



## 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

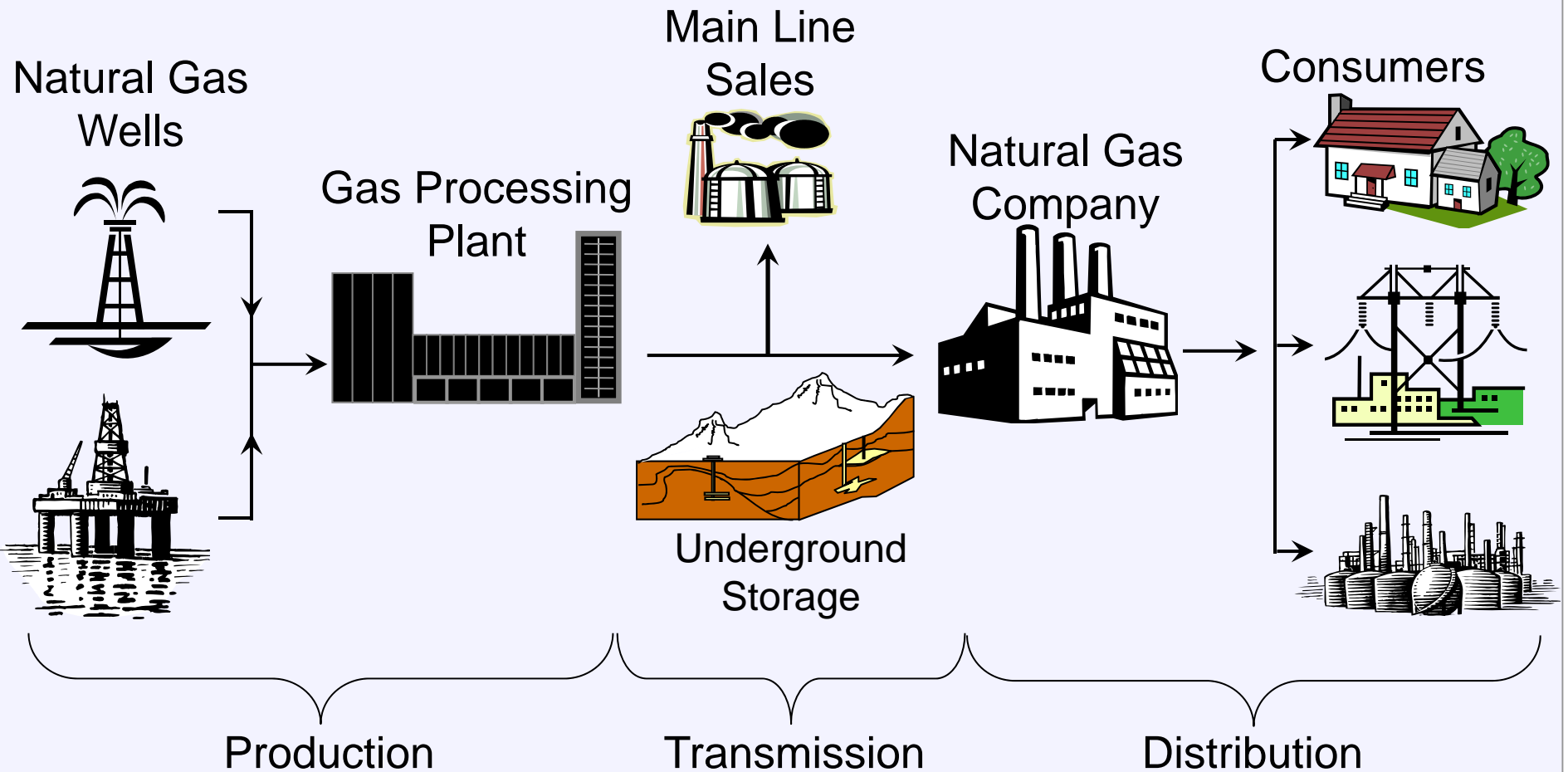


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# What is Natural Gas?

