An Analysis on European and U.S. Gas Industry Deregulation♦
-- From the Viewpoints of Market Liquidity and Transportation Services –

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European and U.S. gas industries have been perceived in Japan as representing cases for initiating market deregulation and large-scale cross-border mergers and acquisitions. In the United States, few studies have been seen regarding the evaluation on the effects and methods of gas industry deregulation by state.

At this moment, U.S. studies tend to focus on future risks of continuous rises on oil, gas and other energy prices, as well as country's energy procurement strategy and security issues amid energy demand growth.

Our report pays attention to differences in gas industry infrastructure, especially to the flexibility and liquidity of gas delivery in Europe and in the United States when compared with Japanese gas market in reviewing their gas industry deregulation. This is because we believe that such differences have influenced the effectiveness of deregulation and of utilization gas transportation services and should be analyzed from the viewpoint of not only the effective market deregulation but also countries' (or gas industry participants') ability of gas procurement among energy security issues as argued in the New National Energy Strategy in Japan.

♦ In preparing this report, we have cited figures, tables and some descriptions from "A Survey on Gas Market Trends in Japan and Abroad" as a fiscal 2005 Ministry of Economy, Trade and Industry survey, and a fiscal 2003 survey report on "U.S. Local Distribution Companies' Gas Transportation Service and the Relevant Code of Conduct" also entrusted by the ministry.
We thank the relevant people of the ministry and contributors to these reports (Mr. Hiroyuki Sagawa at the Energy Planning Division of Tokyo Gas Co., Mr. Shinichiro Kawabata at the Gas Technology Section of the Energy Industries Engineering Division of JFE Engineering Corp., and Mr. Hiroshi Kokubo at the Planning Division of Osaka Gas Co. in addition to the IEEJ researchers as listed above) for their understanding and cooperation in producing this report.

1. Customers' choice of Gas Suppliers and Market Liquidity in Europe and the U.S.

This section focuses on consumers' choice of gas suppliers in Europe and in the United States from the viewpoint of gas flow and relevant infrastructure.

In general, a company (a new entrant) that enters the gas market for small commercial and residential customers, whose gas demand is very sensitive to weather conditions and shows dramatic seasonal changes, must retain its flexibility of gas procurement and supply in competing with incumbent market participants. More specifically, a new entrant may be required to demonstrate gas procurement flexibility as well as its certainty regarding how the company can procure at less cost and more flexibly (in terms of gas procurement amounts and contracts) than competitors, as well as gas supply flexibility regarding how the company can meet demand changes regarding a consumer or a group of consumers when it uses the transportation service of existing networks.

1-1 U.S.

1-1-1 State-level Gas Flow

Here, we will look at gas retail deregulation as well as gas flow at the state level rather than the federal level[1].

As representative cases, we will look at the states of California, New York and Illinois that have implemented full gas market deregulation covering residential consumers and have had relatively large local distribution companies[2] (each with several million customers) (see Figures 1-1, -2, -3 and -4).

All three states depend on other states for meeting local gas supply. Among them, Illinois, where eight interstate gas pipelines interconnect, features more interstate gas trade than its local gas consumption, enjoying ample gas flow. It also boasts of abundant gas storage functions. Illinois thus has the characteristics both of Belgium with large demand for gas transit and of France (discussed later) with abundant underground gas storage functions when compared with Europe.

Among the other two states, New York lags behind California in the ratio of local gas production and storage to total consumption. But New York is superior to California in terms of the interstate gas trade's ratio to local supply.

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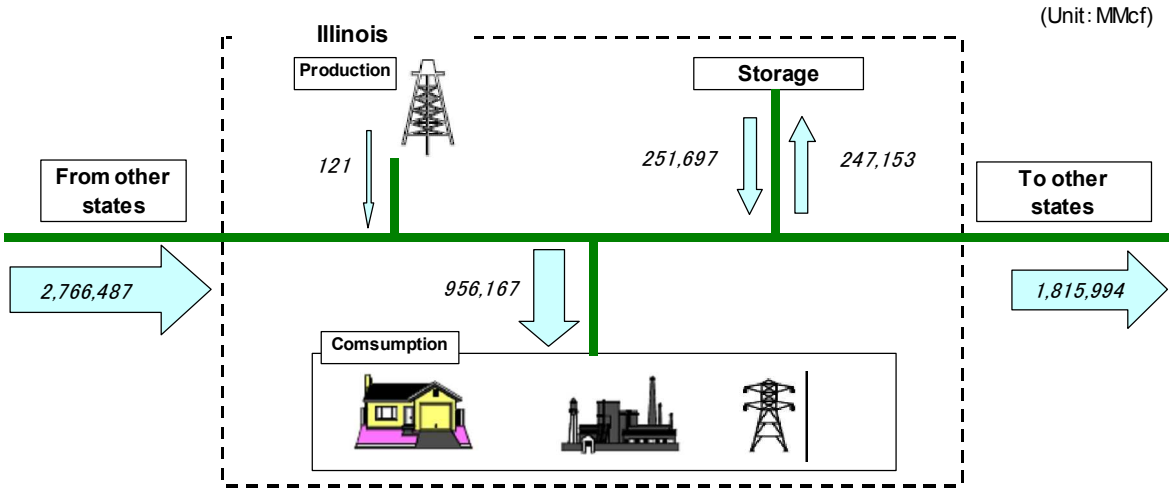
[1] If gas flow flexibility and liquidity were to be analyzed strictly, consideration would naturally have to be given to each gas infrastructure facility's capacity, network structures, gas procurement contracts for incumbent and new market participants, and the like. But here we would like to review basic annual and monthly gas supply data in a bid to simplify the comparison between regions (or countries) given data constraints.

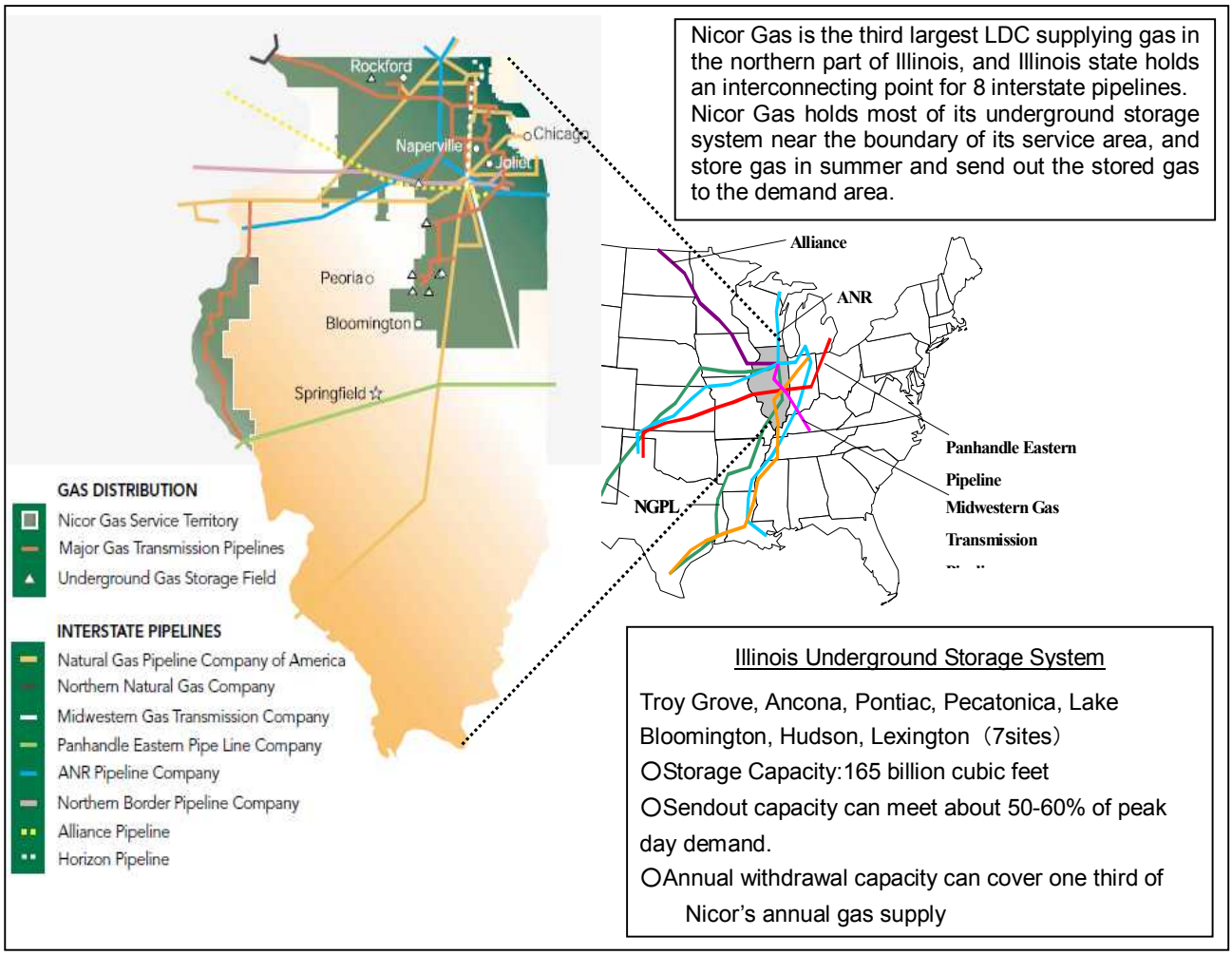
[2] LDCs include PG&E and Socal Gas in California, KeySpan and ConEd in New York and Nicor Gas in Illinois.

Figure 1-1 Gas Flow in Illinois (as of 2004)



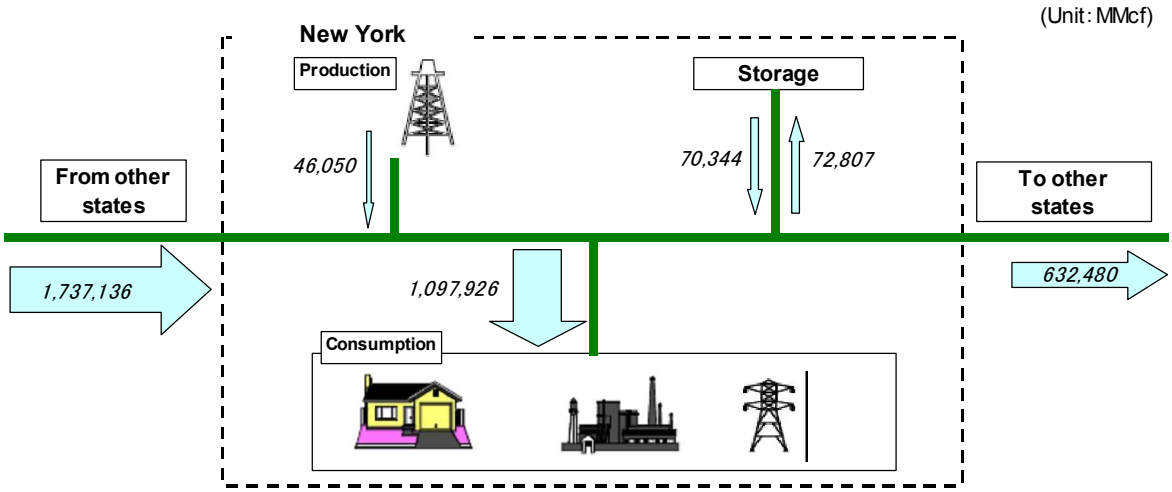
Source: DOE EIA, "Natural Gas Annual 2004"

