

# LNG in the Gulf of Mexico

Jeff Rester

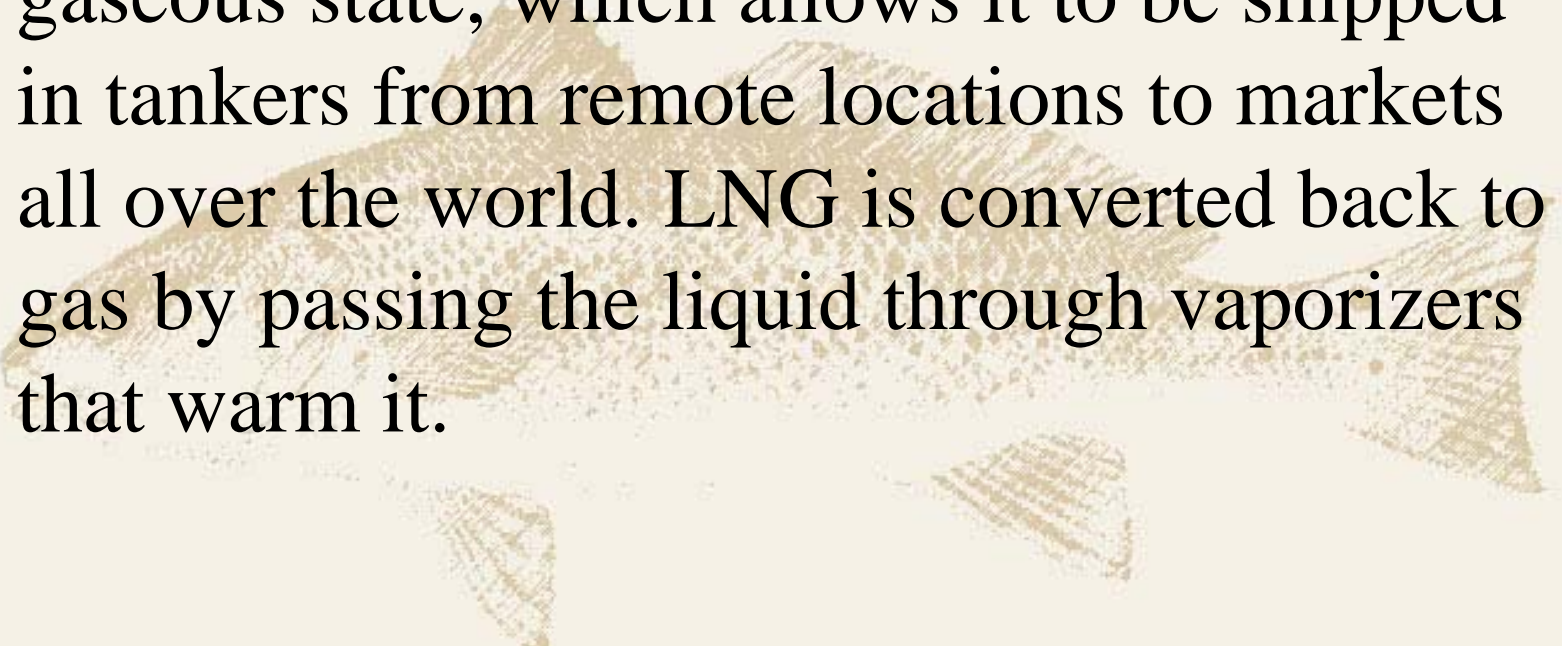
Gulf States Marine Fisheries Commission



# Liquefied Natural Gas

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LNG is natural gas that has been cooled below minus 260 degrees Fahrenheit and condensed into a liquid. LNG occupies 600 times less space than natural gas in its gaseous state, which allows it to be shipped in tankers from remote locations to markets all over the world. LNG is converted back to gas by passing the liquid through vaporizers that warm it.

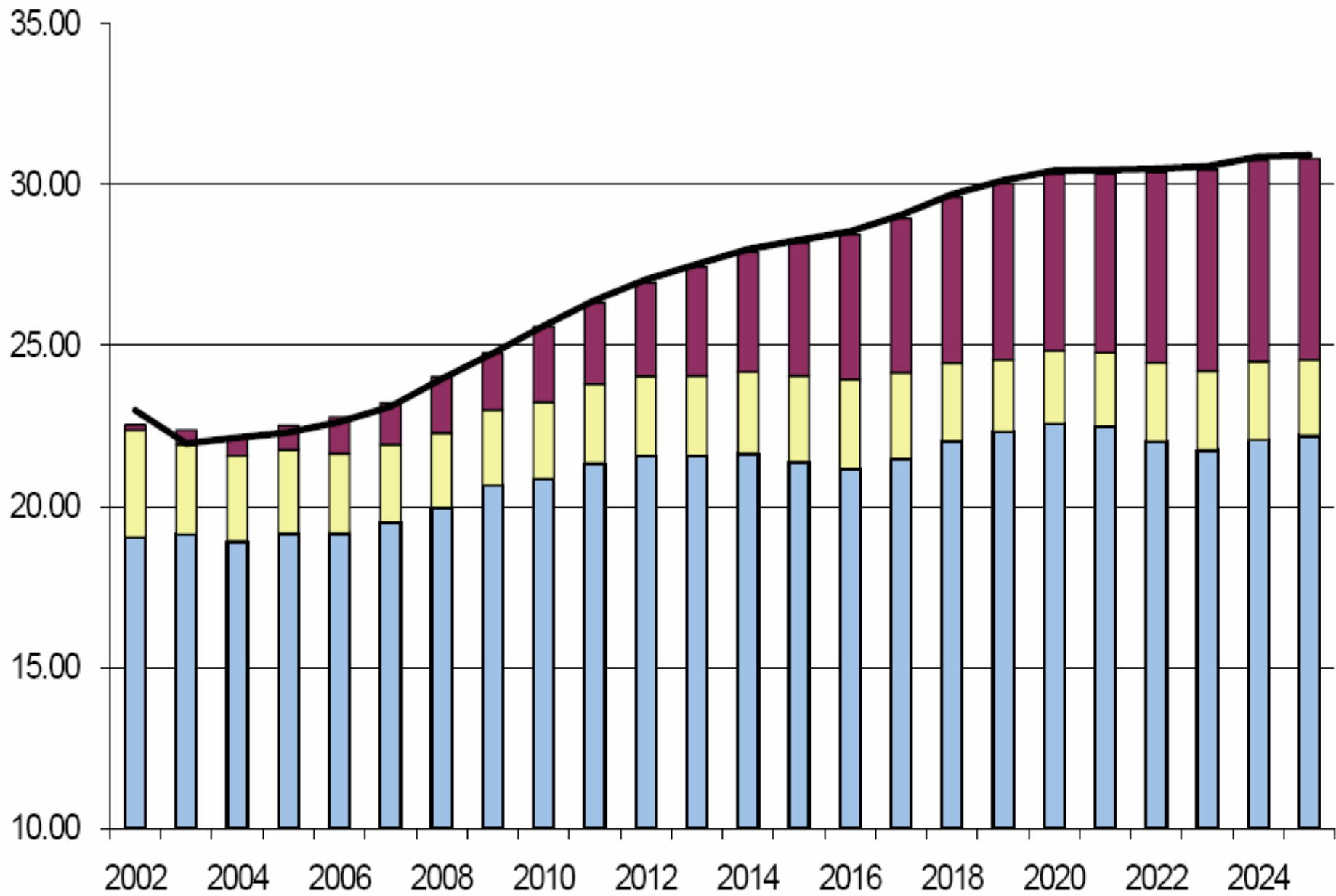


# Liquefied Natural Gas

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Most LNG is imported to the United States from overseas in large tankers to one of five U.S. import terminals in Cove Point, Maryland; Everett, Massachusetts; Elba Island, Georgia; Lake Charles, Louisiana; and the Gulf Gateway Energy Bridge Deepwater Port 116 miles off the coast of Louisiana.





