

Overview and Potential of Tokyo Gas

The Potential of Natural Gas	10
Understanding Tokyo Gas through Comparison	12
Developing Business through the LNG Value Chain	14

The Potential of Natural Gas

Natural gas produces energy that is much cleaner than other fossil fuels, and thus demand is rising for this resource around the world.

Environmental Benefits of Natural Gas

Natural gas is a combustible gas mixture consisting primarily of hydrocarbon methane (CH4). Like oil and coal, it is a fossil fuel. However, it is composed of a lower percentage of carbon (C) than these substances. For this reason, it releases relatively small quantities of carbon dioxide (CO₂) during combustion. After being processed to the point that it can be used to generate energy through combustion, natural gas contains almost no nitrogen (N). It is also exceptionally easy to control this fuel. Accordingly, nitrogen oxide (NOx) emissions during burning are incredibly low. In addition, when liquefied, natural gas contains almost no sulfur or other impurities, meaning that no sulfur oxide (SOx) is emitted, thus making natural gas a source of energy with an incredibly low environmental impact.



Demand for natural gas is rising rapidly on a global scale. This trend can be attributed to such factors as increased affordability, a result of the establishment of international pipeline networks and the spreading usage of unconventional natural gases; strong demand in emerging nations; and attention garnered through the potential for natural gas to be used as an alternative for nuclear power, which has become more significant amidst the acceleration of a global anti-nuclear movement in response to the nuclear accidents in Japan. According to the estimates of an International Energy Agency, demand for natural gas, which is more environmentally sound than oil and coal and more economically feasible than renewable energies, is expected to rise by 50% or more by 2035. Furthermore, the share of natural gas among primary energies is expected to rise from the current 21%, to 25%.

Availability around the World

Currently, reserves boasting volumes of natural gas in the area of 208 trillion m³ have been confirmed. These reserves are located around the world, and are particularly concentrated in the Middle East and Eurasia. While approximately half of all oil reserves are located in the Middle East, natural gas reserves are distributed more evenly throughout the world. In 2011, approximately 3.2 trillion m³ of natural gas was produced. When the volume of gas contained in confirmed reserves is divided by this figure, the result suggests that these reserves will be able to supply enough gas to meet demand for approximately 63 years.



Global Primary Energy Demand Estimates Million tons crude oil equivalent (Mtoe)







The Potential of Natural Gas

Understanding Tokyo Gas through Comparison Developing Business through the LNG Value Chain

Rising Volume of Reserves

When considering the volumes of reserves that are recoverable with current technologies, which exceeds the current volume in confirmed reserves, it can be estimated that there exists, primarily in Russia and the Middle East, reserves boasting volumes of conventional natural gases in the range of 421 trillion m³. Furthermore, reserves of unconventional natural gases have recently been being discovered at a rapid pace, and volumes of roughly 331 trillion m³



Source: "Golden Rules Case," Golden Rules for a Golden Age of Gas, World Energy Outlook, International Energy Agency, May 2012

Growing Demand in the Japanese Market

The ratio of natural gas usage among other primary energies in Japan is notably lower than the global average of 23.7%. However, following the Great East Japan Earthquake, which occurred on March 11, 2011, use of natural gas for thermal power generation has been increasing in an attempt to develop alternatives to nuclear power. Also, dispersed power sources such as cogeneration have been reassessed to be viable sources of power. Consequently, the percent of primary energy consumption attributable to natural gas has risen rapidly from the 17% recorded in 2010 to the present level of approximately 20%, and demand for this resource is expected to rise into the future. are thought to exist, primarily concentrated along the Pacific Rim. This means that the combined total for the volume of conventional and unconventional gases in the reserves spread across the globe could be as much as 752 trillion m³. Looking at the current production volume of natural gas of 3.2 trillion m³ per year, it is entirely possible that the remaining natural gas resources may be able to sufficiently supply the world for over 200 years.

Reserves of Conventional and Unconventional Gases



Domestic and Global Primary Energy



Source: BP Statistical Review of World Energy, June 2012

Differing Prices between Regions

Japan suffers from a lack of gas resources. It also is without an international pipeline network, forcing it to rely on LNG imports utilizing tankers. Regardless of these factors, the price of LNG in Japan was nearly the same as the price in Europe or the United States up until a few years ago. The price of LNG in Europe and the United States has remained at approximately the same level since then due to such factors as the global economic recession that followed the Lehman Shock of September 2008 and the increased supply in the United States following the shale gas revolution. In Japan, meanwhile, the rising price of crude oil has caused a subsequent rise in the price of LNG due to the link between the prices of these two resources and demand for natural gas as a replacement for nuclear power has grown. In this manner, the price of LNG in Japan has increased, further widening the gap between prices in Japan and those in Europe and the United States.

Gas Prices by Region US\$/MMBtu



Source: Compiled by Tokyo Gas from various materials

Understanding Tokyo Gas through Comparison



Developing businesses from upstream activities to sales, in areas where major potential demand is expected.

Business Structure

Activities Spanning Resource Development to Sales

Different from energy companies in Europe and the United States, the Tokyo Gas Group conducts a chain of business operations extending from resource procurement and transportation to customer sales and service.