Figure 1-2 Major characteristics of Nicor Gas's network



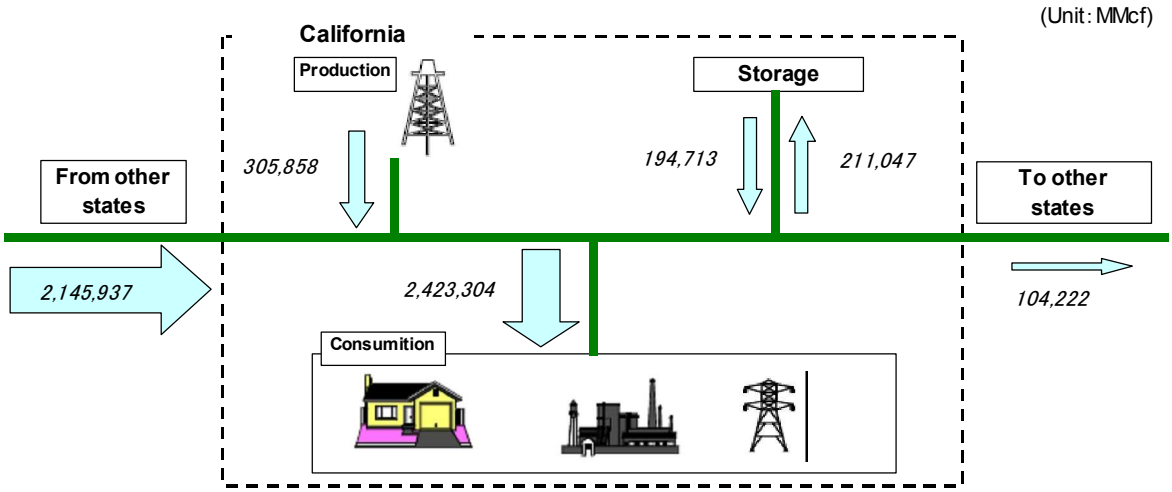
Source: Nicor Gas Annual Report

Figure 1-3 Gas Flow in New York (as of 2004)



Source: DOE EIA, "Natural Gas Annual 2004"

Figure 1-4 Gas Flow in California (as of 2004)



Source: DOE EIA, "Natural Gas Annual 2004"

1-1-2 Relations between Customers' Choice of Gas Suppliers and Gas Flow

In Illinois, which contrasts with New York in terms of the relationship between local gas consumption, gas storage and interstate trade, major local distributor Nicor Gas saw steady growth in the number of residential customers' selection of suppliers as well as the demand size of transportation customers in the past four years to 2005 (see Table 1-1). LDCs in the state showed a similar trend while indicating some performance gaps (see Table 1-2).

Data for the whole of New York State indicate customer selection (deregulation) program participants' share of the total number of customers showed an uptrend until 2001 and leveled off later. No progress has been seen in competition over the past two to three years (Figure 1-5).

Table 1-1 Transportation by Nicor Gas (Thousands of customers)

	2005	2004	2003	2002
Residential	157.1(8.0%) 18.9Bcf(8.6%)	147.9(7.7%) 16.6Bcf(7.5%)	145.1(7.7%) 16.6Bcf(7.2%)	126.8(6.8%) 11.0Bcf(4.9%)
Commercial	58.2(32.6%) 87.5Bcf(66.2%)	59.5(33.8%) 84.1Bcf(65.5%)	58.3(33.7%) 87.8Bcf(65.3%)	62.4(36.4%) 97.5Bcf(70.0%)
Industrial	5.9(44.4%) 113.0Bcf(94.7%)	6.0(44.8%) 117.0Bcf(94.8%)	6.2(45.9%) 121.2Bcf(94.5%)	6.7(48.9%) 149.2Bcf(95.6%)

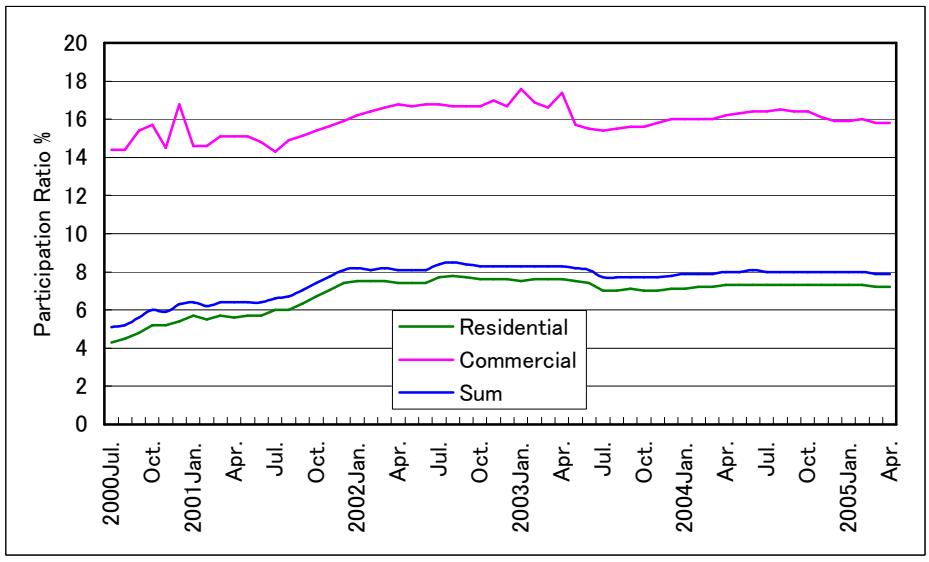
Note: Percentages in parentheses indicate Nicor Gas's share of customers and gas transported in its service territory.
Source: Nicor Gas 10-K Report

Table 1-2 Number of Residential and Small Commercial Customers for Gas Transportation Services (in December of each year)

Program	Residential			Commercial			Total		
	2002	2003	2004	2002	2003	2004	2002	2003	2004
Nicor Gas Customer Select	100,632 -	1145,072 44.2%	147,933 2.0%	50,741 -	48,864 -3.7%	49,575 1.5%	151,373 -	193,936 28.1%	197,508 1.8%
Peoples Choices For You	6,122 -	3,973 -35.1%	5,103 28.4%	9,789 -	8,261 -15.6%	7,246 -12.3%	15,911 -	12,234 -23.1%	12,349 0.9%
North Shore Choices For You	1,364 -	2,804 105.6%	2,431 -13.3%	301 -	353 17.3%	331 -6.2%	1,65 -	3,157 89.6%	2,762 -12.5%
Total	108,118 -	151,849 40.4%	155,467 2.4%	60,831 -	57,478 -5.5%	57,152 -0.6%	168,949 -	209,327 23.9%	212,619 1.6%

Note: "Customer Select" and "Choices for You" are the names of customer selection programs. Lower percentages indicate change from the previous year.
Source: ICC, ANNUAL REPORT ON THE DEVELOPMENT OF NATURAL GAS MARKET IN ILLINOIS JULY 2005

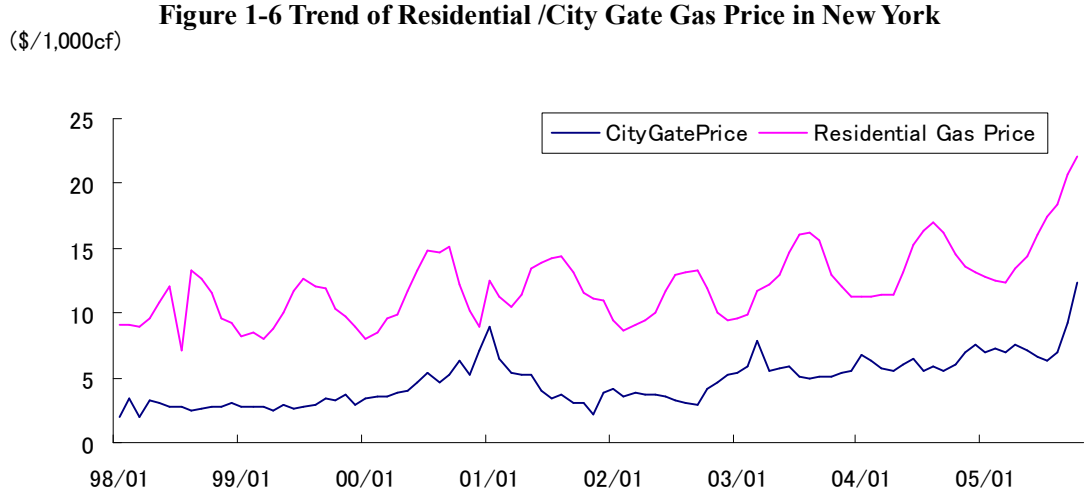
Figure 1-5 Trend of Participation Ratio of "Customer Choice Program" in N.Y.



Source: New York Public Service Commission

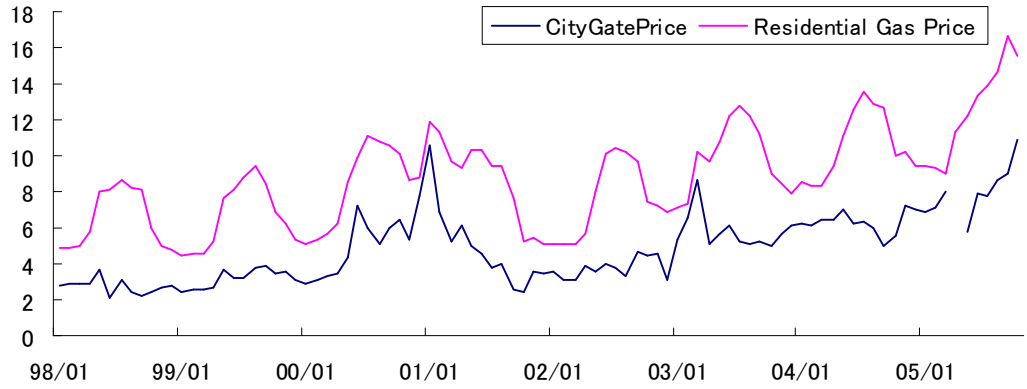
A comparison of state-wise gas wholesale or city gate prices shows that Illinois has had the same price volatility as or a slightly greater volatility than New York (see Figures 1-6 and 1-7).

Figure 1-6 Trend of Residential /City Gate Gas Price in New York



Source: DOE EIA, "Natural Gas Monthly"

Figure 1-7 Trend of Residential /City Gate Gas Price in Illinois



Source: DOE EIA, "Natural Gas Monthly"

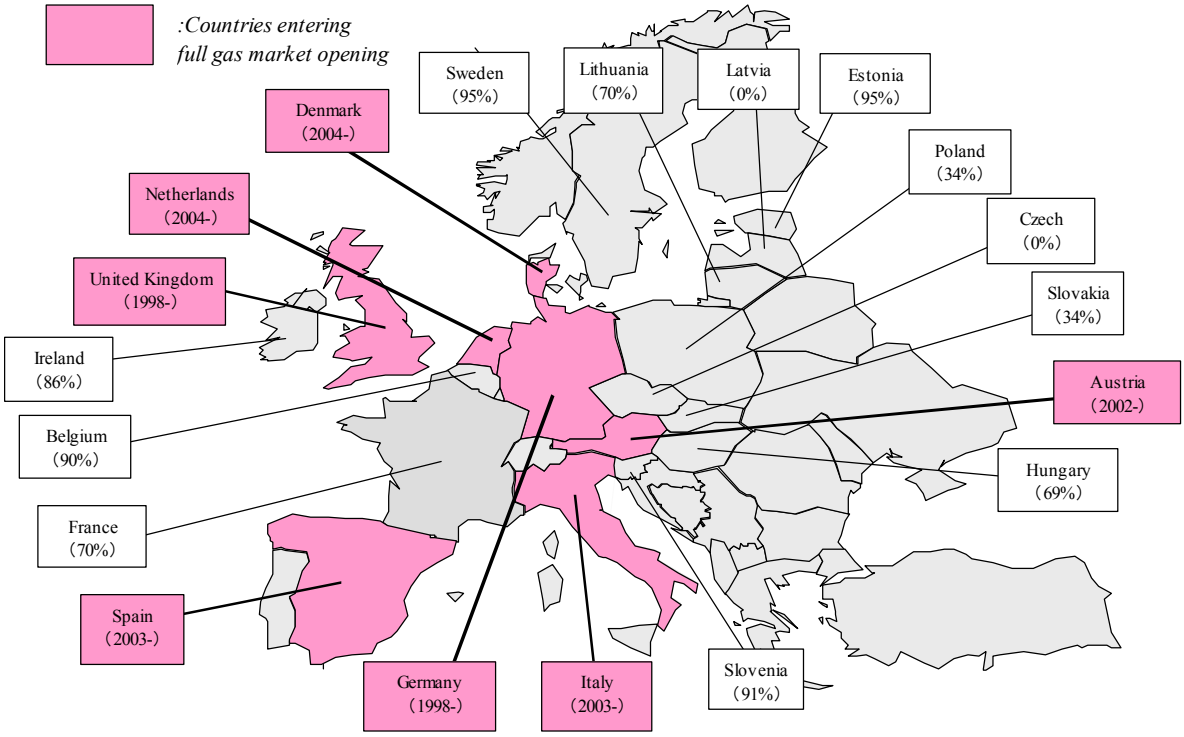
In the United States as a whole, ratio of customer choice other than incumbent LDCs into the markets of retail gas sales to residential and other small customers have decreased. A reason cited for the decline is that it has become difficult for new marketers to offer competitive prices against existing LDCs. The decline may also be attributed to the gas procurement and supply flexibility based on the differences of gas infrastructure and flow (constraints) between Illinois and New York.

