intended nationally determined contributions, and so on. The following are some important ones:

- Decree No. 153/2004/QĐ-TTg: Strategic direction for sustainable development in Viet Nam
- Decree No. 1427/QD-TTg, 02/10/2012: Approval on the National Target Program on Energy Efficiency and Conservation for the Period 2012–2015
- Decree No. 177/2007/QĐ-TTg: Project of Biofuels Development to 2015 and the Vision to 2025
- Decree No. 1993/QD-TTg: Approving the National Green Growth Strategy: Period 2011–2020
- Nationally Determined Contribution in 2015 specifying the national contribution (target) for the period 2021–2030 covering the entire economy
- Decree No. 428/QD-TTg, approved the adjustment of the National Power Development Plan VII (PDP 7 rev) for the period of 2016–2020, vision to 2030.

1.4.1. Current Status of Energy Supply

Viet Nam's total primary energy supply in 2013 was 58.8 million tonnes of oil equivalent (Mtoe), which is a slight increase of 1.3% from the 2012 level and 44% higher compared to the 2005 level according to government's energy statistics source. Energy sources in 2013 were diversified: 29% of the supply came from coal, 25% from oil, 15% from natural gas, 8% from hydropower and electricity import, and 23% from biomass (Figure 2.1.4-2). Viet Nam has been a net energy exporter; however, the trade surplus has significantly decreased over the last decade with implementation of the government's export restriction policy for natural resources, together with the promotion of domestic capacity development in the transformation and manufacturing sectors. Viet Nam's energy consumption has been driven by energy infrastructure extensions, encouraging economic growths rates (6.1% per year on average during 2005–2013 for GDP) along with structural change towards larger contributions from industry and services sectors, and improvement of household income over the past 2 decades. Per capita primary energy consumption and supply steadily increased until 2010, then levelled off. It reached 0.65 tonnes of oil equivalent per person in 2013, equal roughly to 25% of the Asia-Pacific Economic Cooperation (APEC) region's average (APERC, 2016).

Figure 2.1.4-2 Total Primary Energy Supply of Viet Nam, 2005 vs 2013



MTOE = million tonnes of oil equivalent.
Source: APERC (2016).

Transportation has witnessed rapid growth, with road transport accounting for the highest share of passenger and cargo transportation, followed by waterborne transport.

Viet Nam's total final energy consumption increased from 43,202 kilotonnes of oil equivalent (ktoe) in 2008 to 47,873 ktoe in 2012. The changes in final energy consumption per energy type from 2008 to 2012 are shown in Table 2.1.4-1.

Table 2.1.4-1 Energy Consumption in Viet Nam by Type

Fuel type	2008	2009	2010	2011	2012
Coal	8,289	8,966	9,893	9,647	8,390
Oil	13,819	15,851	17,080	15,297	14,896
Gas	540	639	493	894	1,438
Electricity	5,844	6,615	7,461	8,140	9,063
Non-commercial energy	14,710	14,704	13,875	13,938	14,086
Total	**43,202**	**46,775**	**48,802**	**47,916**	**47,873**

Source: MoNRE (2015).

In 2014, Viet Nam's total electricity supply was 145.5 terawatt-hours, increasing over 11% from its 2013 level (Table 2.1.4-2). Of this total electricity output, over 41% came from hydropower plants and other renewables, 57% from thermal power plants, and less than 2% from import (MOIT, 2016).

Viet Nam's power system is the third largest in the Association of Southeast Asian Nations (ASEAN), with a total installed power capacity of over 34.5 gigawatts in 2014. During 2005–2014, over 22.4 gigawatts were newly built, which corresponded to an average growth of nearly 13% per year. Development of renewable power sources recorded the highest growth at 15.1% per year on average.

