



## LNG Facts – A Primer



Presentation before US Department of Energy,  
Office of Fossil Energy, LNG Forums

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- What is Natural Gas?
- Background on LNG
- Why LNG?
- LNG Importers and Facilities

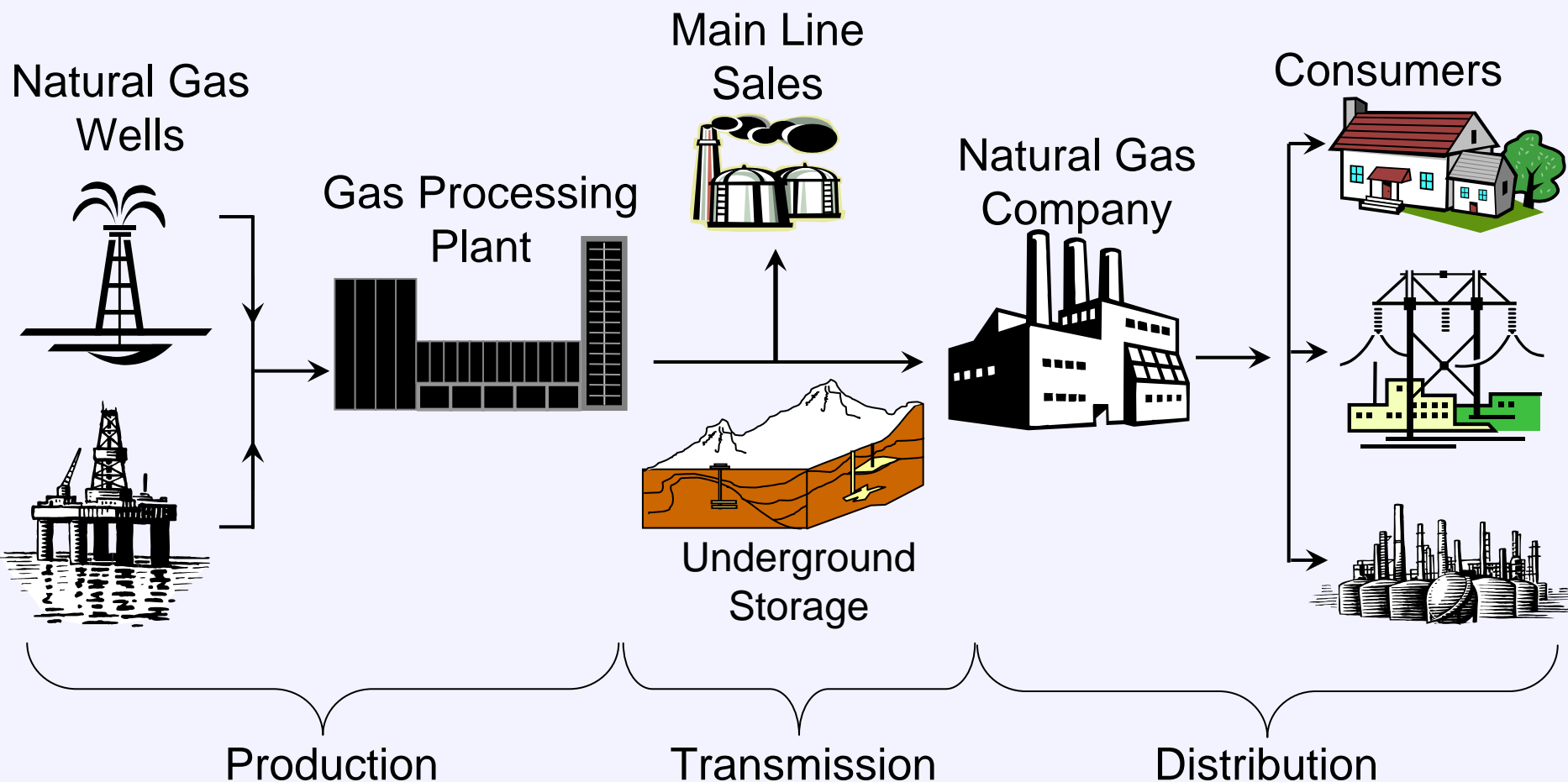


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# What is Natural Gas?

