



Pipeline R&D Forum

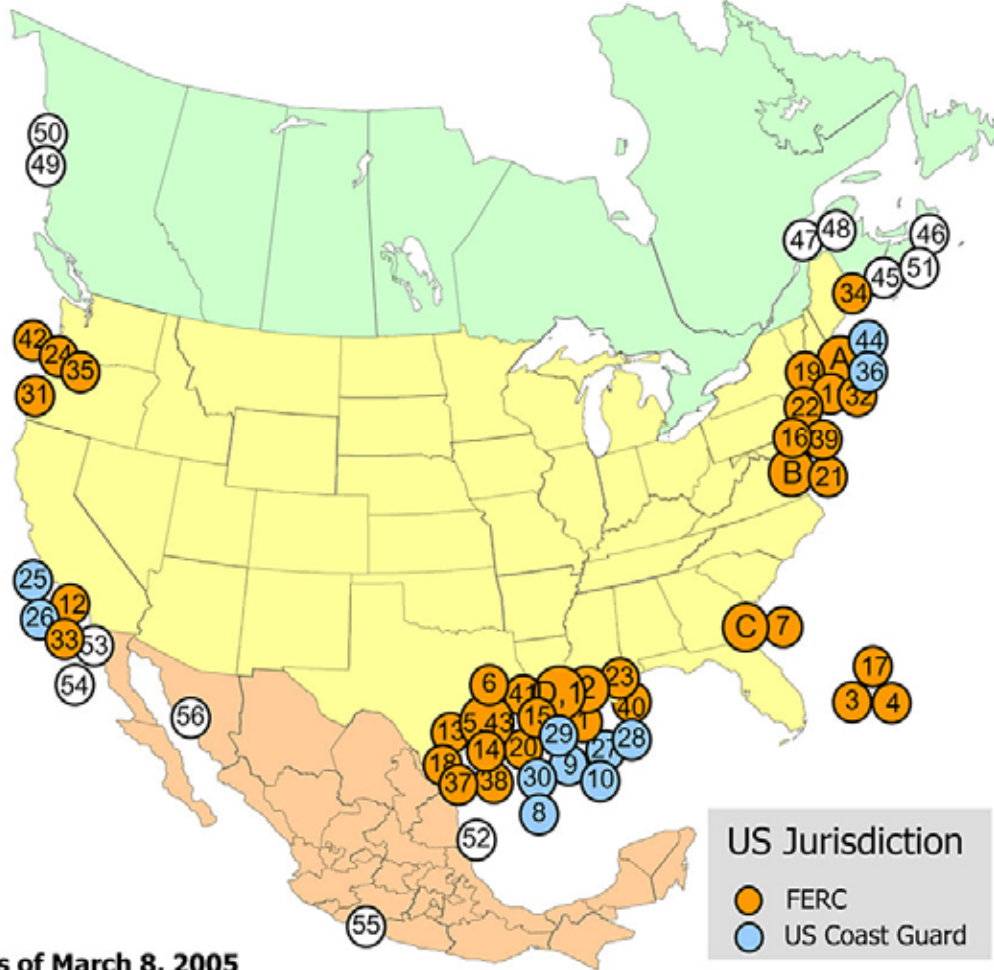
LNG Overview

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Existing, Proposed and Potential North American LNG Terminals



CONSTRUCTED

- A. Everett, MA : 1.035 Bcfd (Tractebel - DOMAC)
- B. Cove Point, MD : 1.0 Bcfd (Dominion - Cove Point LNG)
- C. Elba Island, GA : 0.68 Bcfd (El Paso - Southern LNG)
- D. Lake Charles, LA : 1.0 Bcfd (Southern Union - Trunkline LNG)

APPROVED BY FERC

- 1. Lake Charles, LA: 1.1 Bcfd (Southern Union - Trunkline LNG)
- 2. Hackberry, LA : 1.5 Bcfd, (Sempra Energy)
- 3. Bahamas : 0.84 Bcfd, (AES Ocean Express)*
- 4. Bahamas : 0.83 Bcfd, (Calypso Tractebel)*
- 5. Freeport, TX : 1.5 Bcfd, (Cheniere/Freeport LNG Dev.)
- 6. Sabine, LA : 2.6 Bcfd (Cheniere LNG)
- 7. Elba Island, GA: 0.54 Bcfd (El Paso - Southern LNG)

APPROVED BY MARAD/COAST GUARD

- 8. Port Pelican: 1.6 Bcfd, (Chevron Texaco)
- 9. Gulf of Mexico: 0.5 Bcfd, (El Paso Energy Bridge GOM, LLC)
- 10. Louisiana Offshore : 1.0 Bcfd (Gulf Landing - Shell)