1-2 Europe

1-2-1 Gas Flow in Major European Countries

Amended Gas Directive as a common regulation for EU member countries was approved in June 2003 in order to liberalize gas markets other than those for residential customers by July 2004 and complete the full gas market liberalization by July 2007. Prior to the authorization of amended Gas Directive, seven countries have already has entered full gas market opening. Britain and Germany took the initiative in full gas market liberalization, followed by Austria, Spain, Italy, Denmark and the Netherlands (see Figure 1-8).

Figure 1-8 EU Countries entering full gas market opening (as of 2005)

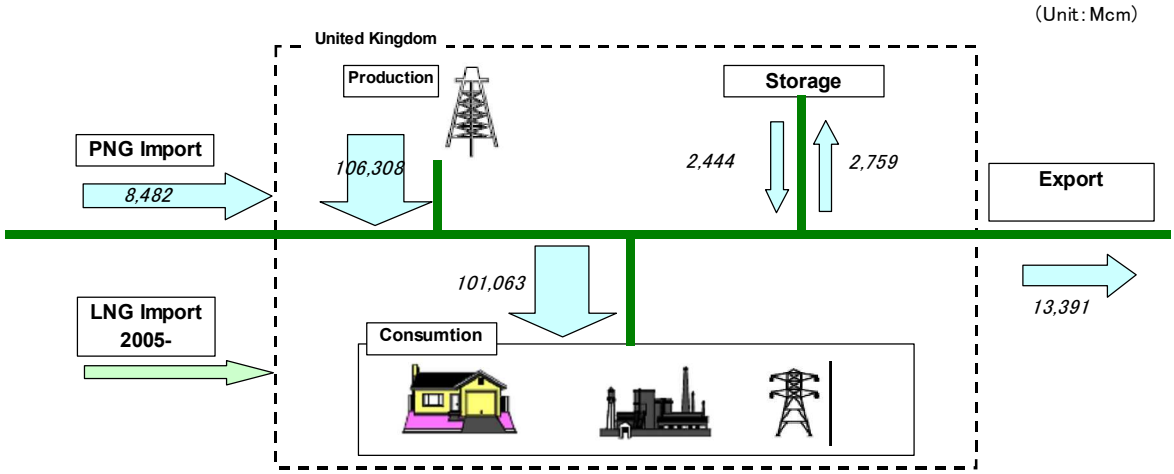


Source: EU, "Report on Progress in Creating the Internal Gas and Electricity Market Technical Annex"

Regarding gas flow or delivery, major European countries depend on either pipeline natural gas or liquefied natural gas for domestic supply (see Figures 1-9, 1-10 and 1-11). They can be classified into four groups – (1) countries that depend heavily on domestic (regional) gas production for domestic supply, (2) countries that depend heavily on foreign gas and utilize storage functions for active gas injection and withdrawal operations, (3) countries that depend heavily on foreign gas and have yet to develop gas storage functions, and (4) countries that feature great demand for transit.

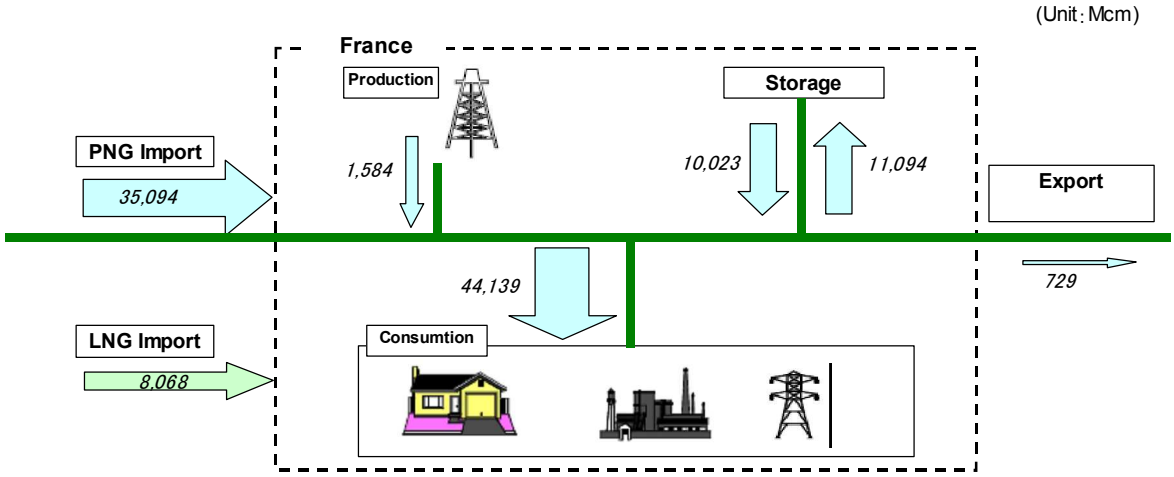
The first group includes Britain, Denmark, Germany and Ireland. Italy, the Netherlands and France belong to the second group. The third includes Spain. In the fourth group is Belgium whose gas transit demand is three times the size of its domestic consumption.

Figure 1-9 Gas Flow in the United Kingdom
(figures representing the average volumes from 2002 to 2004)



Source:IEA, "Natural Gas Information 2005"

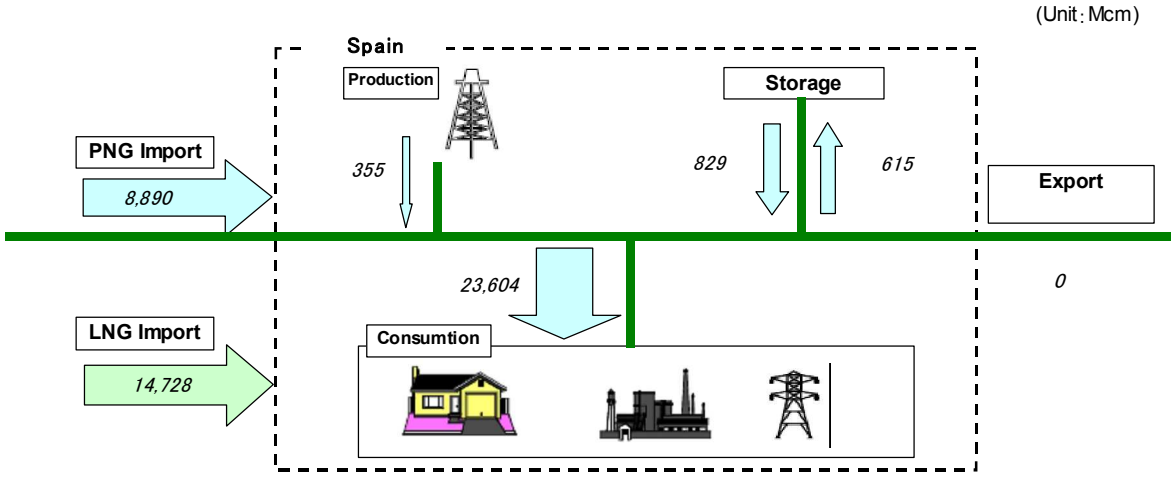
Figure 1-10 Gas Flow in France
(figures representing the average volumes from 2002 to 2004)



Source:IEA, "Natural Gas Information 2005"

Figure 1-11 Gas Flow in Spain

(figures representing the average volumes from 2002 to 2004)



Source:IEA, "Natural Gas Information 2005"

1-2-2 Relations between Consumers' Choice of Suppliers and Gas Flow

We would like to review the progress in switching gas suppliers. Large and small industrial and commercial consumers have made progress in switching gas suppliers especially in Britain, Spain and Denmark (see Table 1-3). Residential and other small consumers have not made so much progress in switching gas suppliers in countries other than Britain (see Figure 1-12).

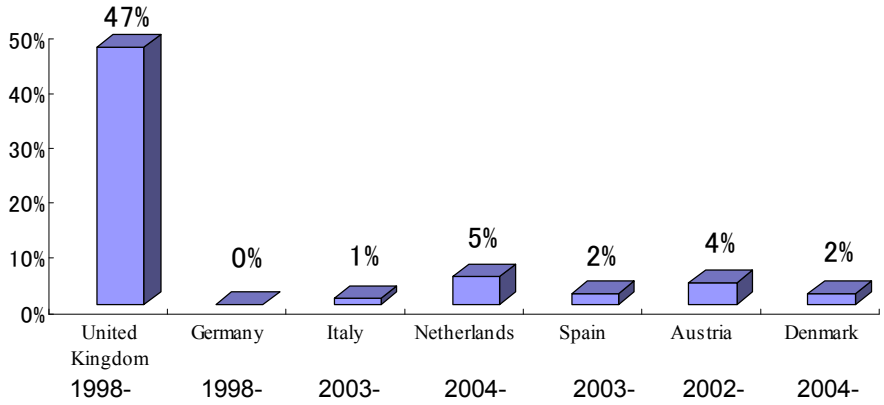
Table 1-3 Customers Switching Gas Suppliers in Major European Countries

(Cumulative switching by customer category in and before 2004)

	Power plants	Large industrial customers	Medium-sized industrial and commercial customers	Residential and other small-sized customers
Austria	6%			4%
Belgium	25%		9%	
Denmark	30%			Less than 2%
France	14%			Full market opening yet to be implemented
Italy	23%		3%	1%
Netherlands	N.A.	N.A.	N.A.	5%
Spain	60%			2%
Britain	Over 90%	Over 85%	Over 75%	47%

Source: Communication from the Commission to the Council and the European Parliament -- Report on progress in creating the internal gas and electricity market (November 2005)

Figure 1-12 Rate of Customer Switching in the EU countries entering full gas market opening



Note) Figures of customer switching are all cumulative basis (as of 2004) since the start of full gas market opening of each country, and in case of UK, multiple switching is simply counted and reflected in this figure (net switching ratio is not calculated in this figure).

Period described under each EU country is the beginning of full market opening.

Source: Communication from the Commission to the Council and the European Parliament -- Report on progress in creating the internal gas and electricity market (November 2005)

Britain and Denmark are characterized by relatively abundant gas production and are apparently easily able to secure the gas procurement flexibility as discussed above.

On the other hand, such countries as Spain are more vulnerable than other European countries in terms of gas infrastructure (including storage systems) and regional production for the purpose of securing the flexibility in supply, while recording a relatively higher ratio of gas supplier switching. But the more supplier switching in Spain is attributable to the following domestic regulations:

- Any gas supplier's share of domestic sales shall not exceed 70% in and after 2003.
- Of Algerian gas supplied through the interconnector, 75% is for regulated customers and 25% is distributed to new market entrants (Gas Release Program).

In Europe, the role of measures to secure gas liquidity (see the next section) as well as gas flow characteristics also seen in the United States has been important to the effectiveness of gas market deregulation. In this sense, attention will be paid to how the market liquidity and progress of gas transportation/supply networks investment within Europe are linked together more closely.

In some European countries including Italy, deregulation has just been implemented for the gas market for residential and other small-sized customers (see Figure 1-8). In addition to Italy, France, where full deregulation is planned for the future (by 2007), is rich with underground gas storage systems for supply/demand adjustments, while depending heavily on foreign gas. Japan may learn lessons from how full gas market deregulation functions in these countries from now on.

2. Measures for Securing Gas Market Liquidity in Europe and U.S.

Among Western countries that have fully deregulated the gas market ahead of Japan, European countries have continuously studied how to secure the gas market liquidity including the flexibility in procurement and supply.