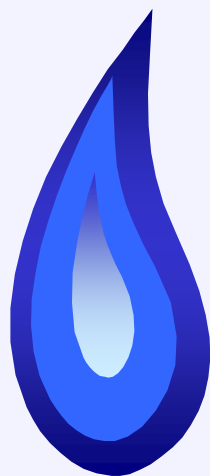


# The Natural Gas Industry





## Natural gas important for all consumers



Natural  
Gas



Residential

Commercial

Industrial

- Furnace/Heat

- Boiler/Steam

-Feedstock

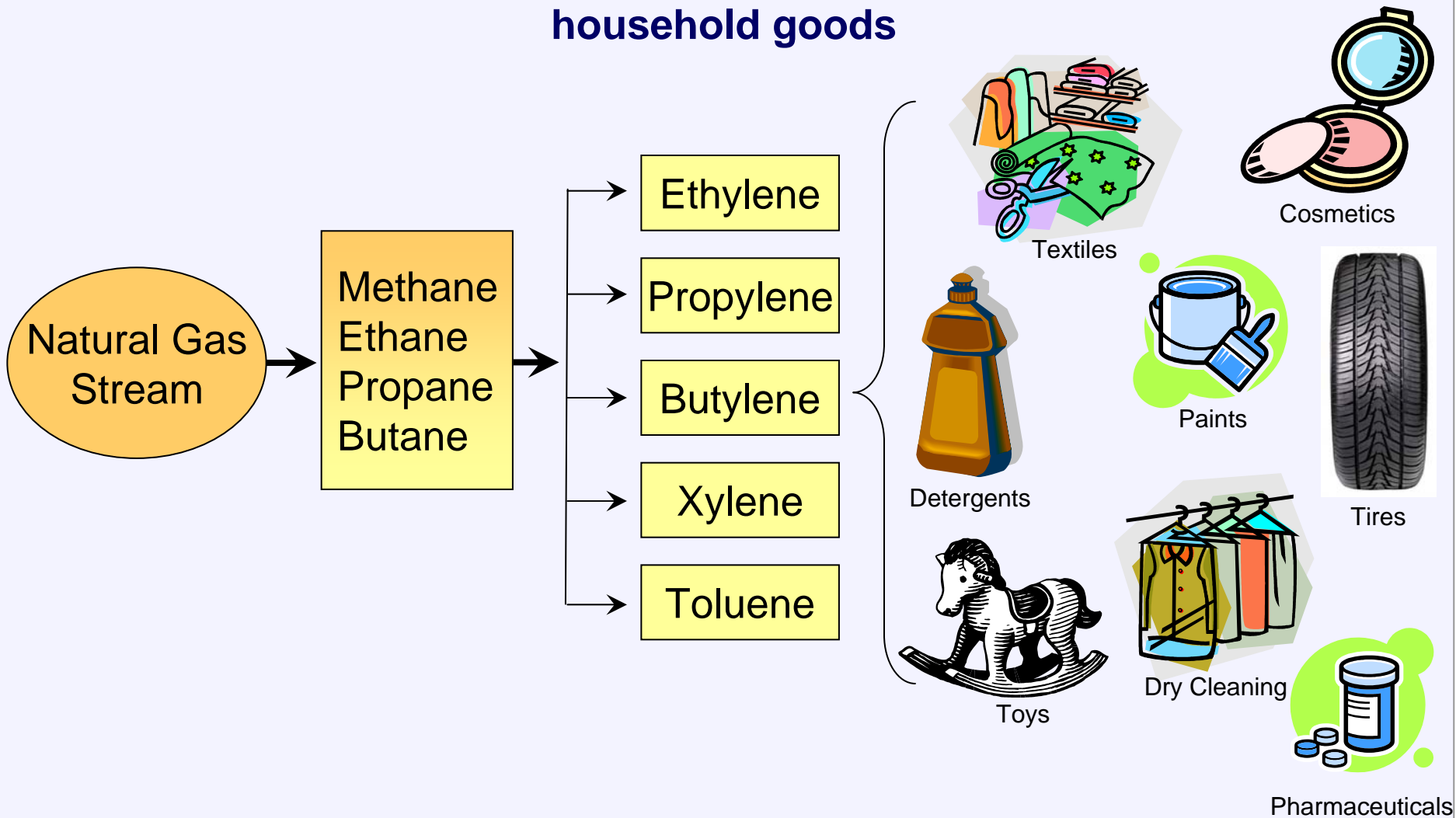
-Power Generation

Power  
Generation



# Components of Natural Gas

Natural gas is the basic building block of many household goods





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# Background on LNG



19<sup>th</sup> century - British chemist and physicist Michael Faraday experimented with liquefying different types of gases

1873 - German engineer Karl van Linde built the first practical compressor refrigerator machine

1912 - First LNG plant built in West Virginia

1941- First commercial liquefaction plant is built in Cleveland, Ohio

January 1959 - The world's first LNG tanker, the Methane Pioneer carries LNG from Lake Charles, LA, to Canvey Island, UK

1964 - British Gas Council imports from Algeria, making the UK the world's first LNG importer and Algeria the first exporter

1969 - LNG exported from Kenai plant, AK to Japan

1971 – Everett, MA import facility is built

1974 – Cove Point, MD import facility is built

1978 – Elba Island, GA import facility is built

1981 – Lake Charles, LA import facility is built

2005 – Energy Bridge in GOM receives its first delivery

1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000



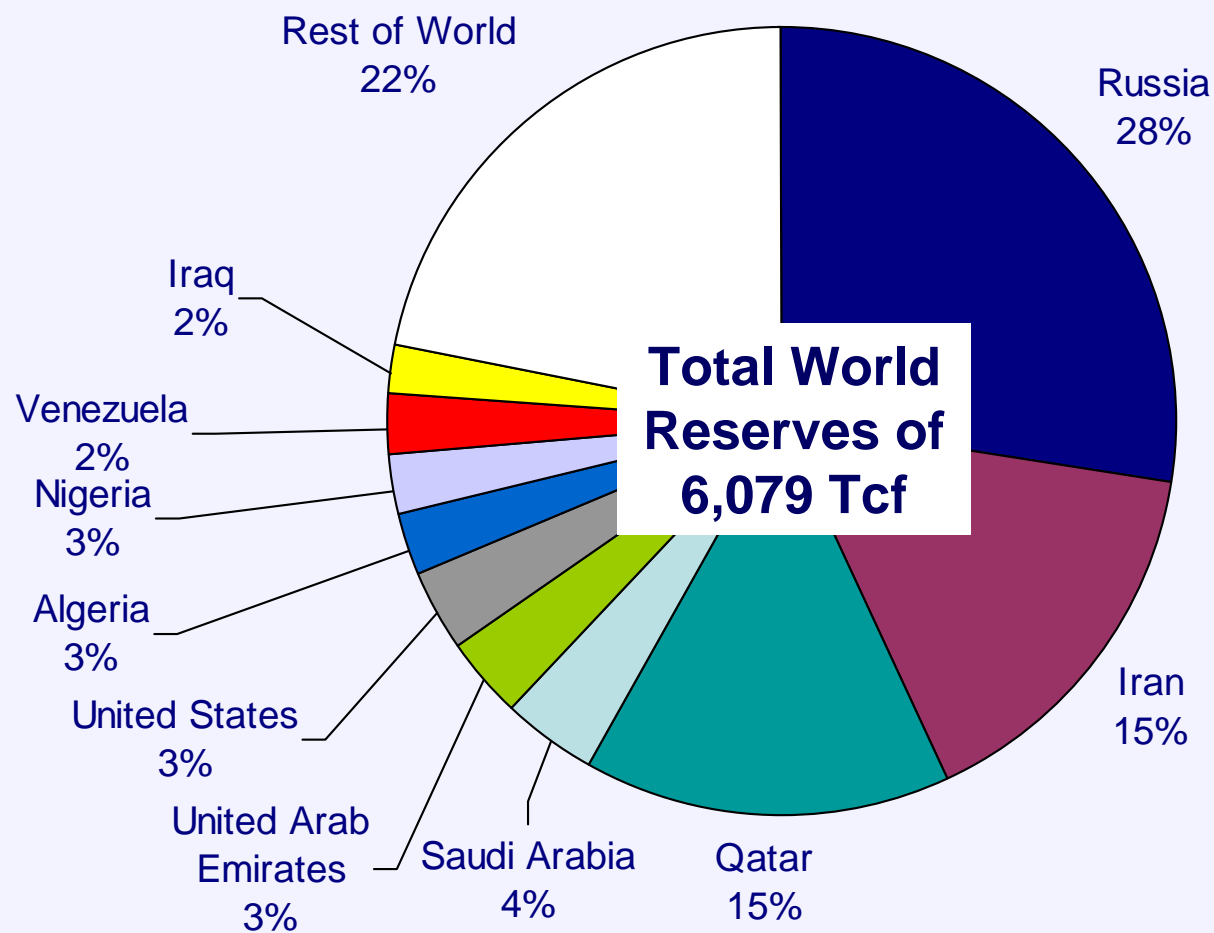


- Liquefied natural gas (LNG) is natural gas that has been turned into a liquid by cooling it to a temperature of  $-256^{\circ}\text{F}$  at atmospheric pressure
- It consists of primarily methane (typically, at least 90 percent)
- LNG is odorless, colorless, non-corrosive and non-toxic
- Liquefying natural gas reduces its volume by a factor of approximately 610
- LNG's flammability range limits are 5 to 15 percent in air



## Natural Gas Reserves by Country (2004)

**Considerable reserves around the world –  
just not in the areas where the gas is needed**





## Regasification terminals are one small portion of the development of an overall LNG project



**Gas Producer**  
\$0.5 to \$1.0 billion  
\$0.50 - \$1.00 / MMBtu  
23% of total cost

**Liquefaction**  
\$0.8 to \$1.0 billion  
\$0.80 - \$1.00 / MMBtu  
28% of total cost

**Shipping\***  
\$0.6 to \$1.2 billion  
\$0.65 - \$1.60 / MMBtu  
35% of total cost

**Receiving Terminal**  
\$300-\$400 million  
\$0.40 - \$0.50 / MMBtu  
14% of total cost

**Cost out of Plant**  
Total Investment: \$2.2 to \$3.6 billion  
\$2.50 - \$3.50 / MMBtu

Note: \*depends upon the distance shipped

Source: Cheniere LNG Industry Profile, <http://www.cheniere.com/LNGIndustryProfile.htm>.