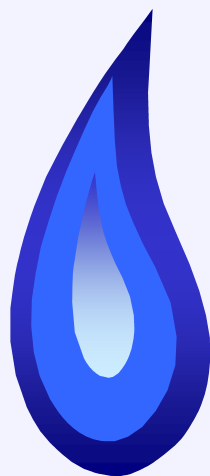


# The Natural Gas Industry





## Natural gas important for all consumers



Natural  
Gas



Residential

Commercial

Industrial

- Furnace/Heat

- Boiler/Steam

-Feedstock

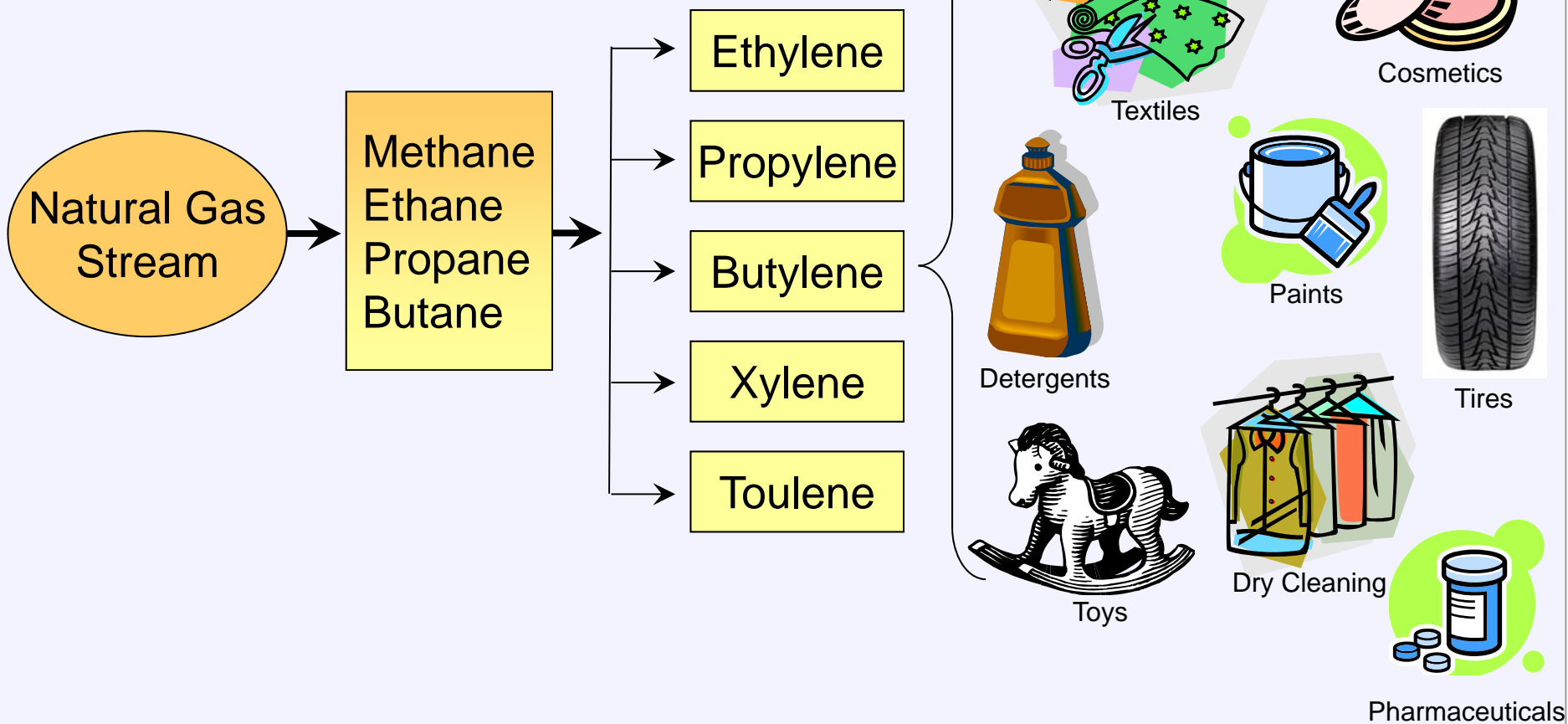
-Power Generation

Power  
Generation



# Components of Natural Gas

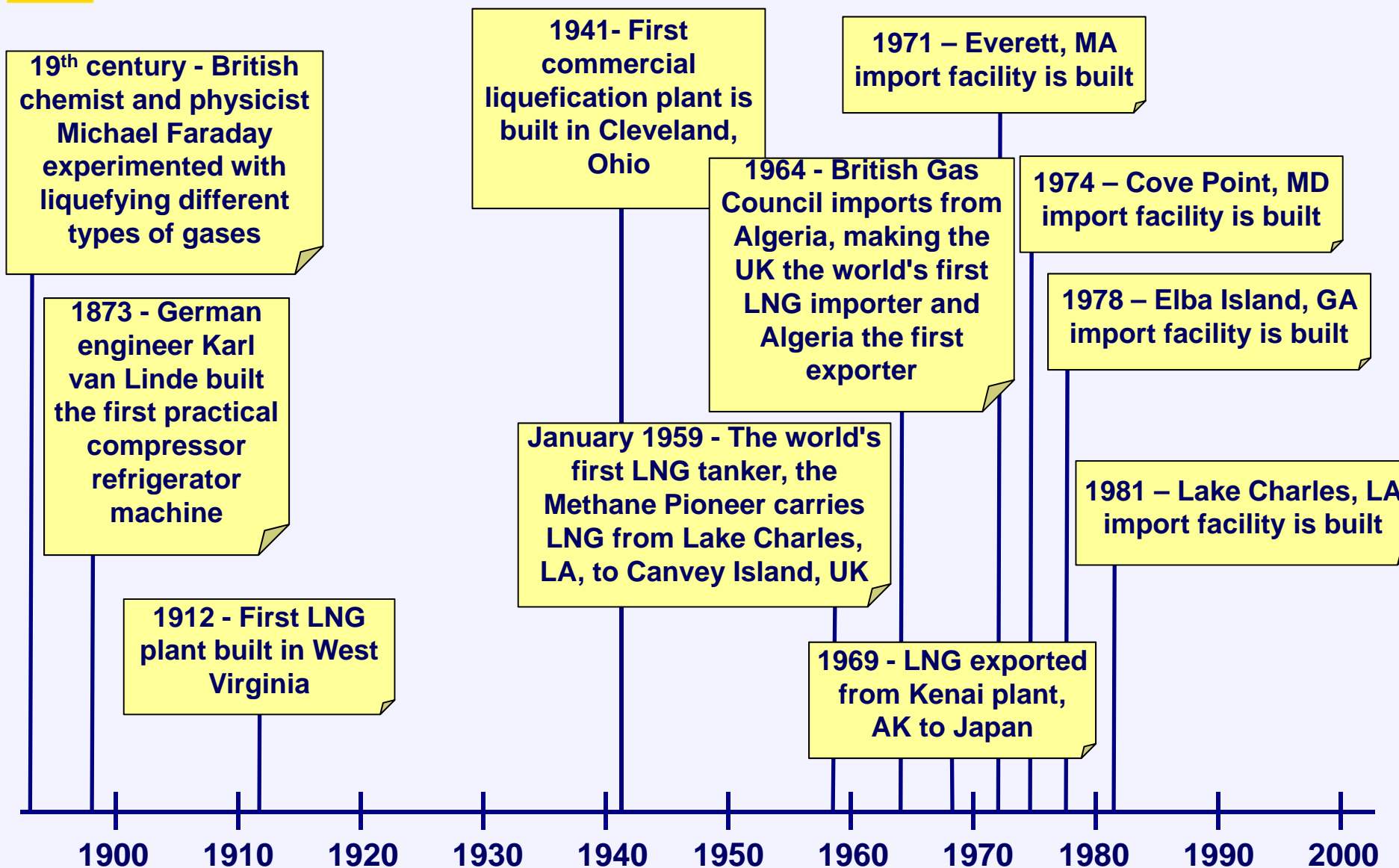
Natural gas is the basic building block of many household goods





