Natural Gas Market in East Asia: Present Situations and Challenges

East Asia Natural Gas Workshop
=Changes in the World Natural Gas Market and Challenges for East Asia=

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Institute of Energy Economics, Japan
Content of the Report for JBIC, titled “Prospect of Natural Gas Market in East Asia”

Executive Summary

Introduction

Part 1. Present State of the East Asian Natural Gas Market
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  Chapter 2. Liberalization of Power and Gas Markets in Japan and South Korea
  Chapter 3. Recent LNG Transactions and Impact of Liberalization

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  Chapter 5. Need for and Future Possibility of Natural Gas Cooperation in East Asia
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- Electricity and Gas Market Liberalization in Japan and South Korea
- Recent LNG Procurement and Impact of Liberalization
Features of LNG Trade (1)

Rigid Contract Terms and Conditions

- **Parties**;
  - **[Buyer]** Power and gas utilities form buyer consortiums (the same terms and conditions apply to every buyer).
  - **[Seller]** Gas-producing nations’ state-run companies, multinational oil majors, trading companies and others form seller groups.
- **Quantities**: Annual contract quantities (ACQ) are provided in sell and purchase agreements. Contractual rights and obligations regarding delivery are based on the ACQ.
- **Contract terms**: Long-term (some 20 years in general) contracts.
- **Elasticity of delivery receipts regarding contract quantities**: Downward elasticity: 5-10%. The take-or-pay clause.
- **Delivery conditions**: Ex-ship contracts: about 80%  FOB contracts: about 20%* based on contract quantities.
  - Indonesian LNG is subject primarily to FOB contracts.
- **Principle of even delivery**
- **Restrictions on destinations**: Ex-ship contracts or sell and purchase agreements (SPAs) designate delivery locations.
  - Even FOB contracts may designate delivery
- **Delivery plans**: An annual delivery plan is worked out every year for the next year to set an annual schedule for chartering LNG tankers.
Features of LNG Trade (1-2)
Long-term Contract and Real Delivery Quantities for Japan and South Korea

Japan

South Korea

Source: Ministry of Finance, *Customs-Cleared Trade.*
Features of LNG Trade (1-3)
Seasonal Gas Sales Gaps in South Korea, 2001

Source: KOGAS
Features of LNG Trade (2)

Higher Prices than in Europe and U.S.

(Comparison of LNG or Natural Gas Prices)

Sources: TEX Report, Gas Almanac 2003 for Japan and Taiwan; KEEI, Korea Energy Review Monthly for South Korea; BP Statistical Review of World Energy for EU and U.S.
Emergence of Factors Affecting Features of Japan’s LNG Trade

- Progress in introduction of competition in electricity and gas markets
- From sellers’ market to buyers’ market (easier market)
  - Japan’s slack LNG demand growth in the second half of the 1990s
  - Emergence of candidates for new LNG development projects
  - Emergence of projects that cannot ensure buyers meeting full capacity
- Less risk burden for the supply side
  - Natural gas liquefaction and LNG tanker construction costs have been falling, while FOB contracts have been increasing.
- Short and spot transactions have emerged in addition to long-term contract transactions.
- Integration with Atlantic Natural Gas Market
  - Middle East project operators positively sell to both Pacific and Atlantic markets.
  - LNG imports have been increasing steadily in Europe and the U.S.
  - LNG receiving terminal construction plans for the U.S. West Coast.

Source: IEEJ hearings
Present States of the East Asian Natural Gas Market

Changes in World Natural Gas Consumption

Source: Cedigaz, *Natural Gas in the World.*
Changes in International Natural Gas Transaction Volume (Pipelines and LNG)

Source: Cedigaz, *Natural Gas in the World.*
Changes in Country-by-Country Transactions of LNG

Source: Cedigaz, *Natural Gas in the World.*
## Changes in Natural Gas Consumption by User Category in Japan and South Korea