In the United States, interstate pipeline companies had maintained dominant control over gas sales and transportation services until 1992. In that year, however, the Federal Energy Regulatory Commission issued Order 636 that required these companies to separate gas sales and transportation services and allow all gas suppliers to use pipeline transportation services subject to equal and transparent conditions.

In addition to the separation of gas sales and transportation services and the provision of nondiscriminatory open access to transportation and storage services as noted above, Order 636 provided for the secondary trading of transportation capacity.

The capacity release is designed for gas suppliers who purchase and resell pipeline capacity. In the secondary capacity market for such transactions, interstate pipeline companies re-release capacity to suppliers who make the highest bid through electronic bulletin boards[3].

How do new gas market entrants obtain pipeline capacity (mainly for transportation) in Europe? Some countries have recommended the "use it or lose it" principle that pipeline capacity to which existing gas network operators are not committed to using should be opened to shippers as new market entrants receiving transportation services. These countries also promote the creation of the capacity resale market allowing shippers to purchase and resell network capacity.

In Europe and the United States, pipeline hubs have traditionally developed into gas trading centers. This common history has become a basis for securing gas market deregulation or liquidity.

The European Commission, the regulator of the European Union, has acknowledged that the gas market lacks liquidity while progress in electricity and gas market deregulation has been insufficient in Europe. In this respect, the commission launched a country-by-country inquiry in June 2005.

The commission has cited the following barriers to new gas market entrants:

(1) Gas incumbents remain dominant in their national markets and largely control gas imports and/or gas production (**Market Concentration**).

(2) Limited liquidity, because of long-term vertical contracts, denies new operators the reliable long-term and short-term sources of gas necessary to enter supply markets (**Vertical Foreclosure**).

(3) Cross-border sales are limited by incumbents' hesitance to enter other national markets, as well as by lack of available capacity on import pipelines and crucial entry points to national gas systems

[3] Electronic bulletin boards are an information system.

(**Insufficient Market Integration**).

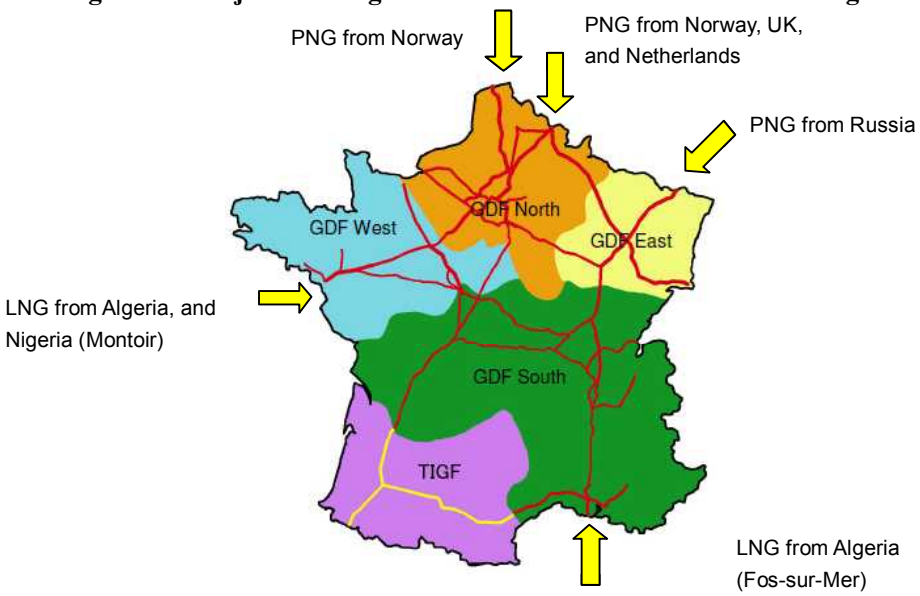
(4) Reliable information made available at the right frequency (notably on available transport capacity) is a key deficit of gas transport access (**Transparency**).

(5) The use of oil price indexes in import contracts has remained the rule (**Prices**).

Individual countries have their respective problems. For example, France sees capacity constraints for key North-South, North-East and North-West pipelines, making it difficult for North Sea gas and British gas supplied via Belgium to be distributed within that country.

The infrastructure constraints have resulted in the concentration of new gas market entrants in the north. Gas market competition in the south will effectively remain difficult unless certain conditions, including third parties' increased access to the Fos-sur-Mer gas terminal, are met. These problems are cited by annual reports and other documents produced by such organizations as the Commission of Regulation of Electricity (CRE), an independent regulator.

Figure 2-1 Major French gas transmission networks and balancing zones



Here, we would like to focus on the first, second problems among the five cited above, and review European measures regarding the gas release program and third parties' access to storage services.

2-1 Gas Release Program

Countries where large gas companies have high market shares have planned or implemented gas release programs where incumbents release (sell) procured gas to new market entrants (see Table 2-1).

Table 2-1 Number of Companies Engaged in Natural Gas Production and Imports

	Number of companies with gas production and import shares at 5% or higher	Largest domestic firm's market share	Market share for Top 3 suppliers to power stations	Market share for Top 3 suppliers to large industrial users	Market share for Top 3 suppliers to medium size industrial and commercial users	Market share for Top 3 suppliers to residential and other small customers	Presence of gas release programs
Austria	2	More than 90%	-	-	-	-	○
Belgium	2	92%	-	90%	99%	100%	-
Denmark	2	80%-85%	100%	92%	100%	100%	○
France	2	91%	-	-	-	-	○
Italy	3	68%	80%	54%	-	33%	○
Netherlands	1	60%	-	-	-	83%	-
Spain	4	40%	-	72%	77%	90%	○
Germany	5	50%	-	-	-	-	○
Britain	7	25%	56%	53%	61%	77%	○

Sources: "Report on Progress in Creating the Internal Gas and Electric Market – Technical Annex (November 2005)," European Commission, etc.

A European Commission report issued in November 2005 said gas release programs were implemented to cope with market oligopolies emerging on mergers between incumbents. For example, a gas release program was introduced as a condition for a merger between electricity giant E.On and the largest gas utility Ruhrgas in Germany.

The European Commission noted that gas release programs have not necessarily contributed to increasing gas market liquidity. The reasons cited for this include the following:

- Even if gas is released to new market entrants, conditions required for them to utilize gas networks including pipelines are not sufficiently prepared.
- Competitive prices have not been offered for released gas.

In Spain, gas is released to companies that have relatively small market shares. The European Commission welcomed the Spanish system as one that stimulates market competition (see Figure 2-2).

Figure 2-2 Outline of Spain's Gas Release Program

- A quarter of Algerian gas supply via pipelines is allocated to new gas market entrants. Based on the prices proposed by new entrants, auctions are carried out to select successful bidders.
- The gas release deadline is January 2004. The release would total 4.24 billion cubic meters (amounting to some 18% of Spain's average annual consumption between 2002 and 2004). Each bidder is allowed to make a commitment to 10% to 25% of the total volume.
- The lowest price for the gas release is set under the formula linked to C.I.F. prices for multiple fuel oil brands.

- Eligible bidders for the gas release program are limited to companies with domestic market shares of 50% or less.
- Successful bidders as announced in October 2001 included such international oil majors as BP and Shell, and domestic electricity utilities like Iberdrola, Union Fenosa and Endesa.

Source: CNE, "Spanish Regulators' Annual Report to the European Commission" (July 2005)"

Figure 2-3 Spanish Gas Release Program

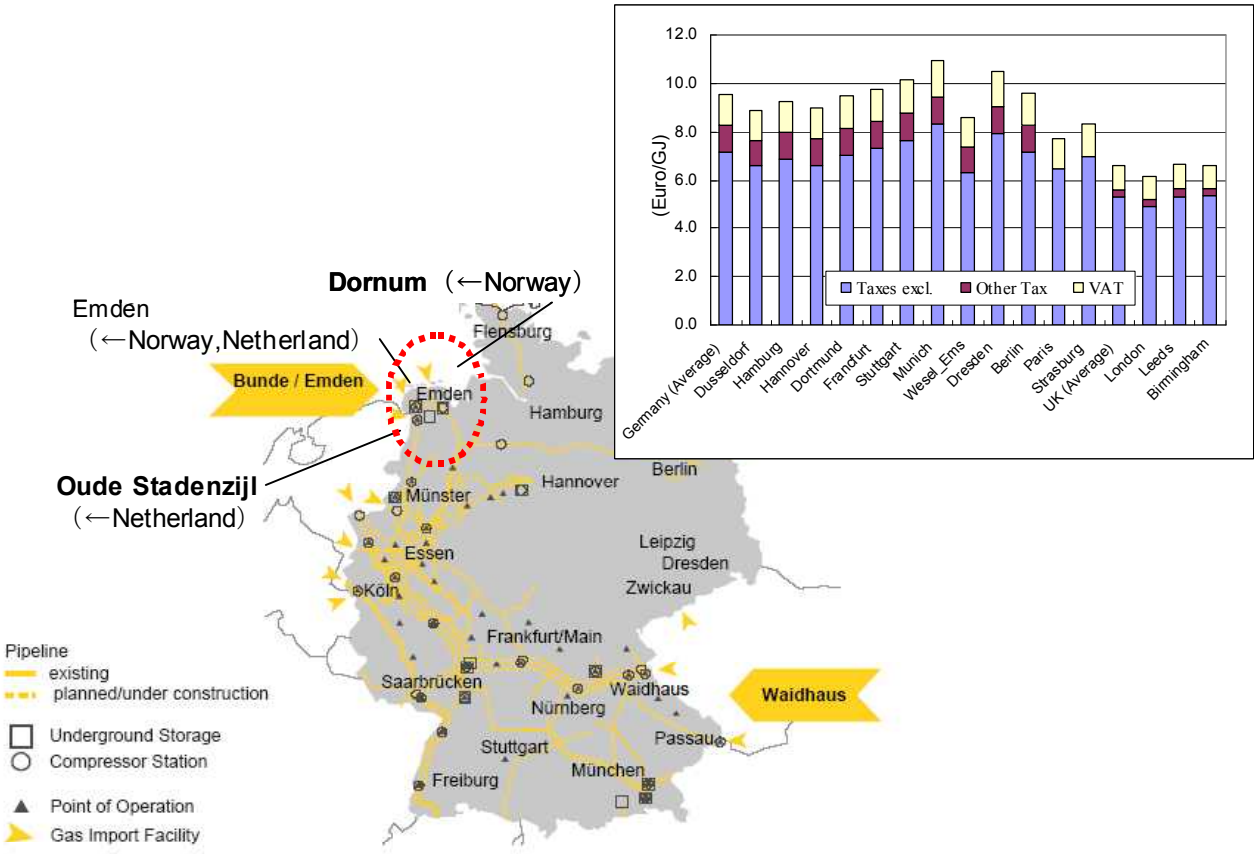
Source: IEA, "Natural Gas Information" etc.

Figure 2-4 Outline of Gas Release Program Accompanying E.On-Ruhrgas Merger in Germany

- Electricity utility E.On's acquisition of major gas company Ruhrgas in Germany was approved by the Federal Ministry of Economics and Labor in August 2002. Then, concern emerged regarding market oligopolization.
- The ministry then made Ruhrgas's gas release one of the conditions for E.On's acquisition of the gas company. Ruhrgas was subsequently required to regularly auction gas for new market entrants over a period of six years from October 2003. Each auction covers a three-year gas release.
- The first gas release auction covered 16 TWh. Toward the second auction, the ministry and Ruhrgas reviewed the first one and agreed on some improvements. First, Ruhrgas was required to include price indicators of fuel oil as competitive fuel into factors for setting lowest bid prices. Second, the minimum daily delivery conditions were eased. Third, new market entrants were allowed to receive gas at Waidhaus in the Southeast as well as Bunde/Emden in the Northeast (see Figure 2-5). The third measure is significant with regard to whether effective gas price competition between German firms and foreign companies (including French and Italian firms) could be promoted in the South where gas prices are relatively higher.

Source: Institute of Energy Economics, Japan

Figure 2-5 German Hubs as well as industrial gas price comparison between EU major cities (as of 2003)



Source: "Ruhrgas Gas Release Programme- The latest Update", Team Consult's Colloquium VII, March 2004 etc.

