

Chapter 3

Brunei Darussalam Country Report

September 2016

This chapter should be cited as

Energy and Industry Department of Prime Minister's office (2016), 'Brunei Darussalam Country Report, in Kimura, S. and P. Han (eds.) in *Energy Outlook and Energy Saving Potential in East Asia 2016*. ERIA Research Project Report 2015-5, Jakarta: ERIA, pp.79-90.

Chapter 3

Brunei Darussalam Country Report

ENERGY AND INDUSTRY DEPARTMENT, PRIME MINISTER'S OFFICE,
BRUNEI DARUSSALAM

1. Background

Brunei Darussalam is located on the north-west coast of Borneo Island in Southeast Asia. The country's proximity to the South China Sea provides it with access to one of the important trade corridors in the world.

The total area of Brunei is 5,765 square kilometres and the country is divided into four administrative districts, namely Brunei–Muara, Belait, Tutong, and Temburong. Its capital city is Bandar Seri Begawan, located in the Brunei–Muara District.

Brunei is an economy with great economic potential. Its gross domestic product (GDP) in 2013 was around US\$10 billion at 2005 constant prices. With a population of 406,200, Brunei's GDP per capita was almost US\$25,000 at 2005 constant prices. About 60 percent of Brunei's GDP is generated by the energy sector, reflecting the huge contribution of this sector to the country's economy. The energy sector also dominates the country's export values, with crude oil, liquefied natural gas (LNG), and methanol exports accounting for over 90 percent of its total exports. The main export destinations for these commodities are India (crude oil), Japan (LNG), and China (methanol).

To lead Brunei's economy into a sustainable future, Brunei's Energy White Paper (EWP), launched in March 2014, set-out three strategic goals. Strategic Goal 1 is

to strengthen and to grow oil and gas upstream and downstream activities; Strategic Goal 2 is to ensure safe, secure, reliable, and efficient supply and use of energy; and Strategic Goal 3 is to maximise economic spin-off from the energy industry.

2. Energy Supply and Consumption in 2013

Oil and natural gas remain the main primary sources of energy for Brunei. In 2013, total primary energy supply (TPES) for both energy sources was 2.87 Mtoe, with 2.17 Mtoe or 75.7 percent for domestic gas consumption. The 2013 TPES was 3.39 Mtoe lower than in 2012, mainly due to a drop in oil and natural gas production in 2013. As an oil and LNG exporter, Brunei exported 85.4 percent of its oil and natural gas (as LNG) produced in 2013.

Public utilities in Brunei have an installed power generation capacity of 806.2 MW including solar photovoltaic at 1.2 MW. Electricity production by the public utilities was 3.9 TWh in 2013. In the same year, installed capacity of auto producers was 110.4 MW; they produced 0.40 TWh of electricity, an increase of 0.05 TWh from 2012, which is related to an increase of electricity demand from the oil and gas industry.

Brunei's total final energy consumption (TFEC) in 2013 amounted to 0.92 Mtoe, a decrease of 0.97 Mtoe from 2012, mainly due to a decline in final energy consumption in the industrial sector from 0.22 Mtoe in 2012 to 0.17 Mtoe in 2013. The transport sector was the highest energy user in 2013, at 0.45 Mtoe or 48.4 percent of the TFEC. This was followed by the 'others' sector (Commercial and Residential) at 0.29 Mtoe (31.8 percent), the Industrial Sector at 0.17 Mtoe (18.3 percent), and Non-Energy use at 0.01 Mtoe (1.5 percent). In terms of energy sources, oil products consumption consisted mainly of gasoline, diesel, kerosene, and LPG at 0.63 Mtoe, which accounted for 68.3 percent of final energy consumption. This was followed by electricity at 0.27 Mtoe (29.4 percent) and town gas at 0.02 Mtoe (2.3 percent).