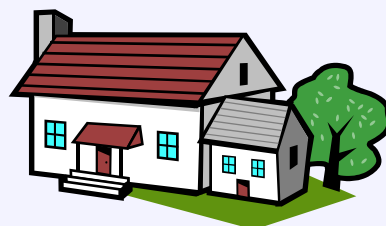
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## LNG Schematic: Production to End-User



**to fuel 2.3 percent of  
Texas' natural gas  
fueled electric power  
plants for 1 month**

**OR**



**to fuel almost 56,000  
of Texas'  
residential customers  
for 1 year (1.4 percent)**

**OR**



**to fuel 1.8 percent  
of Texas'  
industrial plants  
for 1 month**

### Assumptions:

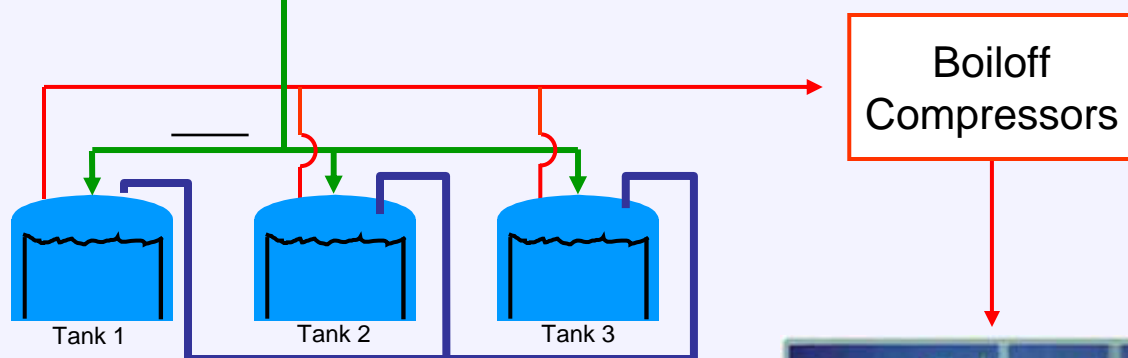
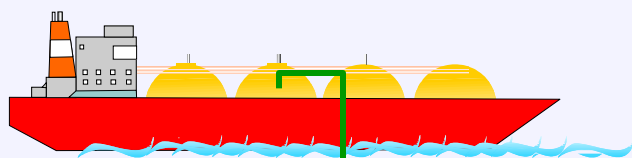
- One 1 LNG tanker carries approximately 125,000 to 138,000 cubic meters of LNG, which will provide about 2.6 to 2.8 bcf of natural gas
- Average monthly power usage of 116,150 bcf;
- Average monthly industrial usage of 151,175 MMcf

Source: Energy Information Administration; Federal Energy Regulatory Commission; Center for Energy Economics, BEG, UT-Austin; and Statoil.com.



## Receiving Terminal – LNG Gas Flow

- LNG – Ship to Tanks
- Natural Gas
- LNG – Tanks to Vaporizers



As gas is required, pumps inside the tanks transfer LNG to the plant vaporizers.

As LNG boils off, the gas is withdrawn from the tanks and compressed.



Gas Pipeline

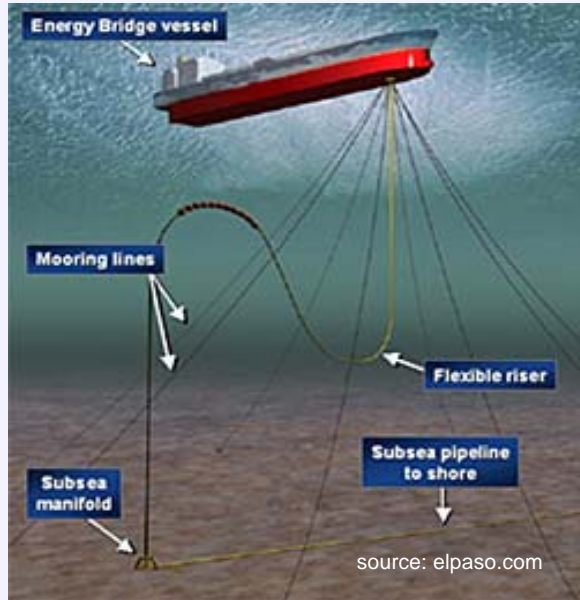
The plant vaporizers warm the LNG until it vaporizes.





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# Types of Offshore LNG Receiving Terminals



