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*Downtown Sydney, Australia (Photo by Flow Research)*

*Daniel Bernoulli*

# Oil, Natural Gas, and LNG Production and Flow in Asia-Pacific

## Abridged Version

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**May 2013**

**Focus:**

- **Trends in energy measurement**
- **Flowmeters for measuring oil, gas, and LNG flows**
- **Australia**
- **Indonesia**
- **Malaysia**
- **The Gorgon Project**
- **Pertamina**

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**Wakefield, Massachusetts**

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# Energy White Paper: Oil, Natural Gas, and LNG Production and Flow in Asia-Pacific

**May 2013**

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*Boulder Canyon, Boulder, Colorado  Photo by Flow Research*

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## Issues and Perspectives

# Getting to the heart of the Asia-Pacific energy market

*by Jesse Yoder, PhD*

It is no secret that China and India have two of the fastest-growing economies in the world. There are multiple reasons for this, including their expanding populations, their vast energy resources, and their desire to modernize and to improve their standard of living. For these reasons, China and India draw much of the attention when it comes to the Asia-Pacific region.

This Energy White Paper focuses on the energy needs of Asia-Pacific. It mainly focuses on oil and gas production and reserves for some of the key countries of this region. It also focuses on the growing energy story that is liquefied natural gas (LNG). Many of the countries in this region are island nations, or nations composed of islands. As a result, they may not be able to import natural gas by pipeline. Instead, they rely on LNG, which is transported by ship. Many countries in this region such as India and China that produce natural gas and import it by pipeline also import LNG. LNG is one of the growing success stories of the Asia-Pacific region.

Because there is already so much emphasis placed on China and India, we decided to concentrate in this White Paper on three countries that play a crucial role in the energy picture for Asia-Pacific**: Australia, Indonesia, and Malaysia**.

Our goal in this White Paper is to provide data on oil and gas production and consumption for these countries, along with a broader account of their energy pictures. We also look at LNG and the role these countries play in LNG exports.

### Australia

Australia is one of the most interesting countries in Asia-Pacific in terms of energy. While Australia's oil production has been declining slowly since 2000, its natural gas production increased every year from 1991 – 2008. Beginning in 2008, conventional natural gas production began to slowly decline. However, Australia has begun to benefit from the production of "unconventional" gas, especially coal-seam gas, shale gas, and "tight" gas. As a result, Australia's total natural gas production has been increasing since 2009.

The Gorgon Project, located in several islands off the northwest coast of Australia, is one of the most exciting projects in the region. The Gorgon Field is located about 130 kilometers off the northwest coast of Australia. Near the Gorgon Field is Barrow Island. There, a consortium of three oil and gas companies is building three LNG trains for the purpose of supplying the Asia-Pacific region with LNG. At a build cost of $54 billion, it is expected to go online in 2014.

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# Issues and Perspectives

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### Indonesia

Indonesia is made up of multiple islands to the north and west of Australia. Its natural gas production has increased by one-third since 2008. Indonesia is also the world's third largest exporter of LNG. This many-island nation boasts the world's fourth largest population behind China, India, and the United States. While Indonesia's natural gas production has been increasing, it has faced modestly declining oil production in the past ten years. At the same time, Indonesia's oil consumption has been increasing at a steady pace.

### Malaysia

While Malaysia is smaller than Australia and Indonesia in population and land mass, it plays a powerful role in the energy picture. Malaysia was the second largest LNG exporter after Qatar in 2011. Its oil reserves are the third largest in Asia-Pacific, next to China and India. Like Indonesia, it has a state-owned oil and gas company (Petronas) that is dominant in oil and gas exploration and production. Like many countries in the region, Malaysia is experiencing a gradual decline in its oil production.

### Trends in Energy Measurement in Asia-Pacific

The following are some of the important trends in Asia-Pacific:

- The Asia-Pacific region has an insatiable desire and growing need for energy.
- This need is driven by an expanding population and by an increasingly large middle class
- There are five main sources of energy: coal, nuclear, oil, natural gas, and renewable
- Renewables take the form of windpower, solar, geothermal, hydro energy, biofuels, wave energy, tidal energy, and others
- There is a long-term movement away from fossil fuels towards renewable, but this will take many years to accomplish
- In the meantime, many companies are turning to natural gas as an alternative to coal and oil
- Natural gas is cleaner than oil and coal and cheaper than oil
- Natural gas is a long-term bridge to renewable; while many countries are experiencing declines in their oil production, they are finding that their natural gas supplies are increasing
- Natural gas supplies are increasing due to unconventional gas, particularly coal-seam gas (CSG) and potentially shale and 'tight' gas.

