BRUNEI DARUSSALAM

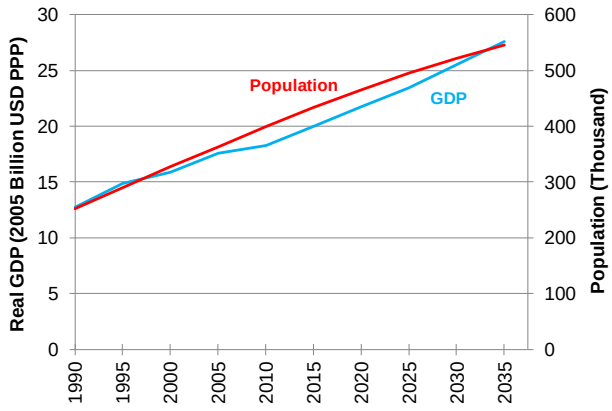
- *Brunei Darussalam has low GDP growth, but high macroeconomic stability.*
- *The economy is highly dependent on LNG and oil exports. The government's efforts to encourage diversification have met with limited success. This is set to change with the introduction of downstream oil and gas industries planned for the first half of the forecast period.*
- *The development of energy-intensive industries is expected to drive final energy demand in Brunei Darussalam, which is projected to increase by 39% from 2010 to 2035, reaching 1.7 Mtoe in 2035.*

ECONOMY

Brunei Darussalam is located on the north-west coast of the island of Borneo. It has a coastline of about 161 kilometres along the South China Sea and a land area of 5765 square kilometres, of which 75% is covered by primary forest. The economy is characterized by hilly lowlands in the west, rugged mountains in the east, and a swampy tidal plain along the coast. The climate is equatorial, with an average temperature of 28°C, high humidity, and heavy rainfall that ranges from 2500 mm to 7500 mm annually. The economy's only neighbour is the Malaysian state of Sarawak, which separates Brunei Darussalam into two parts.

Brunei Darussalam is a small economy with a total population of 423 000 in 2011, of which 27% were foreigners (DEPD, 2012, p. 4). The economy's population is projected to grow at an average annual rate of 1.3% over the forecast period, with the total population reaching about 550 000 by the year 2035. According to the United Nations, 75.6% of the population was urbanized in 2010; this figure is projected to increase to 80.4% by 2035 (United Nations, 2011).

Figure BD1: GDP and Population



Sources: Global Insight (2012) and APERC Analysis (2012)

The majority of the population is concentrated in the capital, Bandar Seri Begawan, and in the oil refining area of Seria in the west. The remaining areas are sparsely populated and largely undisturbed. The economy is wealthy and capable of maintaining a welfare state that provides free higher education and healthcare to its citizens, and subsidized housing, food and fuel.

In 2009, Brunei Darussalam achieved a nominal GDP of USD 17.7 billion (in 2005 USD PPP) and a GDP per capita of USD 45 158, which is one of the highest in the world. Brunei Darussalam's GDP is projected to grow at a modest average annual rate of 1.7% over the outlook period, reaching USD 27.6 billion in 2035. Given the projected 1.3% average annual population growth, GDP per capita will remain high, increasing by about 10% to reach nearly USD 50 563 per capita by 2035.

The oil and gas sector is the backbone of Brunei Darussalam's economy, accounting for 67.7% of GDP and 95.6% of total exports in 2011 (DEPD, 2012, p. 8). Brunei Darussalam is the fourth-largest oil producer in South-East Asia and the ninth-largest exporter of liquefied natural gas (LNG) in the world (BEDB, 2011). The economy's non oil and gas sectors include agriculture, forestry, fishing, aquaculture and banking.

There is a rising awareness the economy is depleting its natural resources and subsequently it needs to diversify away from its over-reliance on upstream oil and gas production. The Wawasan Brunei 2035 (referred to here as the Vision Brunei 2035) formulates Brunei Darussalam's plans to upskill the labour force, reduce unemployment, strengthen the banking and tourism sectors, and widen the economic base beyond oil and gas by 2035 (BEDB, 2011). For the short term, the National Development Plan 2007–2012 supports the Vision Brunei 2035 by allocating BND 9.5 billion (around USD 6.6 billion) for 826 programmes and projects to strengthen the economy's human resources base, social services and infrastructure, and to support the development of competitive industries. Priority industries are finance, hospitality, agriculture, halal products (which includes food, pharmaceuticals and

cosmetics) and software development (APERC, 2009).

