

## Recent Trends in LNG Receiving Terminal Projects On the West Coast of North America<sup>1</sup>

-Background, Current Status and Possible Effect on Existing Asia-Pacific LNG Market-

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### Introduction

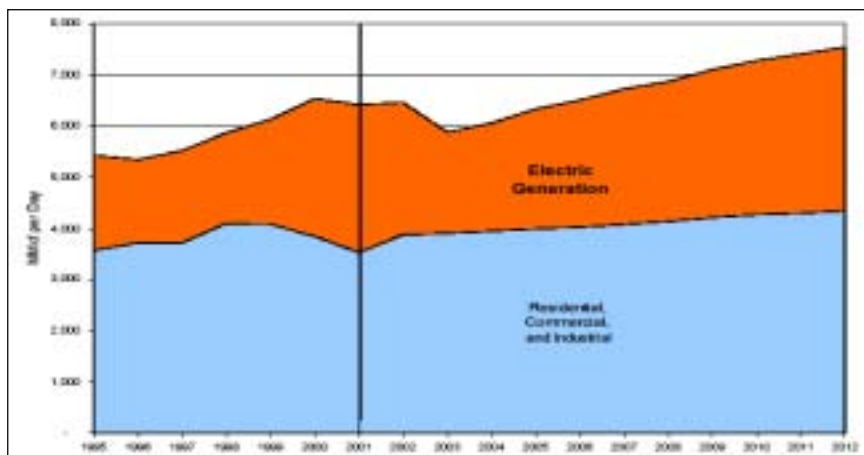
On the West Coast of the United States and Mexico, the planning of over 10 new LNG receiving terminals is currently going. This report will observe the facts and evaluate the effects on the existing Asia-Pacific LNG markets.

### 1. Natural Gas Supply & Demand Trends in California

At first, we will describe the background on LNG receiving terminals planned in and around California according to supply and demand trends for natural gas.

The increases in demand for power generating gas and the lack of a supply capacity in recent years has brought an apparent gap in the supply and demand for natural gas, particularly in California. While demand is expected to grow little for household, commercial and industrial uses of natural gas until 2012, as shown in Figure 1, its use in power generation is expected to increase remarkably in the same period. The importance of power generating gas demand is so high because the ratio of dependence on natural gas from the viewpoint of the power configuration in California is particularly higher than in other states (See Figure 2).

Figure 1 Results and Outlook for Natural Gas Demand in California

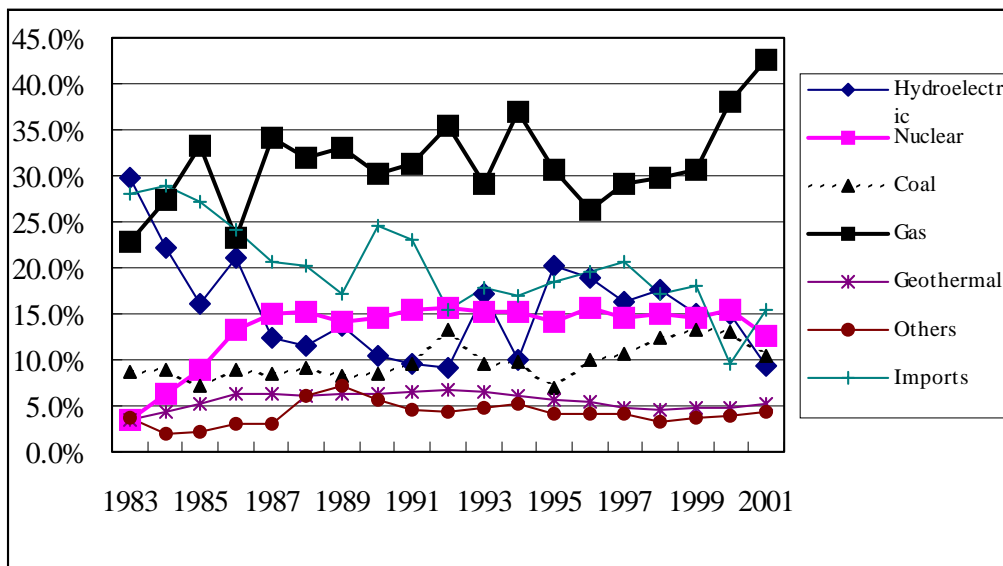


(Source: California Energy Commission, US)

<sup>1</sup> This report is the product of research in 2002 commissioned by the Ministry of Economy, Trade and Industry, which has approved disclosure of this report. We thank ministry staff members for their understanding and cooperation. As we prepared this report, a working group of experts in the natural gas businesses offered many helpful suggestions.

<sup>2</sup> Contact can be also available to Takeo Suzuki, Group Manager, Gas Group.

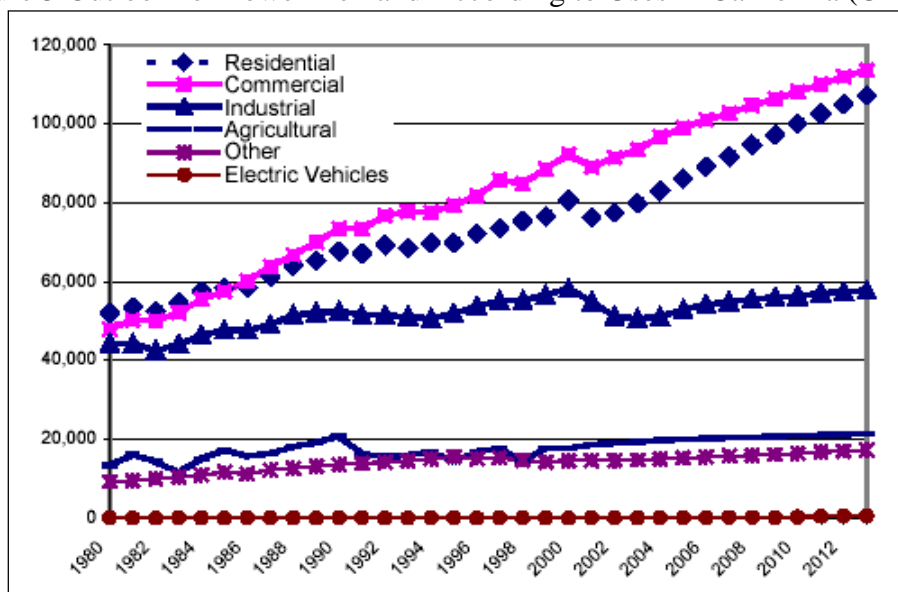
Figure 2 Power Configurations in California



(Source: Prepared by The Institute of Energy Economics, Japan based on data from the California Energy Commission, US)

The question then is what the outlook for power demand behind this matter. By looking at Figure 3, we could see that the forecast is for tremendous growth in household and commercial use rather than in industrial use, which has greater consumption per capita.

Figure 3 Outlook for Power Demand According to Uses in California (Unit: GWh)



(Source: California Energy Commission, US)

The reason why power demand for household and commercial use will grow is in the steady increase of population in California. The rate of growth of population is expected to be 1.6% from 2001 to 2006 and 1.3% from 2006 to 2013 (See Table 1).