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# Background on LNG





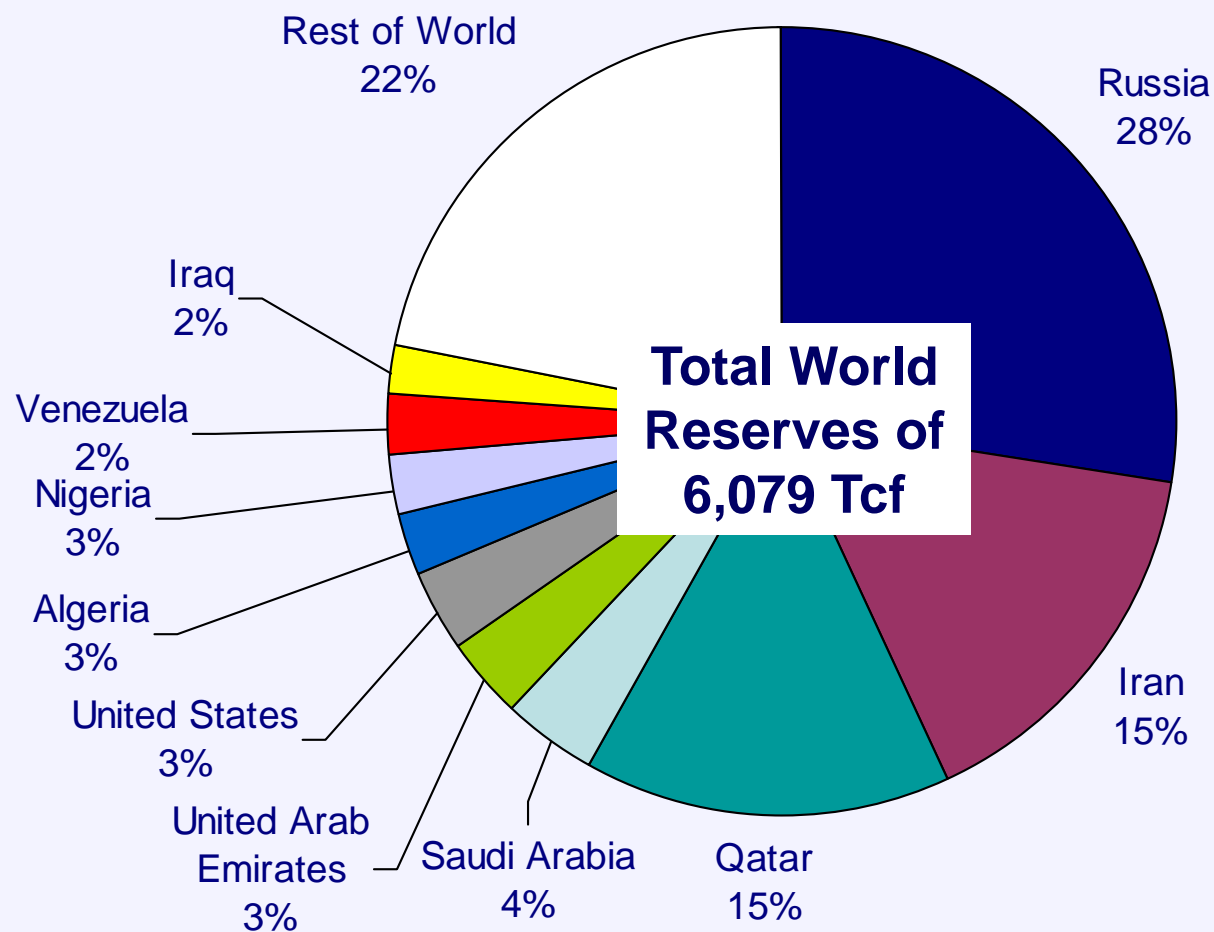


- Liquefied natural gas (LNG) is natural gas that has been turned into a liquid by cooling it to a temperature of  $-256^{\circ}\text{F}$  at atmospheric pressure
- It consists of primarily methane (typically, at least 90 percent)
- LNG is odorless, colorless, non-corrosive and non-toxic
- Liquefying 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 over 20 percent of Massachusetts's natural gas fueled electric power plants for 1 month**



**OR**  
**to fuel almost 2.5 percent of Massachusetts's residential customers for 1 year (over 31,000 customers)**



**OR**  
**to fuel 75 percent of Massachusetts's 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 13.1 bcf;
- Average monthly industrial usage of 3.98 MMcf

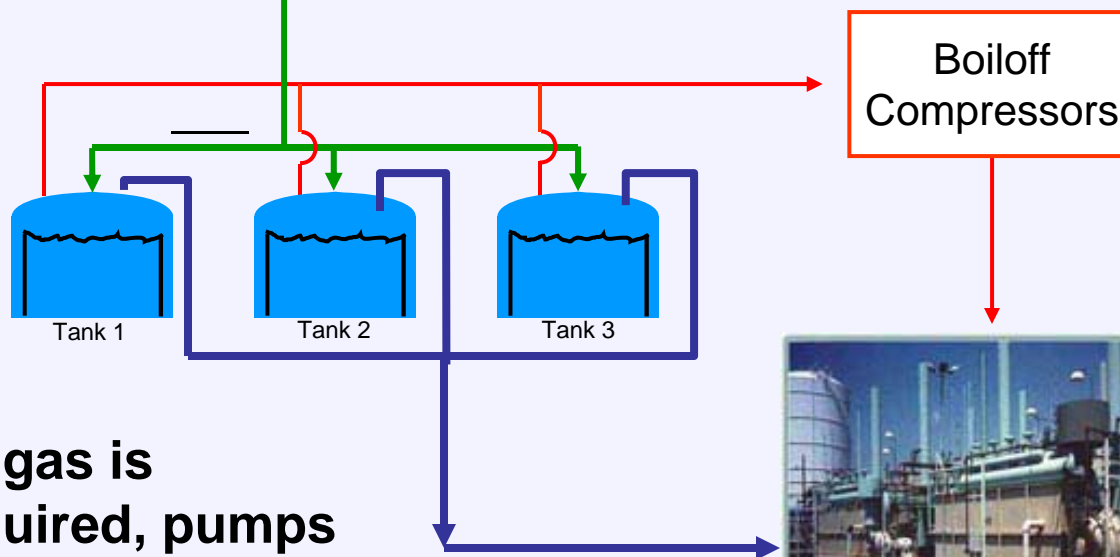
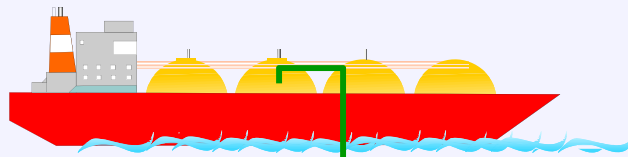
Source: Energy Information Administration; Federal Energy Regulatory Commission; Center for Energy Economics, BEG, UT-Austin; and Statoil.com.



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## 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.

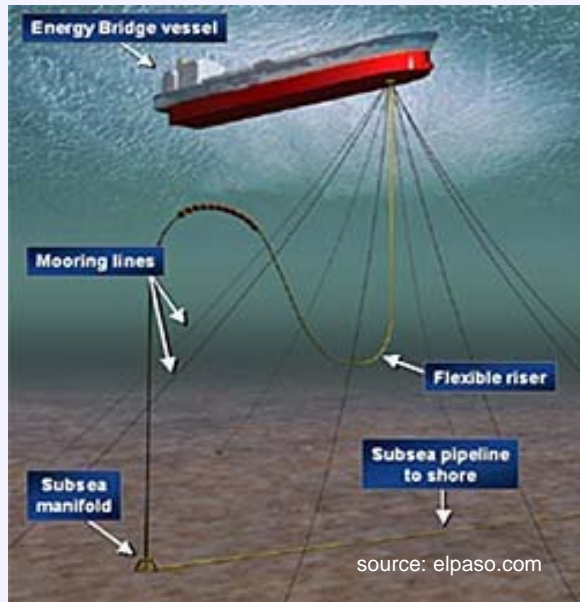
As LNG boils off, the gas is withdrawn from the tanks and compressed.