### The Growth of the LNG Market in Asia-Pacific

Most of the Asia-Pacific countries, including Australia, are rich in natural gas. But transporting the natural gas from the well to its point of use can be challenging. Over long distances, natural gas is mainly transported by pipeline or by ship in the form of LNG. Pipelines are most effective in transporting natural gas within a country rather than between countries when the countries are separated by large amounts of water. Alternatively, pipelines can be buried underwater, as shown by the natural gas pipeline connecting Qatar to Abu Dhabi in the United Arab Emirates (UAE). This pipeline is the source of natural gas for both the UAE and Oman. While

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there are some pipelines in the Indonesia and Malaysia region, distance dictates that much of the natural gas shipped in this region will be LNG. This presents a major opportunity for flowmeter manufacturers, especially for custody transfer applications. Both McCrometer and GE Measurement have released flowmeters designed for LNG measurement. No doubt other companies will step in here. Emerson Rosemount has a vortex meter that can be used for LNG.

### Rationale for this White Paper

The purpose of this White Paper is to supply valuable data that will enable companies to make intelligent decisions about how to become involved in the fast-growing Asia-Pacific energy markets. This includes instrumentation suppliers, end-users, engineering companies, OEMS, and oil and gas companies,. There are many opportunities in this region for measurement, and these opportunities are increasing along with increases in the demand for energy.

Companies in far-flung regions of the world typically end up using the same type of equipment that is used in the United States, Europe, Japan, and China.. Multiple visits to the Middle East several years ago to interview oil and gas suppliers revealed the complaint that no instrumentation suppliers have built a manufacturing facility there. This shows that end-users value good service and prompt attention in distant regions of the world, just as they do everywhere else.

Companies who wish to participate in the fast-growing Asia-Pacific market have many choices. One choice is to select distributors to cover this region. Another is to do direct sales by designating certain salespeople to cover the region. Still another alternative is to partner with a local company or build a sales office in the region. Perhaps the most expensive option is to build a manufacturing plant in the Asia-Pacific region, and many suppliers have chosen this option.

There are many factors to consider when deciding how to participate in the diverse Asia-Pacific region., including competition. But it is also important to see what the current prospects are for energy measurement, and to look ahead to future opportunities. We believe that this White Paper provides some of the critical information for any company that wants to benefit from the fast growth in the Asia-Pacific energy sector.

*Sydney Opera House*

*Macnaught, Sydney, Australia*

*L-R Bob Hill, CEO; Jesse Yoder; Neville Proctor*

## Issues and Perspectives

| Term | Definition |
|---|---|
| **Crude Oil** | A mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Depending upon the characteristics of the crude stream, it may also include:<br><br>Small amounts of hydrocarbons that exist in gaseous phase in natural underground reservoirs but are liquid at atmospheric pressure after being recovered from oil well (casinghead) gas in lease separators and are subsequently commingled with the crude stream without being separately measured. Lease condensate recovered as a liquid from natural gas wells in lease or field separation facilities and later mixed into the crude stream is also included;<br><br>Small amounts of nonhydrocarbons produced with the oil, e.g., sulfur and various metals;<br><br>Drip gases and liquid hydrocarbons produced from tar sands, oil sands, gilsonite, and oil shale.<br><br>Crude oil is refined to produce a wide array of petroleum products, including heating oils; gasoline, diesel and jet fuels; lubricants; asphalt; ethane, propane, and butane; and many other products used for their energy or chemical content. |
| **Dry Natural Gas** | Natural gas which remains after: 1) the liquefiable hydrocarbon portion has been removed from the gas stream (i.e., gas after lease, field, and/or plant separation); and, 2) any volumes of nonhydrocarbon gases have been removed where they occur in sufficient quantity to render the gas unmarketable. (Note: Dry natural gas is also known as *consumer-grade natural gas*.) |
| **Lease Condensate** | A mixture consisting primarily of pentanes and heavier hydrocarbons which is recovered as a liquid from natural gas in lease separation facilities. This category excludes natural gas plant liquids, such as butane and propane, which are recovered at downstream natural gas processing plants or facilities. |
| **Natural Gas Liquids** | Those hydrocarbons in natural gas that are separated from the gas through the processes of absorption, condensation, adsorption, or other methods in gas processing or cycling plants. Generally such liquids consist of propane and heavier hydrocarbons and are commonly referred to as condensate, natural gasoline, or liquefied petroleum gases. Where hydrocarbon components lighter than propane are recovered as liquids, these components are included with natural gas liquids. |
| **Natural Gas - Wet After Lease Separation** | The volume of natural gas left after removal of lease condensate in lease and/or field separation facilities, if any, and after exclusion of nonhydrocarbon gases where they occur in adequate amount to make the gas unmarketable. Natural gas liquids may be recovered from volume of natural gas, wet after lease separation, at natural gas processing plants. |
| **Production - Wet After Lease Separation** | The volume of natural gas withdrawn from reservoirs less (1) the volume returned to such reservoirs in cycling, repressuring of oil reservoirs, and conservation operations; less (2) shrinkage resulting from the removal of lease condensate; and less (3) nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable. Note: Volumes of gas withdrawn from gas storage reservoirs and native gas that has been transferred to the storage category are not considered part of production. This production concept is not the same as marketed production, which excludes vented and flared gas. |

