

# **Oil and Gas Resources off the West Coast of the United States\***

**Drew Mayerson<sup>1</sup>, Kenneth Piper<sup>1</sup>, and Chima Ojukwu<sup>1</sup>**  
**Donald L. Gautier<sup>2</sup>, Presenter**

Search and Discovery Article #20135 (2012)  
Posted February 20, 2012

\*Adapted from oral presentation at AAPG International Conference and Exhibition, Milan, Italy, October 23-26, 2012

<sup>1</sup>Production, Development, and Resource Evaluation, Bureau of Ocean Energy Management & Bureau of Safety & Environmental Enforcement, US Department of Interior, Camarillo, CA. ([drew.mayerson@bsee.gov](mailto:drew.mayerson@bsee.gov))

<sup>2</sup>MS 969, U.S. Geological Survey, Menlo Park, CA ([gautier@usgs.gov](mailto:gautier@usgs.gov))

## **Abstract**

The Federal offshore of California has produced over 1.2 billion barrels of oil and 1.6 trillion cubic feet of gas since the first platforms were placed in southern California in 1967. As of 2009, estimated remaining recoverable reserves for the same fields are about 323 million barrels and 670 billion cubic feet of gas. Development of areas outside the existing offshore leases in southern California has been restricted, due to various congressional moratoriums, presidential exclusions, and an anti-offshore oil sentiment from states and local politicians and citizens dating back to before the last Federal lease sale along the Pacific coast in 1984. Assessments of technically and economically recoverable oil and gas are conducted about every five years. The last published resource assessment was completed in 2005 and concluded that the technically recoverable resources for the Federal offshore California, Oregon, and Washington is almost 11 billion additional barrels of oil and over 18 trillion cubic feet of gas. A more recent resource assessment was due to be published in late Summer 2011.

# Oil & Gas Resources Off the West Coast of the United States

Bureau of Ocean Energy Management  
&  
Bureau of Safety & Environmental Enforcement  
United States Department of the Interior  
Pacific Outer Continental Shelf Region

**Drew Mayerson**  
**Kenneth Piper**  
**Chima Ojukwu**

Presented by  
Don Gautier, U.S. Geological Survey



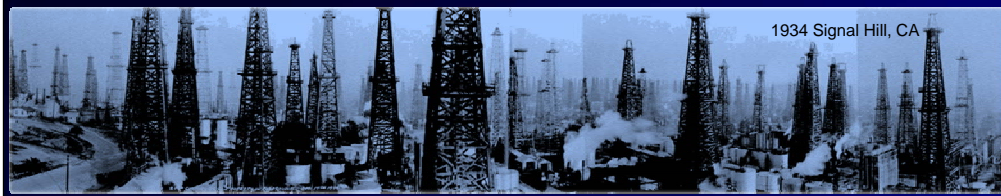
# Overview

- Exploration and Production History
- Geologic Provinces Assessed
  - Assessment History
  - 2011 Assessment Methodology
  - 2011 Assessment Results
- High Potential Areas
  - Santa Maria, Santa Barbara, Oceanside
- Key Points

# EXPLORATION AND PRODUCTION HISTORY

# E & P History – Onshore

- 1860s: 65 oil companies in California
- 1903 California is top oil producing state in USA
- 1920s: major discoveries in the San Joaquin Valley, Los Angeles, and Long Beach
- 1985: Production peaked at > 424 MMBO/yr
- Cumulative production ~29 BBO and 40 TCFG



Presenter's notes: Bullet 4: Examples of fields and their discovery dates in the San Joaquin Valley: Midway-Sunset (1894) (3 Bbbl produced), Kern River (1899) (2 Bbbl produced), South Belridge (1911) (1.5 Bbbl produced), Elk Hills (1911) (1.3 Bbbl barrels produced).

San Joaquin Valley is home to 21 giant oil fields and ranks 5<sup>th</sup> in the nation for onshore daily production in the lower 48 (behind Louisiana #1, Texas #2, Alaska #3, and California #4)

The Los Angeles Basin is home to the Wilmington oil field (1932) (2.6 Bbbl produced), Huntington Beach oil field (1914) (1 Bbbl produced)

The Long Beach oil field (1921) (1 Bbbl)

## E & P History - Offshore

- 1897: 1<sup>st</sup> U.S. offshore well - Santa Barbara pier
- 1932: 1<sup>st</sup> offshore platform in 12 meters of water near Santa Barbara (Indian Petroleum)
- 1967: California's 1<sup>st</sup> platform in Federal waters
- Current Federal production > 22 MMBO/yr
- Cumulative production > 1.2 BBO
- All offshore production is from southern California
- Much of California is now off limits to drilling



Presenter's notes: Bullet 1: The pier was in Summerland, about 10 Km south of the city of Santa Barbara.

Bullet 2: Platform was named "steel island" and was in 12 meters of water. Bullet 3: Platform is named "Hogan." It is in 47 meters of water and is 6 Km from shore. Its cumulative production is 21 MMbbl of oil and 21 Bcf of gas.

Last Bullet:

National Marine Sanctuaries (NMS), south to north, the Channel Islands NMS (surrounding the Channel Islands and forming the southern boundary of the Santa Barbara Channel), the Monterey Bay NMS, the Gulf of the Farallones NMS, and the Cordell Bank NMS. There is also an NMS off the Olympic Coast in Washington Federal waters.