Table 3-1. Energy Supply and Consumption 2013 (Mtoe)

Supply and Consumption	Oil	Gas	Electricity	Total
Primary Energy Supplies				
Indigenous Production	8.01	10.45	-	18.46
Net Import and Others	-7.31	-8.28	-	-15.59
Total Primary Energy Supply	0.70	2.17	-	2.87
Final Energy Consumption				
Industrial Sector	0.15	-	0.02	0.17
Transport Sector	0.45	-	-	0.45
Others Sector ¹	0.02	0.02	0.25	0.29
Non-Energy	0.01	-	-	0.01
Total Final Energy Consumption	0.63	0.02	0.27	0.92

Mtoe = million tons of oil equivalent.

Note: Heating Values conversion factor of for natural gas: 1 TJ = 0.02388 Ktoe is based on IEA conversion factors.

Source: IEA and IEEJ, 2016.

3. Energy Policies

3.1. Supply

Brunei has an aspiration to boost upstream production by maximising the potential of its matured fields and venturing into further exploration and development activities. On the exploration side, in order to ensure the sustainability of crude oil and natural gas production in the country, an increase in the seismic data acquisition activities in Brunei over the last few years has contributed to a high number of exploration successes. In addition, other upstream projects such as secondary and tertiary recovery from existing fields

¹ Others sector includes Residential and Commercial.

have been implemented to increase the recovery from these matured fields and increase in the country's reserve as well as improve the productivity of Brunei's production. However, the country's crude oil and natural gas production in 2013 declined to 372 KBOE per day from 403 KBOE per day in 2012 due to continuous efforts in maintenance activities to address asset integrity issues. The positive impact from asset maintenance activities should become apparent in the coming years

In line with the national vision set out in Wawasan Brunei 2035, Brunei is working further in downstream by maximising the added value creation potential from upstream production and assets. In addition to the Methanol plant, which has been in operation since 2010, preparation for several downstream projects such as export oriented refinery and gas petrochemical projects has progressed. These are expected to be commercially on-stream by 2019.

As for renewable energy, Brunei targets to increase its share of the power generation mix from renewable energy to at least 10 percent by 2035. Brunei has started to develop renewable energy resources, particularly solar photovoltaic (PV) and waste-to-energy which are deemed feasible at this stage. To support the development of renewable energy sources, the government plans to introduce renewable energy policy and regulatory frameworks that will stimulate investment both by the government and the private sector in developing and deploying renewable energy.

3.2. Consumption

Brunei has made much progress in terms of improving energy efficiency and conservation (EEC) with its aims of a 45 percent energy intensity reduction by 2035. In achieving the energy intensity target, relevant government agencies and industry have been collaborating to draw up the appropriate legislation and to introduce financial and fiscal policy measures that promote energy efficiency and low-energy intensive industries.

One initiative was electricity tariff reform, which was implemented on 1 January 2012. The main objective of this reform is to move from a regressive to a progressive tariff structure. Its implementation has shown a positive result, particularly in the residential sector where electricity consumption in 2013 increased by only 0.2 percent, compared with its natural growth of 4 percent per year.

On the power generation side, the government's aspiration is to improve power generation efficiency to over 45 percent by 2020. The simple cycle power plant will be replaced with a more efficient combined-cycle or co-generation plant (CHP plant) and a structured maintenance programme will be put in place.