Table 2.1.4-2 Installed Power Capacity and Generation in Viet Nam, 2013

Power Type	Capacity (MW)	Share (%)	Generation (GWh)	Share (%)
Large Hydro (>30 MW)	**13,260**	**43.2**	**51,945**	**40.8**
Coal thermal	7,116	23.2	26,863	21.1
Gas turbine	7,446	24.3	42,745	33.6
Oil thermal	912	3.0	249	0.2
Diesel	70	0.2	7	0.0
Other Renewables	**1,884**	**6.1**	**5,511**	**4.3**
Small-hydro	*1,670*	*5.4*	*4,989*	*3.9*
Wind	*56*	*0.2*	*62*	*0.05*
Biomass	*150*	*0.5*	*460*	*0.36*
Biogas/MSW	*4*	*0.01*		
Solar power	*4*	*0.01*		
Total	**30,688**	**100**	**127,320**	**100**

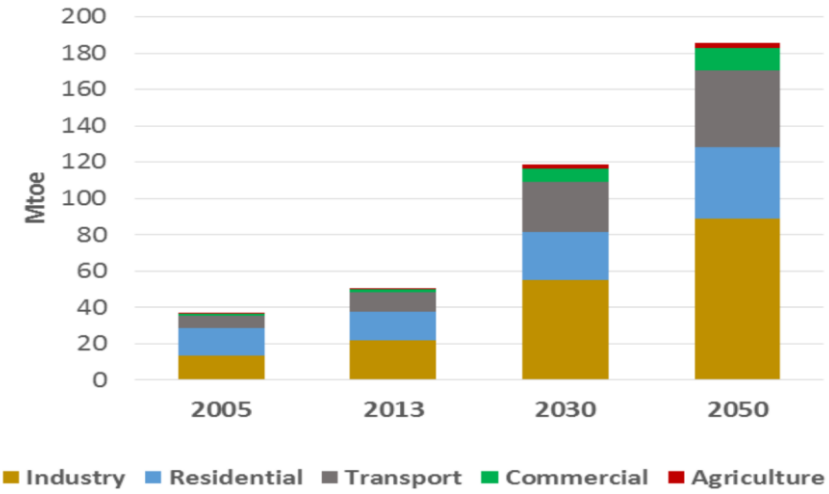
GWh = gigawatt-hour, MSW = municipal solid waste, MW = megawatt.
Source: MOIT (2016).

Viet Nam's total final energy consumption (TFEC) in 2013 was 50.6 Mtoe, up 2.6% from 2012 and 36% higher than the 2005 level (VNEEP, 2015). The demand structure by fuel has changed significantly, with a reduction in the share of biomass (non-commercial energy) and a rise in modern fuels, including oil, coal, gas, and especially electricity. During 2005–2013, electricity demand grew over 13% per year on average, reflecting progress in industrialisation and modernisation of the economy.

1.4.2. Energy Demand

Viet Nam is forecasting economic growth (GDP) between 6.5% and 7.6% per year over the period to 2030 (MOIT, 2015). Under the Energy Efficiency Scenario, Viet Nam's final energy demand is projected to double to 119 Mtoe in 2030 and 186 Mtoe in 2050 (Government of Viet Nam, 2015). This corresponds to an average growth rate of 5% per year during 2013–2030, then lower at 2% per year during 2030–2050. Industry remains the highest-consuming sector throughout the forecast period, with a share increase to 46% in 2030 and 48% in 2050. Transport demand continues to grow quickly and surpasses residential demand, with a share of 23% in 2030–2050. The share of residential demand drops significantly to 22% in 2030 and 21% in 2050. Contributions from the commercial and agriculture sectors rise slightly from 4% in 2013 to about 8% in 2030 and 9% in 2050 (Figure 2.1.4-3).

