

Chapter 4

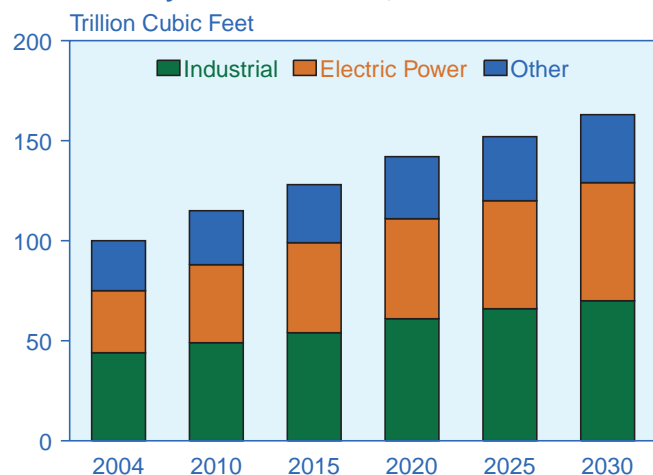
Natural Gas

In the IEO2007 reference case, natural gas consumption in the non-OECD countries grows more than twice as fast as in the OECD countries. Production increases in the non-OECD region account for more than 90 percent of the growth in world production from 2004 to 2030.

Consumption of natural gas worldwide increases from 100 trillion cubic feet in 2004 to 163 trillion cubic feet in 2030 in the IEO2007 reference case (Figure 40). By energy source, the projected increase in natural gas consumption is second only to coal. Natural gas remains a key fuel in the electric power and industrial sectors. In the power sector, natural gas is an attractive choice for new generating plants because of its relative fuel efficiency. Natural gas also burns more cleanly than coal or petroleum products, and as more governments begin implementing national or regional plans to reduce carbon dioxide emissions, they may encourage the use of natural gas to displace liquids and coal.

Much of the world's natural gas use is for industrial sector processes. The industrial sector accounted for 44 percent of world natural gas consumption in 2004 and is projected to account for 43 percent in 2030. With world oil prices expected to remain high relative to historical levels throughout the projection period, natural gas is projected to displace liquids in the industrial sector to some extent. Industrial use of natural gas is projected to increase at an average annual rate of 1.9 percent from 2004 to 2030, as compared with an average increase of 1.1 percent per year for liquids consumption in the industrial sector.

Figure 40. World Natural Gas Consumption by End-Use Sector, 2004-2030

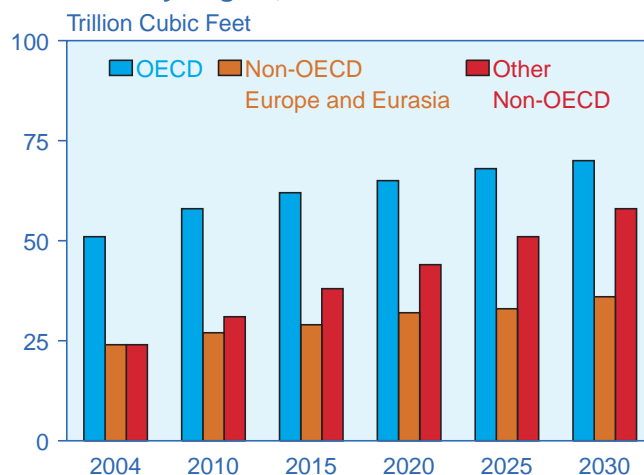


Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

In 2004, OECD member countries accounted for just over one-half of the world's total natural gas use, non-OECD Europe and Eurasia accounted for one-quarter, and the other non-OECD countries accounted for the remainder (Figure 41). In the IEO2007 reference case, natural gas consumption in the non-OECD countries grows more than twice as fast as consumption in the OECD countries, with 2.6-percent average annual growth from 2004 to 2030 for non-OECD countries, compared with an average of 1.2 percent for the OECD countries. Natural gas demand in the non-OECD countries accounts for 71 percent of the total world increment in natural gas consumption over the projection period. In the non-OECD countries (excluding non-OECD Europe and Eurasia) natural gas use increases from less than one-quarter of the world total in 2004 to 35 percent in 2030.

The OECD countries accounted for 40 percent of the world's total natural gas production and 52 percent of total natural gas consumption in 2004; in 2030, they are projected to account for only 27 percent of production and 43 percent of consumption. Natural gas production in the OECD nations increases by an average of only 0.4 percent per year in the IEO2007 reference case, whereas their demand increases by 1.2 percent per year. As a

Figure 41. World Natural Gas Consumption by Region, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

result, the OECD countries are projected to rely increasingly on imports to meet natural gas demand, with a growing percentage of traded natural gas coming in the form of LNG. In 2030, more than one-third of the natural gas consumed in OECD countries is projected to come from other parts of the world, up from 22 percent in 2004.

Reserves and Resources

Historically, world natural gas reserves have, for the most part, trended upward (Figure 42). As of January 1, 2007, proved world natural gas reserves, as reported by *Oil & Gas Journal*,⁹ were estimated at 6,183 trillion cubic feet—71 trillion cubic feet (about 1 percent) higher than the estimate for 2006 [1].