Table 1 Expected Change in California’s Population (Unit: %)

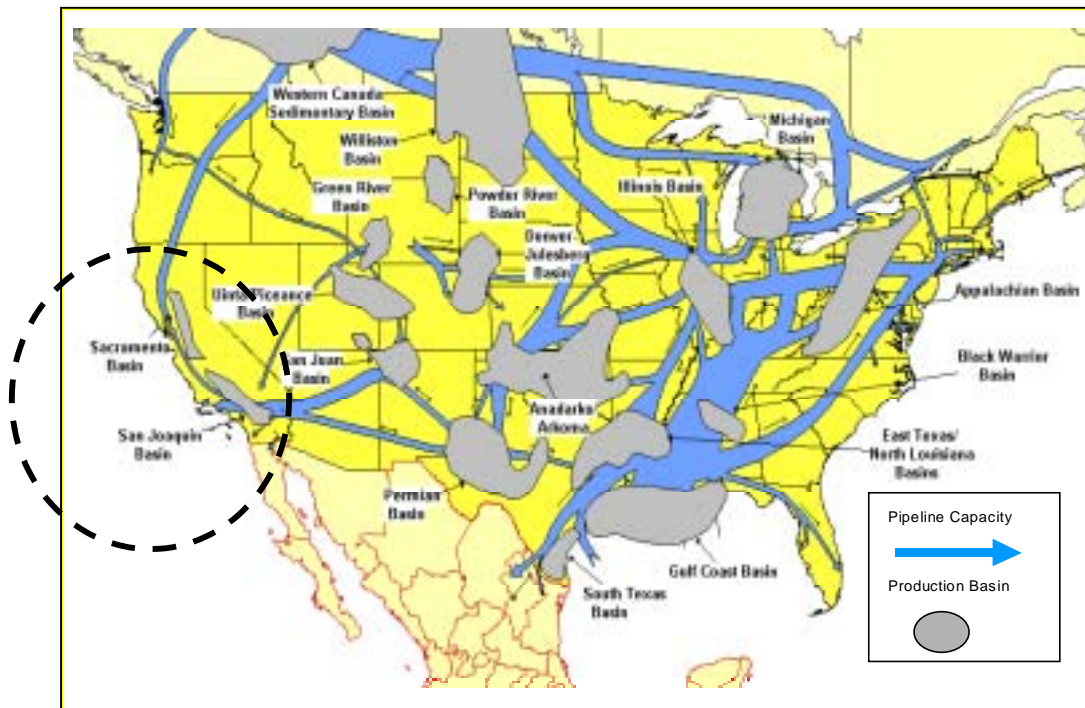
	Los Angeles Basin	San Francisco Bay Area	San Diego	Sacramento	Rest of State	Total State
1980-1990	2.3	1.5	2.9	3.0	2.6	2.3
1990-2001	1.1	1.1	1.1	1.8	1.4	1.2
2001-2006	1.4	1.3	1.9	2.2	2.2	1.6
2006-2013	1.3	0.9	1.3	1.7	1.9	1.3

(Source: California Energy Commission, US)

In contrast, it’s important to note the geographical and economic conditions as shown in the following which we evaluated in terms of the natural gas supply to support these demand increases.

- a. The self-sufficiency rate based on in-state production falls just under 14% due to the demand range despite the fact that California produces natural gas. (2001)
- b. California is dependent on imports from neighboring states (Arizona, Oregon, Nevada) for over half of its natural gas supply (See Figure 4 and Table 2).
- c. The interstate pipelines from neighboring states have insufficient transport capacities, and that cannot overtake the increases in demand.
- d. Economic problems in terms of investments remain due to the requirements for third party access despite visible plans to boost construct new transport pipelines.

Figure 4 Gas Fields and Flow in the United States



(Source: EIA, US)

Table 2 California Interstate Transactions (2001) (Unit: MMcf)

	Imports from Other States	Exports to Other States
Arizona	1,255,625	0
Oregon	680,368	0
Nevada	229,845	22,507
Mexico	0	23,320
Total	2,165,838	45,827

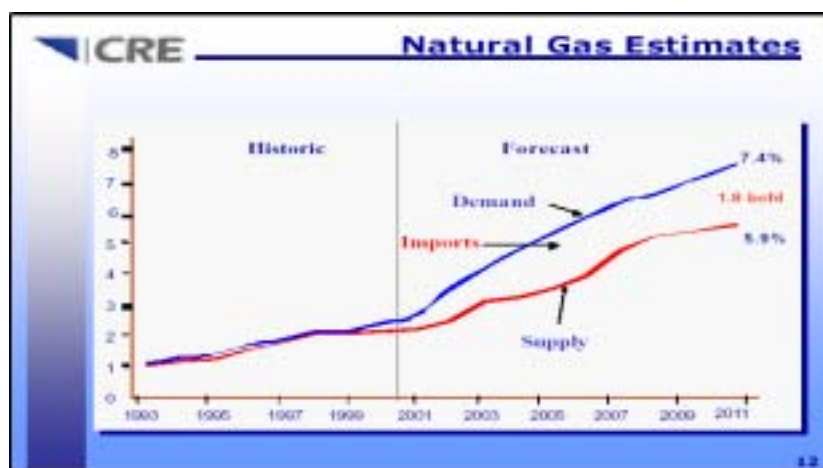
(Source: Prepared by The Institute of Energy Economics, Japan based on 'Natural Gas Annual 2001' of the EIA, US)

## 2. Trends in Natural Gas Supply and Demand in Mexico

We will now outline trends in natural gas supply and demand in order to look into the background of plans to introduce LNG in Mexico.<sup>3</sup>

While Mexico is a country that possesses oil and natural gas resources, its natural gas development has not proceeded at a pace to keep up with increased demand. The reason for this lies with the fact that Petroleos Mexicanos (PEMEX), a state oil company, as will be described later, controls the development of oil and natural gas in Mexico. And as the nation's finances have depended to a great extent on oil revenues, PEMEX has tilted its budget, provided by the national government, towards oil development. As a result, this circumstance makes a structural problem in terms of a lack of funds for natural gas development. So there is a dilemma such that natural gas has to be imported from the United States even though Mexico has its own natural gas resources. Mexico's dependency on imports is expected to rise as they cannot cover the growth in demand despite boosting domestic production in the future. (See Figure 5.)

Figure 5 Results and Outlook for Natural Gas Supply in Mexico



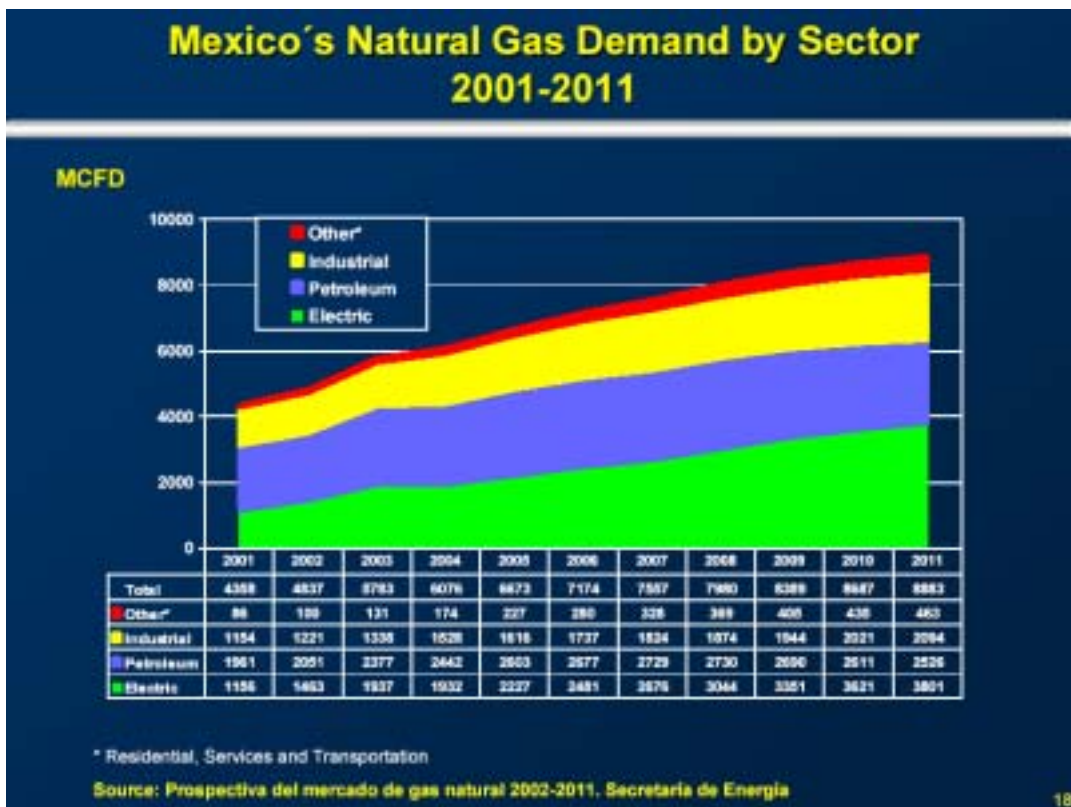
(Source: Comision Reguladora de Energia, Mexico)

A breakdown of demand shows that the average annual rate of growth for all

<sup>3</sup> The current conditions and outlook for the supply and demand of natural gas in Mexico as shown below relies on the "Prospectiva del mercado de gas natural ; 2002-2011" prepared by the Secretaria de Energia (SENER) of Mexico.