PROPOSED TO FERC

- 11. Fall River, MA : 0.8 Bcfd, (Weaver's Cove Energy/Hess LNG)
- 12. Long Beach, CA : 0.7 Bcfd, (Mitsubishi/ConocoPhillips - Sound Energy Solutions)
- 13. Corpus Christi, TX : 2.6 Bcfd, (Cheniere LNG)
- 14. Corpus Christi, TX : 1.0 Bcfd (Vista Del Sol - ExxonMobil)
- 15. Sabine, TX : 1.0 Bcfd (Golden Pass - ExxonMobil)
- 16. Logan Township, NJ : 1.2 Bcfd (Crown Landing LNG - BP)
- 17. Bahamas : 0.5 Bcfd, (Seafarer - El Paso/FPL)
- 18. Corpus Christi, TX: 1.0 Bcfd (Ingleside Energy - Occidental Energy Ventures)
- 19. Providence, RI : 0.5 Bcfd (Keyspan & BG LNG)
- 20. Port Arthur, TX: 1.5 Bcfd (Sempra)
- 21. Cove Point, MD : 0.8 Bcfd (Dominion)
- 22. LI Sound, NY: 1.0 Bcfd (Broadwater Energy - TransCanada/Shell)
- 23. Pascagoula, MS: 1.0 Bcfd (Gulf LNG Energy LLC)
- 24. Bradwood, OR: 1.0 Bcfd (Northern Star LNG - Northern Star Natural Gas LLC)

PROPOSED TO MARAD/COAST GUARD

- 25. California Offshore: 1.5 Bcfd (Cabrillo Port - BHP Billiton)
- 26. So. California Offshore : 0.5 Bcfd, (Crystal Energy)
- 27. Louisiana Offshore : 1.0 Bcfd (Main Pass McMoran Exp.)
- 28. Gulf of Mexico: 1.0 Bcfd (Compass Port - ConocoPhillips)
- 29. Gulf of Mexico: 2.8 Bcfd (Pearl Crossing - ExxonMobil)
- 30. Gulf of Mexico: 1.5 Bcfd (Beacon Port Clean Energy Terminal - ConocoPhillips)

POTENTIAL SITES IDENTIFIED BY PROJECT SPONSORS

- 31. Coos Bay, OR: 0.13 Bcfd, (Energy Projects Development)
- 32. Somerset, MA: 0.65 Bcfd (Somerset LNG)
- 33. California - Offshore: 0.75 Bcfd, (Chevron Texaco)
- 34. Pleasant Point, ME : 0.5 Bcfd/d (Quoddy Bay, LLC)
- 35. St. Helens, OR: 0.7 Bcfd (Port Westward LNG LLC)
- 36. Offshore Boston, MA: 0.8 Bcfd (Northeast Gateway - Exceleerate Energy)
- 37. Galveston, TX: 1.2 Bcfd (Pelican Island - BP)
- 38. Port Lavaca, TX: 1.0 Bcfd (Calhoun LNG - Gulf Coast LNG Partners)
- 39. Philadelphia, PA: 0.6 Bcfd (Freedom Energy Center - PGW)
- 40. Pascagoula, MS: 1.3 Bcfd (Casotte Landing - ChevronTexaco)
- 41. Cameron, LA: 3.3 Bcfd (Creole Trail LNG - Cheniere LNG)
- 42. Astoria, OR: 1.0 Bcfd (Skipanon LNG - Calpine)
- 43. Freeport, TX: 1.5 Bcfd, (Cheniere/Freeport LNG Dev. - Expansion)
- 44. Offshore Boston, MA: 0.4 Bcfd (Neptune LNG - Tractebel)

CANADIAN APPROVED AND POTENTIAL TERMINALS

- 45. St. John, NB : 1.0 Bcfd, (Canaport - Irving Oil)
- 46. Point Tupper, NS : 1.0 Bcfd/d (Bear Head LNG - Anadarko)
- 47. Quebec City, QC : 0.5 Bcfd (Project Rabaska - Enbridge/Gaz Met/Gaz de France)
- 48. Rivière-du- Loup, QC: 0.5 Bcfd (Cacouna Energy - TransCanada/PetroCanada)
- 49. Kitimat, BC: 0.61 Bcfd (Galveston LNG)
- 50. Prince Rupert, BC: 0.30 Bcfd (WestPac Terminals)
- 51. Goldboro, NS : 1.0 Bcfd (Keltic Petrochemicals)

MEXICAN APPROVED AND POTENTIAL TERMINALS

- 52. Altamira, Tamulipas : 0.7 Bcfd, (Shell/Total/Mitsui)**
- 53. Baja California, MX : 1.0 Bcfd, (Sempra & Shell)**
- 54. Baja California - Offshore : 1.4 Bcfd, (Chevron Texaco)
- 55. Lázaro Cárdenas, MX : 0.5 Bcfd (Tractebel/Repsol)
- 56. Puerto Libertad, MX: 1.3 Bcfd (Sonora Pacific LNG)