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**



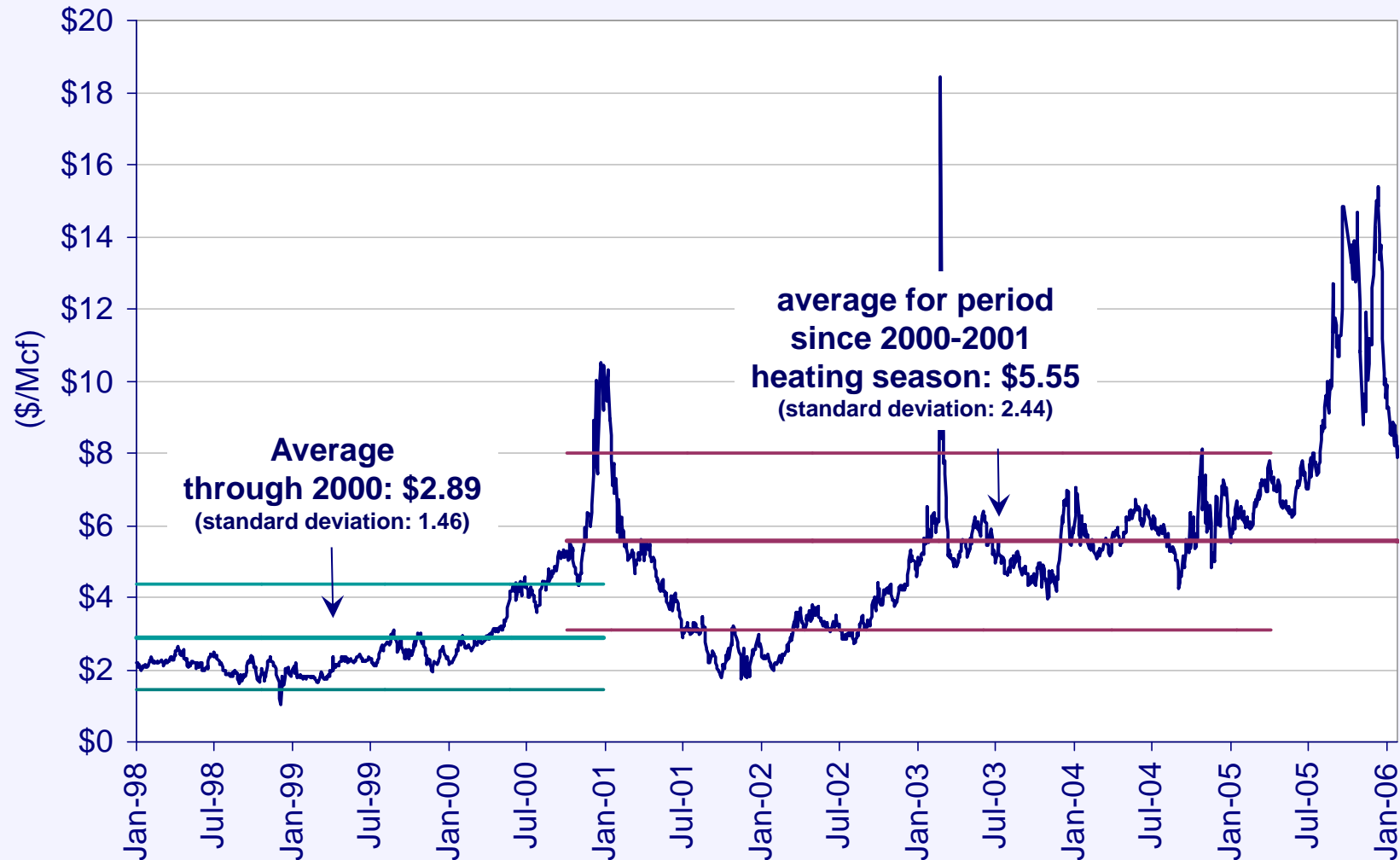
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# Why LNG?



# Daily Henry Hub Prices (1998-Present)

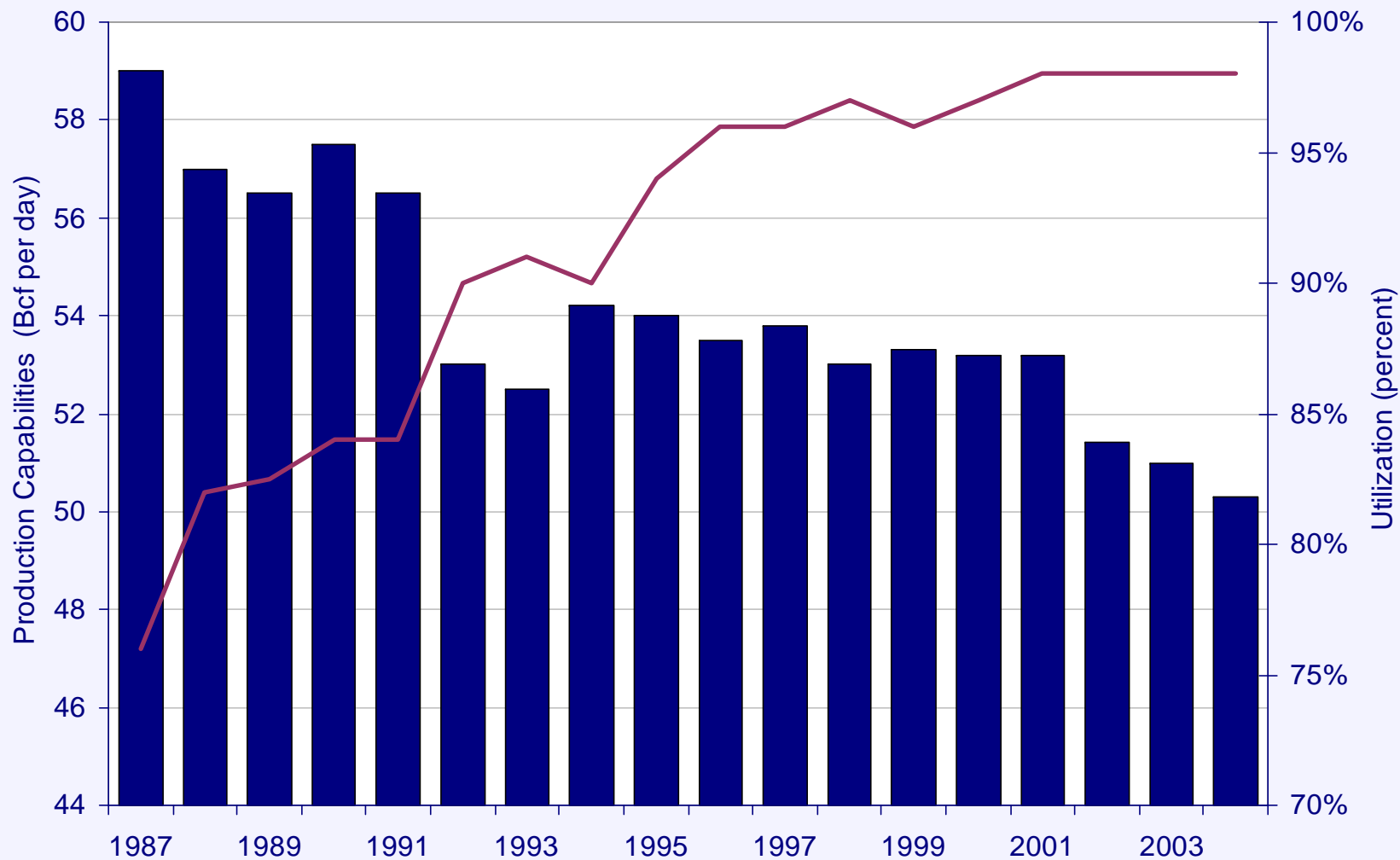
Prices have changed dramatically since winter 2000-01  
when markets for gas became exceptionally tight