One of the key initiatives under the Vision Brunei 2035 is to designate industry cluster-specific sites with supporting infrastructure and facilities. This will facilitate industrial development and promote industrial investments. The first site, established in 2007, was the Sungai Liang Industrial Park (SPARK), designed specifically for downstream petrochemical processing activities. Additionally, 1 trillion cubic feet (Tcf) (28.3 billion cubic meter (bcm)) of natural gas has been allocated for domestic downstream activities over an estimated 20-year span (FGE, 2010).

The first plant built at the SPARK site was a methanol plant developed by the Brunei Methanol Company. The plant began production in May 2010 and is capable of producing 850 000 tonnes of methanol each year. The next project in SPARK is an integrated chemical complex housing six plants that will use part of the allocated 1 Tcf (28.3 bcm) of natural gas as feedstock to produce ammonia, urea, di-ammonium phosphate, ammonium sulphate, melamine and caprolactam. The project is being developed by the Mitsui Consortium and is expected to begin operations in 2015 (Brunei Times, 2011).

The second industrial site is the Pulau Muara Besar (PMB) Island site, designed for the development of oil field support services, such as a marine supply base and fabrication yard, as well as further downstream activities (BEDB, 2012). The anchoring project will be a USD 2.5 billion oil refinery and aromatics cracker project to be developed by the Zheijiang Hengyi Group Co. Ltd. The project is expected to begin operations in 2015, with a production capacity of approximately 135 thousand barrels per day. The first phase will comprise the production of petroleum products such as gasoline, diesel and jet A-fuel, as well as paraxylene and benzene used mainly in textile production (BEDB, 2012). The feedstock for this plant will be locally-sourced crude oil and condensate.

Brunei Darussalam's largest export, after oil and gas, is its manufactured garments. It should be noted the total value of garments exported significantly decreased by about 80% from BND 56.7 million in 2009 to BND 8.2 million in 2010, due to a major trade agreement between the economy and the United States expiring in the same year (DEPD, 2012, p. 8). On the other hand, the economy's first methanol plant began exporting its products in May 2010, and other sectors like the agriculture, forestry and fishery sectors and the services sector showed a healthy growth rate of 3–4% from 2009 to 2010 (DEPD, 2012). This healthy growth in the non oil and gas sectors is consistent with the economy's efforts towards diversification, and is likely to continue in the short to medium term.

Bruneians enjoy a well-developed transport infrastructure; the quality of roads in Brunei Darussalam has been ranked seventh in Asia and third in South-East Asia (Brunei Press, 2011b, p. E89). The major population centres in the country are linked by a network of about 3127.4 kilometres of road (DEPD, 2012, p. 17). Brunei also has one of the highest car ownership rates in the world, with roughly one car for every 2.09 persons (Brunei Press, 2011a). This can be attributed to the limited public transport system, low import tax, inexpensive car maintenance and low unleaded petrol prices. With 170 000 licensed vehicles using the road network daily, the Brunei Darussalam Government is constantly maintaining, upgrading and extending its road network. In its National Development Plan 2007–2012, the government has allocated BND 568.5 million (USD 464 million) for this purpose (Brunei Press, 2011b, p. E89).

The Brunei International Airport (BIA) handles more than 20 000 flights annually. In 2011, 27 822 flights were recorded, including scheduled, non-scheduled, chartered and military flights (DEPD, 2012, p. 17). Brunei Darussalam's major port is at Muara. In 2011, the port handled a total of a little over 1 million freight tonnes of cargo (DEPD, 2012, p. 17). The port authority is continuing its efforts to attract and encourage more shipping lines to call at the port. The Ministry of Industry and Primary Resources is keen to develop the economy's tourism industry by capitalizing on Brunei Darussalam's rich cultural heritage and pristine natural rainforests. If the Ministry's initiative is successful, it is expected the energy demand for both aviation and maritime transport will increase in the coming years.

ENERGY RESOURCES AND INFRASTRUCTURE

Brunei Darussalam owes its current prosperity to its significant natural gas and oil resources. The existing and potential oil and gas reserves lie within the economy's northern landmass and extend offshore to the outer limits of its exclusive economic zone (EEZ). As of 1 January 2012, Brunei Darussalam's proven oil reserves stood at 1.1 billion barrels and its gas reserves were estimated at 13.8 Tcf (390 bcm) (OGJ, 2011). The oil reserves are expected to last about 25 years and the natural gas reserves 40 years. New recovery technologies as well as potential onshore and deepwater fields are expected to add to the lifespan of the reserves.

