



## Malaysia

*International energy data and analysis*

Last Updated: September 29, 2014 ([Notes](#))

[full report](#)

### Overview

*Malaysia is the world's second-largest exporter of liquefied natural gas and the second-largest oil and natural gas producer in Southeast Asia, and is strategically located amid important routes for seaborne energy trade.*

Malaysia's energy industry is a critical sector of growth for the entire economy, and it makes up almost 20% of the total gross domestic product. New tax and investment incentives, starting in 2010, aim to promote oil and natural gas exploration and development in the country's deepwater and marginal fields as well as promote energy efficiency measures and use of alternative energy sources. These fiscal incentives are part of the country's economic transformation program to leverage its resources and geographic location to be one of Asia's top energy players by 2020. Another key pillar in Malaysia's energy strategy is to become a regional oil and natural gas storage, trading, and development hub that will attract technical expertise and downstream services that can compete in Asia.

Malaysia, located within Southeast Asia, has two distinct parts. The western half contains the Peninsular Malaysia, and the eastern half includes the states of Sarawak and Sabah, which share the island of Borneo with [Indonesia](#) and Brunei. The country's western coast runs alongside the [Strait of Malacca](#), an important route for the seaborne trade that links the Indian Ocean and the Pacific Ocean. Malaysia's position in the South China Sea exposes the country to various disputes among neighboring countries over competing claims to the sea's resources. While it has bilaterally resolved competing claims with [Vietnam](#), Brunei, and [Thailand](#), an area of the Celebes Basin remains in dispute with Indonesia. Potential territorial disputes with [China](#), Vietnam, and the [Philippines](#) could emerge as exploration initiatives move into the deepwater areas of the [South China Sea](#).

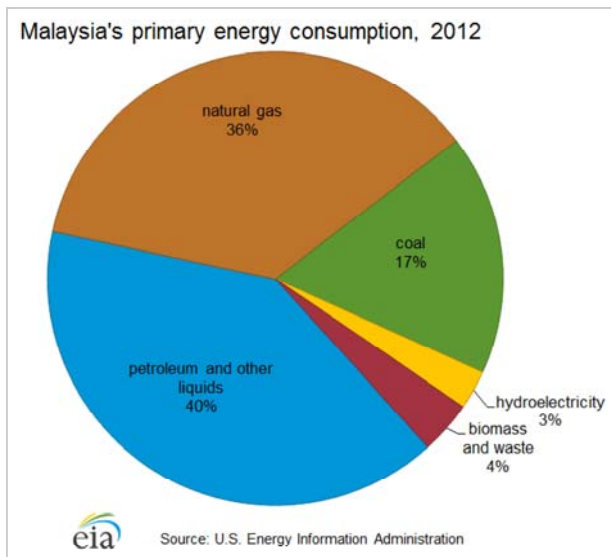
Malaysia has unveiled several major upstream and downstream oil and natural gas projects, some coming online in the next few months, as part of the country's strategy to enhance output from existing oil and natural gas fields and to advance exploration in deepwater areas. The incumbent and long-ruling Barisan Nasional party (BNP) won the May 2013 general election. The BNP has a track record of promoting hydrocarbon investment and intends to continue boosting oil and natural gas production, making energy sector reforms to attract investment, and developing the country's energy infrastructure.





## Primary energy consumption

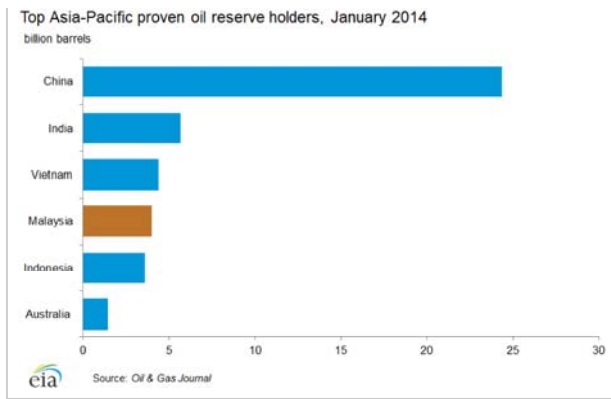
As Malaysia targets economic development and increased manufacturing, the country is focused on securing energy through cost-effective means and diversifying its fuel supply portfolio. Petroleum and other liquids and natural gas are the main primary energy sources consumed in Malaysia, with estimated shares of 40% and 36%, respectively in 2012. About 17% of the country's energy consumption is met by coal. Biomass and waste make up another 4%, and hydropower contributes 3% to total consumption. Malaysia's heavy reliance on oil and natural gas to sustain its economic growth is causing the government to emphasize fuel diversification through coal imports and to promote investments in renewable energy.



## Petroleum and other liquids

*Malaysia's oil reserves are the fourth-highest in Asia-Pacific after China, India, and Vietnam. Nearly all of Malaysia's oil comes from offshore fields.*

According to the *Oil & Gas Journal* (OGJ), Malaysia held proved oil reserves of 4 billion barrels as of January 2014, the fourth-highest reserves in Asia-Pacific after China, [India](#), and Vietnam. Nearly all of Malaysia's oil comes from offshore fields. The continental shelf is divided into three producing basins: the Malay basin offshore peninsular Malaysia in the west and the Sarawak and Sabah basins in the east. Most of the country's oil reserves are located in the Malay basin and tend to be light and sweet crude. Malaysia's benchmark crude oil, Tapis Blend, is a light and sweet crude oil, with an API gravity of 42.7° and a sulfur content of 0.04% by weight.



## Sector organization

Energy policy in Malaysia is set and overseen by the Economic Planning Unit (EPU) and the Implementation and Coordination Unit (ICU), which report directly to the Prime Minister. Malaysia's national oil and gas company, Petroliaam Nasional Berhad (Petronas), holds exclusive ownership rights to all oil and natural gas exploration and production projects in Malaysia, and is responsible for managing all licensing procedures. The company is directed by the Prime Minister, who also controls appointments to the company board. Petronas holds stakes in the majority of oil and gas blocks in Malaysia, and it is the single largest contributor to Malaysian government revenues, up to 45%, by way of taxes and dividends. Since its incorporation in 1974, Petronas has grown to be a world-renowned integrated international oil and gas company with business interests in more than 30 countries. Under legislation enacted in 1985, Petronas is required to hold a 15% minimum equity in production sharing contracts (PSC) with all foreign and private companies.

ExxonMobil, Shell, and Murphy Oil are currently the largest foreign oil companies by production volume. New opportunities for investment in Malaysia's energy sector have attracted small- and medium-sized foreign oil independents such as Talisman Energy (Canada), Lundin Petroleum (Sweden), Roc Oil Company (Australia), and Petrofac (UK).

In 2010, Malaysia provided tax incentives for upstream investment in both enhanced oil recovery (EOR) and marginal field development projects. According to Malaysian Investment Development Authority (MIDA), the income tax rate for marginal fields dropped from 38% to 25%, and the government waived export duties on total oil production from these smaller fields. Malaysia also provided income tax allowances of up to 100% of capital expenditure for EOR projects. Additionally, the government announced more tax incentives for oil and gas trading companies in late 2012.