## Producers are at the limits of production capabilities

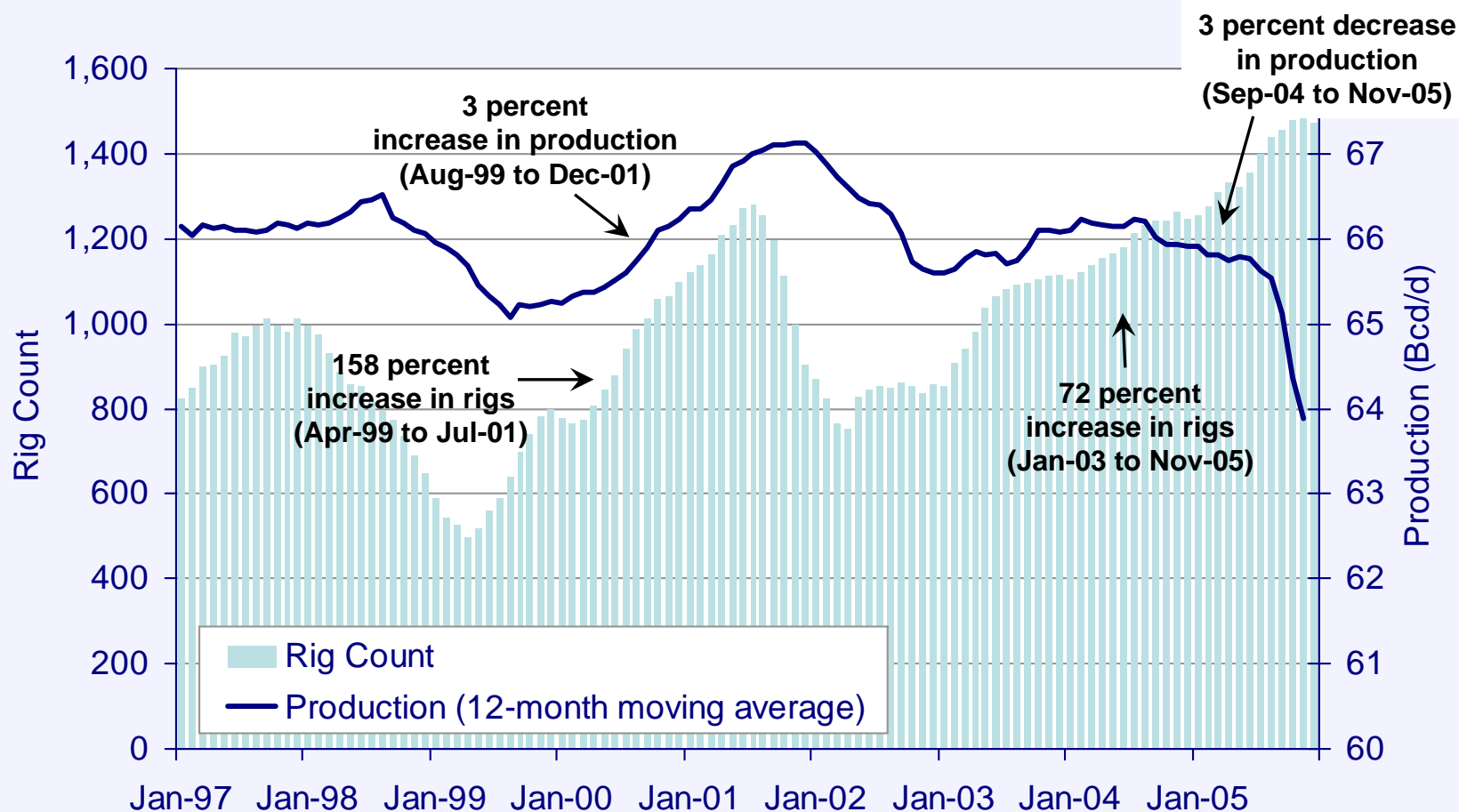


Note: This is an approximation.  
Source: EnergySeer.com



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

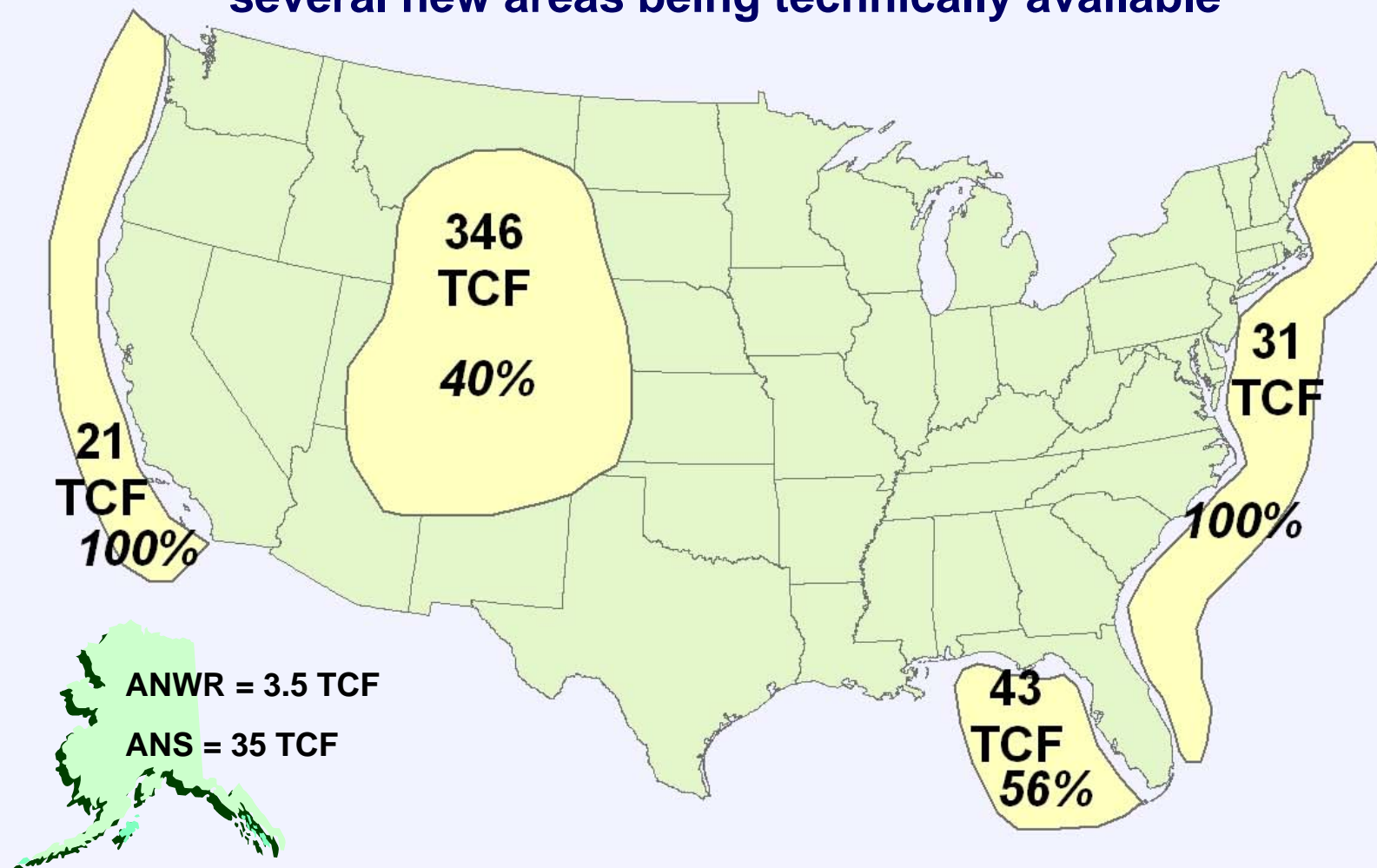
**Despite increased drilling efforts, production is falling;  
The US is seeing decreasing drilling productivity**