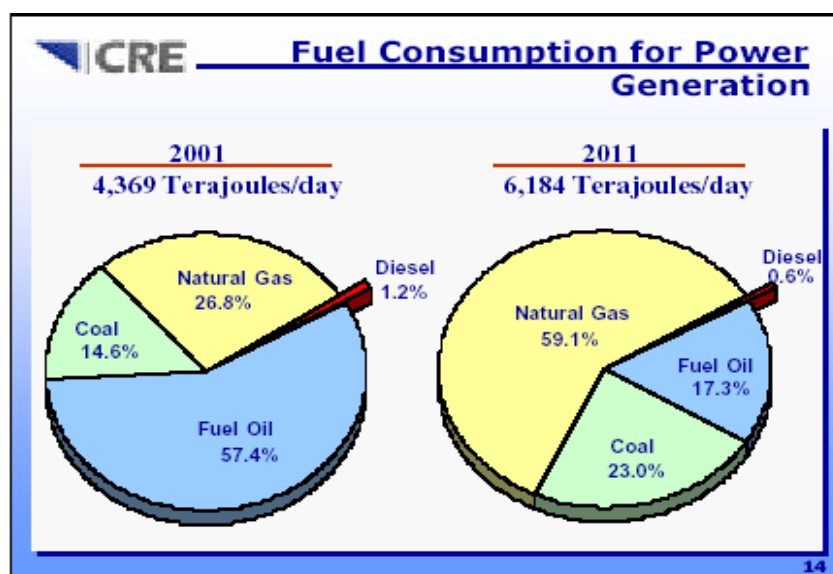
natural gas demand from 2001 to 2011 is 7.4% while the average annual rate of growth for power generation is 12.6%. We can grasp that the driving force for natural gas demand is the demand for power generation as shown in Figure 7.

Figure 6 Outlook for Natural Gas Demand in Mexico (By Use)



(Source: Secretaria de Energia "Prospectiva del mercado de gas natural: 2002-2011", Mexico)

Figure 7 Current Conditions and Outlook for Power Configuration in Mexico



(Source: Data from Comision Reguladora de Energia, Mexico)

In order to deal with increasing demand for power generation, Mexican government and PEMEX are stimulating the LNG imports and the introduction of foreign capital to the domestic gas field (like Burgos Basin) development simultaneously.

The purpose of LNG infusion to the northwestern part of Mexico (Baja California) is mainly to transport natural gas up to California, meaning that it will not contribute to improving the balance of natural gas supply and demand in overall Mexico. The gas transport pipeline network is underdeveloped in Baja California at present and it is not connected to other regions in Mexico, because the northwestern area, including Baja California, is not a production area of natural gas. Baja California (Mexico) and the southern part of California (U.S.) are one unified natural gas market. So we will have to regard the LNG receiving terminals located in the northern part of the Pacific Coast of Mexico as a supply infrastructure for California (U.S.). (See Figure 8)

Figure 8 Transport Pipelines at the US-Mexico Border



(Source: Data from Semptra)

On the other hand, the goal of LNG introduction to the Pacific Coast on the southwestern part on Mexico (Lazaro Cardenas) is to solve the natural gas supply and demand gap in Mexico itself. Lazaro Cardenas is the end of the existing natural gas transport pipeline (See Figure 9 and 10), thus if LNG receiving terminals could materialize here, gas will flow back to the mainland, which would then be expected to contribute to stabilizing the domestic supply and demand balance.<sup>4</sup>

<sup>4</sup> LNG receiving terminals are also being planned in Altamira on the east coast of Mexico, in view of the construction of a combined cycle power plant. The state power company CFE will be the primary contractor for the construction of the power plant while Royal Dutch Shell will be building these receiving terminals. The storage tanks (150,000m<sup>3</sup> x 2) will come on line in 2006 with a vaporization capacity in the range of 500MMcf/d.

Figure 9 Mexico's Natural Gas Transport Pipeline Network



Figure 10 Construction Sites for LNG Receiving Terminals in Mexico



(Source: Data on Figure 9 and 10 comes from the Comisión Reguladora de Energía, Mexico)

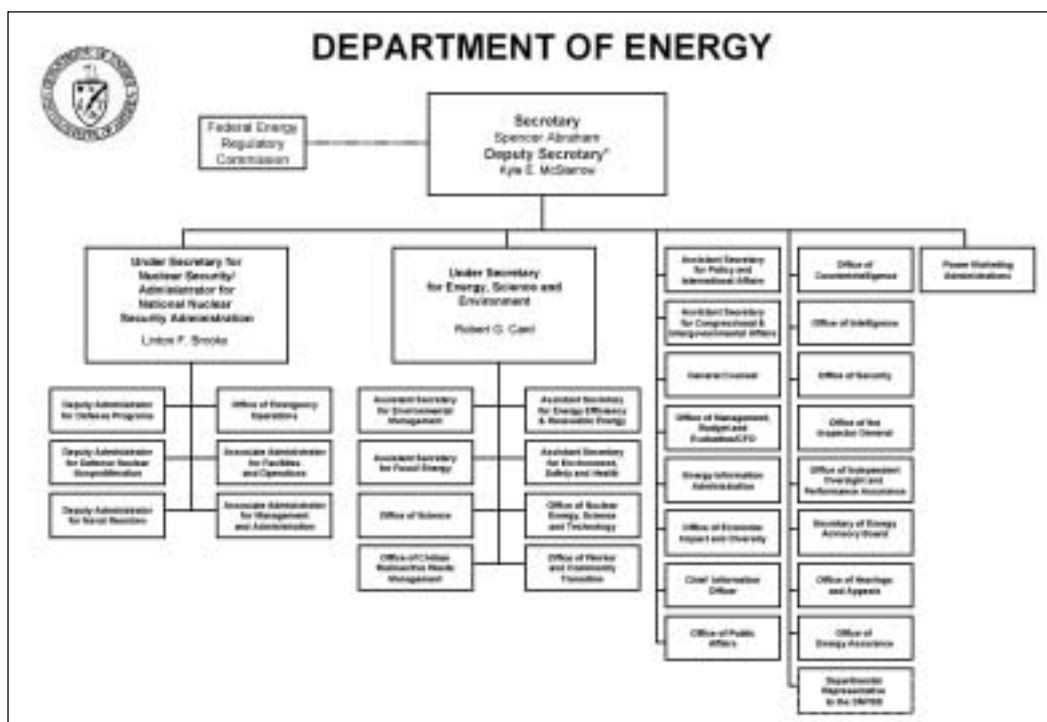
### 3. Regulations for Gas Businesses in the US (Especially regulations on LNG Imports, Terminal Construction and Operations)

(1) Energy Policy Organizations

In the US, the organization charged with forming all national energy policies is the Department of Energy (DOE). While the Federal Energy Regulatory Commission (FERC) is technically an external organ under the direct control of the DOE (See Figure 11), it is legally an independent administrative committee, thus possesses broad jurisdictional authority over electricity, oil and gas, as shown in the following.

- a. Regulations governing interstate pipeline companies (including LNG terminals), storage company services & tariffs
- b. Interstate pipeline construction approvals (evaluation of supply source, marketability, safety, engineering design, environmental impact, project finance and so on)
- c. Approvals for LNG terminal locations, construction, operations (evaluation of same items as interstate pipeline)
- d. Service contents for new customers of interstate pipeline companies and changes to service contents of existing customers.
- e. Evaluations on demolition of interstate pipelines and LNG terminal

Figure 11 Organizational Chart of the US Department of Energy



(Source: US DOE homepage)

(2) Regulations on LNG Importation

Companies who want to import LNG are required to get the approval of the Office of Fossil Energy (FE) of the DOE according to Article 3 of the Natural Gas Act at the federal level. Applications must be approved within 90 days before the start of importation

There are two types of import approvals that are chosen. One is the “Long Term



Authorization” when LNG is imported based on a long-term contract of more than 2 years and the other is “Blanket Authorization” which allows for imports based on short-term contracts of less than 2 years or for spot imports. The establishment of the ‘Two Year Blanket Import Authorization’ system in 1984 simplified the procedures for these, eliminating the need for public hearings on short-term importation contracts while approval could be granted through a simple assessment (quantity, cost and sales target).