Malaysia's oil and gas policy historically has focused on maintaining the reserve base to ensure long-term supply security while providing affordable fuel to its population through subsidized fuel sales. High international oil prices and Malaysia's increasing crude oil import levels have put pressure on government expenditures. As part of Malaysia's goal to lower the government's budget deficit and lift some of the financial burden on Petronas to allow the company to invest more upstream, the government began introducing subsidy reforms. In July 2010, the government initiated the first subsidy reductions for gasoline, diesel, and liquefied petroleum gas (LPG) with the aim of phasing out fuel subsidies by 2015. Public sensitivities over higher fuel costs stalled the reforms until September 2013, when the government increased the price of gasoline and diesel by 10.5% and 11.1%, respectively.

## Exploration and production

*Declines in production at Malaysia's major producing oil fields in the past decade have led government efforts to encourage investment in enhanced oil recovery and development of smaller and marginal fields, as well as deepwater fields.*

Malaysia is Southeast Asia's second-largest oil producer behind Indonesia. Petroleum and other liquids production (including crude oil, lease condensates, natural gas liquids, biofuels, and refinery processing gains) in 2013 was nearly 670,000 barrels per day (bbl/d), hovering around the same level since 2011 and down from the country's peak production of 844,000 bbl/d in 2003. More than a fourth of Malaysian oil production currently originates from the Tapis field in the offshore Malay Basin. The country's oil production has experienced overall decline as a result of maturing fields, particularly larger fields in the shallow waters offshore Peninsular Malaysia. Some recent drilling efforts in the area such as Lundin Petroleum's Bertam oilfield in the Penyu Basin are expected to offset some production declines from mature fields.

Malaysia's domestic oil consumption has risen while production has fallen over the past decade, leaving smaller volumes of oil available for exports. Petronas is working to attract new investment opportunities and reverse production declines by enhancing output from existing fields through advanced EOR techniques and developing small, marginal fields through risk service contracts (RSCs). These contracts are designed for companies to share the risk, where Petronas is the project owner, and investors are the service providers receiving revenues for oil produced throughout the entire life of the project. IOCs are also tapping into new oil and natural gas discoveries in deepwater offshore areas of the Sarawak Basin and the Sabah Basin. These deepwater offshore fields pose more technical challenges, requiring greater investment by Malaysian and foreign energy firms. In 2013, Petronas reported plans to spend more than \$61 billion over five years in Malaysia's oil and natural gas sector to boost oil and natural gas production and offset the current declines from ageing fields.

#### **Enhanced oil recovery (EOR) projects**

Petronas is conducting several EOR projects to extend the production life of Malaysia's oldest oil fields. ExxonMobil and Petronas began work on the Tapis EOR project, which lies 118 miles off Terengganu, in the second half of 2014. Tapis is one of seven mature fields offshore Peninsular Malaysia that ExxonMobil and Petronas agreed to develop as part of a 25-year production-sharing contract that was finalized in June 2010. Under the agreement, which includes provisions for the deployment of EOR, work is being carried out on the seven fields that are part of the Tapis crude oil blend — Seligi, Guntong, Tapis, Semangkok, Irong Barat, Tebu, and Palas. The project is expected to extend the fields' lives by 30 years and add another 25,000 bbl/d to current production.

In 2011, Shell and Petronas agreed to invest \$12 billion over 30 years in two EOR projects offshore Sarawak (Baram Delta offshore covering nine fields) and Sabah (North Sabah development area covering three fields). The projects are expected to boost production by 90,000 bbl/d and use the world's first offshore, chemical injection process for resource recovery. In 2014, Petronas expanded the Baram Delta EOR PSC to include natural gas production, which will be used both for reinjection purposes to assist in oil extraction and for direct gas sales to the domestic and international markets.

#### **Risk service contracts (RSC) projects**

In addition to its EOR projects, Malaysia is also maximizing its production potential by issuing RSCs for smaller, underexplored fields beginning in 2011. These contracts involve risks shared between Petronas, the project owner, and the contractors (foreign and domestic companies), which act as service providers. These companies receive compensation for cost and a return on investment.

As part of its RSC licensing rounds, Petronas has awarded six RSCs since 2011. As of mid-2014, three of these RSCs have commenced production of oil and natural gas including the Berantai fields and the Kapal, Benang, and Meranti cluster located offshore Peninsular Malaysia, and the Balai cluster located offshore Sarawak. These fields were producing more than 30,000 bbl/d in 2014.

#### **Deep water projects - Sarawak and Sabah**

Several major projects are under development in the deepwater area offshore the Sabah state, which could bolster Malaysia's oil production over the next decade. The Kikeh oil field, operated by Murphy Oil in partnership with Petronas, is currently Malaysia's only producing deepwater oil field. The Kikeh field came on stream in 2007 at an initial rate of 20,000 bbl/d, and estimated production in 2013 was 60,000 bbl/d of oil. Output has been hampered by operational delays. Murphy Oil has been working to restore production, which is expected to peak at 120,000 bbl/d.

Also, in offshore Sabah, the Gumusut/Kakap project is under development and will include the region's first deepwater floating production system from 19 subsea wells. The Kakap field came on stream at the end of 2011 with production of 25,000 bbl/d. Production from Gumusut will commence in 2014, and production from both fields is expected to ramp up to 120,000 bbl/d by 2015, according to FGE. Project shareholders are operator Shell with 33%, ConocoPhillips with 33%, Petronas with 20%, and Murphy Oil with 14%. The system will be connected via pipelines to the new Sabah Oil and Gas Terminal being built in Kimanis in the northeastern Sabah state.

The Malikai oil and natural gas field, first discovered in 2004, is another deepwater find located offshore northwestern Sabah and has a peak production capacity of 60,000 bbl/d. The Malikai project will use a tension-leg platform and will tie into the Keabangan Northern Hub development project (KBB) via a petroleum liquids and dry natural gas pipeline. Shell, the operator and a 35% stakeholder, expects to bring Malikai online at the end of 2016. Other project partners include ConocoPhillips (35%) and Petronas (30%).

Development is underway at the KBB slated to begin operations in late 2014. KBB will be a floating platform hub for the development of a cluster of deepwater natural gas fields offshore Sabah and will tie in the Malikai oil field. The KBB platform has a design capacity of 825 MMcf/d of natural gas and 22,000 bbl/d of condensate.

### **Boundary disputes**

Malaysia began cooperating with neighboring countries bordering the South China Sea (SCS) to exploit the area's significant hydrocarbon potential. The country holds estimated reserves of 5 billion barrels of crude oil and liquids and 80 trillion cubic feet of natural gas in the South China Sea, the largest of any of the border countries (see [South China Sea Analysis Brief](#)). In May 2009, Malaysia submitted SCS territorial claims to the United Nations Commission on the Limits of the Continental Shelf and disputes China's territorial claims through its nine-dash line, a series of lines encompassing most of the South China Sea and based on China's historical territorial claims. Malaysia has not filed a legal case against China and has preferred to advance bilateral relations between the two countries.

