LNG:
Falling Prices and Increasing Flexibility of Supply
-Risk Redistribution Creates Contract Diversity-

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Objective of this Report

- Growing Voices Argue That LNG sales contracts,which cost comparatively high and lack flexibility,need to be reviewed if LNG demand should be expanded.
- Under such circumstances,the media reported cheap-priced LNG would be supplied to China.
- The Japanese LNG importers on their part are winning the suppliers' concessions to price cuts and more flexibility of contract volume the media reported negotiations by taking such opportunities as contract renewals.

- This report analyzes changing environment around LNG and key factors behinds the changes, based on which the future of LNG,including price levels and pricing formulas,is discussed.

Contents

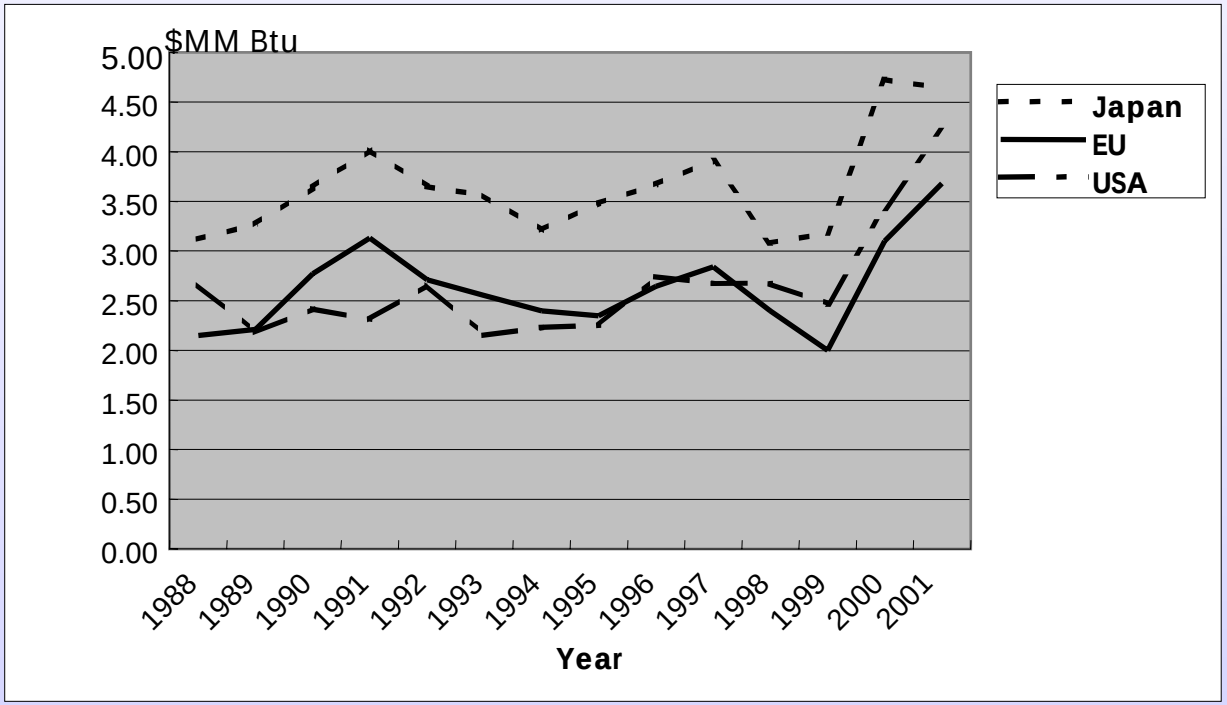
1. What is at stake?

-LNG projects effected by importers' risk taking-

What does the risk mean?

- To start up a LNG project involves huge capital outlayes(e.g. an Australian NWS project, commissioned in 1989, reportedly cost an investment of the a –trillion-yen mark)
- To raise the investment, the Japanese users, or would-be importers from the project, dared to assume considerable risks in such forms as:
- A sizeable contract volume, a contract term as long as lasting 20-25 years, the take-or-pay (TOP) clause (quantitative risk), and;
- Higher prices than in the U.S./Europe (price risk).

(1)Higher prices than in the U.S./Europe
- LNG Import Prices in Japan, the U.S. and the EU -



(Source) IEA, Energy Prices & Taxes

2000	JPN: 4.73$	EU: 3.10$	US: 3.43$
2001	JPN: 4.64$	EU: 3.68$	US: 4.22$

Pricing formula currently in use

- **P = AX + B + S curve**

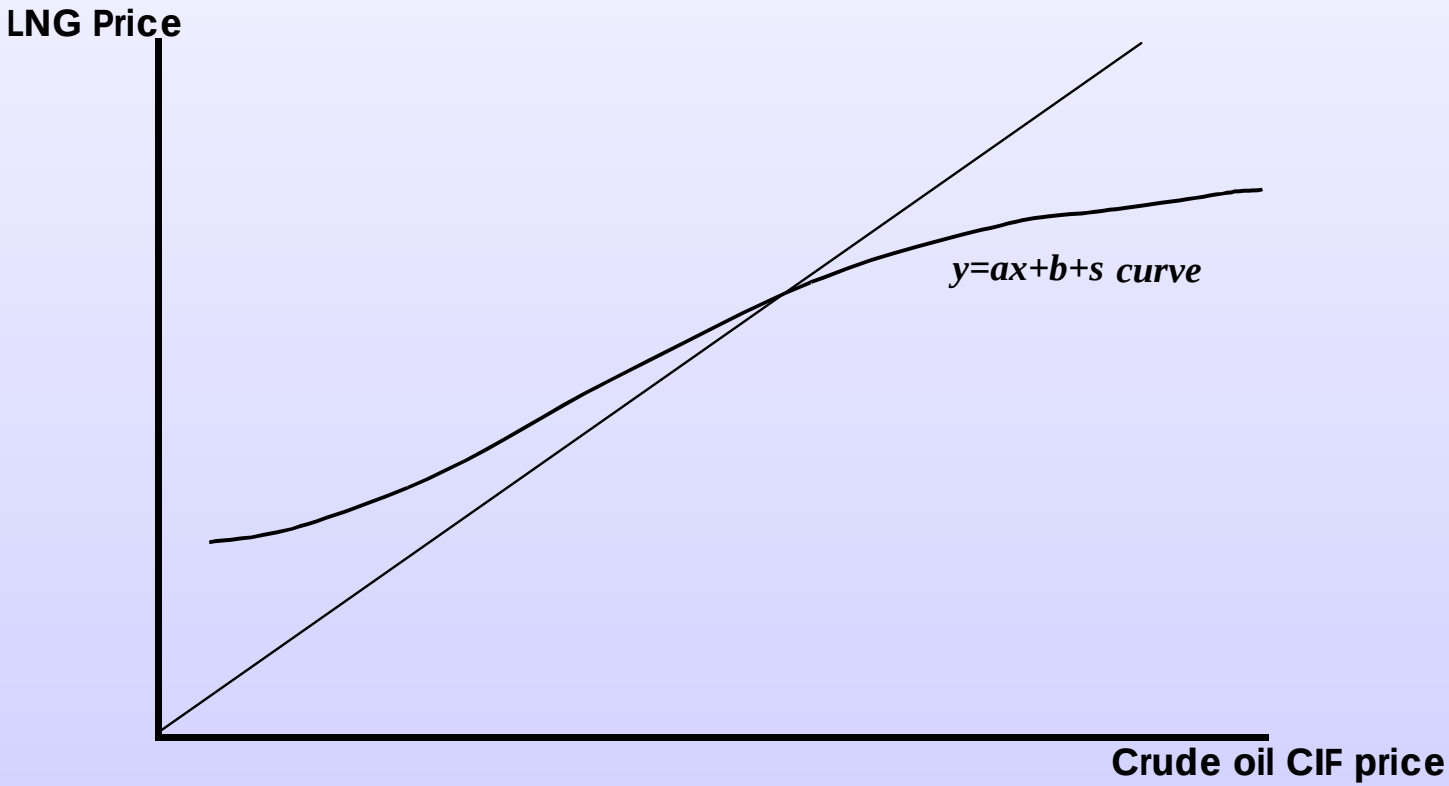
  A, B: Constants

  X: Crude oil CIF price

  S curve: A measure taken to flatten a tilt of the price curve when the curve stands above (or below) a certain price range.

