

A Culture of the Possible



Continental
RESOURCES

**HISTORY OF TECHNOLOGY
ADVANCEMENTS OIL & GAS IN OKLAHOMA**

3/22/2016

50
YEARS

OF EXPLORATION DISCOVERIES

History of Technology Advancements Oklahoma Oil & Gas



Glen Brown joined Continental Resources in January 2012 and manages exploration/geologic development for the company. Prior to joining Continental, Mr. Brown was in private practice as President of NELLC (10 years), Exploration Manager for EOG Resources Midcontinent Division (12 years) and held various staff/middle management positions with TXO Production Corporation (7 years). Mr. Brown holds a B.S. degree in Geology from the State University of New York in Plattsburgh followed by earning M.S. degree in Geology from New Mexico State University in Las Cruces.

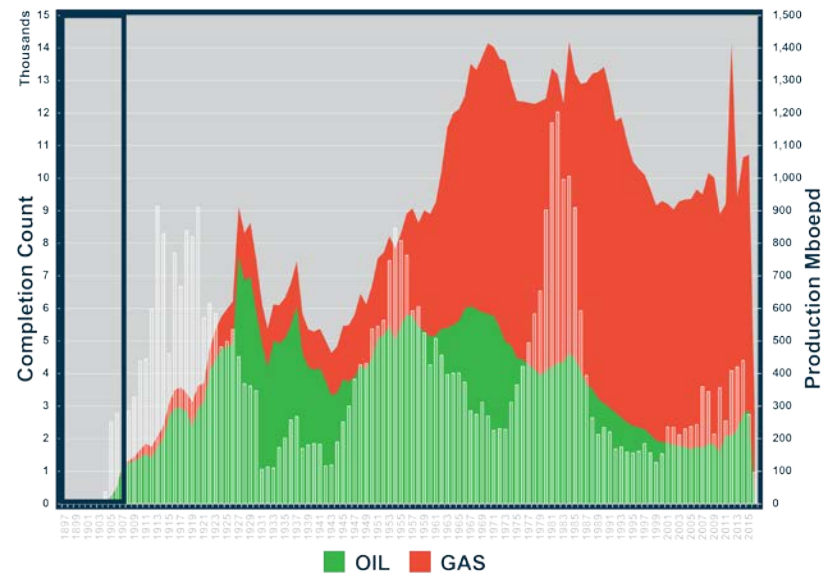
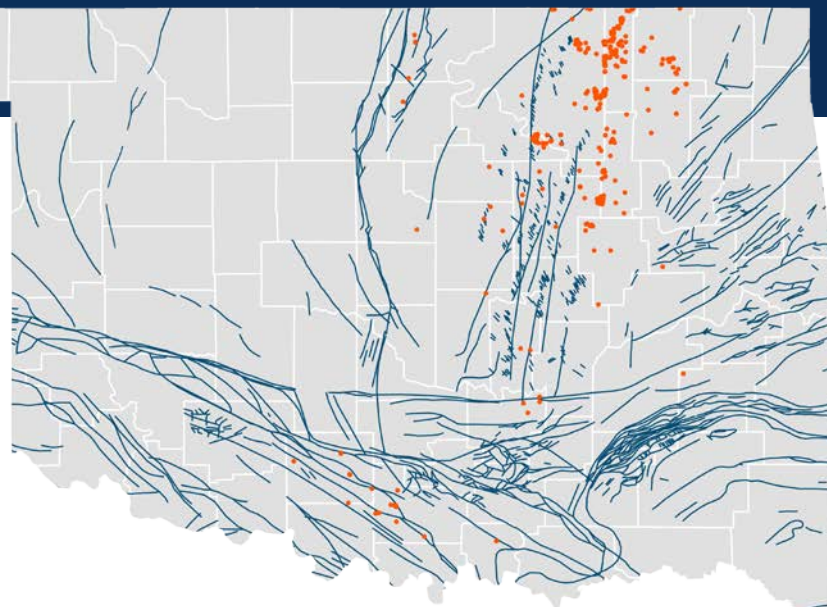
Glen Brown

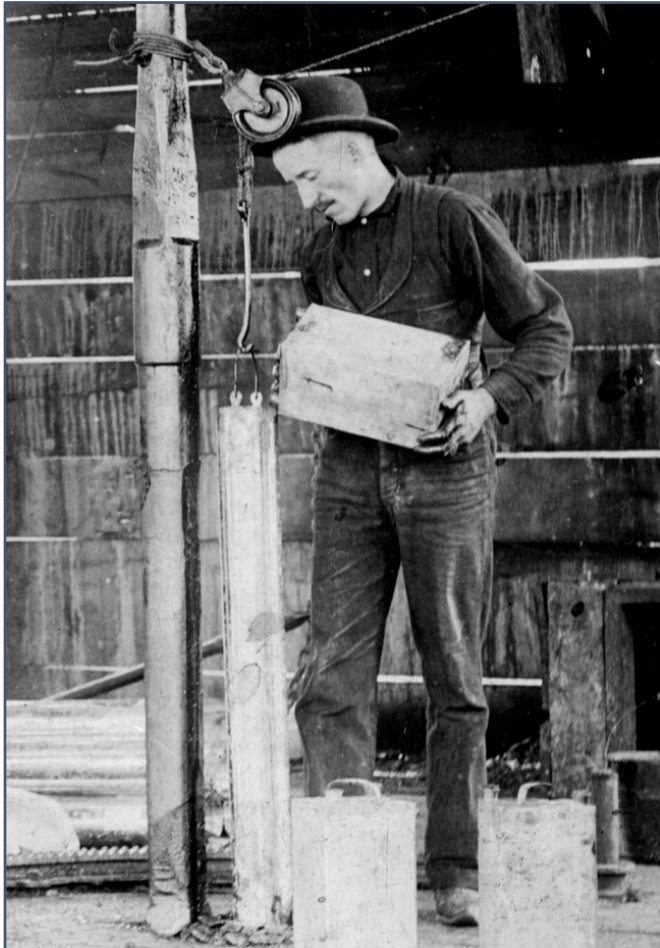
**Sr. Vice President, Exploration
Continental Resources, Inc.**

Oil: \$0.73/bbl | \$18.85/bbl

Inflation adj.

- First U.S. oil well drilled in Titusville, Pennsylvania in 1859.
- Oklahoma Land Run on April 22nd, 1889.
- Early prospecting included Creek-ology and natural oil seeps.
- Nellie Johnstone No. 1 was Bartlesville Field discovery in 1897.
- Glenn Pool was Oklahoma's first significant oil field.
- Early stimulation methods used Nitroglycerine.
- Gasoline priced at \$0.22/gallon.
- U.S. exported oil in late 1800's which sold for \$20/bbl.





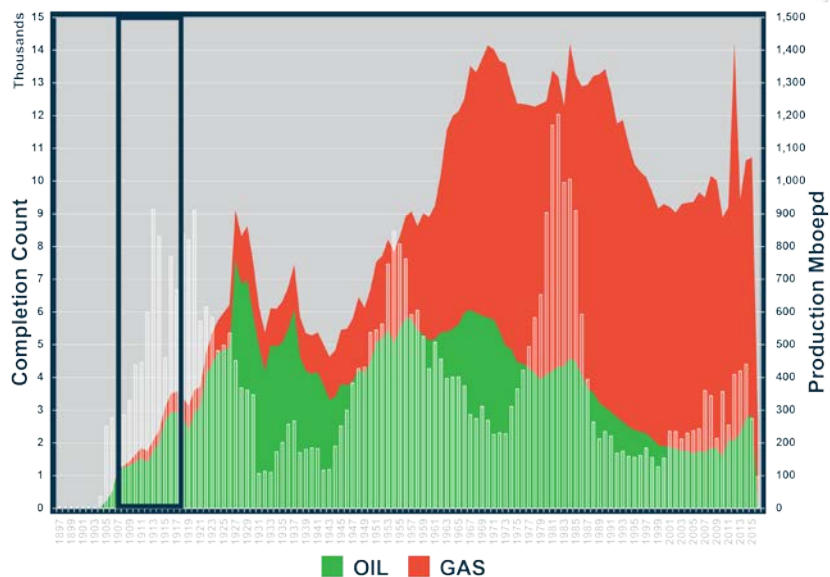
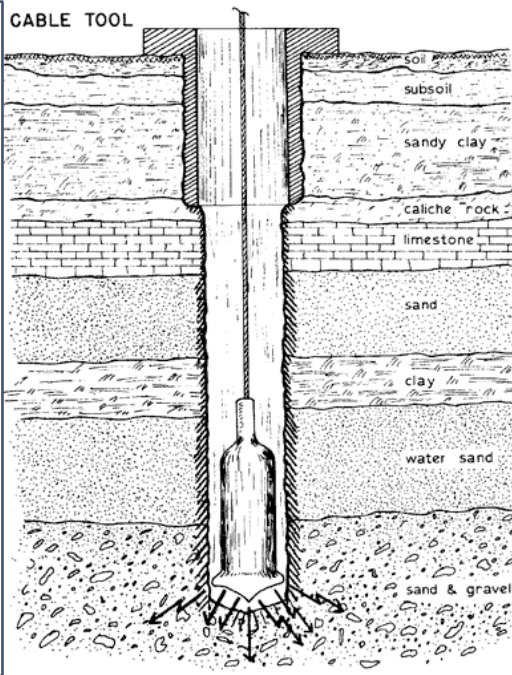
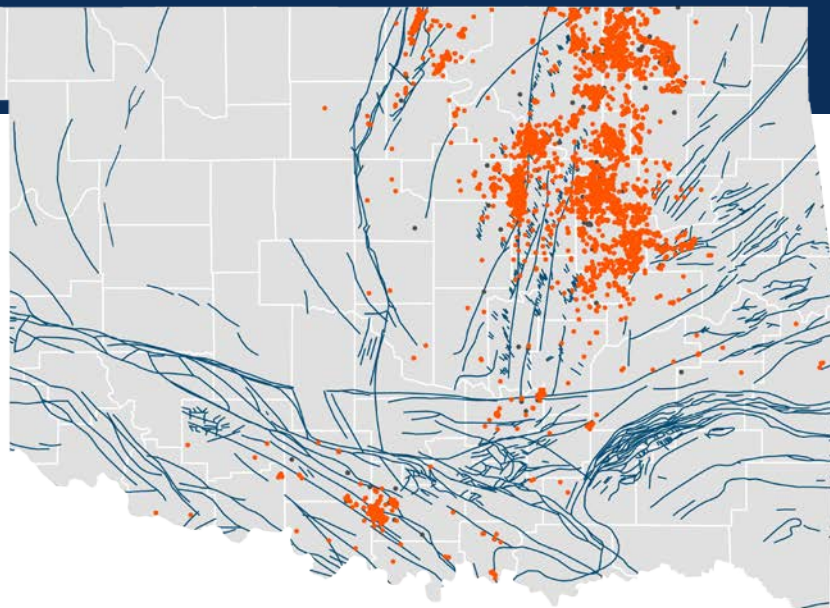
Nitroglycerin was preferred to black powder despite its frequently fatal tendency to detonate accidentally.



First 30 years of drilling was done by inexpensive cable tools rigs with wooden derricks.

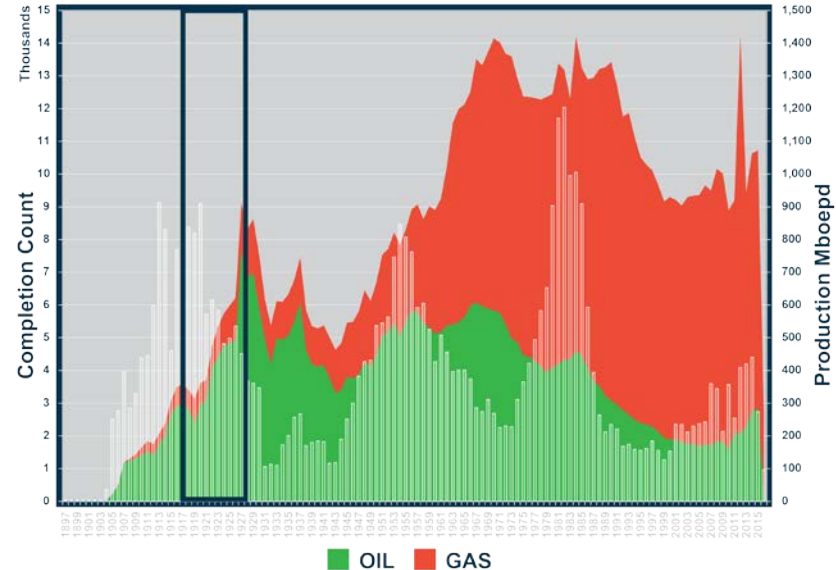
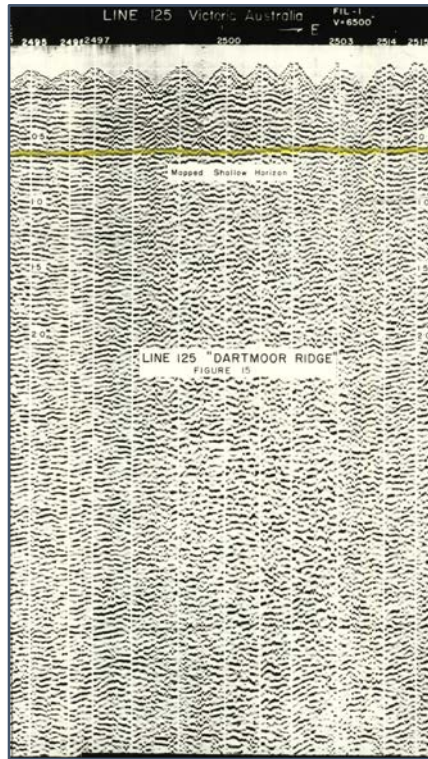
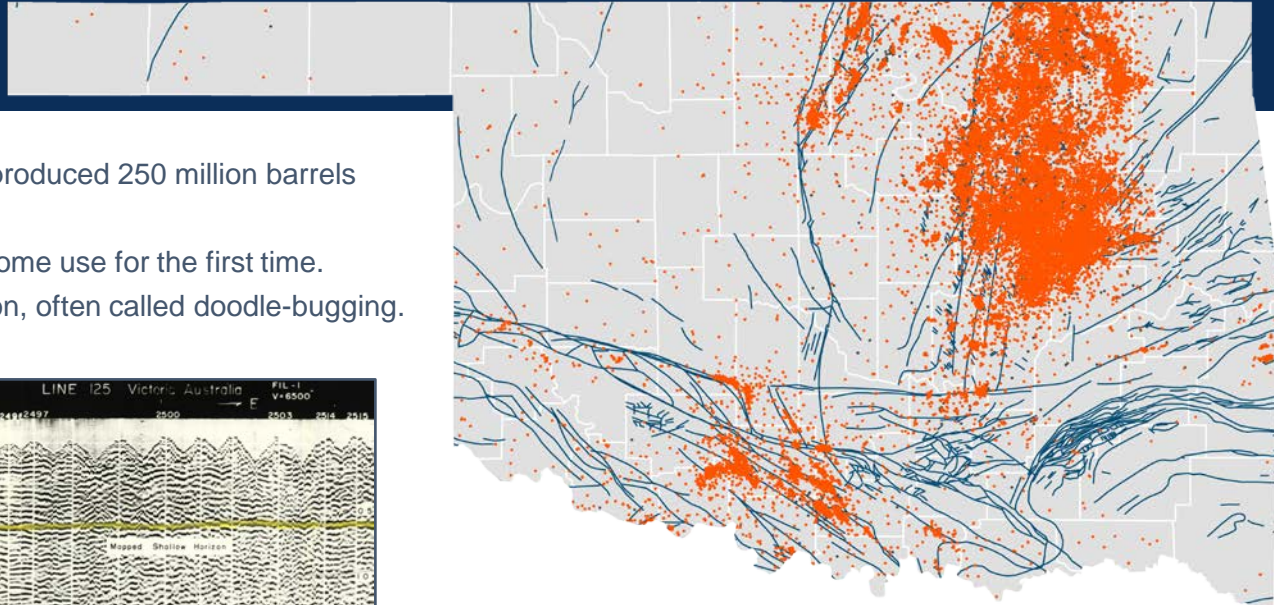
Oil: \$1.56/bbl | \$20.32/bbl

