
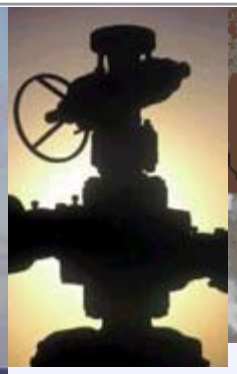
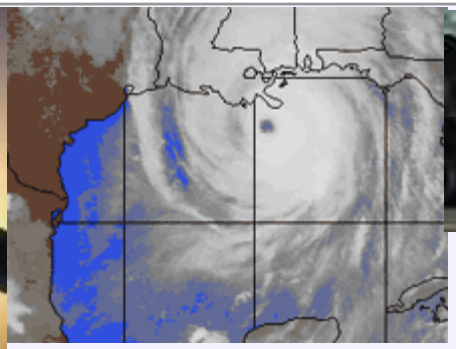

An Overview of the Energy Industry Along the Gulf of Mexico

David E. Dismukes
Center for Energy Studies
Louisiana State University

Society and the Coast Lecture

April 17, 2009

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Importance of the Gulf of Mexico to the US

The Gulf of Mexico region accounts for:

- **Approximately 30 percent of total U.S. crude oil production;**
- **Roughly 20 percent of total natural gas production;**
- **Over $6 billion in federal royalties and fees;**
- **Over 45 percent of total U.S. petroleum refining capacity and 62 percent of the capacity east of the Rockies;**
- **60 percent of all U.S. crude oil imports; and**
- **43 percent of the Strategic Petroleum Reserve ("SPR") storage capacity.**

Nature of the Energy Business in the Gulf of Mexico

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Nature of the Energy Business
Oil and Gas Production

- Currently: **89 rigs operating** in the Gulf of Mexico.
- In 2005, **468,000 Bbls** and **3.2 Tcf** of natural gas were produced in the Gulf of Mexico.
- Employs **160,000 workers** in the Gulf Coast region.
- Contributes about **$73 billion** to Gulf Coast states' GDP.

Note: Gulf Coast states include Louisiana, Texas, Mississippi and Alabama
Source: Bureau of Economic Analysis, US Department of Commerce; Energy Information Administration, US Department of Energy; and Baker Hughes.

Nature of the Energy Business
Pipelines

- Pipelines can transport a variety of raw, unprocessed hydrocarbons, or finished (refined) products that include natural gas, natural gas liquids, crude oil, gasoline, diesel, among others.

- There are over **14,000 miles of pipeline** offshore in the Gulf of Mexico that carry produced oil and gas to onshore facilities.

- Employ over **15,000 people** in the Gulf Coast region.

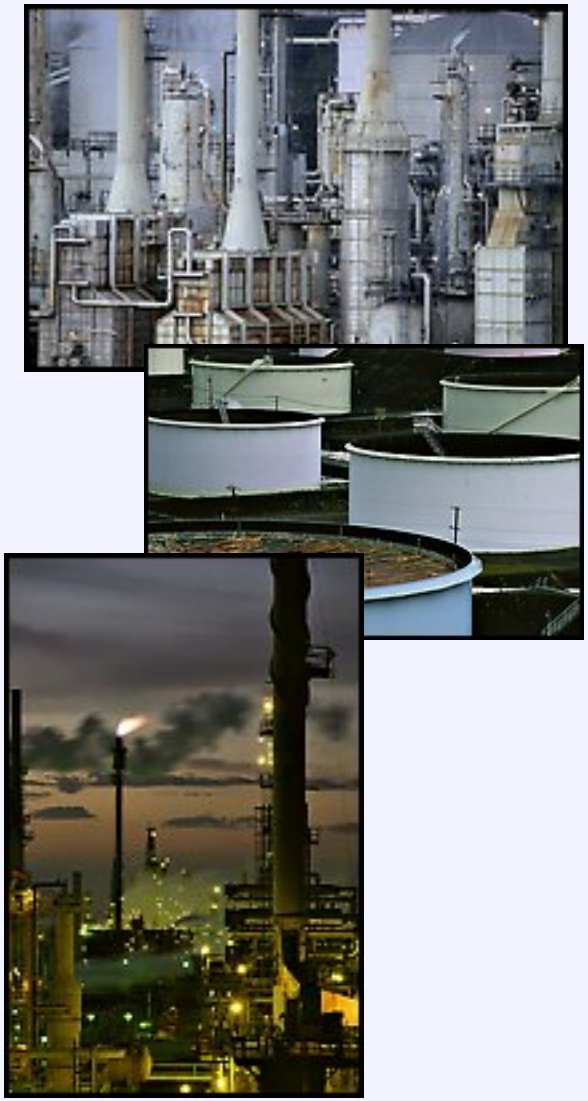
Note: Gulf Coast states include Louisiana, Texas, Mississippi and Alabama
Source: Bureau of Economic Analysis, US Department of Commerce; and Energy Information Administration, US Department of Energy.

Nature of the Energy Business
Gas Processing

- Gas processing facilities clean or process raw or ‘wet’ natural gas immediately after the gas is produced.
- There are **249 gas processing plants** in the Gulf states representing **58 percent** of US gas processing capacity
- In 2005, gas processors in the Gulf Coast states processed over **6.8 Tcf** of natural gas. This represents **46 percent** of the gas processed in the U.S.

Note: Gulf Coast states include Louisiana, Texas, Mississippi and Alabama
Source: Bureau of Economic Analysis, US Department of Commerce; and Energy Information Administration, US Department of Energy.

Nature of the Energy Business
Refineries



- Refineries are industrial facilities that use combinations of heat, steam, and various catalysts to “crack” hydrocarbons into various components that result in gasoline, diesel fuel, jet fuel, kerosene, and many other products.
- There are **47 operating refineries** in the Gulf Coast region, with **7.3 MMBbls/d** of operating capacity. This represents approximately **44 percent** of the nation’s refining capacity.
- Refineries account for approximately **1.5 percent** of Gulf Coast states’ GDP.
- Refineries employ over **35,000 people** in the Gulf Coast region.

Note: Gulf Coast states include Louisiana, Texas, Mississippi and Alabama
Source: Bureau of Economic Analysis, US Department of Commerce; and Energy Information Administration, US Department of Energy.

History of the Oil and Gas Development Across the Gulf Coast

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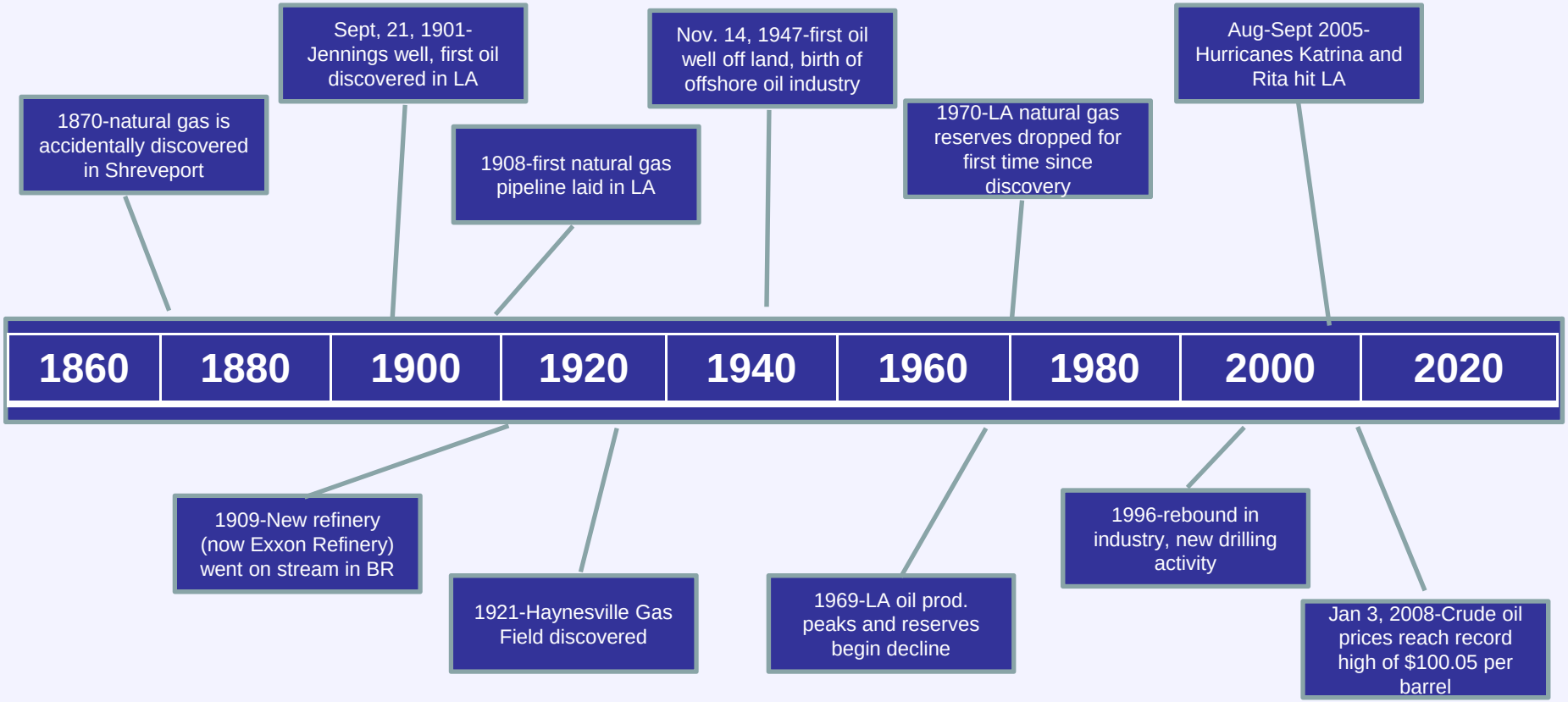
Timeline: A History of Louisiana Oil and Gas



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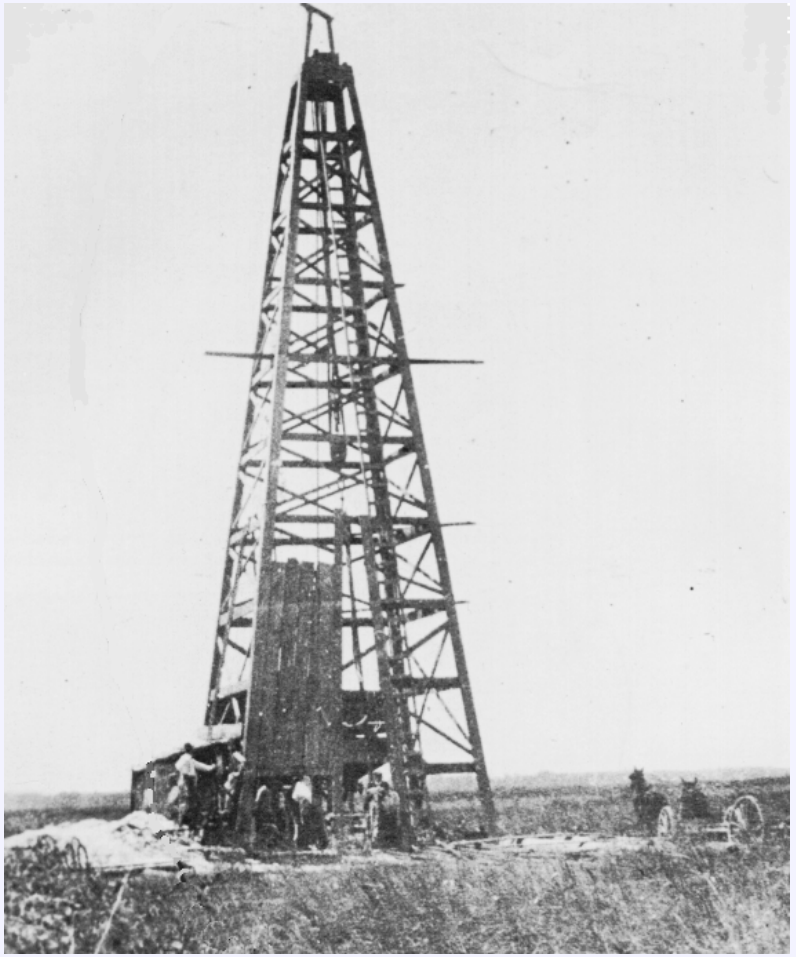
First Oil Well
Jennings, LA

On September 21, 1901 the first successful oil well was completed in Jennings, LA.

The well was called the Heywood #1 Jules Clement well and it drilled to a depth of 1,700 feet

This created an oil rush in Louisiana



Source: Louisiana Oil and Gas Association. “Louisiana Oil and Gas History”

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First Oil Well Off Land

On November 14, 1947 the first oil well out of the sight of land was built by Kerr-McGhee

It was located about 45 miles south of Morgan City, LA

This marked the beginning of the offshore oil industry

Source: MMS-Gulf of Mexico Region. “History of the Offshore Oil and Gas Development in Louisiana”

Typical Oil and Gas Development

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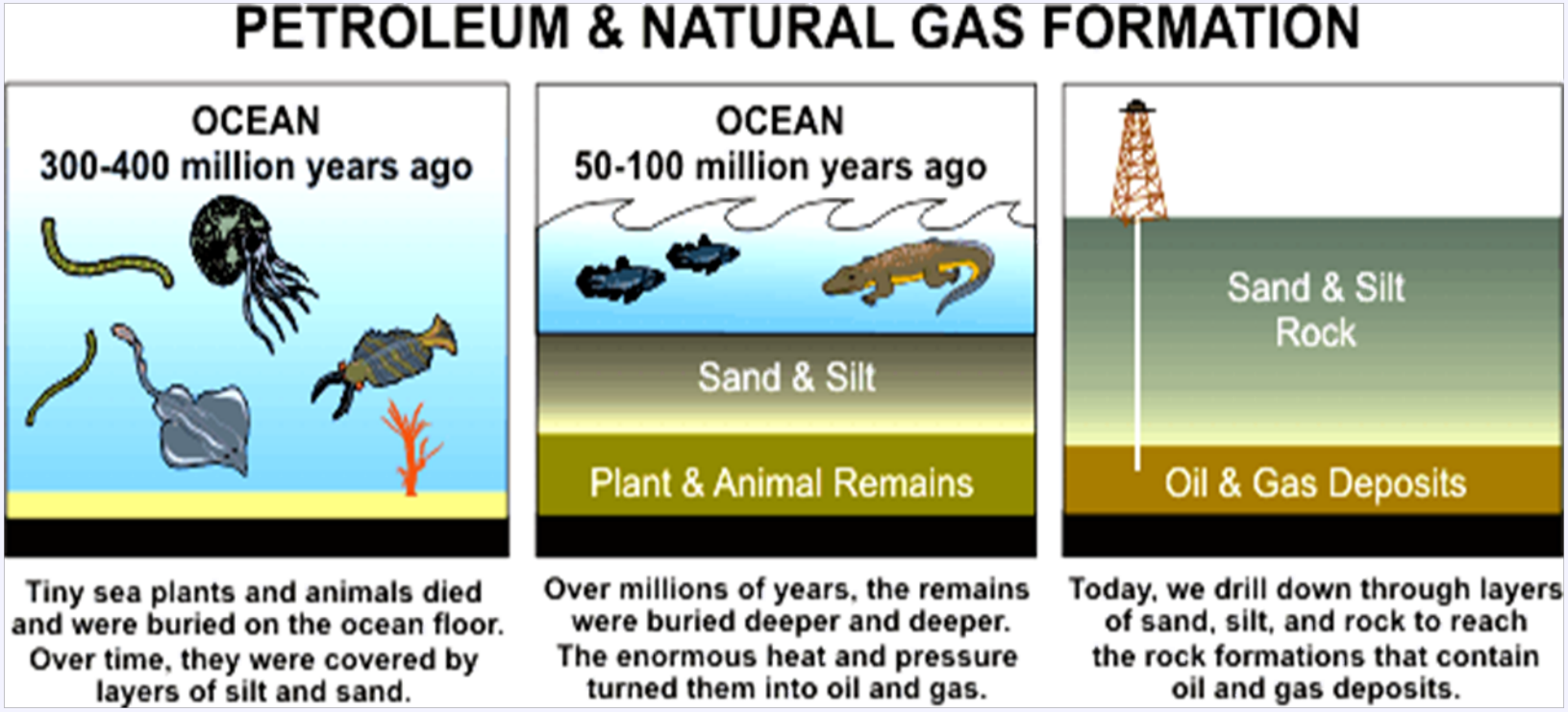
Crude Oil: Where does it come from?