# The Role of Oil & Natural Gas

by Jesse Yoder, PhD

### Five Sources of Energy Compete for Dominance in an Energy-Thirsty World

About the only thing that can dampen the world's growing thirst for energy is a recession. This happened on a rather grand scale in 2009. However, since that time, many of the world's economies have recovered. The U.S. economy, for example, has been in a slow but steady recovery the past several years. And China's economy has been expanding at a fairly rapid pace, even though it has had some ups and downs. With recovering economies comes increased energy use, as construction projects come back online, production ramps us, and consumers spend more.

**Five Main Sources of Energy**
1. Coal
2. Nuclear
3. Oil
4. Natural Gas
5. Renewables

Today, Europe seems to the region with the most economic difficulties. GDP (gross domestic product) statistics showed that the Eurozone had slipped into a mild recession by the end of September 2012. Europe's problems began with Greek debt, and this contagion has migrated to several other countries as well, including Spain, Portugal and Italy. While the Eurozone was technically in recession, the contraction in the third quarter of 2012 was only 0.1 percent, so the recession is about as mild as possible. While such a mild recession may dampen energy use, it will not have nearly the impact as the 2009 recession.

### Demographics Favors Energy Use

Several other factors besides economic recovery are having an impact on energy consumption worldwide. One is the expanding population, which simply means that there are more people who need and use energy. The second factor is that people in developing countries continue to want a higher standard of living. This means more cars, more televisions, more houses, and generally more goods, all of which require energy to produce and consume.

### 5 Main Sources of Energy

There are five main sources of energy:

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# Issues and Perspectives

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1. Coal
2. Nuclear
3. Oil
4. Natural Gas
5. Renewables

Most countries use the energy they have within their own borders, since it is cheaper and more efficient than importing energy. This is why China uses so much coal, despite its environmental impact, because coal is plentiful in China. Japan has very little in the way of oil and gas, so they have had to rely on coal, which they have some of, and nuclear energy. Japan imports oil and gas to make up the deficit. The United States consumes far more oil than it produces, so it imports oil. However, there is a trend in the U.S. to substitute natural gas for oil since the U.S. is rich in natural gas. This is due in large part to advances in the technology for extracting the abundant natural gas supplies in subterranean shale rock formations throughout the U.S.

### Coal & Nuclear Still Widely Used

Coal is still widely used as a source of energy worldwide, especially in China. The biggest problem with coal is that plants burning coal emit significant amounts of pollution. Coal is the most $CO_2$ intensive fossil fuel. Nuclear energy has its risks and dangers, as the incidents at Chernobyl and, more recently, Fukushima show. However, both coal and nuclear will continue to be used as energy sources, despite their dangers. There are inherent dangers in any form of energy, and countries and companies are attempting to address those dangers in a rational way.

### Renewables Offer Hope for the Future

Renewables offer the potential for powering the world without polluting it or emitting $CO_2$ into the air. Forms of renewable energy include wind, solar, geothermal, hydroelectric, fuel cells, and wave energy. Eventually the world will be forced to move to renewable energy as the finite supply of fossil fuels becomes exhausted. However, fossil fuels could last another 100 years, so the reign of renewables is still likely some time away.

The main problem with renewable forms of energy is that they, for the

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most part, are too expensive to compete effectively with fossil fuels. There are also obvious problems like how to gather wind energy when the wind is not blowing or how to rely on solar energy when the sun is not shining. The costs of renewable energy will come down as it is better researched, and its use will become more efficient as methods of storing renewable energy are improved.

### Oil & Natural Gas to Dominate for Next 20 Years

Today, oil and natural gas supply a major portion of the world's energy. While oil has been dominant for many years, natural gas is fast becoming more popular because of its wide availability and because it burns cleaner than oil. The recent discovery of shale gas has significantly increased the potentially recoverable natural gas worldwide. While the United States is in the forefront of shale gas mining, other countries are beginning to take advantage of this natural resource as well. For example, the first shale gas in Australia was pumped from a well in outback South Australia in October 2012.