- Marland strikes oil in Ponca City.
- Cushing Field discovered in 1912.
- Cushing, at one time, produced 3% of world's oil.
- In 1913, the U.S. Supreme Court found Rockefeller's Standard Oil in violation of anti-trust laws and ordered its dissolve separating Standard Oil and Continental Oil who was prominent in Oklahoma.



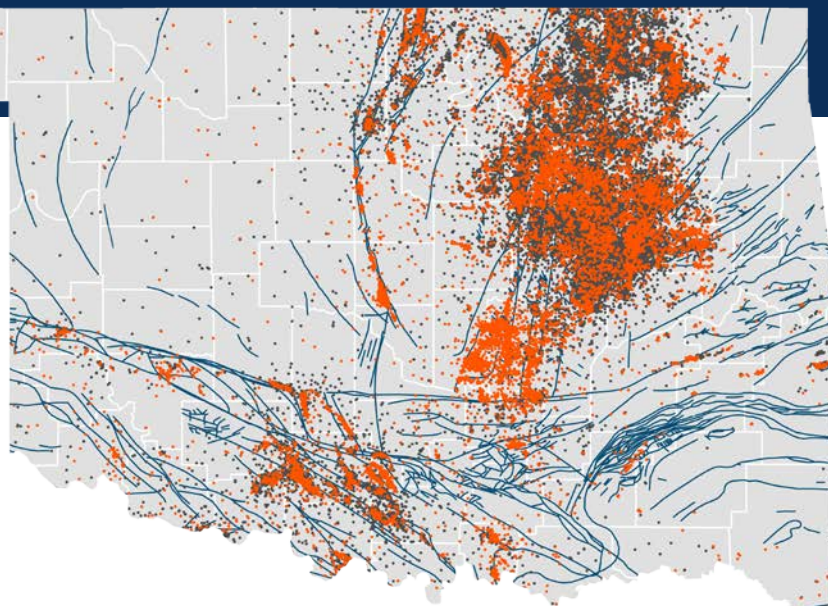
Oil: **\$1.88/bbl** | **\$24.73/bbl**
 Gas: **\$0.10/mcf**

- Greater Seminole Field's discovery well produced 250 million barrels within the first 6 years.
- Phillips Petroleum markets propane for home use for the first time.
- Single-fold seismic first used in exploration, often called doodle-bugging.



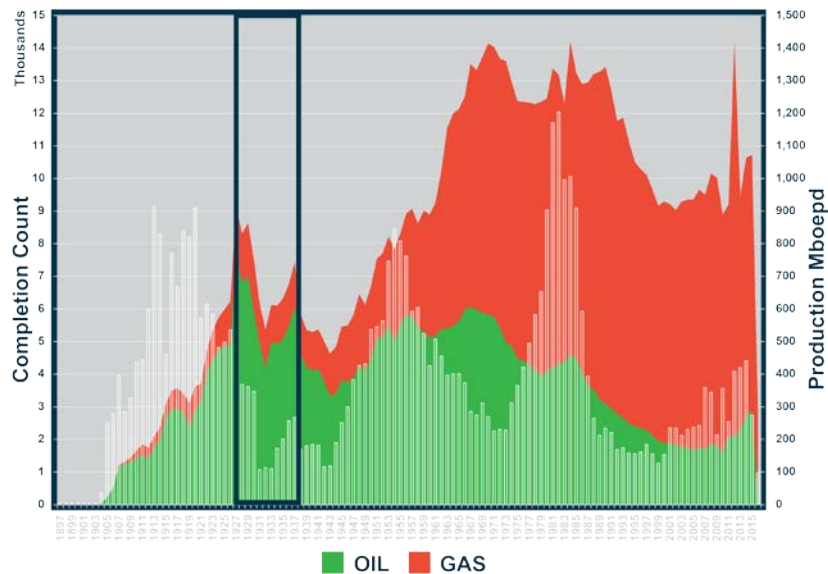
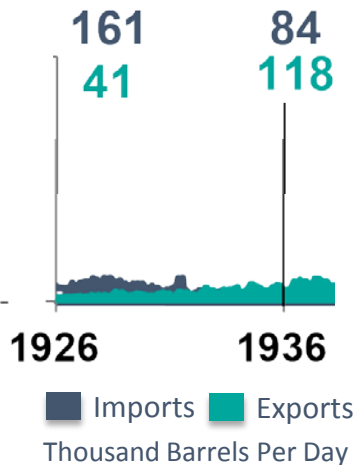
Oil: \$1.09/bbl | \$18.32/bbl
 Gas: \$0.06/mcf

- Modern geology, or Anticline theory, replaced Creek-ology guessing.
- Electric well logging was first used.
- Marland Oil and Continental Oil merged, forming Conoco.
- Oklahoma City Field discovered.
- 3,300 miles of natural gas pipeline was constructed nationally.
- First tri-cone bit developed.
- Rotary rigs became prevalent.

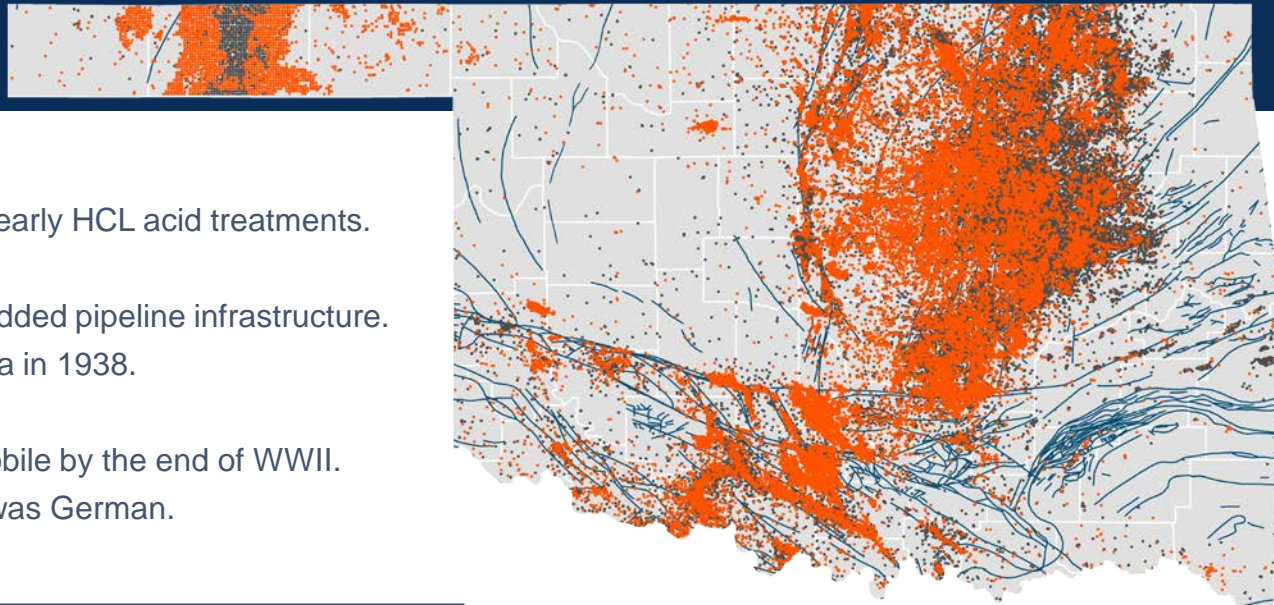


Hughes Tri-Cone Drill Bit

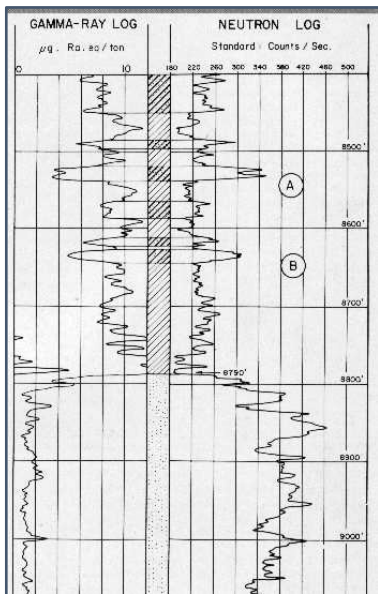
U.S. Exports vs. Imports



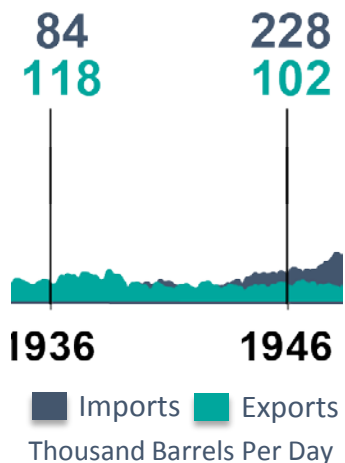
Oil: \$1.12/bbl | \$13.35/bbl
 Gas: \$0.05/mcf



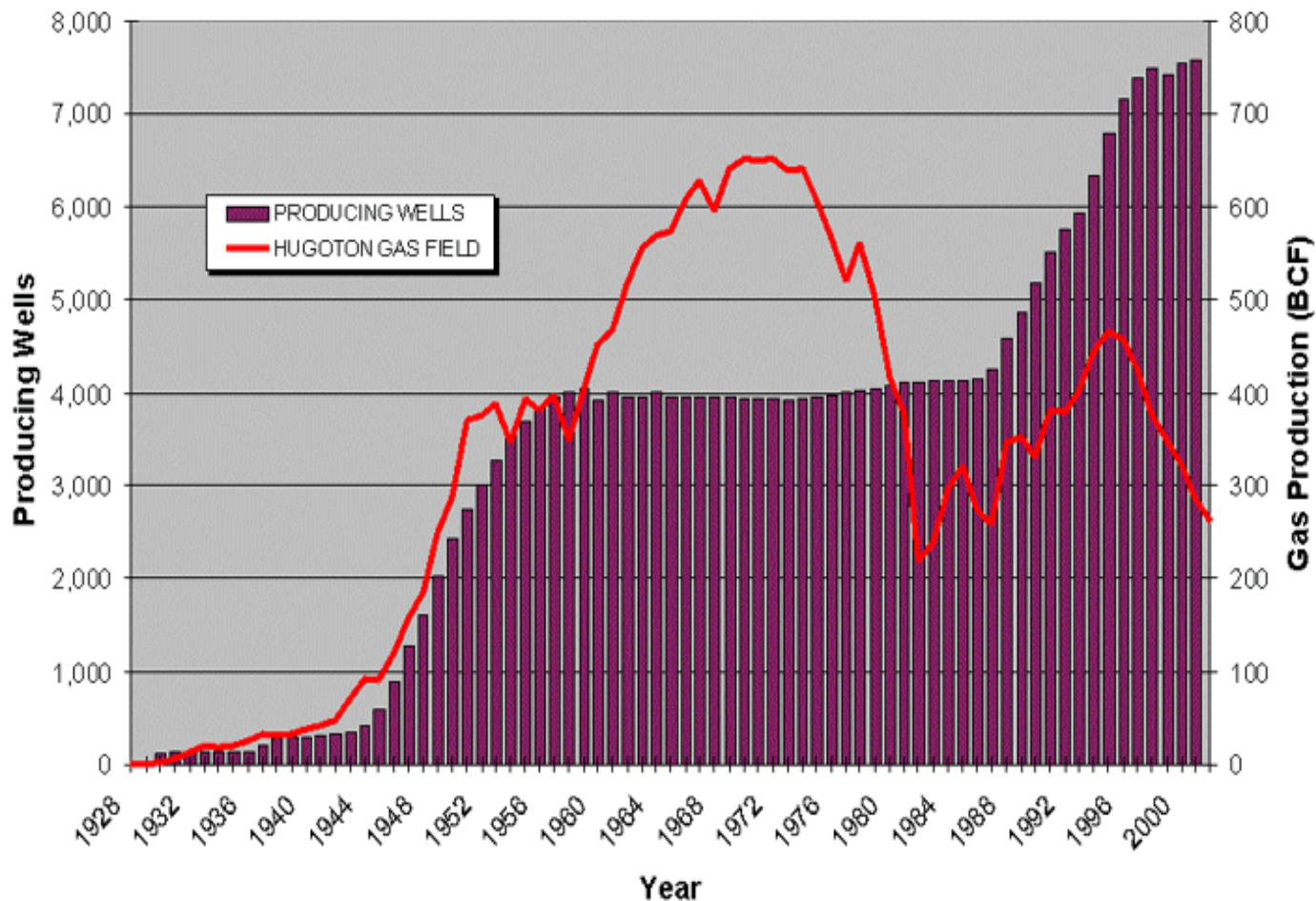
- Neutron Log developed.
- West Edmond Field opened up with early HCL acid treatments.
- Directional drilling techniques began.
- Hugoton Gas Field developed with added pipeline infrastructure.
- U.S. firms discover oil in Saudi Arabia in 1938.
- 4.5 million cars made by 1941.
- 10% of Americans owned an automobile by the end of WWII.
- First computer in the world, the Z4, was German.



