Chapter 17

Vietnam Country Report

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CHAPTER 17

Viet Nam Country Report

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1. Background

Viet Nam has a total land area of about 331,111 square kilometers and lies in the centre of South East Asia. In 2010, Viet Nam had a population of 86.9 million and GDP of US$ 62.8 billion in 2000 US$ terms. The industry sector contributes the most to Viet Nam's GDP (41.9 percent), followed by the commercial sector (41.7 percent) and agriculture (16.4 percent). GDP per capita was 723 US$ per person in 2010.

Viet Nam possesses considerable indigenous energy resources. It has 3,390 million tons of proven recoverable reserves of coal, 460 million cubic meters of crude oil reserves and 610 billion cubic meters of gas reserves.

Viet Nam's total primary energy supply (TPES) was 40.9 Mtoe in 2010. Oil represented the largest share of Viet Nam's TPES at 39.7 percent; coal was second at 33.9 percent, followed by natural gas (19.5 percent), hydro (5.8 percent) and others (1.0 percent). Viet Nam is a net exporter of crude oil and coal but is an importer of petroleum products because of capacity limitations at the Dung Quat oil refinery (6.5 million tons a year) that could meet around 30 percent of domestic demand.

Coal is mainly used in the industry sector with consumption of 9.7 million tons of oil equivalent (Mtoe) in 2010, while gas is largely used for electricity generation.

Viet Nam had 20.9 GW of installed generating capacity and generated 92.2 TWh of electricity in 2010. Most of Viet Nam's electricity generation comes from thermal sources (coal, natural gas and oil), accounting for 70.1 percent of total generation,

and hydro (29.9 percent).

2. Modelling Assumptions

In this outlook, Viet Nam's GDP is assumed to grow at an average annual rate of 7.0 percent from 2010 to 2035. Growth is projected to be slightly lower in the first half of the outlook period increasing at 7.0 percent per year between 2010 and 2020. For the period 2020-2035, the country's economic growth will be faster at an annual rate of 7.1 percent per year. Population growth is projected to increase at a much slower rate, increasing by 0.8 percent per year between 2010 and 2035.

The share of electricity generated from coal-fired power plants is projected to increase considerably, at the expense of other energy types (thermal and hydro). Viet Nam is expected to increase its imports of electricity, particularly from Lao PDR and China. The use of nuclear energy is assumed to start in 2020 in line with Viet Nam's nuclear power development plan. In the BAU scenario, it is assumed that the first unit of nuclear power with capacity of 1,000 MW will be installed in 2020. An additional six (6) units of nuclear power with total capacity of 6,000 MW is expected to be installed in 2030.

Viet Nam's energy saving goal between the periods 2006 to 2010 is assumed to be between 3-5 percent of the total energy consumption equivalent to 5.0 Mtoe. For the years 2010 to 2015, energy saving goal is targeted at 5-8 percent of total energy consumption, equivalent to 13.1 Mtoe. In line with the national target on energy efficiency and conservation (EEC), Viet Nam's energy saving goals beyond 2015 is assumed to follow the trend of earlier periods.

The energy savings goals are expected to be attained through the implementation of energy efficiency programs in the industrial, residential and commercial sectors. For the industry sector, energy savings are expected from improvements in manufacturing technologies and the introduction of energy management systems. In the transport, residential and commercial sectors, fuel substitution, efficient end-use technologies, and energy management systems are projected to induce significant savings.

To complement the demand side energy efficiency measures on the supply side, renewable energy technologies, particularly small hydro, wind and biomass are expected to come online intensively from 2010 in line with the master plan on renewable energy development. Installed electricity generating capacity from renewable energy is assumed to reach 8,100 MW in 2035 with wind contributing 5,200 MW, small hydro 2,400 MW and biomass 500 MW. The installed capacity of nuclear power plants is expected to reach 11,000 MW and 15,000 MW under the APS scenario by 2030 and 2035 compared with 6,000 MW by 2030 in the BAU Scenario.

Viet Nam has considered the use of biofuels to reduce dependency on oil and curb CO_2 emissions. According to the Prime Minister's decision 177/2007/QD-TTg approving the master plan on biofuel development, Viet Nam is assumed to produce 250,000 tons and 1.8 million tons of biofuels (both ethanol and biodiesel, in which ethanol fuel accounts for around 2/3 of the total) in 2015 and in 2025, respectively.