Source: Energy Information Administration

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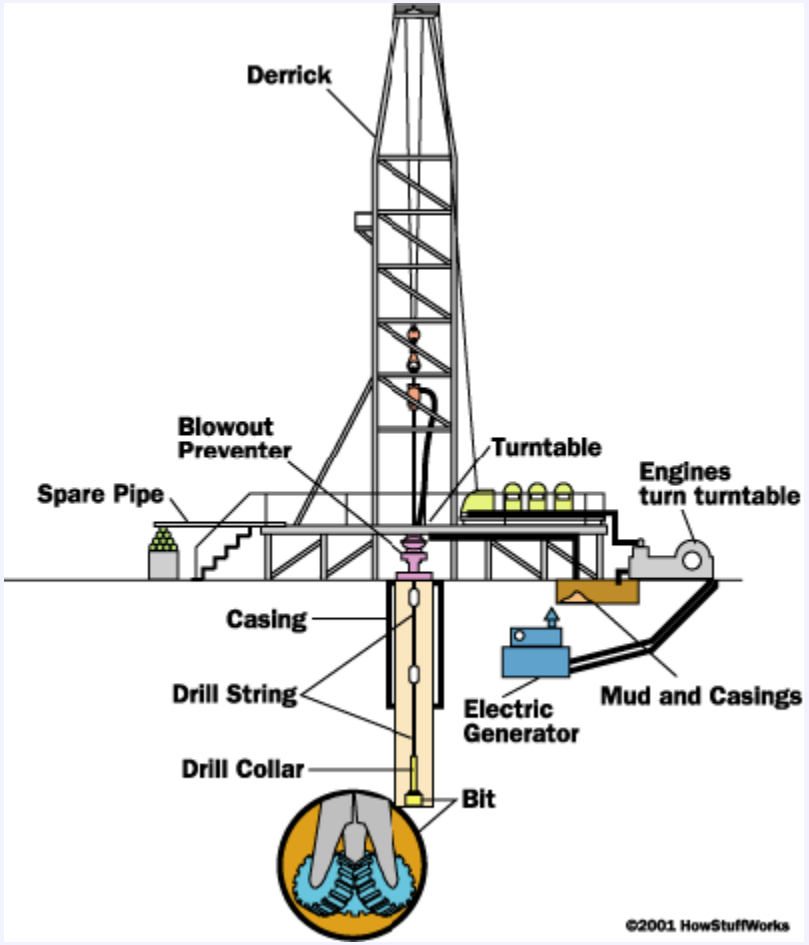
Drilling: Oil Rigs and Derricks

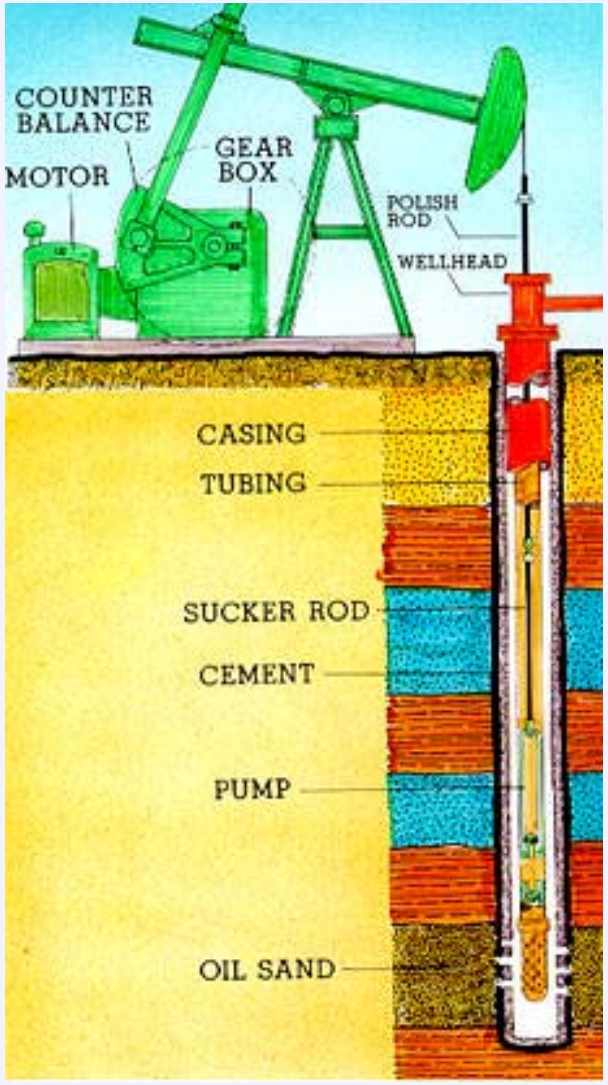
The first step towards the extraction process is the marking of the well site and the installation of a derrick.

A derrick is a tower like steel structure meant to support the drilling equipment. Then a hole will be drilled in to the land to find out if oil or gas exists.



Source: Energy Information Administration

Extraction: Pumps, Casing and Wellheads



Once oil or gas is found, the drilling equipment will be removed from the hole and a casing will be lowered to the hole for the purpose of bringing the crude oil or gas to the surface.

Casing pipe will be cemented here and there to ensure the strength of it. It will then be connected or tied to the system of pipe and valves known as wellhead.

The natural pressure in the well will force the oil to the tanks. If the natural pressure is not strong enough , pumps will inject artificial force.

Source: Extractingoil.net

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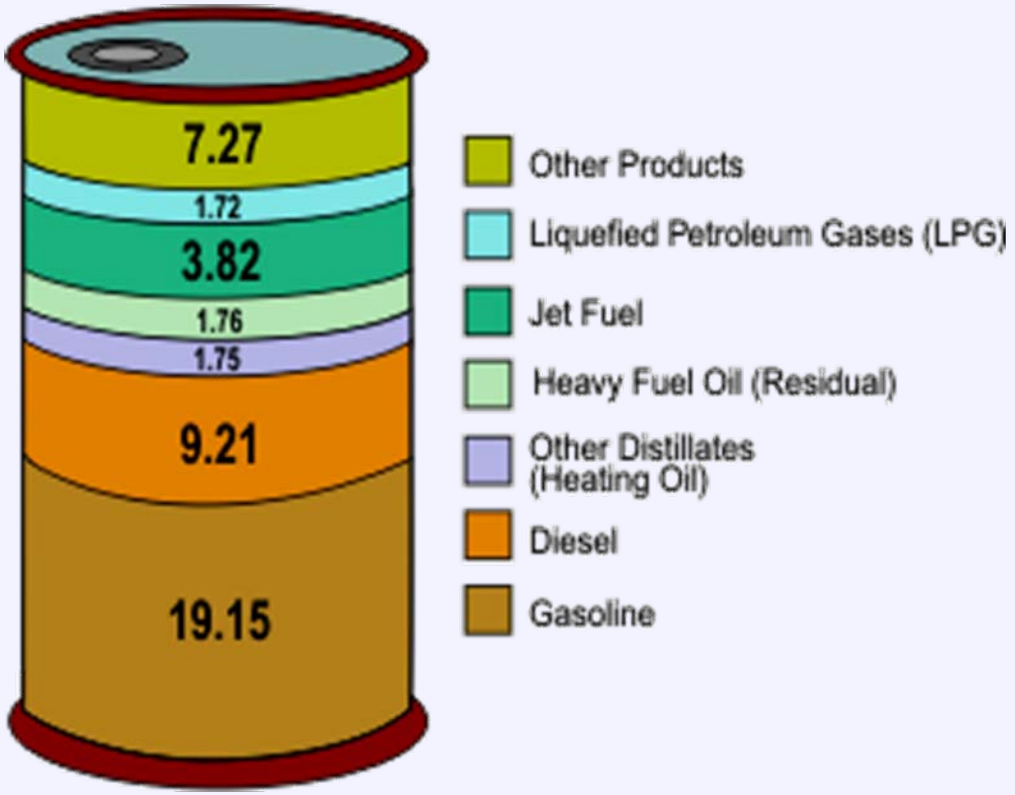
What is Crude Oil Used For?

At a refinery, crude oil is separated into useable products

One barrel is equal to 42 U.S. gallons which provides roughly 44 gallons of petroleum products once it is processed

Products refined from crude oil help to make everything from gasoline for cars to crayons, tires and heart valves

Products made from a Barrel of Crude Oil (gallons)



Source: Energy Information Administration

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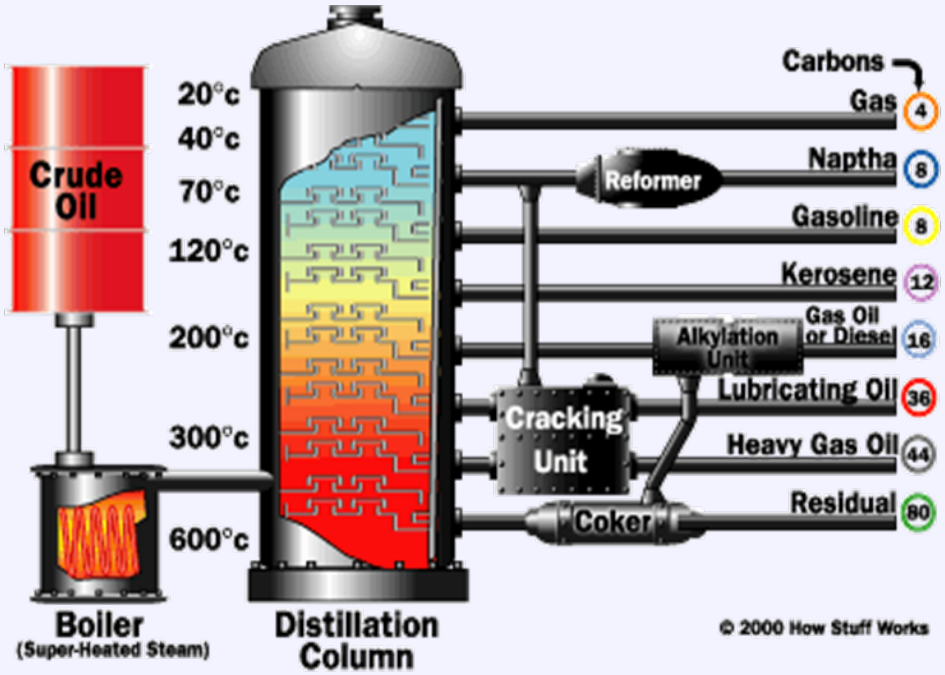
Refining Process: Conversion



To make gasoline, Cracking and rearranging molecules adds value to the products. Fractions from the distillation towers are transformed into streams (intermediate components) that eventually become finished products.

The most widely used conversion method is called **cracking** because it uses heat and pressure to "crack" heavy hydrocarbon molecules into lighter ones. A cracking unit consists of one or more tall, thick-walled, bullet-shaped reactors and a network of furnaces, heat exchangers and other vessels.

Other refinery processes, such as **Alkylation**, rearrange molecules instead of splitting them to add value

Source: Energy Information Administration

Exploration and Production in the Gulf of Mexico

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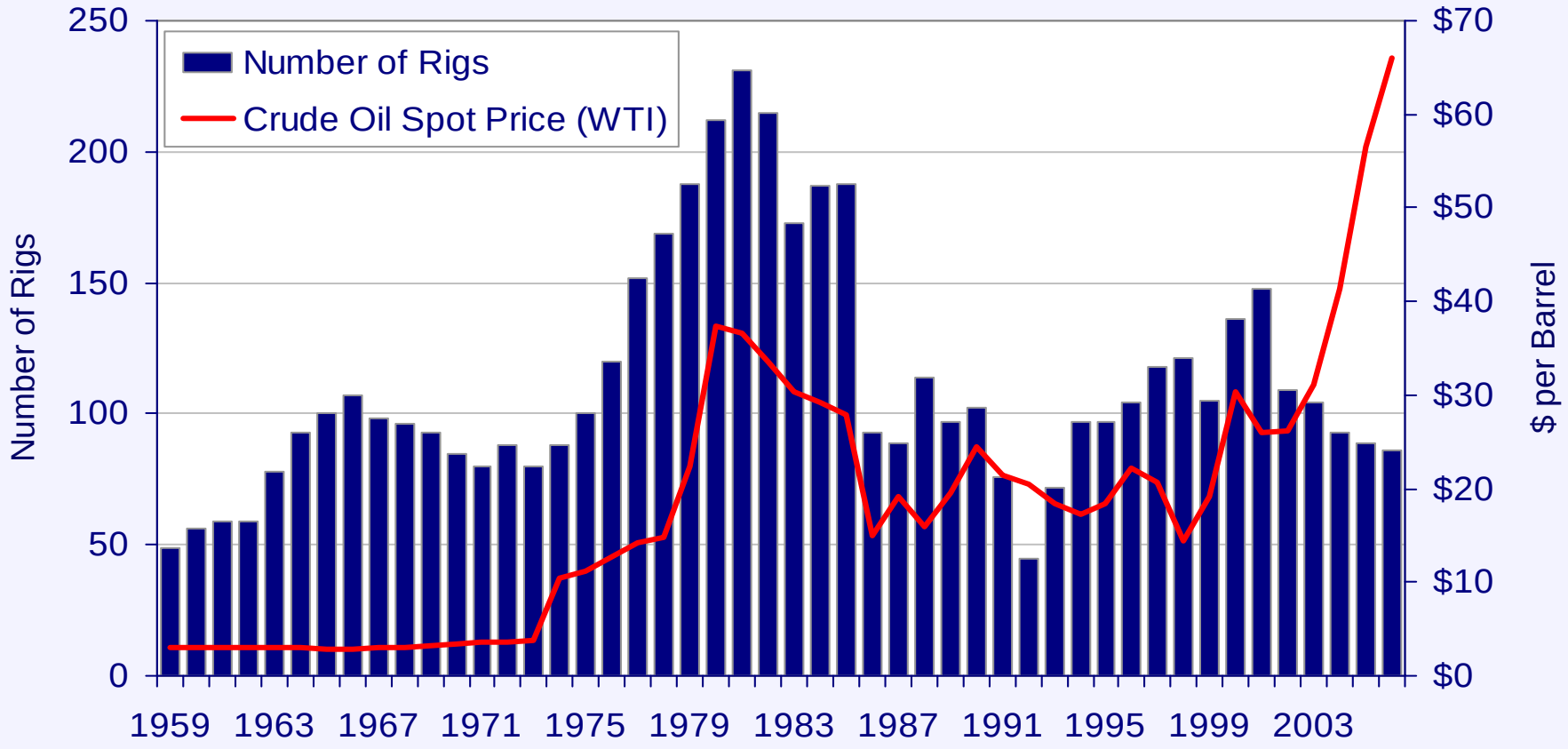
Historic Number of Rigs Operating in the Gulf of Mexico

Drilling rigs in the GOM typically follow oil and gas prices.