Source: EIA 2005



# Deepwater Port Act

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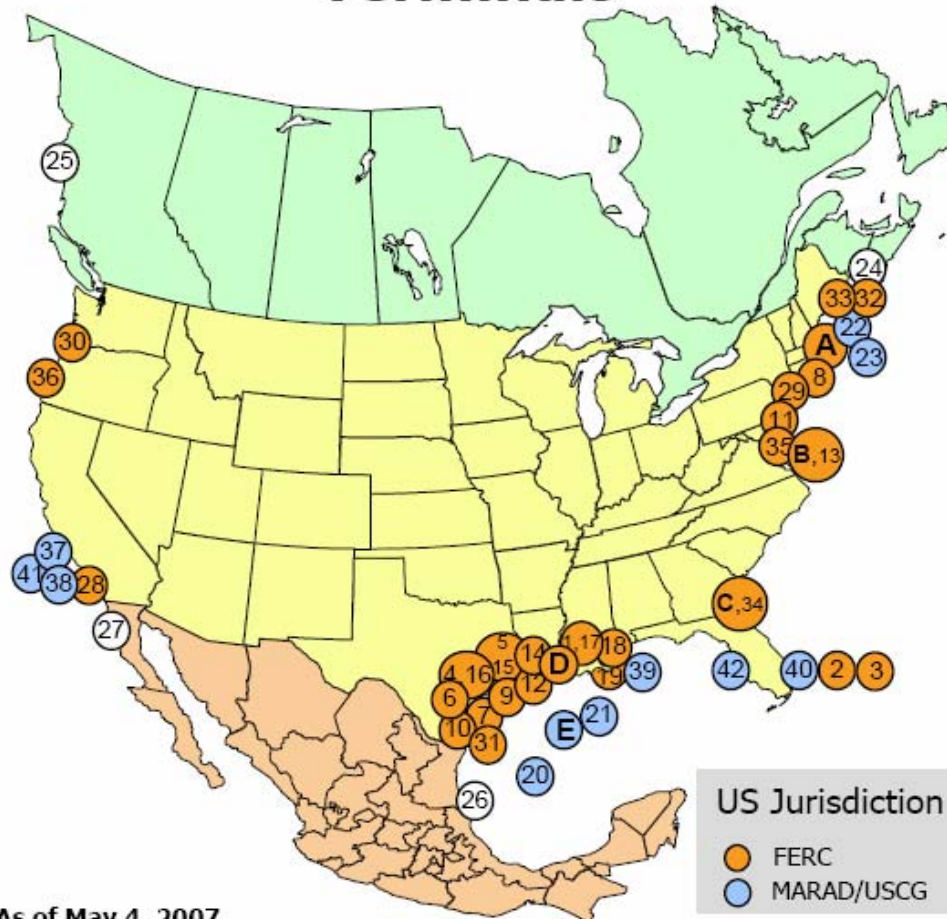
The Deepwater Port Act of 1974 was amended on November 25, 2002 to provide for offshore ports for natural gas. The first application to the U.S. Coast Guard was filed by ChevronTexaco on November 25, 2002 for a LNG deepwater port off the Louisiana coast. The DWPA provides a fast track for approval which is fixed by statute as 356 days after filing. This provision provides a firm statutory timeline for a decision which cannot be extended.

# Deepwater Port Act

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Under the DWPA only a single national federal license is required which is issued by the Department of Transportation. The U.S. Coast Guard is the lead agency that performs the license review, assisted by the Maritime Administration (MARAD). All other federal agencies must coordinate their work with the U.S. Coast Guard. Under the DWPA, the governor of the adjacent state can veto a project. The governor can also ask that the license be conditioned based on the state's interests. The EPA is the only federal agency with similar power.

# Existing and Proposed North American LNG Terminals



As of May 4, 2007

\* US pipeline approved; LNG terminal pending in Bahamas

\*\* Construction suspended

**CONSTRUCTED**

- A. Everett, MA : 1.035 Bcfd (DOMAC - SUEZ LNG)
- B. Cove Point, MD : 1.0 Bcfd (Dominion - Cove Point LNG)
- C. Elba Island, GA : 1.2 Bcfd (El Paso - Southern LNG)
- D. Lake Charles, LA : 2.1 Bcfd (Southern Union - Trunkline LNG)
- E. Gulf of Mexico: 0.5 Bcfd (Gulf Gateway Energy Bridge - Excelerate Energy)

**APPROVED BY FERC**

- 1. Hackberry, LA : 1.5 Bcfd (Cameron LNG - Sempra Energy)
- 2. Bahamas : 0.84 Bcfd (AES Ocean Express)\*
- 3. Bahamas : 0.83 Bcfd (Calypso Tractebel)\*
- 4. Freeport, TX : 1.5 Bcfd (Cheniere/Freeport LNG Dev.)
- 5. Sabine, LA : 2.6 Bcfd (Sabine Pass Cheniere LNG)
- 6. Corpus Christi, TX: 2.6 Bcfd (Cheniere LNG)
- 7. Corpus Christi, TX : 1.1 Bcfd (Vista Del Sol - ExxonMobil)
- 8. Fall River, MA : 0.8 Bcfd (Weaver's Cove Energy/Hess LNG)
- 9. Sabine, TX : 2.0 Bcfd (Golden Pass - ExxonMobil)
- 10. Corpus Christi, TX: 1.0 Bcfd (Ingleside Energy - Occidental Energy Ventures)\*\*
- 11. Logan Township, NJ : 1.2 Bcfd (Crown Landing LNG - BP)
- 12. Port Arthur, TX: 3.0 Bcfd (Sempra Energy)
- 13. Cove Point, MD : 0.8 Bcfd (Dominion)
- 14. Cameron, LA: 3.3 Bcfd (Creole Trail LNG - Cheniere LNG)
- 15. Sabine, LA: 1.4 Bcfd (Sabine Pass Cheniere LNG - Expansion)
- 16. Freeport, TX: 2.5 Bcfd (Cheniere/Freeport LNG Dev. - Expansion)
- 17. Hackberry, LA : 1.15 Bcfd (Cameron LNG - Sempra Energy - Expansion)
- 18. Pascagoula, MS: 1.5 Bcfd (Gulf LNG Energy LLC)
- 19. Pascagoula, MS: 1.3 Bcfd (Bayou Casotte Energy LLC - ChevronTexaco)

**APPROVED BY MARAD/COAST GUARD**

- 20. Port Pelican: 1.6 Bcfd (ChevronTexaco)
- 21. Offshore Louisiana : 1.0 Bcfd (Main Pass McMoran Exp.)
- 22. Offshore Boston: 0.4 Bcfd (Neptune LNG - SUEZ LNG)
- 23. Offshore Boston: 0.8 Bcfd (Northeast Gateway - Excelerate Energy)

**CANADIAN APPROVED TERMINALS**

- 24. St. John, NB : 1.0 Bcfd (Canaport - Irving Oil/Repsol)
- 25. Kitimat, BC: 1.0 Bcfd (Kitimat LNG - Galveston LNG)

**MEXICAN APPROVED TERMINALS**

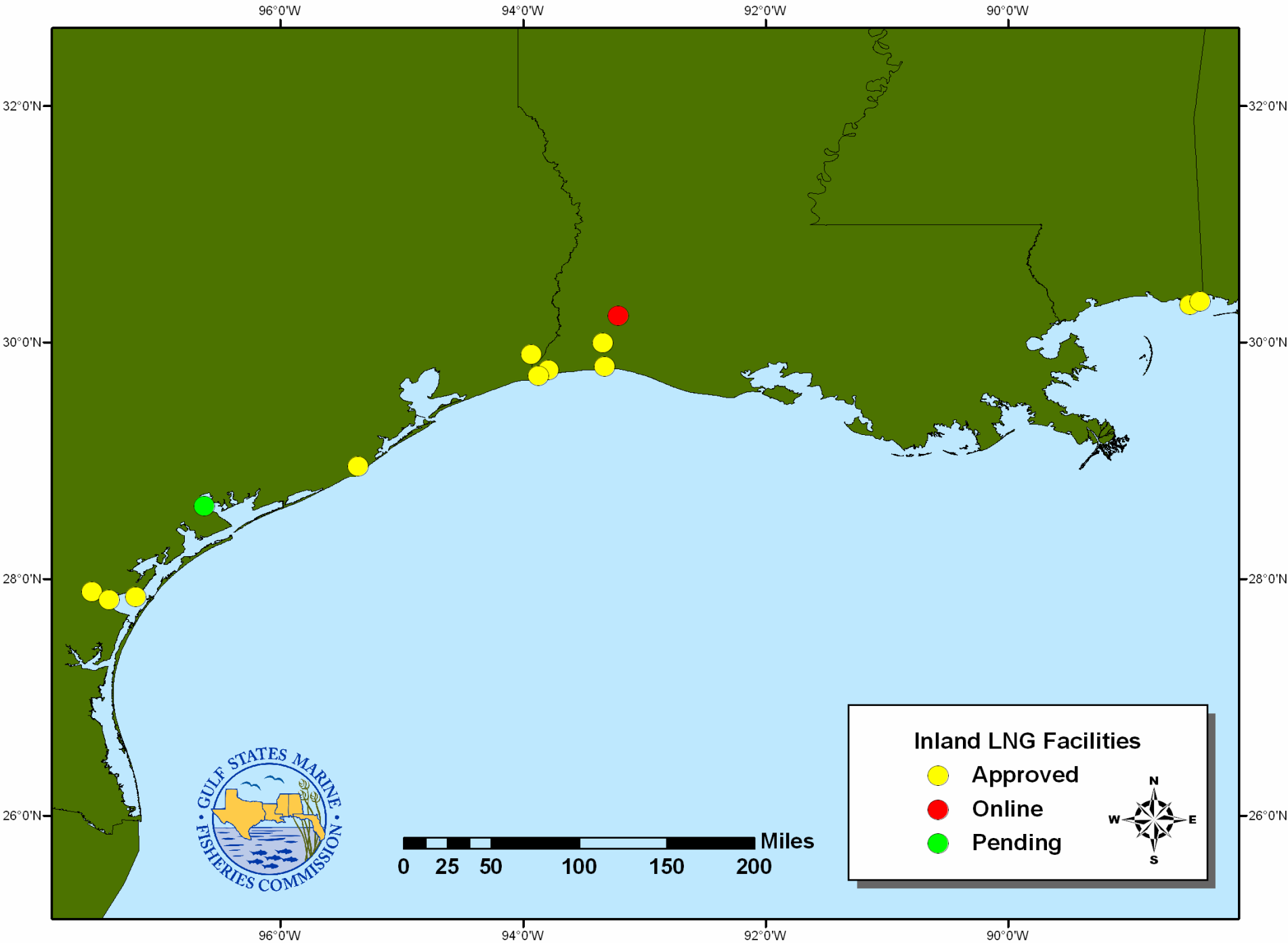
- 26. Altamira, Tamulipas : 0.7 Bcfd (Shell/Total/Mitsui)
- 27. Baja California, MX : 1.0 Bcfd (Energia Costa Azul - Sempra Energy)