3. Outlook Results

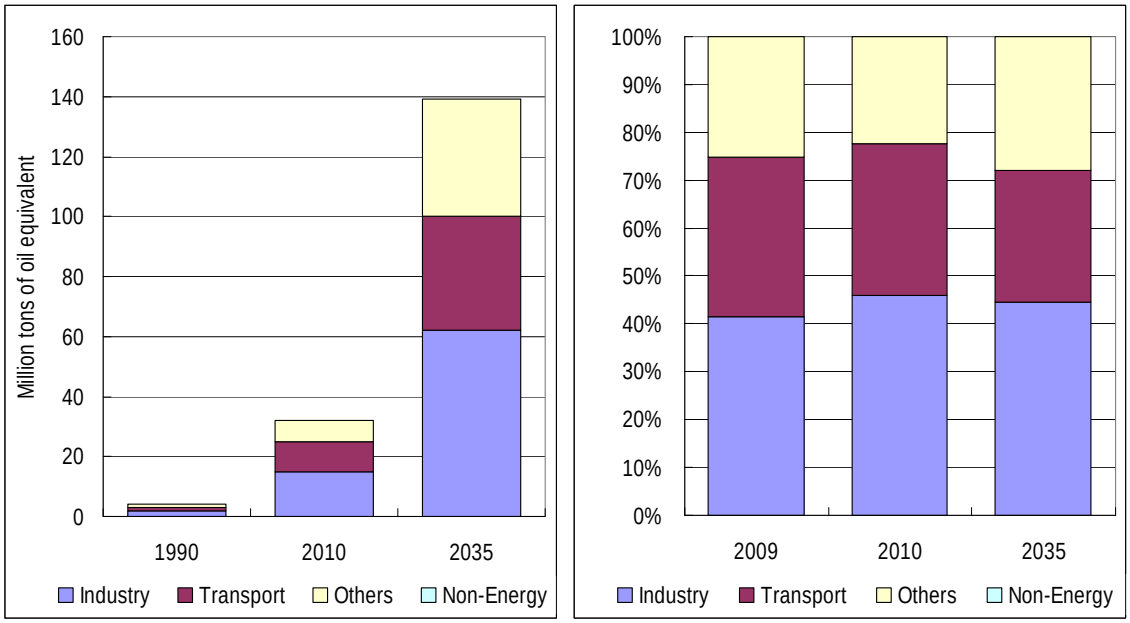
3.1. Business-as-Usual (BAU) Scenario

3.1.1. Total Final Energy Demand

Viet Nam's final energy consumption in 2010 increased at 10.7 percent per year which is 7.6 times more than its 1990 level of 4.2 Mtoe. The fastest growth occurred in the industrial sector (11.2 percent per year) followed by the transport sector (10.4 per cent) and the residential/commercial (others) sector (10.0 percent per year).

For the period 2010 to 2035, final energy consumption is projected to increase at an average rate of 6.1 per year under the BAU. The growth is driven by assumed strong economic growth which is assumed to be at an average annual growth of 7.0 percent and the rising population. On a per sector basis, the strongest growth in consumption is projected to occur in the residential/commercial (others) sector, increasing by 7.0 percent per year. This is followed by the industry sector (5.9 percent per year) and the transportation sector (5.4 percent per year).

Figure 17-1: Final Energy Demand by Sectors, BAU



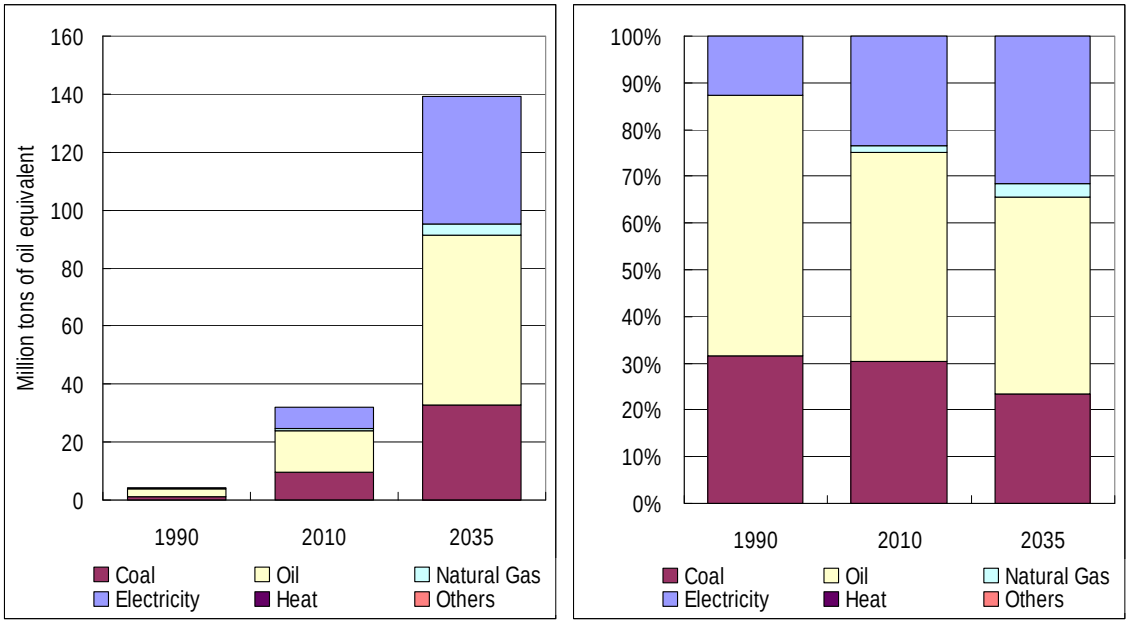
Bulk of the country's energy requirement or more than 40 percent comes from the industrial sector. The trend will still continue though starting 2020 it will have a decreasing share up to 2035. Starting 1990 up to 2035, the transport sector tends to be the second largest consuming sector in Viet Nam. The share of energy consumption in the transport sector will decrease slowly from 33.5 percent in 1990 to 27.4 percent in 2035. Meanwhile, the residential/commercial (others) sector will have an increasing share from 22.3 percent in 2010 to 28.0 percent in 2035. The increasing share of the sector is an impact of the growing population and the growing economy. The impact of economic growth will translate to improvement of standard of living, thus increasing an individual's consumption.