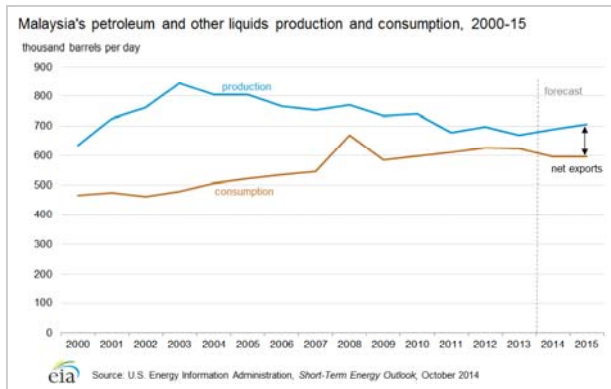
The 20-year dispute between Malaysia and Brunei over land and sea boundaries, particularly in the Baram Delta Basin, was resolved when the two countries signed a boundary agreement in April 2009. Oil blocks L and M were ceded to Brunei, while Limbang, on the Sarawak-Brunei border, was ceded to Malaysia. Since the agreement, energy cooperation between Malaysia and Brunei has strengthened. In 2010, Petronas and the Brunei government agreed to jointly develop the two blocks offshore Borneo Island, and they signed a 40-year PSA for newly named Blocks CA1 and CA2. Drilling commenced in 2011, along with further investment plans. The two countries signed several energy cooperation agreements in 2013 for joint development of some deepwater fields and for Brunei to purchase a 3% share as part of Petronas' stake in the Canadian Pacific Northwest LNG export terminal.

Malaysia and Vietnam share the 520-square mile area of the PM-3 Commercial Arrangement Area (CAA) in the Malay Basin. PM-3 CAA commenced production in 1997 and contributes to the country's oil production from six offshore fields. Talisman Energy (Canada) holds operating interests in the Northern and Southern oil fields in the CAA. Talisman holds a 41% interest, Petronas holds a 46% interest, and PetroVietnam has a 13% interest.

As discussed in further detail below in the natural gas section, Thailand and Malaysia signed an agreement in 1979 to jointly develop oil and natural gas reserves from the Malaysia-

Thailand Joint Development Area (MTJDA), which overlap the maritime borders of both countries.

Other areas in the South China Sea such as the Celebes Basin that borders Indonesia and Malaysia have remained underexplored because there are competing territorial claims between the two countries. Shell holds an exploration contract with Petronas for two deepwater blocks off the east coast of Sabah; however, Indonesia also awarded separate PSCs for the blocks and claims them. It is likely these PSCs will be dormant as long as territorial maritime disputes remain unresolved.



## Oil pipelines

Malaysia has a relatively limited oil pipeline network and relies on tankers and trucks to distribute products onshore. Malaysia's main oil pipelines connect oil fields offshore Peninsular Malaysia to onshore storage and terminal facilities. The 124-mile Tapis pipeline runs from the Tapis oil field and terminates at the Kerteh plant in Terengganu, as does the 145-mile Jerneh condensate pipeline. The oil pipeline network for Sabah connects offshore oil fields with the onshore Labuan oil terminal. This network is currently expanding following the launch of development projects including the Keabangan cluster, the Malikai, Gumusut/Kakap, and Kikeh oil fields. For Sarawak, there are a few other oil pipelines connecting offshore fields with the onshore Bintulu oil terminal. The majority of pipelines are operated by Petronas, although ExxonMobil also operates a number of pipelines connected with its significant upstream holdings located offshore Peninsular Malaysia.

An international oil products pipeline runs from the Dumai oil refinery in Indonesia to the Melaka oil refinery in Melaka City, Malaysia. An interconnecting oil products pipeline runs from the Melaka refinery via Shell's Port Dickson refinery to the Klang Valley airport and to the Klang oil distribution center.

## Oil trade

Malaysia remained a net oil exporter of crude oil and petroleum products in 2013 despite the narrowing gap between production and consumption in the past several years. Malaysia exports about half of its crude oil production because the crude quality (light and sweet) is attractive to the Asian markets and fetches a higher premium compared to other crude oil blends. In return, Malaysia imports lower-cost heavy sour crude oil, about half from the Middle East and the rest from several other regions, for its refineries and domestic needs. In 2013, Malaysia imported 183,000 bbl/d of lower-cost crude oil for processing at its oil refineries.

Malaysia exported 240,000 bbl/d of crude oil in 2013, according to Global Trade Atlas, significantly lower than the 400,000 bbl/d export volume in 2000. All of Malaysia's crude oil is exported within Asia Pacific, the bulk of which is sent to Australia, India, Thailand, and Japan. Japan began buying more crude oil for direct burn in 2011 after it lost nuclear electric generation following the Fukushima accident.

The country's imports of petroleum products have grown faster than its exports in the past few years. Much of Malaysia's oil product trade occurs in Asia, especially with neighboring Singapore. Gasoline is the key import product, making up about 45% of product imports and about a third of all oil product demand.

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## Refining, storage, and transit terminals

*As a result of rising regional and domestic demand for crude oil and oil products, Malaysia plans to become a regional oil trading and storage hub by increasing the country's refining and storage capacity.*

According to FGE, Malaysia has 591,000 barrels per day (bbl/d) of refining capacity at six facilities. Malaysia invested heavily in refining activities during the past two decades and is now able to meet most of its demand for petroleum products domestically, after relying on refineries in Singapore for many years.

As part of Malaysia's goal to compete with the oil refining and storage hub in Singapore, Petronas plans to build a \$16 billion refining and petrochemicals integrated development project (RAPID) in Johor state at the southern tip of Peninsular Malaysia. This project includes a 300,000 bbl/d refinery, which industry expects will turn Malaysia from a net oil product importer to a net oil product exporter once it is operational. The project, which was sanctioned in 2011, has incurred several delays, although Petronas made a final investment decision in 2014. The NOC plans to bring the refinery online in 2019.

Malaysia is expanding its oil terminal and storage capacity as the need for more oil storage and trading grows within Asia and as its neighbor, Singapore, lacks the space to continue increasing its massive storage capacity. Most of Malaysia's oil product and crude oil terminals are located along the eastern coast of Peninsular Malaysia and offshore as floating storage and production facilities. Malaysia intends to expand its storage capacity to about 83 million barrels by 2020 and is in the process of constructing several projects in the next few years.

Malaysia is developing several storage terminals in Johor, adjacent to Singapore. Malaysia International Shipping Corporation (MISC), and global oil trader, Vitol Group, are expanding storage capacity at the new ATT Tanjung Bin Terminal by 2015. This terminal brought 7 million barrels of oil storage capacity online in 2013.

The Pengerang oil storage terminal in Johor, Malaysia's largest commercial oil storage facility, started operations in early 2014. The facility is owned by a joint venture of Vopak (Dutch) and Dialogue Groups (Malaysia) and will have a storage capacity of more than 10 million barrels to house crude oil and oil products by the end of 2014 with a potential to expand to 41 million barrels in the future. This terminal bolstered southern Malaysia's oil storage capacity by 70% to more than 25 million barrels. Concord Energy (Singaporean oil trading firm) and Dialogue proposed another Johor-based terminal with a capacity of 16 million barrels.