## E & P History – Federal Lease Sales

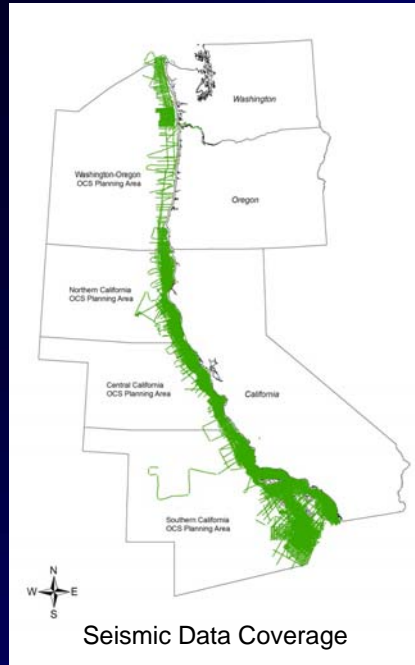
- 1963: 1<sup>st</sup> Federal offshore West Coast lease sale
- 11 Federal sales – last West Coast sale in 1984
- Almost 500 tracts were leased - only 49 remain
- Total revenue from lease sales ~ \$4 billion
- Royalties average \$250 - \$350 million/year



Presenter's notes: Bullet 1: First US offshore lease sale in 1954 in the Gulf of Mexico. Last Bullet: Royalties in the Pacific Region are mostly 16 2/3 % of production value.

# E & P History – Federal Lease Sales

- 1 lease sale north of southern California (1963)
- >215,000 km of seismic off California, Oregon, & Washington 1963-1995
- Data show anticlines along the San Andreas Fault
- 20 offshore basins with 2000 to >12000 m of sediment

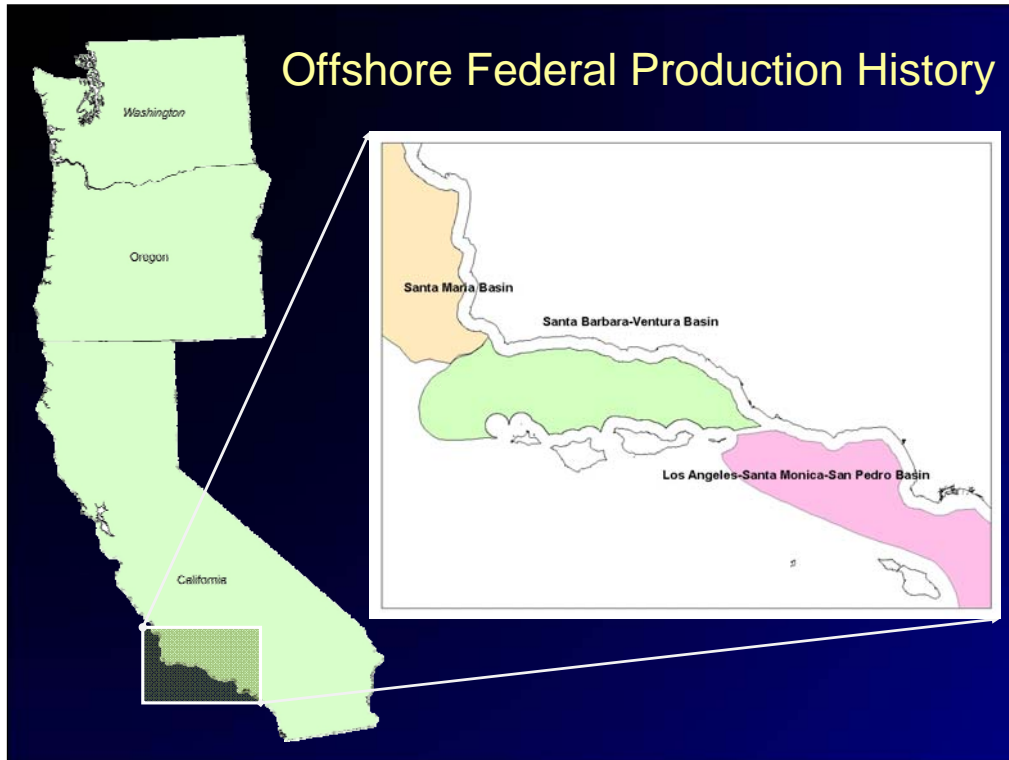


Presenter's notes: Bullet 1: The southern California planning areas extends from the Mexican border to the north county line of the county of Santa Barbara, just north of Santa Maria, California.

- Numerous wells were drilled as a result of that sale but no well tests were run in the Monterey Formation.
- The Monterey has turned out to be the most prolific formation in offshore southern California as well as the onshore San Joaquin Valley.
- Opposition from State and local governments to all attempts to hold more sales in offshore California, and the opposition is especially severe in central and northern California.