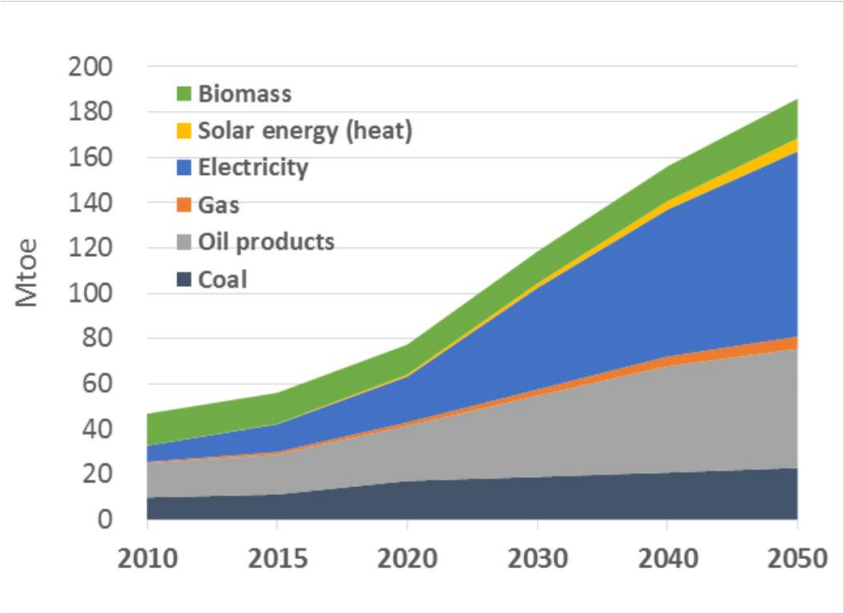
Figure 2.1.4-3. Final Energy Demand in Viet Nam by Sector, 2005–2050



Mtoe = million tonnes of oil equivalent.
Source: Government of Viet Nam (2015).

Final demand for electricity is forecasted to continue to increase strongly at over 10% per year to 2020 and then grow between 6% and 9% per year over the period 2020–2030. Meeting this demand will require an investment of around US$42 billion to 2030, with 58% required for generation and 42% for transmission and distribution (MOIT, 2015). Oil demand will increase faster than the past growth rate: 6.5% per year to 2020 and 4% per year over the period 2020–2030, compared to a rate of 3.5% per year during 2010–2015 (Figure 2.1.4-4).

Figure 2.1.4-4. Final Energy Demand in Viet Nam by Fuel, 2010–2050



Mtoe = million tonnes of oil equivalent.
Source: Government of Viet Nam (2015).

Other assumptions on power generation according to a business-as-usual (BAU) scenario given in the Intended Nationally Determined Contributions (MoNRE, 2015) is presented in Table 2.1.4-3.

Table 2.1.4-3 Assumptions on Power Generation in Viet Nam According to the Business-as-Usual Scenario

Unit: billion kWh

	2010	2020	2030
Large-scale hydropower	27.8	64.6	64.6
Coal-fired thermal power	17.9	163.5	422.4
Gas-fired thermal power	45.3	81.5	107.8
Renewable energy	3.3	3.3	3.3
Nuclear power	0	6.9	70.1
Imported energy	0	9.9	26.4
Total	**94.3**	**329.7**	**694.6**

kWh = kilowatt-hour.
Source: MoNRE (2015).

1.4.3. Revised Power Development Plan 2011–2020, Vision 2030

On 18 March 2016, by Decision No. 428/QD-TTg, the Prime Minister approved the adjustment of the National Power Development Master Plan for the Period 2011–2020 with the Vision to 2030 (PDP 7 rev). Compared to PDP 7 of July 2011, the most obvious change of PDP 7 rev is a stronger emphasis on renewable energy development and on power market liberalisation.

The specific objectives of PDP 7 rev are as follows:

- Provide adequate electricity for the domestic demand, satisfy socioeconomic development objectives with average GDP growth rates of 7% during 2016–2030:
  - Commercial electricity: 235 billion–245 billion kilowatt-hours (kWh) in 2020, 352 billion–379 billion kWh in 2025, and 506 billion–559 billion kWh in 2030
  - Electricity production and import: 265 billion–278 billion kWh in 2020, 400 billion–431 billion kWh in 2025, and 572 billion–632 billion kWh in 2030
- Prioritise the development of renewable energy sources for electricity production; increase the proportion of electricity generated from renewable energy sources (excluding large-scale, medium-scale, and pumped storage hydropower) up to around 7% in 2020 and above 10% in 2030.
- Construct the power transmission grid with flexible operation and high automation capabilities from electricity transmission to distribution; develop unmanned substations and substations with 50% human participation to increase the capacity of the electricity industry.
- Accelerate the programme of electrification in rural and mountainous areas to ensure that in 2020 most of the rural households have access to electricity.