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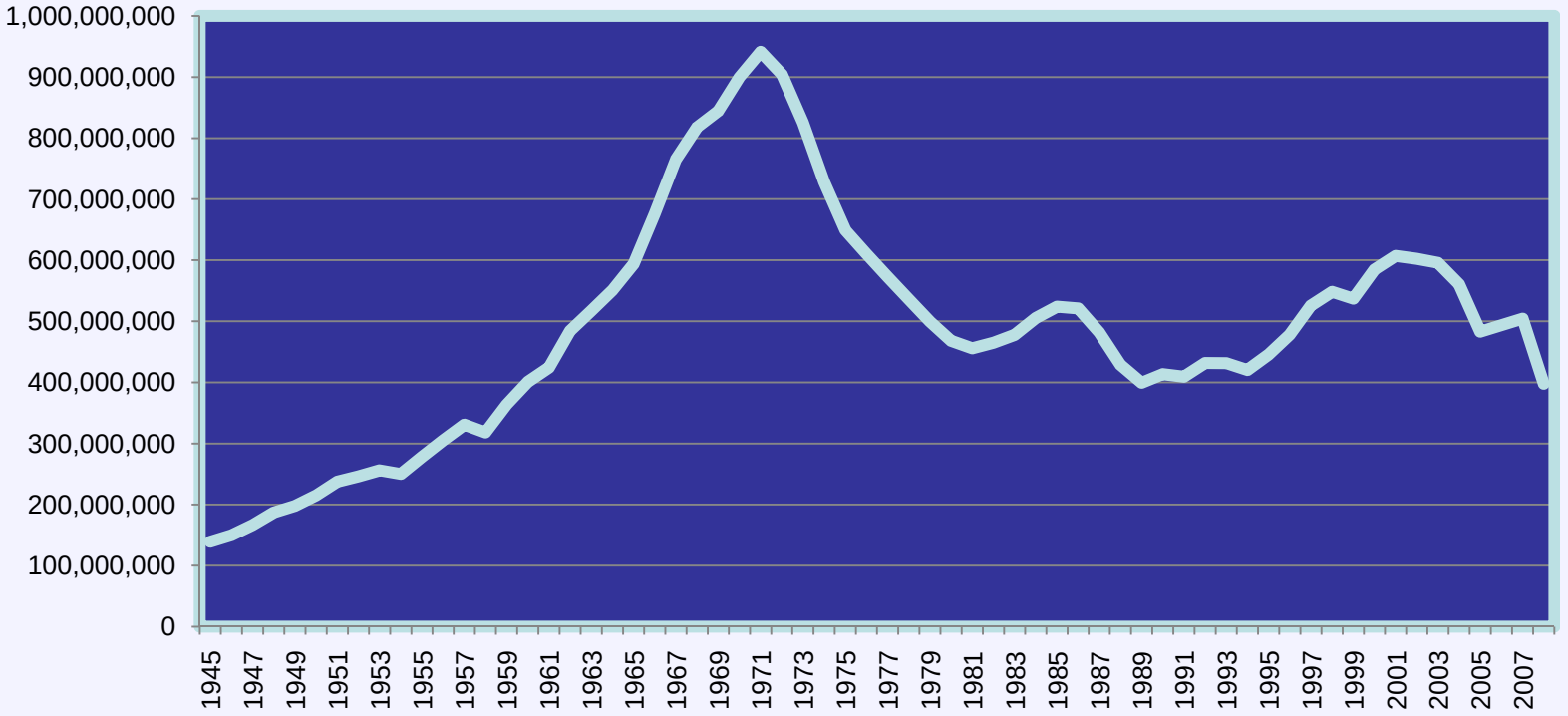
History of Crude Oil Production in Louisiana 1945-2008

Crude oil production in Louisiana lands, water bottoms, and in the Outer Continental Shelf (OCS) adjacent to Louisiana and seaward of Louisiana Offshore region from 1945-2008 (in barrels)

*note peak in production from 1969-1971 and steady decline



Source: Louisiana Department of Natural Resources

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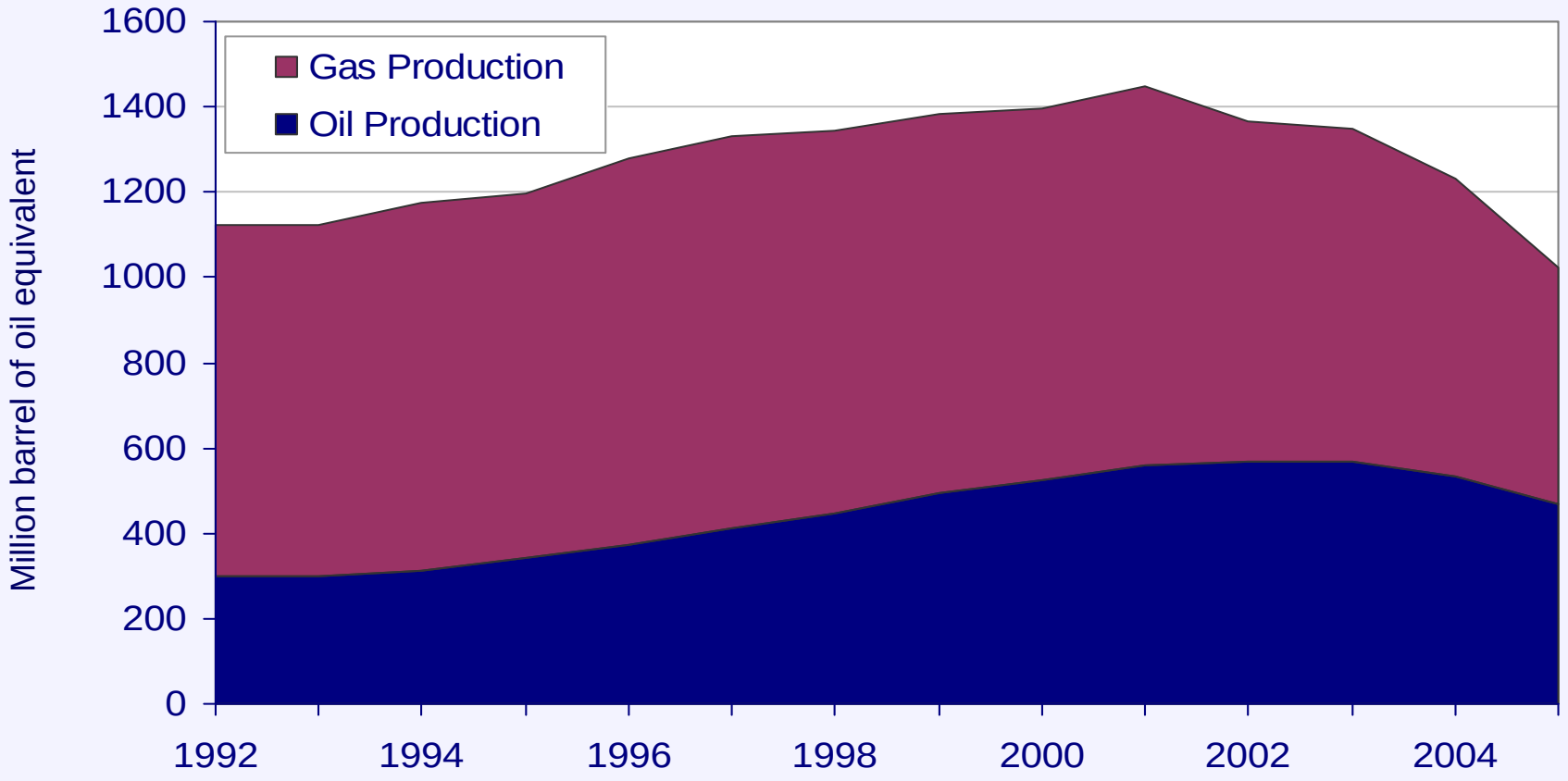
Gulf of Mexico Oil and Gas Production

The GOM enjoyed a number of production successes from the mid-1990s to 2001. Tropical activity in the 2004 to current period has had noticeable impacts.



Source: Energy Information Administration, US Department of Energy

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Top 25 Oil and Gas Producers in the GOM

Producers include majors and increasingly large number of independents

	Operator	GOM Production Oil MMBbl	Gas MMBOE	Total MMBOE
1	Shell Offshore Inc.	89.98	56.61	146.59
2	BP Exploration & Production Inc.	76.18	28.36	104.54
3	Chevron U.S.A. Inc.	41.28	37.13	78.41
4	Kerr-McGee Oil & Gas Corporation	30.42	34.94	65.36
5	Apache Corporation	14.31	13.86	40.58
6	Exxon Mobil Corporation	13.58	27.00	36.34
7	Dominion Exploration & Production, Inc	13.44	2.53	28.17
8	Noble Energy, Inc.	13.15	23.19	16.20
9	Murphy Exploration & Production Compan	8.33	7.87	15.97
10	Newfield Exploration Company	8.30	5.73	15.75
11	Hess Corporation	8.06	5.00	14.03
12	Union Oil Company of California	7.75	3.22	13.09
13	ConocoPhillips Company	4.89	1.29	13.06
14	LLOG Exploration Offshore, Inc.	4.15	3.55	11.17
15	Shell Gulf of Mexico Inc.	3.96	0.68	10.97
16	Walter Oil & Gas Corporation	3.91	4.18	10.12
17	W & T Offshore, Inc.	3.79	7.39	9.40
18	Energy Partners, Ltd.	3.51	1.52	8.32
19	Nexen Petroleum U.S.A. Inc.	3.16	6.24	8.10
20	Stone Energy Corporation	3.11	7.01	8.07
21	Eni Petroleum Co. Inc.	2.77	5.30	7.71
22	MOBIL OIL EXPLORATION & PRODUCING SOUT	2.55	13.20	6.73
23	Marathon Oil Company	2.52	10.57	6.18
24	Hunt Petroleum (AEC), Inc.	2.02	3.27	5.30
25	Pogo Producing Company	1.74	2.03	5.03
	Total Top 25	**366.86**	**311.66**	**685.17**
	Total GOM	**901.11**	**1,024.43**	**1,925.54**
	Top 25 as Percent of Total GOM	**40.7%**	**30.4%**	**35.6%**

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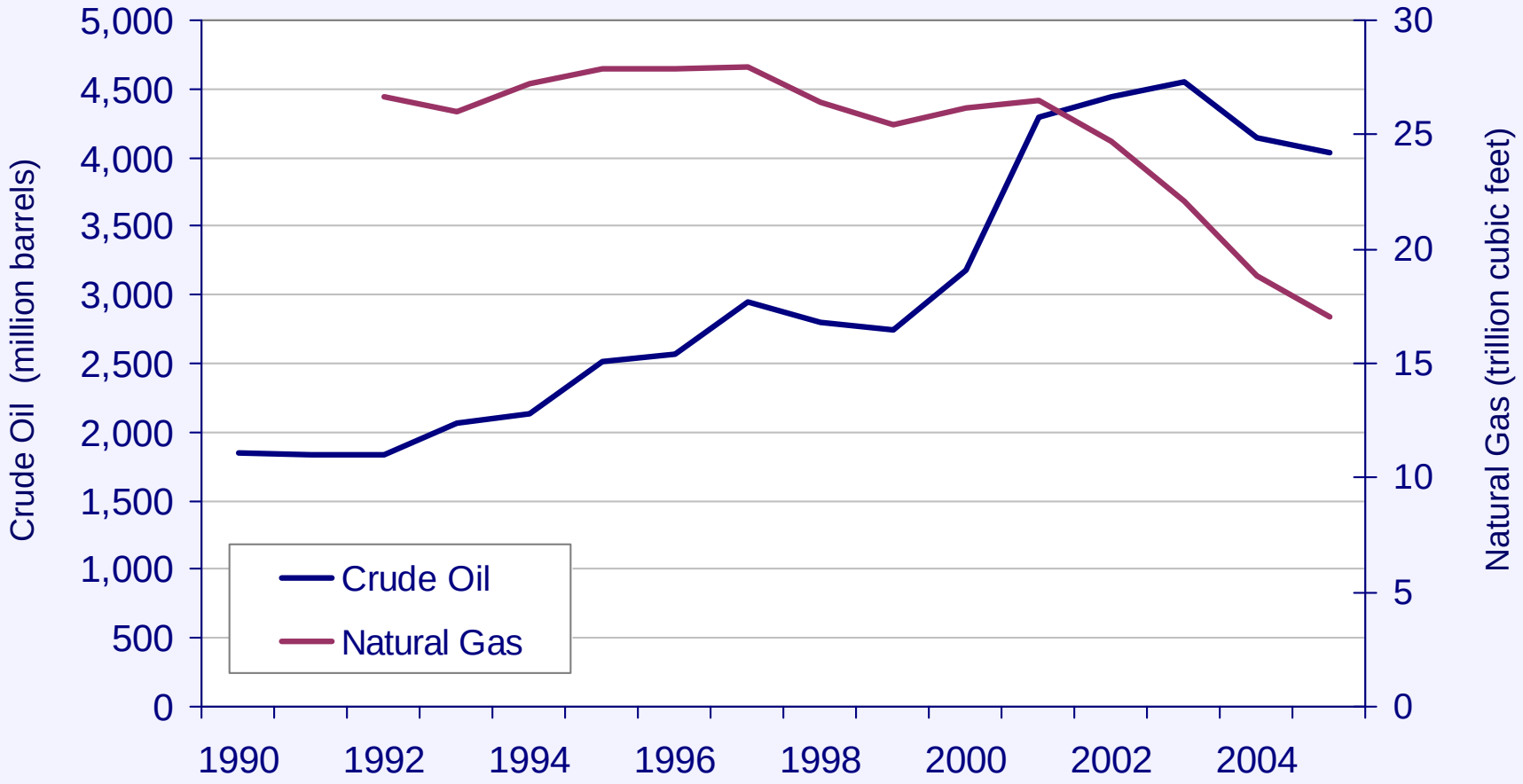
Gulf of Mexico Proved Reserves of Crude Oil and Natural gas

Most of the reserve growth in the GOM has been in the addition of crude oil reserves.