## Resource Estimates – Restricted Areas Estimated Percentage Restricted

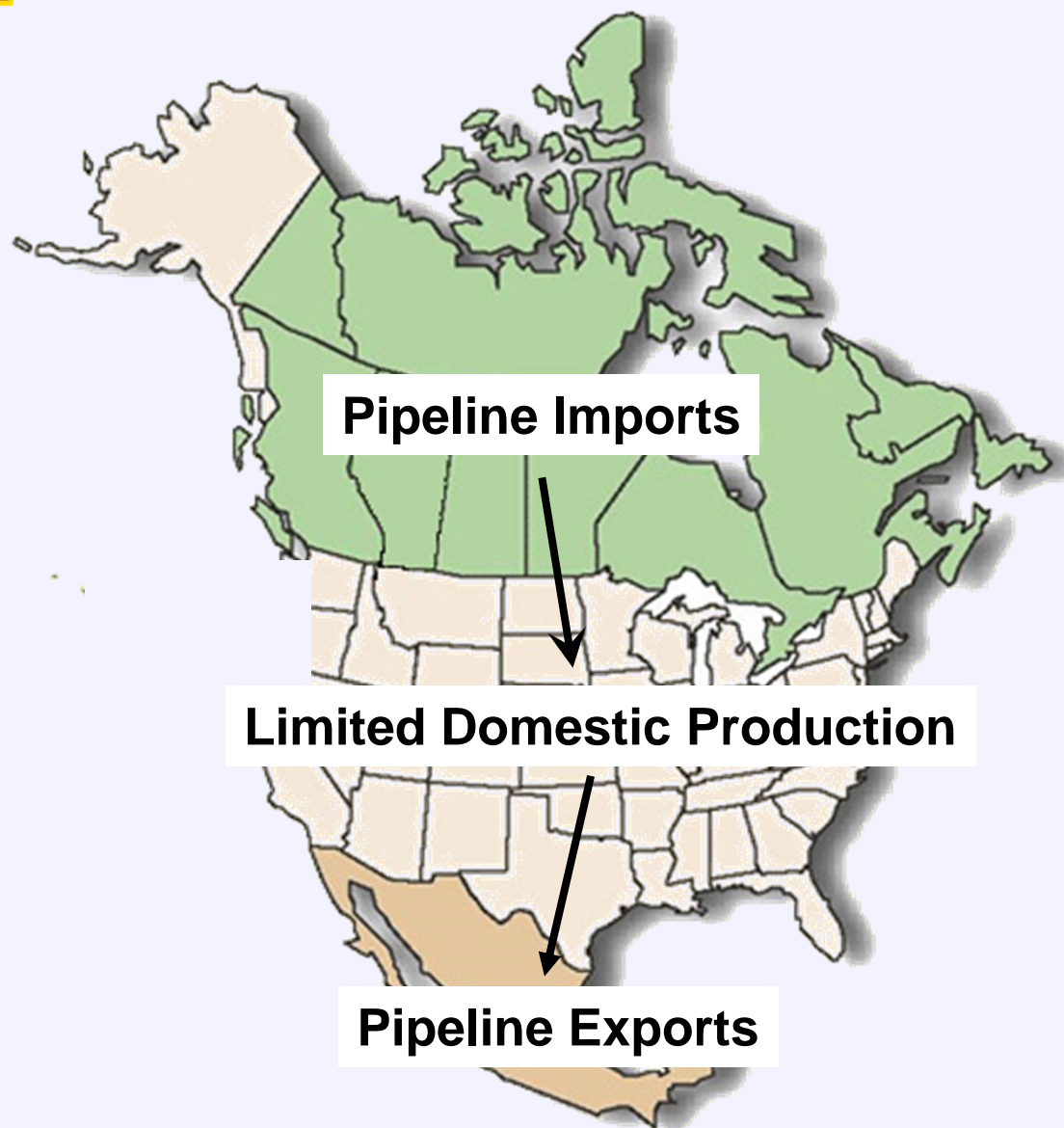
Producers are drilling over the same areas despite  
several new areas being technically available





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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.