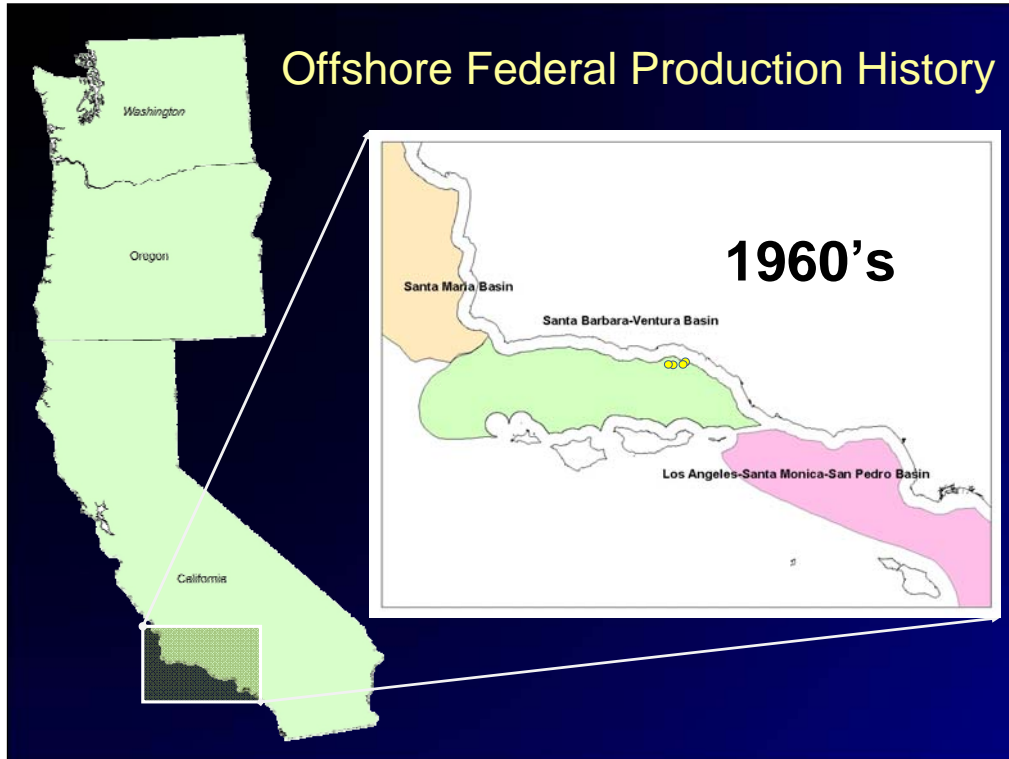


# Offshore Federal Production History

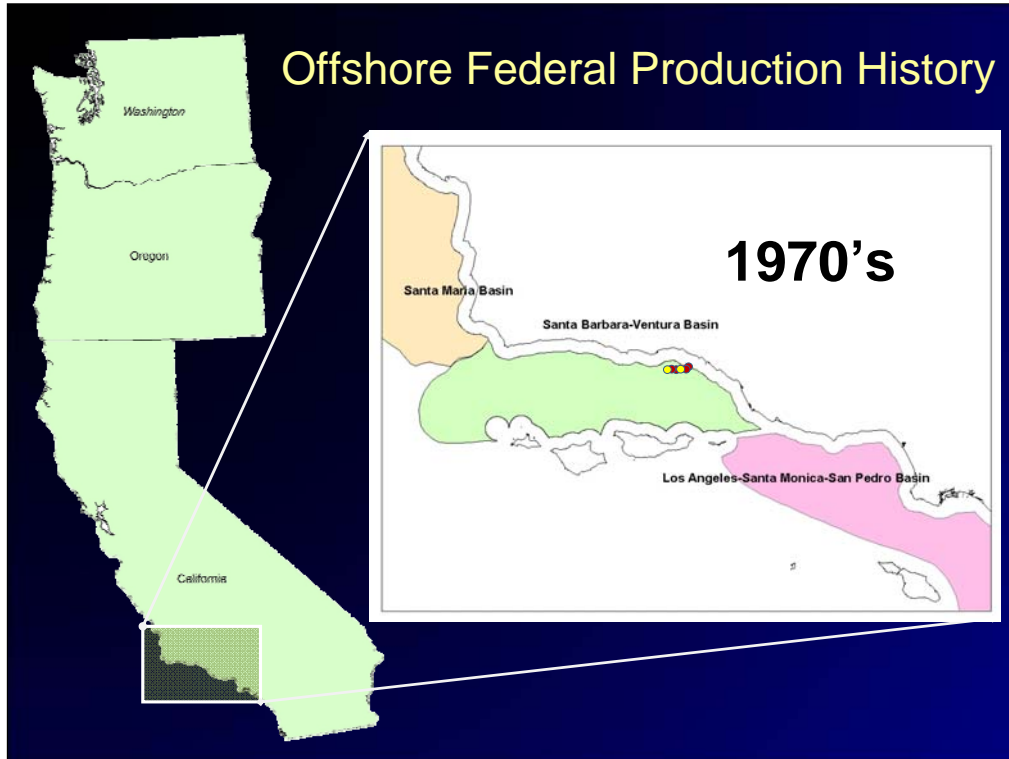


Presenter's notes: The next 5 slides show the progression of platforms built in Federal waters by decade.