**Onboard Vessel Regasification  
System (with submerged buoy)**



**Gravity Based Structure**



**Floating Storage and  
Regasification Unit**



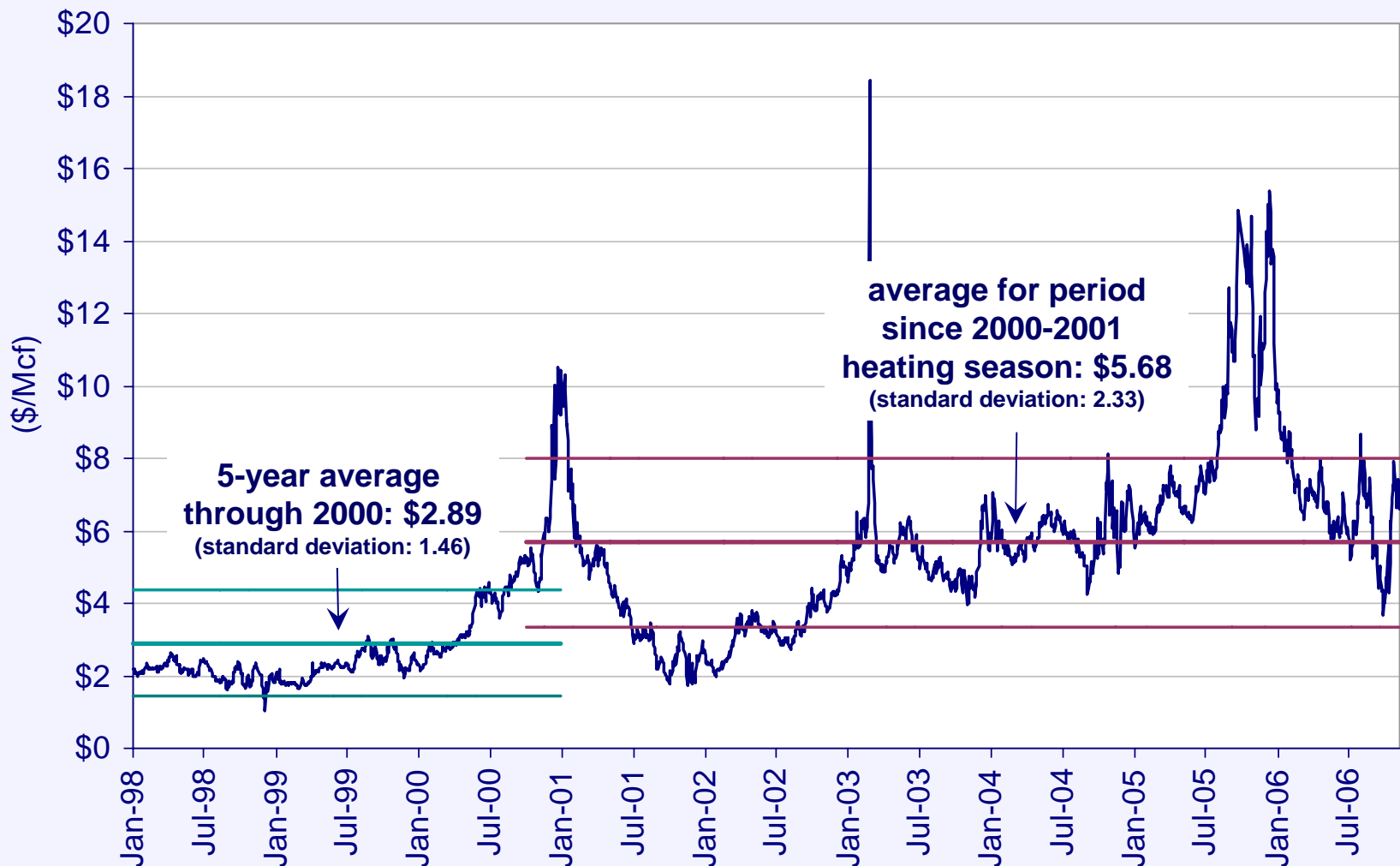
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# Why LNG?



# Daily Henry Hub Prices (1998-Present)

Prices have changed dramatically since winter 2000-01 when markets for gas became exceptionally tight