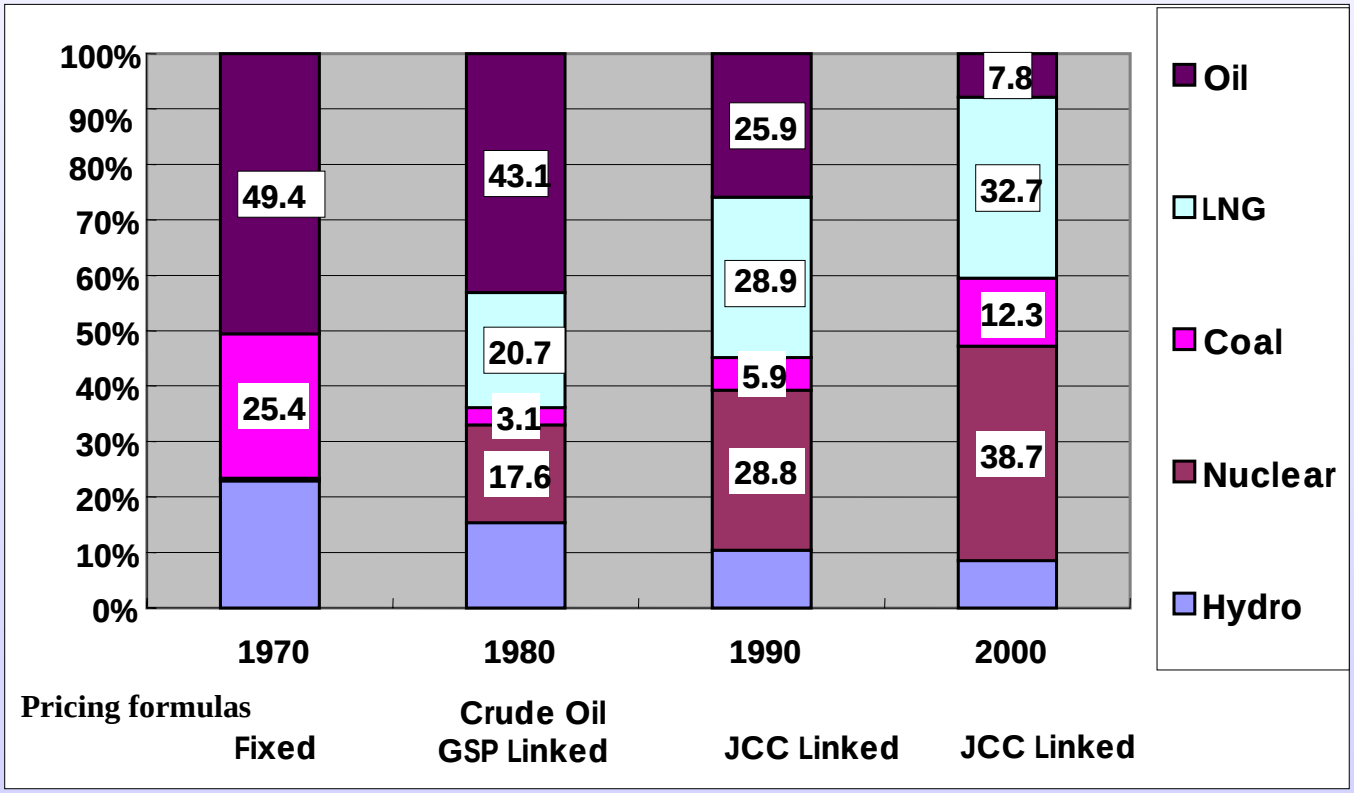
- **<u>Merit</u>: Smaller impacts of the crude price rises**
- **<u>Demerit</u>: Higher price than in the US/Europe**

A Conceptual Drawing of Pricing Formula



(Source) Prepared by IEEJ

Varying Power Source Mixes (9 Utilities) and Changing Pricing Formulas



(Source) IEEJ , EDMC "Handbook of Energy & Economic Statistics in Japan"

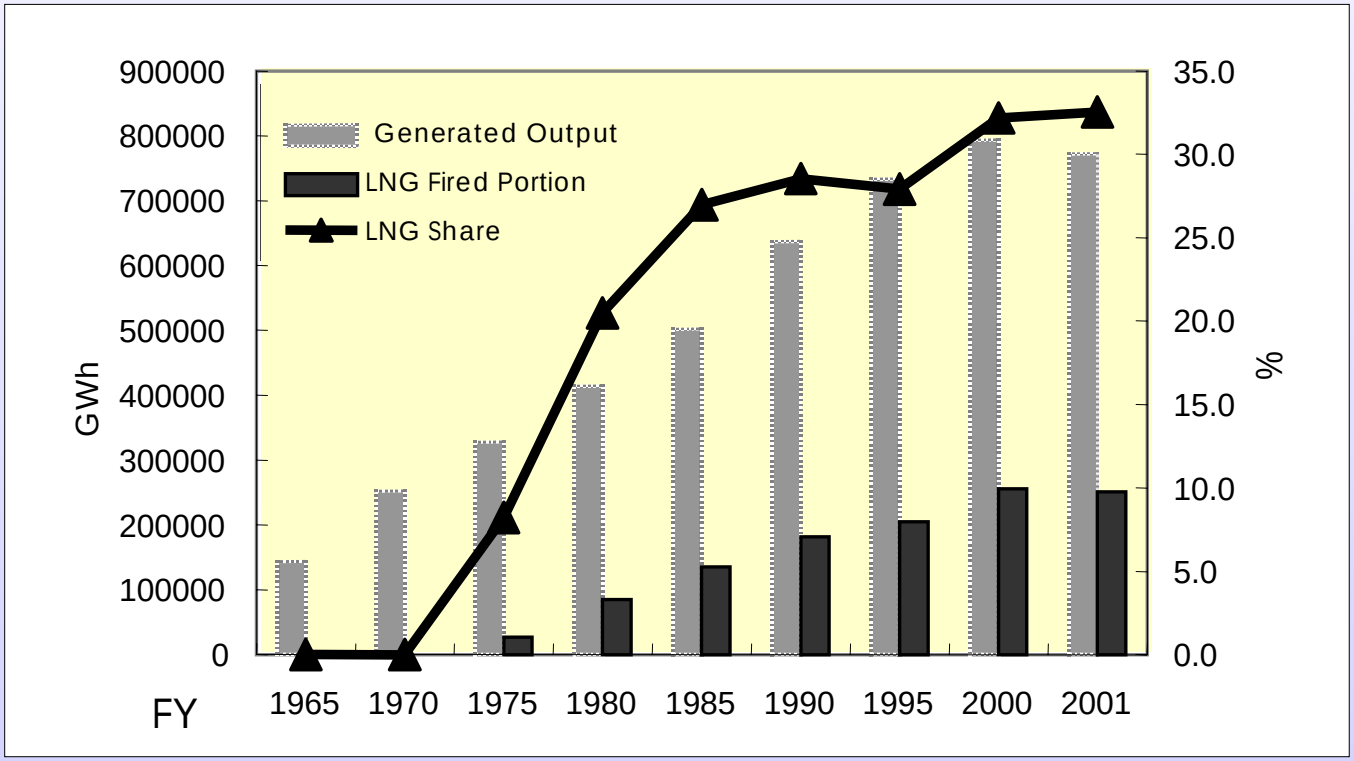
(2) Long-term and rigid trading conditions