Meanwhile, oil is the most consumed product, accounting around 60.0 percent of total final energy consumption in 1990, declining to 44.8 percent in 2010. Coal is the second most consumed product, accounting for 31.5 percent of total final energy consumption in 1990, declining to 30.3 percent in 2010. The share of electricity consumed from 1990 to 2010 had an increasing trend from 12.6 percent to 23.3 percent.

On a per fuel basis under the BAU, natural gas is projected to exhibit the fastest growth in final energy consumption, increasing at 8.6 percent per year between 2010 and 2035. Electricity is projected to have the second highest growth rate of 7.4

percent per year, followed by oil of 5.8 percent and coal of 5.0 percent.

Figure 17-2: Final Energy Demand by Fuel, BAU



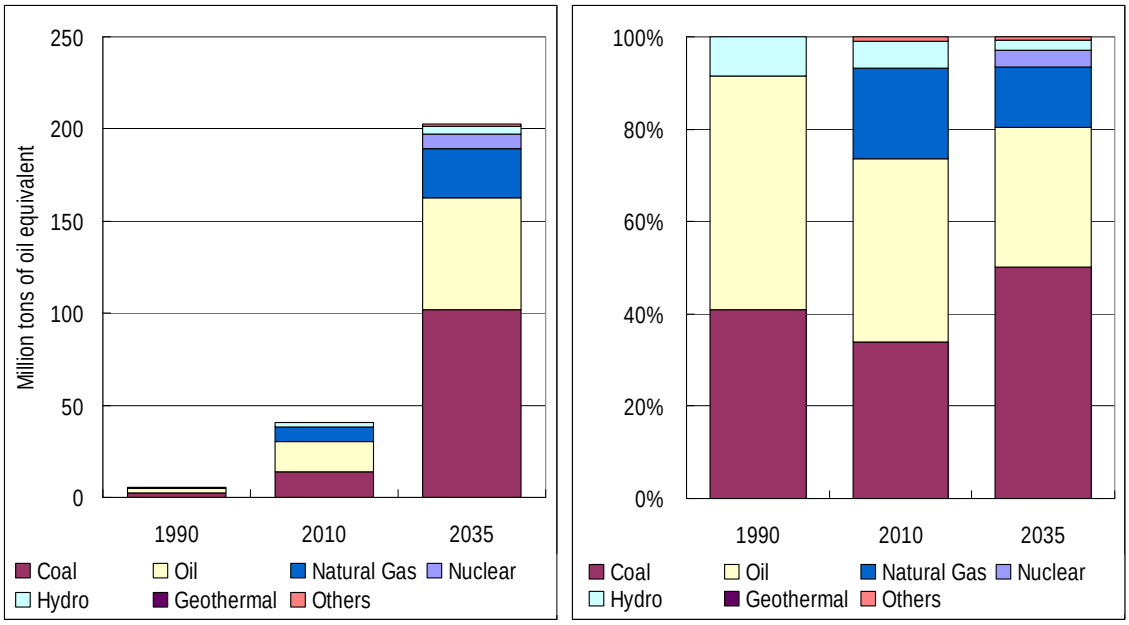
The oil fuel products take the largest share of 44.8 percent in 2010. Oil consumption is projected to decline to 42.1 percent in 2035. Coal which is used primarily for power generation will still be the country's second most consumed fuel with a share of 30.3 percent in 2010 though its share will decline up to 23.5 percent in 2035. On the other hand, the share of demand for electricity will post an increasing trend of 23.3 percent in 2010 to 31.6 percent in year 2035.

3.1.2. Total Primary energy demand

Primary energy demand in Viet Nam grew at a rate of 10.6 percent, from 5.4 Mtoe in 1990 to 40.9 Mtoe in 2010. Among the major energy sources, the fastest growing were natural gas, coal and oil. Natural gas consumption grew at an average annual rate of 48.3 percent between 1990 and 2010 while coal and oil grew at 9.6 percent and 9.3 percent per year, respectively. Hydro energy grew by 8.5 percent per year over the same period, however, it only accounts for a small proportion (5.8 percent) of total primary energy demand 2010 (see Figure 17-3).

In the BAU, for the period 2010 to 2035, Viet Nam's primary energy demand is projected to increase at an annual rate of 6.6 percent per year or 5.0 times from 40.9 Mtoe in 2010 to 202.9 Mtoe in 2035. The fastest growth is expected in coal, increasing at an annual average rate of 8.3 percent followed by other (such as imported electricity) and oil growing at a rate of 5.6 and 5.4 percent, respectively. Similarly, natural gas is expected to grow at an annual rate of 4.9 percent over the same period.