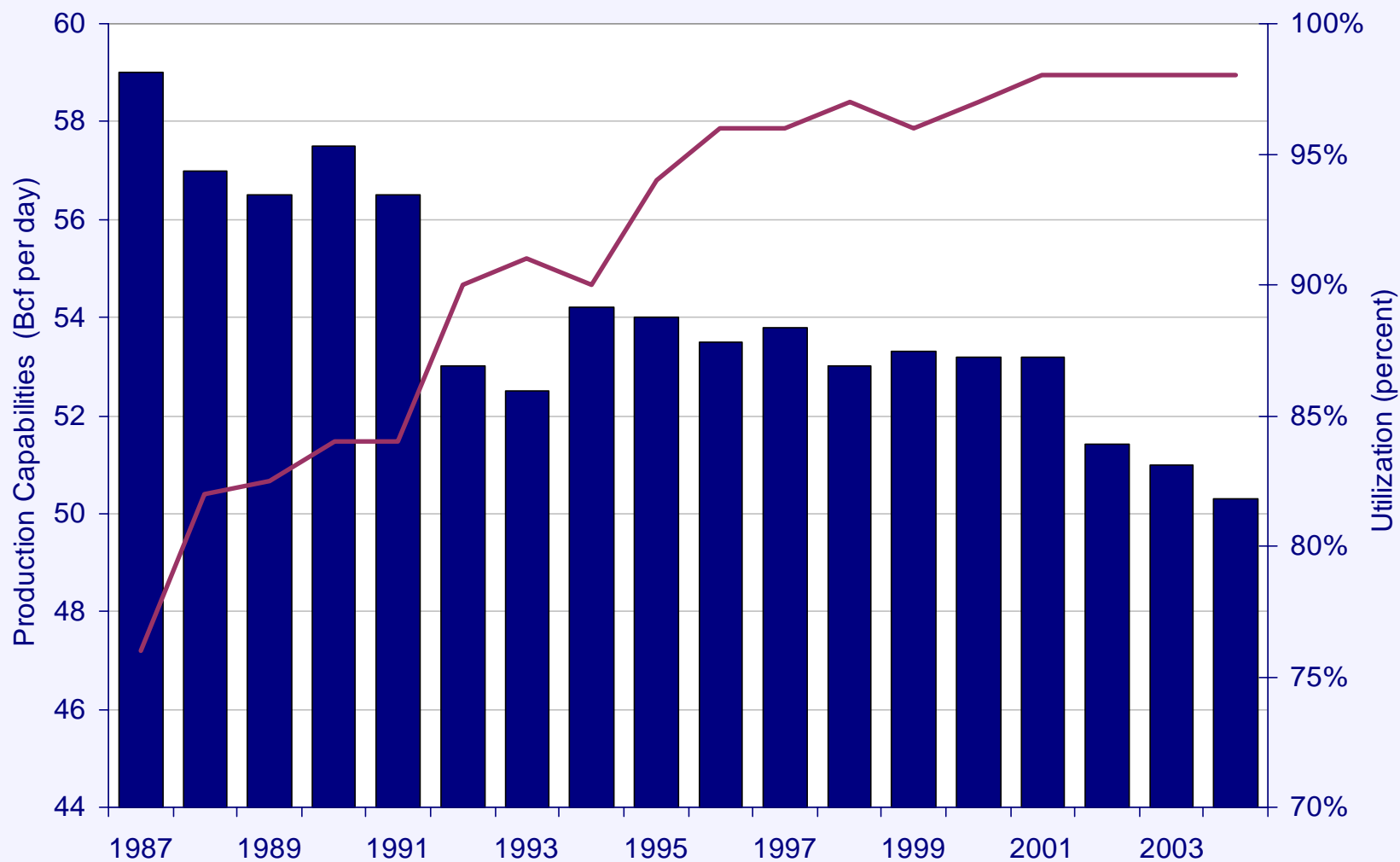


Source: Intercontinental Exchange





## Producers are at the limits of production capabilities

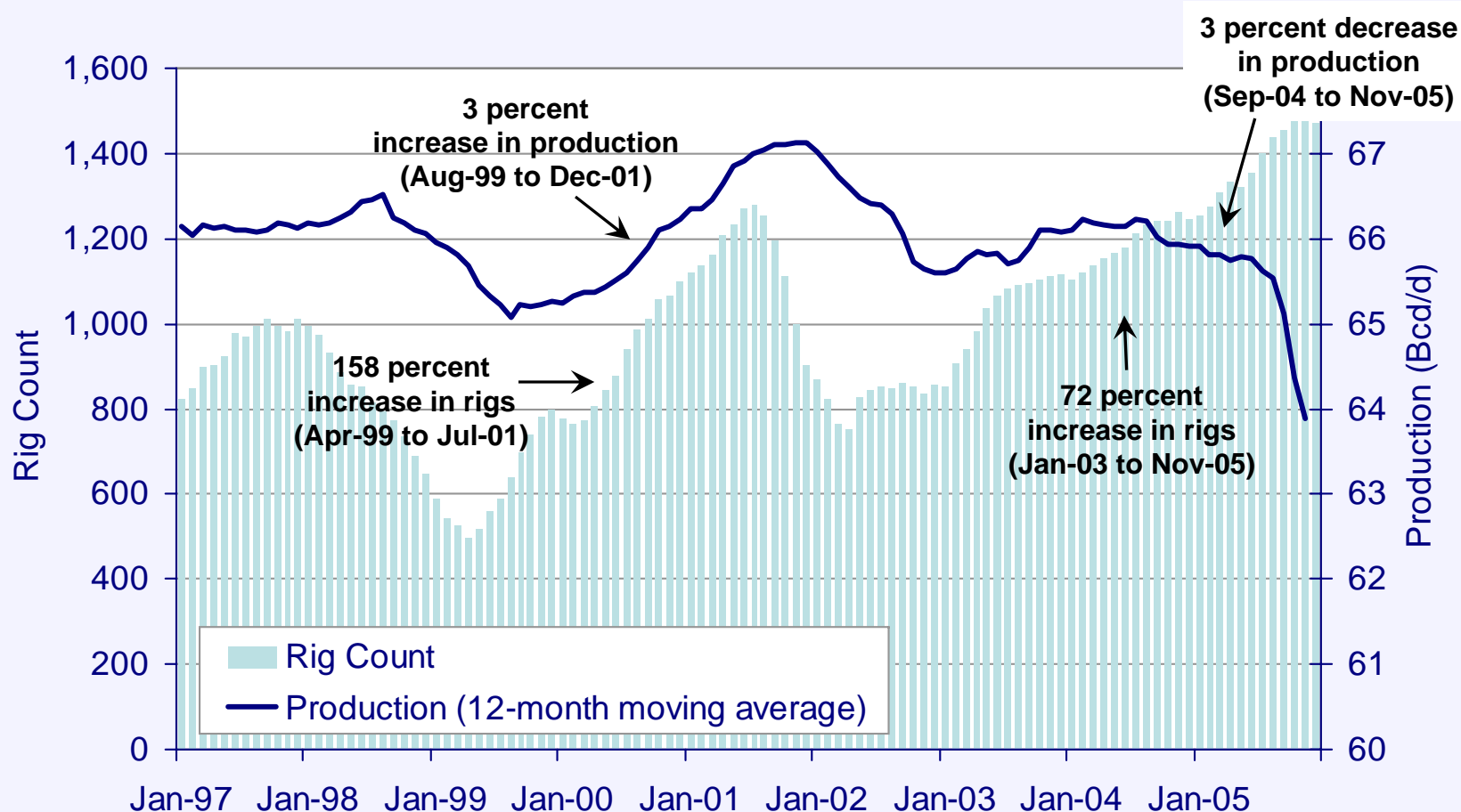


Note: This is an approximation.  
Source: EnergySeer.com



# U.S. Natural Gas Production and Monthly Rig Count (1997-Present)

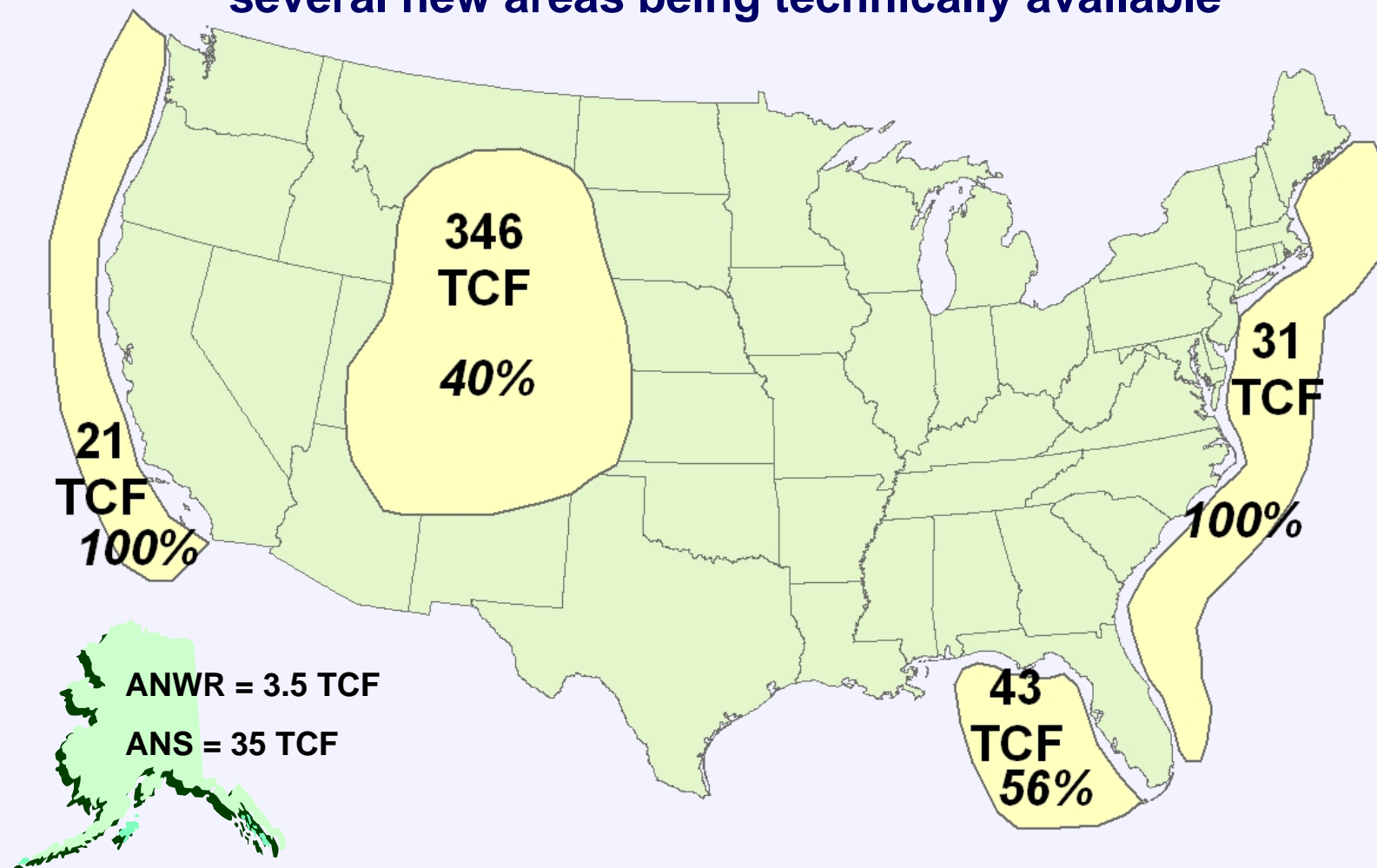
**Despite increased drilling efforts, production is falling;  
The US is seeing decreasing drilling productivity**