2-2 Promoting Utilization of Storage Systems

The EU's amended gas directive[4], adopted in June 2003, provides for third party access to storage systems, which is indispensable for allowing new gas market entrants to follow appropriately customers' changing demand and for promoting fair competition between these new entrants and incumbents (see Figure 2-6).

In line with the principle under the amended EU gas directive, the European Gas Regulatory Forum[5] compiled a guideline in March 2005 on services and rules for third party access to storage systems.

[4] The gas directive in August 1998 provided for gradual deregulation, access to pipeline networks, separate accounting for transportation, storage and distribution, and other standards. The amended gas directive in June 2003 called for such measures as the expansion of scopes specified in the 1998 directive for deregulation, the acceleration of the deregulation schedule, the separation of transportation, storage and distribution companies, the creation of an independent regulatory agency, and incentives for new natural gas infrastructure investment.

[5] The European Gas Regulatory Forum comprises gas market participant organizations, regulators (the European Commission and national regulatory agencies),TSOs, associations of traders and consumer groups etc. to consider the gas industry system for the whole of Europe. The forum, though having no binding force itself, is positioned as an important harbinger of the future course of the European gas industry system.

Figure 2-6 Outline of Amended EU Gas Directive

- Deregulate gas markets other than the residential market by July 2004. Complete full gas market opening by July 2007.
- Legal-unbundling supply functions from transportation/distribution functions. (Cases where a distribution firm becomes too small to shoulder related financial and management burdens are exempted from this measure.)
- Guarantee public service obligations (PSOs) and protect consumers. The PSO covers a wide range of matters from the stability of gas supply, quality and prices to the improvement of energy efficiency.
- Promote third party access to gas storage systems.
- Others (monitoring each country's natural gas supply/demand conditions, creation of an independent regulatory agency, third party access to new natural gas infrastructure etc.)

Source: Institute of Energy Economics, Japan

3. U.S. Gas Transportation Services by LDCs

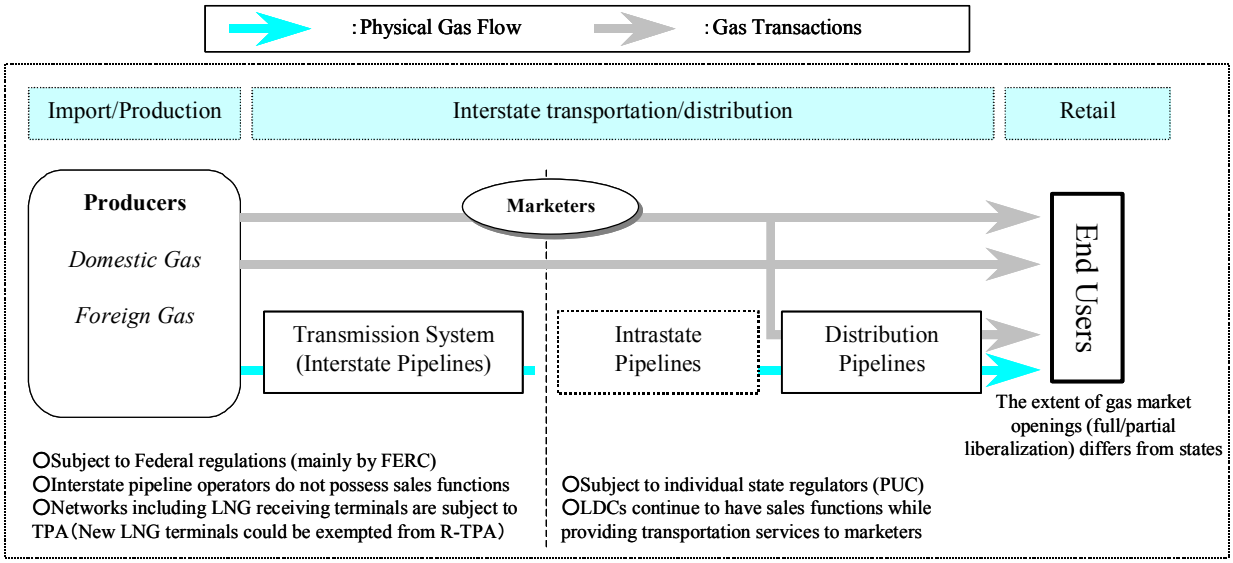
A final report by the Japanese Urban Thermal Energy Subcommittee of the Advisory Committee for Energy in June 2006 presented conclusions on such matters as the gas transportation services according to more gas market opening, rules of new pipeline investment by the entity other than city gas utilities and more flexible receipt of gas with different calorific value regarding transportation services.

In this section, we compare gas transportation systems that are significant for gas market deregulation in Japan and Western countries. The comparison indicates transportation system differences attributable to gas market liquidity gaps as reviewed above.

Here, we will focus on U.S. local distribution companies from the viewpoint of deregulation of retail sales to end users.

When delivering gas to end users, a new market entrant, or a marketer, must conclude gas transportation contracts for both interstate and distribution pipelines (see Figure 3-1). (Alternatively, the marketer may choose the so-called bypass supply that does not use LDC pipeline networks.)

Figure 3-1 Gas Transctions and Flows in the U.S. Gas Market



Source: Institute of Energy Economics, Japan

3-1 General Procedures concerning LDCs' Transportation Services

There are some processes for new market entrants (called "marketers" in the United States) in utilizing local distribution companies' transportation services.

Four basic processes are demand forecasting, pipeline capacity nomination/ confirmation, balancing (adjustment of demand-supply gaps) and billing.

3-1-1 Demand Forecasting

In some U.S. states that have fully deregulated the gas market including sales to residential and other small users, LDCs estimate demand from customers subject to gas transportation, inform marketers of such estimates and request gas procurement in line with these estimates. This means that the demand estimator is not a marketer but an LDC.

In making a gas demand estimate, an LDC bases a daily demand estimate for a customer based on the past consumption pattern, and weather and other variable factors.

For example, KeySpan, a major LDC in New York, estimates customers' consumption under normal weather conditions. It does not reflect temperature forecasts in demand estimation. Based on gas consumption and degree-days[6] for a particular month in the past two years, an LDC makes a consumption estimate under normal weather conditions (degree-days as set by the Public Service Commission) and informs a marketer of the estimate.

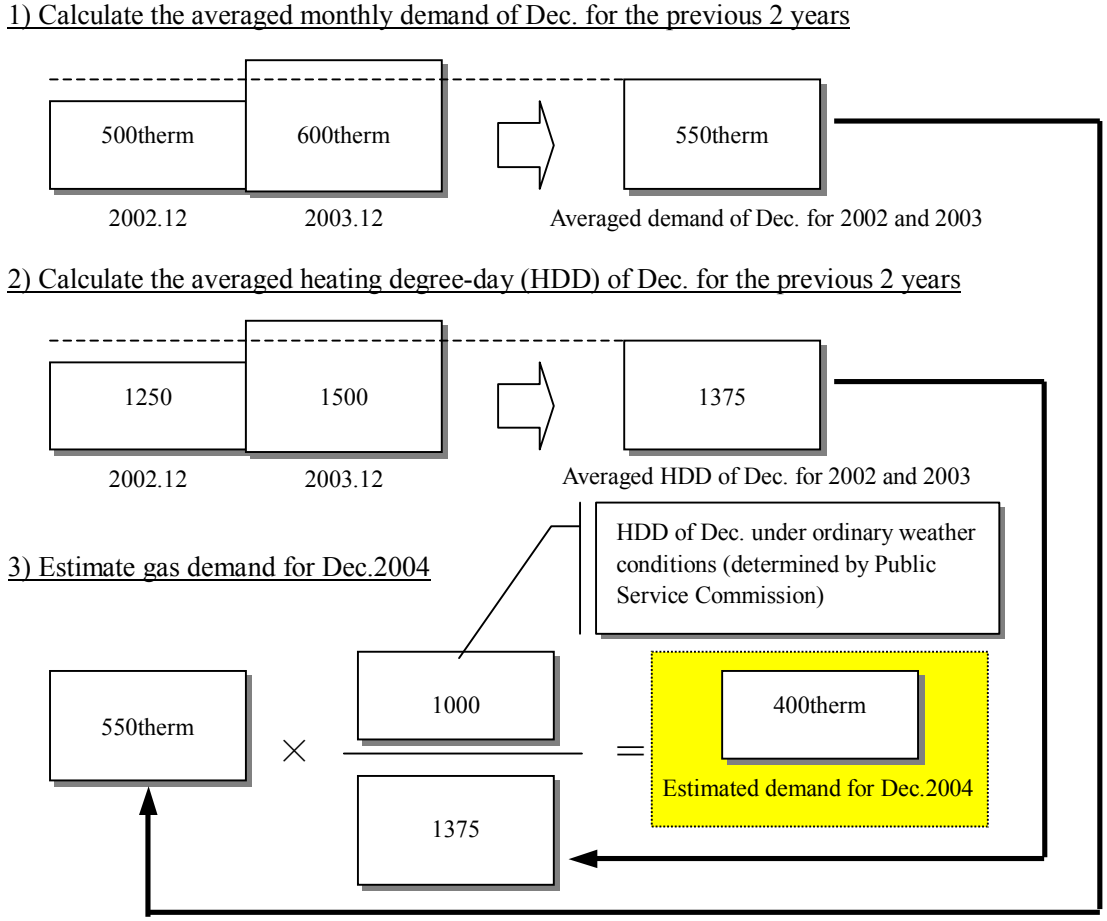
The demand estimation method requires a marketer to procure more gas than needed in a

[6] This measure is used for projecting heating demand. The daily figure is based on a gap between a preset temperature for heating (65 degrees Fahrenheit or 18.3 degrees centigrade in the United States) and is multiplied by the number of days for a specific period of time like a winter season.

warmer-than-usual winter. The past tariff had set unit prices at lower-than-usual levels for the excessive procurement, prompting marketers to file complaints. In response to such complaints, the tariff was revised in July 1999 to use market prices for the excessive procurement and reduce the daily demand estimate in a warmer-than-usual winter.

Figure 3-2 Example of Demand Forecasting by KeySpan concerning transportation services

- Case: Forecasting the transportation customers' demand of Dec. 2004-



Source:FY 2003 survey report on "U.S. Local Distribution Companies' Gas Transportation Service and the Relevant Code of Conduct" also entrusted by the ministry

Regarding the accuracy of the demand estimation, U.S. energy consultant Energy Expert International mentions that real demand other than electricity generation deviated by up to some10% from a daily estimate for PG&E, a local distribution company in California, in January 2006.

In Illinois, real monthly billing data are checked against demand estimates for each LDC. There are a few cases similar to the PG&E case where real demand deviates by up to 10% from an estimate. At Nicor Gas, a major local distribution company in Illinois, cases where the deviation is less than 10% are limited to 55% of the total.

These data are for all users who receive supply from an LDC and fail to reflect demand from individual users or a group of users for a specific marketer. In this sense, these data indicate one trend of the accuracy in LDCs' demand estimates provided to marketers.

Table 3-1 Accuracy of Demand Estimation Methods for Illinois LDCs (based on billing data)

Error Tolerance Levels	Illinois Power Method	Peoples Method	Nl-Gas Method	CILCO Methods		
				Year-ago Method	Month-ago Method	Year-ago, if data available, else Month-ago Method
+/- 10%	32%	31%	55%	32%	10%	20%
+/- 15%	43%	44%	69%	44%	14%	28%
+/- 20%	51%	53%	78%	56%	18%	36%
+/- 30%	63%	65%	87%	73%	28%	48%
+/- 50%	79%	78%	94%	87%	55%	71%

Source: Illinois Commerce Commission, "Gas BILL Estimation Study," September 2001

3-1-2 Pipeline Capacity Nomination and Confirmation

When nominating transportation capacity, marketers may use electronic bulletin boards to obtain relevant information from LDCs.

Marketers make registrations on the EBB and nominate dates, pipelines (interstate pipelines) and capacity for gas transportation and LDCs confirm these matters.

For deals where LDCs undertake transportation without their discretionary supply restrictions under firm contracts, LDCs may be asked to confirm whether gas will be procured as required by marketers and whether sufficient interstate pipeline capacity will be secured.