The largest revisions to natural gas reserve estimates were reported for Kazakhstan, Turkmenistan, and China. Kazakhstan added an estimated 35 trillion cubic feet (a 54-percent increase over 2006 proved reserves), Turkmenistan 29 trillion cubic feet (41 percent), and China 27 trillion cubic feet (50 percent). The United States also reported an increase of 12 trillion cubic feet over its 2006 reserves—a 6-percent increase and the largest increment in U.S. annual reserves since 1970. Declines in natural gas reserves were reported for the Netherlands (a decrease of 12 trillion cubic feet), Trinidad and Tobago (7 trillion cubic feet), Argentina (3 trillion cubic feet), Nigeria (3 trillion cubic feet), and Italy,

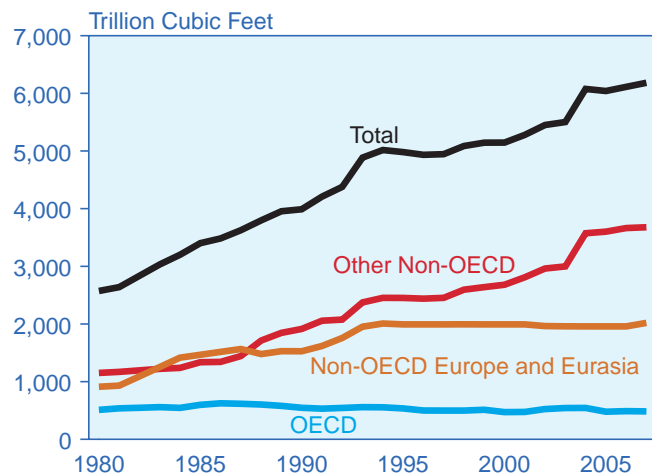
Norway, the United Kingdom, and Saudi Arabia (about 2 trillion cubic feet each).

Almost three-quarters of the world’s natural gas reserves are located in the Middle East and Eurasia (Figure 43). Russia, Iran, and Qatar combined accounted for about 58 percent of the world’s natural gas reserves as of January 1, 2007 (Table 6). Reserves in the rest of the world are fairly evenly distributed on a regional basis.

Despite high rates of increase in natural gas consumption, particularly over the past decade, most regional reserves-to-production ratios are substantial. Worldwide, the reserves-to-production ratio is estimated at 65 years [2]. Central and South America has a reserves-to-production ratio of about 52 years, Russia 80 years, and Africa 88 years. The Middle East’s reserves-to-production ratio exceeds 100 years.

The U.S. Geological Survey (USGS) periodically assesses the long-term production potential of worldwide petroleum resources (oil, natural gas, and natural gas liquids). According to the most recent USGS estimates, released in the *World Petroleum Assessment 2000* and adjusted to reflect current proved reserves, a significant volume of natural gas remains to be discovered. Worldwide undiscovered natural gas is estimated at 4,136 trillion cubic feet (Figure 44). Within the total natural gas resource base, an estimated 3,000 trillion cubic feet is in “stranded” reserves, usually located too far away from

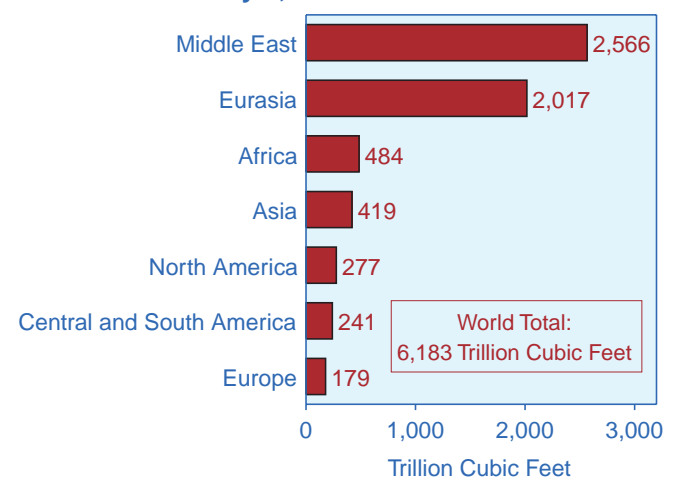
Figure 42. World Natural Gas Reserves by Region, 1980-2007



Sources: **1980-1993:** “Worldwide Oil and Gas at a Glance,” *International Petroleum Encyclopedia* (Tulsa, OK: PennWell Publishing, various issues). **1994-2007:** *Oil & Gas Journal* (various issues).

⁹Proved reserves, as reported by the *Oil & Gas Journal*, are estimated quantities that can be recovered under present technology and prices. Natural gas reserves reported by the *Oil & Gas Journal* are compiled from voluntary survey responses and do not always reflect the most recent changes. U.S. proved reserves of natural gas are reported by the Energy Information Administration and are defined as the estimated quantities of natural gas reserves as of December 31, 2006, which analysis of geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Significant natural gas discoveries made in 2006 are not likely to be reflected in the reported reserves.

Figure 43. World Natural Gas Reserves by Geographic Region as of January 1, 2007



Source: “Worldwide Look at Reserves and Production,” *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 22-23.

pipeline infrastructure or population centers for its transportation to be economical. Of the new natural gas resources expected to be added through 2025, reserve growth accounts for 2,347 trillion cubic feet.

World Natural Gas Supply

Production increases in the non-OECD countries are projected to account for more than 90 percent of the world's total growth in production from 2004 to 2030 (Figure 45). In the non-OECD countries, production is projected to grow by an average 2.6 percent per year, from 59 trillion cubic feet in 2004 to 119 trillion cubic feet in 2030. In particular, Russia and the Middle East each account for around 20 percent of the increase in annual production over the projection period. Both regions are expected to provide connections to natural gas markets in the Atlantic and Pacific basins, with Russia exporting mainly by pipeline and most Middle East exports being shipped as LNG.