### Japan

<table>
<thead>
<tr>
<th>Year</th>
<th>Power Generation</th>
<th>Industry</th>
<th>Households</th>
<th>Transportation</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>33.7</td>
<td>5.4</td>
<td>8.2</td>
<td>0.0</td>
<td>-0.8</td>
<td>46.5</td>
</tr>
<tr>
<td></td>
<td>(Share) 72.5%</td>
<td>11.6%</td>
<td>17.7%</td>
<td>0.0%</td>
<td>-1.8%</td>
<td>100.0%</td>
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<tr>
<td>1996</td>
<td>38.2</td>
<td>7.7</td>
<td>8.3</td>
<td>0.0</td>
<td>1.8</td>
<td>56.1</td>
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<tr>
<td></td>
<td>(Share) 68.2%</td>
<td>13.8%</td>
<td>14.8%</td>
<td>0.0%</td>
<td>3.2%</td>
<td>100.0%</td>
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<tr>
<td>2001</td>
<td>46.4</td>
<td>8.4</td>
<td>7.5</td>
<td>0.0</td>
<td>2.5</td>
<td>64.8</td>
</tr>
<tr>
<td></td>
<td>(Share) 71.6%</td>
<td>13.0%</td>
<td>11.6%</td>
<td>0.0%</td>
<td>3.8%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Average growth (1991/1996): 2.5% for Power Generation, 7.4% for Industry, 0.2% for Households, - for Transportation, - for Others, 3.8% for Total.

Average growth (1996/2001): 4.0% for Power Generation, 1.7% for Industry, -2.0% for Households, - for Transportation, 6.7% for Others, 2.9% for Total.

Average growth (1991/2001): 3.2% for Power Generation, 4.5% for Industry, -0.9% for Households, - for Transportation, - for Others, 3.4% for Total.

### South Korea

<table>
<thead>
<tr>
<th>Year</th>
<th>Power Generation</th>
<th>Industry</th>
<th>Households</th>
<th>Transportation</th>
<th>Others</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>1991</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
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<tr>
<td></td>
<td>(Share) 66.8%</td>
<td>9.1%</td>
<td>33.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
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<tr>
<td>1996</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>(Share) 26.0%</td>
<td>6.9%</td>
<td>33.1%</td>
<td>0.0%</td>
<td>34.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2001</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>0</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>(Share) 21.6%</td>
<td>17.1%</td>
<td>34.8%</td>
<td>0.0%</td>
<td>26.5%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>


Average growth (1996/2001): 7.3% for Power Generation, 33.7% for Industry, 12.6% for Households, - for Transportation, 6.0% for Others, 11.4% for Total.

Average growth (1991/2001): 5.9% for Power Generation, 26.2% for Industry, 18.8% for Households, - for Transportation, - for Others, 18.5% for Total.

## Changes in Natural Gas Consumption by User Category in Taiwan and China

### Taiwan

<table>
<thead>
<tr>
<th>Year</th>
<th>Power Generation</th>
<th>Industry</th>
<th>Households</th>
<th>Transportation</th>
<th>Others</th>
<th>Total (1,000 TOE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>686</td>
<td>611</td>
<td>524</td>
<td>0</td>
<td>0</td>
<td>2,785</td>
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<tr>
<td></td>
<td>(Share) 24.6%</td>
<td>21.9%</td>
<td>18.8%</td>
<td>0.0%</td>
<td>34.6%</td>
<td>100.0%</td>
</tr>
<tr>
<td>1996</td>
<td>1,357</td>
<td>859</td>
<td>586</td>
<td>0</td>
<td>0</td>
<td>3,696</td>
</tr>
<tr>
<td></td>
<td>(Share) 36.7%</td>
<td>23.2%</td>
<td>15.9%</td>
<td>0.0%</td>
<td>24.2%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2001</td>
<td>4,076</td>
<td>644</td>
<td>645</td>
<td>0</td>
<td>0</td>
<td>6,014</td>
</tr>
<tr>
<td></td>
<td>(Share) 67.8%</td>
<td>10.7%</td>
<td>10.7%</td>
<td>0.0%</td>
<td>10.8%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Average growth (1991/1996): 14.6% 7.1% 2.3% -1.5% 5.8%
Average growth (1996/2001): 24.6% -5.6% 1.9% - -6.2% 10.2%
Average growth (1991/2001): 19.5% 0.5% 2.1% - -3.9% 8.0%