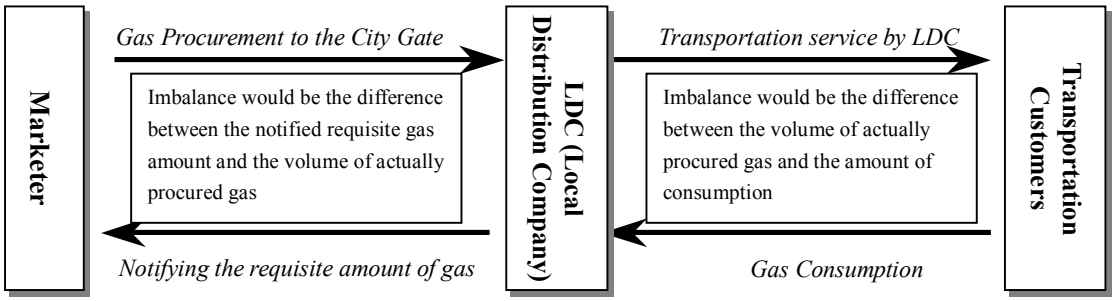
3-1-3 Balancing ((balancing of supply-demand gaps)

Gaps between real gas consumption and transportation (procurement) may be identified in the following two stages for customers receiving gas transportation services:

(i) A marketer delivers gas to an LDC network entrance (city gate) through an interstate pipeline.

(ii) Gas is transported to customers within an LDC network.

Figure 3-3 Basic concepts of "imbalance" in transportation services



Source: Institute of Energy Economics, Japan

Marketers procure gas as required by their transportation service customers for delivery (through interstate pipelines) to LDCs that use their networks for gas delivery to the customers. LDCs may estimate the amounts of gas required for procurement and notify marketers of these estimates. Any imbalance between LDC-notified amounts and marketer-procured amounts may be subject to the so-called "city-gate balancing."

Within an LDC network (after the city-gate balancing), customers' real gas consumption may not necessarily match marketer-procured amounts. Storage services may then be used to balance real consumption with real procurement. Any imbalance left after such adjustment may be subject to commodity cash out where some penalty (imbalance penalty) as well as gas costs may have to be paid.

Such balancing to identify supply/demand gaps is done on a daily or monthly basis for a representative U.S. LDC (on an hourly basis in Japan).

For balancing cash-outs, unit prices may differ depending on gaps or some penalty may be imposed.

The following is a representative case covering unit gas prices for financial adjustments at Con Edison in New York State (see Table 3-2):

Table 3-2 Outline of Monthly Financial Gas Balance Adjustments at Con Edison (New York State)

Billed fees	Percentage gap	Unit price of adjustments
Monthly cash-out credit (Con Edison gas purchases)	~10%	(Wellhead gas price + Transportation cost) x 100%
	10+~15%	(Wellhead gas price + Transportation cost) x 90%
	15+~20%	(Wellhead gas price + Transportation cost) x 85%
	Over 20% (summer)	(Wellhead gas price + Transportation cost) x 70%
	Over 20% (winter)	(Wellhead gas price + Transportation cost) x 60%
Monthly cash-out charge (Con Edison gas deliveries)	~10%	City gate gas price x 100%
	10+~15%	City gate gas price x 110%
	15+~20%	City gate gas price x 115%
	Over 20% (summer)	City gate gas price x 130%
	Over 20% (winter)	City gate gas price x 140%

Source: Consolidated Edison Tariff

3-1-4 Billing

Customers (for transportation services) receive "separate bills from LDCs and marketers" or "consolidated bills from LDCs or marketers."

3-2 Characteristics of U.S. Gas Transportation System

Of the U.S. gas transportation process in 3-1 and the gas flow in 1-1, LDCs' estimation of potential gas demand for marketers and notification of such estimates, and balancing may indicate infrastructure constraints that are different from those seen in Japan.

In Japan, infrastructure constraints regarding wide-area pipelines and underground storage facilities to adjust the imbalance of gas supply and demand have prevented a wholesale gas market from being developed. The type of new market entrants that can flexibly procure and supply gas in accordance with changes in demand from target customers is limited.

If gas network transportation services expand further despite the limited flexibility in gas procurement and supply in Japan, gas supply-demand adjustments may have to be done more carefully. Gas transportation demand estimates made by gas utilities (including pipeline operators) or new market entrants may have to be more accurate than in the United States[7].

In the United States, gas procurement through interstate pipelines and underground storage systems allow gas supply and demand to be easily adjusted, even if demand estimates are not so accurate. Any demand-supply imbalance is identified on a daily or monthly basis. This practice might have worked well so far , and have brought no severe gas network operational problems.

For example, Illinois State's Nicor Gas, as reviewed earlier, has provided marketers with back-up services utilizing underground storage facilities. Imbalances left after the back-up services are subjected to balancing cash-outs.

Specifically, Nicor Gas has different back-up services for residential and small commercial customers (subject to "Customer Select" transportation services) and other customers as follows:

3-2-1 Customer Select

Imbalances, which are resolved monthly, reflect underground storage systems' operations as well as gaps between marketers' (or suppliers') monthly transportation and transportation service customers' monthly consumption.

For an imbalance at the end of a month, an amount up to three times the maximum daily contract quantity (MDCQ) may be included in consumption in the next month. Any excess over this portion may be resolved with gas costs for the relevant month.

Monthly gas costs are based on Chicago gas costs for LDCs (or Chicago city-gate prices)

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[7] In Japan where gas transportation and demand are adjusted on an hourly basis, one option is to improve the accuracy of hourly demand estimates. Another option would be to introduce a looser (ex. daily) demand estimation and balancing system closer to Western systems. Both options can be cited for future consideration.

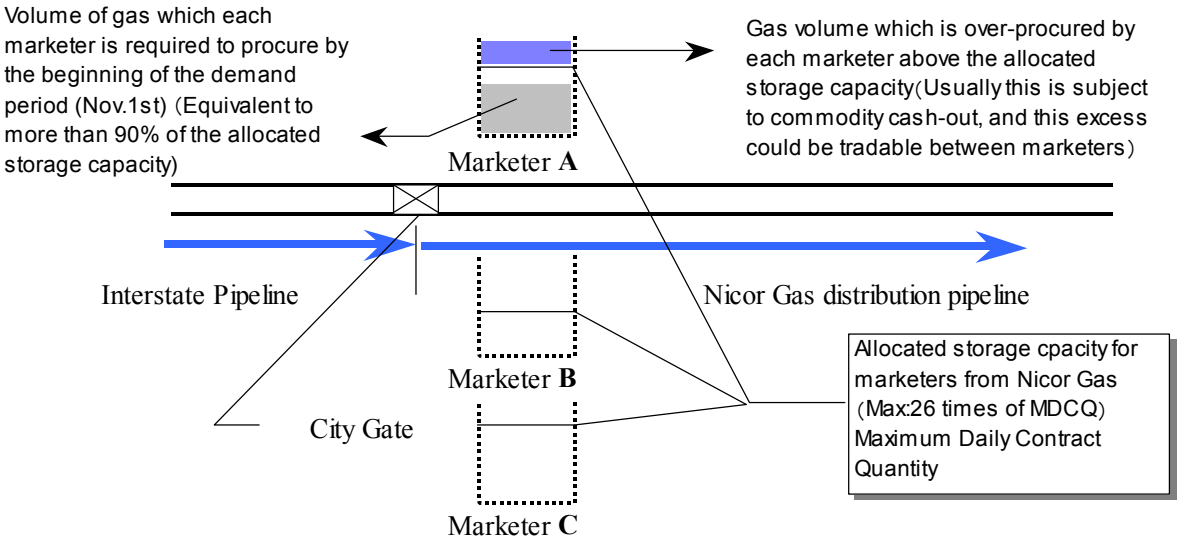
as surveyed by the online Gas Daily or gas costs for large customers.

3-2-2 Balancing Services Available for Marketers

Nicor Gas provides marketers (suppliers) with a storage capacity allocation service called "Storage Banking Service." The service allows a marketer to obtain a storage capacity equal to 26 times the MDCQ of its customers for transportation services[8]. A marketer is required to have procured at least 90% of an assigned storage capacity at the beginning of the demand season starting November 1.

If the amount of gas procured by a marketer exceeds consumption and the assigned storage capacity, an excess cost (10 cents per therm[9]) may emerge monthly. But such excess gas may be sold to other marketers (suffering from gas deficits).

Figure 3-4 Outlines of Storage Banking Service by Nicor Gas



Source: FY 2005 METI Survey on Infrastructure for Promotion of Natural Gas Introduction in Rural Cities "Overseas and Domestic Gas Market Survey"

[8] The service does not necessarily allow marketers to individually reserve capacity at specific underground gas storage facilities. Instead, the service may allow Nicor Gas and marketers to manage gas storage levels, gas receipts and deliveries on a virtual basis by utilizing surplus capacity like bank deposits in view of storage system operations.

[9] The "therm" is a caloric unit of natural gas. 10 therms = 1 dekatherm = 1 million Btu (British thermal unit). One therm is also equal to about 2.29 cubic meters.

Table 3-3 General Characteristics of Major LDCs' Transportation Services

	Distribution networks		
	New York	**California**	**Illinois**
Gas market overview and network characteristics	- Subject to deregulation are any user who annually consumes 35,000 therms (about 80,000 cubic meters) or more and any group of users that annually consumes 50,000 therms (about 115,000 cubic meters) or more. - Gas production and storage systems have not been developed within the state. It is important to secure interstate pipeline capacity for the winter demand season.	- Marketers and other non-LDC players are allowed to supply gas to non-core customers or core aggregations consuming more than 250,000 therms per year. - Major LDCs PG&E and SoCal occupy 75% of the state gas market. - LDCs are not subject to regulations on interstate pipeline capacity openings.	- The state's gas market deregulation is not necessarily based on specific measures. Instead, LDCs propose pilot programs subject to approval by the ICC (Illinois Commerce Commission). - LDCs have provided industrial and other large customers with transportation services since some 20 years back. For small customers, LDCs Nicor Gas, Peoples Gas and North Shore Gas started pilot programs by 2002. - Illinois has become a hub of interstate pipelines. Interstate gas transactions and supply from storage systems within the state are larger than indicated by gas consumption within the state.
Demand estimation	**(Con Edison)** - Demand estimation is done based on balancing services chosen by transportation customers or Con Edison. In most cases, customers' demand estimates are chosen. **(KeySpan)** - In principle, KeySpan makes demand estimates and notifies them to transportation service customers. Demand estimates are based on consumption and degree-days in the past year, rather than future weather forecasts.	- Demand estimates for transportation service customers are based on the previous day's consumption, past trends, predetermined customer-specific business load, demand and price estimates by the Energy Information Administration and research institutes, etc. - LDCs have not published details of their demand estimation methodology. Most LDCs use demand estimates that take the temperature sensitivity into account.	**(Nicor Gas)** - Nicor Gas makes demand estimates. - Nicor Gas notifies marketers of the coming year's consumption estimates, storage system operations, estimated gas balance data for storage systems and MDCQ (maximum daily contract quantity) data on a monthly basis. - Nicor Gas also provides marketers with daily consumption estimates 10 days before a month starts.
Approach on capacity nomination	**(Con Edison)** - Transportation service customers are required to nominate irrevocably firm capacity for one or all five interstate pipelines and delivery point capacity for the Con Edison network for the winter season. **(KeySpan)** - KeySpan releases part of the winter interstate pipeline capacity. - Transportation service customers who reject part or the entire allocated capacity may be prohibited from using the rejected capacity.	**(PG&E)** - New customers conclude gas transportation service contracts specifying demand estimates to meet the needs of their gas appliances for the next 12 months and receive gas supply. **(SoCal)** - SoCal does not allocate transportation capacity for its distribution network. It provides customers with gas through its distribution network on behalf of transportation service providers. - If interstate pipeline capacity other than that for basic LDC demand is available, the available capacity may be released.	**(Nicor Gas)** - Under the CustomerSelect program for residential and small commercial customers, transportation service customers are required to conclude firm gas supply contracts with Nicor Gas for transportation to city gates based on firm interstate pipeline capacity nomination contracts for the winter season.
Capacity nomination process	**(Con Edison)** - The TCIS web system or fax is used for the capacity nomination. - The pre-month nomination is made for the next month. If there is	**(PG&E)** - A marketer can file a capacity nomination application with PG&E through the INSIDEtracc electronic bulletin board system four times a	**(Nicor Gas)** - The capacity nomination may be made thorough the GasExchange electronic bulletin board system.