**PROPOSED TO FERC**

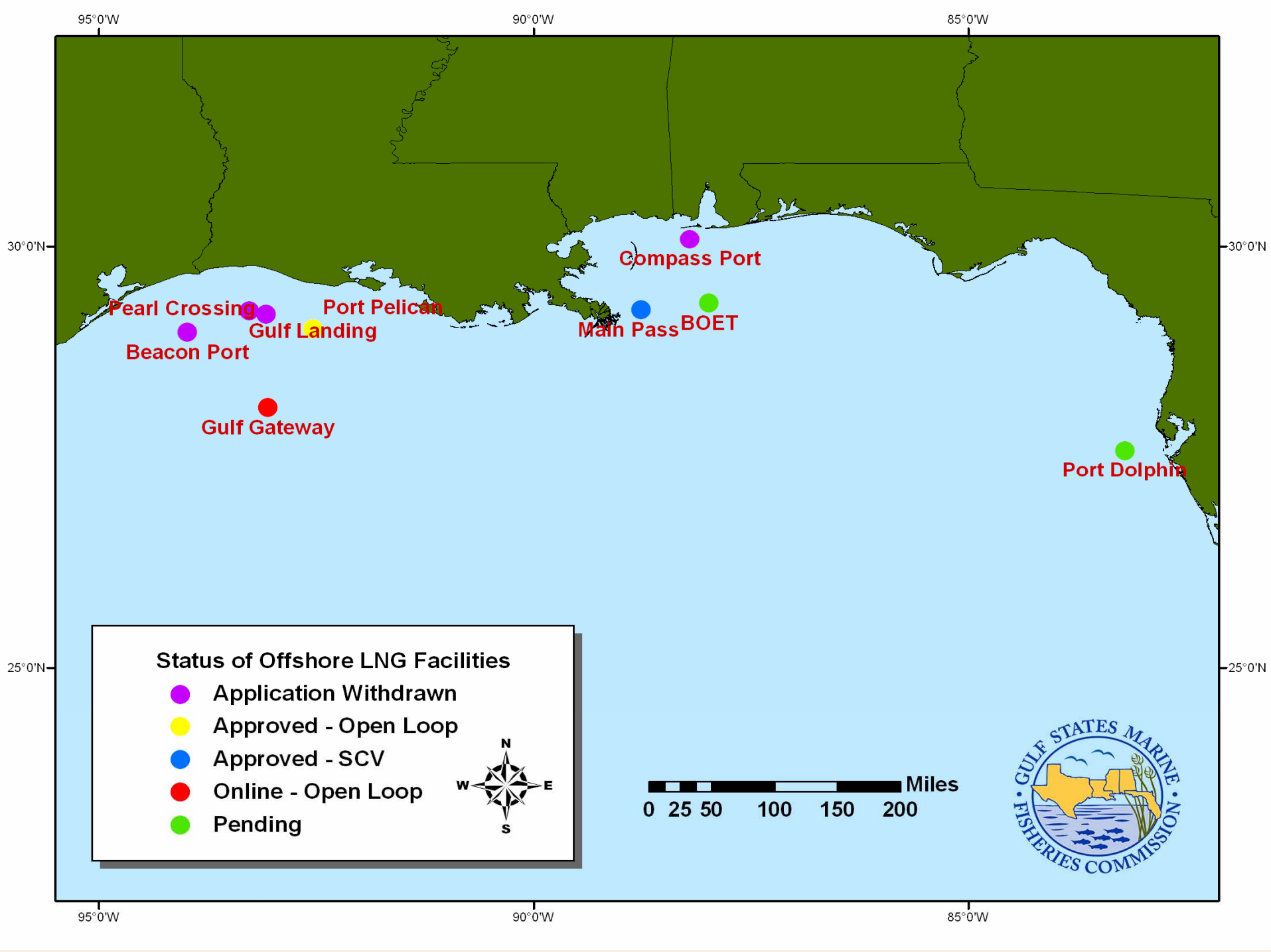
- 28. Long Beach, CA : 0.7 Bcfd, (Mitsubishi/ConocoPhillips - Sound Energy Solutions)
- 29. LI Sound, NY: 1.0 Bcfd (Broadwater Energy - TransCanada/Shell)
- 30. Bradwood, OR: 1.0 Bcfd (Northern Star LNG - Northern Star Natural Gas LLC)
- 31. Port Lavaca, TX: 1.0 Bcfd (Calhoun LNG - Gulf Coast LNG Partners)
- 32. Pleasant Point, ME : 2.0 Bcfd (Quoddy Bay, LLC)
- 33. Robbinston, ME: 0.5 Bcfd (Downeast LNG - Kestrel Energy)
- 34. Elba Island, GA: 0.9 Bcfd (El Paso - Southern LNG)
- 35. Baltimore, MD: 1.5 Bcfd (AES Sparrows Point - AES Corp.)
- 36. Coos Bay, OR: 1.0 Bcfd (Jordan Cove Energy Project)

**PROPOSED TO MARAD/COAST GUARD**

- 37. Offshore California : 1.5 Bcfd (Cabrillo Port - BHP Billiton)
- 38. Offshore California : 0.5 Bcfd, (Clearwater Port LLC - NorthernStar NG LLC)
- 39. Gulf of Mexico: 1.4 Bcfd (Bienville Offshore Energy Terminal - TORP)
- 40. Offshore Florida: 1.9 Bcfd (SUEZ Calypso - SUEZ LNG)
- 41. Offshore California: 1.2 Bcfd (OceanWay - Woodside Natural Gas)
- 42. Offshore Florida: 1.2 Bcfd (Hoegh LNG - Port Dolphin Energy)