Table 2.1.4-4 compares the proportion of power sources as outlined in both PDP 7 as of July 2011 and PDP 7 rev as of March 2016 over the decade from 2020 to 2030. As per the PDP 7 rev structure, the data are presented on the basis of % age share of total electricity production. As indicated in Table 2.1.4-4, coal is projected to be the main source for electricity production, while renewable energy shows an upward trend.

Table 2.1.4-4. Structure of Power Sources in Total Electricity Production in Viet Nam (%)

Power Sources	2015	2020		2025		2030	
		PDP7	PDP7 rev	PDP7	PDP7 rev	PDP7	PDP7 rev
Renewable Energy	3.7%	4.5%	6.5%	-	6.9%	6.0%	10.7%
Coal	34.4%	46.8%	49.3%	-	55.0%	56.4%	53.2%
Gas Turbine	30.0%	24.0%	16.6%	-	19.1%	14.4%	16.8%
Hydro	30.4%	19.6%	25.2%	-	17.4%	9.3%	12.4%
Import	1.5%	3.0%	2.4%	-	1.6%	3.8%	1.2%
Nuclear	-	2.1%	-	-	-	10.1%	5.7%

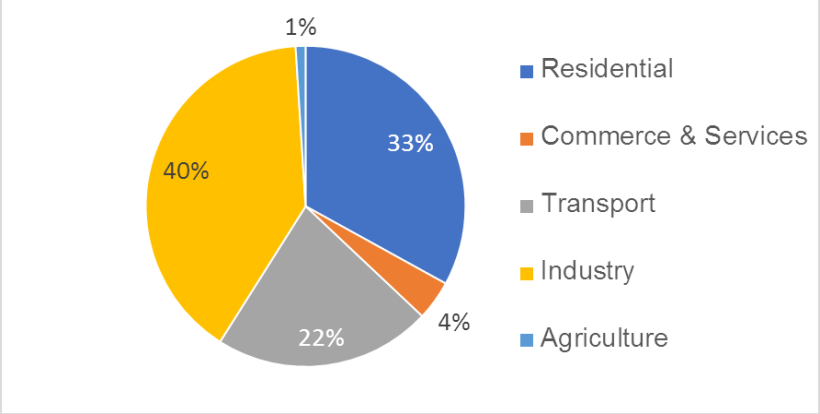
Source: Data extracted from (VN PDP, 2016).

1.4.4. Current Status of Transportation Fuel Supply and Mitigation Scenario in the Transportation Sector

The on-road vehicle population consists of about 3 million cars and 46 million motorcycles. In 2010, the transportation sector ranked third after the industry and residential sectors in terms of share of total energy consumption, constituting of 22% of the overall energy consumption (Figure 2.1.4-5). The share of the transportation sector in the total energy consumption has increased from 14.7% in 2000 to 22% in 2010. Figure 2.1.4-6 illustrates the trend in gasoline and diesel fuel consumption in the road transportation sector from 1980 to 2010. It shows that the road transportation sector consumed slightly more diesel fuel compared to gasoline fuel in the past 2 decades. In a BAU scenario, the proportion of diesel consumption is projected to rise from 48% in 2010 to 71% in 2040 (World Bank, 2013).