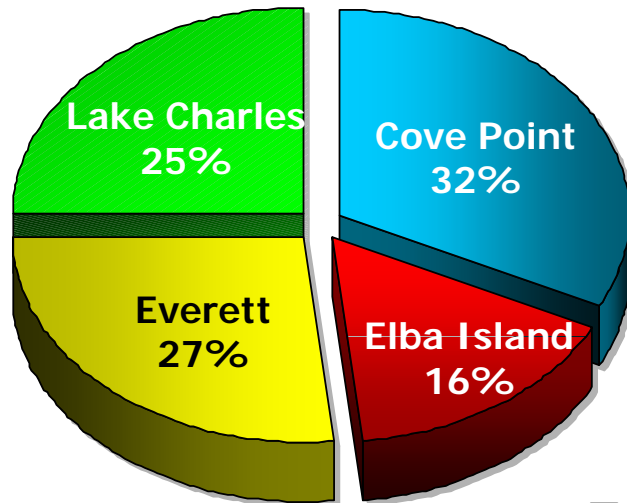
As of March 8, 2005

* US pipeline approved; LNG terminal pending in Bahamas
 ** These projects have been approved by the Mexican and Canadian authorities

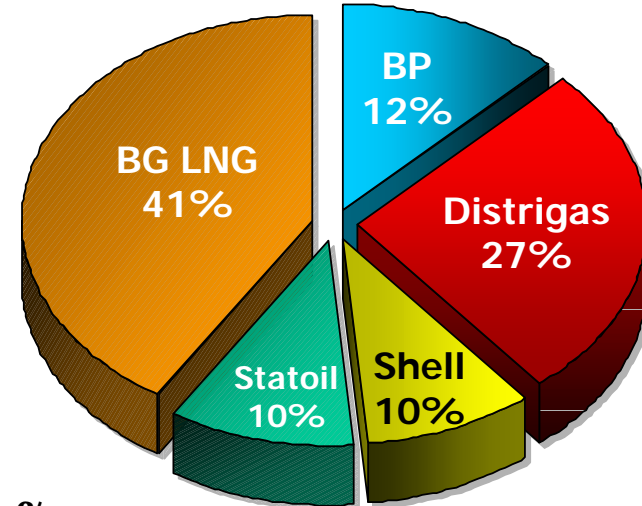
Trunkline LNG Base Facilities

- 630 MMcf/d of sustained sendout
 - 1 Bcf/d of peaking sendout
- 6.3 Bcf of Storage

LNG Imports by Terminal
Jan - Dec 2004



LNG Imports by Company
Jan - Dec 2004



**Total = 652 Bcf/yr
approx. 3% of U.S. Gas
Demand**

*Source: US Department of Energy. Assumes an estimate of 2,285 Bcf for December 2004 consumption.

Trunkline LNG Expansion

- Phase I
 - Construction underway
 - Double sendout capacity to 1.2 Bcf/d
 - Peaking of 1.3 Bcf/d
 - Increase storage capacity to 9.0 Bcf
 - Sendout by 10/2005; Storage by 1/2006
- Phase II
 - FERC approval received September 2004
 - Increase sendout capacity to 1.8 Bcf/d
 - Peaking of 2.1 Bcf/d
 - Completion by mid-calendar 2006
- Trunkline Gas Company Loop
 - Construction underway
 - 22 miles (new construction) of 36” pipeline loop
 - Several (6+) new or expanded delivery points



Construction Photos

Tank D
&
Trestle



New 2nd Stage
Pump Cans



Dock
Monopile
Installation



Recondenser
Piping to 2nd
Stage Pumps



Research Needs for LNG

- LNG Shipping Safety
 - 45 year history
 - 33,000 LNG carrier trips
 - NO significant accident with any LNG spill
- Today over 150 LNG ocean tankers safely transport more than 5,200 Bcf of LNG annually world-wide
- LNG Import Terminals - No significant incident at any import facility world-wide
- New technology for equipment is being developed primarily by private interests (e.g. offshore configurations)
- New Gulf Coast facilities have been permitted. Other greenfield terminals encountering significant public opposition, **not a technology issue**
- LNG composition is typically not readily interchangeable with U.S. domestic natural gas

Interchangeability of LNG with Domestic Gas



- Natural Gas Council + sponsored a Technical Group who produced a White Paper – presented to FERC in March
- Recommended interim guidelines 2 - 3 years (max levels)
 - Wobbe – 1400 HHV – 1100Btu/scf C₅+ - 1.5%
 - Total Inerts – 4% +/- 4% of local historical average
- Identified \$5 million research agenda primarily focused on end-use applications (e.g. appliances & gas turbines)
- Widening range is essential to reduce cost of conditioning AND compete worldwide (Europe is +/-7.5%)
- Current private research could be supplemented by publicly-funded research; a research committee is working
- This is a Current and Critical need awaiting more sponsors