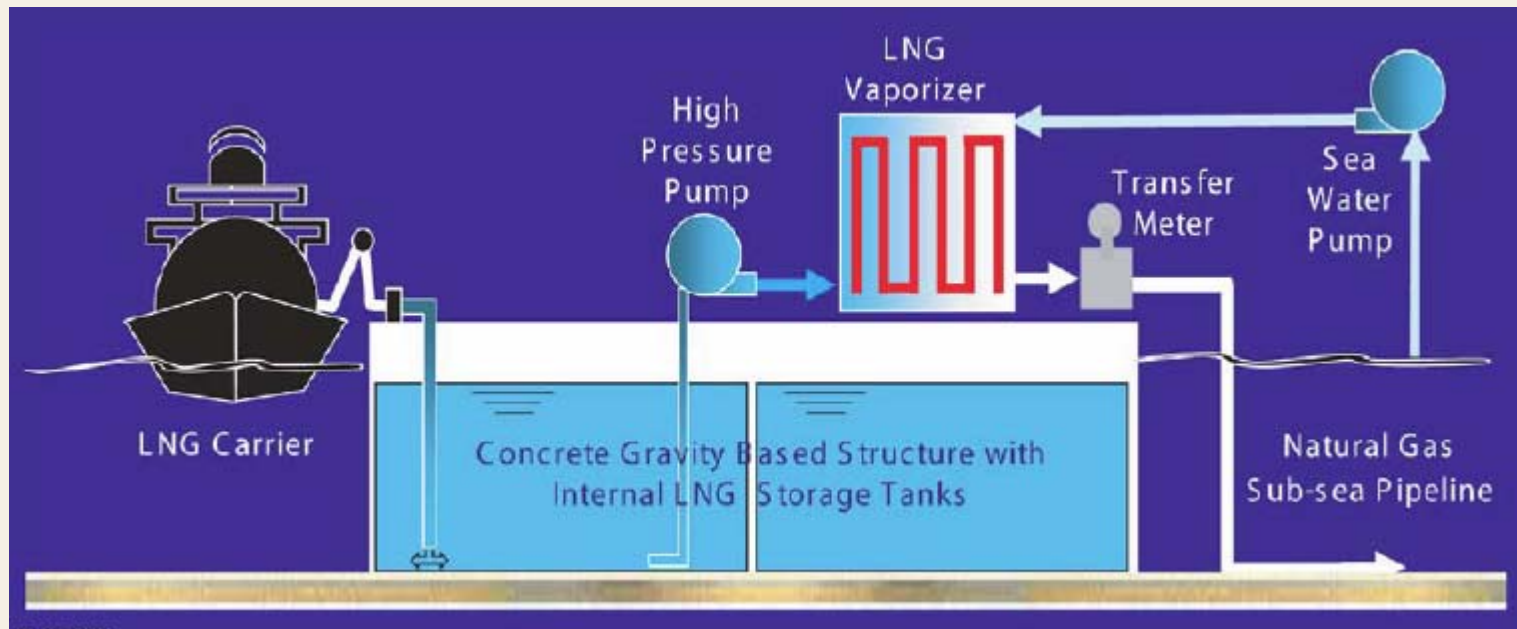






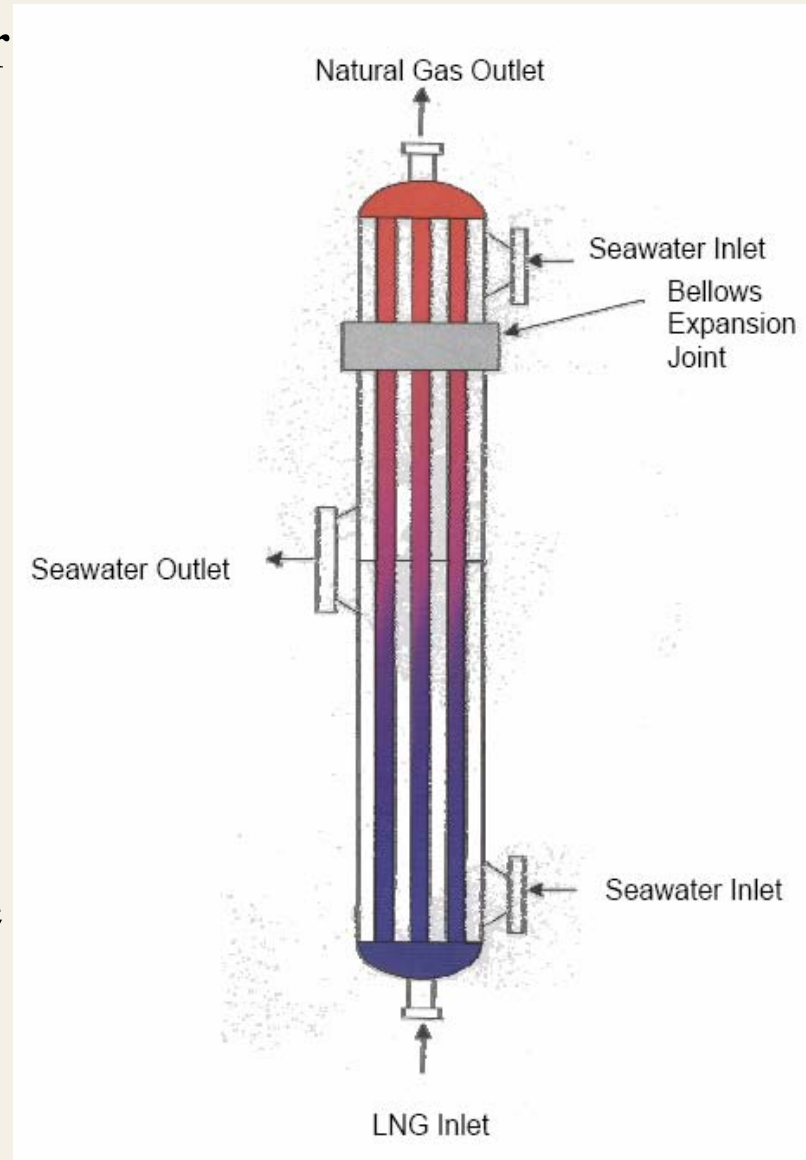
# LNG Vaporization

An open rack vaporizer uses sea water as the heat source for vaporizing the LNG into gas using a series of heat-transfer tube panels. Sodium hypochlorite is usually injected at the intake to prevent marine growth inside the warming water system.



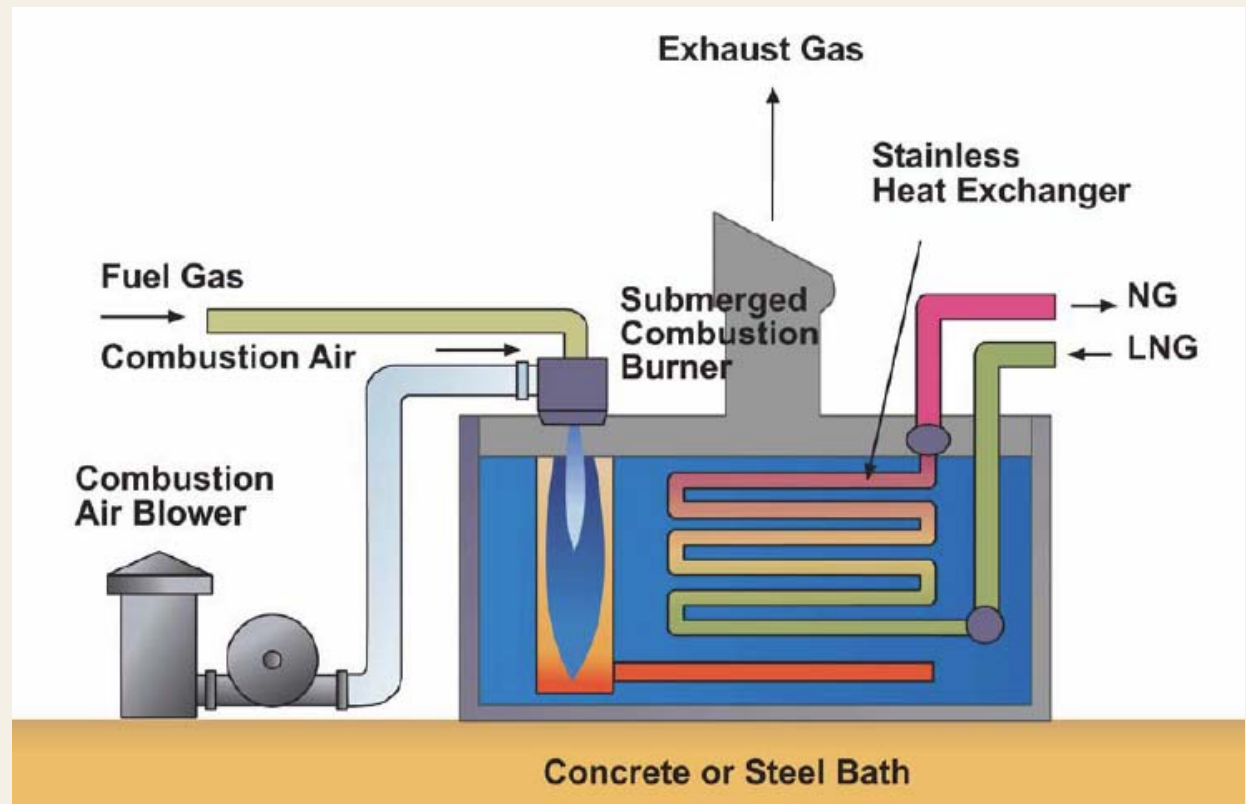
# LNG Vaporization

A shell and tube vaporizer also uses sea water as the heat source. An inlet is located at the bottom, with water running in the same direction as the LNG. The other inlet is located at the top with sea water running counter flow to the LNG. The seawater exits through the center of the STV and is routed to an outfall.



# LNG Vaporization

A submerged combustion vaporizer uses natural gas as a heat source to vaporize LNG back into a gas. A submerged combustion vaporizer consumes 1 to 2 percent of the natural gas produced each year as fuel.