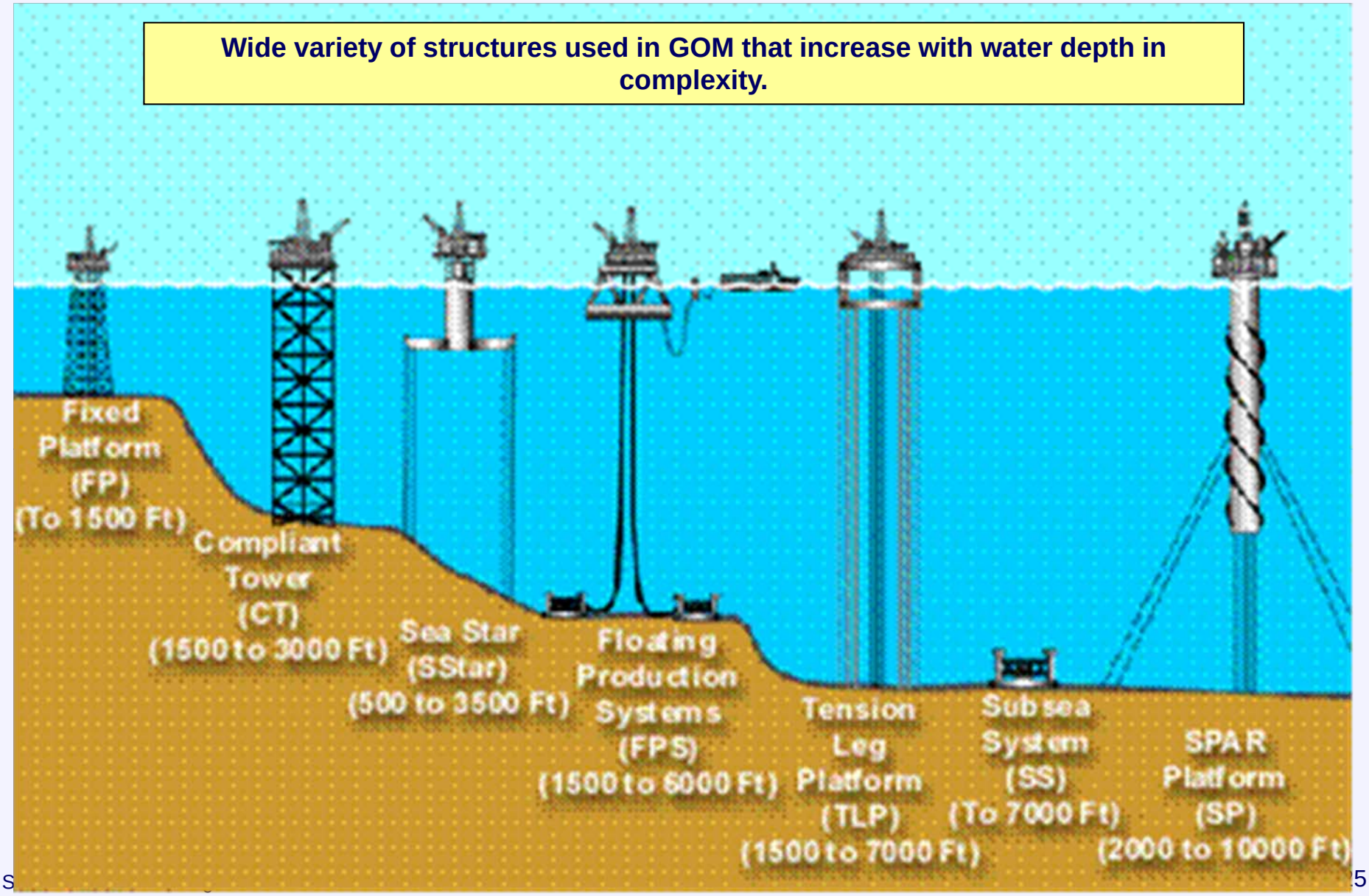


Source: Energy Information Administration, US Department of Energy

Deepwater Activities in the Gulf of Mexico

Types of Offshore Structures

Wide variety of structures used in GOM that increase with water depth in complexity.



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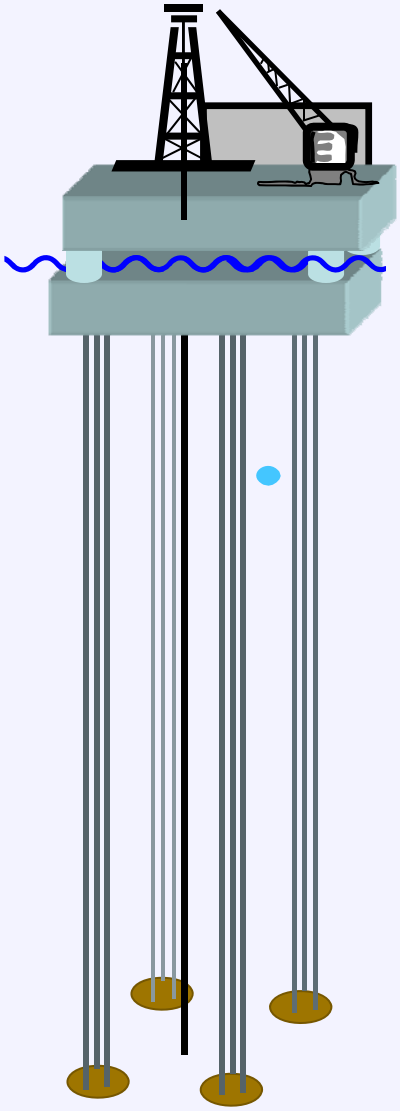
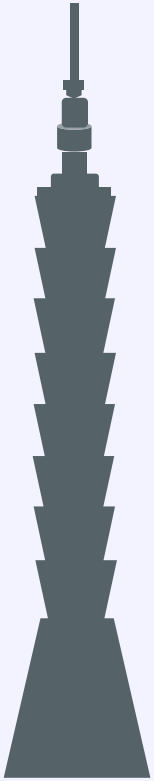
The Magnitude of Offshore Structures

Structures in the GOM are as large some of the world's largest buildings.

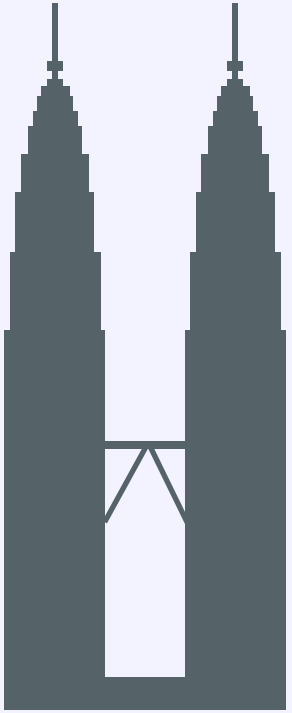


Mars Tension Leg Platform
3,250 feet

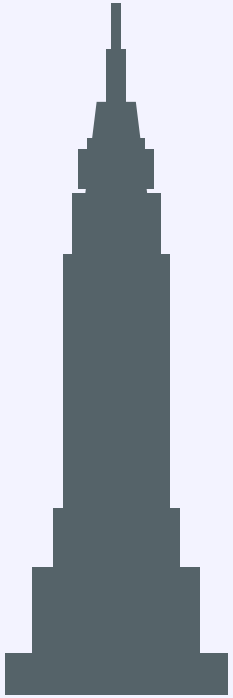
Sears Tower
1,729 feet



Taipei 101
1,667 feet



Petronas Towers
1,486 feet



Empire State Building
1,472 feet

The Magnitude of Offshore Structures

Thunderhorse TLP under final construction.

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Deepwater Discoveries in Water Depths Greater than 7,000 Feet

Over the past six years, the water depth barrier has moved from 7,300 feet to over 9,500 feet.

Project Name	Area/Block	Water Depth (feet)	Discovery Year
Aconcagua	MC 305	7,379	1999
Camden Hills	MC 348	7,530	1999
Blind Faith	MC 696	7,116	2001
Merganser	AT 37	8,064	2001
St. Malo	WR 678	7,326	2001
Trident	AC 903	9,816	2001
Cascade	WR 206	8,143	2002
Great White	AC 857	7,425	2002
Vortex	AT 261	8,422	2002
Atlas	LL 50	9,180	2003
Chinook	WR 469	9,104	2003
Jubilee	AT 349	8,891	2003
Spiderman/Amazoı	DC 621	8,100	2003
Atlas NW	LL 5	8,810	2004
Cheyenne	LL 399	8,987	2004
Mondo Northwest	LL 2	8,340	2004
San Jacinto	DC 618	7,850	2004
Silvertip	AC 815	9,226	2004
Tiger	AC 818	9,004	2004
Tobago	AC 859	9,627	2004
Jubilee Extension	LL 309	8,774	2005
Mondo NW Extens	LL 1	8,340	2005
Q	MC 961	7,925	2005
Stones	WR 508	9,556	2005

Source: Minerals Management Service, US Department of the Interior

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Independence Hub

Has 5 independent E&P partners plus one midstream partner/operator. Operates in 8,000 feet water depth.

Enterprise and the Atwater Valley Producers Group, which includes Anadarko, Dominion, Kerr-McGee, Spinnaker and Devon Energy.

Process ultra-deepwater natural gas and condensate discoveries in the previously untapped Eastern Gulf of Mexico.

- **1 Bcf per day** of processing capacity, the largest in the GOM.
- Tie-back flow lines that are longer than **45 miles**, the longest in the GOM.
- **2.4 miles** of mooring lines.
- The Gulf's **deepest suction pile installation**.
- The Gulf's largest monoethylene glycol (MEG) reclamation unit.
- The Gulf's deepest pipeline inline future tie-in subsea structure.
- The Gulf's **longest single subsea umbilical order**. (carbon instead of steel)
- The **flow lines are 210 miles** in total length, and the umbilicals contain about 1,100 miles of stainless steel tubing.

Source: Offshore-Technology.com

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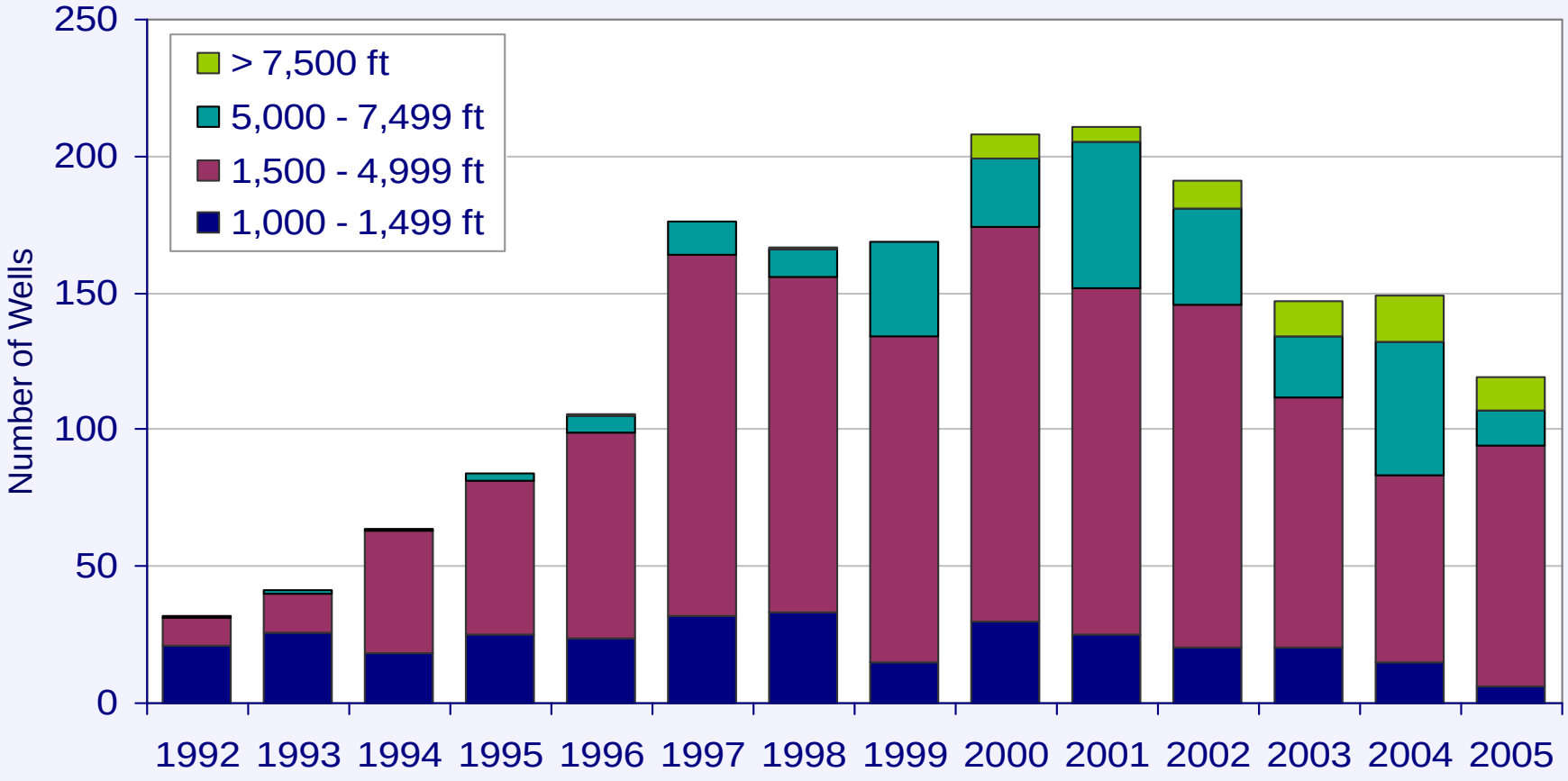
Deepwater Wells Drilled in the GOM by Water Depth

Drilling activity increasing, while down overall, is increasing on relative basis for the deepwater areas of the Gulf.



