

LNG Receiving Terminals in the Californias - Appropriate Safety and Environmental Requirements

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Significance of LNG Imports

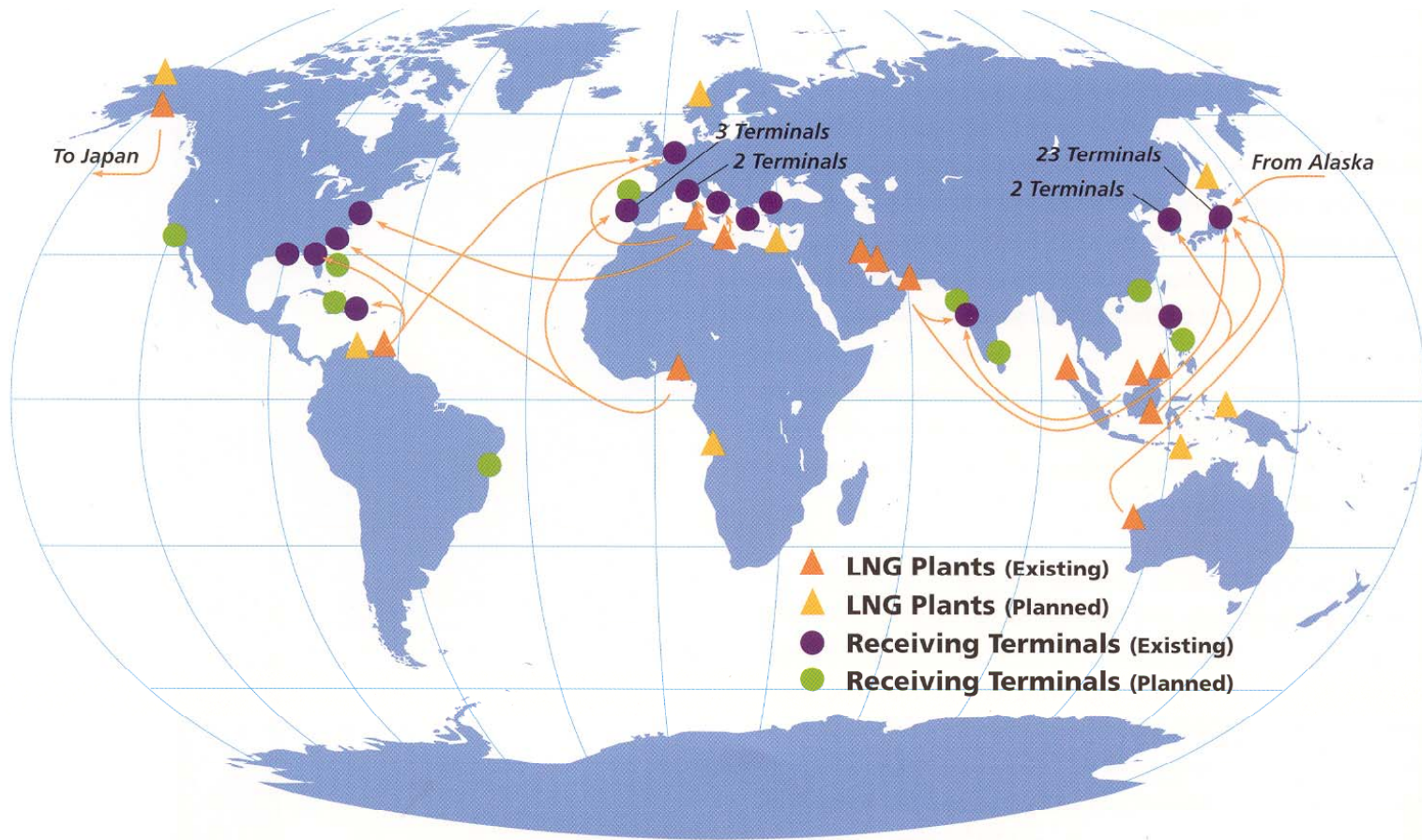


“The U.S. is in the midst of a historic transition from dependence on North American natural gas supplies to one of dependence on megaproject investments and global markets.”

Risky Diet 2003, Natural Gas: The Next Energy Crisis

Center for Energy Efficiency and Renewable Technologies,
September 2003

Worldwide View of LNG Supply Chains



Historical Perspective: California and Onshore LNG Terminals

- California LNG Terminal Act of 1977:
 - *Transfers authority to permit one LNG terminal from CA Coastal Commission (CCC) to CPUC*
 - *CCC directed to survey and rank terminal sites*
 - *Maximum population density 10 people per sq. mi to one mile from fence line, 60 people per sq. mi to four miles from fence line*
 - *Same density standard for LNG shipping lanes*
 - *Power of eminent domain granted to terminal operator to maintain low population densities*

Rationale for Population Density Restrictions

"The Legislature's 4-mile restriction was apparently based on estimates of the skin burn radiation limits from a major fire resulting from a large LNG spill at the terminal. This 4-mile criterion does not specifically address the possible travel of an unignited LNG vapor cloud beyond four miles."

Spills of 25,000 m³ and 125,000 m³ of LNG were evaluated.