In 2010, the economy's major oil fields were the onshore Seria-Tali field, with 292 producing oil wells, and the offshore fields Champion (239 producing oil wells) and South West Ampa (152 producing oil wells) (OGJ, 2011). On average, Brunei's oil fields produced 160 100 barrels per day in 2010. Only a small fraction of the oil produced is refined at Brunei Darussalam's sole refinery in Seria, which has a distillation capacity of 15 000 barrels per day. The main products are motor gasoline, diesel oil and dual-purpose kerosene. These outputs are used almost exclusively for domestic consumption. The rest of Brunei Darussalam's crude oil is exported and refined elsewhere.

Brunei Darussalam's most prolific natural gas field is also its oldest offshore field, the South West Ampa field. It holds more than half of the economy's total natural gas reserves. Other sources include the gas wells in the Fairley, Gannet and Maharajalela-Jamalulalam fields (OBG, 2009). The production from these fields is piped to the Brunei LNG Plant in Lumut to be liquefied. Most of the LNG produced is exported to Japan and Korea (Brunei LNG, 2010).

Brunei Darussalam has an installed electricity capacity of 894 MW that produced 3723 GWh of electricity in 2011 (DEPD, 2012, p. 19). Given the abundance of natural gas available in the economy, almost all of its installed electricity capacity is natural gas-fired. The only exceptions are the diesel power station at Belingus and the demonstration 1.2 MW Tenaga Suria Brunei (TSB) solar energy plant. The solar plant is the largest-scale photovoltaic project in South-East Asia, and is capable of producing 1344 MWh of electricity each year (OBG, 2011). Brunei Darussalam has significant solar, hydro and biomass potential, but it has no concrete plans for exploiting this potential on a large scale due to environmental and cost constraints. Instead, in the near future, the economy will concentrate on reducing its energy intensity through energy efficiency and conservation initiatives.

As reported in the Brunei Key Indicators 2011, 99.9% of the population is already connected to the electricity grid, while the remaining 0.1% is served by stand-alone generators (DEPD, 2012, p. 19). The transmission network is divided into three separate grids, namely the Brunei-Muara network, the BPC network and the Temburong District network. The three grids are operated by two different utilities, the Department of Electrical Services (DES) and the Berakas Power Company Private Limited (BPC). The National Development Plan 2007–2012 proposes that all three of the economy's power grids are interconnected by 2012.

ENERGY POLICIES

Brunei Darussalam's energy policy is centred on its oil and gas industries. In 1981, the Oil Conservation Policy was introduced when oil production peaked at 261 000 barrels per day in 1979. The policy aimed to prolong the life of the economy's oil reserves by rationalizing its oil output. As a result, production gradually dropped to around 150 000 barrels per day in 1989. In November 1990, the government reviewed the policy and removed the production ceiling, resulting in the production of 219 000 barrels per day by 2006 (APERC, 2009). In 2011, oil production averaged 166 000 barrels per day (DEPD, 2012, p. 11).

In 2000, the Brunei Natural Gas Policy (Production and Utilization) was introduced. The policy aimed to maintain gas production at year-2000 levels to adequately satisfy export obligations, to open new areas for exploration and development, and to encourage increased exploration by new and existing operators. Under the policy, priority is always given to domestic gas use, especially for electricity generation.

Brunei Darussalam has set an economy-wide target to reduce its energy intensity by 45% by 2035, with 2005 as the base year. To ensure the 45% reduction target is met, Brunei Darussalam has identified a number of action plans for the generation, residential, industry, government and transport sectors. These action plans are designed to improve energy efficiency performance in these five sectors between 2010 and 2030. Some of the action plans identified include: restructuring the residential electricity tariff structure; improving the efficiency of new and existing power plants; formulating an economy-wide standard and labelling for air conditioning and lighting systems; initiating energy management programmes in government and industrial buildings; and introducing energy efficient vehicles like hybrid and electric vehicles into Brunei Darussalam's automotive market (APERC, 2012). These action plans will be formalized in the Energy White Paper to be published in early 2013.