## Resource Estimates – Restricted Areas Estimated Percentage Restricted

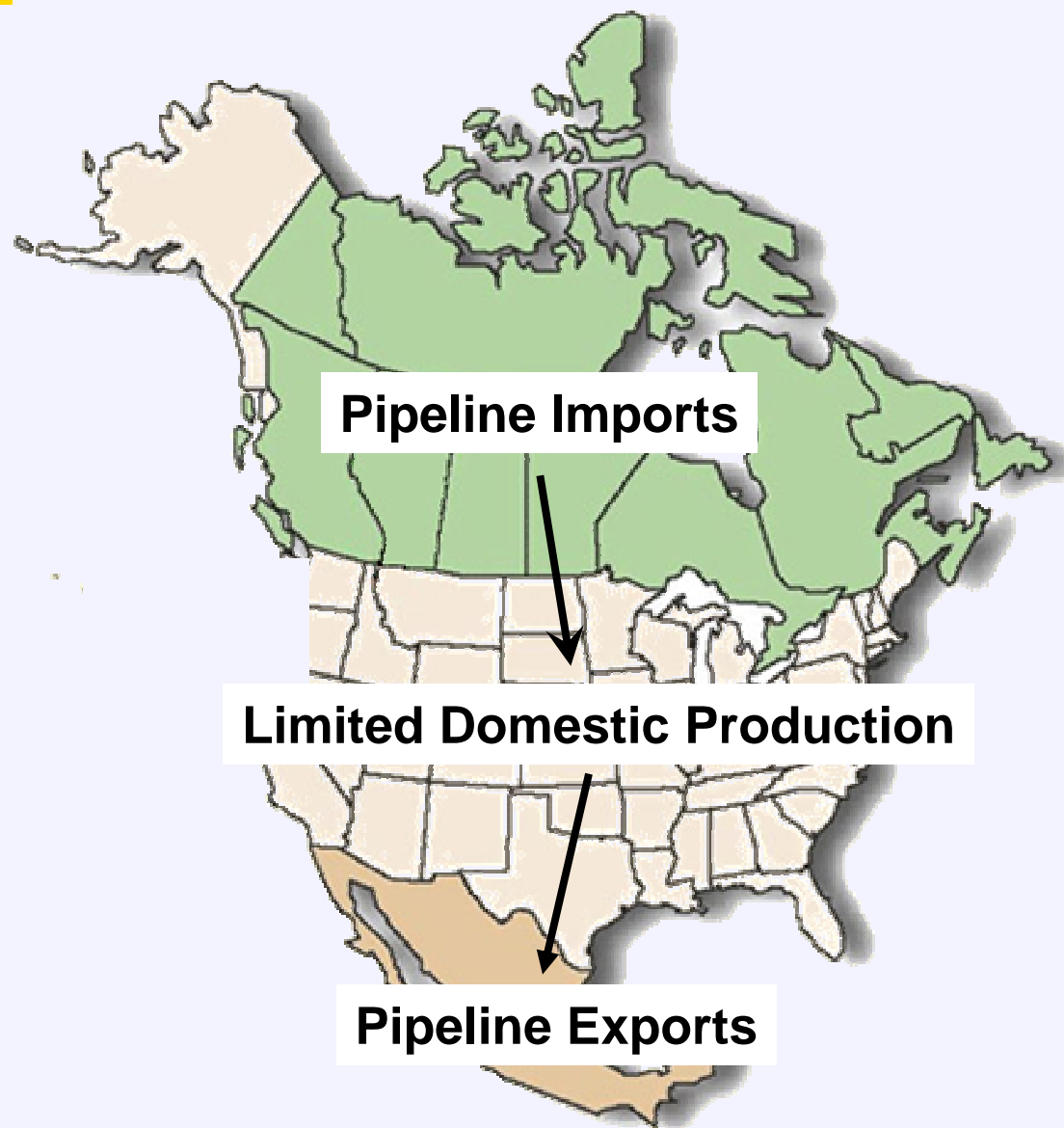
Producers are drilling over the same areas despite  
several new areas being technically available





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## US Natural Gas Market Status



**Pipeline Imports**

**Limited Domestic Production**

**Pipeline Exports**

In addition, the U.S. has limitations on importing natural gas from other parts of North America and it can't be shipped in its natural form.