U.S. Exports vs. Imports



Hugoton Field



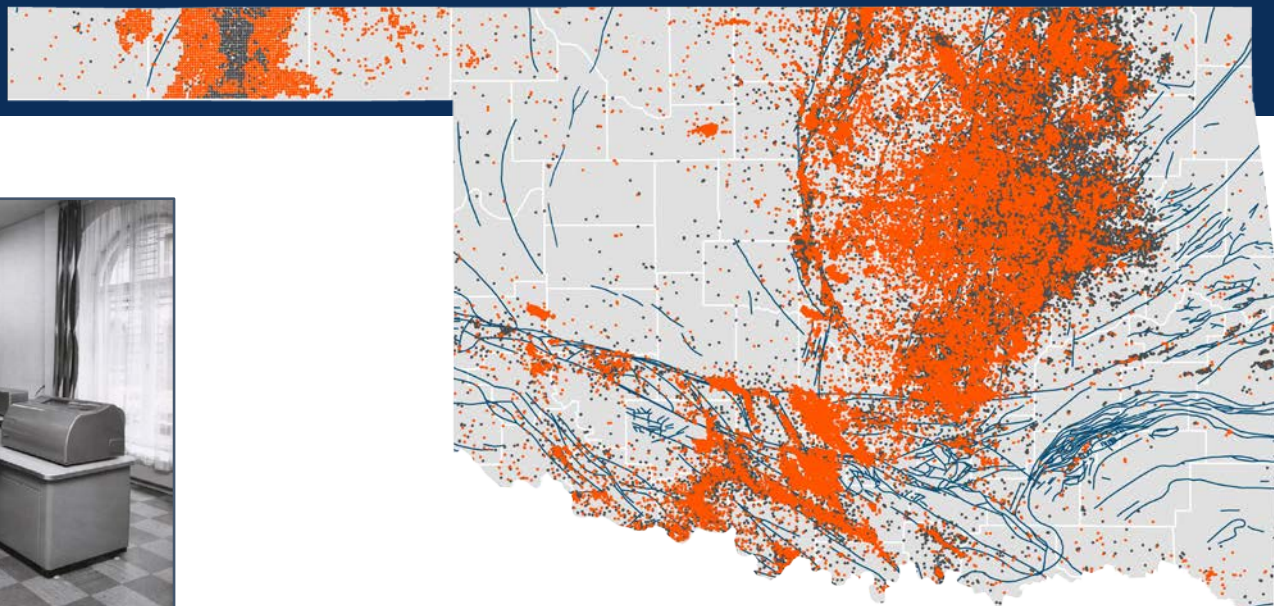
1947 - 1956

WELL COUNT: DECADE 74,672 | STATE TOTAL TO DATE 210,193

DECADE AVG: 488,254 bopd / 1.5 Bcfd

Oil: \$1.90/bbl | \$15.71/bbl

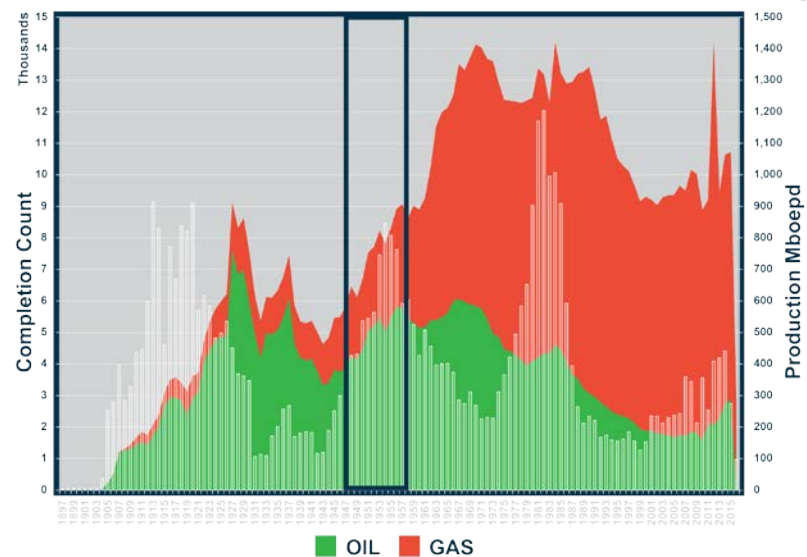
Gas: \$0.11/mcf



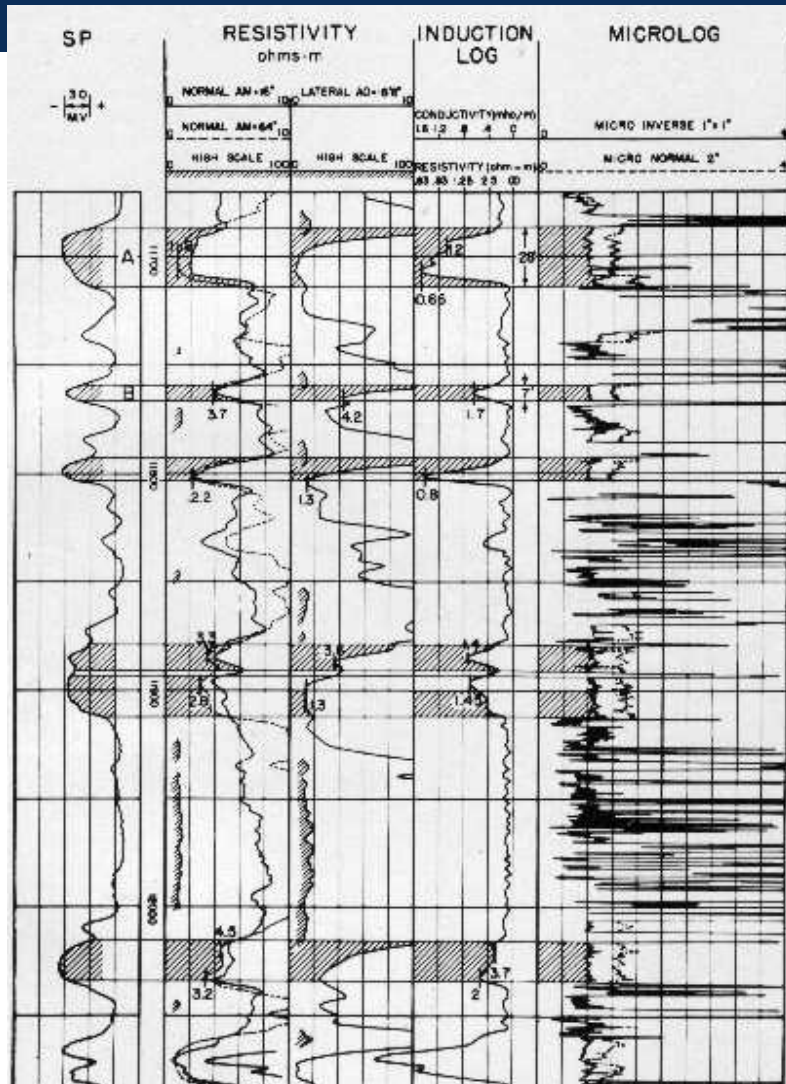
First digital computer called Pegasus in 1956.



Amoco, formerly Stanolind Oil, invented first Hydro-sand stimulation.



■ OIL ■ GAS



LANE *Electrolog* WELLS COMPANY

Location of Well
C5698C
 Signal Oil & Gas
 s. l. s. e 292.1-9

COMPANY: SOUTHWEST EXPLOR. CO.
WELL: STATE 92
RUN NO.: _____ **FILING NO.:** _____
FIELD: HUNTINGTON BEACH
SURVEY: SEC 4-6S-11W
COUNTY OR PARISH: ORANGE
STATE: CALIFORNIA

COUNTY OR PARISH: ORANGE
FIELD OR SURVEY: HUNTINGTON BEACH
WELL: STATE 92
COMPANY: SOUTHWEST EXPLOR. CO.

Elevation: _____

DIAMETER OF HOLE

Run No.	1	2	3	4
Run No. 1	32			
Run No. 2				
Run No. 3				
Run No. 4				

Log Data:

Item	1	2	3	4
Date	10/9/48			
Cg. Shoe—Driller	751			
Cg. Shoe—Elect.	748			
Total Depth—Driller	5320			
Total Depth—Elect.	5313			
Footage Recorded	4564			
Mud—Kind	NATURAL			
Weight				
Visc.				
Res.				
Recorded by	LEIDENKER			
Depth of Penetration	2' - - -			
Curve No. 3				
Curve No. 4				

Depths measured from: KELLY BUSHING

REMARKS

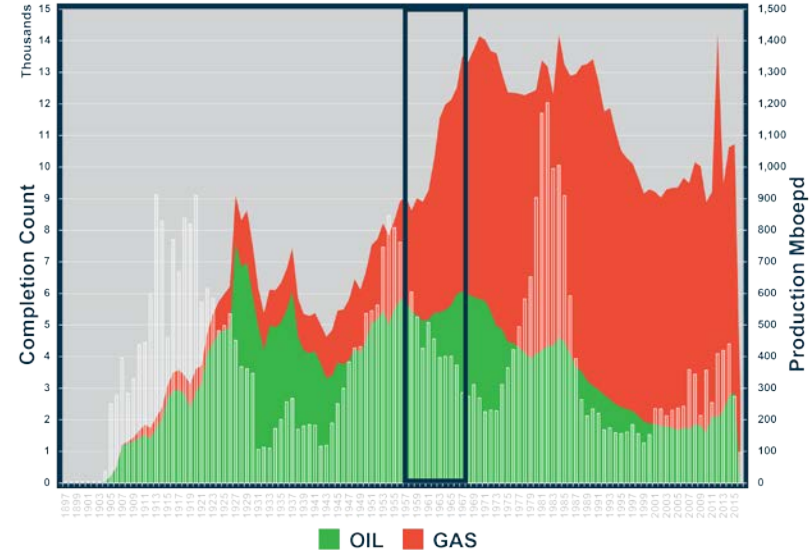
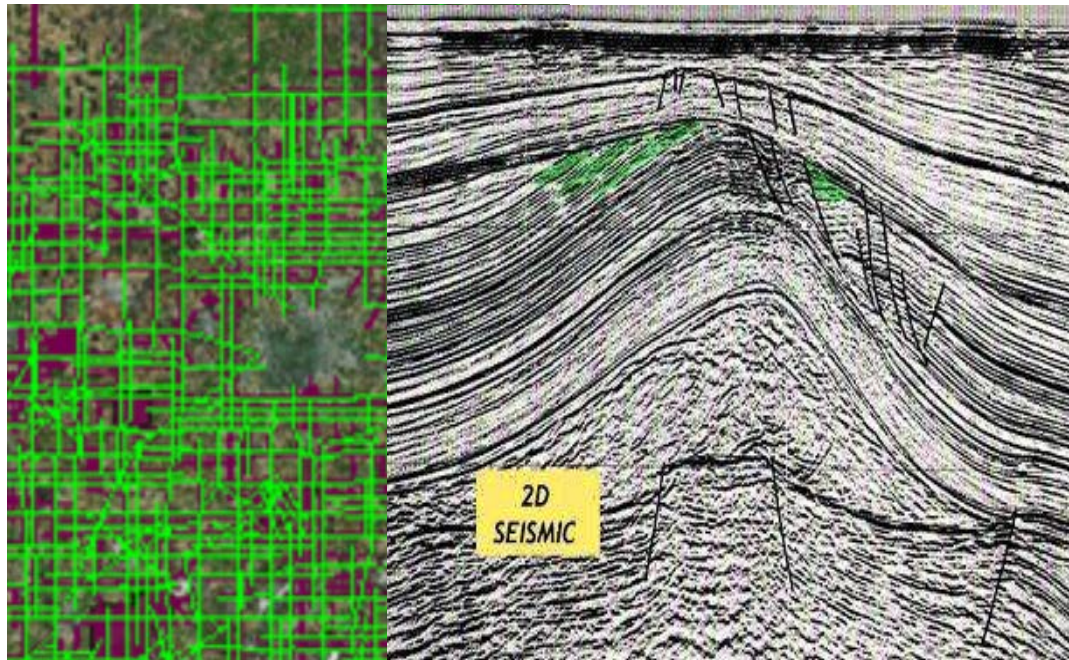
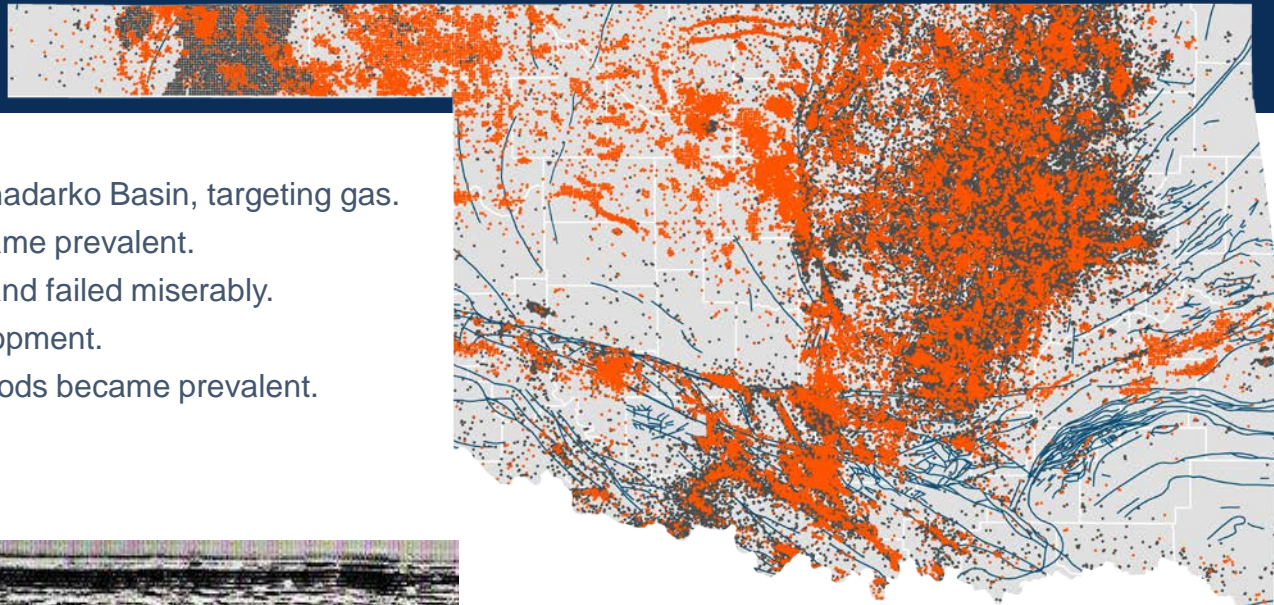
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Depth	DETAIL RESISTIVITY		NATURAL POTENTIAL	
	Shallow Penetration—Curve 2	Deep Penetration—Curve 2	Natural Potential—Curve 1	
0	16 OHMS	40 OHMS	100 MILLVOLTS	