Given the character of LNG projects,
LNG contract is characterized by:

A sizeable contract volume
A long contract term
Take-or-pay (TOP)
Bilateral contracts between specified sellers and buyers
Uniform/fixed-rate deliveries

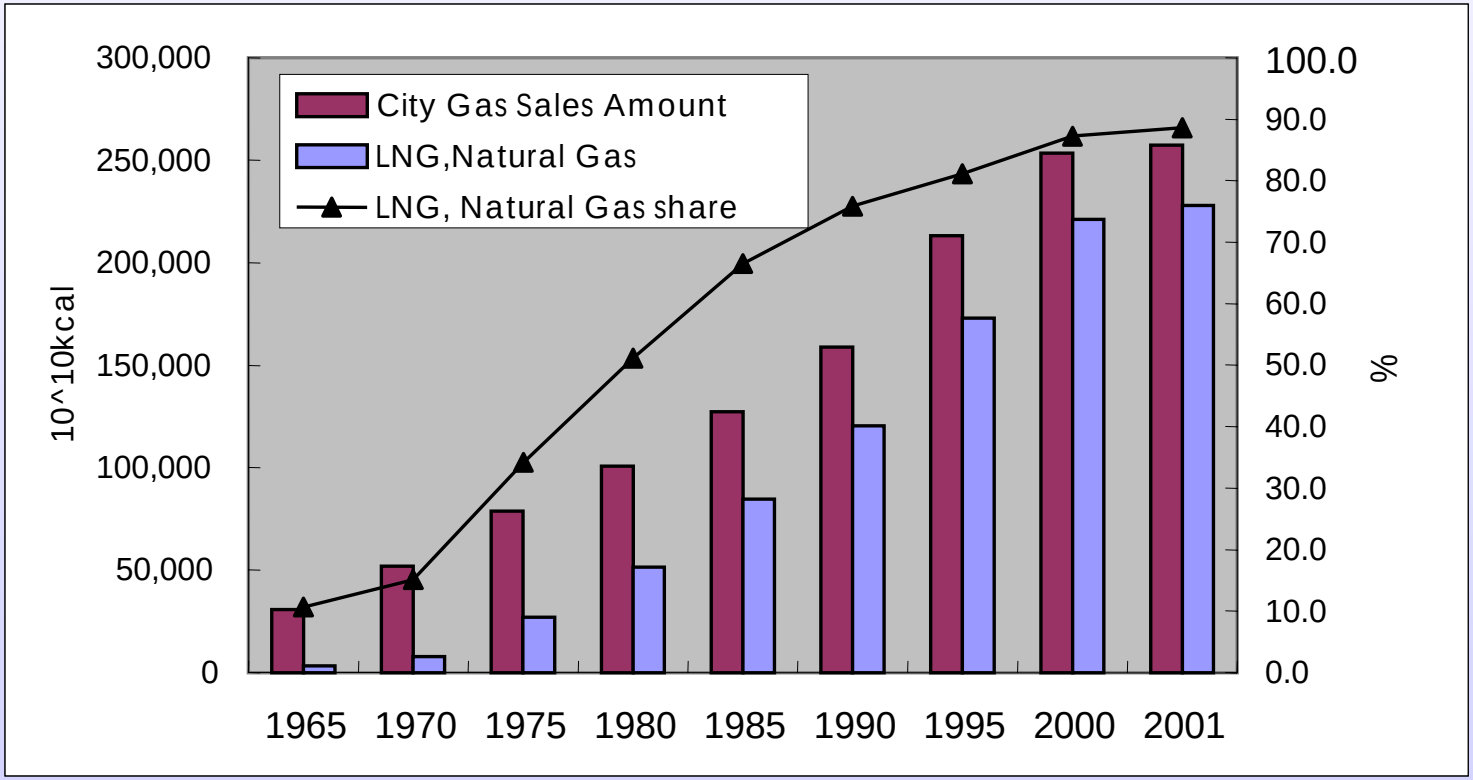
All of these warrant <u>stability</u> of supply,
but concurrently represent <u>rigidity</u>.

Generated Output (9 Electric Utilities) and LNG



(Source) IEEJ , EDMC "Handbook of Energy & Economic Statistics in Japan"

City Gas Sales and LNG



(Source) IEEJ , EDMC"Handbook of Energy & Economic Statistics in Japan"

Why importers have assumed risks?

- **LNG projects involve huge capital outlays --- Needs for raising the required investment --- Beside suppliers, importers are required to take even greater risks.**
- **The buyers' primary concern has been to secure constant supplies by starting up LNG projects smoothly.**
- **The buyers are public utilities capable of taking many risks thanks to their favored position.**

<u>The background described above is changing.</u>

2. What are changing?

– Conventional structure of risk distribution awash with waves of the times –

(1) Waves of liberalization surging on LNG importers Broader-ever scope of electricity & gas liberalization

- **Entering the 1990, liberalization of the electricity and gas industries started.**
- **In December 2002, the 13th Session on Electricity Committee unveiled "The Framework of Desirable Electric Utility Industry System," which called for expanding the scope of liberalized electricity retailing: To electricity consumers with maximum electricity consumption of 500 kW (by around 2004), and to those with 50 kW (by around 2005).**
- **In January 2003, the 3rd Session on Urban Heat Energy subcommittee unveiled "The Framework of Desirable Gas Utility Industry System," which called for expanding the scope of consumers eligible for specified contracts to those consuming more than 500,000 m^3 (by around 2004), and to those over 100,000 m^3 (by around 2008).**

What are impacts of broader scope of electricity and gas liberalization?

- **Electric and gas utilities set to seek as cheap LNG as possible.**
- **Electricity & gas demand becomes more uncertain and volatile than ever --- Greater difficulties in setting fuel/feedstock procurement targets.**
- **Best-matching supplies to demand patterns of their customers will become crucial to electric & gas utilities --- Needs for diversifying fuel/feedstock procurements more than ever.**

The path to pass the "price risk" and "quantitative risk" onto final consumers is closing.