As part of Petronas' plan to invest in upstream and downstream activities in the Sabah state, the national oil company (NOC) is constructing the Sabah Oil and Gas Terminal (SOGT) in Kimanis, Sabah. The terminal is scheduled to receive oil and natural gas by the second half of 2014. SOGT will become a central hub for much of the hydrocarbon development in offshore Sabah from new fields coming online recently – Gumusut/Kakap, Kikeh, and Malikai. The terminal has a design capacity to process 300,000 bbl/d of crude oil, more than 1 billion cubic feet per day (Bcf/d) of natural gas, and 77,000 bbl/d of condensate.

## Malaysia's existing and planned refineries

Refinery	Operator	Capacity (bbl/d)	Notes
<b>Existing LNG terminals</b>			
Melaka 1 (PSR-1)	Petronas	95,000	Distills sweet crude oil and condensate
Melaka 2 (PSR-2)	JV of Petronas and ConocoPhillips	125,000	Processes sour crude oil grades
Port Dickson	Shell	145,000	Supplies solely domestic market; can accept heavier crude oil grades
Port Dickson	San Miguel/Petron (Philippines)	85,000	
Kertih	Petronas	121,000	Processes naphtha condensates through a splitter
Kemaman	Kemaman Bitumen Company	20,000	Converts heavy crude oils to bitumen
<b>Planned projects</b>			
RAPID	Petronas	300,000	Financial investment decision: April 2014. Operational: 2019

Sources: FACTS Global Energy, International Energy Agency, OGJ, company websites

## Biofuels

*Malaysia produced negligible quantities of biofuels in 2013, although the country plays a significant role in supplying palm oil, a key raw material used in biodiesel production.*

Although Malaysia produced no significant quantities of ethanol and only 6,000 bbl/d of biodiesel in 2013, the country plays a significant role in the industry by supplying more than one-third of the world's total palm oil, a vegetable oil and key product used in biodiesel production. Collectively, Indonesia and Malaysia represent 85% of global palm oil production. While a majority of this oil is used in food, both countries have also marketed their palm oil for biodiesel production.

Currently, only about 10% of global palm oil supply goes toward biofuels production. However, palm oil is the second-largest feedstock (after soy oil) used to produce biodiesel. In contrast to Indonesia, Malaysia historically has not converted much of its raw palm oil to biodiesel locally. Instead, Malaysia exports the palm oil to be refined elsewhere like in neighboring Singapore or Europe. Singapore's large renewable diesel plant is a particularly good destination since its advanced hydrotreating capabilities result in a higher quality fuel product that can be used at high blend levels without operational issues.

Despite its currently low biodiesel fuel production, Malaysia has much higher production capacity. Some analysts estimate the country has up to 50,000 bbl/d of capacity, which is 40% of U.S. capacity. However, since 2010, Malaysia's biodiesel capacity has been significantly underutilized as many consuming nations have added land-use criteria for feedstocks used to comply with their biofuels mandates. Production has grown recently from



an estimated 1,000 bbl/d in 2011 to 6,000 bbl/d in 2013 and is currently on a pace to increase production in the next few years.

New blending mandates in Malaysia will likely increase local production significantly for domestic consumption. The National Biofuel Policy in 2006 instituted limited B5 blending requirements (blending 5% of biodiesel with 95% of diesel petroleum) in Peninsular Malaysia. A national B5 program was scheduled to be rolled out on a national scale in July 2014, but has since been delayed until December 2014, after several necessary blending terminals could not be completed in time. Malaysia is following up on the B5 mandate and plans to increase the biodiesel blend to 7% in certain areas starting in 2014.

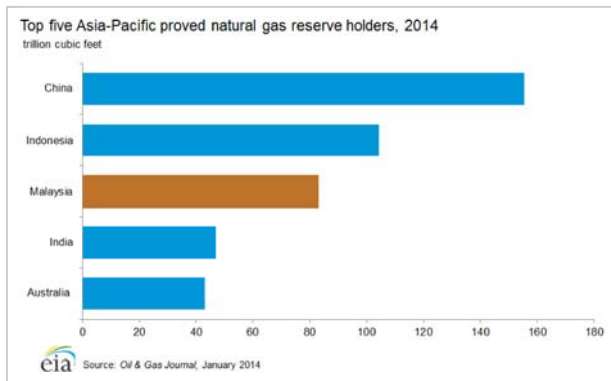
Increased palm oil production also provides a significant amount of solid biomass, which is mostly contained in the husk of the palm seed known as an empty fruit bunch (EFB). There has been increasing interest expressed in using EFB as a cellulosic fuel source. If successful, this would open Malaysia to new markets in countries willing to pay a premium for products capable of lowering greenhouse gas emissions.

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## Natural gas

*Malaysia was the world's second-largest exporter of liquefied natural gas after Qatar in 2013. Although the country's growing domestic demand and regional gas imbalances in the past few years caused the country to open its first regasification terminal as another source of imports.*

According to the OGJ, Malaysia held 83 trillion cubic feet (Tcf) of proved natural gas reserves as of January 2014, and it was the third-largest natural gas reserve holder in the Asia-Pacific region. More than half of the country's natural gas reserves are located in its eastern areas, predominantly offshore Sarawak. Most of Malaysia's gas reserves are associated with oil basins, although Sarawak and Sabah have an increasing amount of non-associated gas reserves that have offset some of the declines from mature oil and gas basins offshore Peninsular Malaysia.



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## Sector organization

As in the oil sector, Malaysia's state-owned Petronas dominates the natural gas sector. The company has a monopoly on all upstream natural gas developments, and it also plays a leading role in downstream activities and in the LNG trade. Most natural gas production comes from PSAs operated by foreign companies in conjunction with Petronas. Shell remains the largest gas producer and a key player in the development of deepwater fields in Malaysia.

MISC, which is 63% owned by Petronas, owns and operates ships for transporting hydrocarbons and chemicals around the world. The company has 27 LNG tankers, placing the company as the second-largest LNG fleet operator in the world, according to PFC

Energy. The company also owns and charters 73 petroleum tankers and 18 ships for chemical transport.

Gas Malaysia is the largest non-power gas distribution company in Malaysia and the only one that can operate on Peninsular Malaysia. Sarawak Gas Distribution Company which is 70% owned by the state government, serves Sarawak gas consumers, and Sabah Energy Corporation distributes gas in the Sabah state.

Natural gas prices for end users are regulated by the Malaysian government, which caps the domestic rates at a level more than half of that for imported LNG. In an effort to reduce gas subsidies that the government pays to Petronas and power producers and to create more incentives for upstream natural gas investment, the government installed a price reform in 2011 that seeks to raise the natural gas price for electric power users every six months and eventually allow domestic natural gas prices to rise to international market levels. Although gas prices remained the same for more than two years, in January 2014 the government lowered the natural gas subsidy level and effectively raised the prices of natural gas for power users by about 11% to about \$4.64/MMbtu. In May 2014, the government also raised the price for large non-power gas users (industrial and commercial sectors) by an average of 20% to about \$5.86/MMbtu.