Source: Minerals Management Service, US Department of the Interior

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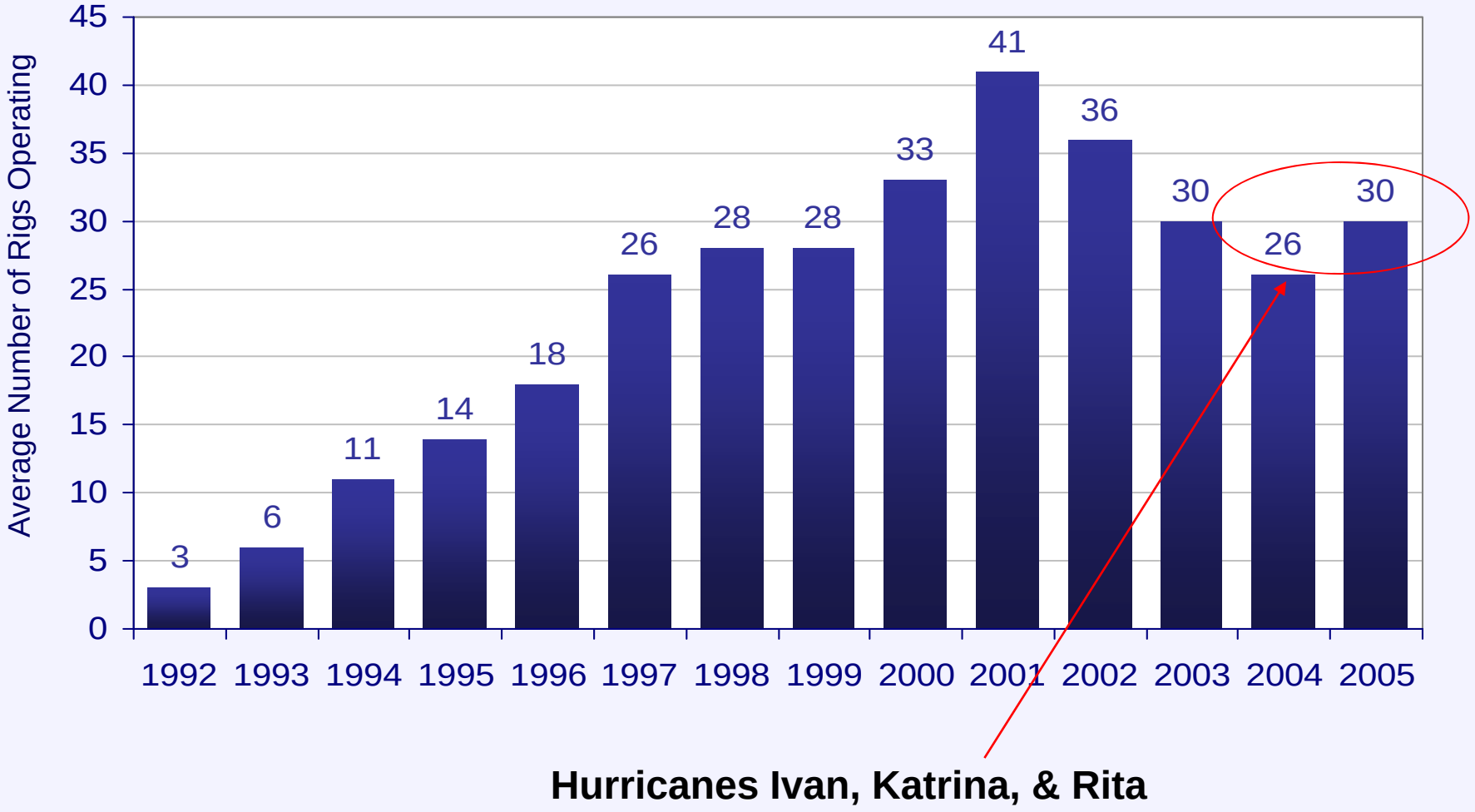
Average Number of Rigs Operating in the Deepwater GOM

Active rigs in total, however are down in the deepwater from 2001 high point.



Source: Minerals Management Service, US Department of the Interior

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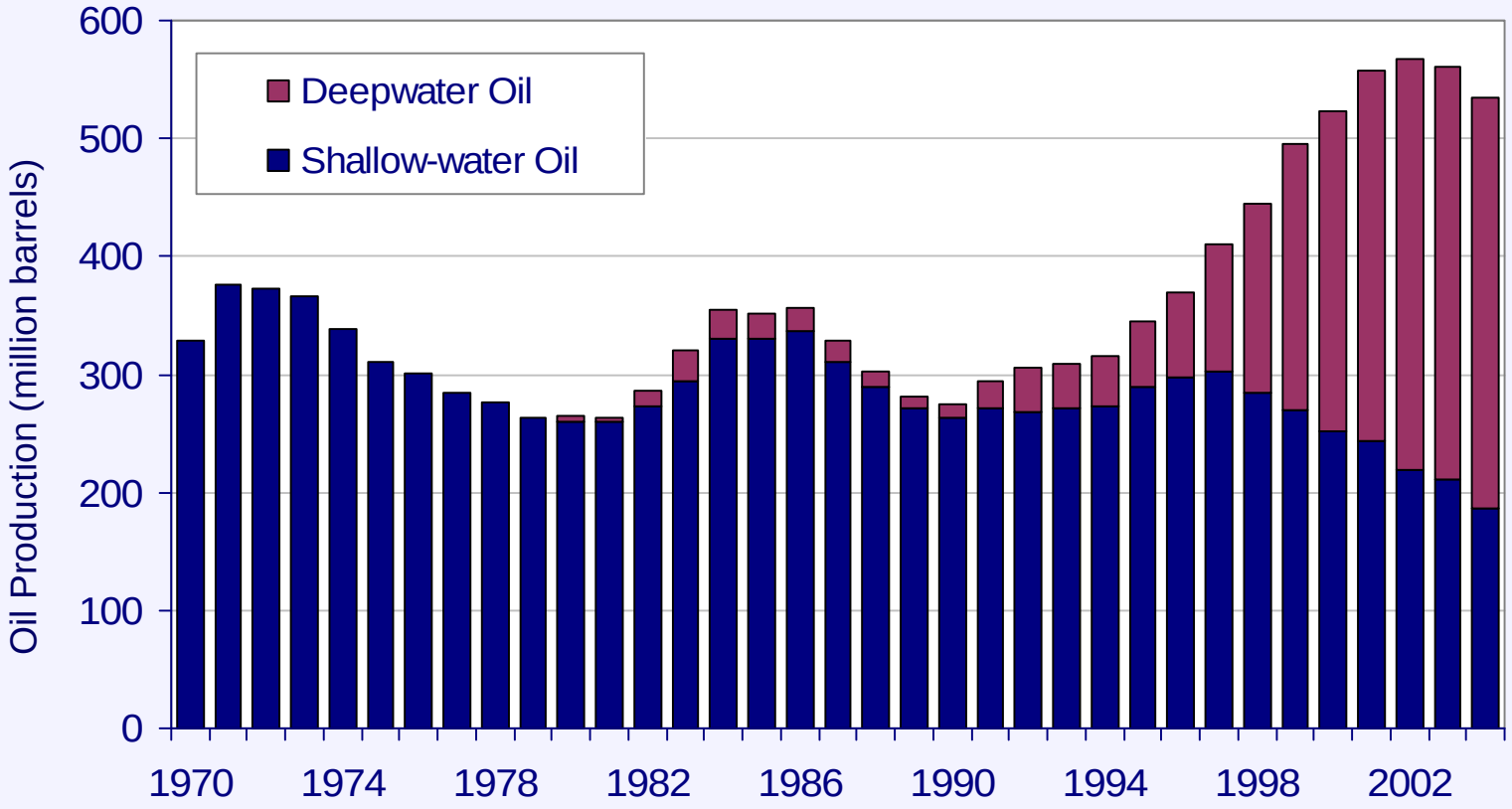
Annual Gulf of Mexico Oil Production

Significant increase in deepwater crude oil production has come as some surprise particularly those anticipating greater natural gas from these areas.



Source: Minerals Management Service, US Department of the Interior

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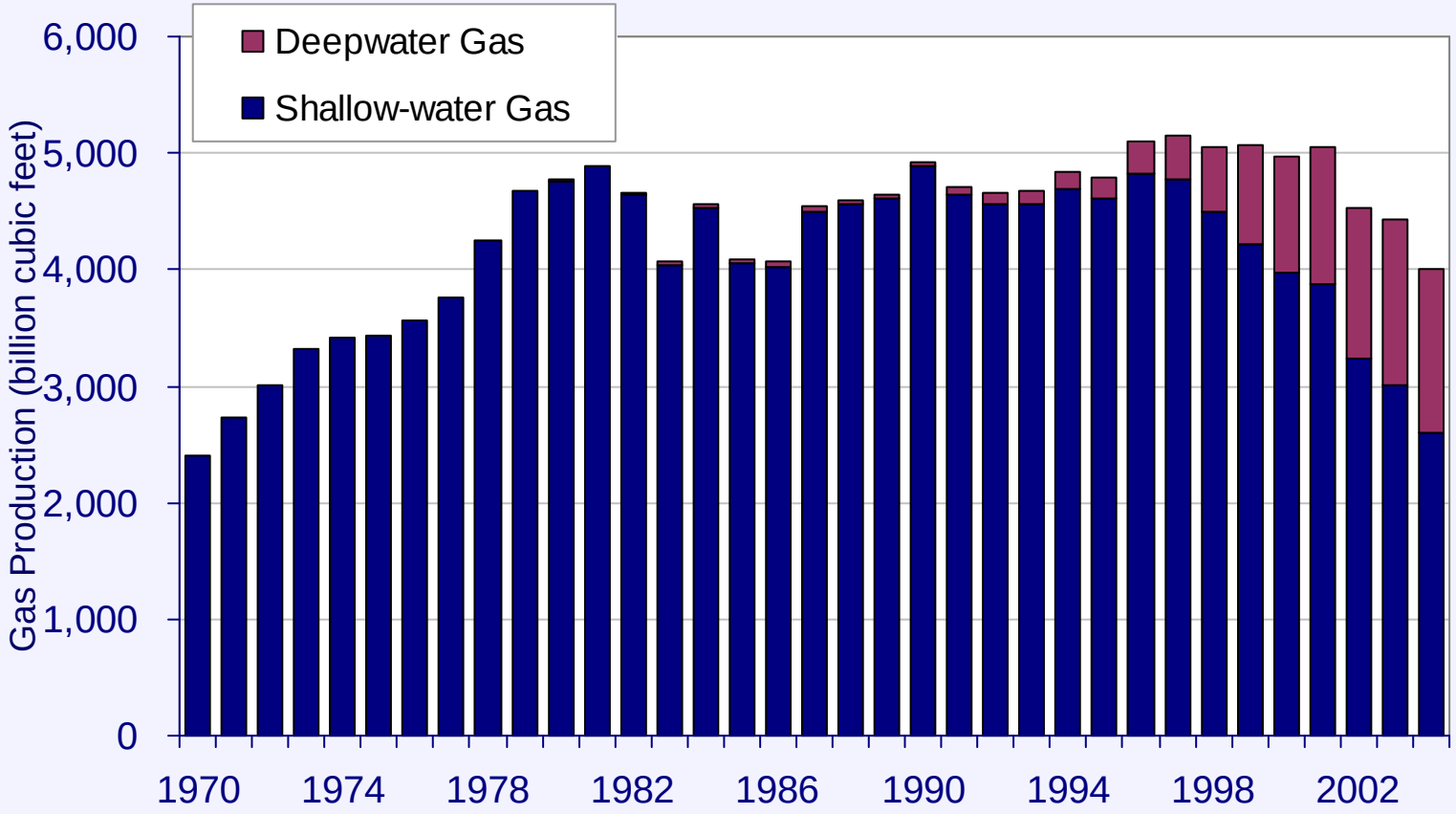
Annual Gulf of Mexico Gas Production

Deepwater share of natural gas increasing despite overall production plummet from 2002.



Source: Minerals Management Service, US Department of the Interior

Hurricane Impacts

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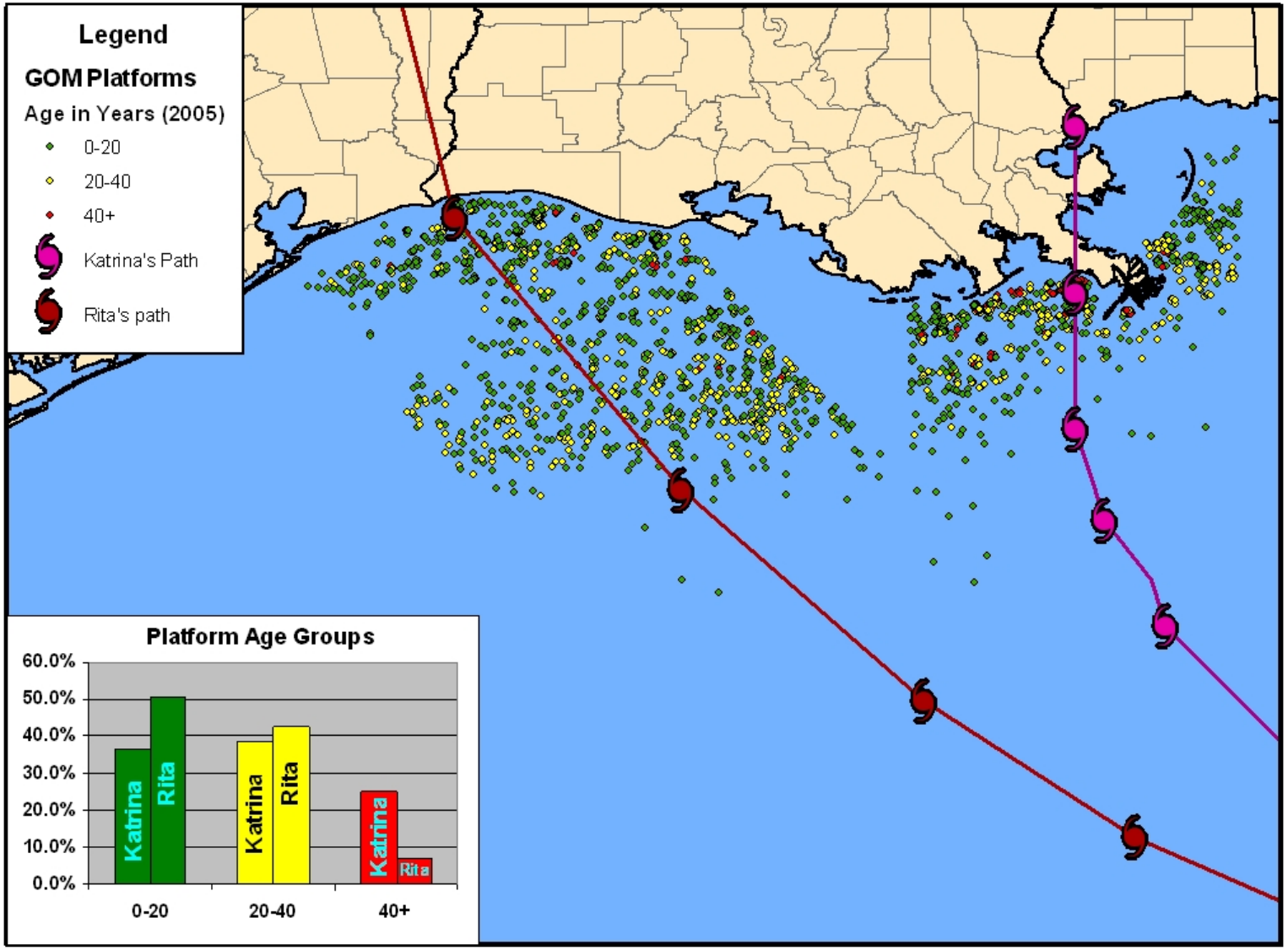
Platforms/Structures Impacted by 2005 Hurricanes