Changing concepts of LNG procurement

Conventional:

- **Top priority given to the security of supply (few choices but accepting long-term contracts)**
- **Economics and flexibility of supply put in the secondary position (accepting higher prices/TOP)**

Mid 1990s onward:

- **Shift to giving increased priorities to economics and flexibility of supply.**
- **Importance of supply security remains unchanged, but its superiority is down in relative terms.**

(2) Jostling new projects on supply side and resultant drastic cost cuts

- **Many candidates for new projects emerging and realized during the 1990s.**
- **Technological innovation and price competition, among others, resulted in falling supply costs (incl. liquefaction plants, LNG tankers)**

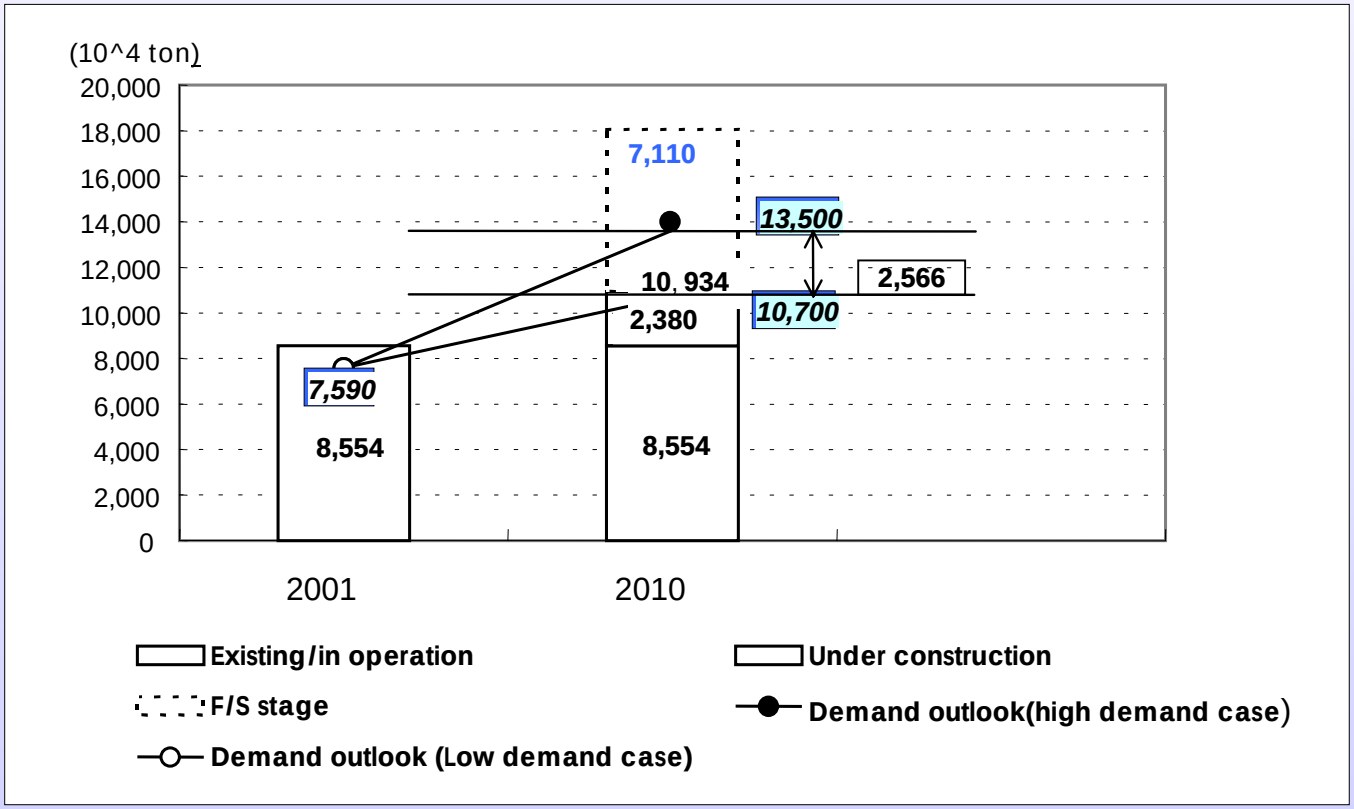
Progress Report on LNG Liquefaction Projects in Asia/Pacific (1)

	Liquefaction (10,000t)	Marine transport to Japan (km)	Remarks
Existing LNG liquefaction terminals in operation			
Asia/Pacific	6,144	4,000 to 7,000	
Abu Dhabi	550	12,000	In operation from 1977 onward
Qatar Gas	770	12,000	In operation from 1977 onward
Ras Rafan (Qatar)	640	12,000	In operation from 1999 onward
Oman	660	11,800	In operation from 2000 onward
Sub-total	8,764		
Shipped to Europe	-210		Qatar to Spain (Gas Natural)
Sub-total after subtracted	8,554		
Projects under construction or with official contracts already signed			
Ras Rafan II	470	12,000	Additional 3rd train installed in order to
Qatar Gas	130	12,000	To be completed in 2005.
MLNG III (Malaysia)	760	4,600	Slated to start operation in 2002.
Tangguh (Indonesia)	600	4,500	Philippines. To be commissioned in 2006.
Expansion at NWS, Australi	420	6,800	Slated to start operation in 2004.
Sub-total	2,380		

Progress Report on LNG Liquefaction Projects in Asia/Pacific (2)