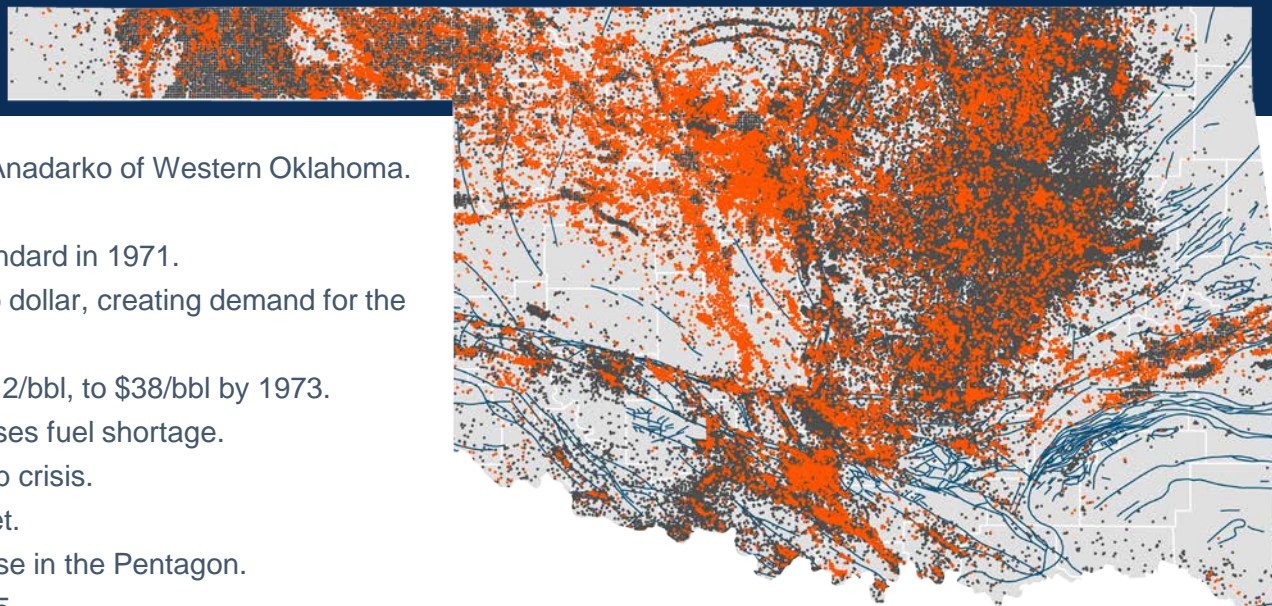
Blind Spot Technology Logging

Oil: **\$1.80/bbl** | **\$12.92/bbl**
 Gas: **\$0.16/mcf**

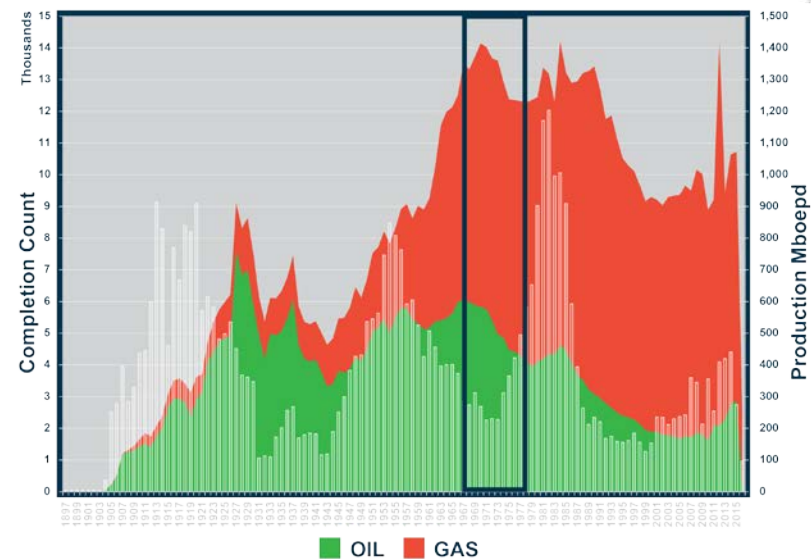
- Drilling pushes to deeper depths of Anadarko Basin, targeting gas.
- Secondary Recovery techniques became prevalent.
- Glass beads were used as proppant and failed miserably.
- Sooner trend extensive vertical development.
- 2D Seismic and modern logging methods became prevalent.
- 11 million cars produced.

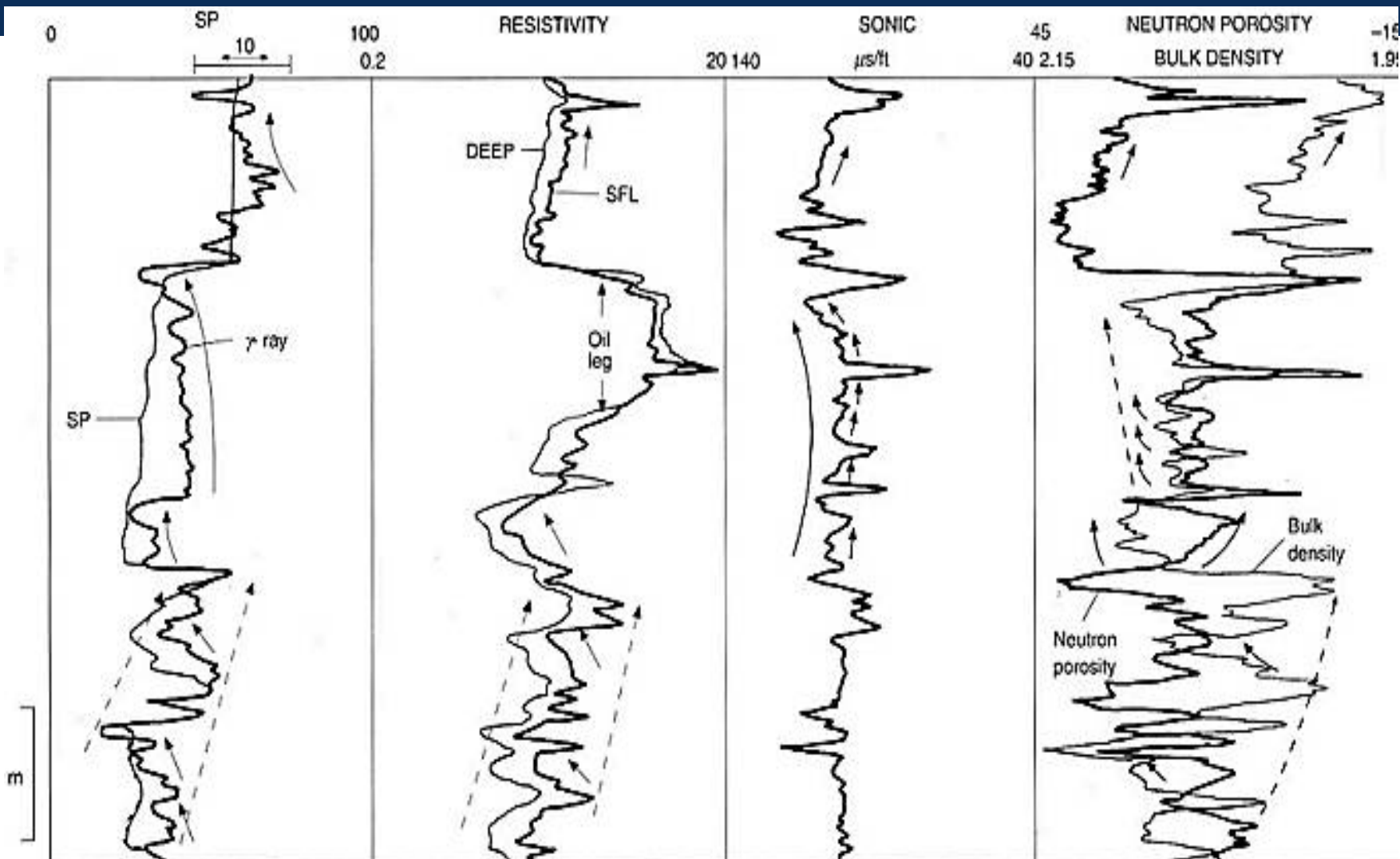


Oil: \$12.80/bbl | \$52.39/bbl
 Gas: \$0.58/mcf



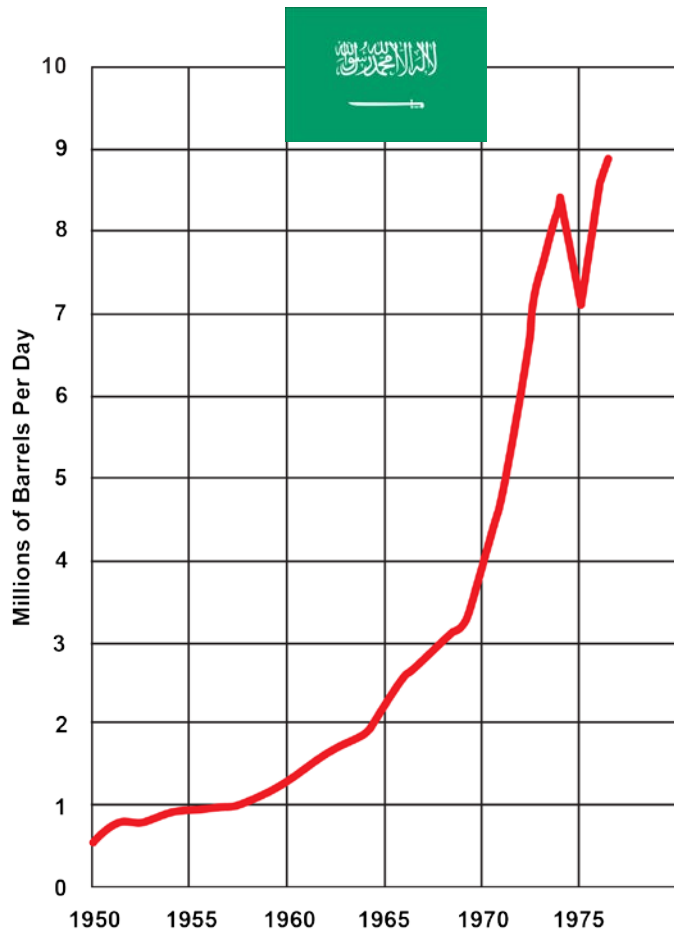
- Record drilling depth of 31,441 ft. in deep Anadarko of Western Oklahoma.
- Continental Resources drilled its first well.
- Nixon removes the dollar from the gold standard in 1971.
- Arabs agree to oil price in dollars, the petro dollar, creating demand for the dollar in exchange for military protection.
- Oil shock: oil price moves from \$3/bbl to \$12/bbl, to \$38/bbl by 1973.
- Arab Embargo due to Yam Kippur war causes fuel shortage.
- U.S. blocks exports of oil as a result of Arab crisis.
- US production Peaks and imports skyrocket.
- Shell Oil computer systems larger than those in the Pentagon.
- Hand calculators replace slide rules in 1975.
- Xerox introduced the 6500, the first electrostatic color copier, eliminated the need for tracing paper.