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## Exploration and production

*Malaysia's natural gas production has risen over the past two decades to serve the growing domestic demand and export contracts. Recent foreign investment in deepwater and technically challenging fields, primarily in the Sarawak and Sabah states, provides impetus to maintain natural gas production levels over the next few years.*

Although Malaysia's dry natural gas production has risen steadily over the past two decades, reaching an estimated 2.3 Tcf in 2012, growth slowed somewhat since 2007. Meanwhile domestic natural gas consumption has increased, reaching 1.1 Tcf in 2013, and it accounted for about 50% of production. The power sector consumed about 51% while the industrial sector accounted for 33% of the Malaysia's natural gas market sales in 2013, according to FGE. Demand for power, especially in Peninsular Malaysia, is expected to steadily increase, and gas demand for industrial development is likely to remain strong as the government pursues greater economic development. Rising domestic demand, particularly in Peninsular Malaysia, and LNG export contract obligations are placing pressure on the natural gas supply and driving Malaysia to actively seek investments for reservoir development. There are several ongoing projects that will expand natural gas production in Malaysia over the near term. Exploration and development activities in Malaysia continue to focus on offshore Sarawak and Sabah. Over the long term, Malaysia needs to attract higher levels of investment and technical capabilities to develop deepwater fields and those fields containing high levels of carbon dioxide and sulfur.

### Malaysia-Thailand Joint Development Area

One of the most active areas for natural gas exploration and production is the Malaysia-Thailand Joint Development Area (MTJDA), located in the lower part of the Gulf of Thailand and the northern part of the Malay Basin. The MTJDA covers 2,800 square miles of territory. The MTJDA reportedly holds 9.5 Tcf of proved plus probable natural gas reserves. The area is divided into three blocks, A-18, B-17, and C-19, and is administered by the Malaysia-Thailand Joint Authority (MTJA), with each country owning 50% of the MTJDA's hydrocarbon resources. Production at Block A-18 started in 2005 at the Cakerwala field, and the project's second phase brought on the Bumi, Suriya, and Bulan fields in 2008. Initial gas production from Block A-18 was 390 MMcf/d, and the second phase added 400 MMcf/d of contracted gas supply. Block B-17 came online in 2009 with a contracted level of 270 MMcf/d. MTJA continues to explore the area for more hydrocarbon discoveries.

### Projects in Sarawak and Sabah

Most of Malaysia's natural gas production is offshore Sarawak and supports LNG exports from Bintulu. Shell has signed three oil and gas PSCs with Petronas in 2012 and stepped up

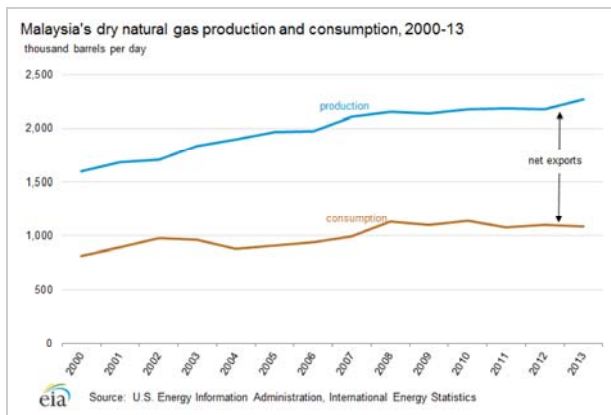
drilling efforts in 2011 to continue developing gas and condensate production offshore Sarawak. The PSCs cover blocks SK319, SK318, and 2B in the Central Luconia Basin.

In 2009, Murphy Oil announced the startup of several smaller new gas fields located in Blocks SK309 and SK311. The Sarawak Gas Project, located 137 miles offshore Sarawak, contains a cluster of fields that are being developed as part of a multi-phase project to supply gas to the Bintulu LNG Terminal. Murphy Oil holds an 85% interest in the project, and Petronas holds a 15% interest. Murphy Oil holds a gas sales contract with Petronas and provides up to 250 MMcf/d.

Newfield Exploration, which recently divested its Asian upstream assets, made a significant gas discovery in the SK-310 PSC offshore Sarawak in 2013. The company claimed the find could boost gas resources by 1.5 Tcf. In 2014, SapuraKencana Petroleum, a Malaysia oil services company, purchased Newfield's Malaysian upstream assets and now holds a 30% share of the SK-310 Block, while Petronas and Mitsubishi have 40% and 30% shares, respectively. SapuraKencana reported that it plans to bring the fields on stream by 2017.

The Keabanggan Petroleum Operating Company (KPOC), a consortium consisting of Petronas (40%), ConocoPhillips (30%), and Shell, the operator, (30%), are developing three contiguous gas and condensate fields including Keabanggan, Kamunsu East, and Kamunsu East Uplift Canyon (KBB Cluster) in the northwest Sabah state. The Keabanggan gas cluster is estimated to hold 4.9 Tcf of gas, according to PFC Energy. Production for KBB is expected to begin in 2014.

As part of the Sabah-Sarawak Integrated Oil and Gas Project, Petronas is commissioning the Kinabalu Non-Associated Gas (NAG) development. The Kinabalu NAG development, comprised of two gas fields located offshore northwest of Sabah, is slated to begin producing by 2015.



## Pipelines

*Malaysia has an extensive gas pipeline network running through Peninsular Malaysia and pipelines that connect offshore fields in all three states to key infrastructure onshore.*

Malaysia has one of the most extensive natural gas pipeline networks in Asia, totaling about 1,530 miles. The Peninsular Gas Utilization (PGU) project, completed in 1998, expanded the natural gas transmission infrastructure on Peninsular Malaysia. The PGU system spans more than 880 miles and has the capacity to transport 2 billion cubic feet per day (Bcf/d) of natural gas. Other natural gas pipelines run from offshore gas fields to gas processing facilities at Kertih. Also, a number of pipelines link Sarawak's offshore gas fields to the Bintulu LNG facility. However, there is limited gas distribution coverage in much of the Sarawak and Sabah states.

The Sabah-Sarawak Integrated Oil and Gas Project, slated to be completed by 2015, includes the 325-mile Sabah-Sarawak Gas Pipeline (SSGP) that will transport 1 Bcf/d of gas

from Sabah's offshore fields to the Petronas LNG complex for liquefaction and export. Some natural gas from the terminal is also reserved for fueling downstream industrial projects and for power generation in Sabah. The SSGP is expected to be ready for operations in conjunction with the SOGT in 2014. Other pipelines link natural gas fields located in offshore Sabah to the Labuan Gas Terminal.

The Association of South East Asian Nations (ASEAN) is promoting the development of a Trans-ASEAN Gas Pipeline system (TAGP) aimed at linking ASEAN's major gas production and consumption centers by 2024. Because of Malaysia's extensive natural gas infrastructure and its location, the country is a natural candidate to serve as a hub in the ongoing TAGP project, which currently has 1,800 miles of pipelines in operation out of a proposed 4,500 miles. The first pipeline connected Malaysia with Singapore and was commissioned in 1991. Singapore currently has two contracts to import 84 Bcf/y of gas from Malaysia. Gas pipelines between West Natuna, Indonesia, and Duyong, Malaysia were installed in 2002, and Malaysia imported more than 40 Bcf of gas from Indonesia in 2013, according to the BP Statistical Review 2014. The Trans-Thailand-Malaysia Gas Pipeline was commissioned in 2005, which allows Malaysia to transport natural gas from the Malaysia-Thailand JDA to its domestic pipeline system.