Brunei Darussalam implements five-year economic development plans known as National Development Plans that also serve as guidance for its energy policies. Currently, the ninth National Development Plan 2007–2012 is in force. In line with this plan, the economy has launched a long-term development plan, the Vision Brunei 2035. The Vision aims to make Brunei Darussalam, by 2035, a nation which will be widely recognised "for the accomplishment of its educated and highly skilled people as measured by the highest international

standards; quality of life that is among the top 10 nations in the world; and a dynamic and sustainable economy with income per capita within the top 10 countries in the world" (DEPD, 2008).

In May 2005, His Majesty the Sultan and Yang Di-Pertuan of Brunei Darussalam created the post of the Minister of Energy. The Energy Division at the Prime Minister's Office was also created, to be responsible for formulating the economy's energy policy as well as presiding over its energy matters. The Petroleum Unit, that oversees the development of Brunei Darussalam's natural gas and oil sector, and the Department of Electrical Services, that is tasked with managing and developing its electricity sector, come under this ministry. In 2011, the Energy Division and the Petroleum Unit merged to become the Energy Department under the Prime Minister's Office.

The Brunei Shell Petroleum Co. Sdn. Bhd. (BSP), jointly owned by the Brunei Darussalam Government and the Royal Dutch/Shell Group of the Netherlands, has been the dominant oil and gas production company in the economy. The only other concessionary is the French multinational oil company, Total E&P Deep Offshore B.V. In 2002, the Brunei National Petroleum Company Private Limited (PetroleumBRUNEI) was empowered to manage Brunei Darussalam's commercial interests in the oil and gas sector. PetroleumBRUNEI has been granted all mineral rights in eight petroleum exploration blocks, nominee shareholder status in the Brunei Methanol Company Private Limited, and one of its subsidiaries, PB Logistics, is a shareholder in the Brunei Methanol Tanker (BMT).

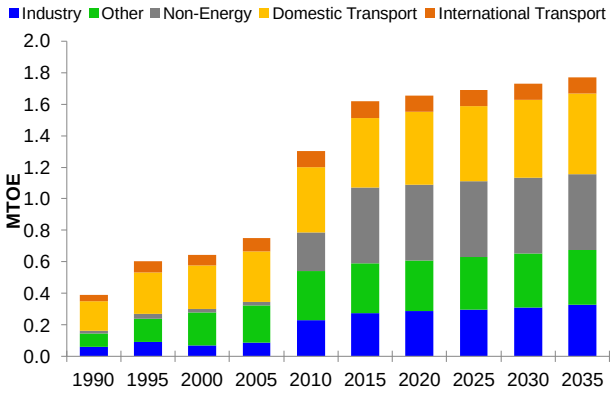
Currently, energy prices are heavily subsidised. Before 2012, the residential electricity tariff was priced at approximately BND 0.06 (USD 0.044) per kWh. A new tariff structure, which came into effect on 1 January 2012, was designed to encourage smart electricity use and to help the poor by rewarding low users and penalising heavy users of electricity. Motor fuel prices remain comparatively low, with petrol prices varying from BND 0.36 (USD 0.26) per litre for regular to a maximum of BND 0.53 (USD 0.38) per litre for premium unleaded (Lawrey and Pillarisetti, 2011). In an effort to address the challenges of increasing demands and depleting resources and to improve energy efficiency performance, the government of Brunei Darussalam has decided to implement progressively increasing electricity tariffs and to adopt European Union equivalent fuel economy regulations. These measures will be formalized in the economy's Energy White Paper to be published in early 2013.

BUSINESS-AS-USUAL OUTLOOK

FINAL ENERGY DEMAND

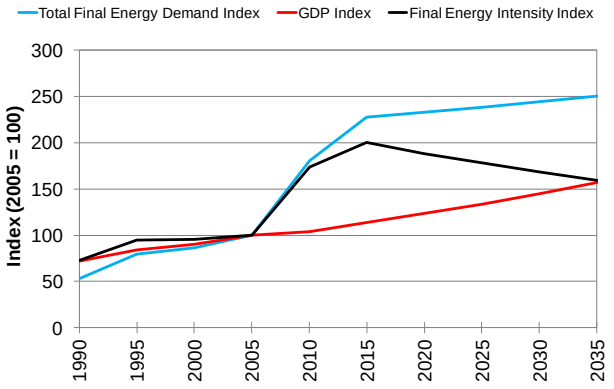
The total final energy demand for Brunei Darussalam is projected to almost double from 0.9 Mtoe in 2009 to 1.7 Mtoe in 2035. The industry and non-energy sectors begin to take up a much larger portion of final energy demand from 2010 onwards, compared to an almost negligible share before 2010. This is due to the methanol plant in SPARK beginning production in that year. The methanol plant will require massive amounts of natural gas as fuel, resulting in gas taking a large chunk of oil's dominant share of final energy consumption. By 2035, oil will still account for the largest share (46%), followed by gas (35%), electricity (19%) and NRE (0.6%).