# Concerns

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- Open loop systems will be drawing in 100 to 195 million gallons of seawater per day on average
- Water leaving the system will be 13.5°F to 20°F colder at outfall and will contain anti-biofouling agents
- Billions of fish and crustacean eggs, larvae, and other zooplankton will be destroyed each year through impingement or entrainment



# Problems Estimating Larval Fish Densities

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- Sampling intensity and timing of SEAMAP data are inadequate for estimating densities at one location (1-2 samples per year per station in summer and fall; winter spawners such as grouper and menhaden are not well represented)
- The short duration of larvae in the water column (e.g., about 20 days for snapper) increases sampling error
- Of the fishery species in the Southeast, scientists can only identify about 30% of larval fish to the species level



# Problems Estimating Larval Fish Densities

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- Oblique plankton tows integrate water column; more representative in fall when water column is mixed
- 0.333-mm mesh net misses some larvae
- Estimates for entrainment mortality are between 1.6 and 13.1 billion eggs and larvae each year



# Concerned Fishery Agencies

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- Texas Parks and Wildlife Department
  - Louisiana Department of Wildlife and Fisheries
  - Mississippi Department of Marine Resources
  - Alabama Department of Conservation and Natural Resources
  - NOAA Fisheries
  - Gulf of Mexico Fishery Management Council
  - Gulf States Marine Fisheries Commission
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# Concerned Leaders

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On May 17, 2005, Louisiana Governor Kathleen Blanco in a letter to John Jamian, Acting Maritime Administrator, stated that “I will oppose the licensing of offshore LNG terminals that will use the open rack vaporizer system. Until studies demonstrate that the operation of the open rack vaporizer will not have an unacceptable impact on the surrounding ecosystem, I will only support offshore LNG terminals using a closed loop system having negligible impacts to marine life.”

# Concerned Leaders

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On June 15, 2005, Alabama Governor Robert Riley stated in a letter to MARAD that “I cannot support the development of terminals using the open-loop system unless there is proof of negligible impacts on the marine fisheries and marine habitat.”

On June 16, 2005, Mississippi Governor Haley Barbour stated in a letter to MARAD that “due to concerns with the open rack vaporization system proposed for the Compass Port project, as Governor of an adjacent State, I oppose the permitting of this facility unless assurances supported by adequate scientific data are provided to ensure our marine resources will be protected.”

# Port Pelican

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- Deepwater Port license was granted in January 2004
- On July 12 2005, Port Pelican announced its decision to put the project on hold indefinitely



# Energy Bridge

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- 116 miles south of Cameron, Louisiana in 298 feet of water
- Open loop system using 76 million gallons of water per day
- Received their license in May 2004
- Commenced operations on March 17, 2005
- All regasification takes place onboard the vessel
- Excelerate Energy has proposed an additional LNG port off Massachusetts that will use the same vessels, but in a closed loop mode
- Due to concerns over using 56 mgd of seawater at the Massachusetts facility for vessel operations, Excelerate Energy agreed to reduce seawater usage to 11.5 mgd

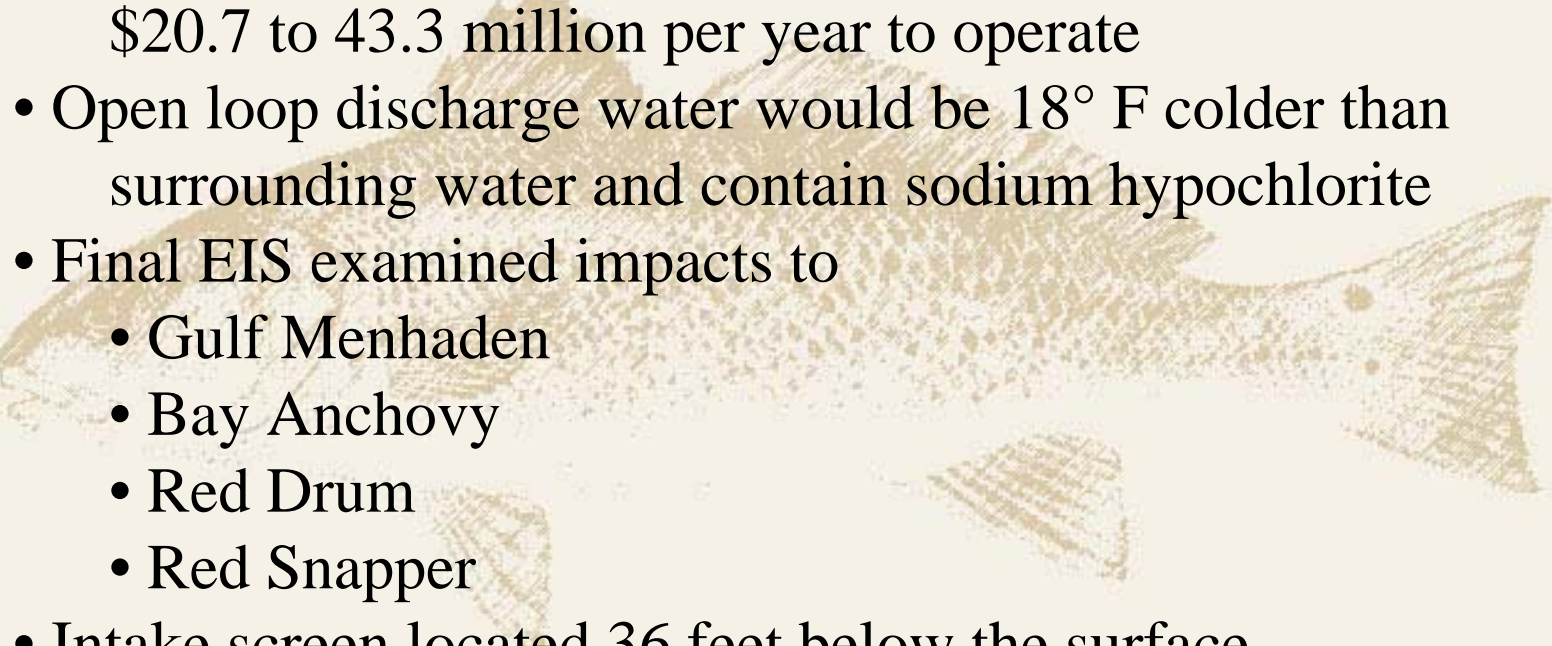
# Ichthyoplankton Assessment Model

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- Uses SEAMAP Ichthyoplankton Data – Data only available for June through November
- Used to calculate potential entrainment impacts on fish eggs and larvae
- Estimates the density of larvae and eggs that could be entrained and applies those numbers to estimate potential impacts on species of concern
- Species of concern were selected based on economic and ecological importance, availability of life history data and the similarity to representative population types
- Red Drum, Bay Anchovy, Gulf Menhaden, and Red Snapper
- Effort was made to assess king and Spanish mackerel, but the current level of information available for these species is insufficient to generate a realistic assessment

# Gulf Landing

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- 38 miles south of Cameron, Louisiana in a water depth of 55 feet
  - Open loop system using 136 million gallons of water per day
  - Closed loop system would use 2.2 % of the natural gas produced each year for heating purposes and would cost \$20.7 to 43.3 million per year to operate
  - Open loop discharge water would be 18° F colder than surrounding water and contain sodium hypochlorite
  - Final EIS examined impacts to
    - Gulf Menhaden
    - Bay Anchovy
    - Red Drum
    - Red Snapper
  - Intake screen located 36 feet below the surface
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# Gulf Landing

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## Potential Annual Fish Egg Entrainment