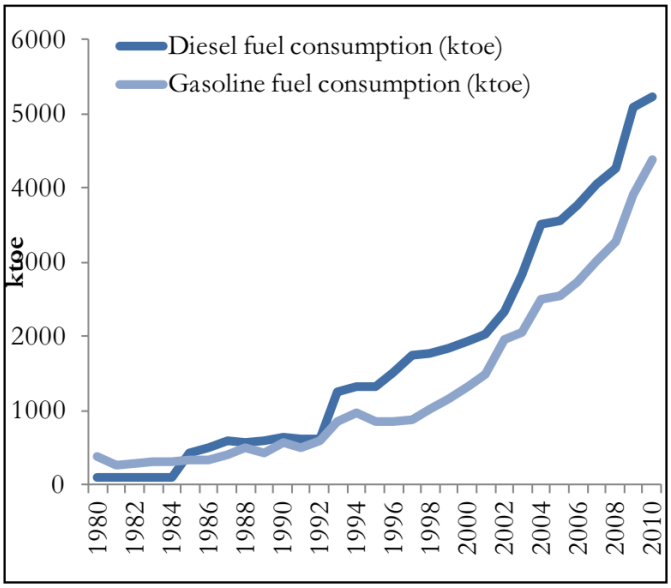
Besides diesel and gasoline fuels, the use of ethanol E5 has been mandated since 1 January 2018 and E10 is intended to be sold to the market soon, expected to be available in the market in 2019 and nationwide in 2020. With E5 fuel mandated, gasoline RON92 was banned and replaced by RON92 E5. RON95 gasoline serves as a premium fuel for luxury vehicles. Euro 5 diesel fuel was also introduced to the market by Petrolimex in January 2018. Compressed natural gas (CNG) is a potential fuel for the transportation sector. This fuel is now used for buses in Ho Chi Minh City and is being considered for use for freights in southern Viet Nam. In the north, expecting the CNG source from Thai Binh province to be exploited, CNG will be introduced for the transportation sector.

Figure 2.1.4-5 Share of Final Consumption in Viet Nam by Economic Sector, 2010



Source: World Bank (2013).

Figure 2.1.4-6 Road Transport Diesel and Gasoline Consumption in Viet Nam, 1980–2010

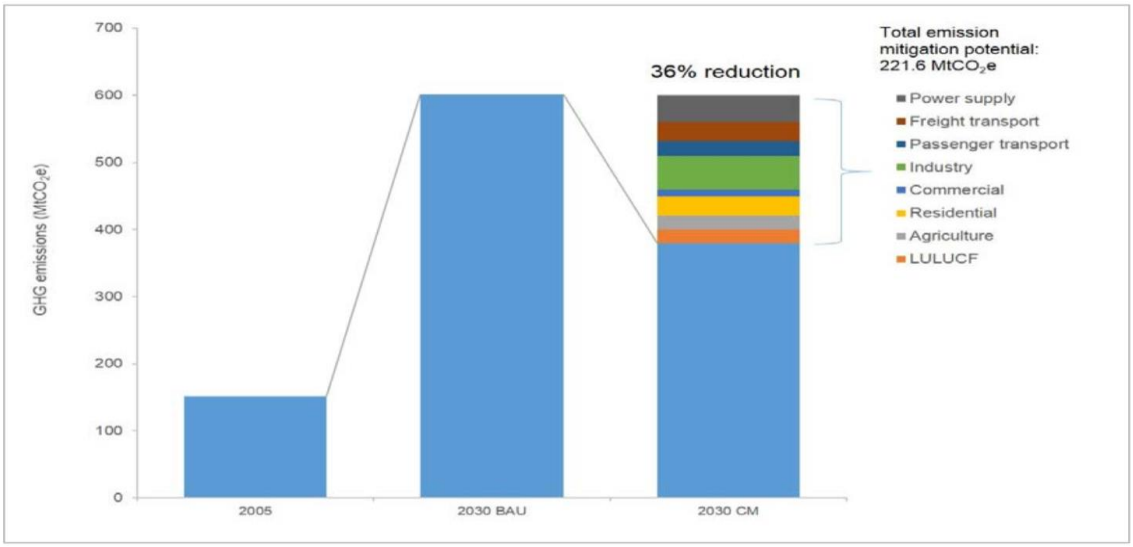


ktoe = kilotonne of oil equivalent.
Source: World Bank (2013).

Diversification of the transport fuel modes is also being considered to pursue greenhouse gas (GHG) emissions reduction targets. Nguyen et al. (2012) projects a 23 million tonnes of carbon dioxide equivalent (tCO2e) and 29 million tCO2e emissions reduction in 2030 from passenger transport and freight transport, respectively, by adopting a selection of low-carbon measures. In 2005, freight transport relied on roads, carrying 71% of the total weight volume, while the rest was transported by maritime (27%) and rail (2%). Considering a growth in emissions from freight transport due to rapid development in the industry sector, the proposed countermeasures include a modal shift from trucks to rail (increase from 2% to 5%) and maritime transport (increase from 27% to 30%), which reflects an emissions reduction of 4.0 metric tonnes of carbon dioxide equivalent (MtCO2e), as well as improvement of the efficiency of vehicles being used.