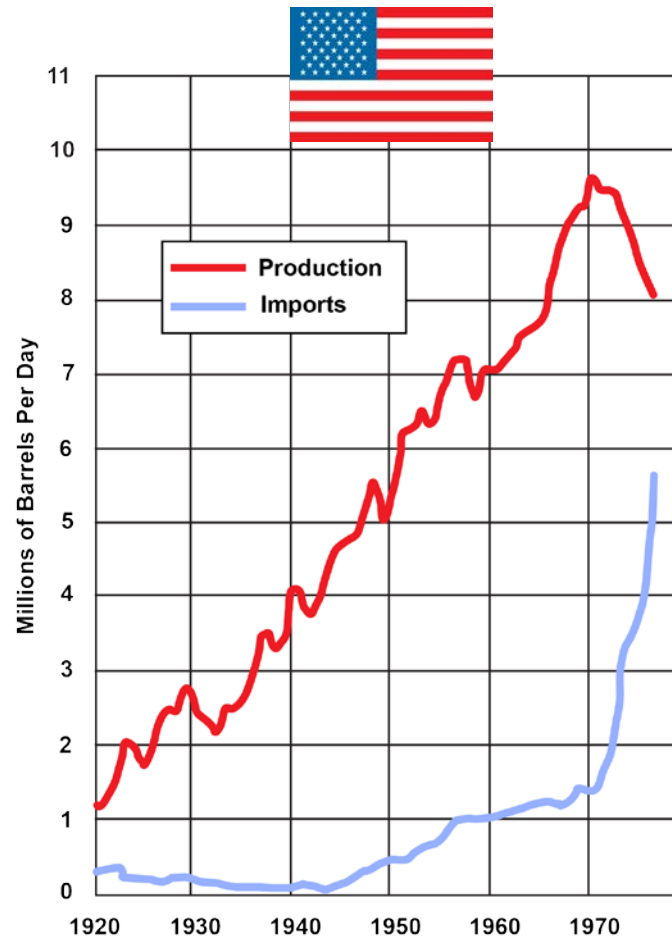


The End of Blind Spot Technology Logging

Saudi Arabia Production climbs to 9 MMBopd



U.S. import hikes



Arab Embargo due to Yam Kippur war causes fuel shortage.



Americans go to work to power America!

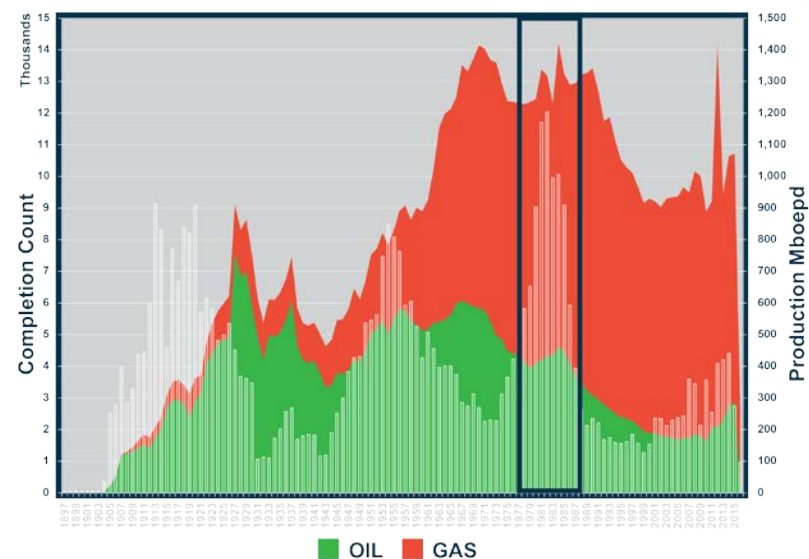


Oil: \$14.43/bbl | \$30.67/bbl
 Gas: \$1.94/mcf

- Oil politics arrive, moving away from simple supply/demand model.
- President Reagan de-regulated natural gas pricing.
- Oklahoma's 1982 rig count of 882 drops to 189 by 1986.
- Pad-acid jobs on carbonate reservoirs 10,000 gallons in size.
- Anadarko mega-pressured compartment recognized.
- Completion sand ramps up to 4 lbs/gal.
- Geophysical workstations become available.



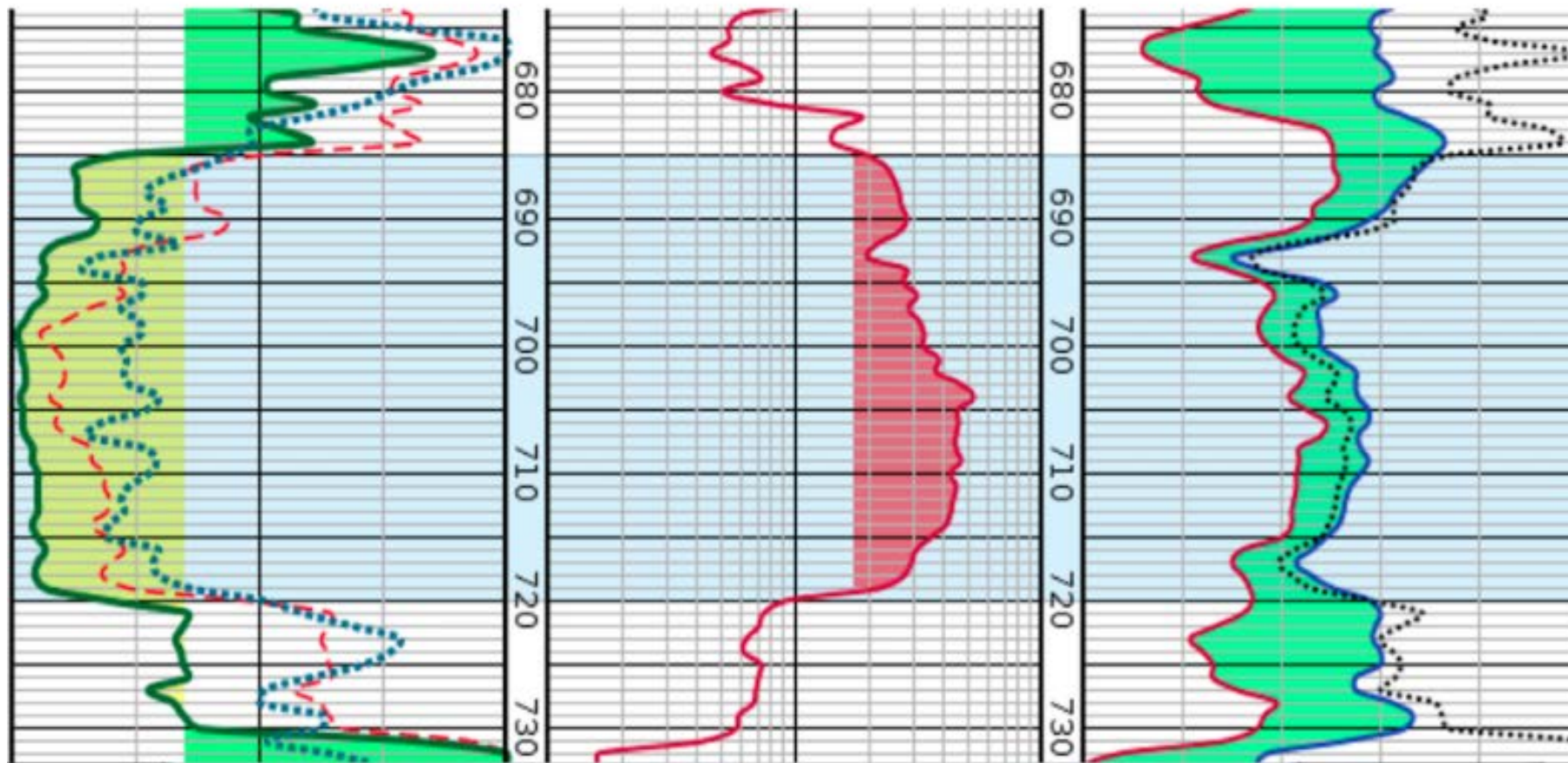
Continental Resources' first geophysical workstation



GR

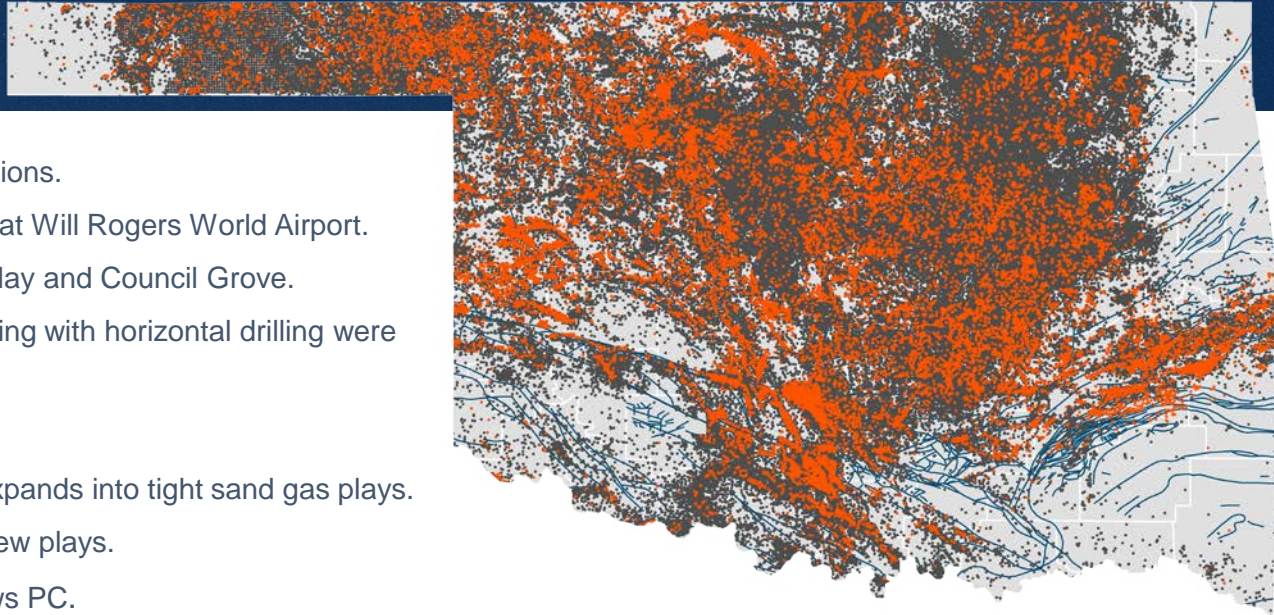
RES

POROSITY

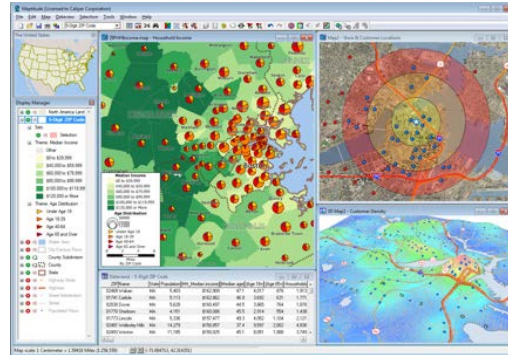
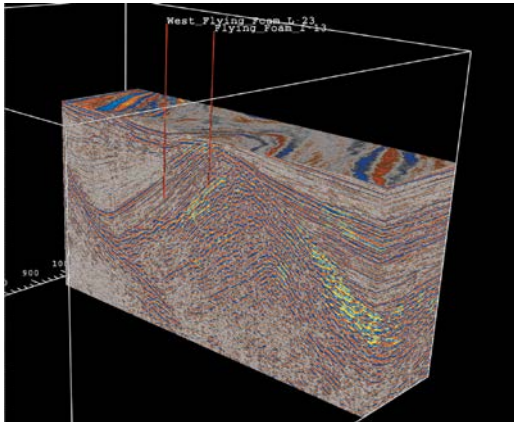


Modern Logging complete with PE Litho-density curve

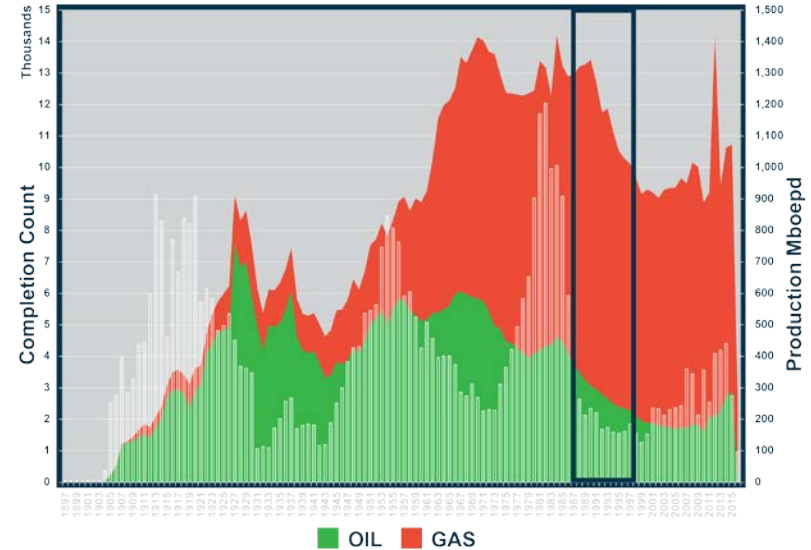
Oil: \$20.67/bbl | \$30.69/bbl
Gas: \$2.17/mcf



- First commercial horizontal oil well applications.
- TXO applies directional drilling techniques at Will Rogers World Airport.
- Horizontal drilling picked up in Cleveland play and Council Grove.
- New technique combining hydraulic fracturing with horizontal drilling were being adopted.
- Well logging delivery via fax being used.
- Coalbed methane tax credit, Section 29, expands into tight sand gas plays.
- Widespread use of 3D seismic opens up new plays.
- Geo-Graphix software released on Windows PC.