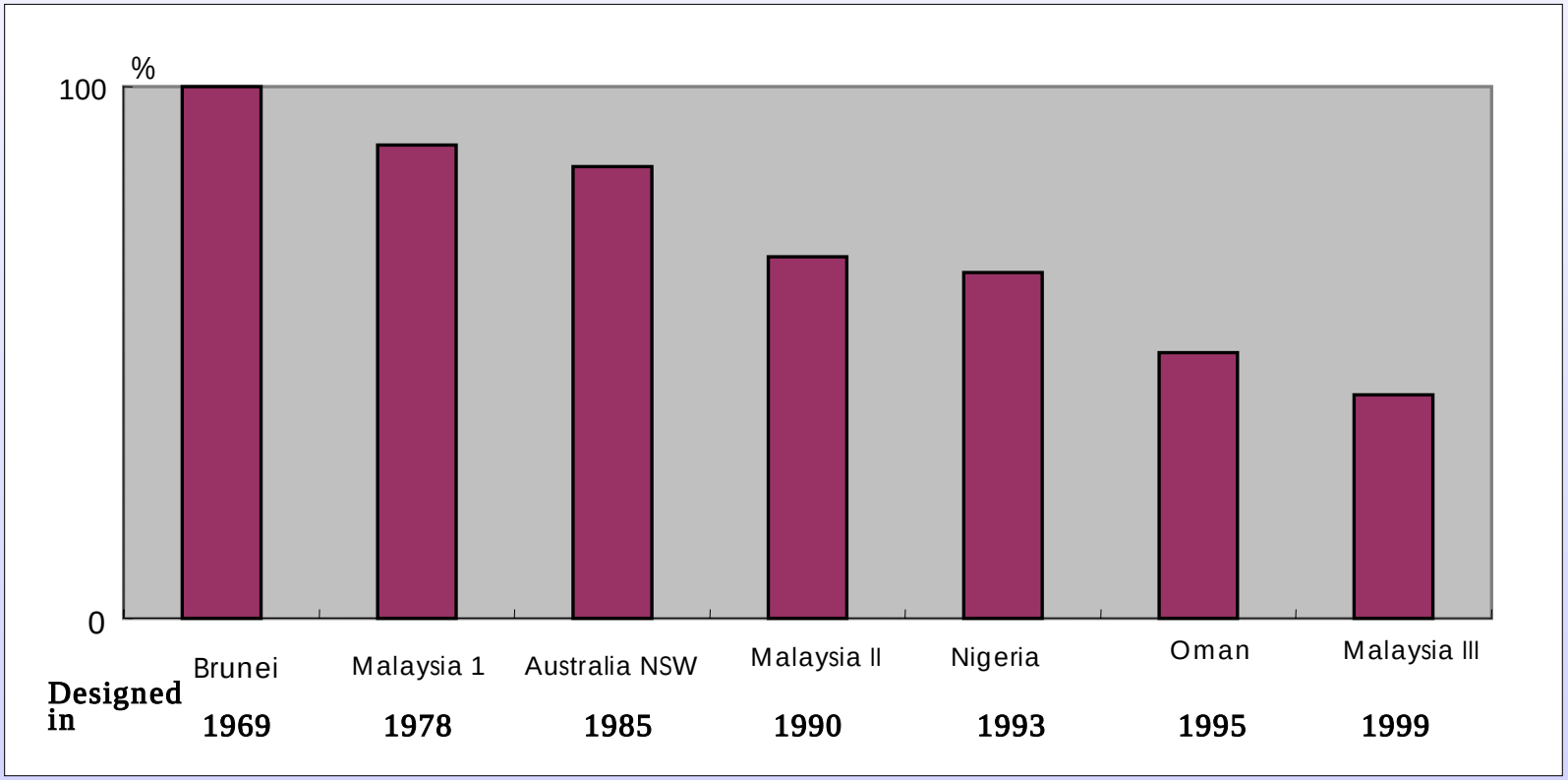
Other projects at F/S stage			
Qatar Gas	480	12,000	MOU already signed on F/S of additional 4th train installation.Slated to ship
			to Enel (Italy) and Repsol (Spain).
Ras Rafan II	470	12,000	Under planning is construction of 4 train designed to serve Edison Gas (Italy).
Oman's capacity expansion	330	11,800	Slated to start operation in 2004.
Iran	800	12,000	LNG supplies to India under considerate.
Yemen	620	12,000	MOU with Pipavav of India canceled.
North Slope (Alaska)	900	6,000	Postponement of current plan announced in 2001.
Sakhalin II (Russia)	960	1,700	Preferably to be commissioned in 2006.
Natsna (Indonesia)	1,400	4,200	Preferably to start production from 2007 onward.
Bayu/Undan (East Timor)			To start LNG supplies to TEPCO and Tokyo Gas from 2007 onward.
Sunrise, Evansshawl (Australia)	480	6,800	To switch over to domestic pipeline gas for the present.
			LNG targeted in around 2011.
Gorgon (Australia)	600	6,800	Preferably to be commissioned in 2005.
Scarborough (Australia)	500	6,800	Preferably to be commissioned in 2005.
Papua New Guinea	400	6,700	Preferably to be commissioned in 2005. To target the Chinese market.
Sub-total	7,940		
Shipped to Europe	-830		To Enel (Italy), 4.80 million t/y to Respol (Spain),
			3.50 million t/y to Edison Gas (Italy)
Sub-total after subtracted	7,110		
Total	18,044		

Supply-Demand Balance Outlook for Asia/Pacific (As of January 2002)



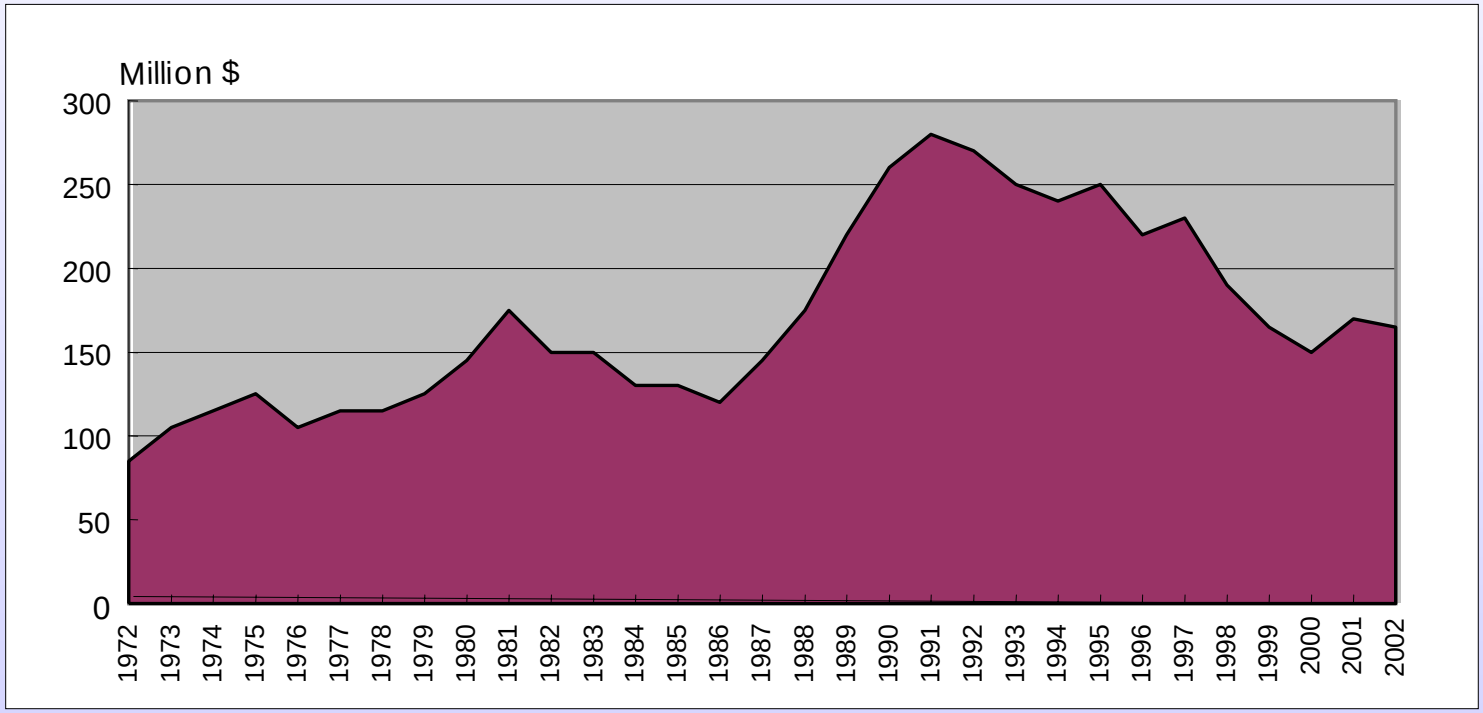
(Source)A Study Report on the World Natural Gas Supply –Demand Trends

An Image of Falling Costs at Liquefaction Plants
(Capital Cost $ / tpa LNG, Real Terms)



(Source) Royal Dutch Shell website

LNG Tanker Construction Costs



(Source) LNG One World

(3) Cheaper-priced LNG bound for Asia

China (Guangdong project)

- **Tangguh, NWS and Ras Gas tendered for the bidding.**
- **NWS won the contract after individual negotiations between the project and the bidders.**
- **It is said that the ex-ship price is set at around $3/MMBTU (when crude oil CIFprice is $20/bbl).**

China (Fujian project)

- **It is rumored that price is cheaper at CIF base than that for Guandong.**

India (Petronet)

- **Price Varies within the range of $2.03 (when crude oil is $16) and $3.04 ($24) (Source) Arab Oil & Gas**

What are changing? (Summary)

Importers side:

The share of LNG has reached the point of saturation.