The switch to biofuel from oil reflects emissions reductions of 23.9 MtCO2e and 1.1 MtCO2e, respectively.

Figure 2.1.4-7 Greenhouse Gas Emissions and Mitigation Potential in Viet Nam



Source: Nguyen et al. (2012).

In another study in 2011, the World Bank outlined several mitigation opportunities in Viet Nam and their theoretical emissions reductions. Since motorcycles are responsible for a large fraction of vehicular emissions in Viet Nam and passenger car ownership is projected to increase as income levels increase, the improvement in fuel efficiency must remain a priority for Viet Nam, including a modal shift from road freight to inland waterways, coastal shipping, and railways (World Bank, 2011). The study indicated that such mitigation opportunities in the transportation sector can theoretically lead to a reduction of 18.37 MtCO2e annually, while its feasible medium-term (2015) goals could reduce 5.49 MtCO2e annually.

1.4.5. Current National Plans for Reduction of Energy Consumption and Greenhouse Gas

Assumptions based on power generation according to BAU in the Intended Nationally Determined Contributions in 2015 (MoNRE, 2015) project that the share of GHG emissions from the transportation sector will be 22.5%, 22.5%, and 13% for the years 2010, 2020, and 2030, respectively.

Table 2.1.4-5 Greenhouse Gas Inventory in 2010 and Projections for 2020 and 2030 for the Energy Sector in Viet Nam

GHG source categories	2010 (MtCO2e)	2020 (MtCO2e)	2030 (MtCO2e)
1 Total	**139.9**	**389.2**	**675.4**
1A Fuel combustion	***123.0***	***355.7***	***620.3***
1A1 Energy industries	41.1	171.3	404.4
1A2 Manufacturing industries and combustion	38.1	69.3	92.5
1A3 Transport	31.8	87.9	87.9
1A4a Commercial/institutional	3.3	8.4	12.1
1A4b Residential	7.1	16.5	20.5
1A4c Agriculture/forestry/fishing	1.6	2.3	2.9
1B Fugitive emissions	***16.9***	***33.5***	***55.1***
1B1 Solid fuels	2.2	16.0	18.5
1B2 Natural oil and gas	14.7	17.5	36.6

GHG = greenhouse gas, MtCO2e = metric tonne of carbon dioxide equivalent.
Source: MoNRE (2015).

For GHG mitigation scenarios, the Intended Nationally Determined Contributions in 2015 specify the national contribution (target) for 2021–2030, covering Viet Nam's entire economy as follows:

- Unconditional contribution: With domestic resources, by 2030, Viet Nam will reduce GHG emissions by 8% compared to BAU.[1]
    - Emission intensity per unit of GDP will be reduced by 20% compared to the 2010 levels.
    - The level of forest cover will increase to 45%.
- Conditional contribution: With international support and the implementation of new mechanisms under the Global Climate Agreement, by 2030, Viet Nam will reduce GHG emissions by 25% compared to BAU as follows:
    - Energy (including transport and communications), agriculture (including land use and forestry), and waste can make the greatest contributions.
    - The cost of adaptation is estimated in excess of 3–5% of GDP by 2030.
    - Investments from the private sector and international support are required.

[1] Viet Nam's BAU scenario for GHG emissions was developed based on the assumption of economic growth in the absence of climate change policies. The BAU starts from 2010 (the latest year of the national GHG inventory) and includes the energy, agriculture, waste, and land use, land-use change, and forestry (LULUCF) sectors.
− GHG emissions in 2010: 246.8 million tCO2e
− Projections for 2020 and 2030 (not including industrial processes):
o 2020: 474.1 million tCO2e o 2030: 787.4 million tCO2e

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