Table 3 shows the application items required for companies to import LNG.

Table 3 Approval Application Items for LNG Importation

(a)	<ul style="list-style-type: none"> <li>➤ Applicant information (name, title, address).</li> <li>➤ Justification for proposed action is not inconsistent with the public interest.</li> </ul>
(b)	<ol style="list-style-type: none"> <li>(1) The scope of the project (the volumes of natural gas, the dates of commencement and completion, the facilities to be utilized or constructed).</li> <li>(2) The source and security of the natural gas supply to be imported (contract volumes, a description of the gas reserves during the import period).</li> <li>(3) Identification of all the participants in the transaction.</li> <li>(4) The terms of the transaction, such as take-or-pay obligations.</li> <li>(5) The provisions of the import arrangement (the base price, volume requirements, transportation and other costs).</li> <li>(6) The need for the natural gas.</li> <li>(7) The potential environmental impact of the project.</li> </ol>
Attached Data	<ul style="list-style-type: none"> <li>➤ A statement, including a signed opinion of legal counsel, showing that a proposed import or export of natural gas is within the corporate powers of the applicant.</li> <li>➤ A copy of all relevant contracts and purchase agreements. (Do not have to be attached for “Blanket Authorization”).</li> </ul>

(Source: Prepared by The Institute of Energy Economics, Japan according to the US Code of Federal Regulations Title 10 Part 590.202)

(3) Regulations on Construction of Receiving Terminal

Companies attempting to construct terminals are required to get the approval of the FERC according to Article 3 of the Natural Gas Act after LNG importation approval of DOE (See Table 4).

Table 4 Approval Application Items for Receiving Terminal Construction

(a)	<p>Information regarding applicant. The name, title, and post office address, telephone and facsimile numbers.</p>
(b)	<p>A detailed summary of the proposal.</p>
(c)	<p>A statement demonstrating that the proposal or proposed construction is not inconsistent with the public interest.</p> <p>The proposal will improve access to supplies of natural gas, serve new market demand, enhance the reliability, security, and/ or flexibility of the applicant’s pipeline system, improve the dependability of international energy trade, or enhance competition within the United States for natural gas transportation or supply.</p> <p>The proposal will not impair the ability of the applicant to render transportation service in the United States at reasonable rates to its existing</p>

	<p>customers.</p> <p>The proposal will not involve any existing contract(s) between the applicant and a foreign government or person concerning the control of operations or rates for the delivery or receipt of natural gas which may restrict or prevent other United States companies from extending their activities in the same general area, with copies of such contracts.</p>
Required exhibits	<p>A. A certified copy of articles of incorporation, partnership or joint venture agreements.</p> <p>B. A detailed statement of the financial and corporate relationship.</p> <p>C. A statement, including signed opinion of counsel, showing that the construction, operation, or modification of facilities for the export or the import of natural gas is within the authorized powers of applicant.</p> <p>D. (For pipeline).</p> <p>E. Evidence that an appropriate and qualified concern will properly and safely receive or deliver such LNG.</p> <p>E-1. A reports on earthquake hazards and engineering (When located in specific regions).</p> <p>F. An environmental report.</p> <p>G. A geographical map of a suitable scale and detail showing the physical location of the facilities.</p>

(Source: Prepared by The Institute of Energy Economics, Japan according to the US Code of Federal Regulations Title 18 Part 153.7,153.8)

In terms of environment and security, approval as per environmental laws, animal protection act, harbor act and technology security act are required at federal level. Similar laws are also imposed at the state level where the terminals are located.

Additionally, authority for construction approval for offshore LNG receiving terminals (in areas at least 3 miles off coast line) was moved from the FERC to the Maritime Administration (MARAD) and the US Coast Guard (USCG) due to the enactment of the Maritime Transportation Act in November 2002 and amendments to the Deepwater Port Act while organizational control of the USCG was shifted from the Department of Transportation (DOT) to the Department of Homeland Security (DHS). The Deepwater Port Act enacted in 1974 governed deep sea oil facilities formerly, now that natural gas equipment is also governed by amendment in 2002. Application procedures for new construction of LNG receiving terminals in offshore now follow the same ‘fast track’ administrative steps whereby all screening extending from the technical to environmental is conducted at the federal and state levels within 351 days after the application is submitted based on Maritime Transportation and Deepwater Port Acts.

(4) Regulations on Operations of Receiving Terminal

On LNG receiving terminal operations, Open-Access and Cost-Based-Rates regulations are imposed because LNG receiving terminal has been regarded as essential facility as well as interstate pipeline up to now. The following is the legal reason for this.

Interstate pipelines are mandated by Open-Access according to Order 636 (1992). And about LNG facilities, Title 49 “Transportation”: Part193 “Liquefied natural gas facilities: Federal safety standards” section 2007 of the Code of Federal Regulation (CFR) stipulates as shown in the following

49CFR193.2007 Definitions

...LNG facility means a pipeline facility that is used for liquefying or solidifying natural gas or synthetic gas or transferring, storing, or vaporizing liquefied natural gas.

LNG plant means an LNG facility or system of LNG facilities functioning as a unit...

Thus LNG equipment is also governed by Order 636 (includes not only LNG receiving terminals but also liquefaction plant and storage equipment).<sup>5</sup>

However, strong resistance and requests from the energy industries including the oil majors, led to policy changes by the FERC when new Dynegy's LNG receiving terminal plans<sup>6</sup> were given interim approval on December 18, 2002. This meant that new LNG receiving terminals to be constructed onshore in the future would be regarded not as equipment similar to pipelines but as production facilities, which is outside of FERC oversight. Thus new LNG receiving terminals would now fall outside the scope of Open-Access and Cost-Based-Rates regulations according to Order 636 described above, whereby these operations would be left to face-to-face negotiations by the parties concerned<sup>7</sup>.

On the background of this policy change, there are fears about worsening supply and demand balance in natural gas in the US as mentioned earlier in this report, which may affect policies that promote LNG infusion based on the need for LNG. The Natural Gas Markets Conference sponsored by the FERC on October 25, 2002 was the turning point in this controversy. Energy businesses such as Shell, BP, ExxonMobil, Tractebel and Dynegy insisted during the conference that Open-Access regulations hampered new terminal construction while inviting natural gas supply and demand pressures, thus revealing their opposition to the policies which mandate Open-Access. The FERC incorporated the opinions of these businesses and promoted new terminal construction by altering policies, which covered LNG receiving terminals, intended to boost LNG introduction, which would contribute to eliminating the supply and demand gap by obtaining access to the international gas trade.

Open-Access does not govern offshore LNG receiving terminal operations. It is supposed that Open-Access requirements are eliminated for onshore receiving terminals as it is consistent with offshore.

#### **4. Gas Business Regulations in Mexico (Especially regulations on LNG Imports, Terminal Construction and Operations)**

##### **(1) Energy Policy Organization**

In Mexico, as shown in Figure 12, the Comision Reguladora de Energia (CRE) supervises energy related regulations under the Secretaria de Energia (SENER). And the state company Petroleos Mexicanos (PEMEX) manages the oil and gas sectors,

<sup>5</sup> As an exception, Order 636 has not regulated the Everett terminal, in the Boston suburbs.