While both oil and gas will be widely used in the next 20 years and beyond, the long-term odds favor natural gas. The world's supply of crude oil is stable to declining. Oil experts debate the theory of "peak oil," which is the point at which the total amount of oil production worldwide begins to decline irreversibly. While it is not clear whether that point has been reached, it seems likely that it will be reached sometime in the next five years, barring major unexpected finds of crude oil reserves.

The situation is quite different with natural gas. There are still vast untapped reserves of recoverable natural gas in the earth, and the discovery of shale oil only increases that amount. Some estimates are that there is enough natural gas in the earth to supply the world with natural gas for another 75 years. This estimated length of time could increase with further natural gas discoveries.

### Where Is the 'Measurement Action'?

Tracking oil and natural gas by production, reserves, imports, exports, and consumption is a major undertaking, especially if done by region, country, and company. This is important information for any flowmeter or instrumentation supplier who wants to know where the

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"measurement action" will be. Both oil and natural gas are measured as they come out of the ground, are transported to a refinery or processing center, and again as they are transported to distributors. Natural gas and oil are also measured at the point of distribution. Many of these measurements involve custody transfer, which requires that the flowmeters used conform to certain publicly approved standards.

Flow Research has already conducted a 2,900-plus page series of six research studies on natural gas that tracks natural gas by production, reserves, imports, exports and consumption. These five categories are also tracked by region, county, and producing companies. The studies also reveal flowmeter use for natural gas by region and by flowmeter type (*www.gasflows.com*). A parallel series of studies is nearly complete for oil and petroleum liquids (*www.oilflows.com*).

While it is not possible to present the full details of this research here, the broader picture reveals some very interesting results. Because most countries use the energy sources available to them within their borders, looking at the difference between production and consumption reveals a lot about what countries are likely to do. For example, if a country consumes more oil than it produces, it will have to import the difference or find an alternative source of energy. Likewise, a country that produces more oil than it consumes will almost certainly be an exporter of the excess oil.

### Oil

A look at a few key countries exhibits some interesting trends. According to the U.S. EIA (Energy Information Administration), the United States consumed 18.9 million barrels per day of petroleum products in 2011. At the same time, the U.S. produced 10.1 million barrels per day of oil. This is a difference of 8.8 million barrels per day, and it explains why the U.S. has to rely so heavily on imported oil, much of it from the Middle East. It also explains what people mean by saying "the United States must become energy independent" or "be self-sufficient in energy." There are only two ways to do this—produce more or consume less. Of course, finding

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an alternative to oil, such as natural gas or solar power is one way to consume less oil.


Saudi Arabia presents a stark contrast to the United States. In 2011, Saudi Arabia consumed 3.0 million barrels per day of petroleum products. At the same time, Saudi Arabia produced 11.2 million barrels per day of oil. This is a surplus of 8.2 million barrels per day. In fact, Saudi Arabia is the world's leading oil producer and exporter.

A look at the numbers for the entire Middle East explains why this region has a well-deserved reputation for being the leading source of oil in the world. In 2011, countries in the Middle East produced 26.9 million barrels of oil per day, while consuming only 7.9 million barrels per day of petroleum products. This is a surplus of 19 million barrels per day, much of which is exported. The leading oil producers in the Middle East after Saudi Arabia are Iran, United Arab Emirates, Kuwait, and Iraq.

### Natural Gas

Unfortunately, the numbers for natural gas are less intuitive because the unit of measurement is billion or trillion cubic feet. However, the differences between production and consumption can still be appreciated. In 2011, the U.S. EIA reports that the United States consumed 24.3 trillion cubic feet of dry natural gas. At the same time, the US produced 23.0 trillion cubic feet of dry natural gas in 2011. This means that the United States has come close to energy self-sufficiency in dry natural gas. Perhaps shale production will make up the difference. In fact, the US has curtailed its imports of LNG (liquefied natural gas) due in large part to the added production

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from shale gas.

Russia, the world's leading producer of dry natural gas, presents a different picture. In 2011, Russia produced 23.7 trillion cubic feet of dry natural gas. During the same year, Russia consumed 18.0 trillion cubic feet of dry natural gas. This leaves a surplus of 5.7 trillion cubic feet of dry natural gas, putting Russia in a position to export this valuable commodity. Russia is, in fact, the world's leading exporter of dry natural gas. In terms of production, after Russia and the United States, the next leading producers of dry natural gas worldwide are Iran, Canada, and Qatar.

### Implications for Flowmeters

Any company that wishes to sell flowmeters and other instrumentation into the oil and gas markets could benefit greatly from looking at where oil and natural gas production is occurring. Oil and natural gas reserves are important too, because they indicate where future growth lies. Imports and exports are also important because importing and exporting of oil and natural gas typically involves a series of custody-transfer measurements. Consumption when compared to production is a likely indicator of imports or exports, and consumption is typically measured. So data by country and region contains a wealth of information for any instrumentation supplier.