The broader-ever scope of deregulation/liberalization leads to:

Intensifying competition and uncertain demand

Increasing difficulties in passing the risks onto final consumers

Changing concept of LNG procurement

No longer afford risk-taking --- Growing moves to review risk sharing

Supply side:

Mounting surplus supply capacity --- Want to sell as much as possible.

Falling costs enable the startup of projects even when LNG price is low.

Want to start up new projects, but no demand growth in existing importing countries

--- **Cheaper price offered to newly emerging countries**

3. Risk redistribution on the rise – Falling price and increasing flexibility of supply –

(1) "New risk distribution model" with lower price and flexibility incorporated

Example: TEPCO & Tokyo Gas

- **Contract renewal with Malaysia I project**

(TEPCO 4.80 million tons, Tokyo Gas 2.60 million tons)

- **Participation in Darwin project, Australia**

(TEPCO 2.00 million tons, Tokyo Gas 1.00 million tons)

Expansion Agreement with Malaysia 1 Project

- **Existing contract: Contract term 20 years, the whole volume under ex-ship contract**
- **Renewed contract: Contract term 15 years**

  Some of contract volumes put under a short-term (four-year) contract. (TEPCO 700,000 tons, Tokyo Gas 500,000 tons)
- **Some of contract volumes put under FOB contract.**

  (TEPCO 1.20 million tons, Tokyo Gas 600,000 tons)
- **Flexibility of supply was increased to around 20% of the contract volume.**
- **The price was cut by 5% (according to press reports).**

Significance of LNG Tanker Possession and Hauling Business

- **Elastic transportation:** **Importers can control transporting capacity by themselves. A surplus transport capacity, if available, allows additional procurement and/or sales to the third party for profit taking.**
- **Transportation cost cuts: Importers can reduce LNG cost in Japan by managing LNG transportation by themselves, of which cost has been borne conventionally by suppliers under ex-ship contracts.**
- **Namely, importers hope new returns by taking some of the risk conventionally borne by suppliers.**

--- <u>The first step toward a "new risk distribution model"</u>

Outline of Darwin Project

- **Buyers: TEPCO, Tokyo Gas**
- **Contract volume: TEPCO 2.00 million tons, Tokyo Gas 1.00 million tons**
- **Contract term: 17 years from January 2006**
- **Contract form: The whole volume under FOB contract (LNG tankers arranged by TEPCO and Tokyo Gas)**
- **Seller: Darwin LNG (stakeholders: Philips, AGIP, Santos, INPEX, TEPCO, Tokyo Gas)**

-- TEPCO and Tokyo Gas participate in the whole of the LNG chain.

Significance of Participation in Upstream Project

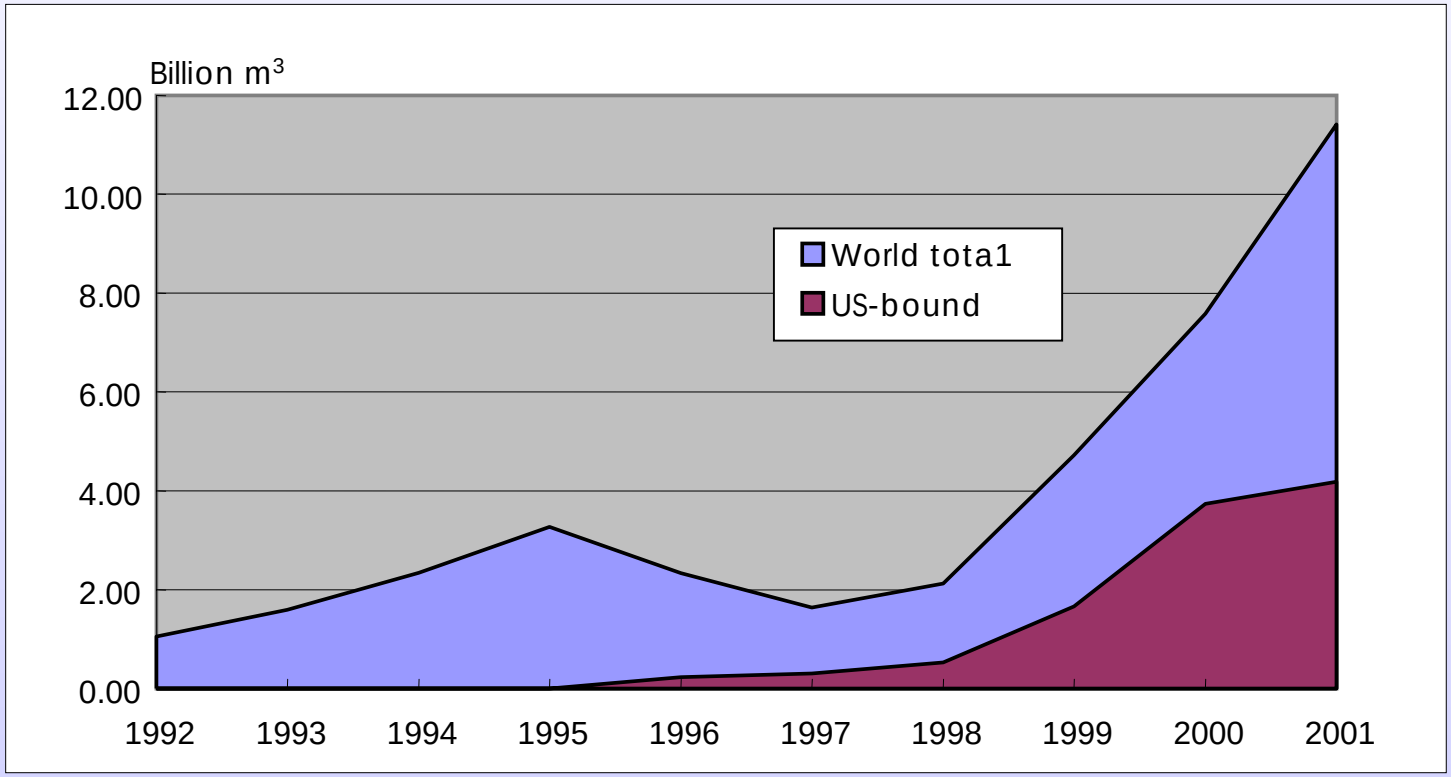
- **To win more competitive contract terms (as buyers).**
- **No needs for marketing and lower risks of project startup because the project participants take the whole output by themselves.**
- **Accumulation of know-how enabled only when participating in the whole of LNG chain.**
- **To try to improve economics of LNG procurement overall by participating in the whole of LNG chain (taking all risks).**

Evolution and evaluation of a "new risk distribution model"

What is a “new risk distribution model”?