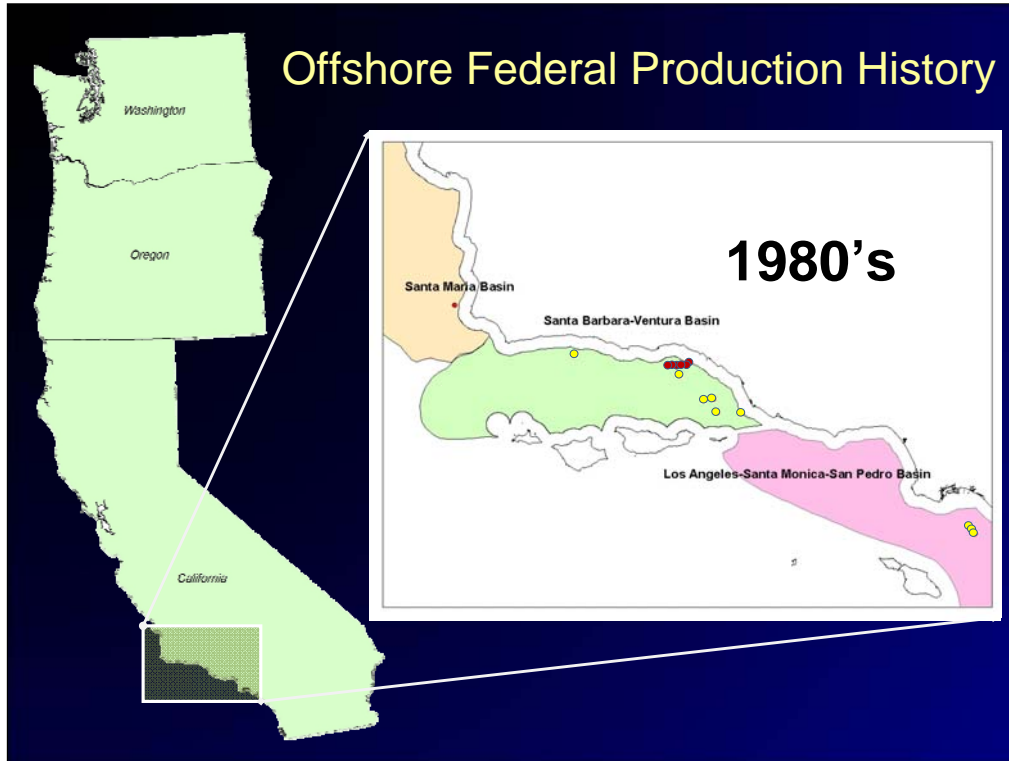
# Offshore Federal Production History



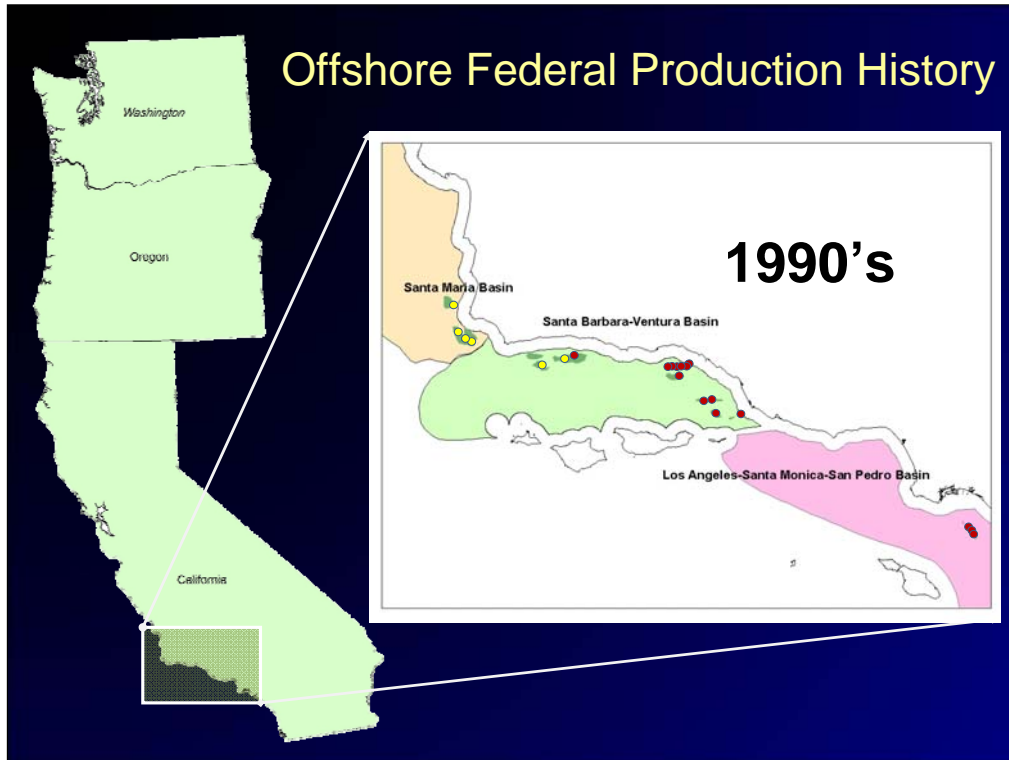
# Offshore Federal Production History



# Offshore Federal Production History



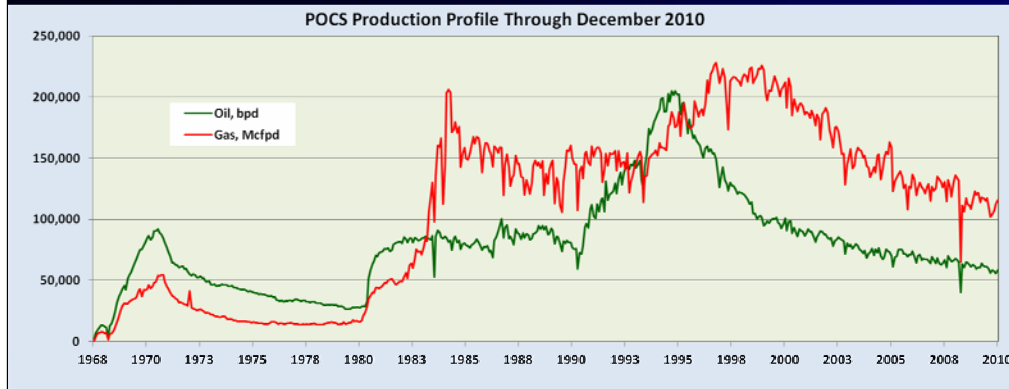
# Offshore Federal Production History



# Production Profile Pacific OCS

1969: FIRST PRODUCTION  
2010: 61 MMB; 113 MMCF/D  
23 PLATFORMS  
391 PRODUCING WELLS  
CUM: ~1.2 BBO; ~1.7 TCF

**PROVED RESERVES:**  
324 MMBO; 669 BCF  
**CONTINGENT RESOURCES:**  
ACTIVE - 116 MMB; 167 BCF  
EXPIRED - 1.2 BBO; 771 BCF



Presenter's notes: The oil curve shows distinct bumps in production. From left to right we see the initial peak in the early 70s from the first offshore platforms placed in Federal waters in the late 60s. An increase in production occurring in the early 80s is associated with the development of leases acquired in the late 70s. The jump in gas in the mid 1980s is probably due to the discovery of the Pacific's only pure gas field (Pitas Point) and the large quantities of gas coming out of the oil from the Hondo field, which went on production in 1981.

The last peak is the result of discoveries made in the late 70s and mid 80s where development was often delayed because of permitting problems with the State and local governments. Current production is at or near the same level that we had 30 years ago. Although it will continue to decline without new leasing, the nature of the Monterey in our experience is that it is a very shallow decline in the mature years.

2011 NATIONAL ASSESSMENT OF  
UNDISCOVERED OIL & GAS  
RESOURCES

## Assessment History

- Conducted about every 5 years since 1984
- Last major revision in 1995; full report in 1997
- 2011 assessment: geological revisions and methodology changes for consistency
- Full report in 2012



# Geological Assessment Methodology

- Technically recoverable resources
- Statistical analysis; Monte Carlo simulation
- Number of pools estimated using input parameters from known discoveries
- If the play has no discoveries, input parameters from nearby wells
- If the play has no wells, input parameters from analog basins

# Economic Evaluation Methodology

- Economically recoverable resources
- Statistical analysis; Monte Carlo simulation
- Input parameters include:
  - Cost, number of necessary platforms and wells
  - Length of pipelines to transport production
  - Duration of production
  - Price of oil & gas
- Cost distributions-- use local costs if available or from other areas if necessary
- Results are calculated for a large range of prices

