

NARG Input - Liquefied Natural Gas

Imports of liquefied natural gas (LNG) must be considered in the NARG model because these imports represent a supply source for the United States (U. S.). The LNG imports could impact the amount of domestic production and Canadian imports of natural gas. These imports could also impact the pipeline capacities required to move natural gas between the various production regions and end users.

Inputs to the NARG model for LNG will include the liquefaction and regasification capacity limits for the years 2002 through 2010. The liquefaction capacity must be reviewed to ensure that there is sufficient capacity in the world market to allow LNG shipment to the U. S and other markets. The regasification capacity establishes the maximum physical limit for LNG that can be imported into the U.S.

The long lead times required for permitting and construction necessitates that the LNG volumes be monitored during the early portion of the assessment to ensure that the NARG model does not add capacity beyond what is physically possible and planned. Cost data associated with the LNG supply chain (natural gas exploration and production, liquefaction, transportation, and regasification) will be inputs to the model. The primary LNG production centers for liquefaction will be identified, along with the transportation routes to the regasification centers that could supply natural gas to the U. S. market.

Regasification

The U. S. regasification capacity will be based on the current operating terminals, their planned expansion, and those facilities that are currently under construction. This capacity will be used to set the maximum amount of LNG that could be imported annually through 2010. The regasification capacities shown in Table 1: NARG Regasification Peak Capacity, 2002 – 2010 (Billion cubic feet per year) will be used as the maximum allowable LNG imports through 2010.

The capacities shown in Table 1 are for peak sendout capacity. Normally the base capacity (average daily send out capacity) would be approximately 80 percent of the peak sendout capacity.

Not included in the capacities shown in Table 1 are the two Bahamas LNG regasification terminals that have not received the permits necessary for construction of the regasification terminals but have received Federal Energy Regulatory Commission (FERC) approval for the construction of natural gas pipelines from these terminals to Florida.

Terminal	2002	2003	2004	2005	2006	2007	2008	2009	2010
Operating									
Everett, Massachusetts	260	260	260	260	260	260	260	260	260
Cove Point, Maryland			365	365	365	365	365	365	365
Elba Island, Georgia	246	246	246	246	246	246	246	246	246
Lake Charles, Louisiana		365	365	365	365	365	365	365	365
Total Operating (Bcfpy)	506	871	1,236	1,236	1,236	1,236	1,236	1,236	1,236
Expansions									
Cove Point, Maryland							116	116	116
Elba Island, Georgia					197	197	197	197	197
Lake Charles, Louisiana				110	110	110	110	110	110
Total Expansion (Bcfpy)				110	307	307	423	423	423
Under Construction									
Port Pelican, Offshore Louisiana					584	584	584	584	584
Cameron, Louisiana						548	548	548	548
Excelerate Energy Bridge, Louisiana					185	185	185	185	185
Quintana Island/ Freeport, Louisiana						548	548	548	548
Costa Azul Energy, Baja Mexico						365	365	365	365
Total Under Construction (Bcfpy)					769	2,230	2,230	2,230	2,230
Total Capacity (Bcfpy)	506	871	1,236	1,346	2,312	3,773	3,889	3,889	3,889

Table 1: NARG Regasification Peak Capacity, 2002 - 2010 (Billion Cubic Feet per Year)

There are additional regasification terminals that have been proposed to serve the U. S. market. These facilities are located in the U.S., Canada, and Mexico. The proposed facilities represent an additional 13,697 Bcfpy, Attachment 1: Operating and Potential LNG Imports Terminals Serving the U.S. Market. After 2010, the NARG model will be allowed to forecast the increases in regasification capacity, its location (West Coast, Gulf Coast, or East Coast) and volumes. The regasification capacity to be located on the West Coast and East Coast will be determined by the NARG model using the economic criteria in the model to evaluate the potential for the proposed regasification terminals to be located in Baja, Mexico or Canada that had not yet received or filed for their permits to serve the U. S. market.