4. Outlook Result

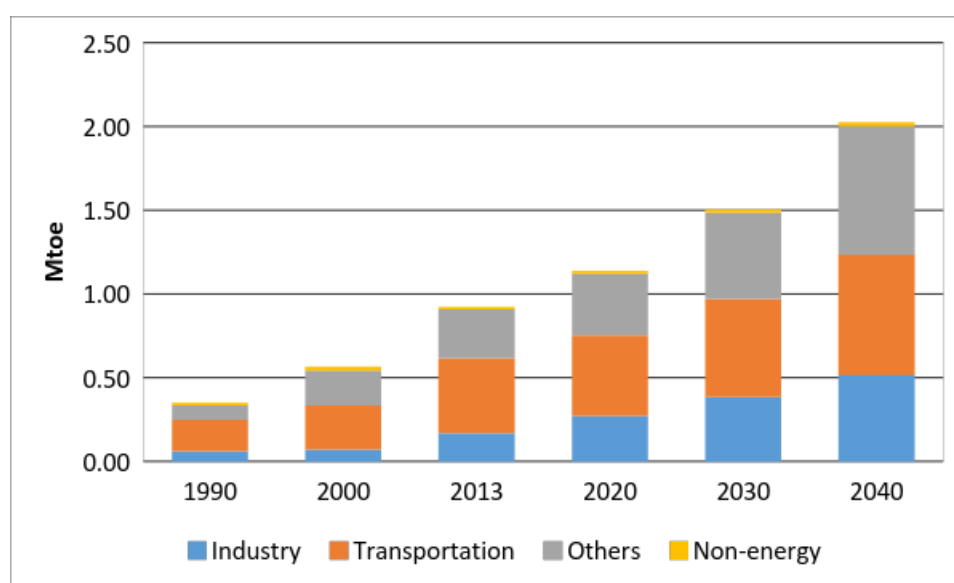
4.1. Final Energy Consumption

Business-as-Usual scenario (BAU)

Brunei's TFEC has increased over the years due to the country's continued overall economic growth – it rose from 0.35 million tons of oil equivalent (Mtoe) in 1990 to 0.92 Mtoe in 2013. Under the Business-as-Usual scenario (BAU), the projected average annual increase in TFEC from 2013 to 2040 is 3.0 percent, from 0.92 Mtoe to 2.02 Mtoe in 2040. This projected increase in TFEC is linked to a projected constant annual GDP growth rate of 3.4 percent over the projection period. The projected GDP growth rate is supported by the country's aspiration to strengthen its economic structure by developing its commercial and services sectors and industrial sector. But the highest rate of increase in energy consumption by sector from the model will come from the industrial sector, which is expected to grow at 4.2 percent per year. Energy consumption of the 'others' sector, covering mainly the residential and commercial sectors, is estimated to increase by 3.6 percent per year. This is driven by annual projected population growth of 1.7 percent from 2013 to 2040 and an increase in the economic activities of the commercial sector. Energy consumption of the transport sector and the non-energy sector is estimated to grow by 1.8 percent each.

In 2040, the share of oil in the country's total energy demand is forecast to be 59.7 percent, mainly to be consumed as transportation fuel. TFEC of oil in 2013 accounted for the largest share in total demand at 68.3 percent. In 2013, TFEC of oil was 0.63 Mtoe and it is projected to increase to 1.21 Mtoe in 2040. The model also predicted that demand for electricity will increase at an average annual rate of 4.0 percent, from 0.29 Mtoe in 2013 to 0.77 Mtoe in 2040.

Figure 3-1. Final Energy Consumption by Sector, BAU



BAU = Business-as-Usual scenario; Mtoe = million tons of oil equivalent.
Source: Author's calculation.

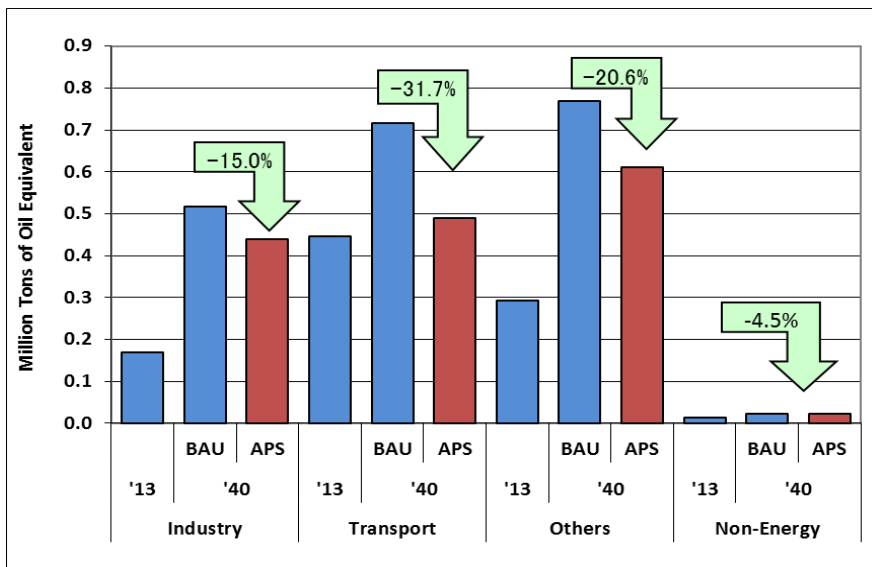
Alternative Policy Scenario (APS)