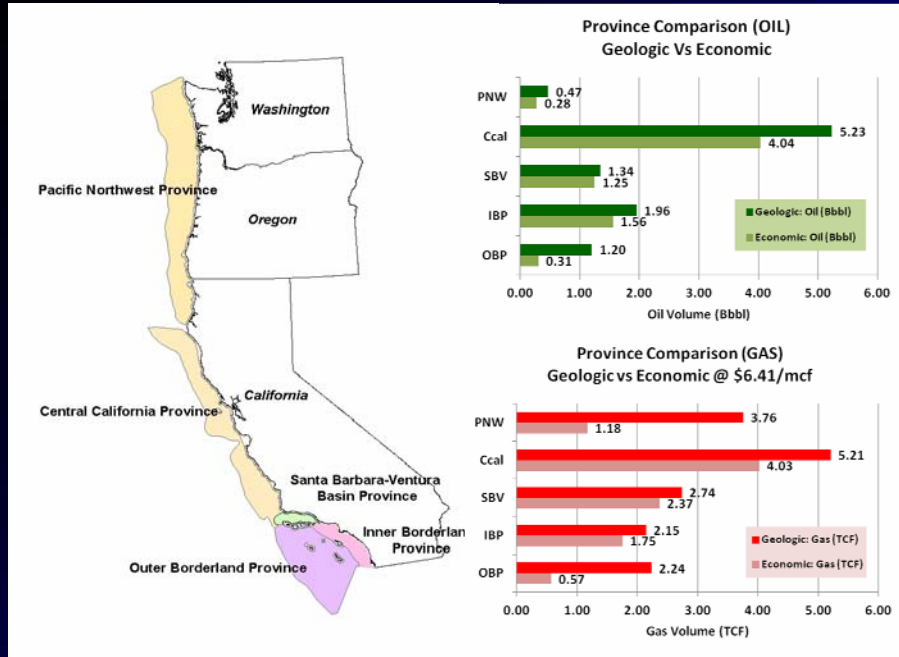
# 2011 ASSESSMENT RESULTS

# West Coast Provinces Assessed

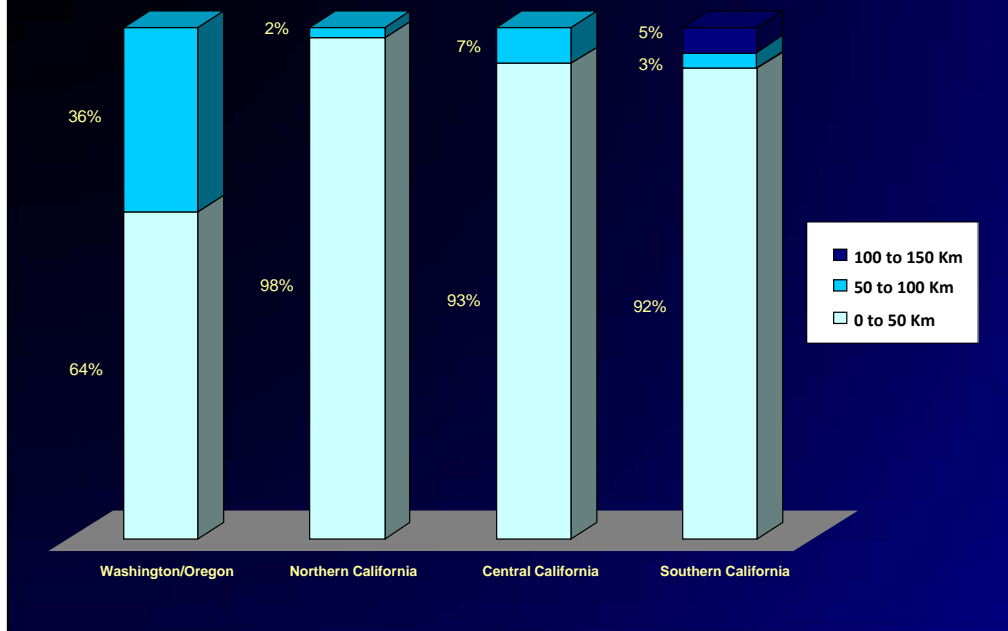


Presenter's notes: This slide introduces the two following slides, which refer to these provinces. This slide is shown again with the comments about the results and the high potential areas.

# 2011 Assessment Results ~ 10 BBO



## > 90% of Resources < 50 Km Offshore



Presenter's notes: Off California, the vast majority of prospects lie close to shore. In fact, most are within 20 km of shore.

This is important because the farther the resources are offshore, the higher the cost to develop those resources. Politicians often float proposals for Federal leasing that prohibits development within 25 miles or 50 miles of shore. If a proposal like this passed, then new California oil and gas resources, for the most part, would not be available.

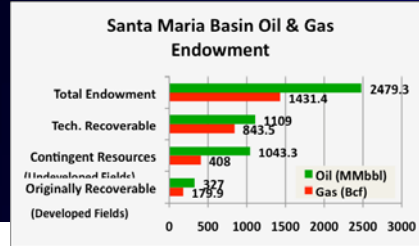
**HIGH POTENTIAL AREAS**

## High Potential Areas

- Large resource base
- Traps/structures along known productive trends
- Near existing onshore infrastructure



# Offshore Santa Maria-Partington Basin



Producing fields  
 Processing facilities  
 5 to 20 km from shore  
 > 2 BB recoverable & contingent