LNG Liquefaction

In 2003 the volume of LNG imports increased by some 120 percent to 506 Bcf (see Table 2: U. S. Natural Gas Liquefied Natural Gas Imports). This increase in U.S. LNG imports is a result of higher domestic natural gas prices and the ability of LNG producers to significantly lower their production costs over the last 20 years. The ability of the LNG industry to lower its costs has occurred in all phases of the LNG supply chain. This lower cost structure for the industry has allowed LNG to become much more competitive in U. S. natural gas market.

Year	Imports in Billion Cubic Feet
2000	226.0
2001	238.1
2002	228.7
2003	506.5

Source: U. S. Energy Information Administration

Table 2: U. S. Liquefied Natural Gas Imports (Bcf)

Currently twelve countries have LNG liquefaction facilities, Table 3: World LNG Movement 2002 (Billion of Cubic Feet). LNG transportation costs are a key element in the ability of LNG producers to compete with natural gas. The transportation cost associated with the LNG production chain has resulted in the world LNG market being separated into two markets, the Asia/Pacific Basin and the Atlantic Basin. As can be seen in Table 3 the Asia/Pacific market is primarily served by LNG liquefaction capacity located in Indonesia, Malaysia, and Australia. The liquefaction centers located in the Asia/Pacific market would be the primary suppliers to the West Coast markets in the U. S.

The Atlantic LNG regasification market is primarily served by LNG liquefaction producers located in Trinidad, West Africa, and North Africa. The liquefaction centers located in these countries would be expected to be a major source of LNG for the regasification terminals serving the U. S. natural gas market along the East and Gulf Coasts.

LNG liquefaction facilities located in the Middle East have the ability to serve both the Atlantic and Asia/Pacific markets.

Exporters	United States	Trinidad	Algeria	Libya	Nigeria	Qatar	United Arab Emirates	Oman	Australia	Brunei	Indonesia	Malaysia
Importer												
United States		151.11	26.58		8.12	35.08		3.01		2.40		2.42
Mexico	0.4											
Puerto Rico		22.18				1.77						
Belgium			117.49			3.07	3.53					
France			364.0		128.19			18.40				
Greece			18.01									
Italy			72.47		145.89							
Portugal					14.62							
Spain		15.89	204.65	21.22	55.90	73.10	13.49	37.68	2.47	2.83		
Turkey			131.41		40.89							
Japan	63.44					325.57	226.02	33.73	356.54	300.46	728.83	532.09
South Korea						237.49	10.95	187.31	8.09	35.49	231.53	406.12
Taiwan											147.26	99.98
Total	63.84	189.18	935.42	21.22	393.62	676.08	253.99	280.13	367.10	341.18	1107.62	1040.61

Source: United States, Energy Information Administration, Department of Energy, last updated September 15, 2003.

Table 3: World LNG Movement 2002 (Billion of Cubic Feet)

These LNG producers have the capacity to liquefy approximately 6,600 Bcfpy of natural gas, Table 4: LNG Liquefaction Capacity (Billion of Cubic Feet Annually).

Region	Operating	Under Construction	Proposed
West Africa	463	399	1,339
North Africa	1,154	594	1,003
South America East Coast	482	253	735
Western Europe		200	
Asia Pacific	3,063	545	1,997
South America West Coast			535
Russia East Coast		234	234
U. S. West Coast	68		680
Middle East	1,359	619	
Total	6,589	2,844	6,523

Source: United States, Energy Information Administration, Department of Energy, The Global Liquefied Natural Gas Market: Status and Outlook, December, 2003.

Table 4: LNG Liquefaction Capacity (Billion Cubic Feet Annually)

The current twelve producing countries will be joined by:

- Norway serving the U. S. East Coast and Western Europe,
- Egypt serving the Western Europe and U. S. East Coast, and
- Russia serving the Asia/Pacific and U.S. West Coast markets.