Russia has an extensive pipeline network reaching into Europe and has proposed the construction of pipelines to China and South Korea. In addition, Russia is

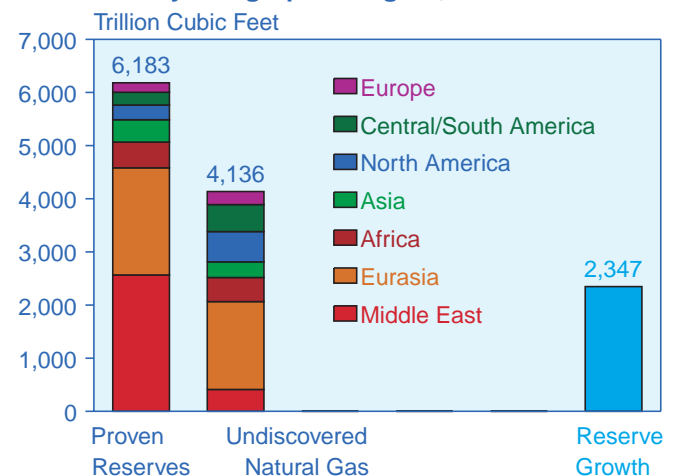
beginning to enter LNG markets. It has traded pipeline gas for Atlantic LNG cargos, has plans to develop LNG export facilities to serve the Atlantic market, and soon will start exporting LNG from its Pacific coast. The Middle East already exports significant quantities of LNG to customers in both the Atlantic and Pacific basins. In 2005, 15 percent of the LNG exports from the region went to North America and Europe and 85 percent to Asia. Qatar has several LNG export projects under construction that are targeted for sales to North

Table 6. World Natural Gas Reserves by Country as of January 1, 2007

Country	Reserves (Trillion Cubic Feet)	Percent of World Total
World	6,183	100.0
Top 20 Countries	5,602	90.6
Russia	1,680	27.2
Iran	974	15.8
Qatar	911	14.7
Saudi Arabia	240	3.9
United Arab Emirates	214	3.5
United States	204	3.3
Nigeria	182	2.9
Algeria	162	2.6
Venezuela	152	2.5
Iraq	112	1.8
Turkmenistan	100	1.6
Kazakhstan	100	1.6
Indonesia	98	1.6
Norway	82	1.3
China	80	1.3
Malaysia	75	1.2
Uzbekistan	65	1.1
Egypt	59	0.9
Canada	58	0.9
Kuwait	55	0.9
Rest of World	581	9.4

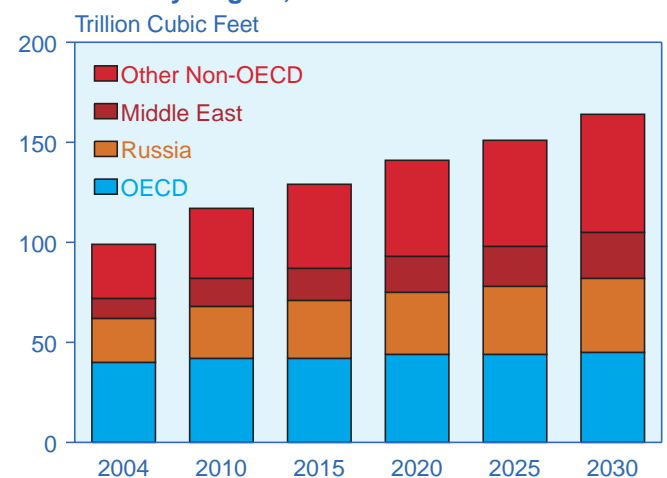
Source: "Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 22-23.

Figure 44. World Natural Gas Resources by Geographic Region, 2006-2025



Source: U.S. Geological Survey, *World Petroleum Assessment 2000*, web site <http://greenwood.cr.usgs.gov/energy/WorldEnergy/DDS-60>; "Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 22-23; and Energy Information Administration estimates.

Figure 45. World Natural Gas Production by Region, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

America and Europe. In December 2006, however, Qatar announced that the LNG from one project originally targeted for Atlantic buyers had been sold to Asian buyers in the Pacific basin.

Africa and non-OECD Asia (excluding China and India) are expected to be important sources of natural gas production in the future. For each of the two regions, natural gas production in 2030 is projected to be some 10 trillion cubic feet above 2004 production levels. The two regions combined accounted for 14 percent of the world's natural gas production in 2004; in 2030, their combined share is projected to be 21 percent. A significant portion of the production from both regions is exported. In 2004, 26 percent of the natural gas production from the countries of non-OECD Asia (primarily from Brunei, Indonesia, Malaysia, and Myanmar [formerly Burma]) and 50 percent of the production from African countries was for export. In 2030, the export share of production from non-OECD Asia is projected to fall to 10 percent, as domestic consumption takes precedence over exports, whereas the export share of Africa's production is projected to increase. Several pipelines from North Africa to Europe are under consideration, and LNG export capacity in West Africa continues to expand.

Historically, the United States has been both the largest producer and the largest consumer of natural gas in North America, and Canada has been the primary source of U.S. natural gas imports. In 2004, Canada provided 85 percent of gross U.S. imports of natural gas. Although Canada's unconventional and Arctic production both are expected to increase over the projection period, and LNG imports into Eastern Canada are expected to begin by the end of the decade, those supply increases are not expected to be sufficient to offset a decline in conventional production in Canada's largest producing basin, the Western Sedimentary Basin. Gross U.S. imports of LNG are projected to exceed gross pipeline imports from Canada after 2015, and Canada's share of gross U.S. imports is projected to decline to 25 percent in 2030.