Figure 17-3: Primary energy demand, BAU



The share of coal is projected to increase from 33.9 percent in 2010 to 50.1 percent in 2035. The growth in coal is due to the projected decline from oil and natural gas. The share of gas is expected to decrease from 39.7 percent to 30.2 percent. The share of oil by 2035 is expected to decline up to 13.1 percent from 19.5 percent in 2010.

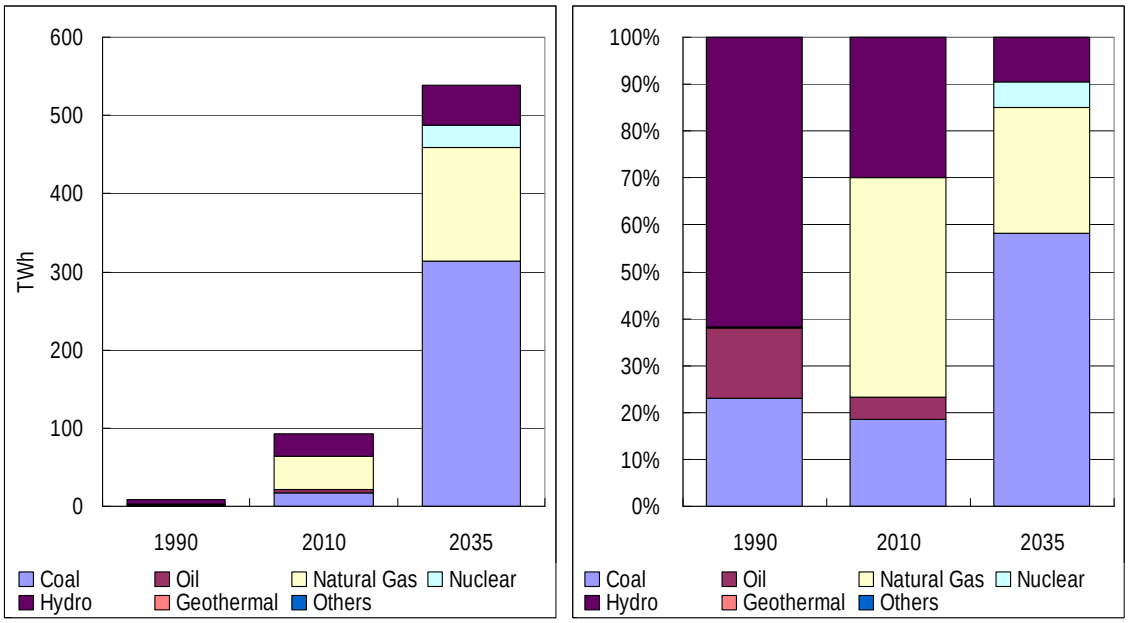
3.1.3. Power Generation

Power generation output increased at a rate of 12.5 percent per year or 10.6 times from 8.7 TWh in 1990 to 92.2 TWh in 2010. The fastest growth occurred in the natural gas thermal power generation (55.9 percent per year) followed by the coal

thermal (11.3 per cent), the hydro power (8.5 percent per year) and oil thermal (6.4 percent).

To meet the demand of electricity under the BAU, power generation is projected to increase at an average rate of 7.3 percent per year or 5.8 times between 2010 and 2035. The fastest growth occurred in the coal thermal power generation (12.4 percent per year) followed by the natural gas (5.0 per cent) and hydropower generation (1.2 percent per year).

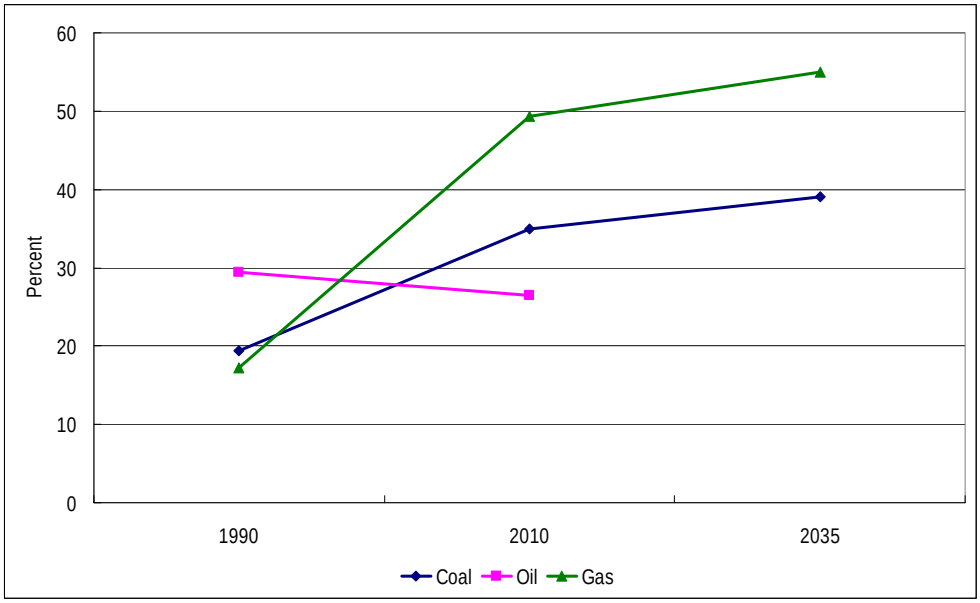
Figure 17-4: Power Generation by Type of Fuel, BAU



By end of 2010, majority of the country power requirement comes from natural gas which comprised around 47.0 percent of the total power generation mix. The share of hydropower generation is around 30.0 percent while the rest were from coal and oil power generation.