<sup>6</sup> The proposed site is Hackberry, Louisiana. The project was sold from Dynegy to Sempra on February 18, 2003 due to financing difficulties. FERC gave final approval to the project, currently called the Cameron Project, on August 18, 2003

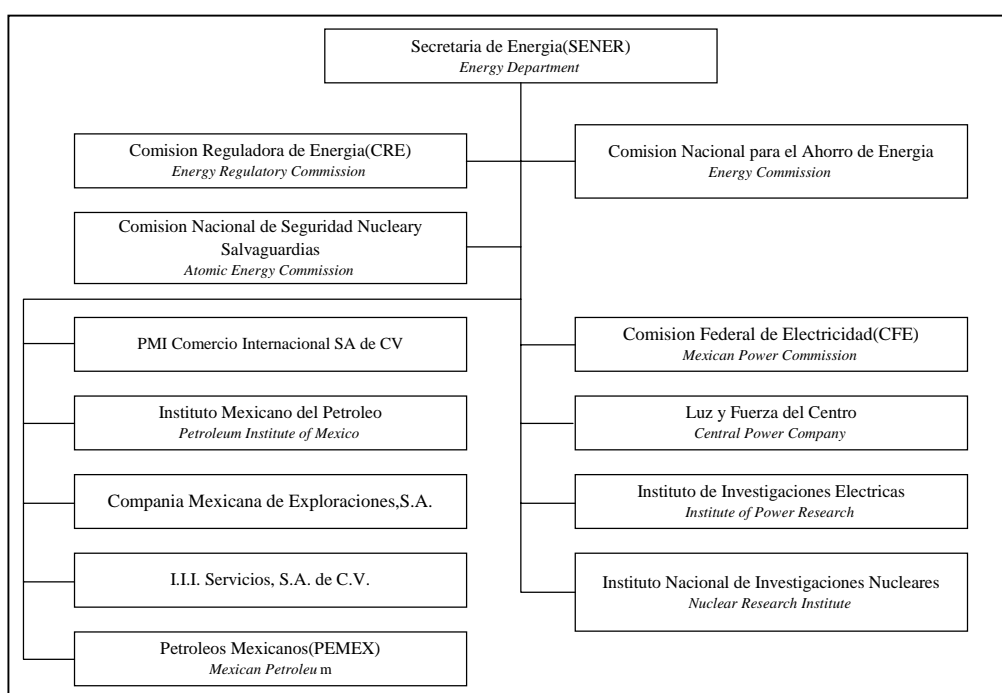
<sup>7</sup> The FERC reserves regulatory authority for competitive policies governing price cartels and illegal transactions.

and the Comision Federal de Electricidad (CFE) controls the electrical sector.

PEMEX was established according to the nationalization of the oil industry in 1938 and is granted exclusive authority as shown in the following.

- a. Oil exploration, development, production, transport, storage, distribution and primary wholesale
- b. Natural gas exploration, development, production, primary wholesale, transport and storage
- c. Manufacture, storage, transport, distribution and primary wholesale used in chemical products as key industry raw materials for derivative products from oil and natural gas

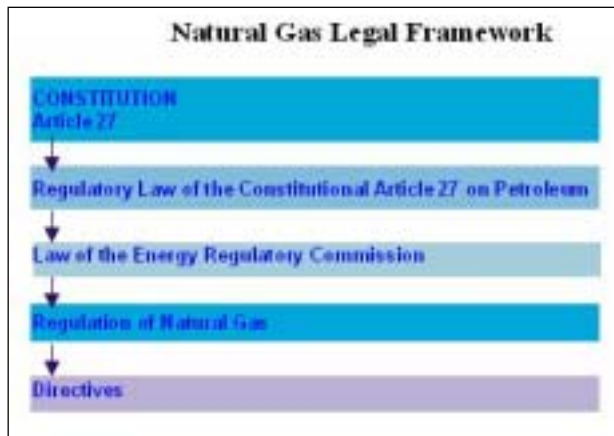
Figure 12 Energy Policy Organizations in Mexico



(Source: Prepared by The Institute of Energy Economics, Japan based on various data)

The major characteristic of energy policies in Mexico is resource nationalism and the nationalization of the major energy industries. Article 27 of the Mexican Constitution places the nation’s resources under the control of the government forming the basis for nationalizing power, oil and other core industries. This provision led to the enactment of the “Regulatory Law of Constitutional Article 27 on Petroleum” (amended 1995) which outlines the oil and gas industry organization and its regulations while the “Law of the Energy Regulatory Commission” (enacted in October 1995) which are statutes enacted under the Regulatory Law that indicate specific regulations for the electricity and gas industries (See Figure 13).

Figure 13 Mexico’s Energy Regulations Structure

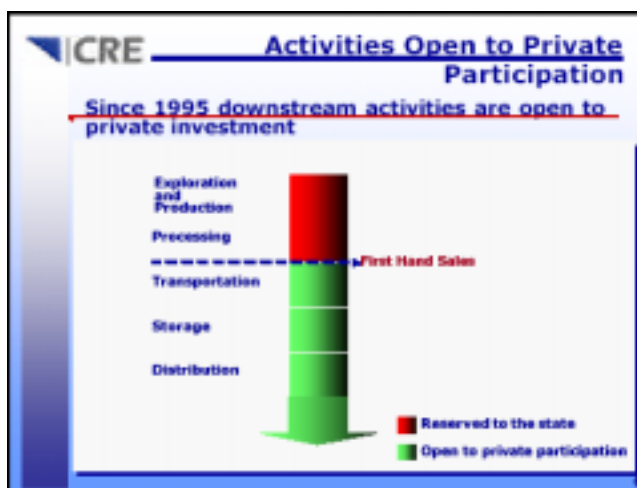


(Source: EIA homepage, US)

The Natural Gas Law was enacted in November 1995 and permits the participation of private companies including transport, storage and distribution after “First Hand Sales” (primary wholesale from PEMEX to distributors). Despite this permission, the same company is not allowed to handle multiple sectors from among transport, storage and distribution in order to prevent the appearance of a vertically integrated company. Domestic natural gas resource upstream (development and production) units are also under the exclusive control of PEMEX, while pipeline gas and LNG are unregulated for the importing and exporting.

Figure 14 shows the current overall structure of the gas industry in Mexico.

Figure 14 Structure of Mexico’s Gas Industry

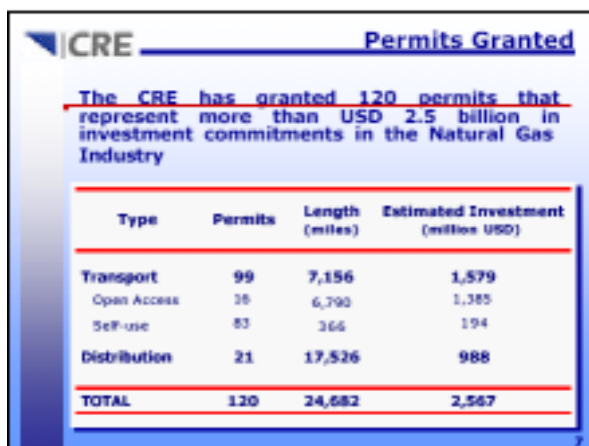


(Source: Data from the Comision Reguladora de Energia, Mexico)

While the gas unit of PEMEX owns most of the transport pipelines, the participation of private companies can also be found (See the Transport Self-use column in Figure 15). Open-Access regulation is established for transport pipelines

owned by PEMEX. Major foreign energy companies such as Sempra, Tractebel, Gas Natural, Gaz de France and Repsol YPF participate at the distribution and retail level as shown in Table 5. Yet there has been little progress in new participation in the import, transport and storage sectors.

Figure 15 Private Companies Participation on Transport and Distribution Sectors



(Source: Data from the Comision Reguladora de Energia, Mexico)

Table 5 Participation of Major Foreign Companies in Distribution Sectors

Company	Sempra	Tractebel	Gas Natural	Gaz de France	Repsol YPF
Distribution Regions	Mexicali	Guadalajara	Bajío Norte	Norte De Tamaulipas	Toluca
	Chihuahua	Queretaro	Bajío		
	La Laguna-Durango	Toluca	Monterrey		

(Source: Data from the Comision Reguladora de Energia, Mexico)

The following are extracts of LNG portions based on the regulatory framework shown above.

- a. Gas imports are unregulated for both Pipeline gas and LNG
- b. Government procedures such as technical assessments performed by the CRE, environmental assessments of the Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT) and land use approval of the local governments are required for terminal construction.
- c. With respect to terminal operations, while regulatory authorities offer their opinion on whether reserve operating capacity, if any, is subject to Open-Access, an example of this does not exist at the present time.<sup>8</sup>

### 5. Outline of LNG Receiving Terminal Projects

An outline of project specifics per companies is shown here. (1) to (10) are plans for California (U.S.) and Baja California (Mexico), while (11) and (12) are plans for the southwestern part of Mexico. Figure 16 shows the sites for these plans.