An Alternative Policy Scenario (APS) was developed with the aim of achieving the energy intensity reduction targets through the deployment of advanced technologies for energy saving and the enforcement of relevant initiatives. It is used as a basis to estimate the energy saving potential for Brunei. Under the APS, the overall TFEC in 2040 will be 1.56 Mtoe. In 2040, about 39.1 percent of total energy demand will be from the 'others' sector, followed by the transportation sector at 31.4 percent and the industry sector at 28.1 percent. Non-energy sector demand will make up 1.4 percent.

The expected improvement in vehicle fuel efficiency as a result of the proposed fuel economy regulations would be the main factor for the declining demand

growth rate in the transportation sector. TFEC is projected to grow at an annual average rate of 2 percent from 2013 to 2040. Based on the result of the Long-range Energy Alternatives Planning (LEAP) model for energy outlook, the TFEC under the APS will be 23 percent lower than that of the BAU. The transportation sector will contribute a large part of the reduction in 2040 by 31.7 percent, followed by the 'others' sector, the industrial sector, and the non-energy sector at 20.6 percent, 15.0 percent, and 4.5 percent, respectively.

Figure 3-2. Final Energy Consumption by Sector, BAU and APS



BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario.
Source: Author's calculation.

4.2. Primary Energy Supply

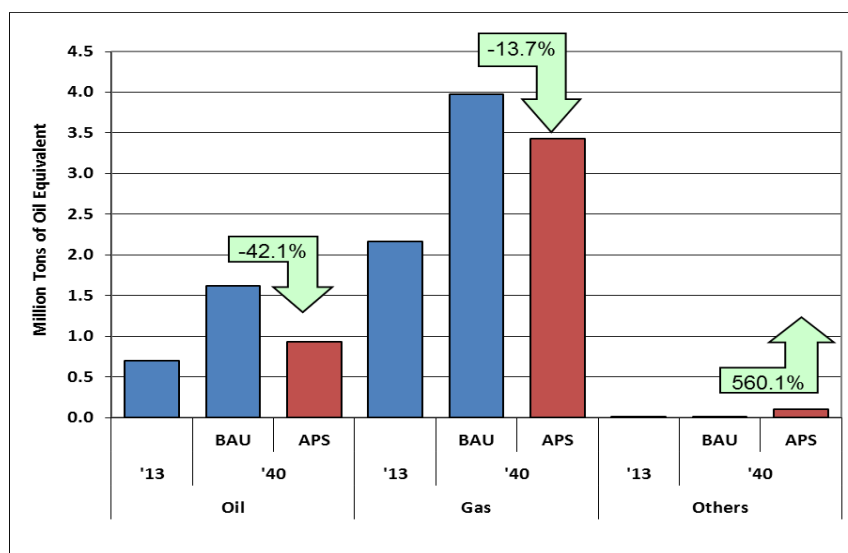
Business-As-Usual Scenario

Under the BAU, TPES of Brunei is projected to reach 5.61 Mtoe in 2040, which represents an annual average increase of 2.5 percent from 2.87 Mtoe in 2013. TPES of Brunei in 2013 was dominated by natural gas, at 75.7 percent, with oil accounting for 24.3 percent.

TPES for oil is expected to grow at an annual average rate of 3.2 percent, from 0.70 Mtoe in 2013 to 1.62 Mtoe in 2040, while natural gas is expected to increase at 2.3 percent per year from 2.17 Mtoe to 3.98 Mtoe during the projection period.

Supply from renewable energy from solar and municipal waste-to-energy plants, will reach 0.02 Mtoe or 0.03 percent of TPES in 2040.

Figure 3-3. Primary Energy Supply by Source, BAU and APS



BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario.
Source: Author's calculation.

Alternative Policy Scenario

A significant decrease in TPES for oil and natural gas is projected between the BAU and the APS in 2040. In 2040, the oil supply under APS will be 0.94 Mtoe against 1.62 Mtoe for the BAU, or 42.1 percent lower. The natural gas supply under the APS is also predicted to be 13.7 percent lower than under the BAU. But there is a significant increase in supply from renewable energy, particularly from solar and waste-to-energy sources, as shown in Figure 3.