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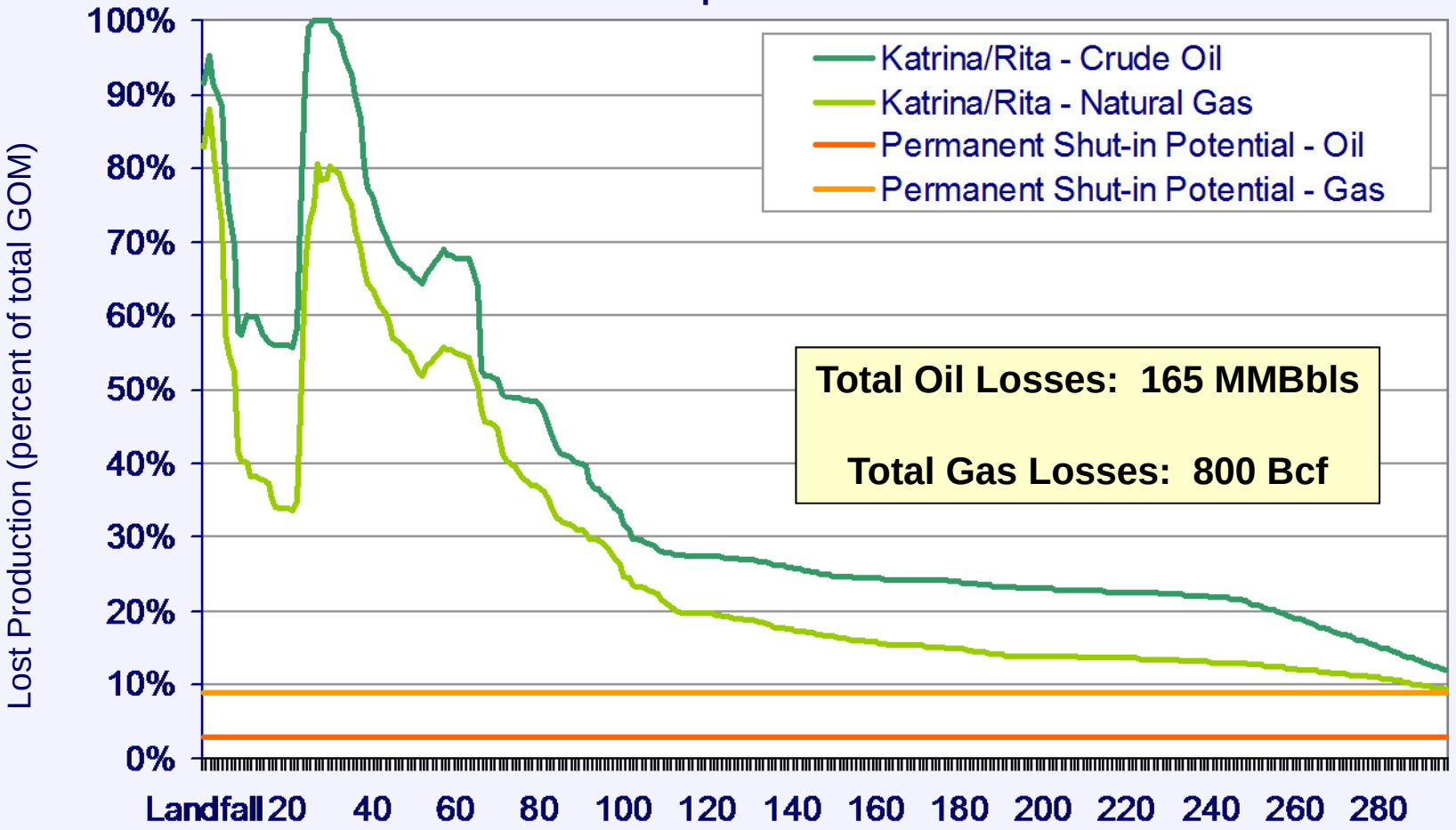
Estimated Return of Existing Crude Oil and Natural Gas Production

As of June 2006, there was 936 MMcf/d and 179 MBBl/d of shut in gas and oil production.



Note: Shut-in statistics for Ivan were no longer reported after 150 days. The last shut-in statistics for Katrina and Rita were published on June 21, 2006 (the 296th day after Katrina made landfall). Total pre-hurricane crude production of 1.5 MMBBls/d and gas of 10 Bcf/d.

Source: Minerals Management Service, US Department of the Interior

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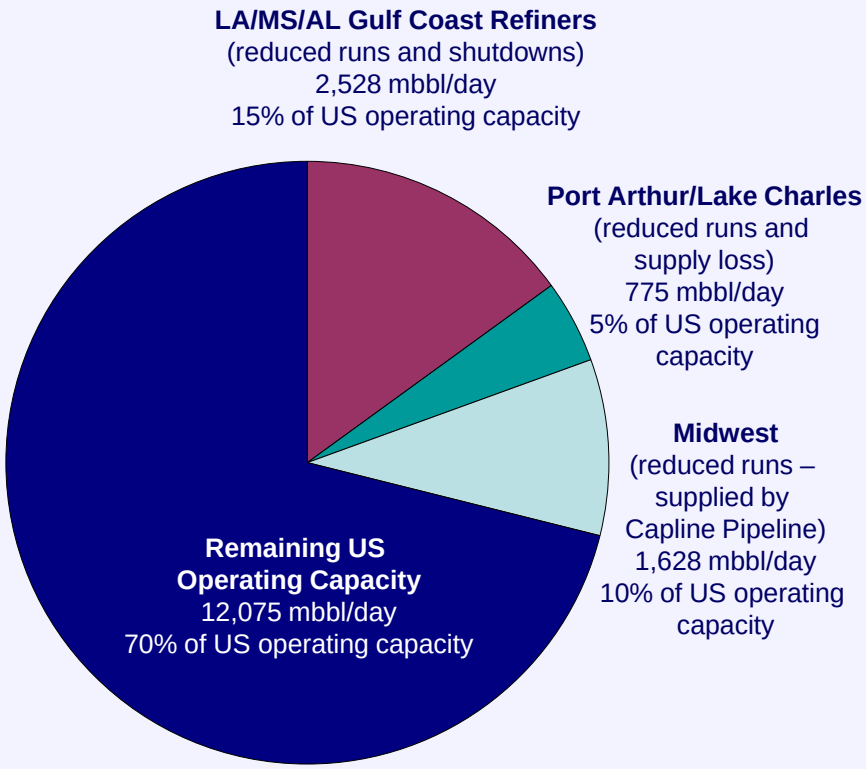
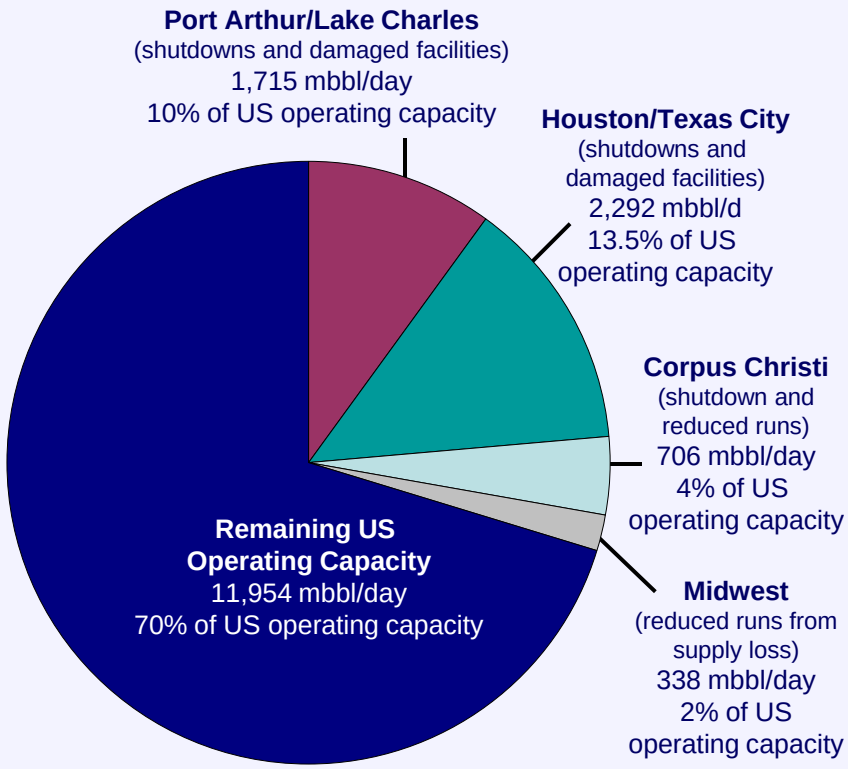
Total Immediate Refinery Impact

Hurricane Katrina



Total Refinery Impact
4,931 mbbl/day
30% of US operating capacity

Hurricane Rita



Total Refinery Impact
5,052 mbbl/day
30% of US operating capacity

Source: Energy Information Administration, Department of Energy

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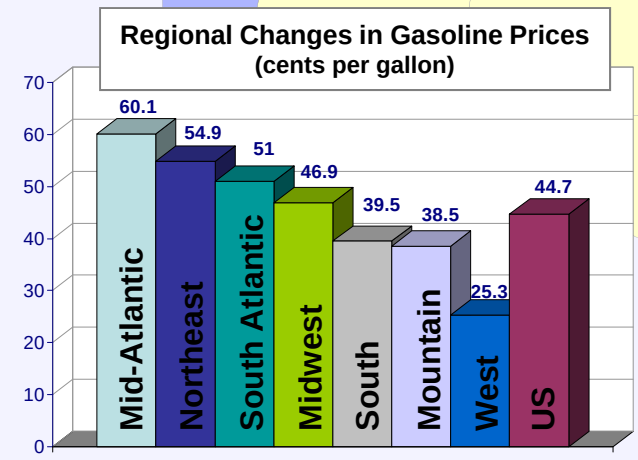
Gasoline Price Increases
August 30, 2005 to September 6, 2005



< 25
25-50
> 50

Colonial / Plantation Pipeline Systems

Source: American Petroleum Institute

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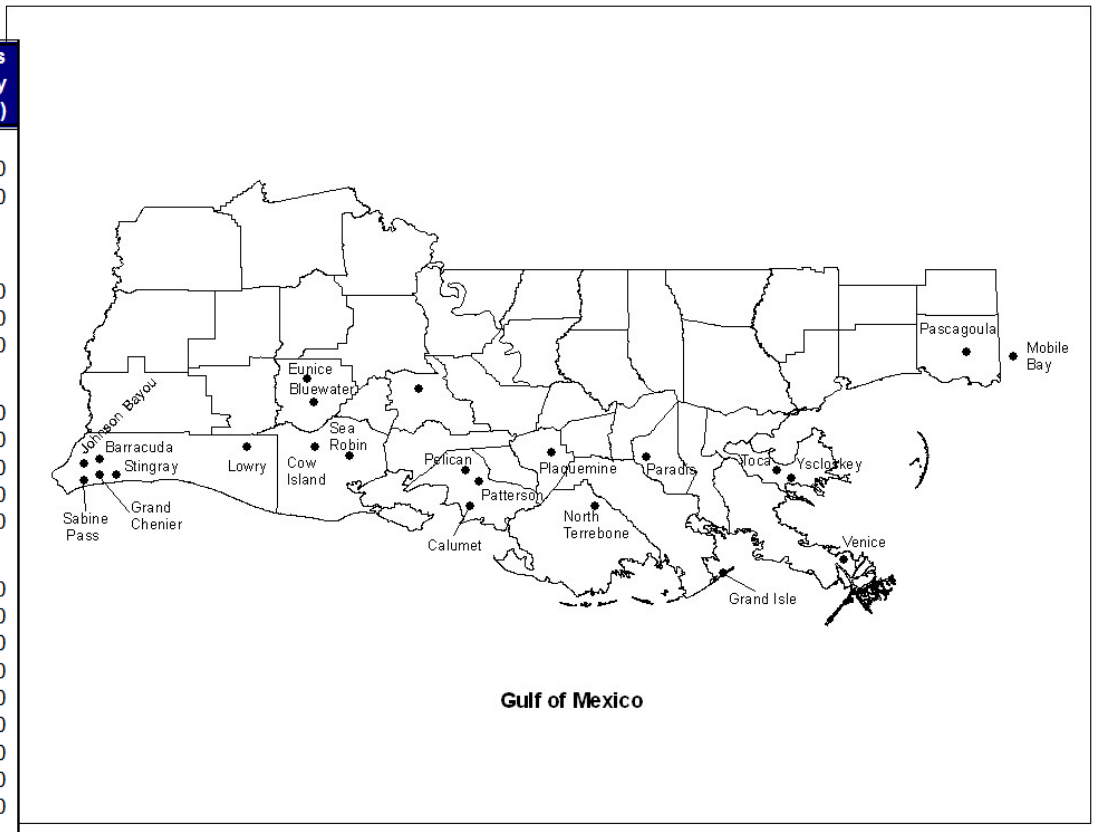
Number of Natural Gas Processing Facilities Out

Outages at gas processing facilities throughout all of south Louisiana was one of the more unique aspects of the combined hurricanes.