### China

<table>
<thead>
<tr>
<th>Year</th>
<th>Power Generation</th>
<th>Industry</th>
<th>Households</th>
<th>Transportation</th>
<th>Others</th>
<th>Total (1,000 TOE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>900</td>
<td>9,100</td>
<td>2,000</td>
<td>200</td>
<td>1,200</td>
<td>13,400</td>
</tr>
<tr>
<td></td>
<td>(Share) 6.7%</td>
<td>67.9%</td>
<td>14.9%</td>
<td>1.5%</td>
<td>9.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>1996</td>
<td>694</td>
<td>12,025</td>
<td>2,308</td>
<td>106</td>
<td>2,112</td>
<td>17,245</td>
</tr>
<tr>
<td></td>
<td>(Share) 4.0%</td>
<td>69.7%</td>
<td>13.4%</td>
<td>0.6%</td>
<td>12.2%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2001</td>
<td>1,344</td>
<td>12,449</td>
<td>6,431</td>
<td>228</td>
<td>10,913</td>
<td>31,365</td>
</tr>
<tr>
<td></td>
<td>(Share) 4.3%</td>
<td>39.7%</td>
<td>20.5%</td>
<td>0.7%</td>
<td>34.8%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Average growth (1991/1996): -5.1% 5.7% 2.9% -11.9% 12.0% 5.2%
Average growth (1996/2001): 14.1% 0.7% 22.7% 16.6% 38.9% 12.7%
Average growth (1991/2001): 4.1% 3.2% 12.4% 1.3% 24.7% 8.9%

East Asia Natural Gas Demand Outlook and East Asia Natural Gas Demand-Supply Balance in 2020

Natural Gas Demand Outlook

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BCM</td>
<td>%</td>
<td>BCM</td>
<td>%</td>
</tr>
<tr>
<td>Japan</td>
<td>75.3</td>
<td>54%</td>
<td>87.4</td>
<td>40%</td>
</tr>
<tr>
<td>South Korea</td>
<td>24.0</td>
<td>17%</td>
<td>35.9</td>
<td>17%</td>
</tr>
<tr>
<td>Taiwan</td>
<td>8.1</td>
<td>6%</td>
<td>14.4</td>
<td>7%</td>
</tr>
<tr>
<td>China</td>
<td>32.6</td>
<td>23%</td>
<td>79.7</td>
<td>37%</td>
</tr>
<tr>
<td>Total</td>
<td>140.0</td>
<td></td>
<td>217.4</td>
<td></td>
</tr>
</tbody>
</table>


Natural Gas Demand-Supply Balance

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand</td>
<td>140</td>
<td>338</td>
</tr>
<tr>
<td>Regional Supply</td>
<td>34</td>
<td>76</td>
</tr>
<tr>
<td>LNG Supply Potential</td>
<td>103</td>
<td>269</td>
</tr>
<tr>
<td>Pipeline Gas Supply Potential</td>
<td>0</td>
<td>76</td>
</tr>
<tr>
<td>Total Supply Potential</td>
<td>137</td>
<td>421</td>
</tr>
</tbody>
</table>
Liberalization of Power and Gas Markets in Japan and South Korea

Chronology of Japan's Power Utility Industry Liberalization (1)

- **1994**: The Electric Utility Industry Council proposes introduction of market mechanisms for promotion of business efficiency in the power utility industry, rationalization of safety regulations and the like.

- **1995**: The Electricity Utilities Industry Law is revised to introduce the IPP (independent power producer), special electric utility suppliers and the yardstick assessment.

- **1999**: The Electricity Utilities Industry Law is revised again to introduce third party access to power transmission cables, partially liberalizing the electricity retail market (2,000 kilowatts or more, and 20,000 volts or more: covering 26% of the electricity retail market) and the addition of the power producer and supplier (see Note) as a new category.

Note: The power producer and supplier (PPS) uses power transmission cables of power utilities for supplying electricity meeting specified-scale users. Registered as PPS, as of December 2003, were 11 companies – Diamond Power Corp., Marubeni Corp., eREX Co., Nippon Steel Corp., ENNET Corp., Summit Energy Corp., Daio Paper Corp., Sanix Inc., Nippon Oil Corp., GTF-institute Co. and Osaka Gas Co.
Chronology of Japan’s Power Utility Industry Liberalization (2)

· 2003: The Electricity Utilities Industry Law is revised again to expand the scope of electricity retail market liberalization (the scope is to cover high-voltage customers with contract electricity capacity at not less than 500 kilowatts, or **40% of the retail market**, in April 2004; and high-voltage customers with contract capacity at not less than 50 kilowatts, or **more than 60% of the market**, in April 2005).

 **In 2007, Debates will start on full liberalization of the electricity retail market including households.**

Decisions will be made on the establishment of the power exchange [1], elimination of power transfer fees [2], information firewalls, tougher behavior regulations to ban internal subsidization and discriminatory treatment, relaxation of balancing rules [3], and other measures. A neutral organization is launched to secure neutrality, fairness and transparency of power generation and transmission service providers.