A key component of expanding the TAGP is to transit natural gas from the massive East Natuna gas field, located in the South China Sea to Southeast Asia. The field is being developed by a joint venture consisting of Pertamina (Indonesia), ExxonMobil, Total, and PTT Exploration and Production (Thailand). Malaysia's Petronas exited the project in 2012, and the field's development has encountered several delays as a result of its remote location and high carbon dioxide levels. These challenges to East Natuna's development could also delay the TAGP, and several Southeast Asian countries are turning to LNG imports to deal with the region's gas shortages.

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## LNG trade

*Malaysia remains a key exporter of LNG as the second-largest exporter in the world after Qatar in 2013. However, the limited natural gas supplies and rising demand in the western part of the country triggered investment in regasification terminals, the first of which commenced in 2013.*

Malaysia remains a key global LNG exporter as the second-largest exporter after Qatar in 2013. Malaysia is developing sizeable reserves in its eastern region. However, growing natural gas supply shortages in demand centers in the western region have prompted Petronas to construct the country's first LNG import terminal in the western region to augment the supply from pipelines.

### LNG exports

Malaysia shipped more than 1.2 Tcf/y of LNG and contributed to 11% of LNG exports worldwide, according to IHS Energy. Key importers of Malaysia's LNG are Japan (60%), South Korea (17%), Taiwan (12%), and China (11%), all holding medium- or long-term supply contracts with Malaysia. Malaysia also has sold LNG cargoes to Petronas LNG Limited, a trading company based in Malaysia, which ships spot LNG cargoes to many locations around the world. Despite growing demand for natural gas at home, Petronas is keen to maintain its long-term export contracts as they currently capture a higher price than natural gas sold domestically where the gas prices are regulated and subsidized.

The Petronas LNG complex located in Bintulu in the state of Sarawak is the main hub for Malaysia's natural gas industry. Petronas owns majority interests in facility's three LNG processing plants (Dua, Tiga, and Satu), which are supplied by the country's offshore natural gas fields. Petronas LNG is one of the largest LNG complexes in the world, with eight production trains and a total liquefaction capacity of 1.1 Tcf/y. Japanese financing has been critical to the development of Malaysia's LNG facilities. The complex at Bintulu also hosts Shell's GTL project, which converts natural gas into nearly 15,000 bbl/d of petroleum liquids. Petronas is currently developing a ninth train and a small-scale expansion at Petronas LNG, and these facilities combined will add 205 Bcf/y of capacity by the end of 2015.

Petronas proposed two floating liquefaction terminals offshore Sarawak and Sabah to capture greater economic value from the country's smaller, more remote gas fields. These plants would have flexibility to serve the export or domestic markets. The Petronas FLNG project, located off Sarawak near the Petronas LNG complex, will have a capacity of 58 Bcf/y and will use natural gas from the Kanowit field. Petronas plans to market gas from the facility to the domestic market. The project is under construction and is scheduled to commence in 2016. Rotan FLNG, the second proposed offshore LNG terminal, will monetize gas production from the Rotan field northeast of Sabah in the South China Sea. The terminal has a design capacity of 72 Bcf/y and could serve some domestic demand in Sabah by reprocessing at the proposed Lahad Datu regasification plant. The project partners intend for the project to be online by 2018. Altogether, proposed liquefaction projects and expansions are likely to add about 335 Bcf/y to Malaysia's export capacity over the next few years.

### Malaysia's existing and planned liquefaction terminals

Project name	Owners	Peak output (Bcf/y)	Target start year
<b>Existing LNG terminals</b>			
Petronas LNG (Satu)	Petronas	389; 3 trains <sup>1</sup>	Operational
Petronas LNG (Dua)	Petronas	432; 3 trains	Operational
Petronas LNG (Tiga)	Petronas	326; 3 trains	Operational
<b>Projects under construction</b>			
Petronas LNG Train 9	Petronas	173	Q4 2015
Petronas LNG Mini Expansion	Petronas	32	Q4 2014
Petronas Floating LNG <sup>2</sup>	Petronas	58; 1 train	Q4 2015
Rotan LNG	Petronas 50%, MISC 25%, Murphy Oil 25%	72; 1 train	2018

<sup>1</sup>A train is an independent unit for liquefaction and purification.

<sup>2</sup>A floating terminal is at the site of an offshore gas field that produces, liquefies, stores, and transfers natural gas.

Sources: IHS Global Insight, FACTS Global Energy, International Energy Agency, company websites

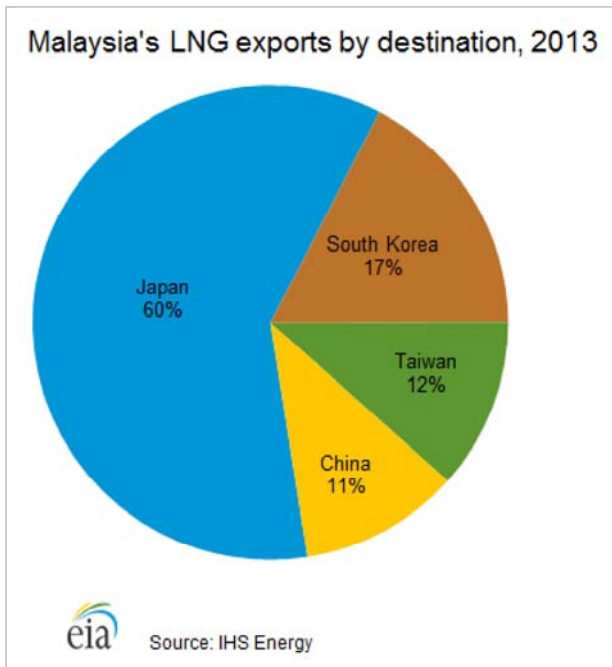
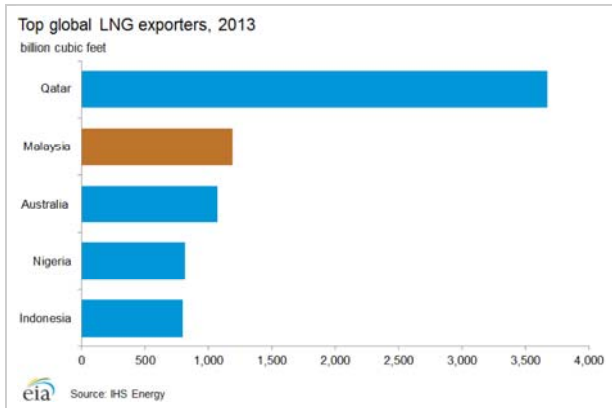
### LNG imports

Although Malaysia is one of the world's largest LNG exporters, the country currently experiences a geographic disparity of natural gas supply and demand among its regions. The Western Peninsular Malaysia demands more natural gas to fuel the power and industrial sectors, while the eastern states of Sarawak and Sabah, located on Borneo Island, produce natural gas and currently lack the local demand for it. To meet pressing gas needs in Peninsular Malaysia, Petronas is developing various regasification terminals to secure supply from the global gas market.