In the BAU, most of fuel for power generation for the period 2020 to 2035 will be supplied by coal increasing from 44.6 percent to around 58.0 percent, respectively. On the other hand, the share of natural gas in the total power generation will decline such that by end of 2035 it share will be around 27.0 percent from its 2010 share of 47.0 percent.

Figure 17-5: Thermal Efficiency, BAU



There are two (2) main types of thermal power technologies in Viet Nam namely, coal and natural gas. Thermal efficiencies of coal and gas thermal power plants have an increasing trend from 35.0 to 49.4 percent in 2020 to 39.0 percent and 55.0 percent in 2035, respectively. Thermal efficiency determines the amount of fuel input needed to produce an output.

3.1.4. Energy Indicators

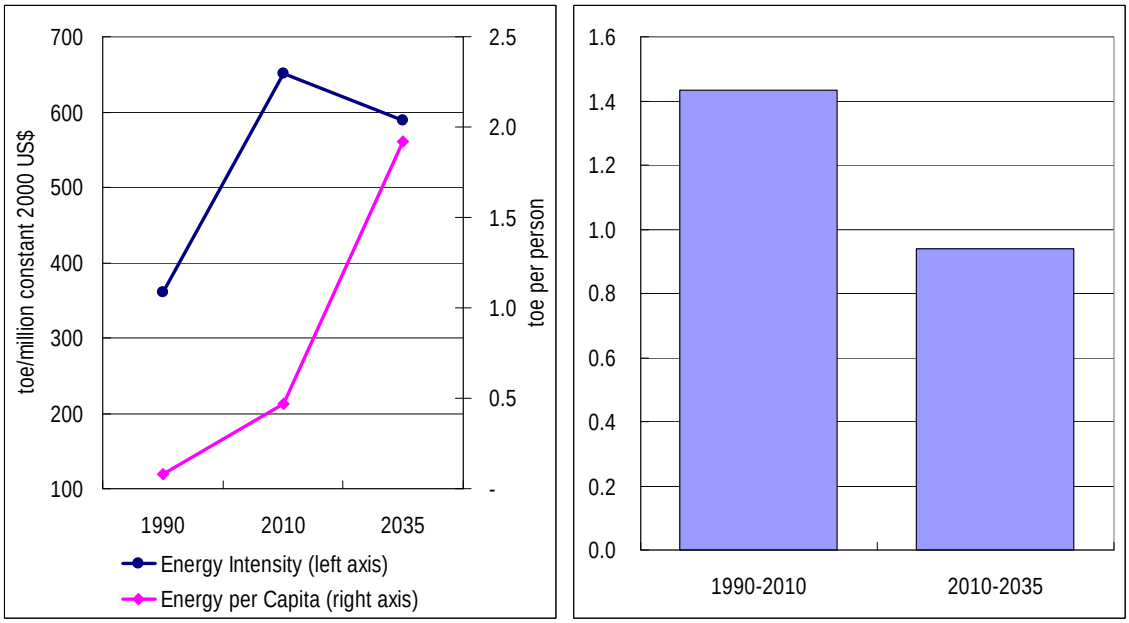
For the period 1990-2010, Viet Nam's energy intensity showed an increasing trend. Energy intensity of the country grew from 361.3 toe/million 2000 US$ in 1990 to 651.1 toe/million 2000 US Dollars in 2010. The major reason is due to the high energy requirement in the industrial sector, particularly, the industries' sub-sectors such as cement, iron and steel of high energy intensities is developed fast in recent years.

By 2035, energy intensity under the BAU is estimated to improve by 9.0 percent compared to the 2010 level of 651.1 toe/million 2000 US Dollars. The improvement is a good indication that energy will be used efficiently in the future for economic development.

Meanwhile, energy per capita had an increasing trend, that is, 0.1 toe/person in

1990 to 0.5 toe/person in 2010. In the BAU, energy per capita will also have trend of increasing from 0.5 toe/person in 2010 to 2.0 toe/person in 2035. This indicates that in the future, the living standards and people's income will increase resulting to increase in energy demand per capita.