[2] Fees for a utility’s power transmission to another utility’s service area.
[3] The rules for stabilization of the power transmission system limits a power demand-supply gap to 3%.
Chronology of Japan’s Gas Utility Liberalization (1)

· **1995:** The Gas Utilities Industry Law is revised to liberalize gas services for the bulk of customers whose annual contract gas consumption is not less than 2 million cubic meters.

**Bulk gas service providers are created.**

The three largest gas utilities -- Tokyo Gas Co., Osaka Gas Co. and Toho Gas Co. -- are required to prepare consignment guidelines.

The yardstick assessment for gas rate changes is introduced.

· **1999:** The Gas Utilities Industry Law is revised again to expand the liberalization scope to cover customers whose annual contract gas consumption is not less than 1 million cubic meters, or 40% of the gas retail market).

Decisions are made to shift to the notification of wholesale services [1] and require the four largest gas utilities (Tokyo Gas Co., Osaka Gas Co., Toho Gas Co. and Saibu Gas Co.) to submit consignment terms and conditions.

Chronology of Japan’s Gas Utility Liberalization (2)

- **2003: The Gas Utilities Industry Law is revised again.** The revised law takes effect in April 2005. The liberalization scope is expanded to cover customers whose annual contract gas consumption is not less than 500,000 cubic meters, or 44% of the gas retail market, in 2004, and those whose annual contract gas consumption is not less than 100,000 cubic meters, or 50% of the market, in 2007.

  Gas pipeline service providers [1] are created as a new category. The scope is expanded of companies required to prepare consignment terms and conditions. Third party access to LNG receiving terminals through negotiations between stakeholders is introduced. Simplified gas service providers are allowed to handle natural gas.

  [1] Gas pipeline service providers exclude gas utilities and include domestically produced natural gas suppliers and power companies that possess or operate pipelines.
Chronology of South Korea’s Power Utility Industry Liberalization

The power utility industry was monopolized by Korean Electric Power Co. (KEPCO), a state-run, vertically integrated utility, between 1982 and 2001.

2001: KEPCO spins off its power generation division, which is divided into five thermal power generation firms and one company for nuclear and hydro power generation. The five thermal power generation firms are planned to be privatized. The nuclear and hydro power generation company is planned to remain as a state-run entity. The transmission, distribution and retail division is scheduled to be spun off by 2008. The retail market is planned to be completely liberalized in 2009.

The Korean Power Exchange has been established to manage an electricity trading pool market, run a power system and control equality of electricity. The Korean Electricity Commission has been set up as the regulator.

South Korea had initially scheduled two (including Korea SouthEast Power Corporation) of the five thermal power generation companies to be privatized in 2002, one by 2005 and the other later. But Korean SouthEast Power Corporation has yet to make an initial public offering. Privatization has failed to make progress in the other four.
Chronology of South Korea’s Gas Utility Industry Liberalization

Korea Gas Corporation (KOGAS) monopolizes LNG imports and wholesales. Thirty-two regional town gas companies monopolize retail markets of their respective service areas. Reorganization of the gas utility industry has lagged behind that of the power utility industry.

Foreign firms have accelerated their penetration into South Korea’s gas retail markets. An SK-Enron joint venture has put eight town gas companies under its control. Belgium’s Tractebel has acquired one.

A bill to break up and privatize KOGAS has failed to be passed in the face of opposition from some lawmakers and a presidential election.

In March 2003, the government announced that KOGAS would retain its facility sector (covering LNG-receiving terminals, storages and pipelines) under its (state) control.

The power and gas utility industry structure reform has been stalled as President Roh Moo-Hyun and his regime have been cautious about the reform in consideration of opposition from labor unions and past confusion over the matter in the parliament. The Roh regime has not specified its opposition to the power and gas utility privatization or liberalization, but it has delayed its decision on the matter. Any progress in the reform is left uncertain.
Recent LNG Transactions and Impact of Liberalization

Changes in Traditional Contract Clauses (1)

Since the early 2000s, moves have emerged to renew LNG contracts and renegotiate prices.

 Parties to contracts
Conflict of interest has emerged between parties. Competition has begun between buyers. Buyers have been individually negotiating with sellers to conclude individual contracts.

 Contract terms
It has grown more difficult for buyers to take delivery of fixed quantities over a long term as they cannot expect persistent growth in demand and lose some of demand to competitors. Buyers have tended to favor shorter contract terms or combine long-term contracts for basic demand with short-term ones for uncertain demand.