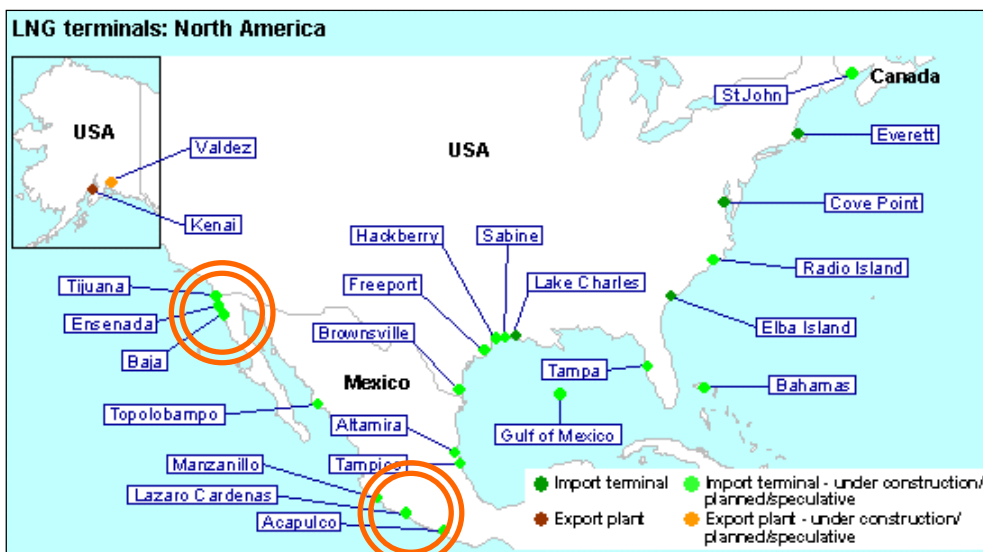
<sup>8</sup> When Mexico's LNG regulations are compared to the developments that have occurred in the US version as a guide, approval of terminal use via face-to-face negotiations with US regulatory authorities is expected to strongly impact on Mexico's LNG regulations.

Figure 6 Projects for LNG Receiving Terminals on the West Coast of North America

		Company	Projected Construction Site	Vaporization Capacity	Start	Other Items to Note
Baja California (Mexico)	(1)	Marathon	Tijuana	750MMcfd	2006	Approved by CRE in 5/2003 LNG supply from Indonesia in 8/2003
	(2)	Sempra	Ensenada	1,000MMcfd	2007	Approved by SEMARNAT in 4/2003 Approved by CRE and local government in 8/2003 LNG supply from Bolivia?
	(3)	Shell Gas & Power	Ensenada	1,000MMcfd	2007	Approved by SEMARNAT in 4/2003 Approved by CRE in 8/2003 LNG supply from Gorgon Australia accepted in 8/2003
	(4)	Chevron Texaco	Offshore of Tijuana	750MMcfd	n.a.	Approval of CRE expected after 11/2003 LNG supply from Gorgon Australia accepted in 8/2003
	(5)	ConocoPhillips	Rosarito	680MMcfd	n.a.	Application to SEMARNAT rejected? LNG supply from Darwin Australia?
California (US)	(6)	Crystal Energy	Offshore of Ventura	500MMcfd	n.a.	
	(7)	Mitsubishi Corporation	Long Beach	700MMcfd	2007	
	(8)	Calpine	Humboldt Bay	n.a.	n.a.	
	(9)	BHP Billiton	Offshore of Ventura	800MMcfd	2008	
	(10)	(Shell&Bechtel)	(Vallejo)	(1,300MMcfd)	↘	(Withdrawn in February 2003)
Southwestern Mexico	(11)	Tractebel	Lazaro Cardenas	n.a.	n.a.	LNG supply from Peru
	(12)	Gstream	Lazaro Cardenas	n.a.	n.a.	LNG supply from Bolivia?

(Source: Prepared by The Institute of Energy Economics, Japan based on various data)

Figure 16 LNG Terminals (Existing and Planned) in North America



(Source: LNG One World)

(1) Marathon (Construction Planned at Tijuana, Baja California)

The total cost for construction is expected to reach \$1.5 billion and will start in 2003. Operations will begin in 2006. This plan is called the “Baja California Regional Energy Center” and includes the construction of vaporization equipment with a vaporization capacity of 750MMcfd and a gas thermal power plant (power generation range of 1,200MW). 80% of the investment for this project will come from Marathon, and the remaining 20% will come from Golar LNG (a Norwegian LNG shipping company, 10% investment) and Grupo GGS S.A. de C.V. (a Mexican engineering company, 10% investment).

The application for new terminal construction submitted to the CRE on August 5, 2002 by Marathon was approved on May 8, 2003. This was the first case approved by CRE. Furthermore, Marathon needs the approval of SEMARNAT and the local government.

The agreement that was reached on transactions with Pertamina and Exspan for joint promotion of the Donggi project on Sulawesi Island, Indonesia was announced on August 27, 2003 to supply LNG. This Memorandum of Understanding (MOU) sets the conditions for transactions for the 20-year period starting from 2007 at 6 million tons LNG annually.

(2) Sempra<sup>9</sup> (Construction is planned at Ensenada, Baja California)

The new construction of the “Energia Costa Azul” LNG receiving terminal is being planned with a vaporization capacity of 1,000MMcfd. Sempra is planning to invest \$600 million and start construction in 2004. Operations will start from 2007.

The terminal construction application was submitted to the CRE on August 6, 2002 and approval came on August 18, 2003. Approvals for environmental assessments came from SEMARNAT on April 16, 2003. Land use approvals were

<sup>9</sup> This project is likely to be promoted by Sempra alone as the CMS Panhandle natural gas infrastructure unit that includes the Lake Charles terminal was sold to the Southern Union Panhandle Corporation, which is owned by Southern Union Co., the gas distributor, and AIG Highstar Capital, because of the worsening financial situation at CMS Energy, despite the fact that this plan was first launched jointly with CMS Energy.



received from the local Ensenada authorities on August 18, 2003 meaning that Sempra now has all three major approvals in its need.

The LNG supply source has not been determined as yet despite Bolivia being the point of focus. Sempra announced a MOU which signed jointly with Pacific LNG<sup>10</sup> on December 4, 2001. The MOU called for Sempra and Pacific LNG to work together on exclusive plans for shipping natural gas that originates in the Margarita gas fields of Bolivia (estimated storage capacity of 13 Tcf) only for Ensenada over a 20-year period. Negotiations on the exclusive monopoly of Sempra and Pacific LNG were invalidated in August 2002 as the Bolivian government was unable to reach agreement with either Peru or Chile for a LNG shipping port by the end of the negotiating period.<sup>11</sup> Sempra is currently seeking a supply source.

Sempra possesses two sub-companies: Southern California Gas Company (SoCalGas) and San Diego Gas & Electric (SDG&E). They supply electricity and gas to the southern part of California neighboring the Mexican border. Thus strengthening the natural gas supply capacity in the southern part of California is an important business challenge for Sempra. Sempra also manages distributors within Mexico in 3 separate regions: Mexicali, Chihuahua and La Laguna-Durango in the north, through Sempra Energy International, thus possessing strong, direct interests in these areas.

(3) Shell Gas & Power (Construction Planned at Ensenada, Baja California)

The plan for an LNG receiving terminal to be constructed in Ensenada, Baja California was announced on March 27, 2002. The construction of an LNG receiving terminal with a storage tank capacity of 170,000m<sup>3</sup>×2 and a vaporization capacity of 1,000MMcfd (1,300MMcfd at peak times) calls for an investment of \$500 million in construction costs and operations will begin in 2007. Approval for the project was given by the CRE on August 18, 2003 while approval for an environmental assessment came down from SEMARNAT on April 8, 2003. The supply source will be the Gorgon gas fields in Australia, which are developed by Shell itself. According to the Letter of Intention (LOU) concluded on August 5, 2003, transactions will be spread over a 20-year period starting from 2007 at 2 million tons annually.

(4) Chevron Texaco (Construction Planned at Offshore Baja California)

An offshore LNG receiving terminal is currently being planned at a vaporization capacity of 1,400MMcfd. This plan will employ a structure that is similar to the Port Pelican planned by Chevron Texaco on the Gulf of Mexico. The Mexican regulatory authorities have not approved it yet. According to a press release dated August 4, 2003, the supply source will be the Gorgon gas fields of Australia developed by ChevronTexaco itself. LNG at amounts at least 2 million tons annually will be supplied for Mexico from 2008. Chevron Texaco, the operator on

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<sup>10</sup> A consortium of Repsol YPF 37.5%, BG Bolivia Corporation 37.5% and Pan American LLC 25%. 60% of Pan American LLC investment comes from BM while 40% comes from Brides.