- **For importers, it is more significant than simply reducing the risks they have borne.**
- **It enables them to seek returns for a new risk they dare to assume by launching into the upstream and transport sectors conventionally offered by suppliers.**
- **Namely, it should not be overlooked that the “new risk distribution model” is significant in a sense that importers are oriented toward optimization of LNG procurement through redistribution of profits.**

(2) Expanding spot trading contributes to increasing flexibility of supply



(Source) Prepared from IEA, Flexibility in Natural Gas Supply and Demand

Strategies of LNG Trade Expansion by Oil Majors

- **No longer idle in the position of LNG suppliers, oil majors, among others, become LNG buyers by themselves and aggregate surplus capacities of many projects, while tapping new demand.**
- **LNG left unsold is shipped to the U.S. market, which explains why the US-bound LNG spot trading is rapidly growing.**
- **LNG originally destined to the U.S. is shipped to meet LNG demand in any market outside the U.S., if necessary. Thus, non-U.S. market demand is satisfied flexibly, while the spot positions destined to U.S. market is covered by pipeline gas.**
- **Introduction of a similar concept is also under consideration in the Asia/Pacific.**
- **LNG terminal construction projects and commercialization of on-board gasification technology in the U.S. West Coast, among others, all support this concept.**

Significance and issues of Spot Trading

- **Spot trading enables suppliers to put their surplus capacity fully in operation.**
- **It gives consumers flexibility in their LNG procurement.**

- **Spot prices are affected by NYMEX.**

- **There are many subjects to be solved. The biggest one is "destination clause" specified in LNG procurement contracts.**
- **Namely, in the Asia/Pacific market, a LNG tanker departing from a LNG terminal can not sail toward any port other than the specified in the contract.**

(3) Plural number of price negotiations and contract expansion talks imminent

- **This year a few projects are about to enter price negotiations. NWS of Australia is among them.**
- **Looking further into 2010, some projects have their contract terms matured and involve negotiations if to be renewed (extended). They include NSW and Indonesia's basic agreements.**
- **After the talks, the <u>LNG price is likely to go down and the so far rigid contract terms to improve</u>.**
- **Improvements will be made in such forms as a shortened contract term, increased flexibility of supply and more variable (not uniform) deliveries than ever.**

Grounds for the Expected Price Cuts and Greater Flexibility

1. **The supply-demand balance will remain loose in the medium run.**
2. **The costs to construct liquefaction plants and LNG tankers have dropped.**
3. **Most of the existing projects have their investment recovery over.**
4. **Expanding spot trading leads to greater influence of the US price.**
5. **Cheapness of the LNG price payable by the Guangdong project is well known among the LNG importers in Japan and the rest of Asia.**

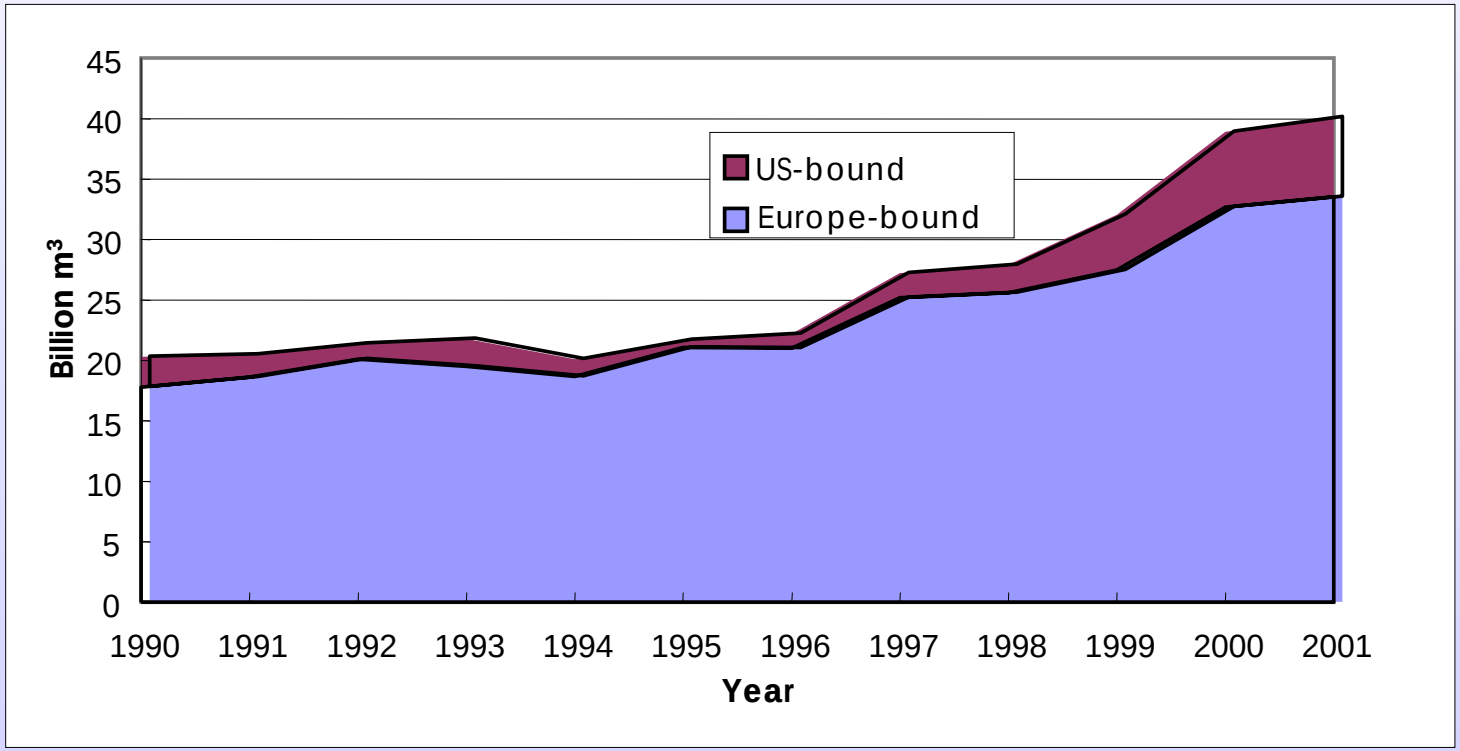
To What Extent the Price Go Down?

- **Importers are likely to demand a price cut to the same level as the price offered to the Guangdong project in China, that is, the level of $3-strong/MMBTU at CIF Japan (when crude oil is $20/bbl). If so, it appears reasonable to expect the LNG price in Japan to converge into this level.**
- **Some expect drastic price cuts to result from the price negotiations scheduled this year. But, to win a drastic price cut to the Guangdong level can be more time-consuming.**
- **Perhaps it won't be before 2005, when China actually receives LNG from NWS and Tangguh projects, or around 2008, when negotiations start on expansion agreements of NSW and Indonesian projects.**

Yet, negotiations won't be easy.