Figure 17-6 : Energy Intensity and Energy Per Capita



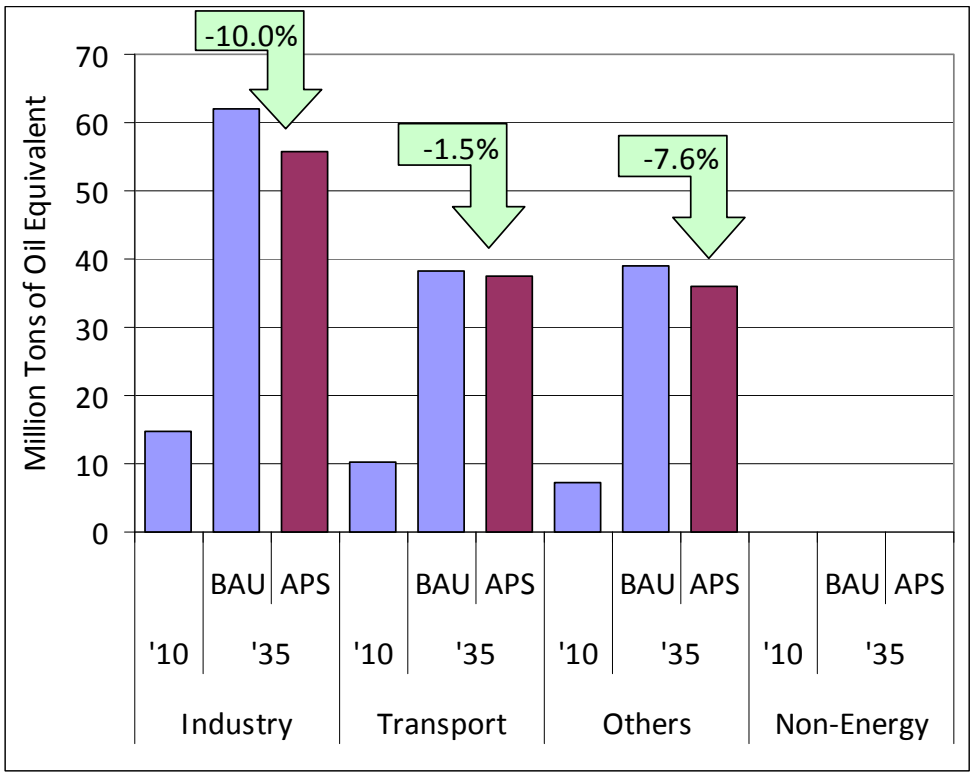
The relationship between changes in primary energy demand and changes in GDP is known as the elasticity of energy demand. In the period of 1990 to 2010, the elasticity of energy demand is 1.44, which is higher than 1.0, which means that there was an inefficient use of energy. For the period 2010 to 2035, the elasticity of energy demand in the BAU is projected to be reduced to around less than 1 or 0.95 from 1.4 in the period of 1990 to 2010 which is a good indication that energy will be used efficiently for economic development.

3.2. Energy Saving Potential and CO_2 Reduction Potential

3.2.1. Final Energy Consumption

In the Alternative Policy Scenario (APS), final energy consumption is projected to increase at a slower rate of 5.7 percent per year (compared with 6.1 percent in BAU) from 32.0 Mtoe in 2010 to 129.4 Mtoe in 2035 due to Energy Efficiency and Conservation (EEC) programs. Savings in the final energy consumption will amount to 9.7 Mtoe or 7.0 percent compared to BAU in 2035. The bulk of the savings are expected to occur in the industry sector (6.2 Mtoe), followed by the residential/commercial (others) sector (3.0 Mtoe) and the transportation sector (0.6 Mtoe). Improvement in end-use technologies and the introduction of energy management systems is expected to contribute to the slower rate of consumption growth, particularly in the industry, transport and others sector (residential and commercial sectors).

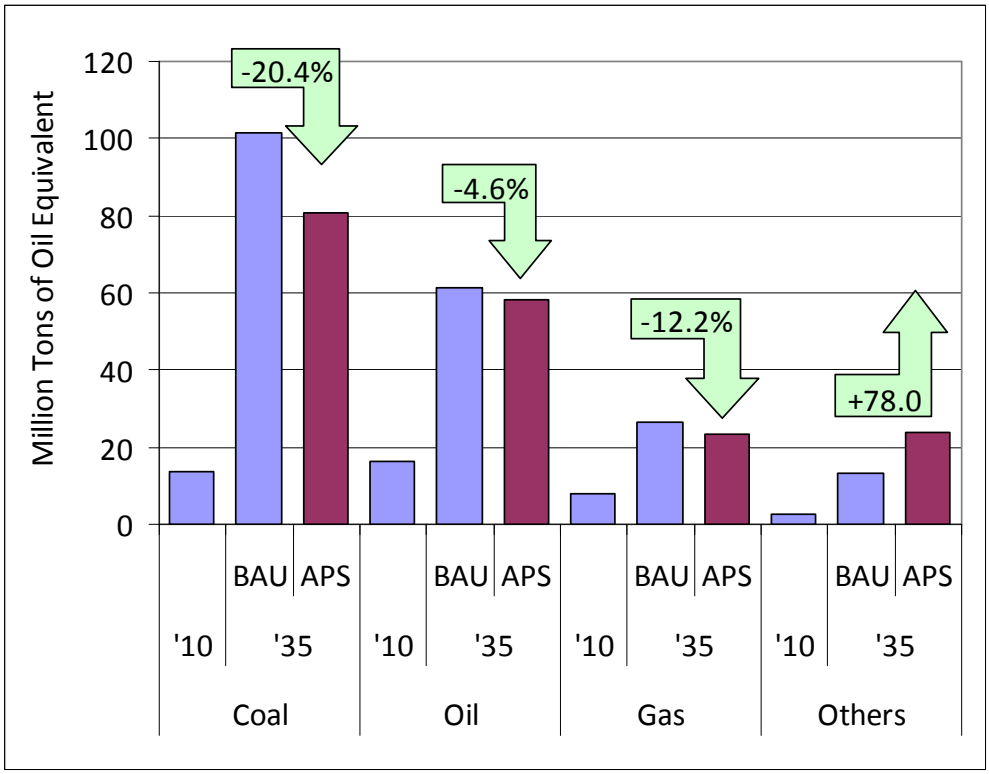
Figure 17-7: Final Energy Consumption, BAU vs. APS