Figure BD2: BAU Final Energy Demand



Source: APERC Analysis (2012)
Historical Data: *World Energy Statistics 2011* © OECD/IEA 2011

Figure BD3: BAU Final Energy Intensity



Source: APERC Analysis (2012)

Under BAU scenario, Brunei Darussalam's final energy intensity is expected to increase by 60% between 2005 and 2030. This increase will be driven primarily by a growing demand for energy for the new industries in the industry and non-energy sectors. The energy efficiency action plans and

measures to be initiated in the Energy White Paper may help to alleviate some of this increase.

Industry

The changes in the final energy demand depend on two aspects: the expansion of the energy-intensive industry sector and the start of methanol production at the SPARK site in 2010. Other industries proposed for the SPARK and Pulau Muara Besar industrial sites are not considered in this analysis—they are still in the early stages of planning and their definite time of entry has yet to be established.

The final energy demand for industry in Brunei Darussalam is projected to increase by 41% from 2010 to 2035, reaching 326 kilotonnes of oil equivalent (ktoe) by 2035. The industry sector's energy demand will be for oil (58%), electricity (22%) and gas (20%).

Transport

The domestic transport sector's demand for energy is projected to continue to increase during the forecast period, reaching 512 ktoe in 2035. Petroleum products are expected to remain the dominant transport energy source, but their growth will slow with the expected improvements in vehicle fuel efficiency.

Other

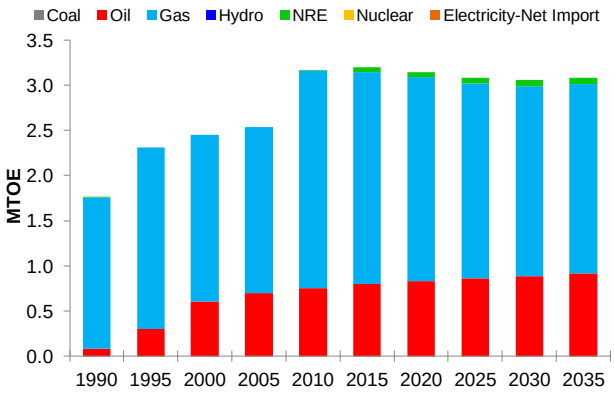
The final energy demand in the 'other' sector, which represents the residential, commercial and agricultural sectors, is projected to increase by 12.5% from 2010 to 2035, reaching 349 ktoe by 2035. This will be driven mostly by the residential sector. Electricity consistently holds a two-thirds share of energy demand for the 'other' sector throughout the outlook period.

PRIMARY ENERGY SUPPLY

Brunei Darussalam's primary energy supply is expected to remain fairly constant at about 3 Mtoe over the forecast period. Natural gas and oil will remain the dominant supply fuels for primary energy with small contributions from solar and biomass.

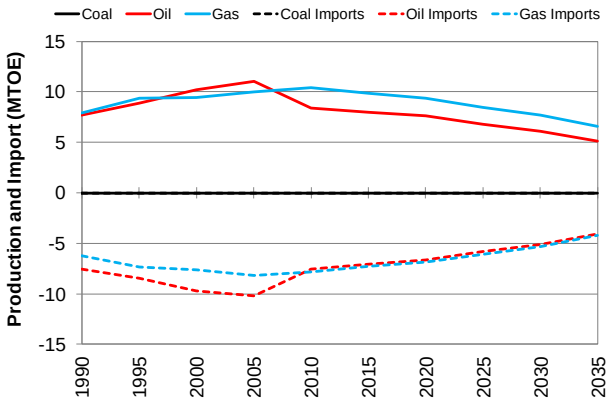
Natural gas production and oil production are forecasted to gradually decrease over the 2010–2035 period due to maturing reserves and the increasing complexity of resource exploration in the economy. Since domestic consumption is modest and priority is given to domestic use, it is expected that the decrease in production will be reflected in the amount of oil and gas exported each year. There is no coal production or coal consumption in this economy.