State/Company	Facility	Gas Capacity (MMcf/d)
Alabama		
Duke Energy Field Services	Mobile Bay	600.0
Shell Western E P Inc	Yellowhammer	200.0
Louisiana		
East Louisiana Plants		
Venice Energy Services Co LLC	Venice	1,300.0
Enterprise Products Operating LP	Toca	1,100.0
Dynegy Midstream Services LP	Ysclosky	1,850.0
West Louisiana Plants		
Dynegy Midstream Services LP	Barracuda	225.0
Dynegy Midstream Services LP	Stingray	305.0
BP PLC	Grand Chenier	600.0
Williams Cos	Johnson Bayou	425.0
Gulf Terra Energy Partners LP	Sabine Pass	300.0
Central Louisiana Plants		
Amerada Hess Corp	Sea Robin	900.0
Duke Energy Field Services	Patterson II Gas Plant	500.0
Dynegy Midstream Services LP	Lowry	300.0
Enterprise Products Operating LP	Calumet	1,600.0
Enterprise Products Operating LP	Neptune	650.0
Gulf Terra Energy Partners LP	Cow Island	500.0
Gulf Terra Energy Partners LP	Pelican	325.0
Marathon Oil Co	Burns Point	200.0
Norcen Explorer	Patterson	600.0
Mississippi		
BP PLC	Pascagoula	1,000.0
TOTAL		**13,480.0**
TOTAL GOM CAPACITY		**20,285.0**
PERCENT OF TOTAL GOM		**66.5%**



Source: Oil and Gas Journal; Energy Information Administration, Department of Energy

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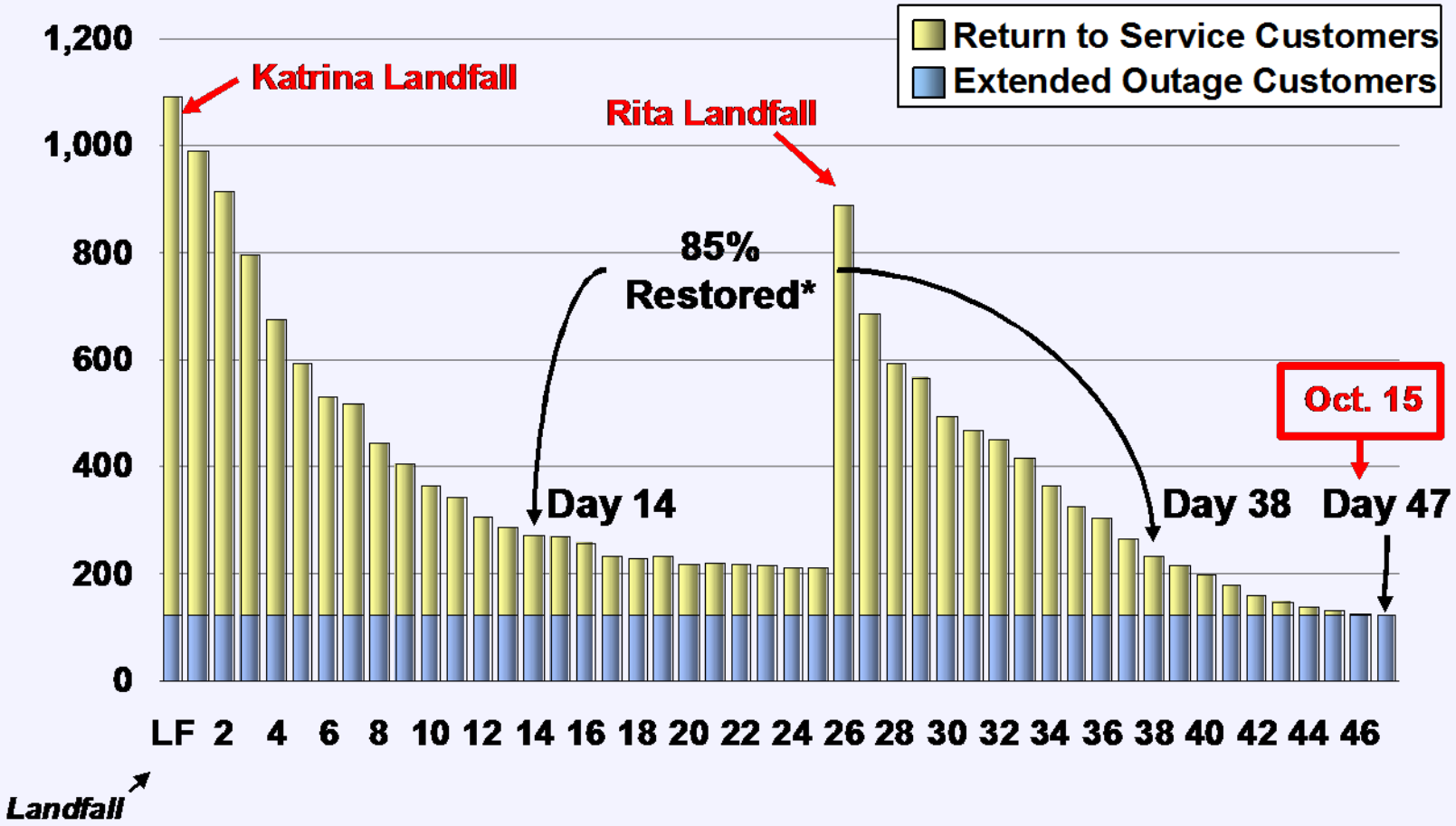
Power Outages From Hurricanes

Damage to power infrastructure (transmission) extensive. Restoration was monumental and impressive, but still created "nervous" moments for other energy infrastructure.



Source: Entergy Corp.

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Examples of Energy Infrastructure Damage

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Shell Mars Tension Leg Platform

Source: Shell.com

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Shell Mars Tension Leg Platform

Source: Shell.com

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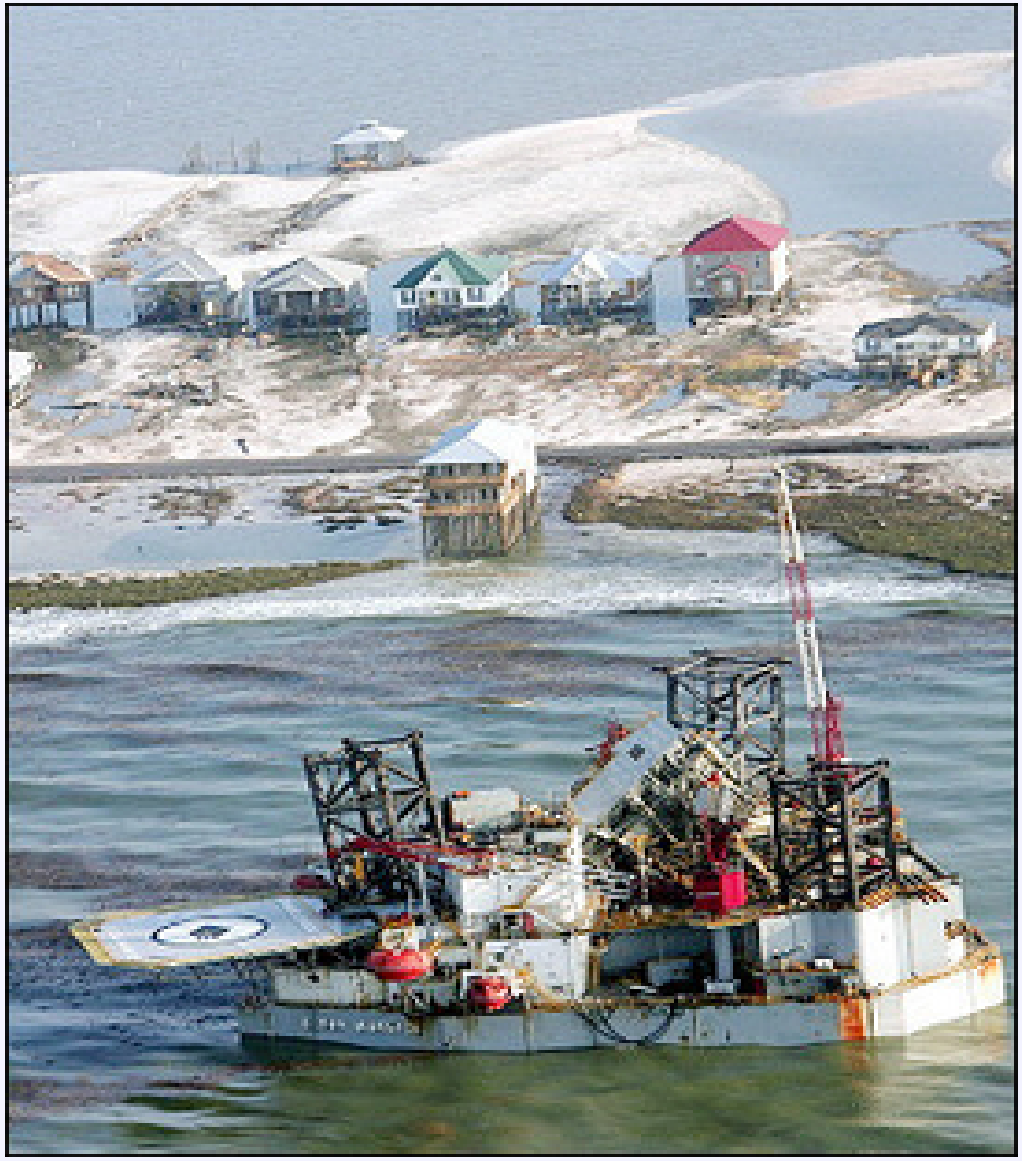
Ocean Warwick
Dauphin Island, AL



Source: Rigzone.com

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Semi-Sub Stuck Under Bridge
North Mobile Bay

Source: Rigzone.com

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Venice Port, Supply & Crew Bases

Source: LIOGA

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Chevron Refinery
Pascagoula, MS

Source: Chevron

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Air Products Facility – Normal Day
New Orleans, Louisiana (Intracoastal Drive)

Source: Air Products

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Air Products Facility – During Hurricane Katrina New Orleans, Louisiana

Source: Air Products

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Air Products Facility – Post Hurricane Katrina New Orleans, Louisiana

Source: Air Products

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Power Outages
Generating Stations – Entergy Patterson

Source: Entergy

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Power Outages
Substation Damage

Source: Entergy

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Then,
Along Comes Rita

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Henry Hub, September 25, 2005

Source: LIOGA

Entergy Transmission

Source: Entergy.com

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Citgo Refinery – Storage Tank
Lake Charles, Louisiana
Post-Rita

Source: Citgo

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Citgo Refinery – Onsite Dock
Lake Charles, Louisiana
Post-Rita

Source: Citgo

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Citgo Refinery – Cooling Tower
Lake Charles, Louisiana
Post-Rita

Source: Citgo

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Citgo Refinery – Tent City
Lake Charles, Louisiana
Post-Rita

Facility rental of $3.5 million for 3 weeks – for 250 employees – roughly $156 per day per person

Source: Citgo

Natural Gas Pipeline Leak

Temporary Natural Gas Release: To date, all subsea safety valves have held. There have been a couple of incidents where pipeline damage has allowed the temporary venting of gas that was in the pipeline. There are currently no known incidents of gas venting from wells and the temporary venting from pipelines appears to have stopped.

Source: MMS

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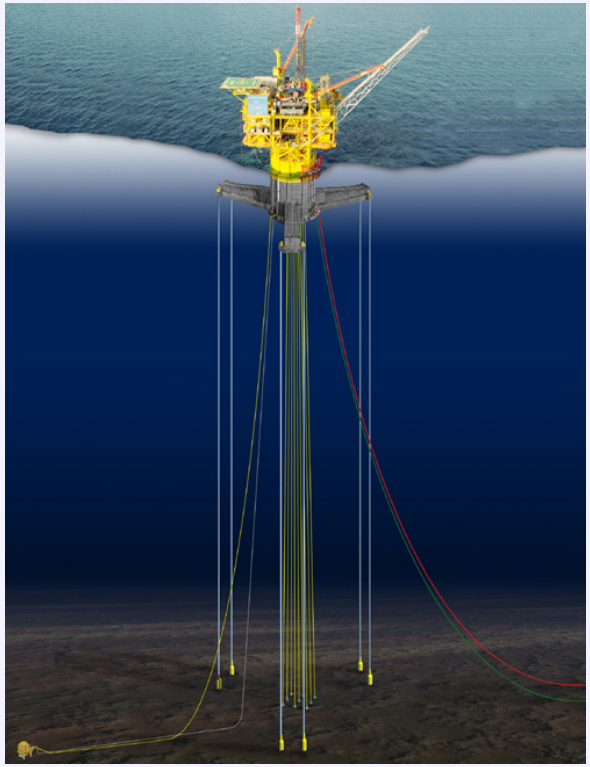
Chevron Typhoon TLP



Source: Chevron, Rigzone.com

Current Production and Outlook

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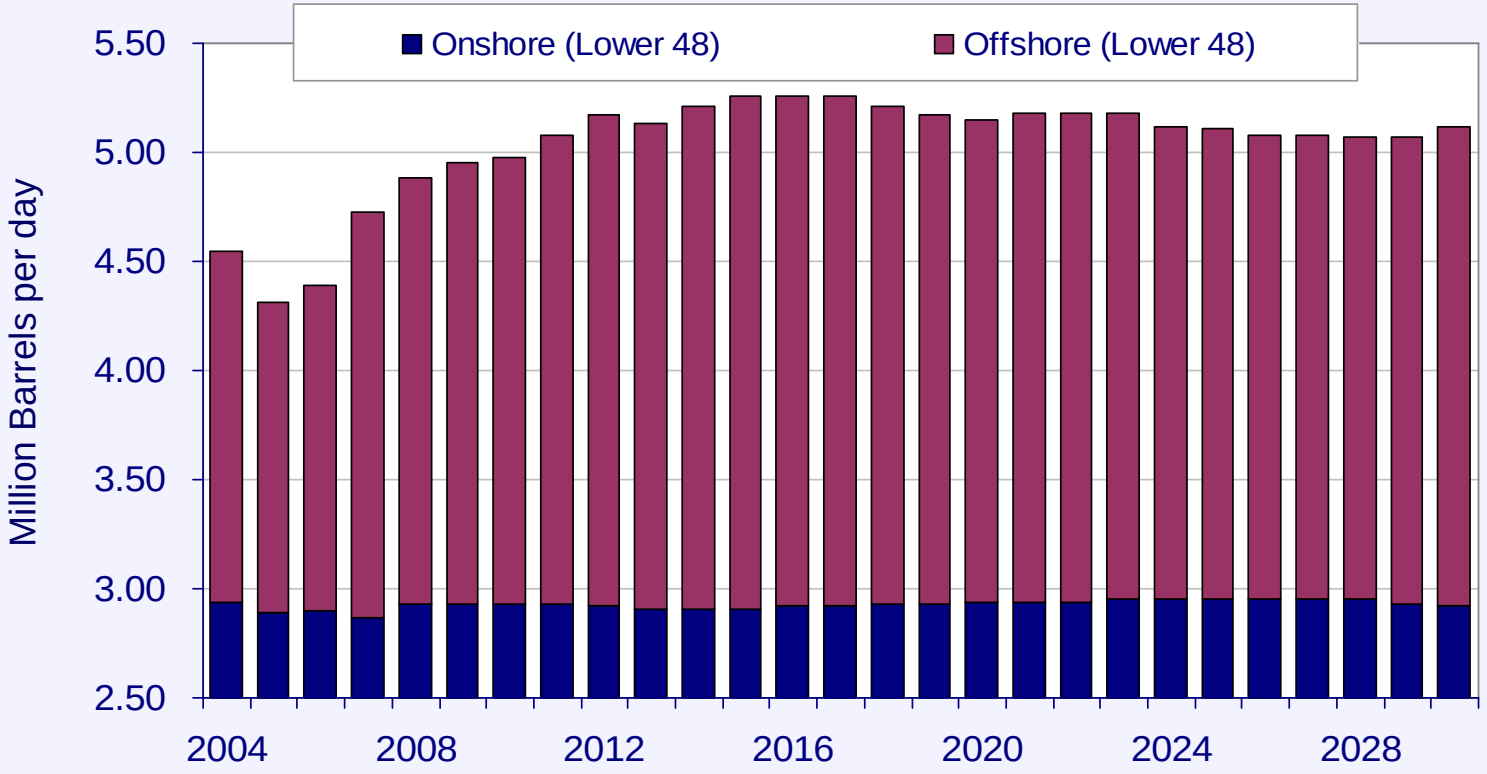
Long Term Forecast of US Crude Oil Production

Crude oil production anticipated to be relatively flat for entire US.