Rising natural gas prices are expected to make it economical for two major North American pipelines that have long been in the planning stages to come online. The first, a Canadian pipeline to transport natural gas from the MacKenzie Delta, is expected to become operational in 2012. The second, an Alaska pipeline, is expected to begin transporting natural gas from Alaska to the lower 48 States in 2018, contributing significantly to U.S. domestic supply. Alaska's natural gas production accounts for all of the projected growth in domestic U.S. conventional natural gas production from 2004 to 2030, with flows on the Alaska pipeline increasing to 2.2 trillion cubic feet in 2030. As a result, Alaskan

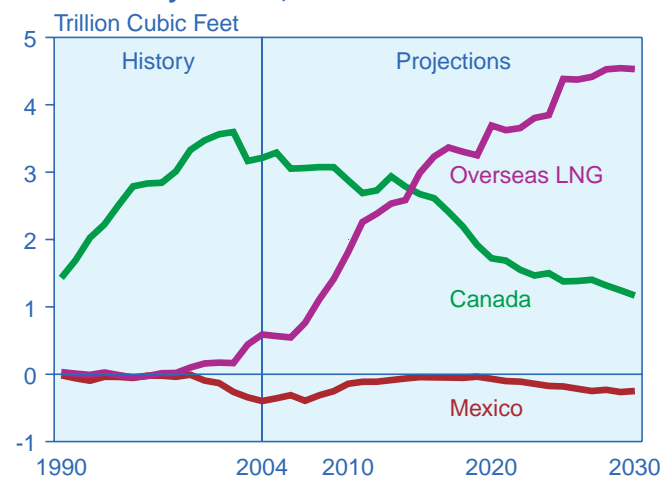
production is projected to account for 22 percent of the increase in U.S. natural gas supply in 2030 relative to the 2004 total.

A large portion of North America's remaining technically recoverable resource base of natural gas consists of unconventional sources, which include tight sands, shale, and coalbed methane. With most of the large onshore conventional fields in the United States already having been discovered, the United States, like Canada, must look to these costlier sources of supply to make up for declines in conventional production. Unconventional production, especially from tight sands formations, is expected to be a significant source of U.S. incremental supply, increasing from 40 percent of total domestic production in 2004 to 50 percent in 2030 and accounting for 28 percent of the increase in U.S. natural gas supply in 2030 relative to the 2004 total.

By far the largest source of U.S. incremental natural gas supply (50 percent of the increase in 2030 relative to 2004) is expected to be LNG. Currently, the United States has five LNG import facilities in operation with a total peak capacity slightly above 5.8 billion cubic feet per day. Four additional facilities are under construction in the Gulf of Mexico. When completed, the four new terminals will more than double U.S. LNG import capacity. Peak annual U.S. LNG import capacity in 2030 is projected to reach 6.5 trillion cubic feet, with actual imports of 4.5 trillion cubic feet (Figure 46).

The growth of U.S. LNG imports is expected to be strong through most of the projection period. The significant

Figure 46. U.S. Net Imports of Natural Gas by Source, 1990-2030



Sources: **History:** Energy Information Administration (EIA), *Annual Energy Review 2005*, DOE/EIA-0384(2005) (Washington, DC, August 2006), web site www.eia.doe.gov/emeu/aer. **Projections:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), web site www.eia.doe.gov/oiaf/aeo.

growth in U.S. LNG imports is indicative of the country's growing dependence on imports and the increasing globalization of natural gas markets. The emerging LNG markets in Canada and Mexico, both of which have facilities either in operation (in Altamira, Mexico) or under construction, also highlight this trend.

Mexico has significant untapped reserves of natural gas, but the Mexican government does not have the resources needed to develop them and to date has been relatively unsuccessful in attracting foreign capital. Currently, only the state oil and natural gas company, Pemex, is allowed to have any ownership interest in Mexico's oil and natural gas reserves, which makes participation in the development of Mexico's oil and gas resources unattractive to foreign investors.

Outside North America, the Australia/New Zealand OECD region is projected to see the most rapid expansion of natural gas production among all the world regions (but starting from a much lower point than many other producing regions). Production in Australia/New Zealand is projected to grow by an average of 4.3 percent per year from 2004 to 2030 (Table 7), and most of the increase is expected to be used for LNG exports. Australia currently has 0.75 trillion cubic feet of LNG export capacity from five liquefaction trains, including four at the Northwest Shelf project and one at the Darwin project that began operation in February 2006. More than 2.5 trillion cubic feet per year of additional LNG liquefaction capacity has been proposed. The Australia/New Zealand region is projected to account for 5 percent of the growth in world natural gas

Table 7. World Natural Gas Production by Region and Country, 2004-2030
(Trillion Cubic Feet)