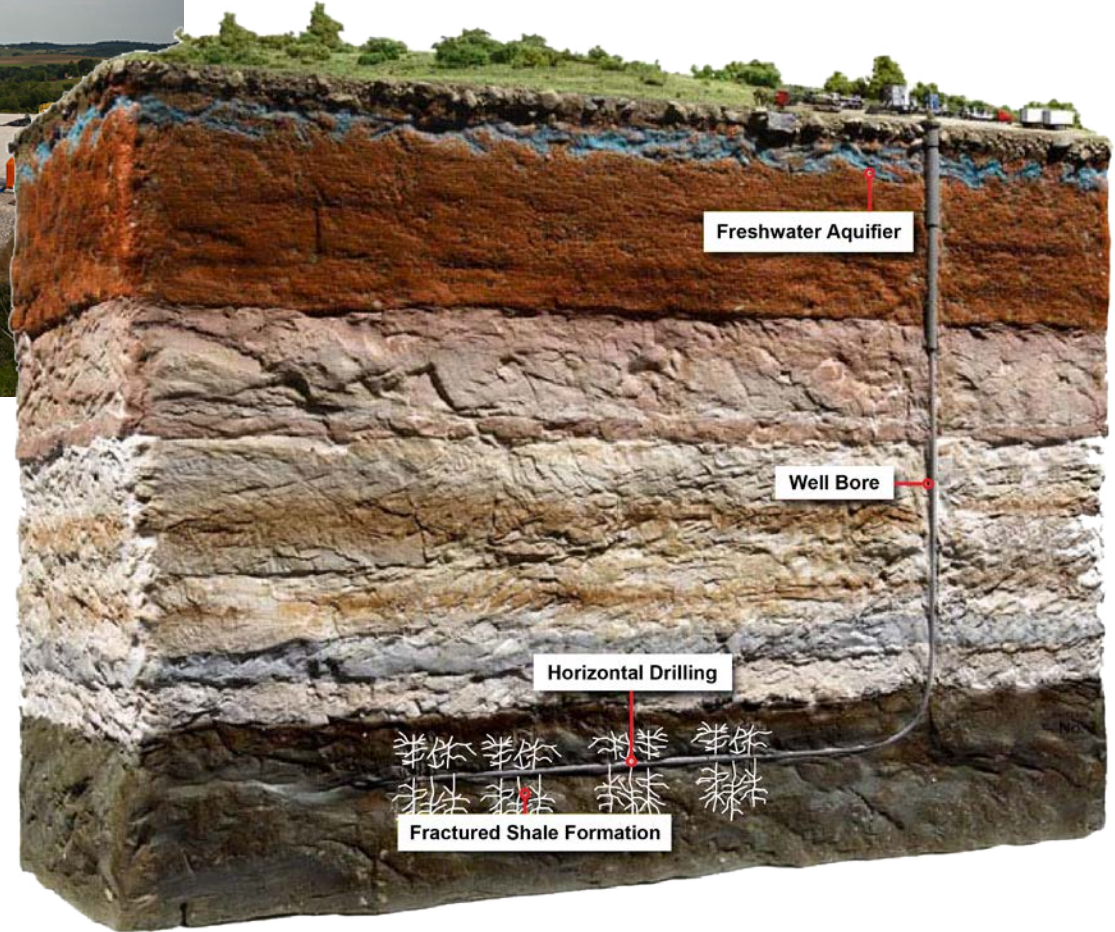


GeoGraphix

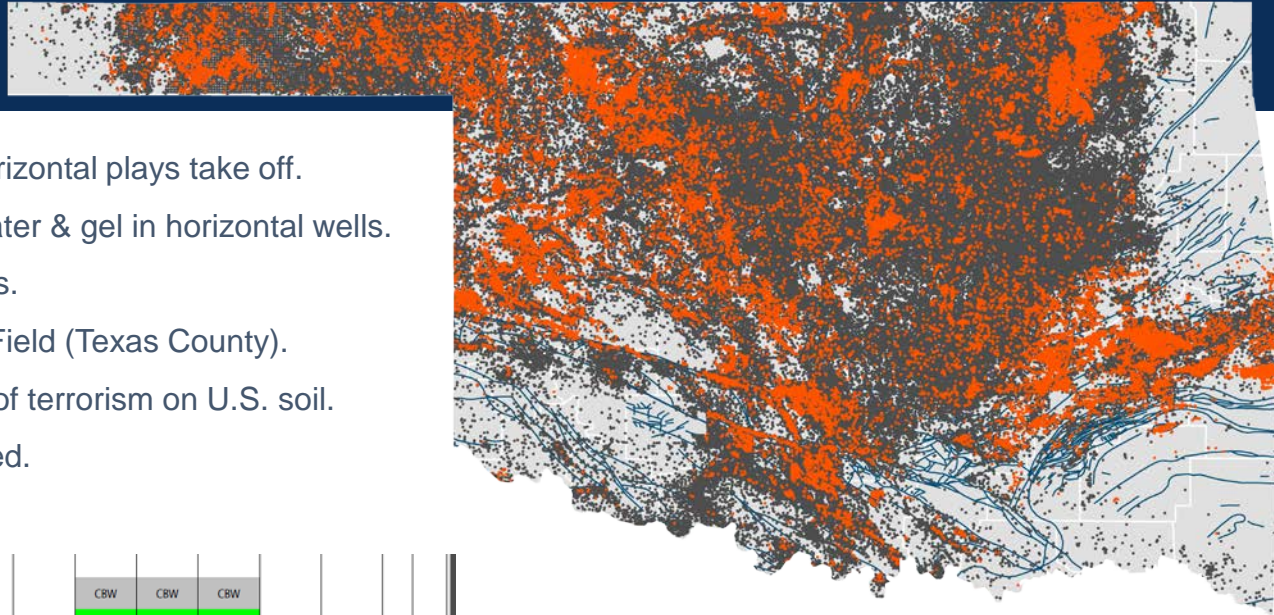




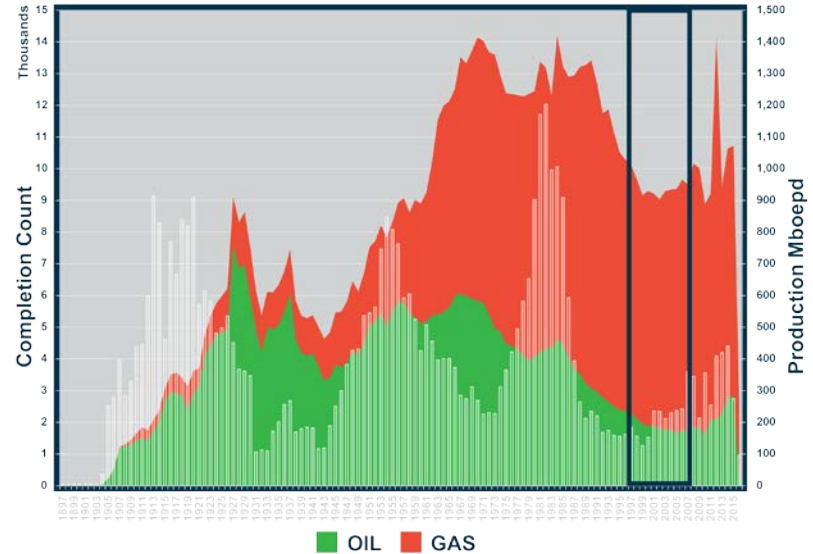
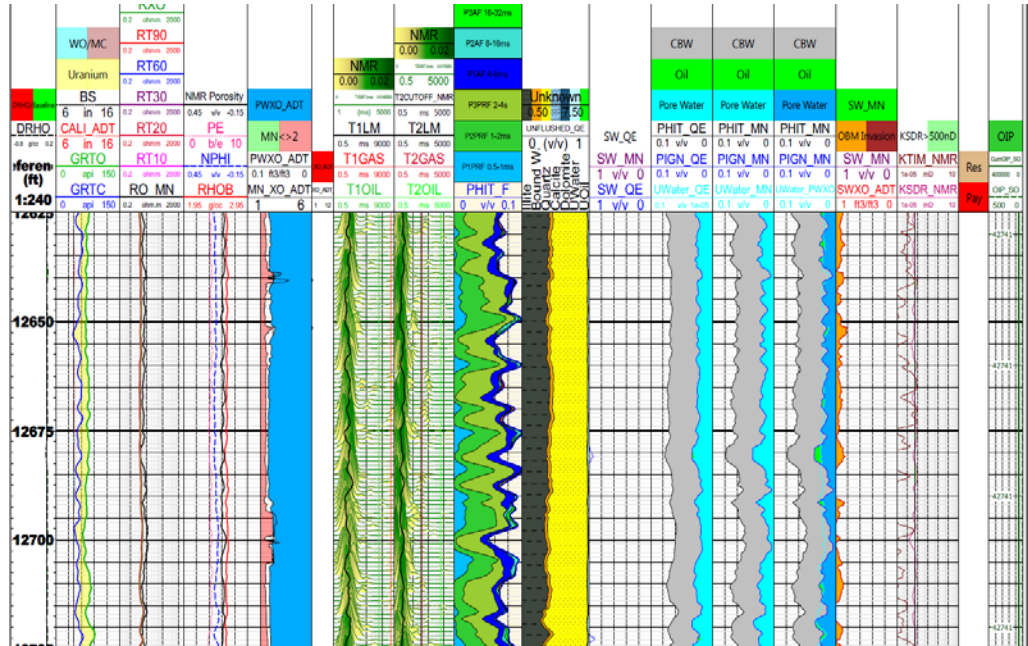
New technique combining hydraulic fracturing with horizontal drilling were being adopted.



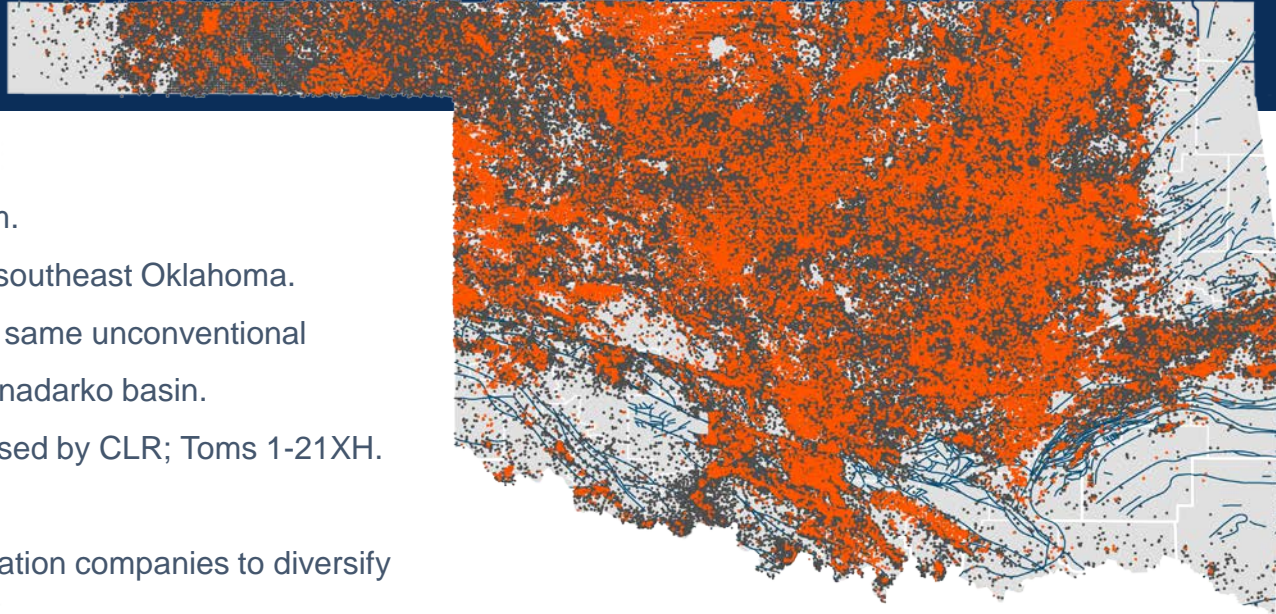
Oil: \$65.14/bbl | \$75.28/bbl
 Gas: \$6.39/mcf



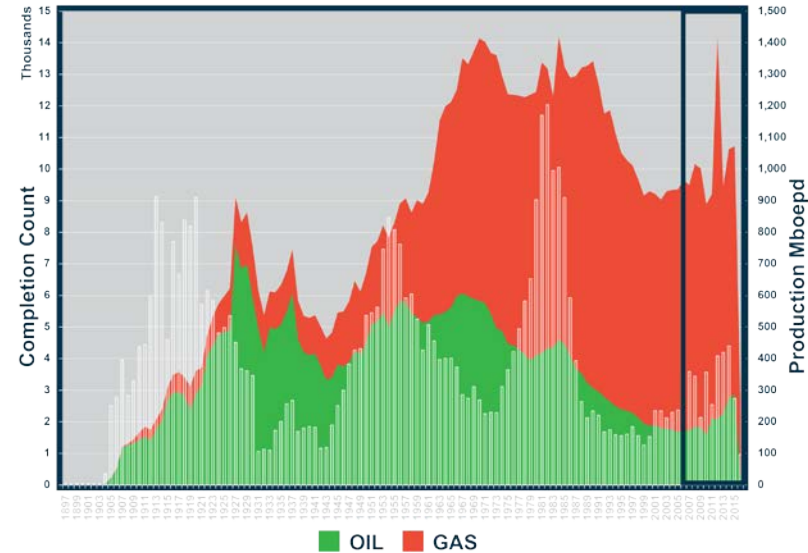
- Granite Wash, Redfork, Cleveland horizontal plays take off.
- Larger stimulations using both slickwater & gel in horizontal wells.
- Arkoma Woodford shale play emerges.
- First CO2 Flooding applied in Postle Field (Texas County).
- September 11th, 2001: Deadliest act of terrorism on U.S. soil.
- Modern shale logging suites introduced.