There are other potential LNG producers located in Alaska processing North Slope natural gas, Bolivia, Peru, Angola, Equatorial Guinea, Venezuela, and Iran.

Production, transportation, and regasification costs for the LNG production chain will be inputs to NARG model for the current regional liquefaction centers and U. S. regasification centers along with those that are expected to commence operation during the assessment period, Table 5:LNG Costs, Dollars per Thousand Cubic Feet (\$/Mcf).

The NARG model runs will use these inputs along with the costs associated with other natural gas resources to select the volume and production centers for LNG imports to the U.S.

Table 5: LNG Costs, Dollars per Thousand Cubic Feet (\$/Mcf)

	Natural Gas		Liquefaction		Transportation		Regasification		Total	
South America East Coast										
Gulf Coast	\$0.50	\$1.00	\$0.85	\$1.65	\$0.32	\$0.41	\$0.30	\$0.70	\$1.97	\$3.76
Northeast	\$0.50	\$1.00	\$0.85	\$1.65	\$0.30	0.39	\$0.35	\$0.80	\$2.00	\$3.84
Mid Atlantic	\$0.50	\$1.00	\$0.85	\$1.65	\$0.29	\$0.38	\$0.03	\$0.80	\$1.67	\$3.83
Southeast/Bahamas	\$0.50	\$1.00	\$0.85	\$1.65	\$0.27	0.35	\$0.30	\$0.70	\$1.92	\$3.70
West Africa										
Gulf Coast	\$0.50	\$1.00	\$0.95	\$1.90	\$0.67	\$0.86	\$0.30	\$0.70	\$2.42	\$4.46
Northeast	\$0.50	\$1.00	\$0.95	\$1.90	\$0.59	0.76	\$0.35	\$0.80	\$2.39	\$4.46
Mid Atlantic	\$0.50	\$1.00	\$0.95	\$1.90	\$0.61	0.78	\$0.03	\$0.80	\$2.09	\$4.48
Southeast/Bahamas	\$0.50	\$1.00	\$0.95	\$1.90	\$0.63	0.81	\$0.30	\$0.70	\$2.38	\$4.41
North Africa										
Gulf Coast	\$0.50	\$1.00	\$0.90	\$1.80	\$0.59	\$0.76	\$0.30	\$0.70	\$2.29	\$4.26
Northeast	\$0.50	\$1.00	\$0.90	\$1.80	\$0.42	\$0.54	\$0.35	\$0.80	\$2.17	\$4.14
Mid Atlantic	\$0.50	\$1.00	\$0.90	\$1.80	\$0.47	\$0.60	\$0.03	\$0.80	\$1.90	\$4.20
Southeast/Bahamas	\$0.50	\$1.00	\$0.90	\$1.80	\$0.49	\$0.63	\$0.30	\$0.70	\$2.19	\$4.13
Middle East										
Gulf Coast	\$0.50	\$1.00	\$0.85	\$1.70	\$1.07	\$1.37	\$0.30	\$0.70	\$2.72	\$4.77
Northeast	\$0.50	\$1.00	\$0.85	\$1.70	\$0.78	\$1.15	\$0.35	\$0.80	\$2.48	\$4.65
Mid Atlantic	\$0.50	\$1.00	\$0.85	\$1.70	\$0.89	\$1.20	\$0.03	\$0.80	\$2.27	\$4.70
Southeast/Bahamas	\$0.50	\$1.00	\$0.85	\$1.70	\$0.89	\$1.20	\$0.30	\$0.70	\$2.54	\$4.60
Asia/Pacific										
Northeast	\$0.50	\$1.00	\$0.80	\$2.10	\$1.32	\$1.69	\$0.35	\$0.80	\$2.97	\$5.59
West Coast	\$0.50	\$1.00	\$0.80	\$2.10	\$0.88	\$1.14	\$0.05	\$0.09	\$2.23	\$4.33
South America West Coast										
West Coast	\$0.50	\$1.00	\$0.90	\$2.20	\$0.36	0.47	\$0.50	\$0.85	\$2.26	\$4.52
Russia										
West Coast	\$0.50	\$1.00	\$0.90	\$2.00	\$0.51	\$0.66	\$0.50	\$0.85	\$2.41	\$4.51
Alaska										
West Coast	\$0.50	\$1.00	\$0.80	\$2.00	\$0.29	0.38	\$0.50	\$0.85	\$2.09	\$4.23