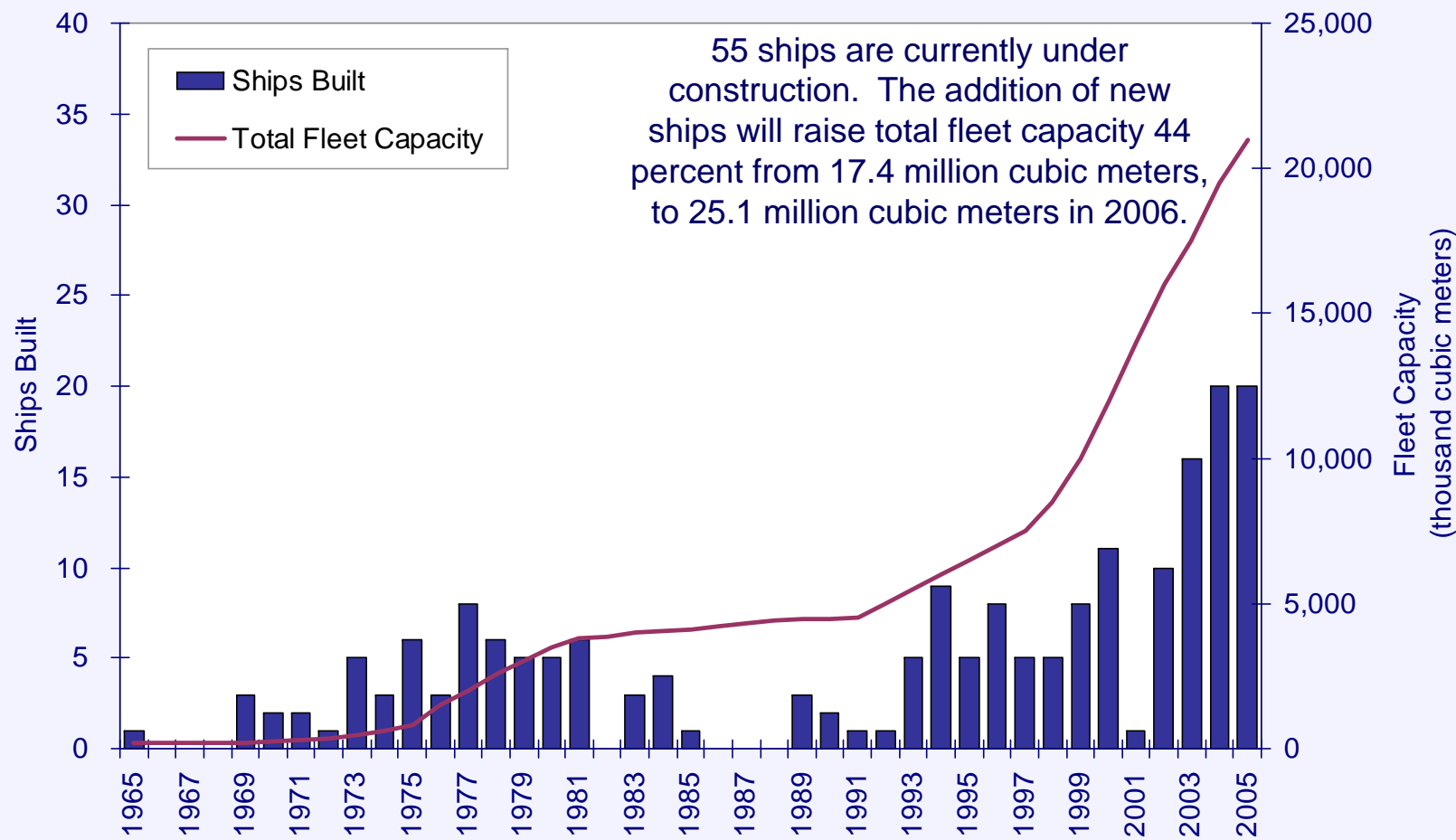


	<u>LNG Regasification Import</u>		<u>LNG Liquefaction Facilities</u>	
	<u>Terminals</u>			
	Number of Storage Tanks	Storage Capacity (thousand m <sup>3</sup> )	Number of Trains	Capacity (million tons/year)
Africa	-	-	29	43.4
Europe	33	2,836	-	-
Asia	202	18,543	31	72.2
Middle East			11	32.0
North America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





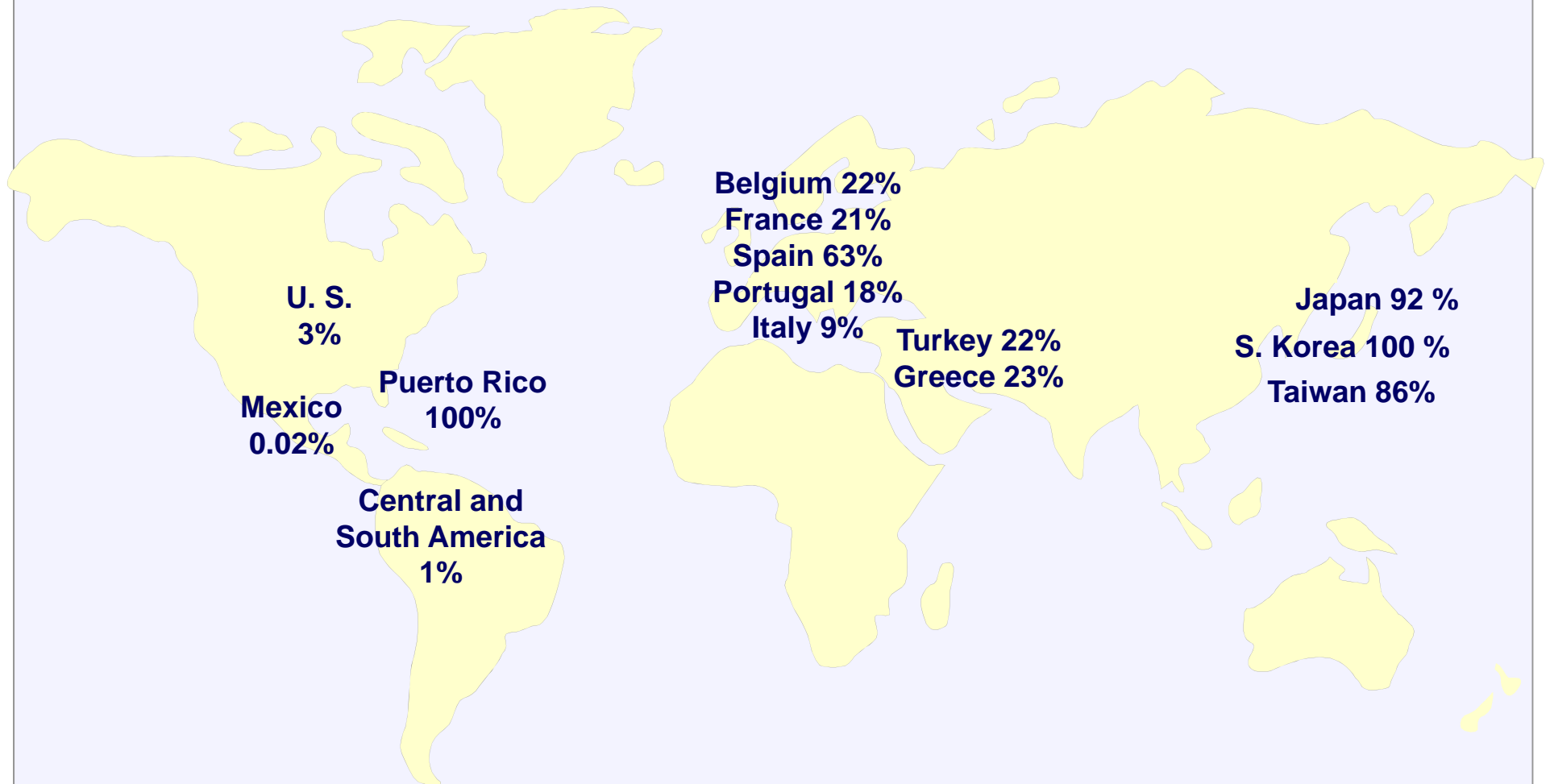
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# LNG Importers and Facilities