Figure BD4: BAU Primary Energy Supply



Source: APERC Analysis (2012)
Historical Data: *World Energy Statistics 2011* © OECD/IEA 2011

Figure BD5: BAU Energy Production and Net Imports



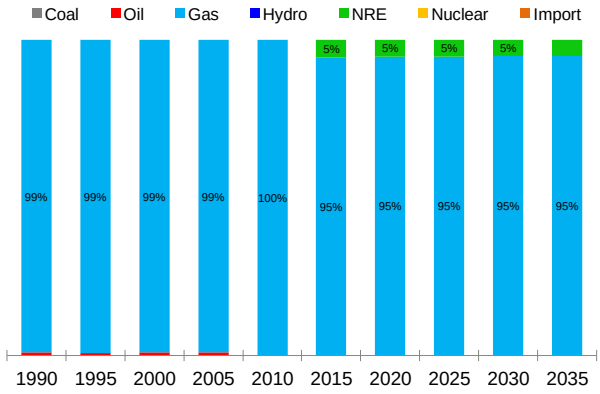
Source: APERC Analysis (2012)
Historical Data: *World Energy Statistics 2011* © OECD/IEA 2011

ELECTRICITY

Brunei Darussalam is projected to continue to rely heavily on natural gas for electricity generation. The economy is expected to improve its conversion efficiency by replacing the existing single-cycle power plants with combined-cycle gas units and by ensuring all new power plant installations have over 45% efficiency (APERC, 2012).

Brunei Darussalam will also begin to diversify its energy resources by taking advantage of its available new renewable energy (NRE) potential. The economy already has a 1.2 MW solar power plant and will continue to develop more solar capacity during the outlook period. Another form of NRE capacity that will likely be introduced is biomass generation, using landfill gas as fuel. By 2035, NRE's contribution to total power generation will increase to 5%, compared to zero in 2009.

Figure BD6: BAU Electricity Generation Mix

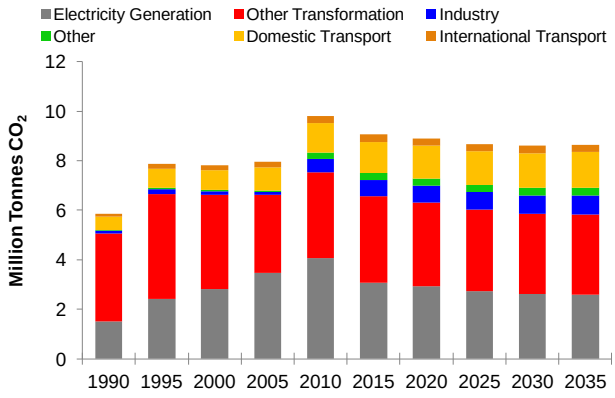


Source: APERC Analysis (2012)
Historical Data: *World Energy Statistics 2011* © OECD/IEA 2011

CO_2 EMISSIONS

Brunei Darussalam's annual CO_2 emissions from fuel combustion are projected to begin to decrease from 2010 onwards, reaching about 8.65 million tonnes of CO_2 in 2035. This compares to 5.9 million tonnes in 1990 and 8.0 million tonnes in 2005. The sudden increase in CO_2 emissions from the industry sector in 2010 can be attributed to production starting at the SPARK methanol plant. Improvements in power generation efficiency will contribute to reducing the CO_2 emissions from this sector over the next 25 years.

Figure BD7: BAU CO_2 Emissions by Sector



Source: APERC Analysis (2012)

The decomposition analysis in Table BD1 shows that from 1990 to 2005, the growth in CO_2 emissions was underpinned by growing GDP, but from 2010 to 2035, total change in CO2 emissions will show a declining trend, driven by declining trends in CO_2 intensity and energy intensity.