Mean	2,331,734,269
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Lower	684,271,697
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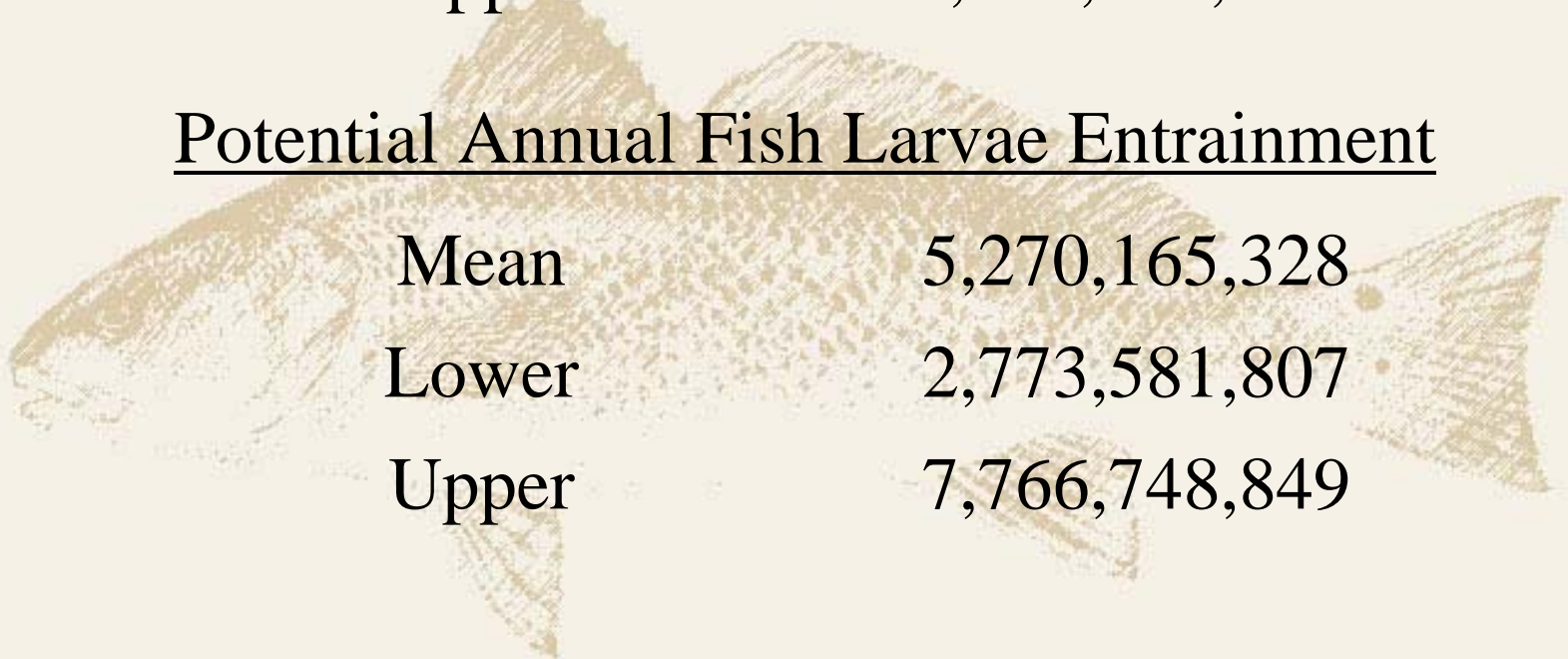
Upper	3,979,196,841
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## Potential Annual Fish Larvae Entrainment

Mean	5,270,165,328
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Lower	2,773,581,807
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Upper	7,766,748,849
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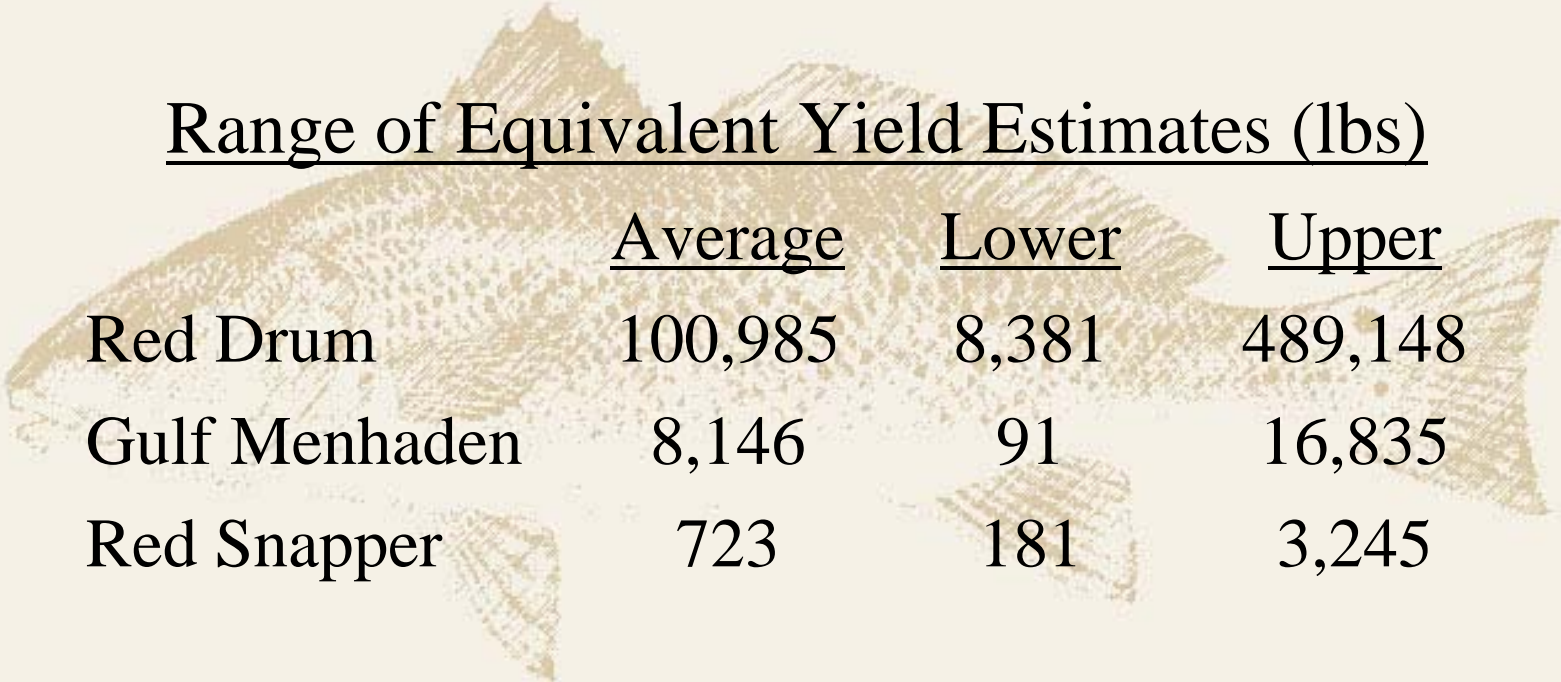


# Gulf Landing

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Equivalent yield estimates adjust the estimated larval impacts forward in time to resemble a fishery yield or harvest. The equivalent yield estimate is used as a base for reasonable comparison to other fisheries to help assess potential stress on the population.

## Range of Equivalent Yield Estimates (lbs)



	<u>Average</u>	<u>Lower</u>	<u>Upper</u>
Red Drum	100,985	8,381	489,148
Gulf Menhaden	8,146	91	16,835
Red Snapper	723	181	3,245

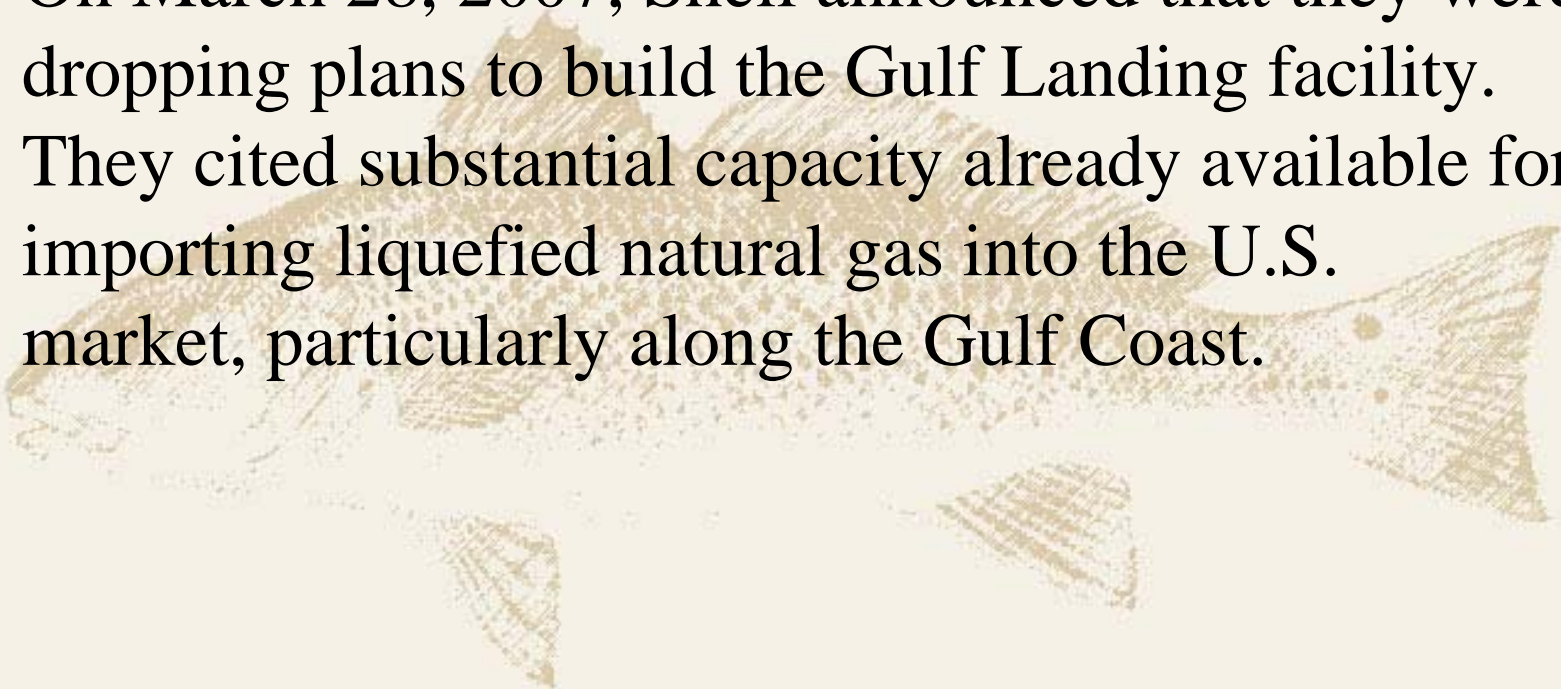


# Gulf Landing

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Status – Deepwater Port License Application to operate an open rack vaporizer was approved on February 16, 2005.