In Japan, the Gas Utility Industry Law assigns supply districts to providers of city gas. At the same time, the law obliges providers to supply gas safely throughout their districts. Although this arrangement creates a monopoly on supplying users who consume less than 100,000 m³ of gas per year (46 MJ/m³), gas rates are regulated.

Meeting our obligation to provide a stable supply in resource-poor Japan requires us to conduct long-term, stable resource procurement based on accurate forecasts of future demand. The situation is similar with regard to pipeline networks and other infrastructure, which are less developed than in Europe and the United States. Tokyo Gas and other major players in Japan must plan investments on the basis of demand assumptions, moving steadily forward in production, supply and sales efforts in an interconnected manner. Furthermore, whereas in Europe and the United States customers are responsible for their own safety, in Japan gas companies are accountable for all aspects of safety, all the way to customers' gas valves. We maintain consistently high levels of safety from supply through to sales.

In addition to these activities, in recent years we have also begun participating actively in resource development projects in order to procure resources more consistently and competitively. By forging stronger links among our business activities, we aim to achieve a better overall balance in our operations, maximizing LNG's value and providing natural gas in a safe and consistent manner. We also endeavor to provide energy solutions that meet customers' needs, including for electricity, heat, and renewable energy.

Differences in Business Structure between the Tokyo Gas Group and European and U.S. Energy Companies

Natural gas resource development

Procurement, transportation

Production, power generation

Supply

Business Structure of Tokyo Gas

Conducts business through an LNG value chain spanning upstream to downstream operations

Common Business Structure in Europe

As one aspect of European integration, formerly monopolistic national providers are being compelled to separate and privatize their operations to create consistency across the market. Nowadays, production, transportation, and supply are typically handled by different companies. A common division is into companies that handle (1) importing and domestic production, (2) transportation and storage, and (3) distribution and retail.



Common Business Structure in the United States

Gas industry regulation in the United States comprises two layers: federal regulation and the regulations of individual states. For interstate pipelines, U.S. law requires pipeline operations to be conducted by different companies than those handling procurement, supply, and sales. Here, the gas business tends to be divided into four types of entities: (1) producers, (2) interstate pipeline operators, (3) gas distribution companies, and (4) marketers.

* Operation of pipelines within individual states differs by state.

Sales, services

Developing Business through the LNG Value Chain

Business Area's Potential

The Potential of Natural Gas

Developing Business in One of the World's Largest Economic Areas

rstanding Tokyo Gas through

As of September 2007, Tokyo Gas had more than 10 million customers, and the figure is currently around 10.85 million (as of March 31, 2012). This business base is on a par with those of leading public service companies in the gas business in Europe and the United



States. Furthermore, although Japan's total population began to decline in 2010, our customer base is expected to continue increasing at a pace of around 1% per year, owing to the ongoing influx of people into the Tokyo metropolitan area.

Customer Comparison among the World's Leading Gas Companies



ource: Compiled by Tokyo Gas from individual companies' public documents (Figures for the three companies other than Tokyo Gas are as of December 31, 2011.)

Major Potential Demand Expected in the Tokyo Area

The Kanto region, which extends for a 200-kilometer radius around Tokyo, accounts for around 40% of Japan's GDP and is its largest area of concentrated energy demand. The Chiba–Kashima Line, which opened in March 2012, has begun supplying gas to industrial customers in the Kashima waterfront industrial zone in Ibaraki prefecture. Going forward, we will work to meet industrial demand concentrated in the northern Kanto region by extending necessary pipelines and boosting gas supply capacity through the construction of the Hitachi LNG Terminal. As a result, we expect demand to increase, centering on fuel conversion and cogeneration. We will also encourage the uptake of cogeneration—an effective means of generating electricity and heat on-site—from the perspective of creating dispersed energy systems that will help to reduce the burden on grid electricity and contribute to peak savings.

Potential for Industrial and Commercial Demand in the Kanto Region (200-kilometer radius around Tokyo)



Gas Sales Volumes of the Four Leading Companies (Consolidated) $\ensuremath{\mathsf{Million}}\xspace$ m^3



Source: Compiled by Tokyo Gas from individual companies' public documents

Customers for the Four Leading Companies (Consolidated)



Source: Compiled by Tokyo Gas from individual companies' public documents

Developing Business through the LNG Value Chain

We aim to develop our business throughout the LNG value chain, maximizing value through linked business spanning the procurement and transportation of LNG, the production and supply of city gas, and the provision of energy solutions.

Natural Gas Resource Development

As well as ensuring the stable procurement of gas resources, we aim to lower procurement prices in a bid to ensure fair prices in the Asian market. To achieve these goals, in addition to conventional large-scale projects we are pursuing unconventional sources of natural gas and actively taking various upstream interests.