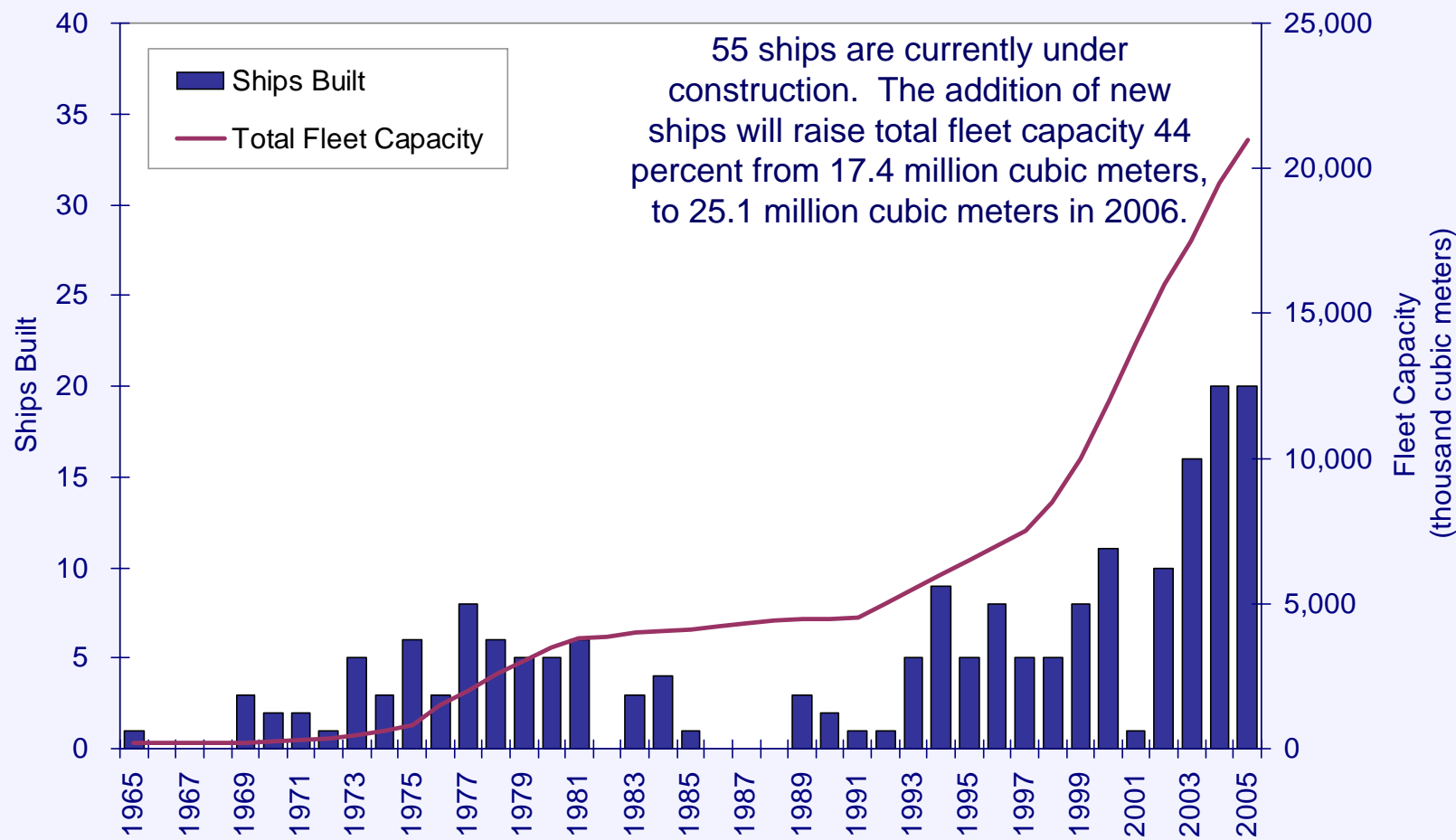


	<u>LNG Regasification Import</u>		<u>LNG Liquefaction Facilities</u>	
	<u>Terminals</u>			
	Number of Storage Tanks	Storage Capacity (thousand m <sup>3</sup> )	Number of Trains	Capacity (million tons/year)
Africa	-	-	29	43.4
Europe	33	2,836	-	-
Asia	202	18,543	31	72.2
Middle East			11	32.0
North America	13	1,005	1	1.5
South America	3	320	3	9.9



# LNG Worldwide Tanker Fleet (1965-2005)

As of 2003, 151 LNG tankers were in operation worldwide





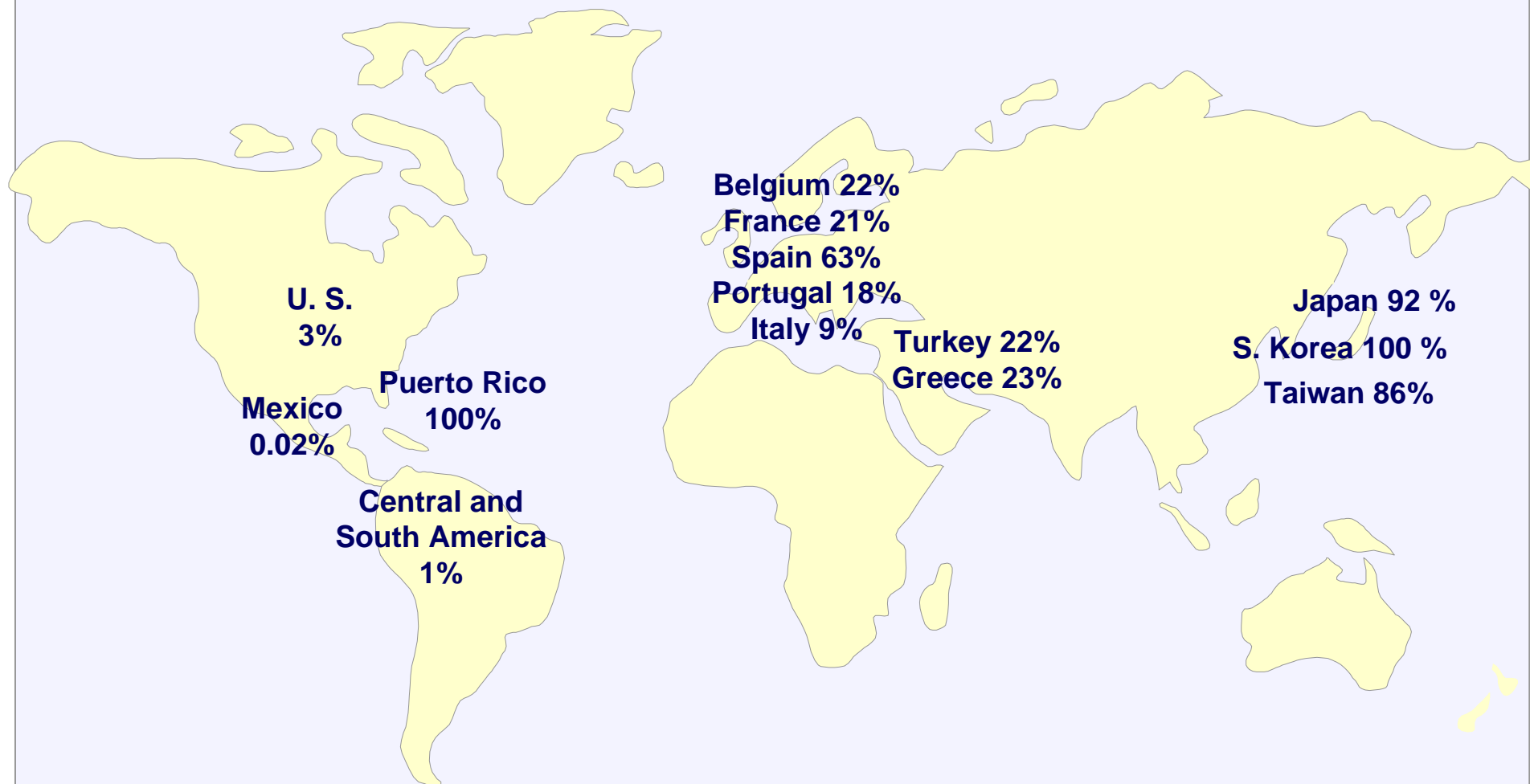
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# LNG Importers and Facilities



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## World Importers of LNG: Imports as Percent of Total Natural Gas Consumption (2003)