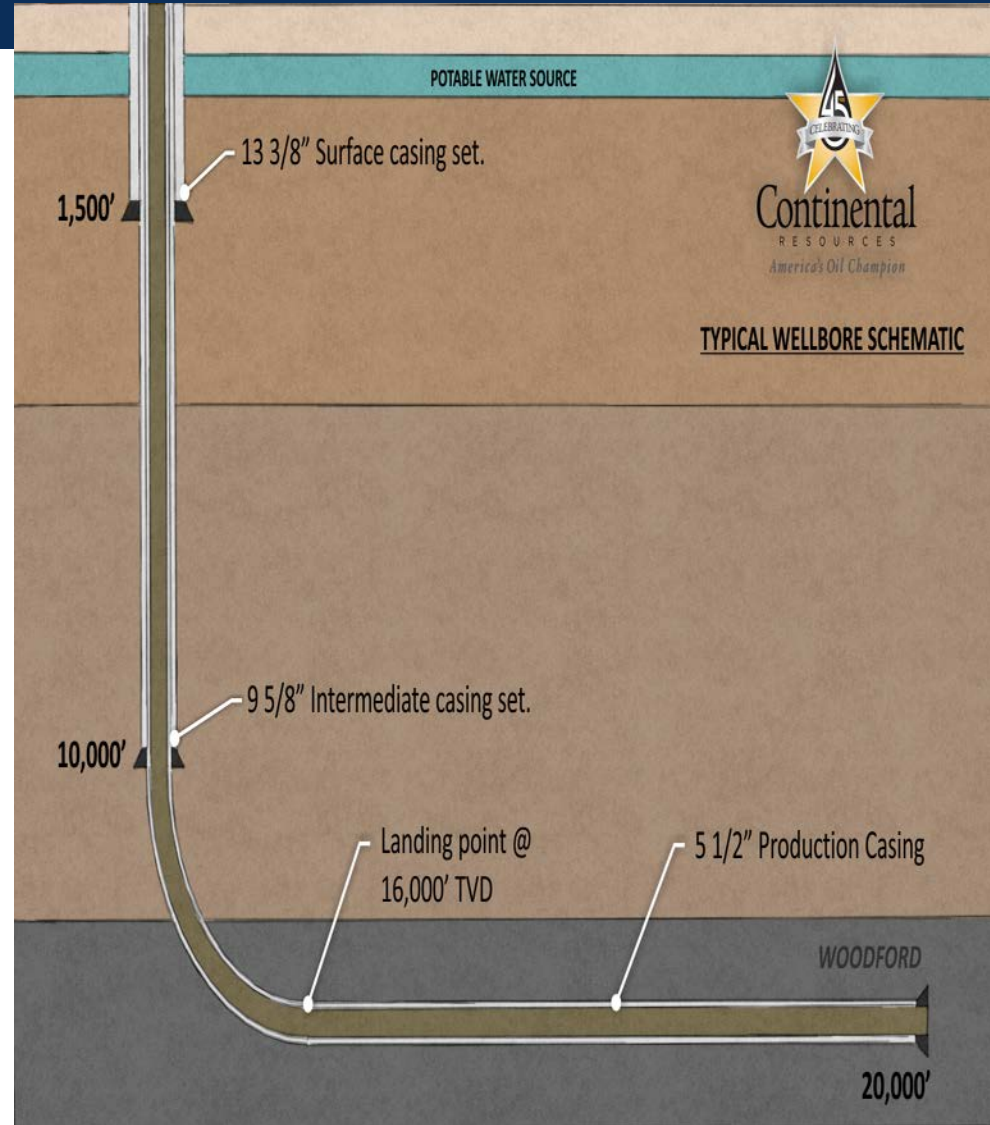


Oil: **\$51.13/bbl**
 Gas: **\$2.66/mcf**

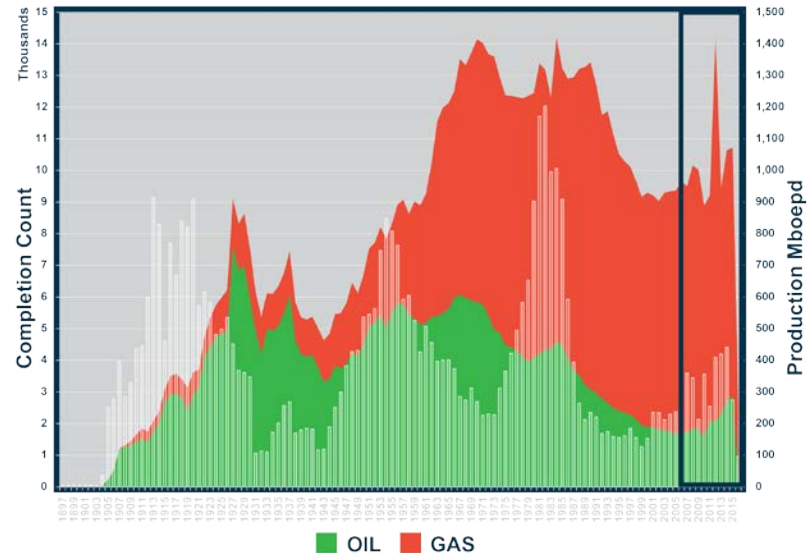
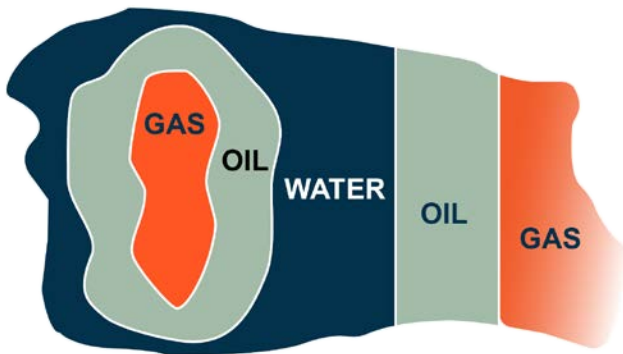
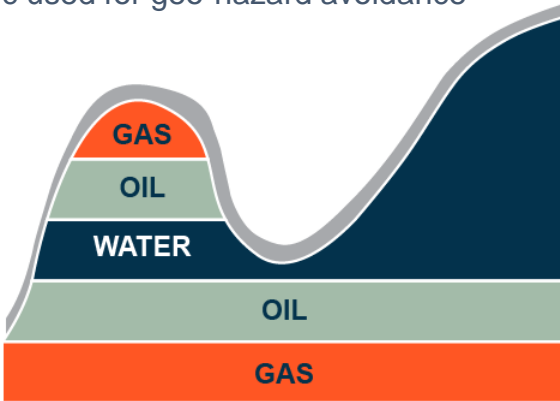
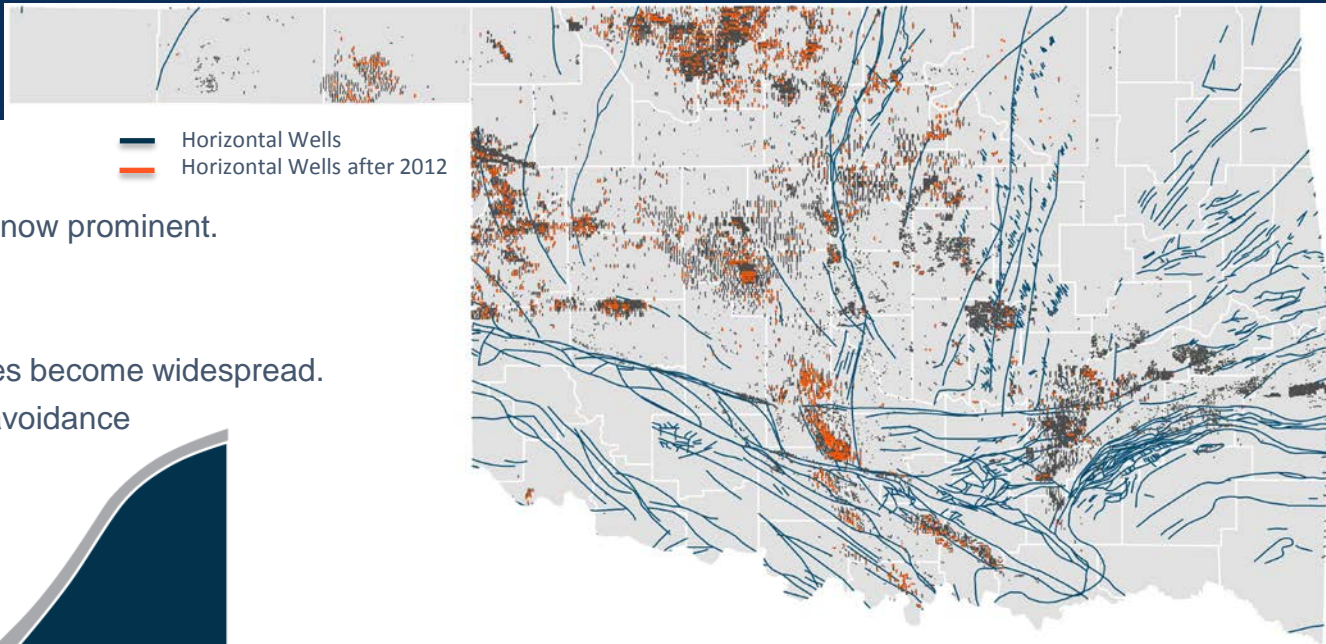


- Horizontal drilling becomes the norm.
- CLR acquires Woodford position in southeast Oklahoma.
- CLR discovers SCOOP and applies same unconventional techniques to the Woodford in the Anadarko basin.
- First Woodford multi-unit statue passed by CLR; Toms 1-21XH.
- Springer play discovered.
- Gas Market crash forces gas exploration companies to diversify to more oil-rich plays.
- Mississippi/Hunton dewatering play prevalent across northern Oklahoma.
- STACK emerges as new top play in U.S.
- 95% of all rigs in Oklahoma are now horizontal.
- 19% of U.S. oil is used in petrochemical industry.
- U.S. oil export ban lifted, as U.S. shifts to swing producer.
- Oil politics come back into play, OPEC floods market.

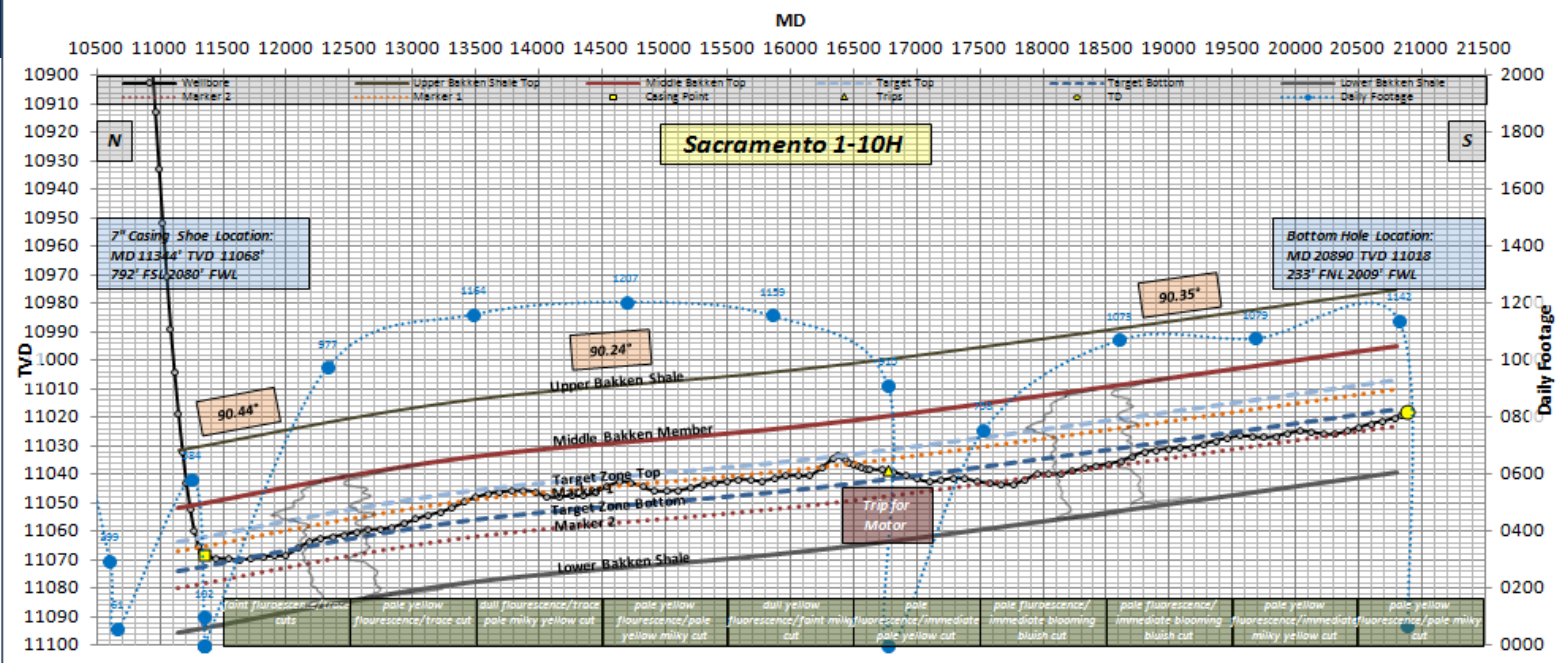




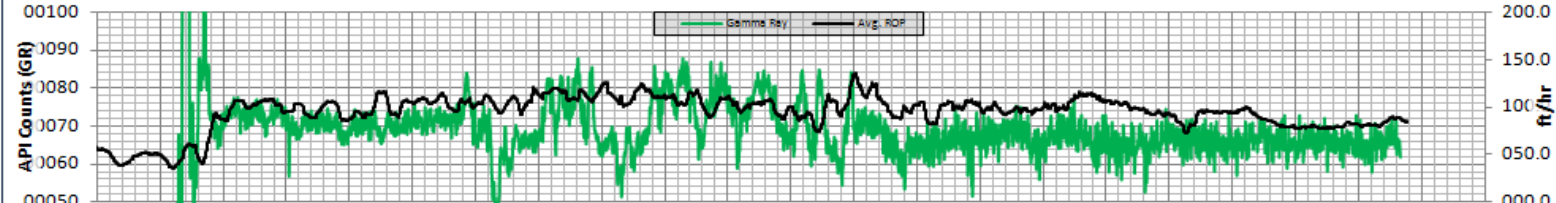
- Reversed drilling in the kitchen is now prominent.
- Water above oil above gas.
- Exploration world is upside down.
- Enhanced geo-steering capabilities become widespread.
- 3D seismic used for geo-hazard avoidance