The leading flowmeters for oil flow measurement in terms of revenues in 2011 were Coriolis and differential pressure (DP) fllowmeters with primary elements. Other important flowmeter types for oil flow are turbine, positive displacement, and ultrasonic. For natural gas, the leading revenue generators in 2011 were DP flowmeters, including primary elements, ultrasonic, positive displacement, and turbine.

Coriolis flowmeters are making great strides in measuring petroleum liquids, especially now that they are available for line sizes up to 16 inches. With the price of crude oil approaching $90 per barrel, end-users are looking for highly accurate and reliable measurements, which are strengths of Coriolis flowmeters. However, the traditional technologies of DP flow, positive-displacement, and turbine flowmeters are still well entrenched in petroleum liquid measurement. Positive-displacement flowmeters are widely used for measuring petroleum liquids at the distribution end as they are transferred to trucks, ships, and planes for transportation purposes. However, they are being displaced by Coriolis flowmeters in some of these applications.

In natural gas, multipath ultrasonic flowmeters are making inroads into DP and turbine flowmeters for custody transfer of natural gas. However, DP and turbine flowmeters still have a large installed base since they received AGA (American Gas Association, *www.aga.org*) approval long before ultrasonic meters. Positive-displacement flowmeters are widely used for utility measurement of natural gas.

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### The Future of Natural Gas & Oil

Natural gas is sometimes described as "a long-term bridge to renewables." However, the extent to which this occurs depends on the region and the country, and what other energy resources they have. China has made it clear that it intends to continue to use coal as a resource, which it has abundant amounts of, despite its effect on the environment. On the other hand, China does use significant amounts of natural gas. It is unlikely that natural gas will serve as a bridge to renewables for most countries in the Middle East, as long as they have such vast oil reserves.

In Asia Pacific, where many countries are islands unconnected to pipelines, the use of LNG is growing rapidly. Australia is investing $54 billion in the Gorgon Project for the primary purpose of supplying LNG to the region. The first natural gas from this project is expected in 2014. Japan has very little oil and gas, and imports its natural gas in the form of LNG. China also imports significant amounts of LNG, while Malaysia and Indonesia are major exporters of LNG, with Qatar remaining the world's leading LNG exporter.

**Sydney, Australia**

*Photos by Flow Research*

# Oil and Natural Gas in Asia-Pacific

## Production and exports

by Norm Weeks

### LNG Exports

The LNG export business is expanding worldwide, with particularly high growth occurring in the Asia-Pacific Region. As the 2008-2009 global recession ended and economies stabilized, and with several areas returning to robust growth once again, new LNG exporters and importers joined the market. At the end of 2011, there were eighteen countries exporting LNG, an increase of five since 2006. There were also ten new countries importing LNG since 2006, bringing the worldwide total to twenty-three.

The five most recent LNG exporting countries are: Norway, Peru, Equatorial New Guinea, Yemen, and Russia. Of these five, Russia is of the most interest within the context of the Asia-Pacific region for two primary reasons. First, Russia has the largest natural gas reserves in the world and thus tremendous upside potential for increasing LNG production. And, second, Russia has ports on the Pacific Ocean and thus has convenient access to some of the largest LNG importing nations, and is in that sense on a somewhat equal footing with the largest export countries in the region. There is also the factor of their having deep reserves of working capital available. All of these factors together have led to Russia already acquiring a 4 percent global LNG market share in just a few years, with more growth in the forecast.

**LNG Exporting Countries: 2011**

| Exporter | MT |
|---|---|
| Qatar | 75.5 |
| Malaysia | 25.0 |
| Indonesia | 21.4 |
| Australia | 19.2 |
| Nigeria | 18.7 |
| Trinidad | 13.9 |
| Algeria | 12.6 |
| Russia | 10.5 |
| Oman | 7.9 |
| Brunei | 6.8 |
| Yemen | 6.7 |
| Egypt | 6.4 |
| United Arab Emirates | 5.9 |
| Equatorial Guinea | 4.0 |
| Peru | 3.8 |
| Norway | 2.9 |
| United States | 0.3 |
| Libya | 0.1 |
| **World Total** | **241.5** |

### Gas Production

Natural gas production in the region has been a mix of success and recovery for the subject countries. China and India have each had a continuous increase in dry gas production propelled by their needs to fuel the high growth rates of their economies. Indonesia and Malaysia have each experienced production declines during the course of the last several years, but have instituted policy changes to encourage investment in their energy businesses. These policies are just now effecting positive changes. Japan is poor in natural gas reserves but a prize as a major importer.