	UTRR	UERR
Gas (BCF)	844	611
Oil (MMB)	1109	844

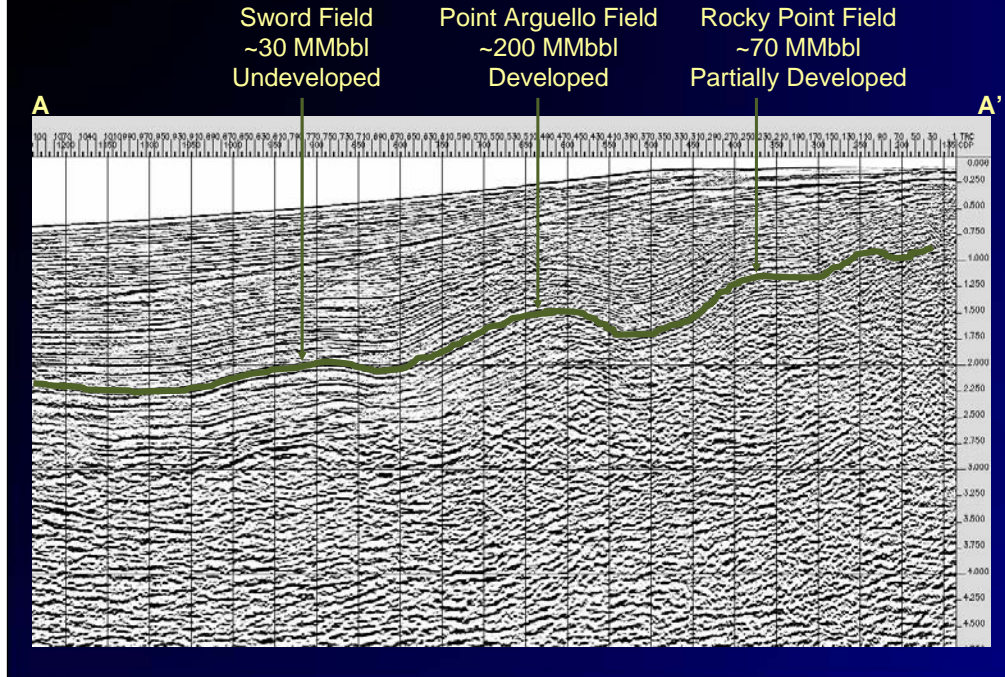
Presenter's notes: \*Contingent resources in Santa Maria Basin are in discovered fields containing ~750 million barrels of oil. A lawsuit, settled in 2009, returned the fields to the government inventory.

Key points about the lawsuit:

1. Initially, the State of California sued the Department for the right to review the leases in Santa Maria Basin (and some in the Santa Barbara Channel) for impacts to the California coastal zone. Previously, California had reviewed these leases and found them to be consistent with the California Coastal Plan. However, they wanted a second chance.
2. The Department objected to this second review.
3. However, the court ruled for California; the Department appealed and lost on appeal.
4. When the Department lost the appeal, the owners of the leases sued the U.S. for breach of contract and won.
5. They were awarded the return of their bonus bids, totaling about \$1.2 Billion.

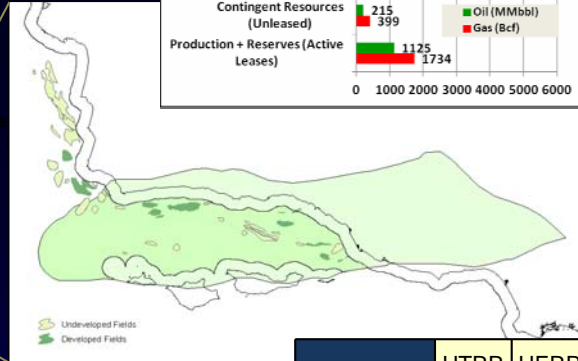
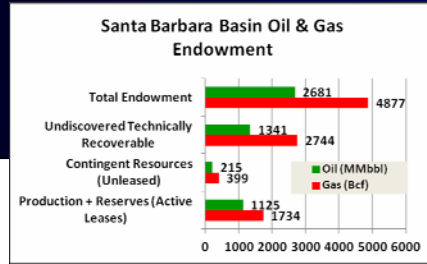
The fields outlined on the map of Santa Maria Basin have had over 50 exploratory wells drilled in them. Oil reserves are ~750,000,000 barrels. Because the geological risk is nil, the costs would be minimal (in an oil and gas sense) to develop these resources. That is why this area is designated as high potential.

# Representative Seismic Line for Santa Maria



Presenter's notes: Sword field shows ~30 million barrel in recoverable resources. We estimate that the field has over 1 Billion barrels of oil in place, but it is very heavy (8-11 API gravity). Technology is changing rapidly and 8-11 API is no longer as difficult to produce as it once was. If we were to conduct another field study on the Sword Field, the estimate is that the technologically recoverable number would jump to 200 to 300 million barrels. However, until we conduct a new study, 30 million barrels is the "official number."

# Santa Barbara – Ventura Basin



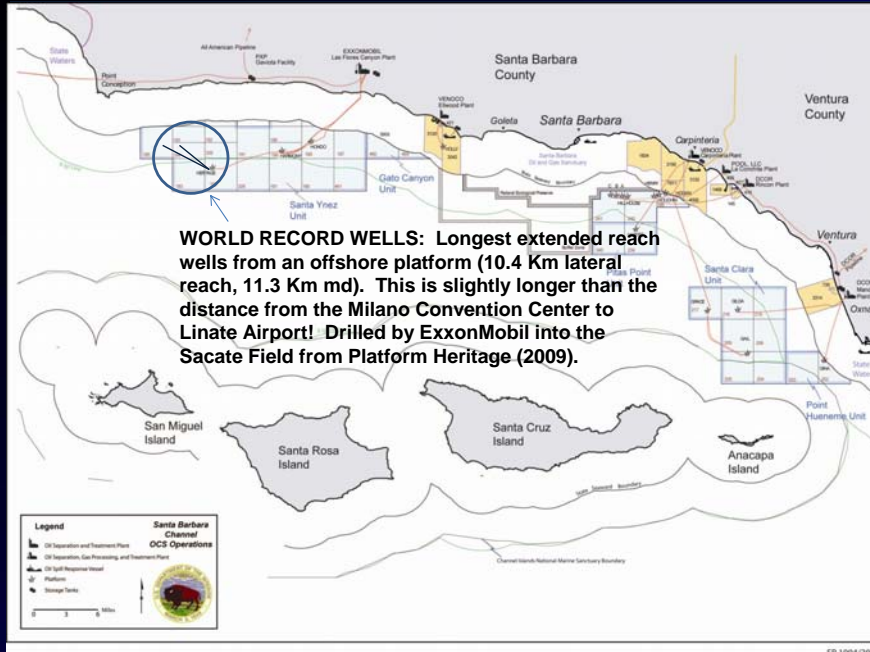
Producing fields                      5 to 20 km from shore