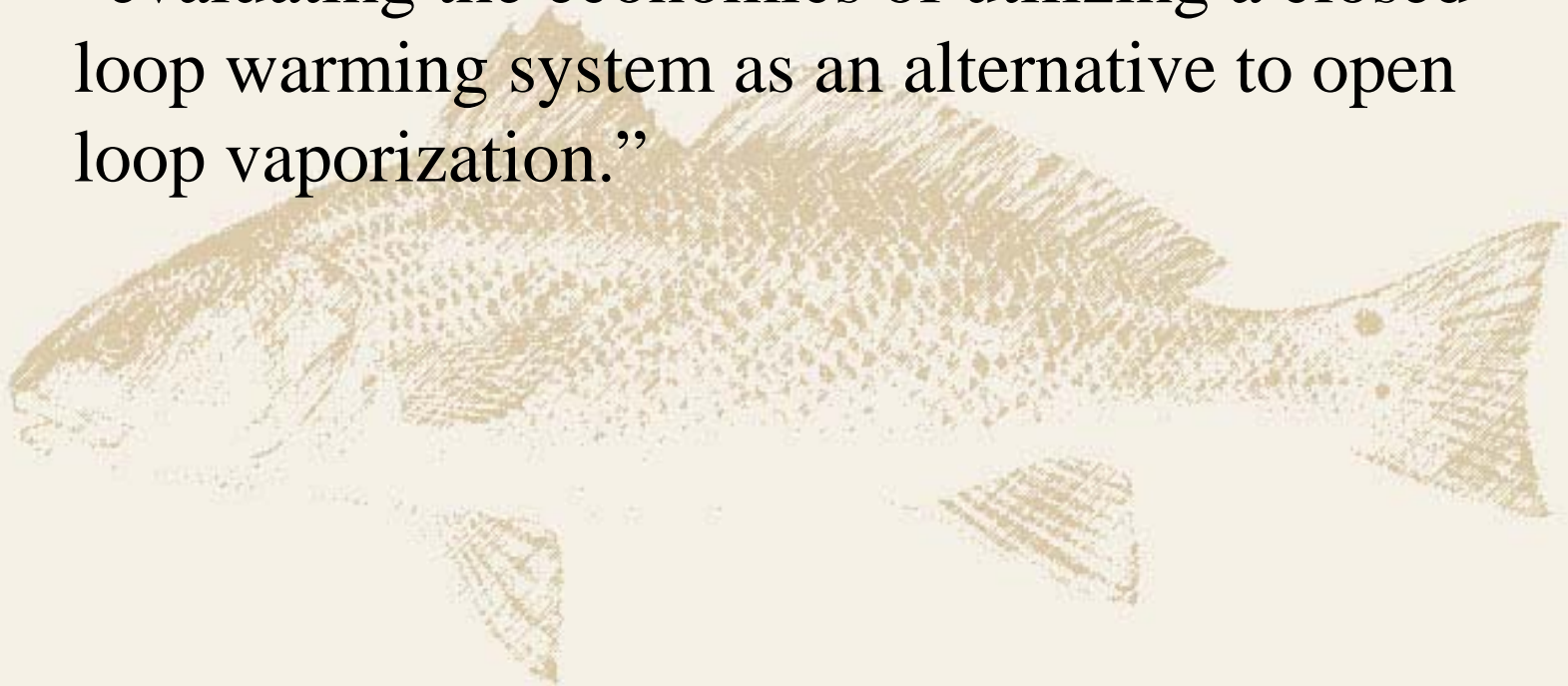
On March 28, 2007, Shell announced that they were dropping plans to build the Gulf Landing facility. They cited substantial capacity already available for importing liquefied natural gas into the U.S. market, particularly along the Gulf Coast.



# Compass Port

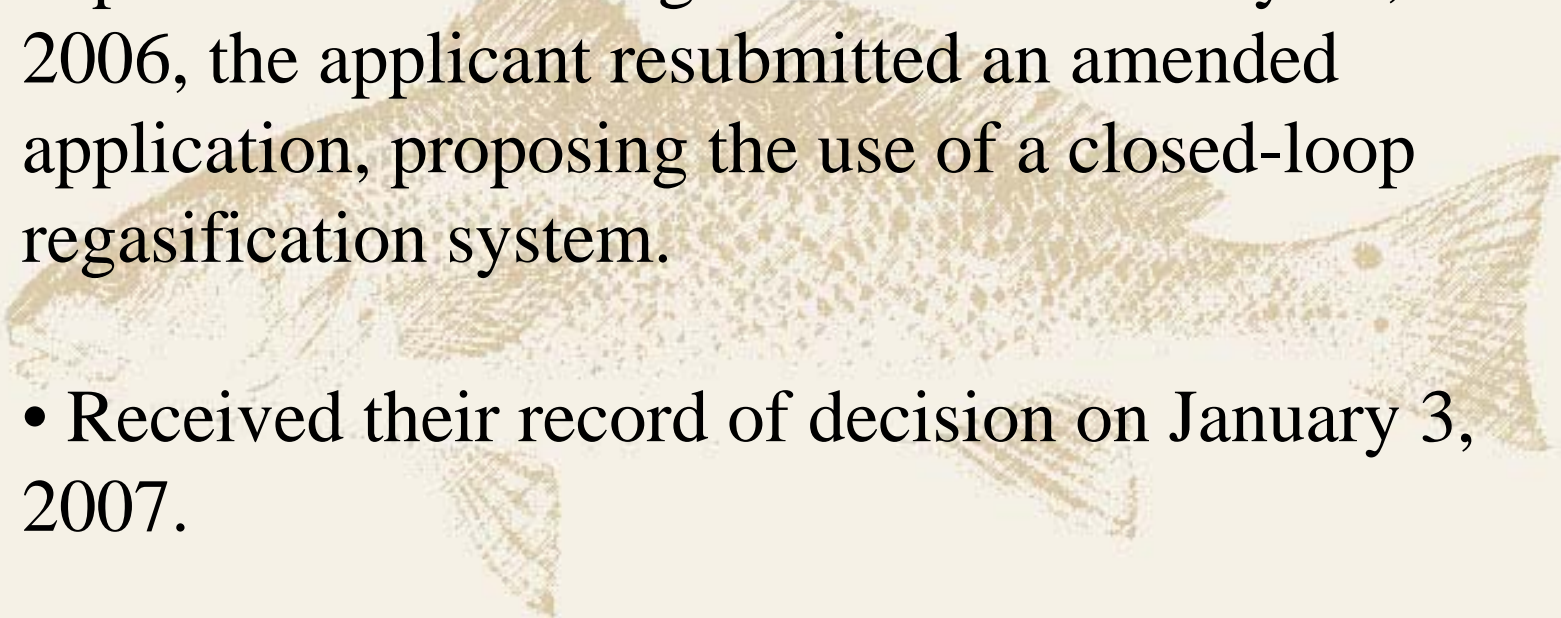
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Status – On June 8, 2006, ConocoPhillips advised MARAD of the withdrawal of its Compass Port Deepwater Port application. ConocoPhillips has stated they were currently “evaluating the economics of utilizing a closed loop warming system as an alternative to open loop vaporization.”



# Main Pass

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- Originally proposed to use an open rack vaporizer.
  - On May 5, 2006, the Governor of Louisiana used the adjacent coastal state authority to veto the project based on the proposed use of an open rack vaporizer for LNG regasification. On May 31, 2006, the applicant resubmitted an amended application, proposing the use of a closed-loop regasification system.
  - Received their record of decision on January 3, 2007.
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# Beacon Port

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On November 3, 2006, ConocoPhillips sent a letter to the U.S. Coast Guard stating “Since filing our application for the Beacon Port Deepwater Port project in January 2005, regulatory authorities have approved a number of new LNG import projects and expansions of existing or proposed facilities in the western Gulf of Mexico. With our capacity at Freeport and nearby Golden Pass, ConocoPhillips no longer has a business need for an LNG terminal off the coast of Texas at this time.”