 Elasticity of delivery receipts regarding contract quantities
The delivery elasticity, an allowable gap between real demand and contract quantities, has been increased. New contracts reflect buyers’ request for the downward elasticity of the take-or-pay clause on a demand loss and the upward elasticity on a sudden demand expansion.
Changes inTraditionalContractClauses(2)

**Delivery conditions**
A shift has been seen from the ex-ship to the FOB. Buyers have begun to own and arrange LNG carriers to help save costs. The possibility has emerged of new transactions being developed including spot deals, swaps, backhauling and arbitraging.

**Delivery plans**
In the past, shipping plans had been made every year for the next year for even shipments and deliveries throughout a year irrespective of seasonal demand changes. At present, however, uneven shipments have been seen to meet real demand profiles reflecting seasonal demand changes.

“Master agreements” have emerged as a new trading means. These agreements provide for rough terms and conditions without specifying cargoes or quantities and allow parties to promptly implement spot cargo transactions through confirmation letters specifying necessary simple information including prices, quantities and delivery dates.
Cooperation between LNG-Consuming Countries (Users)

Since 2003, reports have emerged on partnerships between LNG users.

- Mutual LNG accommodation between Chubu Electric Co., CPC and KOGAS, and between Tokyo Electric Power Co. and KOGAS.
- Tohoku Electric Power Co. and KOGAS signed an agreement on mutual cooperation regarding LNG procurement.
- Chubu Electric Power and KOGAS inked a contract for seasonal LNG swaps.

These deals indicate that users that are geographically close to each other are forming partnerships to meet short-term demand changes. They can be appreciated as contributing to flexibility of their procurement and stability of their supply.
Recent Specific Changes in LNG Procurement Deals (1)

Western Australia Northwest Shelf Project expansion

- A consortium of Japanese buyers has broken up and buyers have shifted to individual negotiations.
- Supply to KOGAS has been set for winter delivery.

<table>
<thead>
<tr>
<th>Company</th>
<th>Period</th>
<th>Amount (MT/y)</th>
<th>SPA Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>KOGAS</td>
<td>2003</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Tokyo Gas</td>
<td>2004</td>
<td>10.73</td>
<td></td>
</tr>
<tr>
<td>Tohoku Gas</td>
<td>2004</td>
<td>0.297</td>
<td></td>
</tr>
<tr>
<td>Osaka Gas</td>
<td>2004</td>
<td>1</td>
<td></td>
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<tr>
<td>Shell</td>
<td>2004</td>
<td>Up to 3.7 for 5 years</td>
<td>SPA</td>
</tr>
<tr>
<td>CNOOC</td>
<td>2005</td>
<td>3.3</td>
<td></td>
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<tr>
<td>Shizuoka Gas</td>
<td>2005</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Tohoku Electric</td>
<td>2005</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Kyushu Electric</td>
<td>2006</td>
<td>0.5</td>
<td></td>
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<tr>
<td>Chubu Electric</td>
<td>2009</td>
<td>0.6</td>
<td></td>
</tr>
</tbody>
</table>

First Train (Satu) Project in Malaysia (contract renewal)

- The maximum trading quantity has remained unchanged.
- The contract term has been shortened to 15 years.
- Short-term quantities have been introduced to considerably increase the elasticity of delivery receipts. Some of contract quantities have shifted to the FOB for improvement of transportation elasticity and reduction of freight costs.
- Allowable increases and reductions in quantities have been expanded to flexibly adjust procurement quantities.
Recent Specific Changes in LNG Procurement Deals (2)

**Sakhalin 2 Project**
Tokyo Electric Power and Tokyo Gas have shifted to the FOB delivery receipts. For Tokyo Electric Power, a delivery startup schedule has been set and the buyer’s options on quantities have been introduced. The contract including these conditions is appreciated as more flexible and economical than traditional contracts.

**Darwin LNG Project**
Tokyo Gas and Tokyo Electric Power participate in the Darwin LNG project for gas field development, and LNG production and marketing. They also use their own LNG carriers for transportation. They thus take part in the whole of the LNG chain ranging from gas production, liquefaction, marketing and transportation to consumption for electricity or gas utility services.

**Third Train (Tiga) Project in Malaysia**
* In July 2003, KOGAS signed a contract to take delivery of 1.5 million tons annually (with an option on additional 500,000 tons) over seven years. Delivery receipt condition reflect seasonal demand changes (20% in summer and 80% in winter). The price is estimated as the same as under an old long-term contract.

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