Processing facilities                >1.5 BB recoverable & contingent resources

	UTRR	UERR
Gas (BCF)	2744	2371
Oil (MMB)	1341	1246

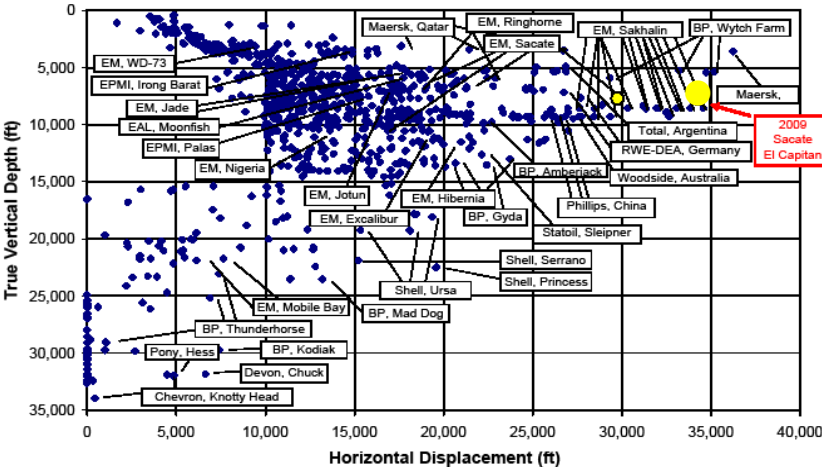
Presenter's notes: The Santa Barbara Channel is our most developed area on the West Coast. Most of the fields are mature. However, the amount of undiscovered oil that is technically recoverable is still significant at 1.3 Billion barrels of oil and 2.7 Tcf of gas.

# World Record Wells Near Santa Barbara

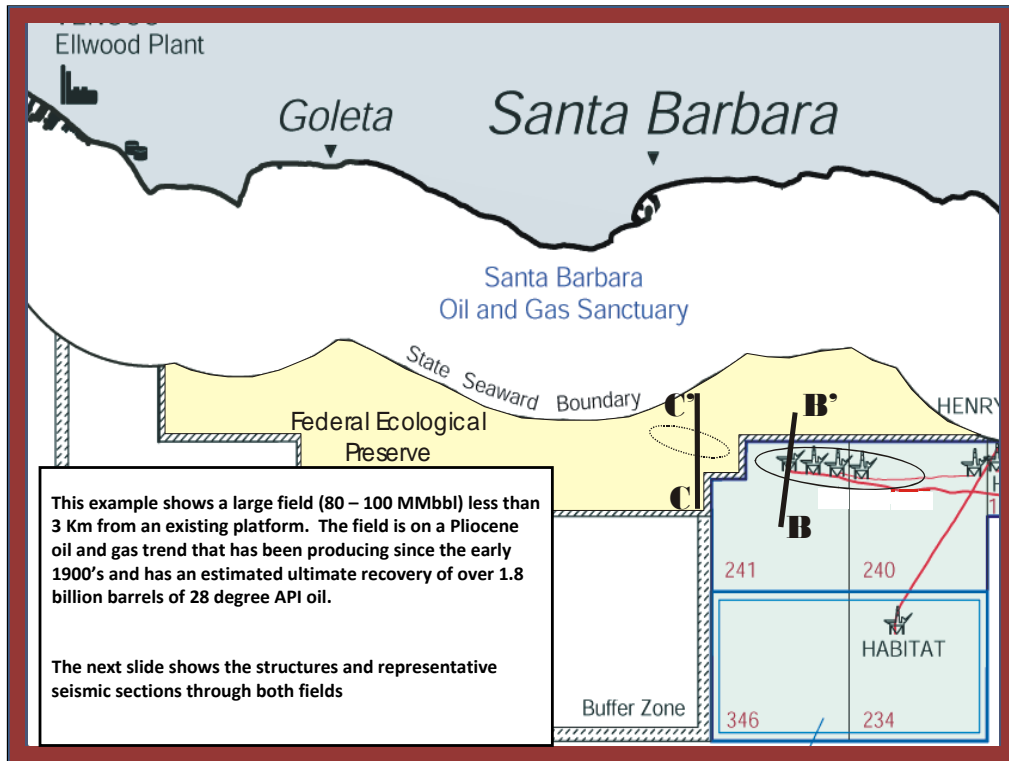


Presenter's notes: Highlighted here are some state-of-the-art technology in use on the West Coast. Although there are a few longer extended reach wells in the world, notably at Wytch Farm in England and off Sakhalin Island in Russia, they are from a land base and drilled into the offshore and therefore somewhat easier to drill.

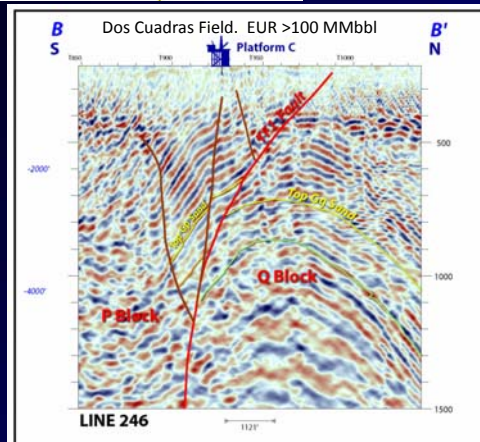
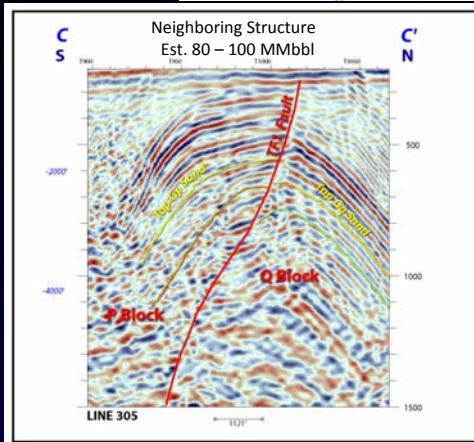
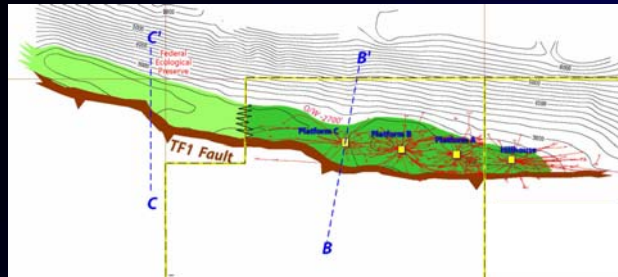
# Worldwide Horizontal Displacement