Table BD1: Analysis of Reasons for Change in BAU CO_2 Emissions from Fuel Combustion

(Average Annual Percent Change)

	1990-2005	2005-2010	2005-2030	2005-2035	2010-2035
Change in CO_2 Intensity of Energy	-0.5%	-0.8%	-0.7%	-0.5%	-0.5%
Change in Energy Intensity of GDP	0.3%	3.7%	-0.7%	-0.9%	-1.7%
Change in GDP	2.2%	0.8%	1.5%	1.5%	1.7%
Total Change	2.1%	3.7%	0.1%	0.1%	-0.6%

Source: APERC Analysis (2012)

CHALLENGES AND IMPLICATIONS OF BAU

As a major oil and gas producer and exporter, Brunei Darussalam's economic and energy security is assured. Unfortunately, based on historical data, this abundance of wealth and resources has not created an environment conducive to energy efficiency and conservation measures.

Brunei Darussalam's Vision Brunei 2035, published in 2008, and the upcoming Energy White Paper, to be published in 2013, outline environmental policy directions and initiatives designed to minimize environmental impacts and to conserve existing oil and gas resources. These measures may help Brunei Darussalam meet its challenges to maintain economic and energy security as well as to improve environmental sustainability.

ALTERNATIVE SCENARIOS

To address the energy security, economic development, and environmental sustainability challenges posed by the business-as-usual (BAU) outcomes, three sets of alternative scenarios were developed for most APEC economies.

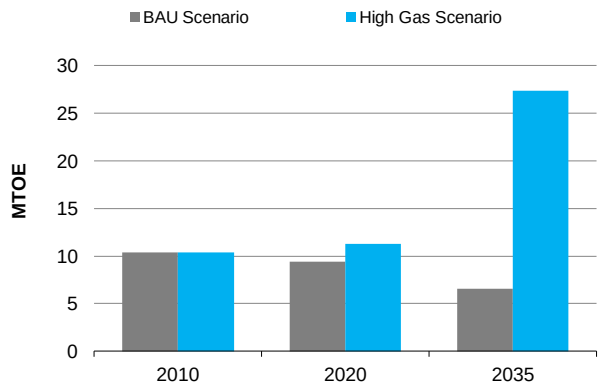
HIGH GAS SCENARIO

To understand the impacts higher gas production might have on the energy sector, an alternative 'High Gas Scenario' was developed. The assumptions behind this scenario are discussed in more detail in Volume 1, Chapter 12. The scenario was built around estimates of gas production that might be available at BAU prices or below if constraints on gas production and trade could be reduced.

The High Gas Scenario for Brunei Darussalam assumed the production increase shown in Figure BD8, which equals 315% by 2035. This is based on the draft for Brunei Darussalam's Energy White Paper, in which the economy proposes to explore deepwater offshore commercial blocks more aggressively and to review the potential of developing small and marginal fields that have previously been deemed infeasible. The success of these proposed initiatives will certainly increase Brunei Darussalam's gas production. The Energy White Paper provides estimates for the potential increase in gas production,

and these estimates were adopted for the High Gas Scenario for this economy.

Figure BD8: High Gas Scenario – Gas Production



Source: APERC Analysis (2012)

Additional gas consumption in each economy in the High Gas Scenario will depend not only on the economy's own additional gas production, but also on the gas market situation in the APEC region. Since domestic power generation in Brunei Darussalam is almost fully gas-based, the additional gas production will likely be exported as LNG. As a result, no change is expected in the economy's electricity generation mix or in its CO_2 emissions. Thus, Figures BD9 and BD10 are not included for this economy.

ALTERNATIVE URBAN DEVELOPMENT SCENARIOS

To understand the impacts of future urban development on the energy sector, three alternative urban development scenarios were developed: 'High Sprawl', 'Constant Density', and 'Fixed Urban Land'. The assumptions behind these scenarios are discussed in Volume 1, Chapter 5.

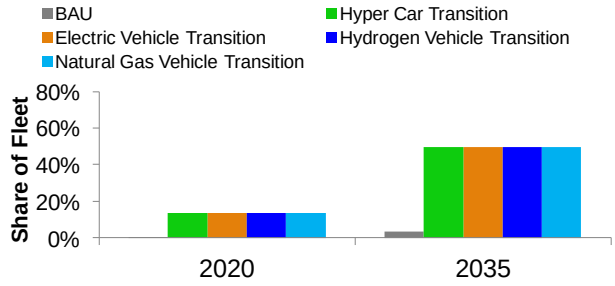
The alternative urban development scenarios evaluate potential transport energy savings from urban planning by modelling the relationship between travel distance, vehicle efficiency and vehicle ownership. Unfortunately, there is not sufficient data on urban land use available for Brunei Darussalam to run this scenario. Figures BD11–BD13 are therefore not included for this economy.