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# Oil and Natural Gas in Asia-Pacific

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The biggest natural gas story in the region is Australia. The country has had a serious boost in production over the last five years of more than 45 percent, and has tremendous additional potential due to the work going on now at the Gorgon Project, an immense enterprise located in an area off of the northwestern coast. In addition to innovative floating platforms and other field technologies, the project includes the construction of a new liquefaction plant on Barrow Island. The full impact of the find and its future production will not begin to be felt until 2014. One estimate is for 15 million tons of LNG to be produced and shipped as early as 2015. There are ready markets for this capacity, and long-term purchase agreements have already been signed with the project's joint venturers and customers in Japan, China, India, and South Korea.

**Selected Asia-Pacific Dry Natural Gas Producers: 2007/2011**
**(Billion Cubic Feet per Year)**

| Country | 2007 | 2011 |
|---|---|---|
| China | 2,446 | 3,629 |
| Indonesia | 2,422 | 2,693 |
| Malaysia | 2,104 | 2,180 |
| Australia | 1,354 | 1,970 |
| India | 1,108 | 1,682 |
| Japan | 189 | 176 |
| ***Selected Countries* Total** | **9,623** | **12,330** |
| ***Asia-Pacific* Total** | **13,870** | **17,172** |
| ***World* Total** | **104,047** | **117,466** |

## Oil Production

Much the same picture emerges regarding the subject countries in the production of oil as in the production of natural gas. China and India have each recorded steady gains in production over the last five years, while Australia, Indonesia, and Malaysia have had net losses in production during the same period. The region overall has seen an increase in production, mostly led by gains from China.

The regional picture will change as, for example, the effects of policy changes instituted in Indonesia and Malaysia take hold. Both of these countries have recognized the impairment to their economies that a lack of oil field infrastructure improvement has caused, and have taken steps to incent new foreign investment as a way of inviting new capital. These initiatives are working and have already begun to show measurable results.

**Selected Asia-Pacific Oil Producers: 2008/2012**
**(Thousands of Barrels per Day)**

| Country | 2008 | 2012 |
|---|---|---|
| China | 4,036.7 | 4,416.2 |
| India | 875.0 | 979.4 |
| Indonesia | 1,065.4 | 954.0 |
| Malaysia | 730.6 | 633.5 |
| Australia | 587.7 | 525.2 |
| Japan | 125.3 | 135.5 |
| ***Selected Countries* Total** | **7,420.7** | **7,643.8** |
| ***Asia-Pacific* Total** | **8,693.4** | **8,963.1** |
| ***World* Total** | **85,476.4** | **89,090.1** |

*(Continued on page 30)*

# Oil and Natural Gas in Asia-Pacific

*(Continued from page 29)*

China is also an active participant in oil exploration and development activities both inland and in offshore regions such as the South China Sea. China, the world's second largest economy, cannot be supplied with sufficient petroleum energy from just their domestic sources, however. China is a major investor in South American, African, and Middle East projects where their equity positions ensure a real return to them as E&P results are realized.

China's foreign interests have seen new competition from Japan and India as these two other economic powerhouses embark on their own searches for new oil-based energy supplies. India has a fast growing economy based in one of the world's largest populations, but is relatively energy poor. Japan, while a mature economy and very slow growing over the last twenty years, has had a tremendous interest in pursuing an alternative to nuclear power since the dual tragedies of the 2011 earthquakes and tsunami were visited upon them. Japan has the financial strength and national incentive to be a formidable competitor in the energy development arena.

**Liquefaction Plants Under Construction: Asia-Pacific Region**

| Country | Project Name | Start Year | Capacity (MT) |
|---|---|---|---|
| Australia | Pluto LNG T1 | 2012 | 4.3 |
| Australia | Gorgon LNG T1 | 2014 | 5.0 |
| Australia | Queensland Curtis LNG T1 | 2014 | 4.3 |
| Australia | Australia Pacific LNG T1 | 2015 | 4.5 |
| Australia | Gladstone LNG T1 | 2015 | 3.9 |
| Australia | Gorgon LNG T2 | 2015 | 5.0 |
| Australia | Gorgon LNG T3 | 2015 | 5.0 |
| Australia | Queensland Curtis LNG T2 | 2015 | 4.3 |
| Australia | Gladstone LNG T2 | 2016 | 3.9 |
| Australia | Wheatstone LNG T1 | 2016 | 4.5 |
| Australia | Wheatstone LNG T2 | 2016 | 4.5 |
| Australia | Ichthys LNG T1 | 2017 | 4.2 |
| Australia | Ichthys LNG T2 | 2017 | 4.2 |
| Australia | Prelude LNG (Floating) | 2017 | 3.6 |
| Indonesia | Donggi-Senoro LNG | 2014 | 2.0 |
| Papua New Guinea | PNG LNG T1 | 2014 | 3.3 |
| Papua New Guinea | PNG LNG T2 | 2014 | 3.3 |