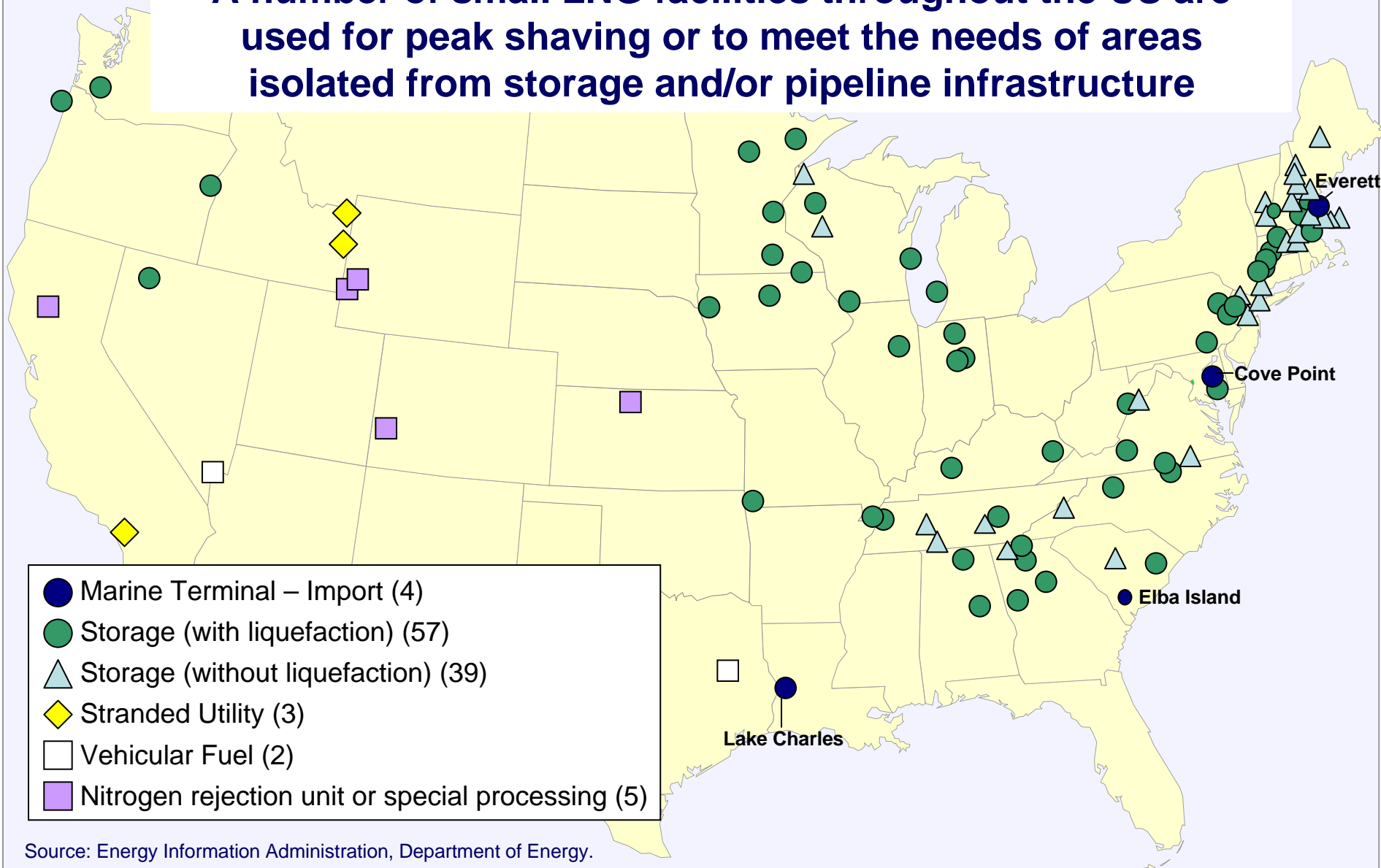


Source: Energy Information Administration, Department of Energy





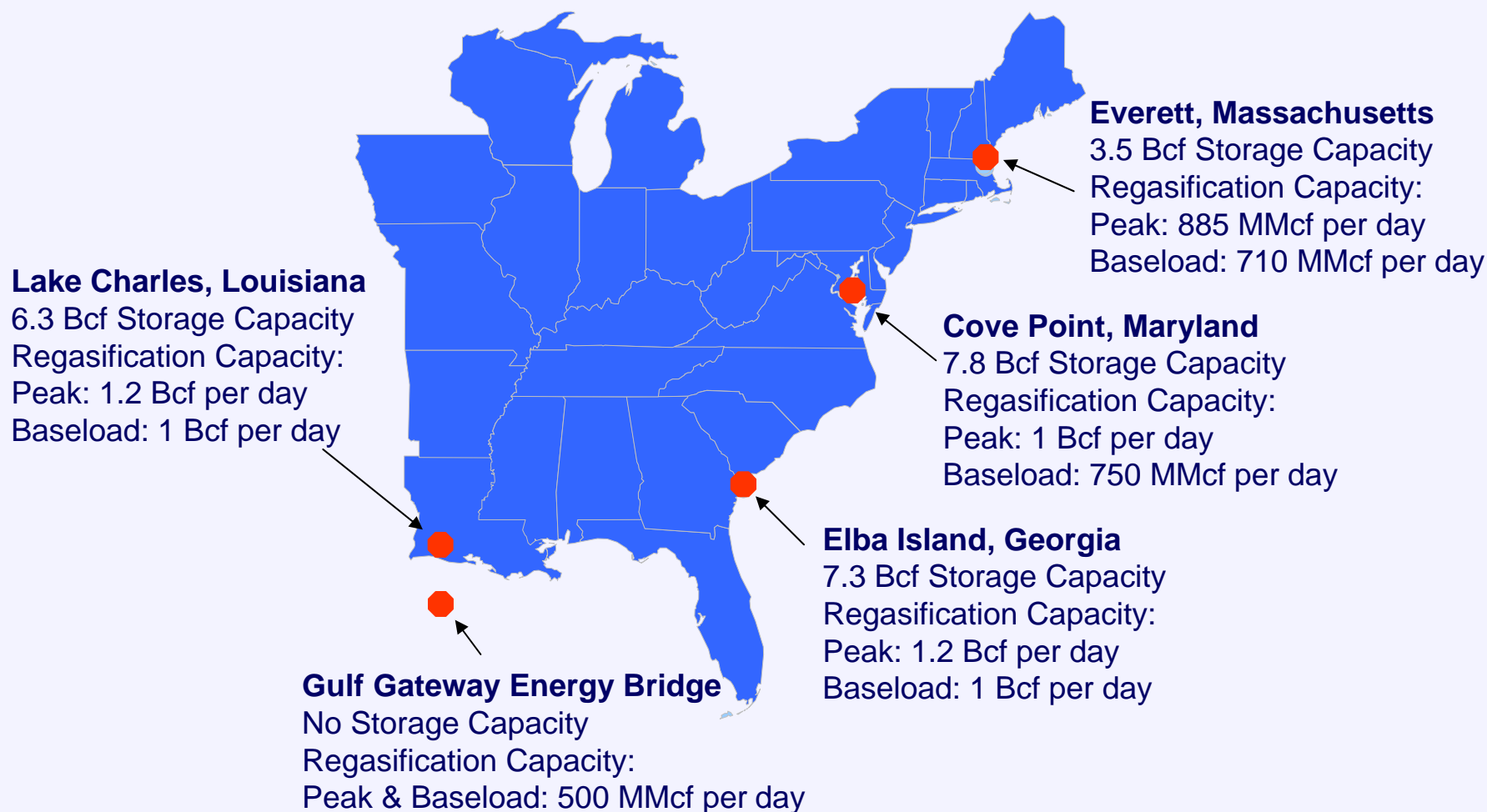
**A number of small LNG facilities throughout the US are used for peak shaving or to meet the needs of areas isolated from storage and/or pipeline infrastructure**



Source: Energy Information Administration, Department of Energy.



## Current US LNG Import Terminals





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**Thank You**

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**[www.enrg.lsu.edu](http://www.enrg.lsu.edu)**