	any change, a daily nomination may be made by the business day just before the transportation day. **(KeySpan)** - The capacity nomination may be made through the electronic bulletin board. - Four types of nomination schedules are adopted to meet the standards of the North American Energy Standards Board. A schedule may be modified once on the day just before the transportation day or twice on the transportation day.	day. - Advanced contracts for transportation of fixed quantities precede additional contracts. **(SoCal)** - A marketer can file a capacity nomination application with SoCal through the Envoy electronic bulletin board system four times a day. - A nomination application cannot be cancelled. But transportation amounts may be changed for the evening and on an intraday basis.	- Nicor Gas notifies each marketer of a required daily delivery (RDD) quantity. Based on the notice, each marketer makes a capacity nomination. - Nicor Gas accepts only one gas transportation nomination for each transportation day.
Balancing	**(Con Edison)** - There are six balancing services for firm transportation and interruptible/off-peak transportation. **(KeySpan)** - An imbalance between a marketer's daily transportation and nomination quantities is financially resolved as gas costs. - The daily commodity cost of gas multiplied by an imbalance quantity is used for a balancing cash-out. If a marketer's daily transportation quantity exceeds a nomination quantity, KeySpan may make a balancing cash-out to the marketer. In a reverse case, the marketer may make a balancing cash-out to KeySpan.	**(PG&E)** - There are monthly balancing and self-balancing cash-outs. The monthly balancing cash-out tolerates an imbalance more flexibly and is chosen by most transportation service providers. - There are commodity and transportation cash-outs. For commodity cash-outs, gas prices at interstate pipeline hubs and bid week benchmarks are used. For transportation cash-outs, unit prices by transportation channel are used. Unit prices are higher for transportation surpluses than for shortages. **(SoCal)** - Monthly consumption is subject to balancing cash-outs. If an imbalance between application and real consumption quantities is limited to 10% or less, no cash-out is requested. But an imbalance for a month may be carried over to subsequent months. - For a transportation surplus, the lower of the minimum monthly unit gas price or the relevant month's unit price for consumers may be used as the unit price for a cash-out. For shortages, the unit price for billing is 150% of the highest gas price for the California-Arizona border plus a broker fee ($0.0266/MMBtu).	**(Nicor Gas)** - Marketers' balancing cash-outs reflect storage system operations as well as a monthly imbalance between customers' consumption (gas meter data) and transportation quantities. - Under the CustomerSelect program, imbalances are resolved monthly. Of an imbalance at the end of a month, a portion up to three times the maximum daily contract quantity (MDCQ) may be included in consumption in the next month. Any excess over this portion may be resolved with gas costs for the relevant month. Monthly gas costs are based on Chicago city-gate prices as surveyed by the online Gas Daily or gas costs for large customers.
Billing	**(Con Edison)** - Con Edison bills marketers. - Con Edison bills marketers for balancing cash-outs as well as for transportation services.	- An LDC bills a transportation service customer on a calendar-month basis. - Transportation service customers may receive separate bills from LDCs and sales firms like marketers. (Note) The state regulatory agency has called for consolidation of separate bills. In reality, however, bills are separated in most cases.	**(Nicor Gas)** - There are two billing options. One option is for separate bills from an LDC and a marketer. Another is for a consolidated bill made by an LDC or a marketer.

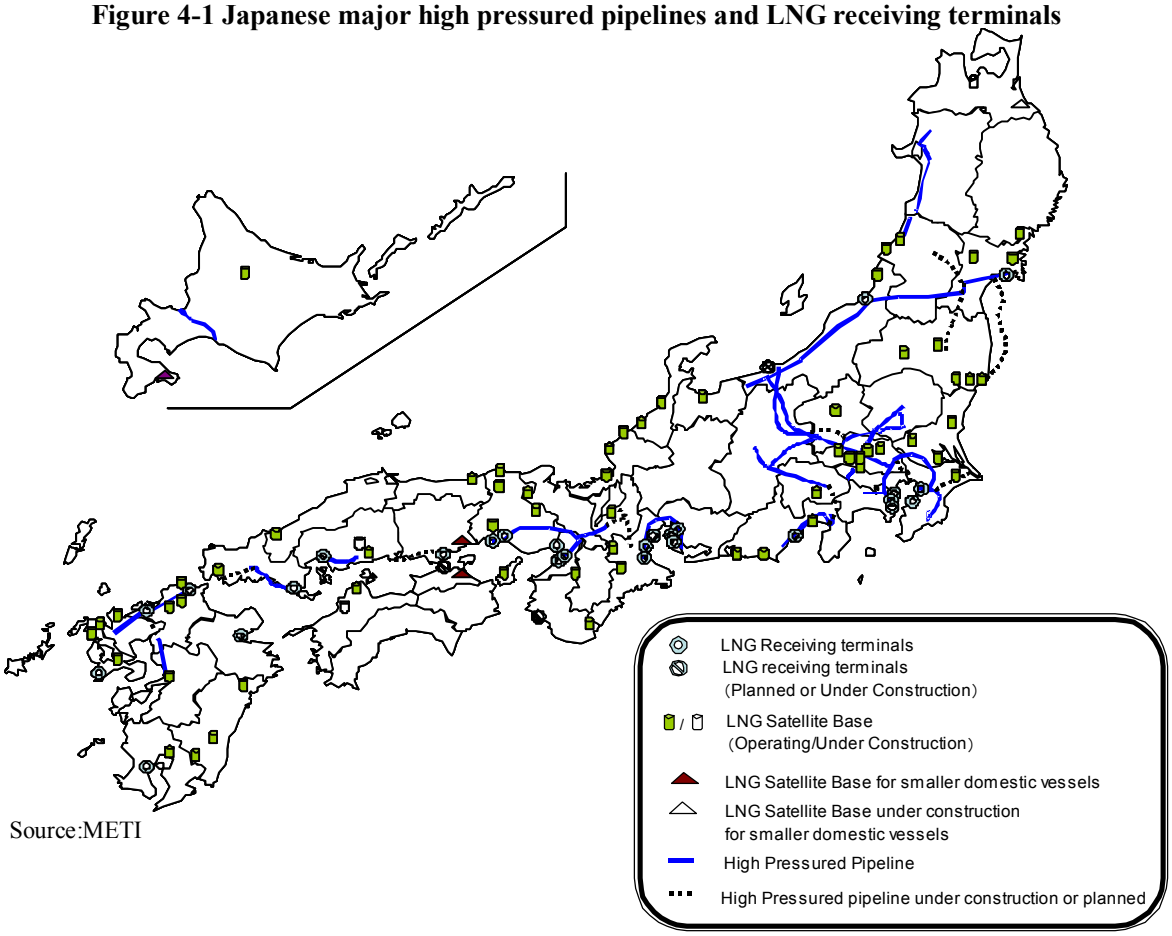
Source: FY 2005 METI Survey on Infrastructure for Promotion of Natural Gas Introduction in Rural Cities "Overseas and Domestic Gas Market Survey"

4. Japan's Characteristics Compared with Europe and U.S., and Future Problems

In Japan, LNG terminals partially play the role of European and U.S. underground storage systems (to adjust the imbalance between supply and demand). Therefore, it is not easy to compare gas market conditions in Japan and foreign countries. Japan's gas infrastructure development has the following characteristics:

- Gas trunklines covering the whole of Japan have not been developed. Pipelines for inter-regional cooperation have been limited (although some Western countries and states have more gas flow than indicated by their consumption, such a situation is difficult to expect in Japan). Naturally, the formation of pipeline hubs has also been limited (see Figure 4-1).
- In Japan, gas wholesale and retail transactions have been done through LNG lorries, LNG tank containers and domestic LNG vessels as well as pipelines. In consideration of geographical and demand conditions, Japan has promoted natural gas without limiting transportation means to pipelines.
- Japan depends only on LNG terminals for storing gas and adjusting gas supply to seasonal demand changes. Gas storage capacity's ratio to annual gas consumption in Japan is not necessarily as high as in foreign countries (see Table 4-1).

Figure 4-1 Japanese major high pressured pipelines and LNG receiving terminals



Source:METI

Table 4-1 Gas Storage Capacity and Annual Natural Gas Consumption in Japan and Foreign Countries (at the end of 2004)

Country	Annual consumption	Storage capacity				Storage/consumption
		LNG		Natural gas		
		Capacity	Revaporization capacity	Capacity	Releasing capacity	
Japan	83,548	8,563	391	0	0	10.2%
France	45,582	314	27	10,800	189	24.4%
Spain	27,012	621	51	2,121	13	10.2%
Italy	80,608	62	6	12,743	288	15.9%
Belgium	17,063	161	9	635	22	4.7%
Britain	102,550	0	0	3,586	131	3.5%
Germany	101,252	0	0	18,934	468	18.7%
U.S.	631,002	686	51	113,686	2,345	18.1%

Note: Consumption and storage capacity are in millions of cubic meters (MMcm), revaporization capacity in millions of cubic meters per year (MMcm/y) and releasing capacity in millions of cubic meters per day (MMcm/d). (U.S. data for 2003)
Source: IEA, "Natural Gas Information 2005"

Gas distribution and supply in Japan are less flexible than in Europe and the United States, as follows:

- Only some large gas utilities have looped pipeline networks like European and U.S. transportation pipelines where two-way gas flow is secured.
- Interruptible contracts and other supply-restricting options based on suppliers' descretions are substantially limited[10].

In the course of Japan's gas market deregulation, gas has competed with petroleum fuels and electricity (continuous drops in electricity charges have exerted pressure on gas prices to be lowered). At the same time, the size of new gas market entrants has been expanding due to large-lot supply through transportation services (see Table 4-2 and Figures 4-2 and 4-3).

Gas infrastructure development and gas flow liquidity in Japan are different from those in foreign countries. Unless gas liquidity, or flexibility in gas procurement and domestic supply, is secured, constraints on gas-to-gas competition may emerge in the near future.

[10] If gas supply rises and drops were to be controlled more flexibly in Japan or a certain domestic region, measures would have to be taken not only by gas utilities but also electricity utilities that consume most (some 70%) LNG imports and pursue the best fuel mix. This is because Japanese gas customers are not familiar with interruptible gas supply contracts.

Table 4-2 Increases/Decreases of Unit Gas Prices and Unit Operating Costs at Major Gas Utilities

(yen per cubic meter)

[Tokyo Gas Co.]

	1990-1994	1995-1999	2000-2004
Average unit gas price	-19.54	-5.68	-13.59
Raw material cost	-11.63	1.45	2.18
Wages	-2.12	-2.42	-5.91
Repair cost	-1.56	-0.60	-2.53
Other costs	-4.51	-4.22	-3.82
Depreciation	-2.47	0.00	-4.67

[Osaka Gas Co.]