VIRTUAL CLEAN CAR RACE

To understand the impacts of vehicle technology on the energy sector, four alternative vehicle scenarios were developed: 'Hyper Car Transition' (ultra-light conventionally-powered vehicles), 'Electric Vehicle Transition', 'Hydrogen Vehicle Transition', and 'Natural Gas Vehicle Transition'. The assumptions behind these scenarios are discussed in Volume 1, Chapter 5.

Figure BD14 shows the evolution of the vehicle fleet under BAU and the four 'Virtual Clean Car Race' scenarios. By 2035, the share of the alternative vehicles in the fleet reaches around 50% compared to about 3% in the BAU scenario. The share of conventional vehicles in the fleet is thus only about 50%, compared to about 97% in the BAU scenario.

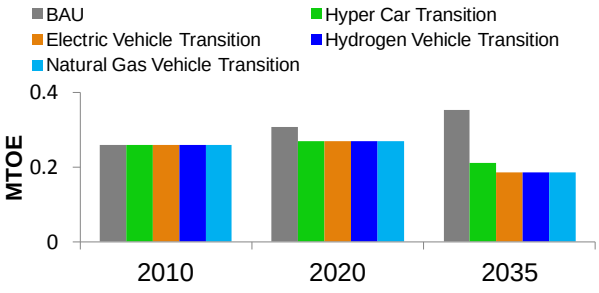
Figure BD14: Virtual Clean Car Race – Share of Alternative Vehicles in the Light Vehicle Fleet



Source: APERC Analysis (2012)

Figure BD15 shows the change in light vehicle oil consumption under BAU and the four alternative vehicle scenarios. Oil consumption drops by 47% in the Electric Vehicle Transition, Hydrogen Vehicle Transition, and Natural Gas Vehicle Transition scenarios compared to BAU by 2035. The drop is large as these alternative vehicles use no oil. Oil demand in the Hyper Car Transition scenario is also significantly reduced compared to BAU—down 39% by 2035—even though these highly-efficient vehicles still use oil.

Figure BD15: Virtual Clean Car Race – Light Vehicle Oil Consumption

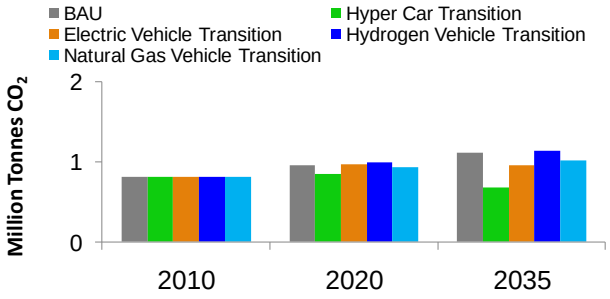


Source: APERC Analysis (2012)

Figure BD16 shows the change in light vehicle CO_2 emissions under BAU and the four alternative vehicle scenarios. To allow for consistent comparisons, in the Electric Vehicle Transition and Hydrogen Vehicle Transition scenarios the change in CO_2 emissions is defined as the change in emissions from electricity and hydrogen generation. The impact of each scenario on emission levels may differ significantly from its impact on oil consumption,

since each alternative vehicle type uses a different fuel with a different level of emissions per unit of energy.

Figure BD16: Virtual Clean Car Race – Light Vehicle CO_2 Emissions



Source: APERC Analysis (2012)

In Brunei Darussalam, the Hyper Car Transition scenario is the clear winner in terms of CO_2 emissions reduction, with an emissions reduction of 39% compared to BAU in 2035. Hyper cars rely on their ultra-light carbon fibre bodies and other energy-saving features to reduce oil consumption. In the other alternative vehicles oil combustion is replaced by other fuels; namely electricity for electric vehicles, hydrogen for hydrogen vehicles and natural gas in natural gas vehicles. In Brunei Darussalam virtually all electricity generation comes from gas combustion, thus the additional demand for electricity and hydrogen generation would require more gas combustion, which in turn would produce more CO_2 emissions.

The runner-up in this race is the Electric Vehicle Transition scenario offering a 14% emissions reduction compared to BAU, followed by the Natural Gas Vehicle Transition scenario (8%). The Hydrogen Vehicle Transition scenario offers the least benefit, producing 3% more emissions compared to BAU in 2035.

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