Region/Country	2004	2010	2015	2020	2025	2030	Average Annual Percent Change, 2004-2030
OECD North America	26.9	28.1	28.2	29.3	29.2	29.6	0.4
United States ^a	19.0	19.5	19.7	20.9	20.7	20.7	0.3
Canada	6.5	6.8	6.4	6.0	5.9	6.0	-0.3
Mexico	1.5	1.8	2.0	2.4	2.6	3.0	2.7
OECD Europe	11.4	11.7	11.2	10.7	10.5	10.1	-0.4
OECD Asia	1.6	2.2	3.1	3.8	4.3	4.7	4.2
Japan	0.1	0.1	0.1	0.1	0.1	0.1	0.4
South Korea	0.0	0.0	0.0	0.0	0.0	0.0	—
Australia/New Zealand	1.5	2.1	3.0	3.7	4.2	4.6	4.3
Total OECD	39.9	42.0	42.5	43.8	44.1	44.5	0.4
Non-OECD Europe and Eurasia	28.6	33.2	36.4	39.5	42.4	45.2	1.7
Russia	22.4	24.9	27.4	30.0	32.6	35.2	1.7
Other	6.3	8.3	9.1	9.5	9.8	10.0	1.8
Non-OECD Asia	10.5	13.6	16.4	19.1	22.2	25.2	3.3
China	1.4	2.5	3.1	3.5	4.0	4.3	4.1
India	1.0	1.5	1.7	2.1	2.4	2.5	3.5
Other non-OECD Asia	8.1	9.6	11.5	13.5	15.8	18.4	3.1
Middle East	9.9	13.8	17.4	20.1	21.8	24.1	3.3
Africa	5.3	7.8	9.5	11.1	13.0	15.1	4.0
Central and South America	4.5	5.8	7.0	7.7	8.4	9.2	2.7
Brazil	0.3	0.6	0.7	0.8	0.9	1.0	4.1
Other Central /South America	4.2	5.3	6.3	6.9	7.6	8.2	2.5
Total Non-OECD	58.9	74.3	86.7	97.4	107.8	118.8	2.6
Total World	98.9	116.3	129.2	141.2	151.9	163.3	1.9

^aIncludes supplemental production or forecast discrepancy. For details, see Energy Information Administration (EIA), *Annual Energy Outlook 2007*, p. 159, Table A13, "Natural Gas Supply, Disposition, and Prices."

Note: Totals may not equal sum of components due to independent rounding.

Sources: **2004:** EIA, *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **2010-2030: United States:** EIA, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007) (Washington, DC, February 2007), web site www.eia.doe.gov/oiaf/aeo. **Others:** EIA, System for the Analysis of Global Energy Markets (2007).

production from 2004 to 2030 and 3 percent of total production in 2030.

Investment in Australia's natural gas sector projects has been helped by the country's reputation as a stable political environment that takes no state equity in reserves or LNG assets. Even in Australia, however, state involvement has a bearing on project economics. The Gorgon LNG project to develop reserves off Australia's northwest coast faces not only stringent environmental requirements but also, in an agreement with the Western Australia state government, a requirement that the project must allocate 15 percent of Gorgon reserves for domestic consumption. The Western Australia government negotiated a similar agreement with the Northwest Shelf LNG developers, reserving 4.7 trillion cubic feet of Northwest Shelf natural gas for the domestic market. The requirement for domestic sales has kept natural gas prices in Western Australia below the LNG netback equivalent; however, all of the reserved natural gas has been consumed or allocated, and the Western Australia government is now looking at options for applying domestic reservation requirements to all future liquefaction projects that would process offshore gas in Western Australia [3].

Increasing state involvement in the upstream natural gas activities of several large reserve holders throughout the world is threatening to delay or discourage investments in new production and export capacity. In May 2006, Bolivia nationalized its energy resources, prompting investors to suspend further investment, including suspending plans to expand export pipelines. In January 2006, Venezuelan President Hugo Chavez proposed changing the constitution to make both natural gas and petroleum assets subject to state control. And in October 2006, Russia announced that there would be no foreign ownership in the giant Shtokman natural gas reserves, although it may bring foreign firms in as contractors to help with the development. Also in Russia, the majority state-owned firm Gazprom has gained a controlling share in the Sakhalin-2 LNG project, owned by a consortium led by Royal Dutch/Shell, ending disputes with authorities about environmental issues that had plagued the project [4].

World Natural Gas Demand

OECD North America

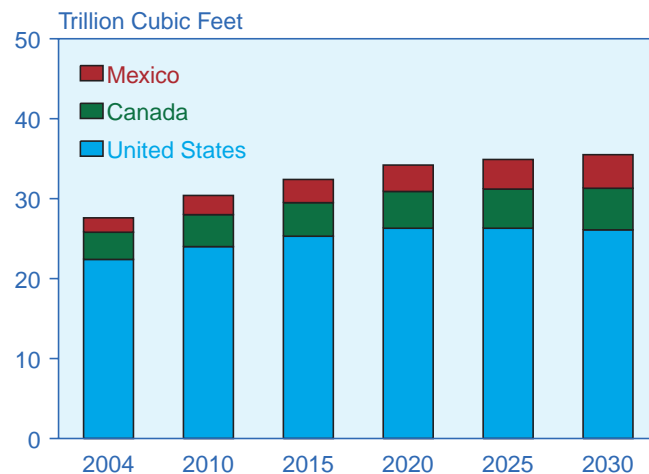
Natural gas consumption in North America (Figure 47) is projected to increase at an average annual rate of 1.0 percent from 2004 to 2030. The average annual growth rate for natural gas demand in the United States is projected to be 0.6 percent, significantly less than in Canada and Mexico, largely because of the impact of higher natural gas prices and supply concerns in U.S. natural gas markets. As North America's largest consumer, the

United States accounted for more than 80 percent of the 27.6 trillion cubic feet of natural gas consumed in North America in 2004. As a result of the relatively slow growth in U.S. demand and robust growth in Canada and Mexico, the U.S. share of North America's total natural gas consumption in 2030 falls to 74 percent.