4.3. Power Generation

In Brunei, power generation capacity from public utilities is dominated by natural gas. From 806.2 MW of installed capacity (including 1.2 MW Solar PV), only 12 MW is contributed by diesel. In addition to the public utilities capacity, the auto producers' capacity in 2013 was 110.4 MW. Based on the model projection under the BAU, about 10.47 TWh of electricity will be generated in 2040 from both public utilities and auto producers, including from renewable energy of 0.05 TWh.

This represents an average annual increase of 3.7 percent. Under the APS, electricity generation is projected to increase by 2.9 percent per year, reaching 8.46 TWh in 2040, which includes renewable energy, at 0.9 TWh. Total power generation under the APS will be 2.01 TWh or 19.2 percent lower compared with the BAU.

4.4. Projected Energy Saving²

The energy saving potential that could be achieved through the implementation of legislative measures on EEC, as well as the development of renewable energy in Brunei, is about 1.14 Mtoe of TPES or equivalent to a reduction of 20.3 percent from the BAU in 2040.

4.5. Carbon Dioxide (CO₂) Emission

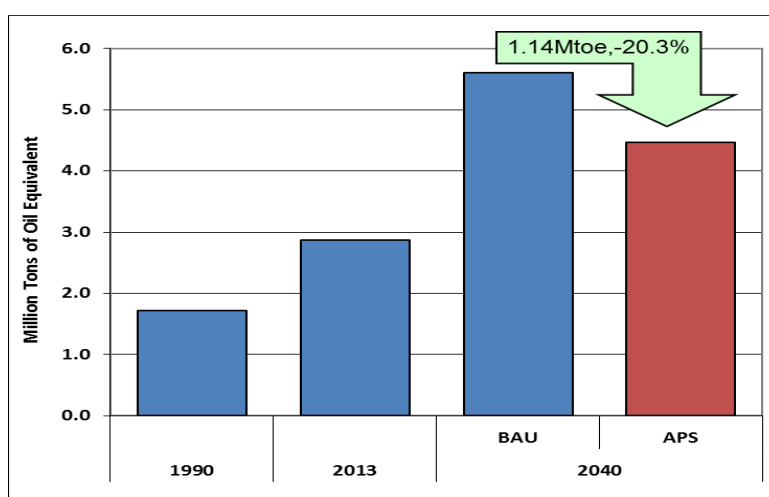
Business-As-Usual

The percentage increase in the CO₂ emission correlates to the increase in TPES. This is expected because the energy mix for Brunei is 99 percent dependent on fossil fuels. The CO₂ emission in 2013 was 1.9 Mt-C. An increase of 2.5 percent per year is expected with an eventual value of 3.7 Mt-C in 2040.

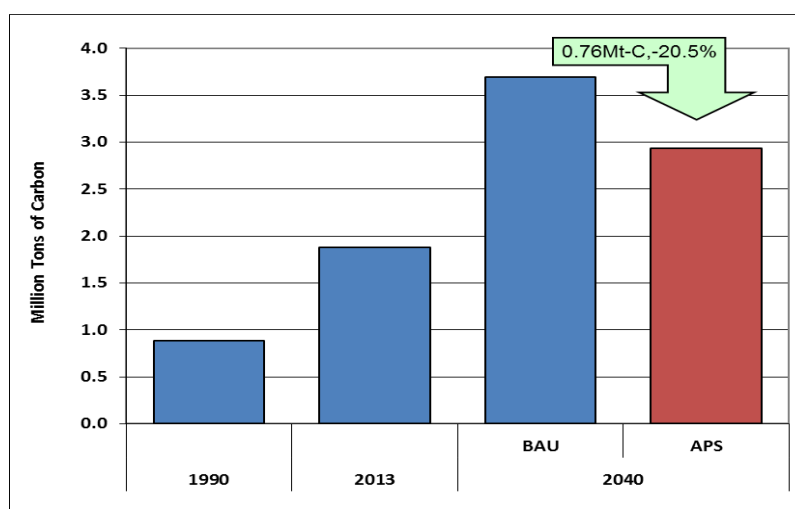
Alternative Policy Scenario

In the APS, CO₂ emission could decrease by 20.5 percent in 2040 compared with the BAU. The result of the model shows that a total of 2.9 Mt-C will be emitted by 2040. The decrease in CO₂ emission is attributed to the lower oil consumption, particularly in power generation plants.