# Pearl Crossing

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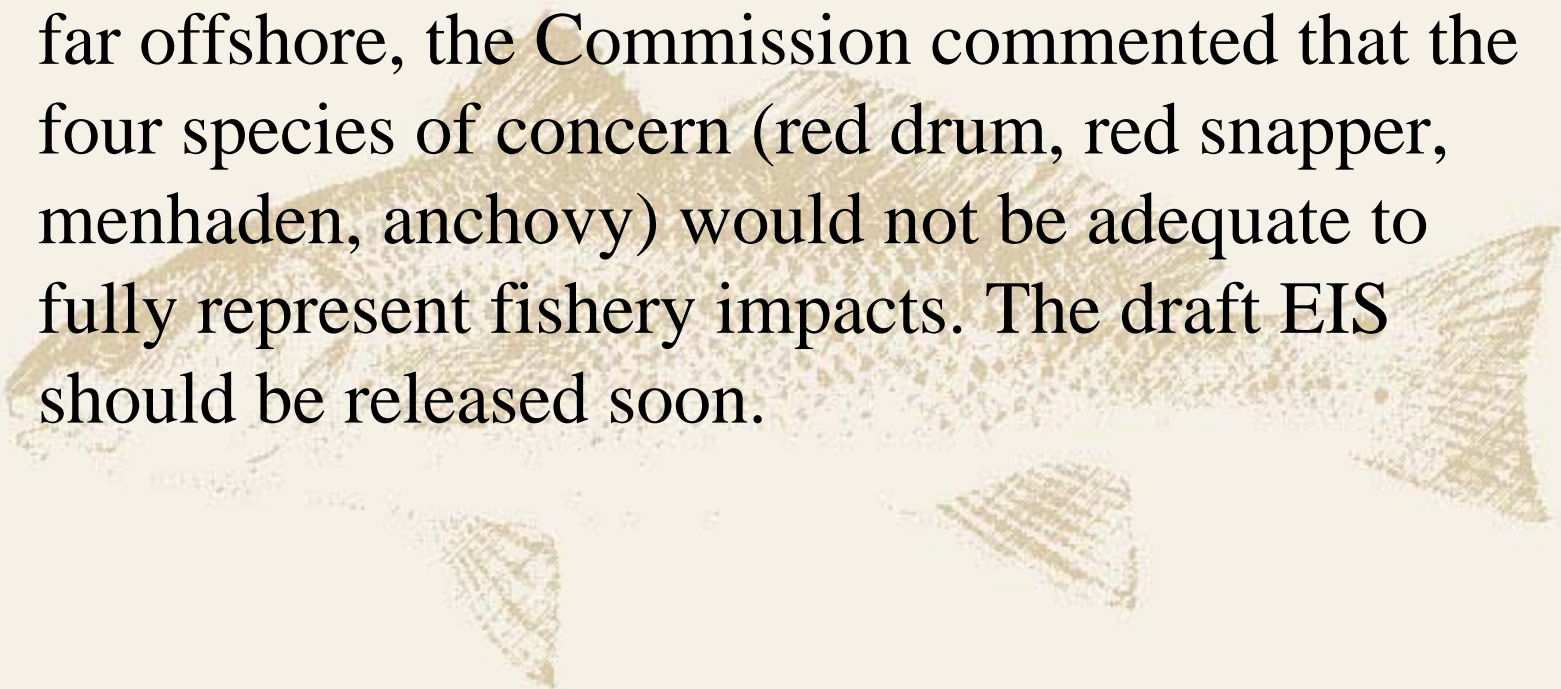
Status – On October 19, 2005, ExxonMobil stated that they “no longer have a current business need for an offshore terminal in the Gulf of Mexico,” and withdrew their deepwater port license application.



# Bienville Offshore Energy Terminal

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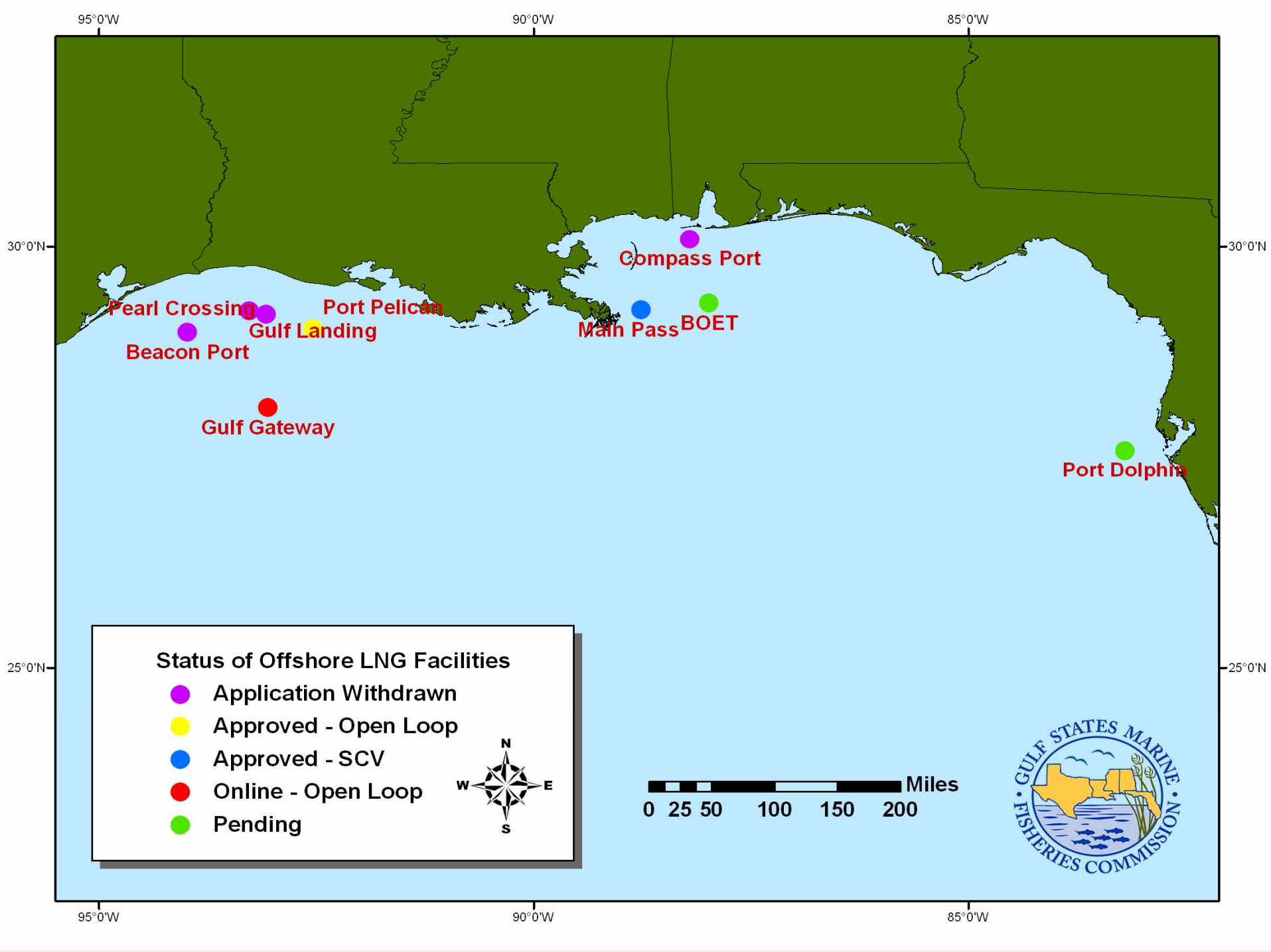
U.S. Coast Guard published a notice of intent to prepare an EIS on June 1, 2006 and requested scoping comments for the facility. The facility is approximately 63 miles south of Mobile Point, Alabama in water depths of 425 feet. Since it is so far offshore, the Commission commented that the four species of concern (red drum, red snapper, menhaden, anchovy) would not be adequate to fully represent fishery impacts. The draft EIS should be released soon.



# Port Dolphin

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Port Dolphin Energy LLC filed its license application on March 29, 2007 for a LNG facility located 28 miles offshore of Tampa, Florida in approximately 100 feet of water. The proposed port would consist of two mooring areas centered on two Submerged Turret Loading Buoys similar to those used in the Gulf Gateway Energy Bridge deepwater port. The proposed port would be capable of mooring up to two Shuttle and Regasification Vessels (SRV). The SRVs are vessels designed to regasify the LNG onboard the vessel.



**Status of Offshore LNG Facilities**

- Application Withdrawn
- Approved - Open Loop
- Approved - SCV
- Online - Open Loop
- Pending



0 25 50 100 150 200 Miles