In 2004, natural-gas-fired plants accounted for less than 20 percent of electricity generation in the United States, while coal-fired plants accounted for about 50 percent. The natural gas share of generation is projected to rise to 22 percent in 2015. After 2015, higher natural gas prices, along with tax incentives for clean coal technologies, are expected to discourage the construction of new natural-gas-fired plants in favor of coal-fired plants, leading to a decline in the natural gas share to 16 percent and an increase in the coal share to 57 percent in 2030. U.S. natural gas consumption for electricity generation is projected to peak in 2020 at 7.2 trillion cubic feet, followed by a decline to 5.9 trillion cubic feet in 2030.

In Canada, natural gas consumption in the residential and commercial sectors is expected to increase steadily at rates of 0.5 and 0.7 percent per year, respectively. Strong growth rates of 2.2 percent per year in Canada's consumption of natural gas for electricity generation and 2.1 percent per year for industrial uses—including vast quantities of natural gas consumed in the mining of the country's oil sands deposits—are the main contributors to Canada's projected consumption growth. The expected growth in domestic consumption, coupled with a projected production decline of 0.3 percent per year, would leave less Canadian natural gas available for export. In 2004, Canada consumed 52 percent of its

Figure 47. Natural Gas Consumption in North America by Country, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

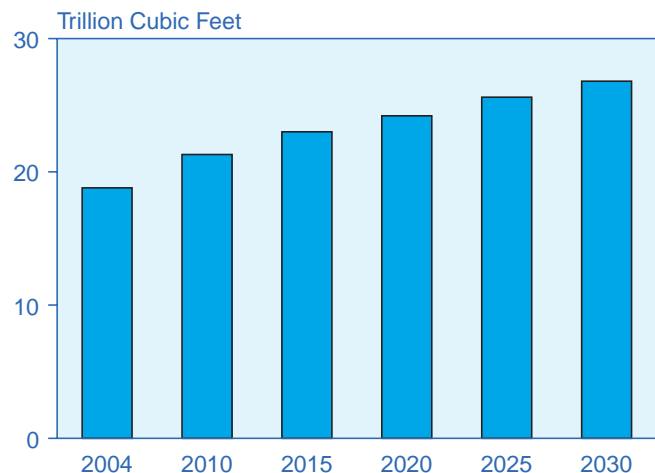
own natural gas production. In 2030, it is expected to consume 87 percent of its production domestically.

In Mexico, strong growth in natural gas consumption is expected in all sectors, with total consumption more than doubling between 2004 and 2030. Although the absolute quantities are small, average annual growth of 3.8 percent and 3.7 percent are expected for natural gas consumption in the residential and commercial sectors, respectively. Industrial consumption is projected to almost double, and consumption for electricity generation is expected to almost triple. Mexico's natural gas production is expected to double between 2004 and 2030, from 1.5 trillion cubic feet to 3.0 trillion cubic feet, but the projected growth in consumption over the period (2.4 trillion cubic feet) far exceeds the production growth, leaving Mexico dependent on LNG-exporting countries and on pipeline imports from the United States for needed supplies. Mexico remains a net importer of natural gas from the United States throughout the projection period.

OECD Europe

Natural gas is expected to be the fastest growing fuel source in OECD Europe, with demand increasing at an annual average rate of 1.4 percent, from 18.8 trillion cubic feet in 2004 to 23.0 trillion cubic feet in 2015 and 26.9 trillion cubic feet in 2030 (Figure 48). Growth in natural gas use for power generation is projected to account for the majority of total incremental gas use to 2030. Natural-gas-fired generation is less carbon-intensive than oil- or coal-fired generation and is expected to remain more cost-competitive than renewable energy, making natural gas the fuel of choice for new generating capacity in OECD Europe.

Figure 48. Natural Gas Consumption in OECD Europe, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

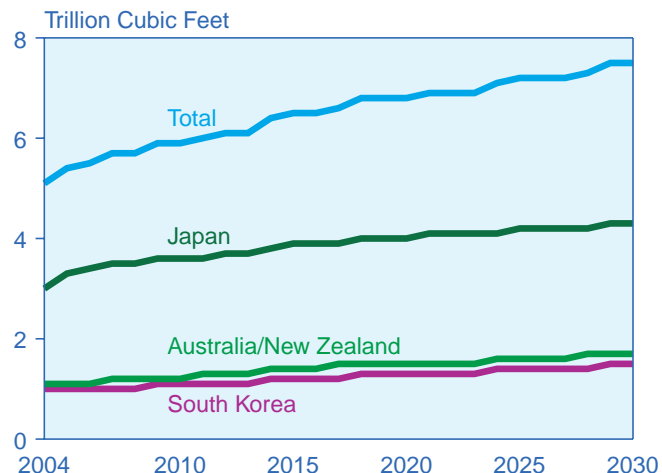
OECD Asia

In Japan, natural gas consumption is projected to grow on average by 1.4 percent per year over the projection period, from 3.0 trillion cubic in 2004 to 4.3 trillion cubic feet in 2030 (Figure 49). The strongest growth in consumption is projected for the electric power sector, averaging 1.7 percent annually from 2004 to 2030.

Total natural gas consumption in South Korea is projected to grow at an average annual rate of 1.6 percent from 2004 to 2030. In 2004, the residential sector was the country's predominant source of demand for natural gas, accounting for 39 percent of the total. The electric power sector was a close second at 33 percent of total natural gas use, followed by the industrial sector at 20 percent of the total.