Petronas is the leading developer of several regasification projects slated to start operations by 2017. Malaysia's first regasification terminal, located near Malacca with a capacity of 184 Bcf/y, began operating in May 2013. In 2013, Malaysia imported 76 Bcf of LNG from Lekas LNG. In addition, Petronas Gas has plans to construct two regasification terminals in Lahad Datu in Sabah and one in Johor in Peninsular Malaysia over the next four years. Lahad Datu is the only project located in the eastern region of Sabah. It is a smaller terminal designed to primarily serve the proposed 300 megawatt (MW) power generator at Lahad Datu and replace some of the diesel that is heavily used for power in the Sabah state. Petronas' terminal in Johor is part of the NOC's RAPID project that will include regasification and LNG storage and serve as a strategic oil and gas trading hub for the Asian region. A consortium composed of Royal Vopak, Dialogue Group, and the State Government of Johor proposed a

second terminal in Johor with a similar concept “to be the first independent LNG trading facility in Asia, allowing users to store and trade gas.

Petronas signed several agreements to supply its planned regasification capacity for the next decade. The NOC has a combination of long-term agreements with Qatargas and Gladstone LNG (Australia) and short-term agreements with Pluto LNG (Australia), Snohvit LNG (Norway), and GDF Suez for its global portfolio. Shell also holds a contract with Brunei LNG to deliver LNG to Malaysia. Petronas plans to source some of the gas from its new liquefaction projects coming online in Sarawak. The NOC could also direct natural gas supply from its stakes in liquefaction facilities in Australia and Canada to the proposed regasification facilities, according to PFC Energy. Although, Petronas has not signed any purchase contracts for the supply from its proposed liquefaction projects.



**Malaysia's existing and planned regasification terminals**

Project name	Owners	Peak output (Bcf/y)	Target start year
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Sources: IHS Global Insight, FACTS Global Energy, International Energy Agency, company websites

Project name	Owners	Peak output (Bcf/y)	Target start year
<b>Existing LNG terminals</b>			
Lekas LNG/ Malacca	Petronas	184	2013
<b>Planned projects</b>			
Pengerang LNG	Petronas	184	2016
Pengerang LNG	Dialogue Group (Malaysia) 46%, Royal Vopak (Netherlands) 44%, Johor state government 10%	Not determined	2016
Lumut LNG	Petronas	Not determined	Not determined
Lahad Datu LNG	Petronas	39	Delayed from 2015
Pahang LNG	Performance Management & Delivery Unit of Malaysia	Not determined	Not determined

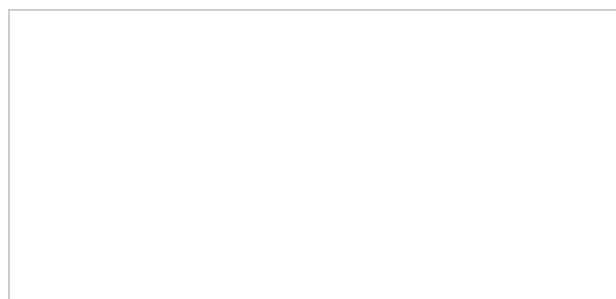
Sources: IHS Global Insight, FACTS Global Energy, International Energy Agency, company websites

## Electricity

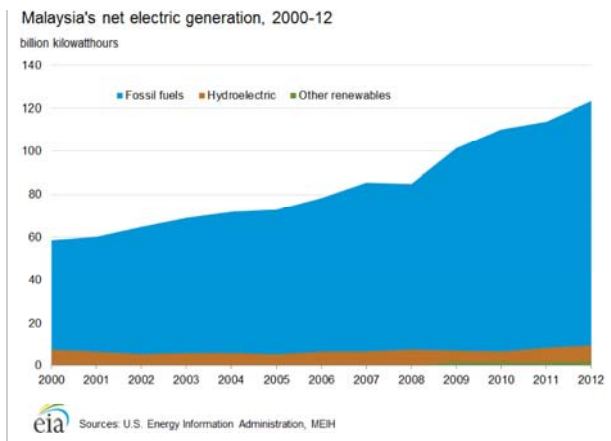
*Malaysia's electricity demand, mostly met by natural gas and to a lesser extent coal, continues to expand rapidly. This growth coupled with insufficient natural gas supply in high demand centers is driving the country to diversify power generation fuel mix and add electricity capacity to avoid future power shortages.*

Malaysia's economic development and population growth have resulted in substantially higher electricity generation over the past decade. The country's electricity generation doubled in the past decade, landing at 134 billion kilowatthours in 2012, according to MEIH data. The Malaysian states anticipate that electricity demand will grow by more than 3% at least through 2020. The high demand centers, particularly in Peninsular Malaysia, are facing fuel shortages in natural gas and are experiencing a need for greater generation capacity. Malaysia is seeking to diversify its portfolio of power generation fuels and reduce the use of more expensive fuel sources.

According to the Energy Commission of Malaysia, the industrial sector is the primary source of power demand and accounted for about 45% of the total in 2012. Commercial and residential demand was 33% and 21%, respectively. Transportation and agriculture made up less than 1%.







## Sector organization

Each of Malaysia's three states has a key state utility that holds a monopoly in the transmission and distribution sectors. These companies are the largest stakeholders in power generation, although there is a sizeable private ownership through independent power producers (IPPs) that generate about half of the country's electricity. Tenaga Nasional Berhad (TNB) located in Peninsular Malaysia, held a 42% market share of electric generation in the state in 2011, while Petronas Gas and IPPs held the remaining shares. Syarikat SESCO Berhad, (a subsidiary of Sarawak Energy) is responsible for the generation, transmission, and distribution of power in Sarawak and sells all of Sarawak's power generation through a government joint venture. Sabah Electricity Sdn Berhad (SESB) is 80% owned by TNB and 20% by the Sabah government. IPPs generate more than 50% of the electricity in Sabah.

The country has three electric transmission grids located in Peninsular Malaysia, Sarawak, and Sabah. The grid in Peninsular Malaysia, the largest of the three, connects with electricity systems in Thailand and Singapore. TNB plans to reduce transmission losses and increase electric supply reliability in Peninsular Malaysia over the next two decades. Sarawak Energy and Indonesia are constructing a transmission line from Sarawak to West Kalimantan, Indonesia (also located on Borneo Island). Sarawak Energy plans to export up to 230 MW to Indonesia starting in 2015.

One of Malaysia's energy policies in recent years is to reduce government energy subsidies by raising overall electricity and natural gas tariffs and pass fuel costs to electricity end users. Malaysia raised electricity tariffs on average by 7.1% in June 2011 to help reduce the subsidy the government provides on behalf of electricity companies. The country's domestic natural gas prices are also fixed by the government at prices much lower than those of imported LNG. The government raised the price of natural gas to power consumers in June 2011. The government also planned to pass fluctuations in fuel prices and raise natural gas prices paid by electric power generators every six months starting in late 2011. However, natural gas prices remained at these rates for more than two years until January 2014, when the government reduced the natural gas subsidy for power generation and in essence raised the natural gas price for power production by about 11%. The subsidy for coal-fired power was also reduced, and prices for power production in Peninsular Malaysia and Sabah increased by 15% and 17% on average, respectively.