² The difference between primary energy supply in the BAU and the APS.

Figure 3-4. Reduction of Primary Energy Supply, BAU and APS

BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario.
Source: Author's calculation.

Figure 3-5. CO₂ Emission from Energy Consumption, BAU and APS

BAU = Business-as-Usual scenario; APS = Alternative Policy Scenario.
Source: Author's calculation.

5. Findings and Policy Implications

5.1. Findings

Along with the economic development to achieve the objectives of the Wawasan Brunei 2035, a significant increase in the activity level of all economic sectors is expected. Despite the increased focus on EEC, the energy demand of Brunei is projected to increase steadily, but at a slower growth rate. In meeting the

growing domestic energy demand, fossil fuels will remain the primary sources of energy supply for the country.

The result of the model used by this study shows the improvement in energy efficiency, when coupled with the implementation of appropriate legislative measures and development of renewable energy, contributing to a reduction in both TPES and TFEC at 20.3 percent and 22.7 percent, respectively. The model also shows that the improvement in energy efficiency will help to reduce CO₂ emission by 20.5 percent.

5.2. Policy Implications

The projected increase in TPES and TFEC requires Brunei to undertake concerted efforts and close coordination among relevant stakeholders such as those of the government agencies, industries, and also individuals, to continuously promote EEC as well as achieve renewable energy development. Despite its aspiration to increase oil and natural gas production by 2035, Brunei acknowledges the importance of the national aspiration to reduce TPES by 63 percent by 2035 from the BAU. The primary energy supply reduction is focused on fossil fuel supplies for inland use, such as fossil fuel for power generation.

These aspirations generate the following policy implications for Brunei:

1. Energy Efficiency and Conservation
 - Brunei should continue to strengthen its efforts to promote standards and labelling for products and appliances, raising awareness of EEC, as well as implementing EEC Building Guidelines for Non-residential buildings. At the same time, Brunei also needs to continue its efforts to ensure the implementation of fuel economy regulation and the development of relevant financial incentives to promote EEC.

2. Renewable Energy
 - Brunei's government is planning to utilise a waste-to-energy facility. This facility is expected to have an installed capacity of up to 10 MW. Whether other alternative energy sources such as wind power, hydro

power, and ocean are economically and technically feasible in the medium term and the long term is still being researched. These initiatives are supporting the government's aspiration of generating at least 10 percent of the total power generation mix from renewable resources by 2035.

- In this regard, the country should prioritise its efforts to introduce renewable energy policy and regulatory frameworks and market deployment of solar PV and waste-to-energy technology by means of exploring policy incentives such as Feed-in Tariff and Net-Energy metering.

3. Energy Security

- For domestic consumption of petroleum products, the current refinery has a capacity of 12,000 barrels per day for its crude distillation unit and 6,000 barrels per day for its reformer unit. Based on the current domestic demand, it can only meet about 60 percent of total demand. The balance is met by imported products. Domestic supply of natural gas for power plants has been stable at around 3.3 million m³ per day in the last several years. With regard to power efficiency improvement, Brunei should continue with its efforts to improve power efficiency with the aim of all power generation reaching an efficiency of at least 45 percent by 2020.
- To support future energy security, Brunei should continue to strengthen upstream in order to meet the country's production target.

4. Technology Development to support EEC and Renewable Energy

- Brunei should continue to support research, development, and demonstration activities as well as promote technology transfer on EEC and renewable energy. This includes continuing to work with the Brunei National Energy Research Institute (BNERI) on sustainable energy policies and research, increase collaboration with local institutions such as Universiti Brunei Darussalam and Universiti Teknologi Brunei, and enhance the international partnership on promoting sustainable energy.