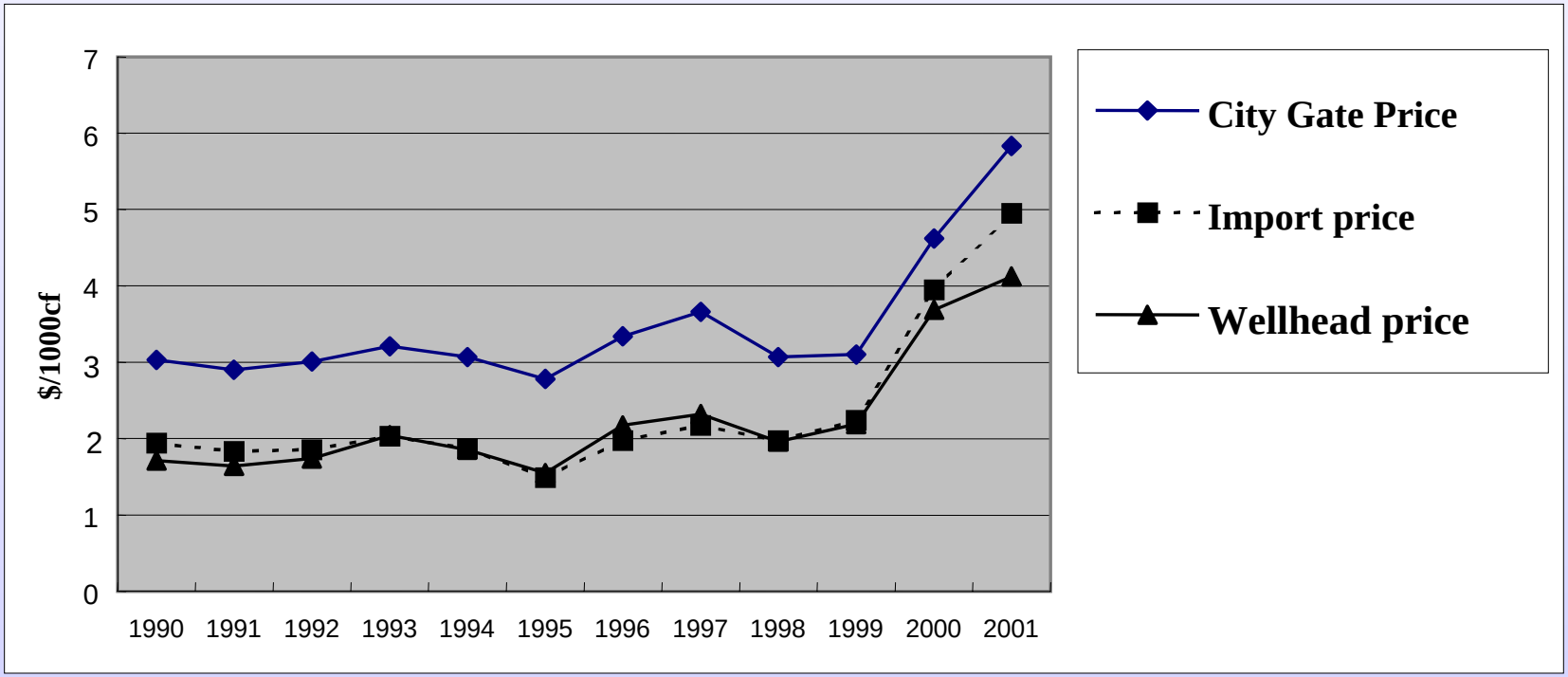
- **Supply and demand won't always be loose.**
- **The price not only depends on "cost basis" but also reflects market conditions.**
- **The market-based LNG price in the U.S. is not always cheap.**

Rapid Expansion of the Atlantic Market is Noteworthy



(Source) Prepared from BP Statistics

Inevitable Impacts of U.S. Price – Which Is Not Always Cheap –



(Source) US DOE, Energy Information Agency

(4) Consideration of New Pricing Formula (1)

- **PETRONAS: To get free from the crude oil link. Talks on the fixed price under way with importers.**

  (Muri Mohammed, Vice President for Gas, at SPEC 2002)

- **A Japanese importer: Linkage to crude oil should be limited to the natural gas price" at wells, with liquefaction and transportation to be charged in a lump sum (cost + fee) system.**

  LNG price = Natural gas price at wells (linked to crude oil)

  + the lump sum incurred in gas processing and liquefaction

  + the lump sum incurred in transportation

  (at World Gas Congress)

Consideration of New Pricing Formula (2)

- **India's Petronet: The price, though JCC-linked, varies within the range between $2.03 (when crude oil price is $16) and $3.04 (crude oil $24) with the ceiling and floor prices preset (according to Arab Oil & Gas).**

- **China (Guangdong project): The price varies only within a limited range because 'a' in the formula of P = aX + b is set much smaller than in the formula applicable to Japan (unconfirmed information).**

(Reference)

- **Natural gas in Continent Europe: Linked to heating oil, heavy fuel oil, coal, etc. (resulting in a competitive pre-burner price against rivaling fuels).**
- **USA: Linked to NYMEX futures and Henry Hub.**

Options of LNG Pricing Formula (1)

- **Fixed pricing (stated by a PETRONAS vice president for gas at SPEC 2002; oriented toward a crude oil price-free mechanism)**
- **Quasi-fixed pricing by setting a small figure for "a" in the formula, P = aX + b (adopted by China/India; oriented toward lower price and stability)**
- **Raising the ratio of fixed elements while lowering the ratio of crude oil-linked portion (stated by a Japanese importer at the World Gas Congress 2000; oriented toward lower price and stability)**
- **The retail price of coal/coal-heavy fuel oil-crude oil/electricity, etc. taken as price indicators (prevailing in European Continent; to help LNG-fired power retain/fix its competitiveness against rivaling power sources).**

Options of LNG Pricing Formula (2)

- **Petroleum products, like heavy fuel oil and kerosene, taken as price indicators (prevailing in European Continent; to help LNG-derived city gas retain/stabilize its competitiveness against rivaling fuels)**
- **LNG pricing linked to NYMEX/IPE futures (in order to reflect on-going market conditions)**
- **To make a contract two-tiered, with a flexible delivery portion to better meet seasonal demand and a fixed delivery portion (separation of price and flexibility).**

Consideration of Future LNG Contracts (1)

- **Many options of pricing formula will be available in the future.**
- **Moreover, a wide variety of LNG contracts can be arranged by pairing different pricing formulas with various trading patterns, each having flexibility of its own (e.g. long, medium and short contract terms, varying TOP coverage, non-uniform deliveries).**
- **The importers are most likely to procure LNG based on as many LNG contracts as necessary for meeting their demand patterns and customers' needs.**

Consideration of Future LNG Contracts (2)

- **When signing a new contract with NSW, Korea Gas Corporation already reached an accord that ensured a medium-term (7-year) highly flexible supply (widely variable deliveries, mostly concentrating in winter seasons).**

- **As a result, there will be a diminishing necessity for all importers to organize a consortium and buy LNG priced with a uniform formula.**

- **There will be an increasing number of LNG procurements, each made by a single importer or a group of a few buyers.**

Conclusion (1)
– Risk redistribution creates contract diversity –

- **The Japanese LNG consumers are waiting for the start of second- and third-round negotiations, during which the "new risk distribution model" is expected to evolve further.**

- **The evolution of the "new risk distribution model" means the importers not only claim the suppliers to bear some of the risks they have taken, but also begin aggressively seeking new profits in return for additional risks they assume by launching into an entire LNG chain.**

Conclusion (2)

- **The evolution of "new risk distribution model" is expected to spur the rise of diverse LNG contracts. This allows electric utilities to lower generating costs and realize the best power mix easier ever, which ultimately leads to expansion of electricity demand. Gas utilities too can improve competitiveness of city gas against rivaling fuels, thus developing new demand, particularly in the industrial sector where natural gas use is not popular right now.**

- **A matter of vital importance for the Japanese importers is to construct an optimal portfolio of LNG contracts by pairing different pricing formulas with different trading terms so that they can best match their demand patterns and customers' needs.**