3.2.2. Total Primary energy demand

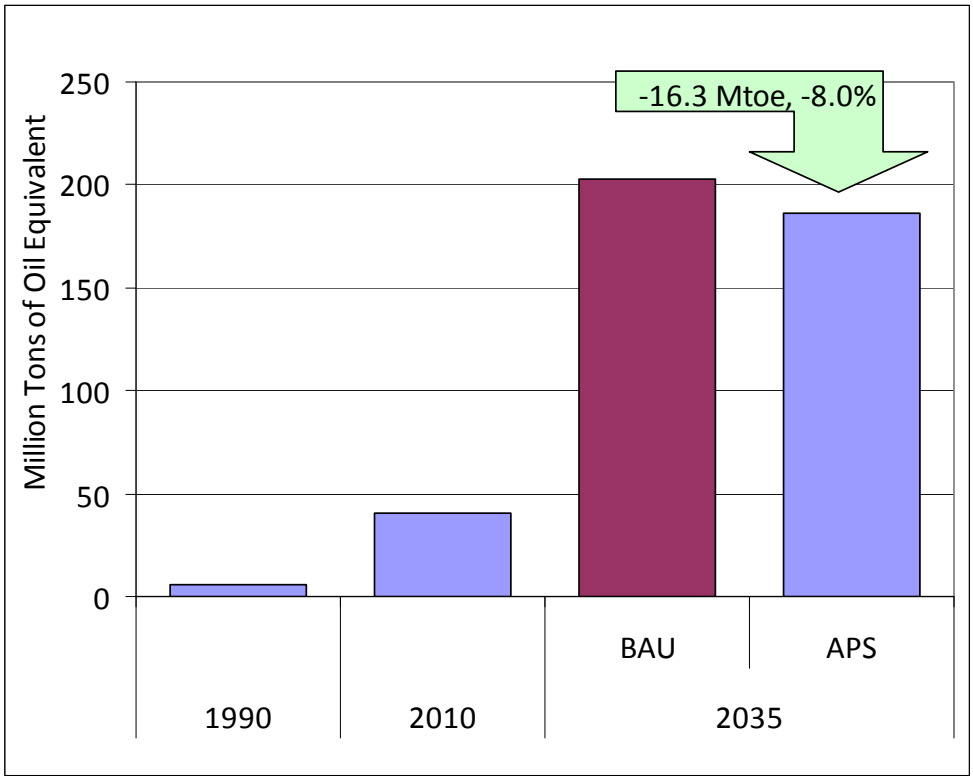
In the APS, primary energy demand is projected to increase at a slower rate of 6.3 percent per year from 40.9 Mtoe in 2010 to 186.6 Mtoe in 2035. Also, coal is projected to grow at an average annual rate of 7.3 percent compared with 8.3 percent in BAU, followed by oil and natural gas with 5.3 percent and with 4.4 percent (compared with 5.4 percent and 4.9 percent in BAU), respectively over the same period. The slower growth in consumption, relative to the BAU scenario, stems from EEC measures on the demand side and the more aggressive uptake of renewable and nuclear energy on the supply side. Coal has highest energy saving potential with 20.4 percent, followed by natural gas (12.2 percent) and oil (4.6 percent).

Figure 17-8: Primary energy demand, BAU and APS



The savings that could be derived (the difference between primary energy demand under both scenarios) from the energy saving and conservation goals and action plans of Viet Nam amount to 16.3 Mtoe. This is equivalent to 8.0 percent of total Viet Nam's primary energy consumption in 2035 (Figure 17-9).