<sup>11</sup> Developments up to now in determining the shipping port for Pacific LNG consists firstly of an announcement to postpone the decision on choosing a shipping site which was set for August 2002 to a new date at the end of 2003, which was further postponed to the present time. The background for this are the political problems that have arisen with shipping terminal decisions made separate from economic judgments on investments due to historical circumstances in which Bolivia lost its coastline to Chile in the Pacific War at the end of the 19<sup>th</sup> century (war between Bolivia and Peru joining forces against Chile). Thus there is still no outlook for a decision to be made as selection of the shipment site from the Margarita gas field inevitably involves Bolivia, Peru and Chile leading to political problems.

the Gorgon Project in Australia, will invest and develop 4/7, Shell will invest and develop 2/7 and the remaining 1/7 will be handled by ExxonMobil.

(5) ConocoPhillips (Construction Planned at Rosarito, Baja California)<sup>12</sup>

A new LNG receiving terminal at a storage capacity of 160,000kl×2 and a vaporization capacity of 680MMcfd will be constructed and will start in 2005. Nevertheless, SEMARNAT has rejected the environmental assessment plan and CRE has not given its approval. The LNG supply source will probably be Darwin of Australia, which possesses the interests.

(6) Crystal Energy (Construction Planned at Ventura County in Southern California)

The existing platform (used for oil development from 1980 to 1997) which exists 11 miles offshore from Ventura County, located just to the west of Los Angeles, will be modified for LNG receiving and vaporization facilities and be connected to an inland pipeline via an underwater pipeline. The vaporization capacity is 500MMcfd and the total construction cost will be \$125 million. Crystal Energy is a subsidiary of Small Ventures USA LLC, and was established to materialize this LNG project. As this project does not need to construct totally new facilities, operations are expected to start within a short 18 months or 2 years after receiving authority's approval. This was the first instance globally where an existing oil platform is to be converted to the gas facilities. The Maritime Administration and the US Coast Guard (not the FERC) hold the main assessment authority as per the Maritime Security Act because this facility will be located offshore.

(7) Mitsubishi Corporation (Construction Planned at Long Beach, California)

Approval has been received from the Long Beach Port Authority but not from the FERC and other agencies as yet. Operations will start from 2007 at an investment total of \$400 million and a vaporization capacity of 700MMcfd.

(8) Calpine (Construction Planned at Humboldt Bay in Northern California)

Calpine, a major independent power company in US, is planning to construct a LNG receiving terminal (scale is unknown) and a natural gas-fired power plant (minimum 200MW) at an investment of \$750 million.

(9) BHP Billiton (Construction Planned at Offshore Ventura County in Southern California)

BHP Billiton, which possesses interests in the gas fields on the Northwest Shelf of Australia, is planning to construct the "Cabrillo Port" LNG receiving terminal with an investment of \$600 million, a storage capacity of 6Bcf and a vaporization capacity of 800MMcfd.

(10) Shell & Bechtel

A plan to construct a LNG receiving terminal on the Mare Island in Vallejo City, located in San Francisco Bay was announced on May 3, 2002. Owing mainly to strong objection from local community, Shell declared the withdrawal from the construction on January 17, 2003, and Bechtel soon followed on January 31, 2003.

(11) Tractebel (Construction Planned at Lazaro Cardenas in Michoacan State)

A gas thermal power plant and a new LNG receiving terminal (each costing \$500 million) are planned. The CRE has not yet approved the project. The LNG supply source is Camisea of Peru, for which Tractebel provides capital participation for downstream projects. Tractebel is already involved in the gas distribution business

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<sup>12</sup> El Paso, which had initially been involved in this plan, withdrew from the LNG business on February 5, 2003 due to a worsening management situation.

in three state of Mexico (Queretaro, Panuco and Guadalajara) and has indicated interest in expanding its business.

(12) Gstream (Construction Planned at Lazaro Cardenas in Michoacan State)<sup>13</sup>

The said company, which belongs to the Repsol YPF Group, is planning to construct a LNG receiving terminal with an investment of roughly \$500 million. The candidate to be the supply source is Pacific LNG which is led by Repsol YPF. Gas Natural of the Repsol YPF Group is also engaged in gas distribution businesses in three regions in Mexico through its local subsidiary, Gas Natural Mexico.

While we can recognize that there are currently 12 plans as shown above, there is uncertainty which of these will be carried out to fruition. The question then is how many of these can succeed.

Firstly, the demand increment for California is approximately 1,000MMcfd between 2001 and 2012 (equivalent to roughly 7.6 million tons/year when converted to LNG) (See Figure 1 shown before). These insufficiencies will be compensated for with the following options.

- Increase import volume from other states through expanding interstate pipeline capacities or through new construction.
- New LNG receiving terminal construction
- Boosting in-state production volume (Note that huge increases are not expected)

Thus if there will be no expansion or new construction of interstate pipelines, the achievable level may be approximately 1,000MMcfd. The conclusion is that there are about 2 places that are probably within reach as the receiving terminal range currently being planned for is about 500 to 1,000MMcfd.

Secondly, in Mexico, the difference between the demand increases and domestic production as of 2011 is predicted about 1,800MMcfd. Toward this gap, the following measures will be taken.

- Boosting pipeline imports from the US (Infrastructure will have to be maintained)
- New LNG receiving terminals on the Atlantic Coast
- New LNG receiving terminals on the Pacific Coast

The only amount for the LNG receiving terminal that can be tracked in Mexico is the 500MMcfd vaporization capacity being planned at Altamira on the East Coast. So that we cannot jump to a conclusion as to the possible number of terminals on the Pacific Coast, but there will probably be one or so.

These conclusions are also the same opinion as the one mentioned by persons from the regulatory authority and the energy businesses of both countries when we IEEJ conducted local hearings, while similar views were also expressed by senior officials of Mexico's CRE which appeared in Reuters and the Natural Gas Weekly magazine.

## 6. Issues in Materializing LNG Receiving Terminals

While there are many issues to be considered in order to materialize LNG receiving terminal, including transport capacity and other concerns regarding the connecting pipeline (interstate, intrastate) from the terminal to the demand site, we

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<sup>13</sup> Name was changed by Repsol YPF Midstream in April 2002.

can focus upon the following four issues which are thought to be critical in nature at this point for evaluation.

- a. Regulations of government authorities
  - b. NIMBY issues
  - c. Heating value control at receiving terminal
  - d. Competition between LNG and pipeline gas
- (a) Firstly, LNG import procedures are becoming more simplified as described above. While one of the big obstacles for business entities intending to plan/construct/own a new LNG receiving terminal, is mandated Open-Access regulations, we can also say that even these regulations are moving to better directions for them, because such access can be made based on the face-to-face negotiations as previously mentioned. As for future trends in Mexico, we need to see carefully, since currently on-going figure seems a tentative one-
- (b) The greatest problems being confronted by business entities today are opposition from local residents. This is called NIMBY i.e. Not-In-My-Back-Yard (= do not construct such an unpleasant facility in my neighborhood). This deep-seated unease or skepticism exists considerably in the US in particular in terms of LNG safety (a different reaction from the one you experience in Japan) such that the tendency to oppose the construction of energy facilities in their neighborhoods is intense. Thus work in obtaining the understanding and acceptance by the residence in the process of securing a site and construction poses, quite naturally, extreme difficulties. The opposition from local residents against proposals by Shell (over 11,000 people signed a petition) who were planning to construct on Mare Island in California were strong, despite all the favorable assessments of the project made by the government authorities.<sup>14</sup> The NIMBY issues themselves are reason enough for planning to locate LNG receiving terminals in Baja California, Mexico, where infrastructure for California is present.
- (c) Third is the fact that you have to consider about heating value control/adjustment at receiving terminals. The LNG calorific value differs depending on the production site as shown in Table 7, with regions such as the Middle East and Asia; the main regions supplying LNG exist, largely exceeding 1,100Btu/cf.