Source: CCC, Final Report Ranking LNG Terminal Sites, May 24, 1978, p. 68.

Historical Perspective: Onshore CA LNG Terminals

- 1978 California Coastal Commission report, "Final Ranking of LNG Terminal Sites," 82 sites evaluated, all but 4 sites rejected
- Evaluation criteria: population density, land and water site characteristics, maritime conditions, seismic activity, and coastal resources
 - *L.A. Harbor site rejected, presumably due to population density (not stated in final ranking)*
 - *Humbolt Bay site rejected*

Source: CCC, Final Report Evaluating and Ranking LNG Terminal Sites, May 24, 1978

Historical Perspective: Offshore CA LNG Terminals

- CCC Resolution - WHEREAS, it is possible that one or more offshore sites and terminal types could prove more appropriate than the best onshore site and terminal type, considering safety, cost, timing and the policies of the (1976) Coastal Act,
- NOW THEREFORE BE IT RESOLVED, if an onshore LNG terminal is not approved by July 31 (1978) the Governor and Legislature should establish a procedure for the simultaneous consideration of the overall ranking of the most appropriate alternative onshore and offshore sites, and for the granting of a permit to the single most appropriate site.

Historical Perspective: Offshore CA LNG Terminals

- CCC, *Offshore LNG Terminal Study*, Sept. 15, 1978
- Most appropriate offshore site - international waters (Ventura Flats) off the coast of Ventura County
- Minimal adverse impacts on sensitive marine resources and public recreation along the coast
- Estimated cost for 1.3 bcf/d baseload and 1.6 bcf/d peak sendout floating terminal, including connecting subsea and overland pipelines, from \$400 to \$600 million (1978 dollars)
- Maritime conditions - weather at Ventura Flats is acceptable for an offshore marine terminal, but not as mild as off Camp Pendleton

BHP Billiton Offshore LNG



Estimated Cost of Baja and California LNG Terminals

Project	Sendout Capacity (bcfd)	Capital Cost (\$ millions)
Shell	1.3	~500
Sempra	1.0	600
ChevronTexaco	1.0	NA
Marathon/Golar	0.75	550
BHP Billiton (Oxnard)	1.5	600

Historical Perspective: U.S. Law and LNG Terminals

- Pipeline Safety Act Amendments of 1979:
 - *Government Accounting Office (GAO), investigative arm of Congress, states before Senate "We believe remote siting is the primary factor in safety" (for LNG and LPG terminals)*
 - *GAO recommendation incorporated in 1979 Act*

Source: Mobile Register article, Nov. 16, 2003

Remote Siting of LNG Terminals and U.S. Pipeline Safety Act

- Pipeline Safety Act Amendments of 1979:
 - *Final bill states "Secretary of Transportation shall prescribe minimum safety standards for deciding on the location of a new LNG facility"*
 - *The law lists six factors the Secretary must consider in setting these minimum standards*
 - *Factor No. 6 states "the need to encourage remote siting"*
 - *Factor No. 6 not incorporated into implementing regulations, according to author of legislation*

Bill Author's Intent: U.S. Law and LNG Terminals



Federal officials appear to be ignoring a congressional mandate designed to discourage construction of liquefied natural gas terminals in populated areas, according to U.S. Rep. Ed Markey, D-Mass., author of the 1979 House bill outlining minimum safety standards for such facilities.

Source: Mobile Register article, Nov. 16, 2003

Bill Author's Intent: U.S. Pipeline Safety Act

"When Congress passed my LNG safety bill back in 1979, it directed the Department of Transportation to prescribe standards for the siting of new LNG facilities that were supposed to consider the need to encourage remote siting. I am not satisfied that DOT has been doing enough to comply with this congressional intent."

Source: Congressman Markey quote, Mobile Register article, Nov. 16, 2003

Homeland Security and Onshore LNG Terminals

Department of Homeland Security Nov. 21 warning of increased risk of terrorist attacks:

Of particular concern is "al-Qaeda's continued interest in aviation, including using cargo jets" to attack infrastructure such as bridges and dams "as well as targeting liquid natural gas, chemical and other hazardous materials facilities," the Department said in a statement.

DOE/FERC LNG Accident Modeling Controversy

- *"The author of a study used by federal officials to demonstrate that LNG facilities pose few hazards for cities like Mobile has now written those officials to warn that his study cannot be used in that way."*
- *"Federal officials have used the Quest study in public hearings, federal documents and in letters to members of Congress to suggest that fires stemming from an LNG tanker accident would endanger only a small area around the ship. Other studies have indicated that such a fire could be a half-mile or more wide, and produce searing heat a mile or more away."*

Proposed CA LNG Projects

Project	Location	Regas method	Distance to pop. density > 60 sq. mi.
Shell/Bechtel -withdrawn-	onshore	SCV	1
Calpine Humbolt Bay	onshore	unknown	1
BHP Billiton 20 mi. off Oxnard	floating offshore	SCV	20+
Mitsubishi Long Beach Harbor	onshore	process water	2