Attachment 1: Operating and Potential LNG Imports Terminals Serving the U. S. Market

	Status	Facility	Billion Cubic Feet per Year	Storage CM- LNG	Operator	Start Up Year	Permit Status
United States Atlantic Coast							
Massachusetts	Operating	Everett	260	155,000	Tractebel Sonat/Southern Natural Gas Company	1971	Operating
Georgia	Operating	Elba	246	180,000	Dominion Resources	1978	Operating
Maryland	Operating	Cove Point	365	240,000	Dominion Resources	1978	Operating
Maryland	Under Construction	Cove Point	0	134,400	Dominion Resources Sonat/Southern Natural Gas Company	2005	Storage expansion only/approved by FERC
Georgia	Under Construction	Elba	131		Excelerate Energy	2006	FERC approved 2003
Massachusetts	Proposed	Gloucester Terminal/ Offshore Boston	292		Excelerate Energy	2007	Under discussion with State and Local officials
Maryland	Proposed	Cove Point	292	460,800	Dominion Resources	2008	Started prefilng in 2004
New Jersey	Proposed	Crown Point	438		BP	2009	FERC Application Filed
Rhode Island	Proposed	Providence LNG	183		Keyspan/BG LNG		Feasibility study to upgrade the LNG storage facility to an import terminal filed with FERC 2004
Maine	Proposed	Quoddy Bay	183		Quoddy Bay LLC		No permit application filed/Located on the Passamaquoddy/Sipayik Reservation
Massachusetts	Proposed	Somerset	237		Somerset LNG		No permit filings
New Jersey	Proposed	Belmar Offshore New Jersey			El Paso Global		No permit filings
Bahamas							
Ocean Cay	Proposed	Ocean Breeze	307		AES Corp	2007	Received FERC permit for pipeline to Florida/Awaiting Bahamas approval for facility
Grand Bahamas Island	Proposed	High Rock Facility/Seafarer	183		El Paso	2008	Pipeline applications filed with FERC and facility permit filed with the Bahamas government
Freeport Grand Bahamas	Proposed	Freeport Facility/Calypso	303		Tractebel LNG	2010	FERC and Florida Governor approved Calypso Pipeline between the facility and Florida (Pipeline Capacity 832,000 Dth/d)/Bahamas granted preliminary approval

Canada

New Brunswick	Proposed	St. John Canaport	365	480,000	Irving Oil	2007	Approved by Canadian and Provincial Governments
Nova Scotia	Proposed	Bear Head/Point Tupper	365		Anadarko	2007	Approved by Canadian and Provincial Governments
Nova Scotia	proposed	Keltic LNG	183		Keltic Petrochemicals		No permit application filed
Nova Scotia	Proposed	Strait of Cansol/Point Tupper	183		Statia Terminals		No permit application filed
Quebec	Proposed	Rabaska Terminal	183		TCPL/Gaz Mar		Company plans to file EIS in late 2004