South Korea has large seasonal swings in demand for natural gas, importing more than twice as much LNG at its annual winter peak as at its lowest point during the summer—primarily to meet demand for heating in the residential sector. For a country that imports all its natural gas supplies as LNG and has no underground storage facilities, this can be an expensive undertaking. Korea Gas Corporation paid as much as \$26 per million Btu for LNG on the spot market in 2005 and 2006, when it faced steep competition for winter cargoes [5]. In the reference case projection, however, with nearly flat population growth, South Korea is expected to see the growth of natural gas consumption in its electric power and industrial sectors outpace growth in the residential sector, potentially moderating seasonal swings in overall demand.

Figure 49. Natural Gas Consumption in OECD Asia by Country, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

In Australia and New Zealand, the industrial sector currently is the predominant consumer of natural gas and is projected to account for more than 50 percent of all natural gas consumption in the region throughout the projection period. Natural gas is the fastest growing fuel in Australia and New Zealand in the *IEO2007* reference case, accounting for 30 percent of the projected growth in the region's total energy consumption from 2004 to 2030. It is also the fastest growing fuel in the region's electric power sector. Although Australia has not ratified the Kyoto Protocol, several of the government's environmental policies have been put in place to help stimulate increases in natural gas use for electric power generation and to moderate growth in the use of coal, of which Australia has large reserves.

In January 2003, the government of New South Wales instituted a greenhouse gas abatement scheme that applies to electricity retailers [6]. Also, starting in January 2005, the Queensland government's "13 percent Gas Scheme" requires all electricity retailers to source at least 13 percent of their electricity from natural-gas-fired generation. The scheme allows certificates from qualified generation to be traded independently of the electricity generated. Electricity retailers are then required to acquire and turn in certificates representing their 13-percent minimum. The scheme aims to reduce greenhouse gas emissions and boost the natural gas industry in Queensland [7].

Non-OECD Europe and Eurasia

The non-OECD Europe and Eurasia region is more reliant on natural gas than any other region in the world. Russia is second only to the United States in total natural gas consumption, with demand totaling 16.0 trillion

cubic feet in 2004 and representing 55 percent of Russia's total energy consumption (Figure 50). The other countries of non-OECD Europe and Eurasia met 44 percent of their combined total energy needs with natural gas in 2004, consuming 8.4 trillion cubic feet.

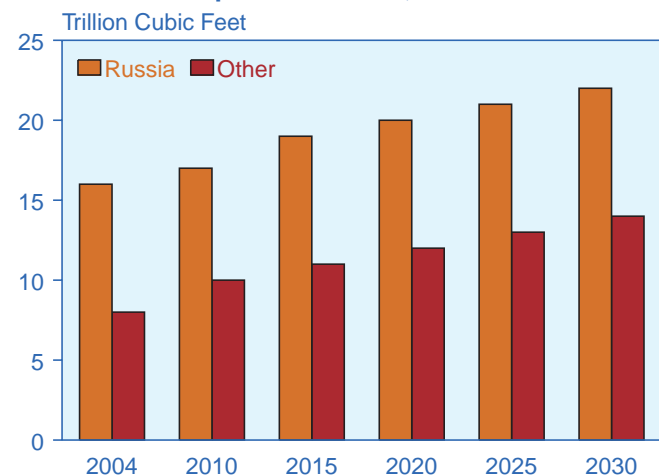
Natural gas intensity (defined as the amount consumed per dollar of GDP) in non-OECD Europe and Eurasia is greater than in any other region of the world, although it has improved in recent years from 9.7 thousand Btu per dollar of GDP in 1996 to 7.5 thousand Btu per dollar in 2004. In the *IEO2007* reference case, natural gas intensity in the region is projected to continue improving (decreasing) at an average rate of 2.8 percent per year from 2004 to 2030. Even at that rate, however, natural gas intensity in non-OECD Europe and Eurasia is not projected to equal the 2004 level of North America's natural gas intensity until after 2030.

Non-OECD Asia

The fastest growth in natural gas consumption among all regions is projected for non-OECD Asia, which accounted for only 8.5 percent of the world total in 2004 but is projected to account for almost 30 percent of the increase in total natural gas consumption from 2004 to 2030. Natural gas consumption in non-OECD Asia more than triples in the *IEO2007* reference case, from 8.5 trillion cubic feet in 2004 to 27.4 trillion cubic feet in 2030 (Figure 51).

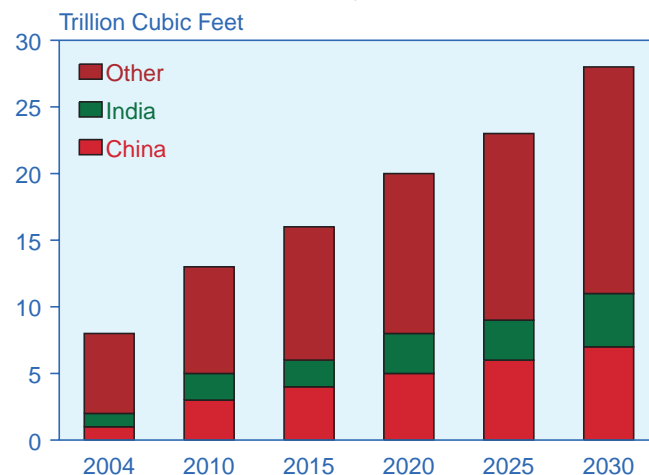
Led by demand in China and India, natural gas consumption in non-OECD Asia is projected to expand by 4.6 percent per year on average from 2004 to 2030. In both China and India, natural gas currently is a minor fuel in the overall energy mix, representing only