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

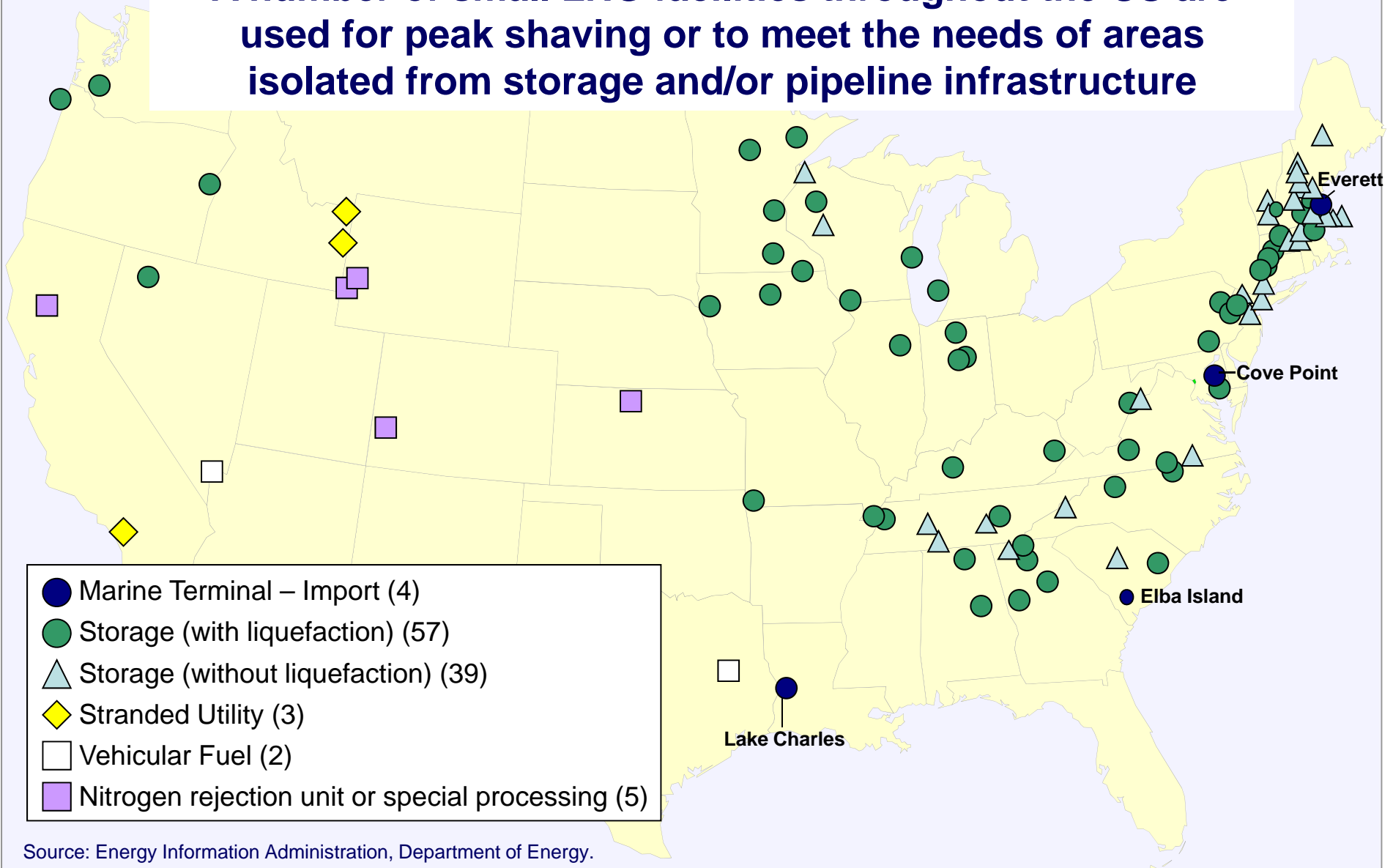


Source: Energy Information Administration, Department of Energy



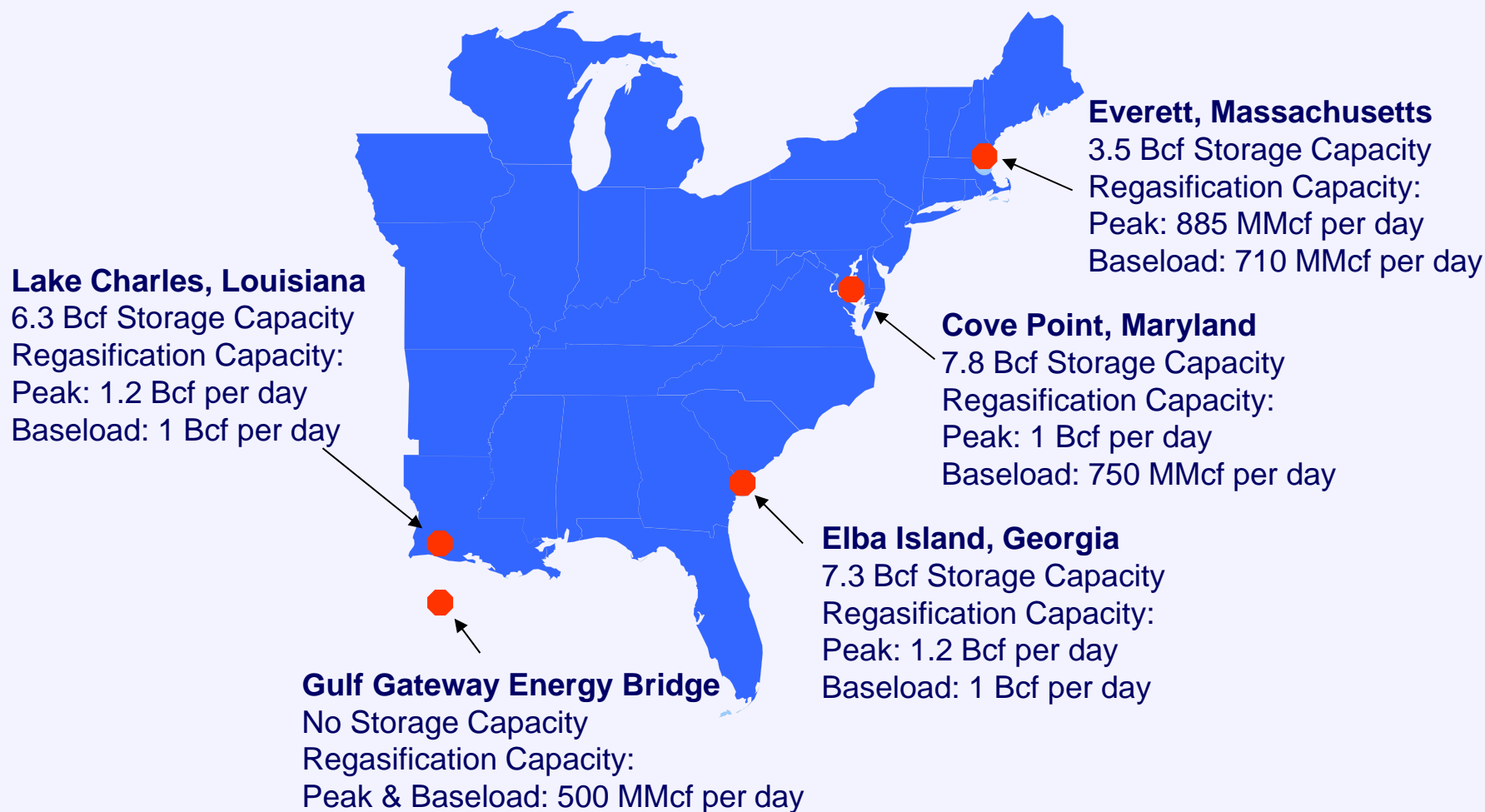


**A number of small LNG facilities throughout the US are used for peak shaving or to meet the needs of areas isolated from storage and/or pipeline infrastructure**





## Current US LNG Import Terminals





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**Thank You**

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