## Electricity generation and capacity

*Most of Malaysia's electricity generation capacity is natural gas-fired, although gas shortages in Peninsular Malaysia and growing electricity demand in recent years have spurred the use of other fuels such as coal, diesel, and renewable sources.*

Total installed generation capacity at the end of 2012 was 29.1 gigawatts (GW), located mostly in Peninsular Malaysia, according to Malaysia's government. To meet the country's projected electricity demand, the government anticipates an additional 6 GW of new



generation will come online between 2015 and 2020. The government's efforts are centered on meeting increasing electricity demand through a more balanced portfolio of electric generation using coal, renewable sources, and to a lesser extent natural gas, in the next decade. Malaysia's policy to reduce power consumption also entails reforming electricity prices to be more reflective of market values and promoting demand-side conservation measures.

Fossil fuels, primarily coal and natural gas, made up about 86% of Malaysia's installed electric generation capacity and 92% of the country's electricity output in 2012. Natural gas accounted for about 53% of the country's total installed capacity and about 46% of the electricity generation in 2012, according to MEIH. Many of these gas plants are located in Peninsular Malaysia, and some have dual-fuel capabilities allowing for greater flexibility in fuel type. Tightness of natural gas supply in Peninsular Malaysia in recent years, particularly in 2011, caused by the state's production declines has resulted in power outages and has increased use of coal-fired generation and more expensive fuel oil and diesel-fired generation. Peninsular Malaysia intends to import LNG as well as diversify its power generation portfolio with other fuels such as coal and hydroelectricity to alleviate power constraints.

TNB is constructing a 1,071 MW combined-cycle gas turbine plant in Penang, Peninsular Malaysia to be completed at the end of 2015. Also, Sabah is building two 300 MW gas-fired plants including the Kimanis Power Plant, which will purchase gas from the Sabah oil and gas terminal in 2015. The Lahad Datu power plant is being developed to use gas from the adjacent regasification terminal project.

Although petroleum products currently account for a small portion of the capacity and generation and have been replaced by natural gas and coal inputs, they have played a critical role as an alternative fuel in the past few years to alleviate power shortages when other fuels are in short supply. Also, diesel is the main fuel used in the Sabah state. Diesel and petroleum products accounted for 5% of Malaysia's electricity generation in 2012.

Coal, which accounted for 26% of total installed capacity and 41% of electricity generation in 2012, has become much more competitive with natural gas-fired power in terms of fuel price and has gained a larger share of power generation in Peninsula Malaysia in the past few years. There are plans to increase coal-fired capacity in Peninsular Malaysia and Sarawak by 2020. Malaysia signed construction contracts for the country's first use of ultra-supercritical coal technology for two power plants located at Manjung 4 and Tanjung Bin on Peninsular Malaysia. The plants are scheduled to add 2 GW of coal-fired capacity by 2016. A joint venture consisting of Mitsui of Japan and a subsidiary of Malaysia's Ministry of Finance is constructing a 2 GW coal-fired plant, Jimah East Power, to commence electricity generation by 2018.

As part of the government's Sarawak Corridor of Renewable Energy (SCORE) program designed to use Sarawak's vast energy resources to serve the power needs of several proposed energy-intensive manufacturing projects, the state intends to increase generation capacity from domestic hydroelectricity, coal, and other renewable sources by a total of 28 GW over the next two decades. Sarawak plans to use the country's limited coal production, located on Borneo Island, for the Balingian project. The 600 MW plant is under construction and is scheduled to commence operations in 2018. The SCORE program includes expanding the state's coal-fired capacity by 5 GW.

Malaysia produced only 3.4 million short tons of coal in 2012, about 12% of its coal consumption, and is limited in domestic coal reserves. Malaysia's coal imports, mainly from Indonesia, have doubled in the past five years to about 24 million short tons to fuel expanding coal-fired generation.

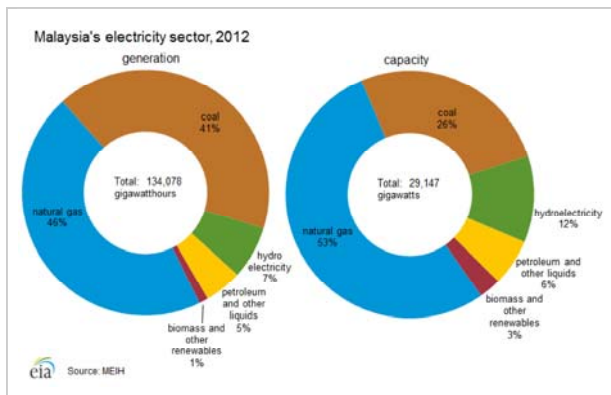
Hydroelectricity, which accounted for 11% of total electric capacity and 7% of electricity generation in 2012 in Malaysia, is undergoing significant expansion. Most of the hydroelectric facilities are small or medium in size and are located in Peninsular Malaysia. However, the

Sarawak state has the most potential for substantial hydroelectric growth considering its rainfall and geography.

As part of the SCORE program, Sarawak intends to harness the state's abundant hydro potential. Sarawak is in the process of constructing several sizeable dams. In 2012, hydroelectricity was about 35% of Sarawak's power generation and is anticipated to expand to 80% by 2020, replacing much of the natural gas-fired capacity with the addition of several hydroelectric dams, according to the government. Sarawak Hidro, a subsidiary of the Ministry of Finance, developed the massive 2,400 MW Bakun Hydroelectric plant in Sarawak. The first 300 MW unit came online in mid-2011, and the other seven turbines were brought online a year later. The 944 MW Murum Dam is nearly complete and is expected to be operational by 2015. The Sarawak government plans to construct another nine hydro dams with a total generation capacity of 4 GW by 2025. According to the Sarawak government, total potential hydroelectric capacity in the state is 20 GW.

As part of its efforts to reduce carbon dioxide emissions 40% by 2020, compared to its 2005 level, and to diversify its electricity fuel mix, Malaysia encourages investment in other types of renewable energy projects. Besides hydroelectricity from large dams, another key renewable fuel used to generate electricity is biomass based from palm oil, sugarcane bagasse, and manure, among others. The government's goal is that renewable sources, excluding large hydroelectric plants, will account for 5.5% of electricity capacity by 2015 compared to 3% in 2012. As part of this endeavor, Malaysia enacted feed-in tariffs for solar, biomass, biogas, and mini-hydro projects. Malaysia envisions electricity capacity from non-hydro renewables will grow from a reported 834 MW in 2012 to 2,080 MW in 2020.

Malaysia has also discussed building two nuclear power facilities by 2021, although this project has encountered delays resulting from industry reluctance following Japan's Fukushima nuclear disaster in 2011.



## Notes

- Data presented in the text are the most recent available as of September 29, 2014.
- Data are EIA estimates unless otherwise noted.

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