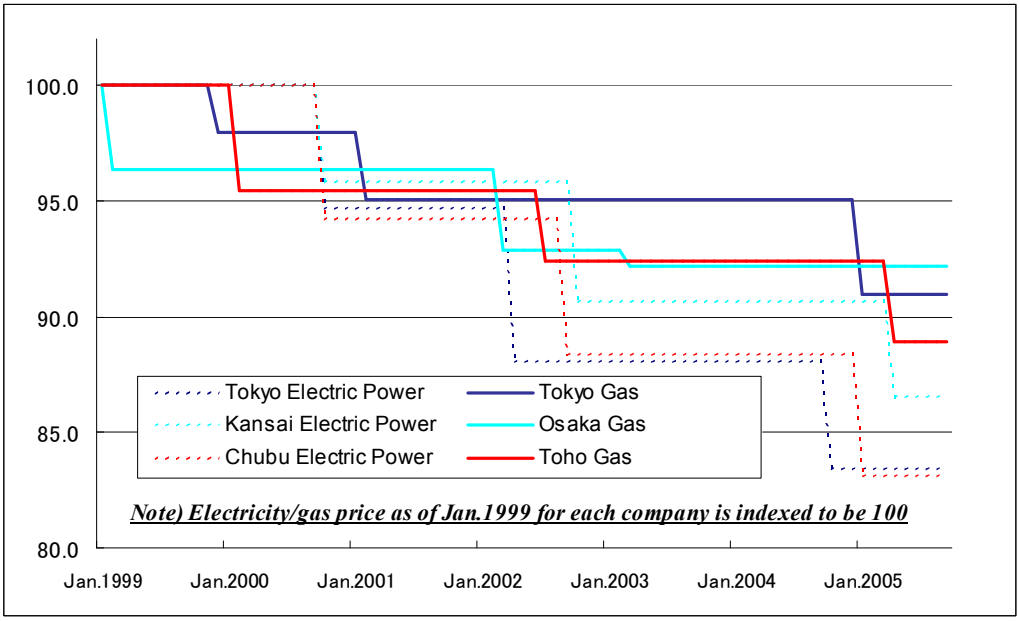
	1990-1994	1995-1999	2000-2004
Average unit gas price	-16.94	-7.96	-6.28
Raw material cost	-10.96	2.72	1.76
Wages	-1.90	-2.73	-4.20
Repair cost	-1.51	-3.23	-0.53
Other costs	-4.45	-4.45	-2.77
Depreciation	-1.44	-1.82	-1.81

[Toho Gas Co.]

	1990-1994	1995-1999	2000-2004
Average unit gas price	-14.10	-10.24	-9.39
Raw material cost	-17.32	1.35	1.55
Wages	-1.60	-4.39	-1.67
Repair cost	0.54	-1.88	-4.79
Other costs	-3.49	-4.10	-3.16
Depreciation	2.25	-3.34	1.64

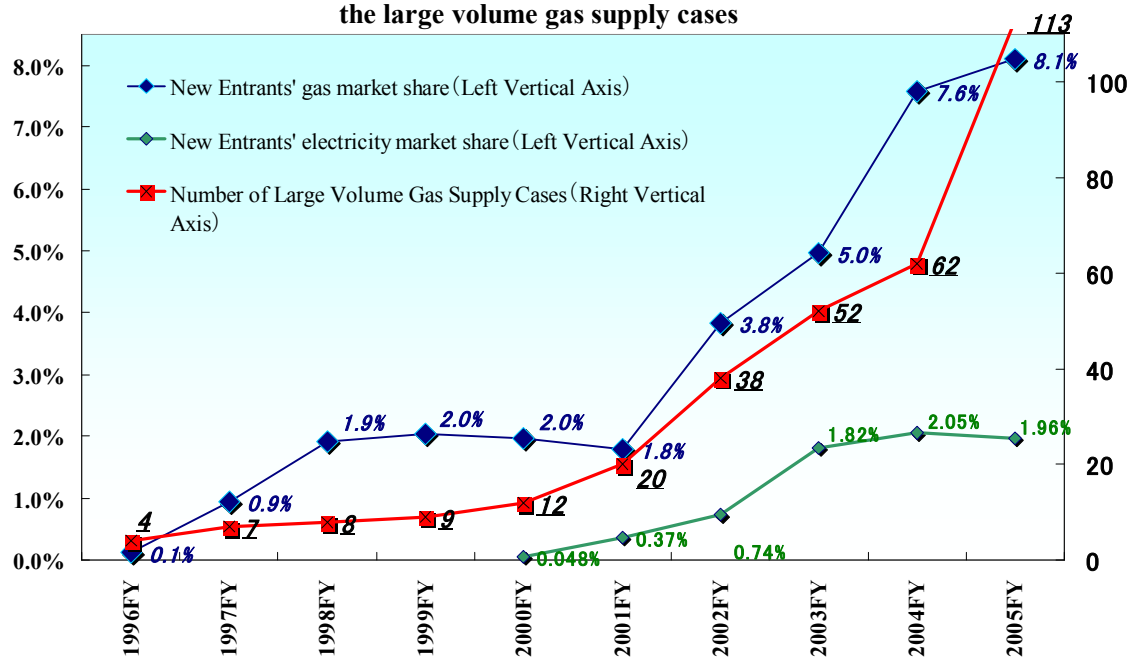
Sources: Financial statements published by major gas utilities

Figure 4-2 Revises of electricity/city gas prices by major Japanese electric/city gas companies



Source: FY 2005 METI Survey on Infrastructure for Promotion of Natural Gas Introduction in Rural Cities "Overseas and Domestic Gas Market Survey"

Figure 4-3 New Entrants' Gas Market Share in the liberalized sector as well as the number of the large volume gas supply cases



Source:METI

If the gas-to-gas competition as seen for gas market deregulation in Europe and the United States were to be required in Japan, how to procure price-competitive gas overseas would be primarily important for new and incumbent gas market participants. At the same time, we would have to consider how to secure Japan's gas market liquidity.

As reviewed above, Western countries, which have deregulated gas markets ahead of Japan, differ from Japan in gas infrastructure terms and have bases for developing a diversity of gas distribution means including widespread pipelines. Even these countries have continuously implemented enhanced TPA of storage and other gas infrastructure systems, gas release programs and other measures to increase gas market liquidity.

As seen in France, pipeline capacity shortages in some areas have become obstacles to new market entrants. Gas infrastructure development is thus viewed as the key to promotion of wider gas delivery and market competition.

In Europe and the United States, that are expected to depend more on foreign countries for gas supply, the development of gas infrastructure (including domestic and international pipelines and storage systems) is seen as important for security as well as deregulation or market integration reasons. In this sense, Japan may be able to learn from European and future European and U.S. infrastructure development and operational practices and the assessment of their effects and effectiveness.

In order to increase gas market liquidity, Japan will have to enhance existing pipeline

networks, interconnections of LNG terminals through pipelines or utilize other gas transportation measures (including domestic transportation vessels, containers and LNG lorries) to invigorate wide gas delivery[11]. At the same time, the enhancement of supply/demand adjustment functions (e.g. storage systems) will be important for more effective deregulation and energy security[12].

In this respect, pipelines can secure greater gas transportation capacity than other transportation means. The development of large-diameter, longer pipelines to interconnect existing networks will not only promote wide-area gas transactions but also allow a gas supply buffer to be created for adjustment by controlling the "line pack" (gas held within distribution networks).

When comparing gas market deregulation measures in Japan, Europe and the United States, this report discussed U.S. state-level cases of distribution networks (rather than transportation pipelines) regarding transportation services as a key element to invigorate market competition. Gas transportation services differ from one state to another or from one LDC to another based on interstate trading and storage infrastructure conditions (differences are seen in balancing period for counting gas supply-demand imbalances and balancing cash-out conditions).

Therefore, Japan should not establish any unified transportation services but allow gas market players to choose transportation services meeting the respective conditions of gas network.

We can refer to various U.S. state-level cases regarding gas transportation services. However, we do not have to focus on any single case. We should fully analyze gas network development levels and gas flow characteristics behind various gas transportation services, put in order various services in U.S. states and Europe and reflect them in Japan's gas transportation service system as necessary.

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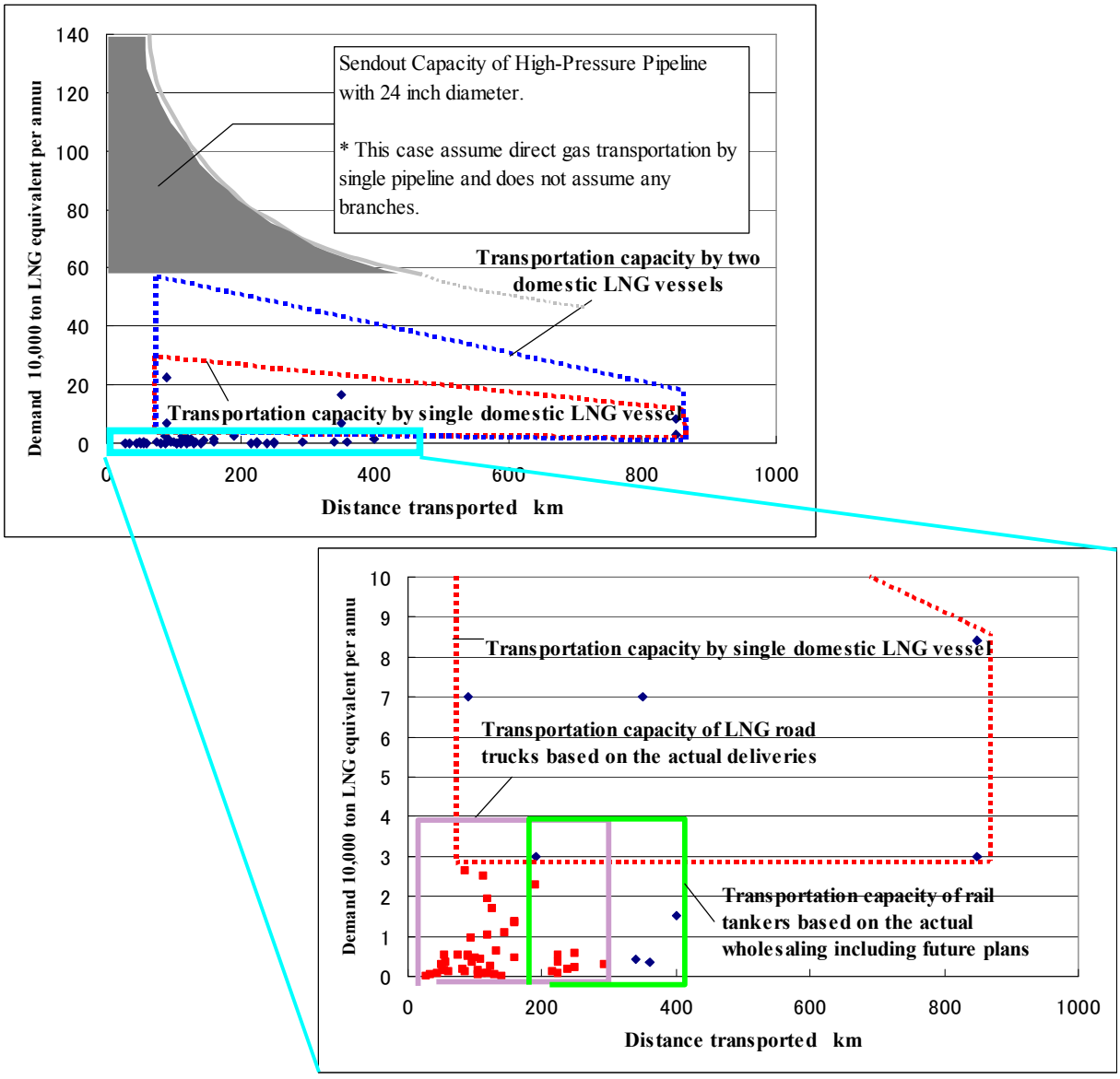
[11] At the Urban Thermal Energy Subcommittee's gas policy group, an advisory panel to consider Japan's urban gas services under the Advisory Committee for Energy, a member proposed measures to require gas and electricity utilities to sell some of their LNG imports to new large gas suppliers. This is similar to the gas release system introduced in Europe.

These measures' feasibility in Japan should be considered after the nation's present gas wholesale market through pipeline, LNG lorries, domestic shipping freighters and railway containers are full evaluated.

[12] On natural gas, the new national energy strategy, as adopted by Japan in May 2006, indicates the following guideline giving priority to comprehensive measures covering from the upstream sector (drilling and production) to the downstream sector (wholesales, retail sales and other distribution operations in consumption regions):

- The private sector will enhance overseas oil and natural gas development. The government will support such private sector efforts with resources diplomacy and risk money provision.
- Japan will enhance natural gas procurement capacity through strategic inter-company alliances, energy technology strategy development and support for technology development.
- The government will conduct surveys and discussions on the development of wide-area natural gas pipelines and underground storage systems to improve energy security and invigorate wide-area delivery of natural gas.

Figure 4-4 Conditions preferable to each gas transportation mode concerning demand size and distance where gas is transported



Source:METI, "Evaluation on the feasibility of gas infrastructure as well as its induced effects on gas supply/trade" 2004

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