# Country Spotlight: Malaysia

## Malaysia: The second largest LNG exporter worldwide


Malaysia is not a large country in terms of population, ranking just 43rd in the world with a population of less than 30 million. In terms of land mass, Malaysia ranks just 65th in the world, and its territory is spread over the end of the Malay Peninsula and the island of Borneo. Yet, Malaysia is an important player on the world energy stage, and is of special importance within the Asia-Pacific Region

Petronas (Petroliam Nasional Berhad) is the state-owned energy company and dominates the upstream end of both oil and gas exploration and production markets. Petronas has grown beyond its original domestic scope of activities, and today is an an integrated international oil and gas company with business interests in over 30 countries. Since 1985, the company has been guaranteed by statute to have an equity stake of at least 15 percent in all foreign and private oil development contracts.

### Malaysia Energy Highlights

- Petronas is a state-owned energy company involved with both oil and gas development
- Oil reserves are the largest in Asia-Pacific Region after China and India
- Is the world's second largest LNG exporter after Qatar (2011)
- Is strategically positioned near 5 of the top 7 importing LNG countries in the world

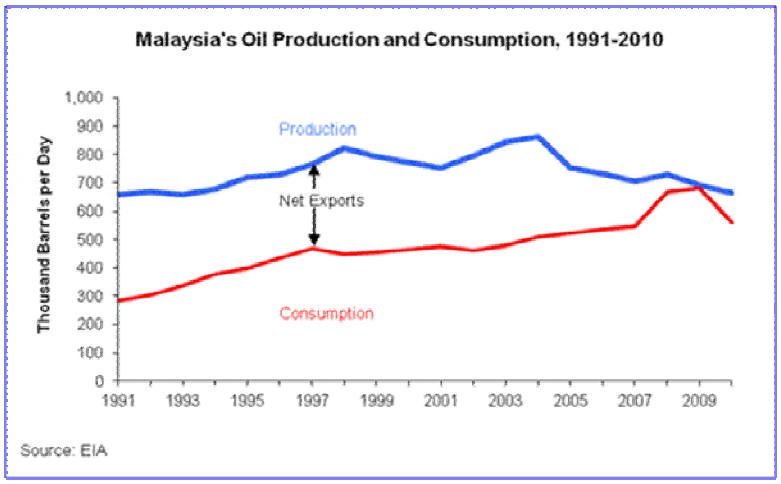
Malaysian oil reserves total approximately 4 billion barrels, with the great majority of this amount located in offshore fields in the Malay Basin in the northwest part of the country, and in the Sarawak and Sabah Basins in the east. Malaysia benchmark crude oil, the Tapis Blend, is of the preferred light and sweet variety. The Tapis field produces more than 50 percent of all of Malaysia crude oil.

A problem for Malaysia has been the decreasing production of its oil fields. In 2011, total oil production was approximately 630,000 barrels per day (bbl/d), a decline of more than 5% from the 2010 production level of 665,000 bbl/d. These production levels are well below the peak of 2004, when production volume reached 862,000 bbl/d. This decline is attributed to the maturing of existing reservoirs, and the lack of investment in new recovery methods.

# Country Spotlight: Malaysia

*(Continued from page 50)*

The country's falling oil production is particularly onerous given that Malaysia's growing population and increasing energy usage per capita is driving energy demand upward. This trend is increasing at a rising rate and is the cause of occasional electricity shortfalls.




While the oil energy story about Malaysia features a decline over the last ten years, the energy story about Malaysia's liquefied natural gas (LNG) industry is quite the opposite. The story begins with the fact that in 2011 the Asia-Pacific Region consumed 153 MT (million tons) of LNG, with Japan being the largest importer in the world at 78.8 MT, or just slightly less than one-third of the entire world total of 241.5 MT.

| Top Ten LNG Importers – 2011 | |
|---|---|
| **Importer** | **MT** |
| Japan | 78.8 |
| South Korea | 35.8 |
| United Kingdom | 18.6 |
| Spain | 17.1 |
| China | 12.8 |
| India | 12.7 |
| Taiwan | 12.2 |
| France | 10.7 |
| Italy | 6.4 |
| United States | 5.9 |
| *(World Total)* | *(241.5)* |

The worldwide LNG market is structured differently than other energy markets in that spot trading is far more prevalent here than anywhere else. The use of long term contracts between buyers and sellers has been on a steep decline over the last five years especially, and now accounts for some 25 percent of global trade. An advantage that Malaysia has in this market is that it is well-positioned geographically to respond quickly to changes in spot market prices due to its proximity to major importers. LNG trade is by ship, and distance counts in such a volatile price environment.