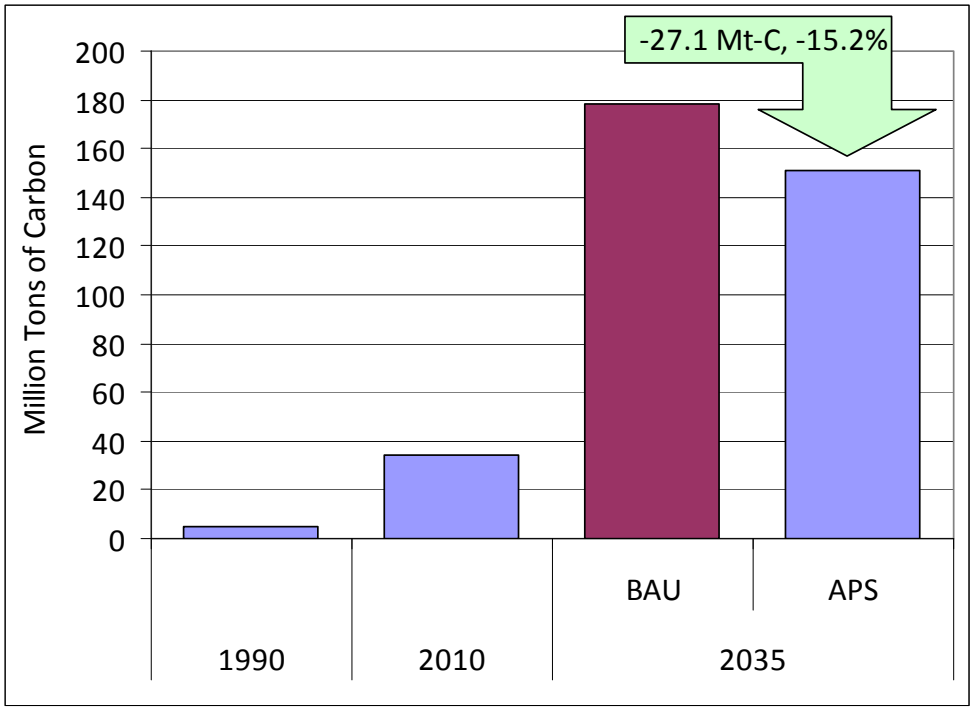
Figure 17-9: Evolution of Primary energy demand, BAU and APS



3.2.3. CO_2 Reduction Potential

CO_2 emissions from energy consumption under the BAU are projected to increase by 6.8 percent per year from 34.2 million metric ton of carbon (Mt-C) in 2010 to 184.9 Mt-C in 2035. Meanwhile, under the APS, the annual increase in CO_2 emissions between 2010 and 2035 is projected to be around 6.1 percent yearly which is 0.7 percentage points lower than the BAU. Improvement on CO_2 emissions under the APS will be around 27.1 Mt-C (15.2 percent reduction) in 2035, indicating that the energy saving goals and action plans of Viet Nam are very effective in reducing CO_2 emissions (Figure 17-10).

Figure 17-10: Evolution of CO_2 Emissions, BAU and APS



4. Key Findings and Policy Implications

From the above analysis on energy saving potential, some keys findings could be recognized as follows:

- Energy demand in Viet Nam is expected to continue to grow at a significant rate, driven by robust economic growth, industrialization, urbanization and population growth. Energy efficiency and conservation measures have the potential to contribute to meeting higher demand in a sustainable manner.
- Viet Nam's energy intensity, which is amongst the highest in the world, indicates high saving potential. However, the energy saving potential derived from the EEC goals of Viet Nam (16.3 Mtoe) seem to be modest (because energy efficiency goals focus heavily on the industry sector and buildings) compared with its potential.
- Annual growth of energy demand in residential and commercial (other) sectors is projected at highest rate of 7.0 percent in BAU and it's share is increasing continuously from 22.3 percent in 2010 to 28.0 percent in 2035.

This shows that residential and commercial (other) sectors have large potential on energy saving.

- Electricity demand is increasing with an annual growth rate of 7.4 percent in BAU and is projected to decline to 6.9 percent in APS. This decline seems to be modest compared with its potential.
- Coal thermal power plants will be the major source of energy for power generation in Viet Nam in coming years. Its share in the total of power generation output is increasing continuously from 18.5 percent in 2010 to dominated share of 58.1 percent in 2035. This is the area with the largest energy saving as well as the GHG mitigation potential in Viet Nam.

From the findings above, the following actions are recommended to effectively implement EEC activities in Vietnam:

- **Establishment of new targets and a roadmap for EEC implementation**: The targets for EEC in Viet Nam have been set up for a short-term period (2006–2015) and focused on the industry sector and buildings. The new targets for long term should be set up based on an assessment of energy saving potential for all energy sectors, including residential and commercial sectors, which have large potential on energy saving up to 2035.
- **Compulsory energy labeling for electrical appliances:** Annual growth of energy demand in residential and commercial (other) sectors is projected at highest rate of 7.0 percent in BAU, especially demand on electricity use. Therefore, compulsory energy labeling for electrical appliances is an effective management measure for energy saving.
- **Priority for development of advanced coal thermal power technology:** Coal thermal power plants will be the major power generation in Viet Nam up to 2035. Therefore, advanced coal thermal power or energy effective technologies should be prioritized for coal thermal power plant development at stage of project design.
- **Priority for renewable energy development:** Coal is projected to comprise the majority share of power generation by 2035 which will result to the country's reliance on coal imports for power generation. Renewable energy

technology-based power generation is an important factor for energy independence, energy security and GHG abatement. Therefore, it is necessary to build up the strategy and mechanisms to support renewable energy development.

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