Proposed Baja LNG Projects and Distance from US Border

Project	Miles to border	Location	Distance to pop. density > 60 sq. mi.
Sempra	40	onshore	2.5
Shell	40	onshore	3
ConocoPhillips/ El Paso (on hold)	15	onshore	>1
ChevronTexaco	10	offshore	8
Marathon/Golar	3	onshore	>1

All projects will use seawater for regas except Marathon (waste heat) ¹⁸

Sempre and Shell Terminal Sites - Costa Azul Area





Elba Island, GA LNG Incident

- Plant suffered major damage in September 2000 when a cargo ship lost its steering and rammed the LNG dock
- Severe damage to the ship and offloading dock
- No LNG being stored at time of the accident
- Coast Guard captain of the port indicated if a tanker had been at dock when ship struck, and if the tanker's . . . hull had been breached, LNG could have vaporized, found a source of ignition and flamed back to the ship

Yemen Attack and Double-Hulled French Oil Tanker

- Explosion rips large hole in French crude oil supertanker Limburg
- Small boat loaded with explosives caused damage
- Both hulls of double-hulled vessel breached
- Vessel set on fire

Source: BBC News Online article, Oct. 6, 2002

Air Quality Impacts of LNG Terminals

Terminal Source	NO _x tons/year
Tugboats	230
LNG tankers	210
Gas turbines (25 ppm)	70
Diesel equipment	35
Total	545

U.S.Coast Guard draft EIS, ChevronTexaco Port Pelican Offshore LNG Terminal, - Phase I, Attachment E, May 2003

Air Quality Impacts of LNG Terminals

- LNG tanker NO_x emissions alone are equivalent to NO_x emissions from 1,000 MW power plant controlled to 2 ppm NO_x
- Total terminal NO_x emissions equivalent to emissions from 2,500 MW of combined-cycle power plant capacity

Air Quality Impacts of LNG Terminals - NO_x Offsets

- In non-attainment areas, Federal project would undergo conformity review as specified in 40 CFR 93 to demonstrate that the project is in conformity with the State Implementation Plan
- In the event that the emissions increases are above de minimis thresholds set forth in the conformity rule, NO_x offsets required at 1:1 ratio

Air Quality Impact of “Hot” (High Btu) LNG

- Characteristics of available Pacific Rim LNG - high Btu ($>1,100$ Btu/ft³), high ethane
- Far Eastern LNG customers want high Btu content, these customers drive LNG business
- SoCal Rule 30: heat content $\leq 1,150$ Btu/ft³
- ARB CNG fuel spec: ethane ≤ 6 percent
- Investment risk issue - Who will pay to “cool” the hot gas to meet CA specs? Ethane removal or N₂ dilution are expensive steps.

2003 SCAQMD Hot Gas Emissions Study

- Millions of space heaters, hot water heaters, stoves with no controls to adjust for increase in natural gas Btu content
- For these units, NO_x increase roughly proportionate to Btu content increase
- Test program - increased Btu content from 1,000 to 1,150 Btu/ft^3 , NO_x increased 20%
- Not a major issue for combustion systems with adjustable controls (GTs, boilers, engines)

Impact of Seawater LNG Vaporization and U.S. Practice

- Mortality of entrained marine life is 100%
- Once-through seawater usage rate is equivalent to that of a 300 MW combined-cycle power plant
- Seawater temperature is reduced by as much as 20 °F
- None of the four operational continental U.S. LNG terminals use seawater for regas

May 2003 USCG EIS for proposed Port Pelican LNG terminal Phase I (0.8 bcfd) and July 15, 2003 envr coalition comment letter on USCG EIS. See www.borderpowerplants.org

Top Three 1978 CA LNG Sites Did Not Use Seawater for Regasification

- Horno Canyon (Camp Pendleton) regas heat source - San Onofre nuclear plant cooling water discharge
- Rattlesnake Canyon (SLO) - Diablo Canyon nuclear plant cooling water discharge
- Little Cojo (Goleta) - seawater regasification system prohibited by CA Coastal Commission

Source: CCC, Final Report Evaluating and Ranking LNG Terminal Sites, May 24, 1978

Conclusions - Part 1



- All of the onshore LNG terminals currently proposed in Baja California or California would have been rejected by the CCC using population density criteria established in 1977 California LNG Terminal Act (expired).
- CCC site selection criteria consistent with intent of 1979 National Pipeline Safety Act Amendments - need to encourage remote siting

Conclusions - Part 2

- Current controversy (Markey) over lack of inclusion of remote siting objective for LNG terminals in implementing regulations
- Current controversy over use by DOE and FERC of non-conservative accident scenario models in onshore licensing proceedings
- None of top three onshore terminal sites selected by CCC in 1978 would have used seawater for regasification
- None of the four operational terminals in the continental U.S. use seawater for regasification

Conclusions - Part 3

- Issue of hot gas remains to be resolved - either terminal must include additional process step or gas quality requirements must be addressed at liquefaction plant
- Any increase in Btu content above $\sim 1,000$ Btu/ft³ will result in increased NO_x emissions from sources with no control adjustment capability
- Air emissions from LNG marine traffic are high
- NO_x emissions from marine vessel traffic may need to be offset in non-attainment areas