Table 7 LNG Calorific Value by Gas Producing Country

Gas Producing Country	LNG Calorific Value (Btu/cf)
Alaska	1,009
Trinidad	1,075
Algeria (Arzew)	1,113
Nigeria	1,125 to 1,150
Abu Dhabi	1,136
Oman	1,100 to 1,150
Qatar	1,075 to 1,130
Australia NWS	1,127
Brunei	1,127
Indonesia (Bontang)	1,114
Indonesia (Tangguh)	1,050
Malaysia	1,117

(Source: World Gas Intelligence)

<sup>14</sup> Taken from the "Liquefied Natural Gas in California" survey report of the California Energy Commission (July, 2003)

LNG receiving terminals have a heating value control/adjustment criteria/specifications that limits the acceptable kind of LNG due to quality control. This means that even if there is an attractive LNG with its price, there can be a case that they cannot take due to the criteria/specifications. Let us take, for example, the receiving terminals on the US East Coast which are currently in operation in order to get a better understanding of what these conditions actually are.

Table 8 Calorific References at LNG Receiving Terminals on the US East Coast

	Receivable LNG Calories (Btu/cf)
Elba Island	1,075
Cove Point	1,100
Everett	1,150
Lake Charles	1,200

(Source: World Gas Intelligence)

As shown in Figure 8, the Elba Island and Cove Point terminals can receive up to 1,100 Btu/cf while the Everett terminal comes it at 1,150 Btu/cf. Thus we can see that imports for the Elba Island and Everett terminals come mainly from Trinidad (1,075 Btu/cf) followed by Algeria (1,113 Btu/cf) and no others. Though the Cove Point terminal came in operation again in August 2003, the first cargo was from Trinidad. Only the Lake Charles terminal with its maximum 1,200 Btu/cf is the only one terminal at present which can receive LNG imports from various countries like Trinidad and Algeria as well as from the Middle East (Oman, Qatar) and Asia (Malaysia, Brunei, others).

Although such limitation exists on heating value, required equipment/facility to adjust heating value (practically speaking, to mix with LNG with lower heating value or to dilute by injecting nitrogen, etc.), enables to accept wider range of LNG sources. However, this issue is an important for the people to build/own/operate a LNG receiving terminal.

(d) The most important issue is the competition between LNG and pipeline gas. Energy businesses planning for LNG receiving terminals need to secure the return on investments and earn profits by obtaining reliable LNG customers/demands, the real concern here is how competitive is LNG vis-à-vis pipeline gas. Both in California and Mexico, price competition between LNG and pipeline gas will emerge as the price of natural gas is expected to rise on account of future supply shortfalls, resulting LNG becomes more competitive.

On the other hand, however, pipeline infrastructure improved relatively faster in the region, LNG competitiveness will be ultimately weakened.

Though it is said that the current potential LNG price competitiveness is at about the \$3.00 - 3.50/MMbtu levels due to lowers costs for liquefaction plants and LNG vessels, LNG competitiveness will surely be affected by the price of pipeline gas.

## 7. Impact When LNG Receiving Terminal Would Be Materialized

Let us conclude by observing the impact in California and Mexico as well as the one on the existing Asia-Pacific LNG market if an LNG receiving terminal project is realized, based on the verifications as above.

(1) Domestic Impact on California and Mexico

- (a) When an LNG receiving terminal project is realized on the West Coast of California or Baja California, the natural gas supply balance will be improved by connecting to the existing pipelines in California. Baja California is separated from the existing main pipeline network in Mexico, thus is of less effect in filling the current supply and demand gap in Mexico.<sup>15</sup>
- (b) When an LNG Receiving Terminal is installed in on the Pacific Coast of Southwestern Mexico, as southwestern Lazaro Cardenas and other areas are in close proximity to the existing natural gas pipeline network in the country, which make connection easy, it will certainly improve the supply and demand gap in Mexico.

(2) Impact on the Asia-Pacific LNG Market

- (a) The first question here is which LNG supply source to be chosen for the West Coast of North America. Bolivia and Peru are superior to other countries due to their proximity to the customer site, as shown in Table 9. Some businesses are assessing LNG importation from South America as shown in Table 6.

Table 9 Transport Distances from Gas Producing County to Rosarito, Baja California  
(Unit: Miles)

Peru (Lima)	Sakhalin II (Prigorodnoye)	Indonesia (Bontang)	Malaysia (Bintulu)	Australia NWS
3,662	4,468	7,171	7,314	8,105

(Source: Prepared by The Institute of Energy Economics, Japan based on various data)

When we turn our attention to the Asia-Pacific LNG market, we can see that there are many new LNG production projects that the product take-off for the production capacity has not committed yet. These projects could be the potential LNG supply source to North America.

While there are differences in progress being made with each project, we can cite specific examples such as Sakhalin in Russia<sup>16</sup>, Tangguh in Indonesia<sup>17</sup>, Tiga in Malaysia<sup>18</sup> and Gorgon in Australia<sup>19</sup> and others, where the current trend in Pacific LNG markets seems to be in a state of oversupply. The demand range in California, and southwestern Mexico is around 7.6 million and 3.8 million tons of LNG per year, respectively. Considering such figures, the new supply sources will be supposed as a new project, even when LNG is supplied from Asian area to the West Coast of North America. Therefore, LNG supply and demand across the entire Pacific region, including such existing LNG consuming countries in

<sup>15</sup> Note that this will become the domestic supply point as long as the infrastructure which connects Mexico to the LNG receiving terminals is maintained, thus incremental importation comparable to covering domestic Mexican demand is expected which will contribute to improving the supply and demand balance.

However, PEMEX never really had the idea to develop this infrastructure, so we can say that the initiative is being put into private capital.

<sup>16</sup> The contracted amount from the planned production volume of 9.6 million tons as of August 2003 is 2.8 million tons (1.1 million tons for Tokyo Gas, 1.2 million tons for Tokyo Electric and 500,000 tons for Kyushu Electric)

<sup>17</sup> The supplies already agreed to from the planned production volume of 7 million tons is 2.6 million tons for the Fujian Province, China and 1.15 million tons for POSCO+SK South Korea

<sup>18</sup> The long-term contracted amounts from the planned production volume of 6.8 million tons as of August 2003 are approximately 5.0 million tons, including options (900,000 for Tohoku Gas, 1.6 million tons for Tokyo Gas/Toho Gas/Osaka Gas, 480,000 tons for the Japan Petroleum Exploration Company and 2.0 million tons for KOGAS).

<sup>19</sup> The outlook is for the entire amount to be supplied for North America from the Chevron Texaco and Shell LNG chain developers themselves.

Northeast Asia as Japan, South Korea, and Taiwan, will probably not be affected to any major extent.

(b) Next, considering the transaction price, the SOCAL prices (Southern California prices: interstate delivery prices to southern California) will be referred to the consuming region for Pacific Coast of California, U.S., and Baja California, Mexico. For the Mexican Pacific Coast of southwestern part, the domestic price may be referred. Therefore, a different price formula from the existing Asian one (where employing mainly JCC [Japanese Crude Cocktail] as the price index) will probably be set to the West Coast of North America even when LNG is supplied from the same liquefaction project.

(c) The question at last is any change would be foreseen in trade pattern in the existing Asia-Pacific LNG market. The LNG trade there has been rather rigid and non-flexible so far. However, recently, we see more flexible LNG trades such as spot trade of KOGAS, South Korea in winter and contract renewal to Satu, Malaysia of Tokyo Electric and Tokyo Gas, which includes factors of short-term, spot and others, as reported. Once LNG receiving terminals are materialized on the West Coast of North America, such non-conventional trade will be introduced into the Pacific region. Also another possibility is that, assuming the destination clause in the LNG supply contract would be loosen, re-sale from the existing three Northeast Asian countries to the North American depending upon LNG prices and the LNG vessel availability. Given this perspective, the materialization of LNG receiving terminals on the West Coast of North America may open the door to further diversification and vitalization of LNG businesses in the existing Asia-Pacific markets.<sup>20</sup>

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<sup>20</sup> Future changes to the Pacific LNG market call for other factors to be considered such as the existence of China and India as new LNG importing countries.

This may also impact heavily on reviews of the LNG price formula for Northeast Asia cited in this report when a new price formula is created for these new importing countries.