United States Gulf Coast

Louisiana	Operating	Lake Charles	365	286,200	Southern Union/Trunkline	1980	Operating
Louisiana	Under Construction	Lake Charles	219		Southern Union/Trunkline	2005	FERC approved 2002
Louisiana	Under Construction	Port Pelican/Offshore	584		ChevronTexaco	2006	License for Port Pelican was issued by the Maritime Administration for the terminal. FERC granted authorization to Sempra to construct and operate LNG terminal September 2003.
Louisiana	Under Construction	Cameron	548		Sempra LNG	2008	
Louisiana	Proposed Expansion	Lake Charles	367		Southern Union/Trunkline	2006	Filed application with FERC 2004
Louisiana	Proposed	Sabine Pass	949	480,000	Cheniere	2007	FERC issued a favorable Draft EIS for the terminal and pipeline connection.
Texas	Proposed	Ingleside Energy Center	365		Occidental Energy Venture	2007	Announced plans for the facility March 2004/FERC filing
Texas	Proposed	Corpus Christi (Cheniere)	745	480,000	Cheniere, BPH LLC	2008	Filed with FERC/waiting on a draft environmental impact statement from FERC
Louisiana	Proposed	Pearl Crossing/ Gulf of Mexico	365	250,000	ExxonMobil	2008	Coast Guard filing pending
Texas	Proposed	Vista Del Sol	365		ExxonMobil	2009	Company is in the permitting process with FERC
Texas	Proposed	Golden Pass	365	480,000	ExxonMobil	2009	Filed with FERC late 2003.
Texas	Proposed	Port Arthur	548	480,000	Sempar	2009	Company has made a pre-filing notification to FERC.
Louisiana	Proposed	Gulf Landing Offshore	365		Shell	2009	Pending at Coast Guard
Alabama	Proposed	Mobil Bay	365		ExxonMobil	2009	No FERC filing/local LNG safety issues to be addressed.

Alabama	Proposed	Pinto Island	365		Cheniere	2010	Cheniere has acquired a option to purchase site for LNG terminal/Considerable local opposition
Texas	Proposed	Main Pass/Freeport	365	250,000	McMoRan		Pipeline permit pending with FERC/Facility permit submitted to the Coast Guard
Alabama	Proposed	Compass Port	365	300,000	ConocoPhillips		Coast Guard has scheduled public scoping meeting for project
Texas	Proposed	Brownsville (Cheniere)	548		Cheniere		Cheniere acquired an option on 125 acre site for an LNG terminal. Project is in the planning stages
Louisiana	Under Construction	Energy Bridge (Offshore)	185		Excelerate Energy	2006	Approved by Coast Guard
Texas	Under Construction	Quintana Island/Freeport	548	320,000	Cheniere/Contango/ConocoPhillips	2007	FERC approved the construction and operation.
Mexico Gulf Coast							
Tamaulipas	Under Construction	Altamira	475	300,000	Shell	2006	Shell won the concession to construct the LNG terminal. Approved by state and federal Mexican agencies
United States West Coast							
California	Proposed	Long Beach/SES/Mitsubishi	256		Sound Energy Solution	2008	Filed application with FERC January 2004.
California	Proposed	Cabrillo	548		BHP	2008	Pending at Coast Guard and California State Lands Commission
California	Proposed	Clearwater Port/Platform Grace	183		Crystal Energy	2010	Filing with Coast Guard and California State Lands Commission
California	Proposed	Camp Pendleton	274		ChevronTexaco	2012	Pentagon confirmed Marine Base a possible LNG site/No permit application filed
Oregon	Proposed	Port Westward	256		Port Westwood LLC	2012	No permit application filed
Mexico West Coast							
Baja California	Under Construction	Costa Azul Energy	365		Sempre/Shell	2007	Permits received/Ground clearing and road work started
Baja California	Proposed	Coronado Island/Offshore Tijuana	511		ChevronTexaco	2007	Permits Pending
Lazaro Cardenas	Proposed	Lazaro Cardenas	353		Repsol-YPF	2008	Repsol-YPF won the concession to construct the LNG terminal/Permits pending at Mexican Regulatory Agencies.

Sonora	Proposed	Puerto Libertad, Sonora	292	320,000	DKRW Energy	2008	DKRW has an agreement with the Government of Sonora to build an LNG Terminal/permits application pending
Canada West Coast							
British Columbia	Proposed	Kitimar	124		Galveston LNG		
British Columbia	Proposed	Prince Rupert	365		WestPac Terminals		