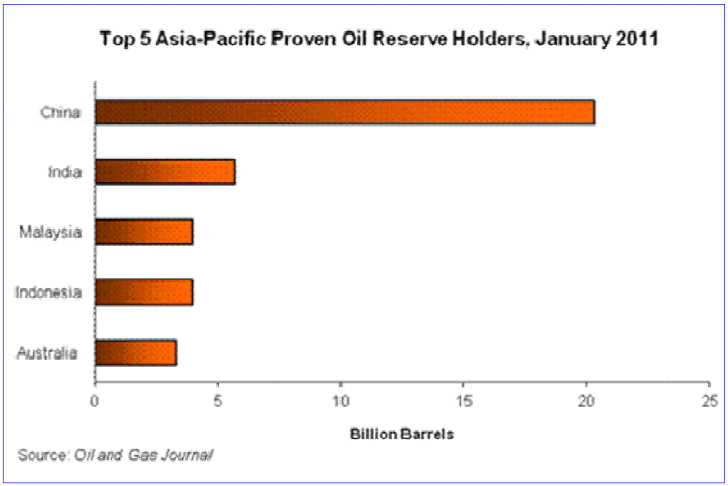
One other interesting aspect of the LNG story that assists Malaysia is that while worldwide LNG import volumes continue to increase, certain major players have reduced import requirements over the last few years and should continue to do so. Three of these countries are the United States, Spain, and France - and all of these LNG buyers are among the top ten importers and all are outside of the Asia-Pacific Region. This trend improves the economic prospects for Malaysian LNG over the mid- to long-term.

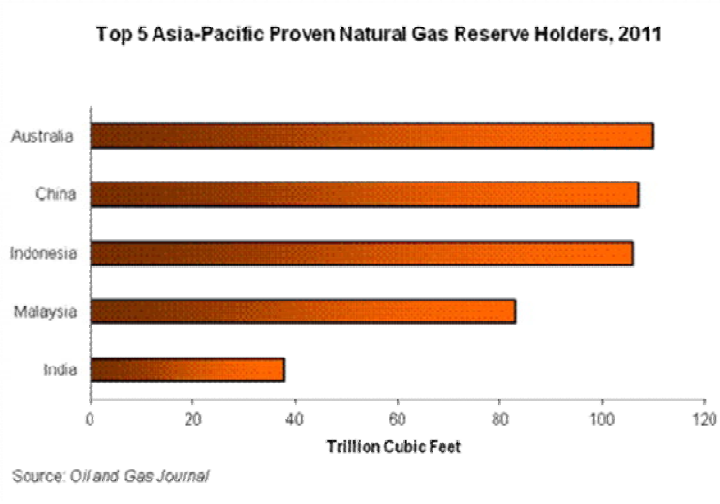
The Malaysian government has recognized the

*(Continued on page 52)*

# Country Spotlight: Malaysia

difficulties the country's economic future faces if there is not an improvement in oil and gas supply. There is a new focus on enhancing output from existing production sites, and to invite foreign participation in the exploration and development of offshore areas with much potential. A stated goal is to increase combined oil and gas production by a factor of 5 percent per year through 2020 in order to meet rising domestic demand and to continue to capture important foreign business in LNG and crude oil exports.




The LNG goal is on its way to being obtained, but the oil and gas objective is in some doubt due to the vagaries of well exploration and development. Initial results are promising, however, and continued investment has been forthcoming to sustain the effort. For example, new tax and other investment incentives enacted in 2010 were welcomed by Malaysian energy industry participants both domestic and foreign. One of these results has been the initiative to make Malaysia a regional oil storage and trading hub to take advantage of its strategic location in the region at the juncture of major shipping lanes.

In 2011, the natural gas reserves of Malaysia were estimated to be 83 trillion cubic feet (TCF). This volume ranked the country at number four among Asia-Pacific nations. The majority of Malaysia's gas reserves are located in its eastern fields, particularly in the offshore Sarawak Basin. These gas deposits are prime targets of the new development projects aimed to relieve the domestic energy crunch and to take advantage of the burgeoning LNG trade market.

We view Malaysia as a growth economy with a plan in place to further fulfill its potential as an energy provider to the world. Wise process control instrumentation suppliers, OEM's, and engineering companies would do well to take note of the concentrated investments being made in Malaysia today as it works to achieve this long term goal.

# *Worldflow energy white paper*


*Change*

## Abridged Version

**For information on receiving the full version of this White Paper, go to www.worldflow.com**

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