Overview of Major Overseas Upstream Operations

Project	Annual contracted quantity (thousands of tons)	Inception of project	Duration	Contract type	Upstream interest (%)
Darwin	1,000	2006	17 years (-2022)	FOB	3.07
Pluto	1,500–1,750	2012	15 years	Ex-Ship, FOB	5.0
Gorgon	1,100	(2014)	25 years	FOB	1.0
Queensland Curtis	1,200	(2015)	20 years	Ex-Ship	1.25 (Upstream) 2.5 (Midstream)
Ichthys	1,050	(2017)	15 years	FOB	1.575





Darwin LNG Project

Qata

Tokyo Gas Long-Term LNG Contracts





Procurement and **Transportation**

We import more than 11 million tons of LNG per year, based on long-term contracts through 11 projects in six countries, centered on politically stable regions.

We strive to keep transportation costs down by using our own eight-tanker fleet efficiently to meet our own needs, as well providing transportation for other companies.

Tokyo Gas LNG Imports by Country

Thousands of tons				FY
Location	2009	2010	2011	Composition
Malaysia	4,274	4,479	4,479	(39.0%)
Australia	2,416	2,297	2,264	(19.7%)
Brunei	1,166	1,155	1,362	(11.9%)
Indonesia	730	843	1,011	(8.8%)
Russia	505	983	1,243	(10.8%)
Qatar	297	358	290	(2.5%)
Alaska	141	139	-	-
Other	523	440	826	(7.2%)
Total	10,052	10,692	11,476	(100.0%)



LNG Carrier "Energy Advance"

e Potential of Na	atural Gas	>	Understanding Tokyo Gas through Comparison		>	Developing Business thro Value Chain			
	Ohgishima Powe	r Co., I	Ltd.	Kawasaki Natural Generation Co., Lt		Tokyo Gas Yoko Co., Ltd.	osuka Power	Tokyo Gas Baypo	wer Co., Ltd.
Capacity	407 MW x 3 stations	s* 1,2	20 MW	420 MW x 2 stations	840 MW	240 MW x 1 station	n 240 MW	100 MW x 1 station	100 MW
Generation method	Combined cycle gen	eration		Combined cycle gener	ration	Combined cycle ge	eneration	Combined cycle gene	ration
Start of operation	Rollout of operations commencement in 2			2008		2006		2003	
Tokyo Gas interest	75%			49%		75%		100%	

* Reached decision to construct third station in autumn of 2012

Production and Power Generation

With three plants in the Tokyo metropolitan area, our LNG storage and production facilities are some of the largest in the world. We are continuing to expand our production system to meet growing demand for city gas. We also operate highly efficient power generation facilities that employ leading-edge technology and feature reduced environmental impact. By fiscal 2020, we expect to increase our generation capacity of the current 2,000 MW to between 3,000 MW and 5,000 MW.

Hitachi LNG Terminal (Plan)

Sodegaura LNG Terminal

Ohgishima LNG Terminal

Supply

Tokyo Gas provides a stable supply of city gas via a pipeline network totaling 59,575 km (consolidated), centered on the Tokyo metropolitan area. Moving forward, we will extend our pipelines into regions of demand, promote earthquake preparedness measures and build supply networks that are highly resistant to disaster.

Sodegaura LNG Terminal

Import volume FY2011 4.851 million ton/year 1,610,000 kl Storage capacity Vaporization capability 1,100 t/h

Ohgishima LNG Terminal

Import volume FY2011 3.326 million ton/year 600,000 kl Storage capacity 1.115 t/h Vaporization capability

Negishi LNG Terminal

Import volume FY2011 3.299 million ton/year 1,155,000 kl Storage capacity 560 t/h Vaporization capability







Tokyo Gas high-pressure transmission pipelines

- High-pressure transmission pipelines of other companies
- ····· Tokyo Gas high-pressure transmission pipelines under construction Tokyo Gas Group supply area
 - Supply areas of wholesale customers

Negishi LNG Terminal

The Potential of Natural Gas

Understanding Tokyo Gas through Comparison ing Business through the LNC

Major Overseas Mid-Downstream Operations (Energy and Engineering Services)



Malaysia Gas Malaysia Bhd. City gas supply project (Tokyo Gas interest: 14.8%)

Belgium T-Power Natural gas power project (Tokyo Gas interest: 26.66%)



Mexico Bajio Natural gas power generation (Tokyo Gas interest: 49%)

India Delhi, Mumbai Energy services project (feasibility study underway)



Mexico MT Falcon Natural gas power generation (Tokyo Gas interest: 30%)



Brazil Malhas Project Natural gas pipeline project (Tokyo Gas interest: 15%)

Vietnam Commissioned FEED project at LNG receiving terminal

Energy services project (feasibility study underway)







Gas air conditioner



Solar heat collector

Gas Sales and Service

In the residential sector, spearheaded by Tokyo Gas LIFEVAL communitybased marketing systems we are proposing lifestyle values based on gas. We are also working to promote "ENE-FARM" residential fuel cells and are **supplying electricity**. In the commercial and industrial sectors, we introduce cogeneration and air conditioning systems and promote fuel conversion from other sources. In these ways, we help to provide energy and contribute to <u>reductions in CO₂ emissions</u>. In addition to selling gas for energy, we are endeavoring to maximize added value by offering **energy services**, including equipment provision and maintenance.