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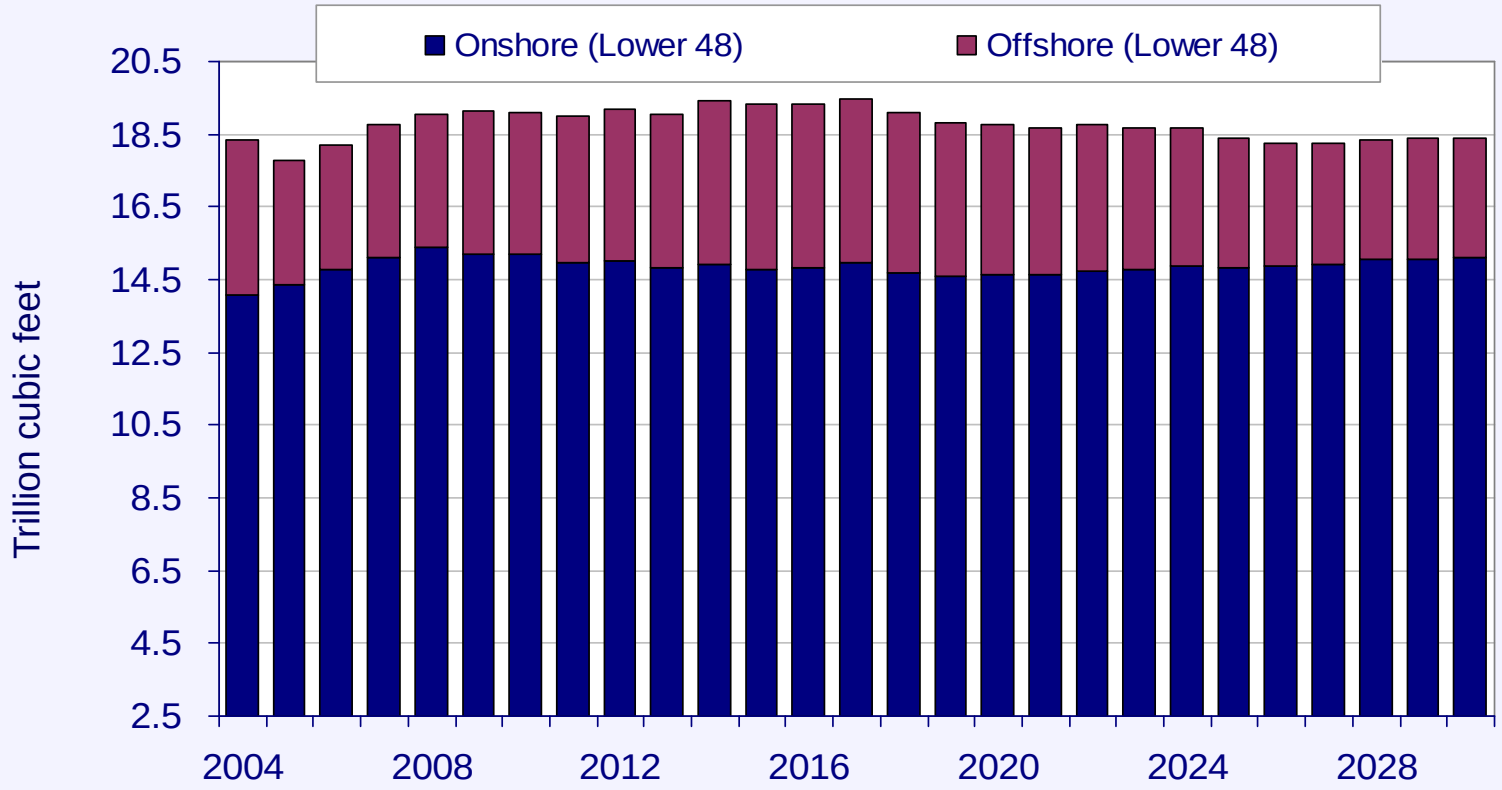
Long Term Forecast of US Gas Production

Natural gas production falls off around 2015 (slightly) onshore (unconventional) gains slightly.



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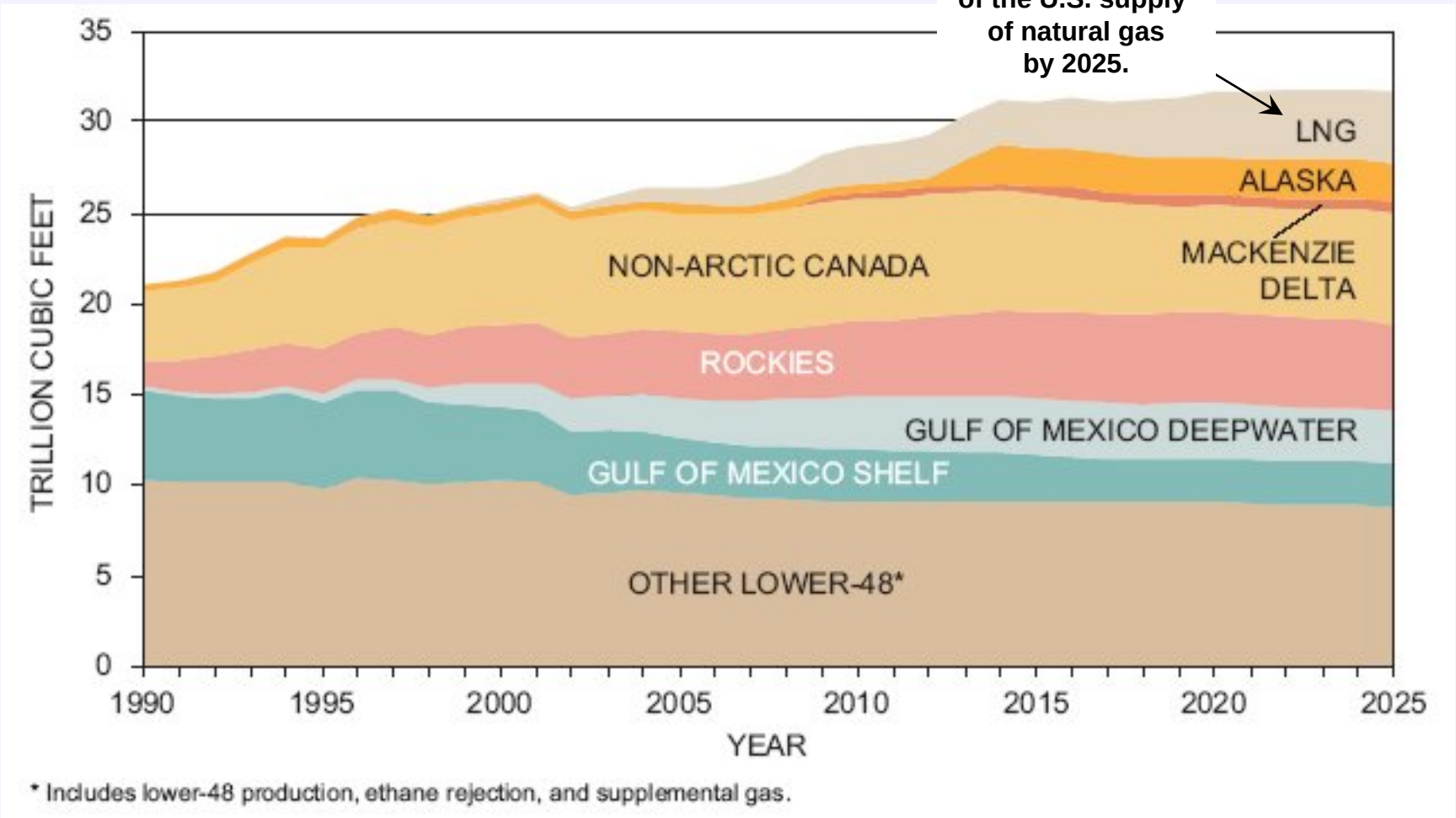
U.S. and Canadian Natural Gas Supply



Source: National Petroleum Council

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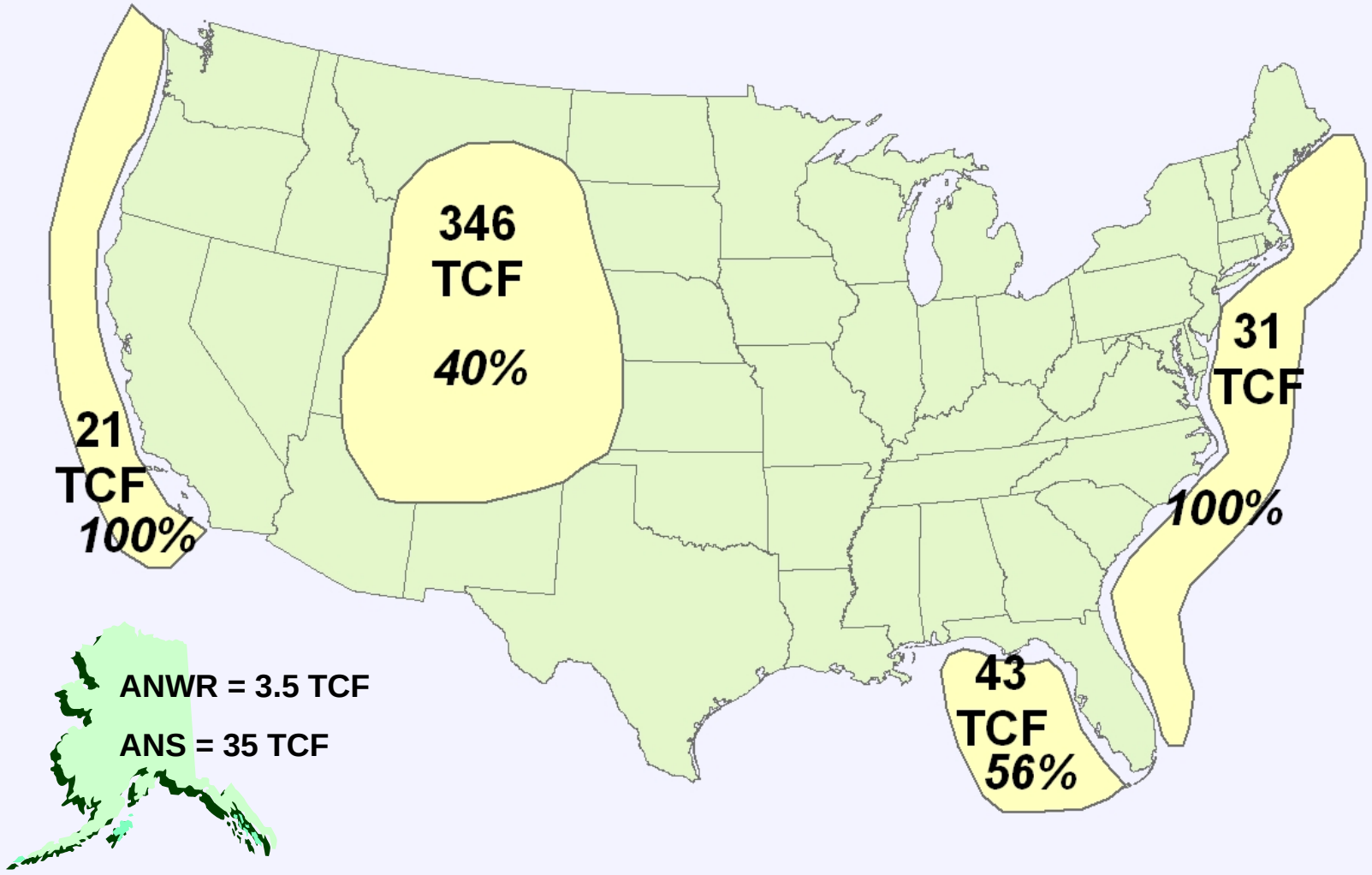
Resource Estimates – Restricted Areas
Estimated Percentage Restricted

Many high-yield areas exist, but are unavailable due to drilling restrictions.



Source: Natural Gas: Can We Produce Enough?" Independent Petroleum Association of America, website: http://www.ipaa.org/govtrelations/factsheets/NaturalGasProdEnough.asp.

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Publicly Announced Lower Tertiary Trend Discoveries in the Gulf of Mexico

Prospect	Block	Operator	Discovery Date
Trident	AC 903	Chevron	2001
Great White	AC 857	Shell	2002
Cascade	WR 206	BHP	2002
Chinook	WR 469	BHP	2003
St. Malo	WR 678	Chevron	2003
Tobago	AC 859	Chevron	2004
Silvertip	AC 815	Chevron	2004
Tiger	AC 818	Chevron	2004
Jack	WR 759	Chevron	2004
Stones	WR 508	BP	2005
Gotcha	AC 856	Total	2006
Kaskida	KC 292	BP	2006

During the last ten years, the average deepwater field has added over 67 MMBOE of proved and unproved reserves.

About 60 billion barrels of oil found in deepwater fields to date.

Some 8- to 10 billion barrels have already been produced.

Yet-to-find potential could be 114 billion barrels of oil, and 68 billion barrels of oil equivalent (BOE) of gas. [Oil and Gas Investor, May 2006]

Source: Minerals Management Service, US Department of the Interior

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Challenges with Recent Announcements

The recent announcements have been very favorably received in the market and press. However, consider:

- **The actual Jack find may be smaller than announced. The entire Walker Ridge play has some 9-15 BBbls of reserves (current GOM is 4.2 BBbls), including Jack.**
- **No reserves have been formally booked.**
- **Some question recovery rates of these finds.**
- **Questions about contractual obligations on royalties (are the cap requirements of DWRRA applicable?)**
- **More expensive wells ($120 MM/well versus $80-100 MM/well)**
- **More expensive infrastructure (upwards of $1.5 billion)**
  - **175 miles offshore**
  - **Drilling depths of 28,000 to 32,500 feet**
  - **Water depths of 5,800 to 8,200 feet.**

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Conclusions

GOM Important Energy Producing (Consuming) Region

- GOM is home to considerable critical energy infrastructure. Outages ripple throughout North America and even the world.
- Continued affordable energy important to the large industrial processing economy located in the region.

Supply Additions Becoming more Challenging and More Expensive

- Recent discoveries in the GOM, while promising are expected to be more expensive (Lower tertiary wells = $80 million to $120 million each; structures between $600 million and $1.5 billion).
- GOM challenges make other sources like non-conventional sources (particularly natural gas) and Canadian reserves (our largest source of imported oil) more important.
- Recent crude discoveries raise questions about natural gas.
- Imported sources into the region (particularly LNG) becoming more important as supply supplements.

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Questions, Comments, & Discussion

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