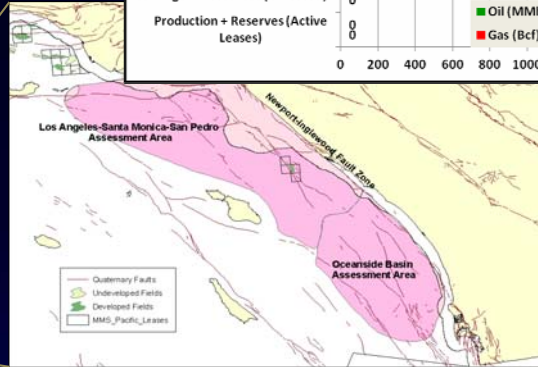
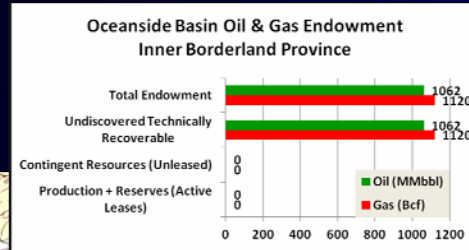
Slide courtesy of ExxonMobil Corp. (2009)



Presenter's notes: The field with the C – C' cross section is inside the Federal Ecological Preserve which was established by the Secretary of the Interior in 1969 after the Santa Barbara Oil Spill. The Federal Ecological Preserve prohibits platforms from being placed within its borders. Extended-reach drilling is not specifically prohibited, but if leasing is allowed, expect strong resistance from the neighboring City of Santa Barbara as well as the State of California and environmental groups.



# Oceanside Basin



- On Newport-Inglewood trend
- Broad structures
- 5 – 30 Km offshore
- 3 structures > 800 MMBO

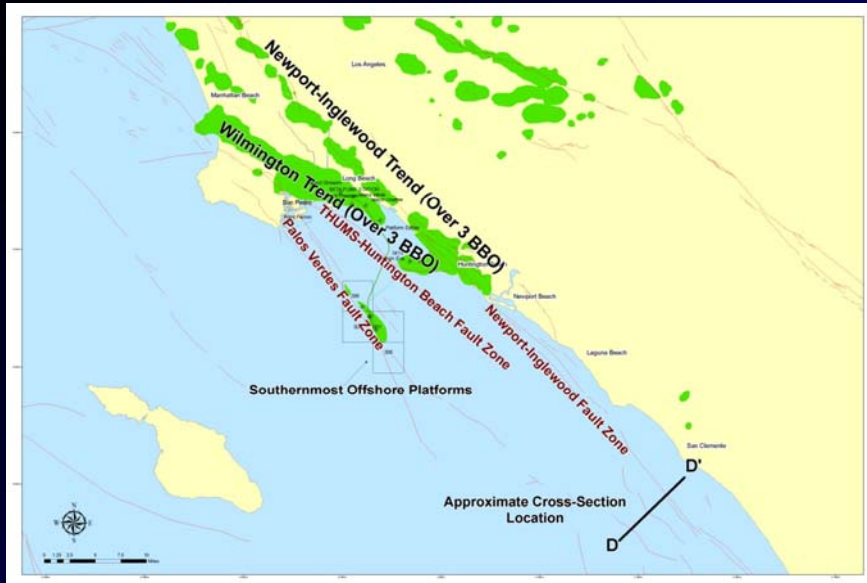
	UTRR	UERR
Gas (BCF)	1120	930
Oil (MMB)	1062	876

Presenter's notes: Last Bullet: The importance of the Marine Base is that the visual impacts of development would mainly be seen by the military and not the coastal residents. This may make leasing slightly more palatable to the State and the public.

Two shallow core holes have been drilled in this area. One was on the east side of the Newport-Inglewood fault and was a failure. The other was on just on the west side of the fault, but information is held closely by ExxonMobil., even though it was drilled in the 1960s before regulations were in place for release to the public.



# OCEANSIDE BASIN IS ON A PROLIFIC TREND



Presenter's notes: This slide exemplifies the importance of high grading a prospect or area because it is on a known producing trend. In this case, two trends that have supergiant fields along them extend along the Newport-Inglewood Fault to the Oceanside Basin. As can be shown on the following slide, very large structures are present in that basin.



## Key Points

- California – prolific producer for > 100 years
- Oregon and Washington are mainly gas-prone
- Offshore Production is confined to southern California
- 23 platforms with almost 400 producing wells
- 2 of the world's longest extended reach wells

Presenter's notes: Offshore California production is confined to Southern California due to negative public attitudes toward oil and gas and the presence of multiple marine sanctuaries.

## Key Points - continued

- The 2011 National Assessment Mean Estimate:  
10 BBO, 16 TCF technically recoverable;
- 7 BBO and 10 TCF are economic
- High potential areas have large resource volumes, are on producing trends, and near shore
- High potential areas contain > 3.5 BBO and 4 TCF of technically recoverable oil and gas

Thank you to John Brooks and the Division of Professional Affairs for inviting this presentation

Thank you to Don Gautier of the USGS for making this presentation in our absence

More information:

<http://www.boemre.gov/omm/pacific/production-development-resources/prod-dev-resource-eval.htm>