Figure 50. Natural Gas Consumption in Non-OECD Europe and Eurasia, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

Figure 51. Natural Gas Consumption in Non-OECD Asia, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

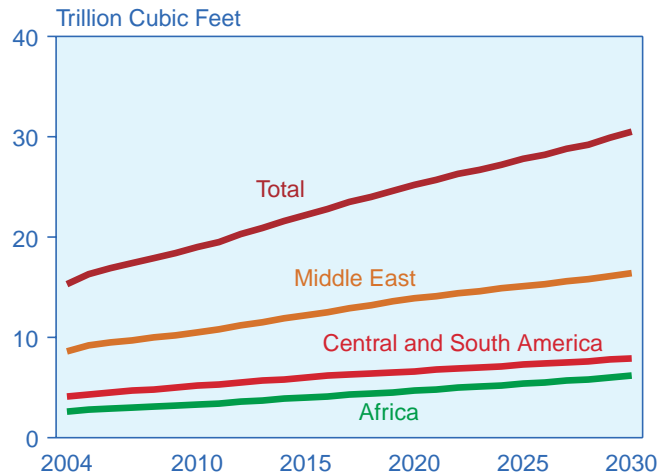
3 percent and 8 percent, respectively, of total primary energy consumption in 2004; however, both countries are rapidly expanding infrastructure to serve demand. China received its first-ever LNG cargo in mid-2006 under a long-term contract with Australia.

India increased its spot and short-term LNG purchases in 2006, reportedly paying more than \$9 per million Btu for one cargo (a year earlier, Royal Dutch/Shell could not find customers for LNG from its Hazira regasification terminal at a price of about \$8 per million Btu). Natural gas shortages in India have reportedly left natural-gas-fired electric power plants and fertilizer plants underutilized in the past few years. In the *IEO2007* reference case, India's natural gas consumption is projected to rise rapidly in the mid-term, growing by 6.2 percent per year on average from 2004 to 2015. As international natural gas prices gain acceptance in India, and as supplies from the Krishna-Godavari basin come on line around 2010, domestic natural gas supply is expected to catch up with currently underserved demand and also expand to serve new demand.

Natural gas supplies have also been tight in other parts of non-OECD Asia. LNG exports from Indonesia's Arun and Bontang liquefaction plants have been declining steadily, as dwindling production from the aging fields has been diverted to satisfy local demand. Startup of the Tangguh liquefaction plant, scheduled for 2009, should boost Indonesia's exports for a time, but it is expected that the country will soon lose its place (to Qatar) as the world's largest exporter of LNG.

Growth in natural gas consumption is projected to outstrip production growth in the non-OECD Asia region

Figure 52. Natural Gas Consumption in Central and South America, Africa, and the Middle East, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

over the projection period. In 2004, net exports from the region were equal to 19 percent of its total production. In the *IEO2007* reference case, its net exports fall to 4 percent of production in 2015, and in 2020 the non-OECD Asia region is projected to be a net importer, with importing exceeding production by 9 percent.

Other Non-OECD

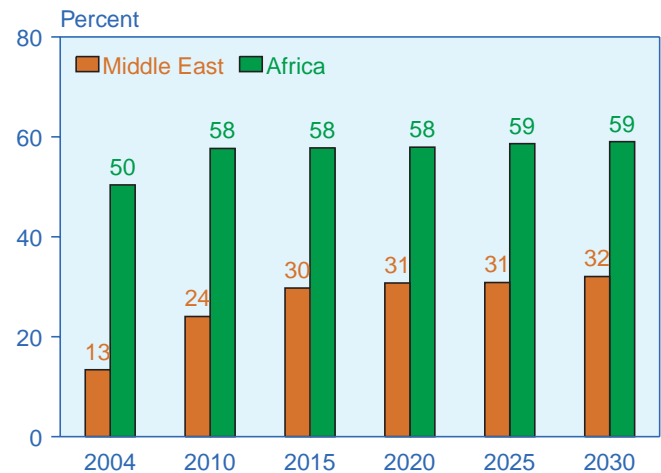
In the *IEO2007* reference case, natural gas consumption grows at average annual rates of 2.5 percent in the Middle East and 3.3 percent in Africa from 2004 to 2030. Natural gas consumption in the Middle East almost doubles over the projection period, and consumption in Africa more than doubles (Figure 52). Before 2015, most of the increase in natural gas production in both regions is projected to be for export projects. As a result, the export share of production increases from 2004 to 2015 in both regions (Figure 53). After 2015, production increases in the two regions are expected to be directed more toward domestic consumption, and their export shares of production show only slight increases from 2015 to 2030.

In Central and South America, natural gas is the fastest growing fuel source, with demand increasing on average by 2.6 percent per year, from 4.1 trillion cubic feet in 2004 to 7.9 trillion cubic feet in 2030. Brazil accounts for more than 20 percent of the projected increase in the region's consumption of natural gas in 2030 relative to total consumption in 2004.

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1. "Worldwide Look at Reserves and Production," *Oil & Gas Journal*, Vol. 104, No. 47 (December 18, 2006), pp. 22-23.

Figure 53. Export Share of Natural Gas Production in the Middle East and Africa, 2004-2030



Sources: **2004:** Derived from Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

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