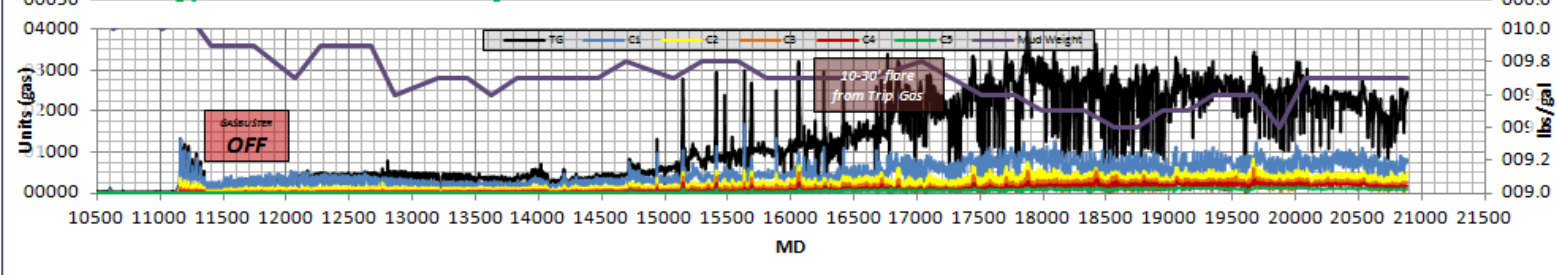
Target



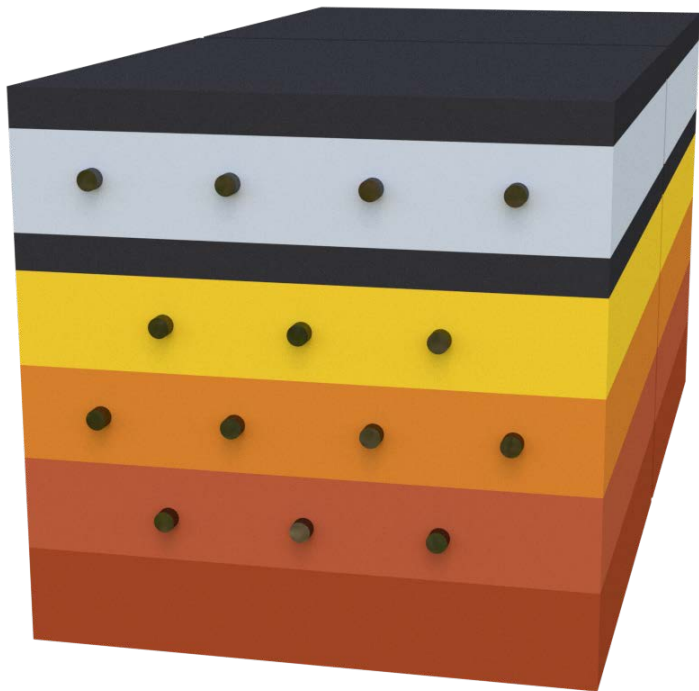
Gamma/ROP



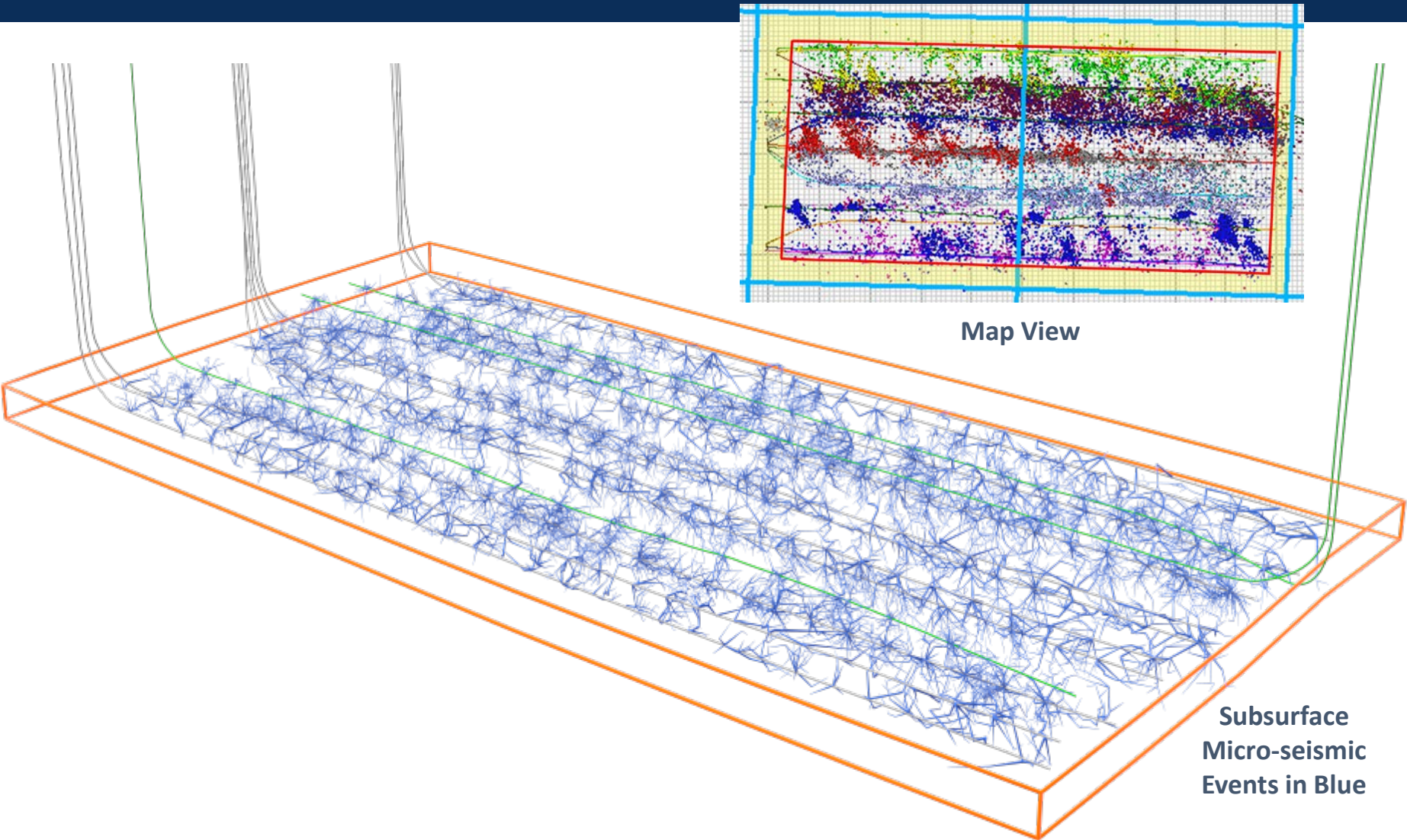
Gas



- Typical unit development, 640 to 1280-acre units.
- Wine Rack pad development.
- Eco-Pads; multi-well pad drilling.
- SIMOPs; drilling-while-completing.
- Walking Rigs
- Larger Stims



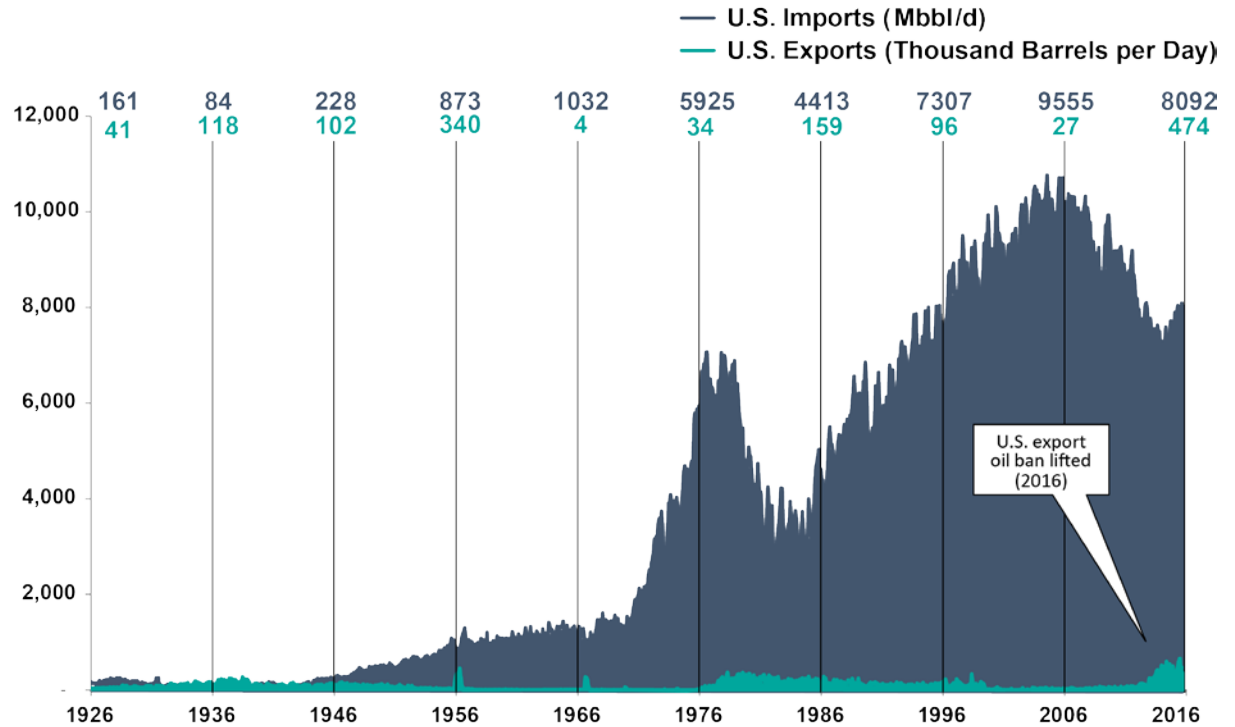
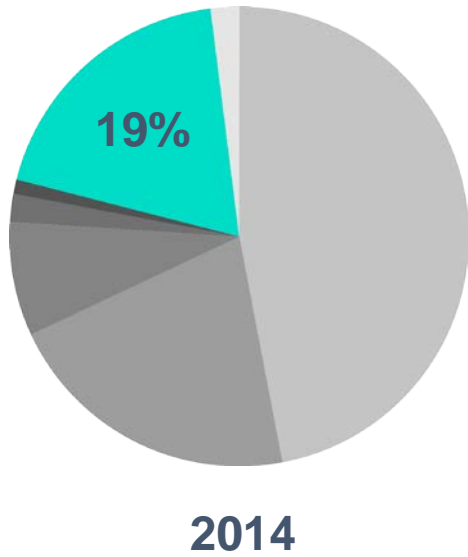




Map View

Subsurface
Micro-seismic
Events in Blue

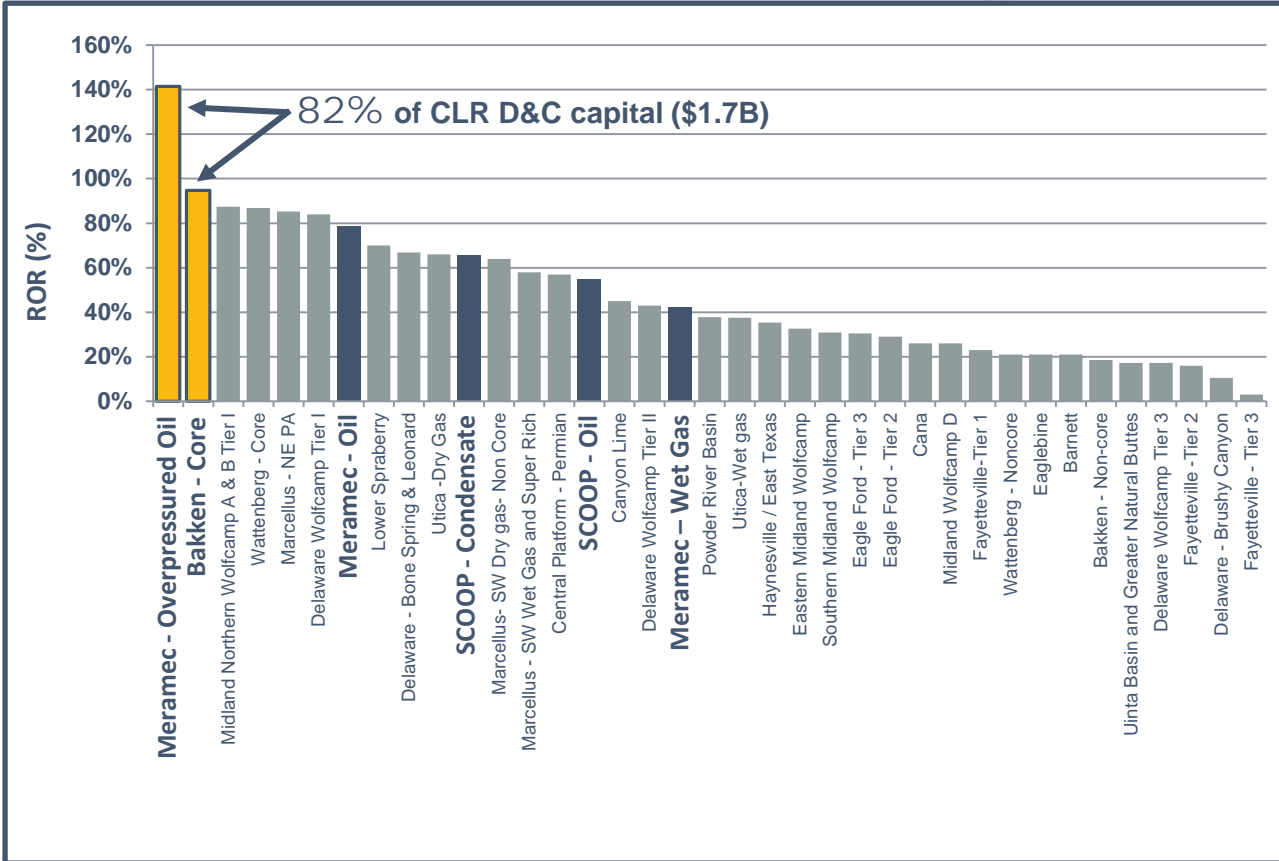
19% of U.S. oil consumption for petrochemical use



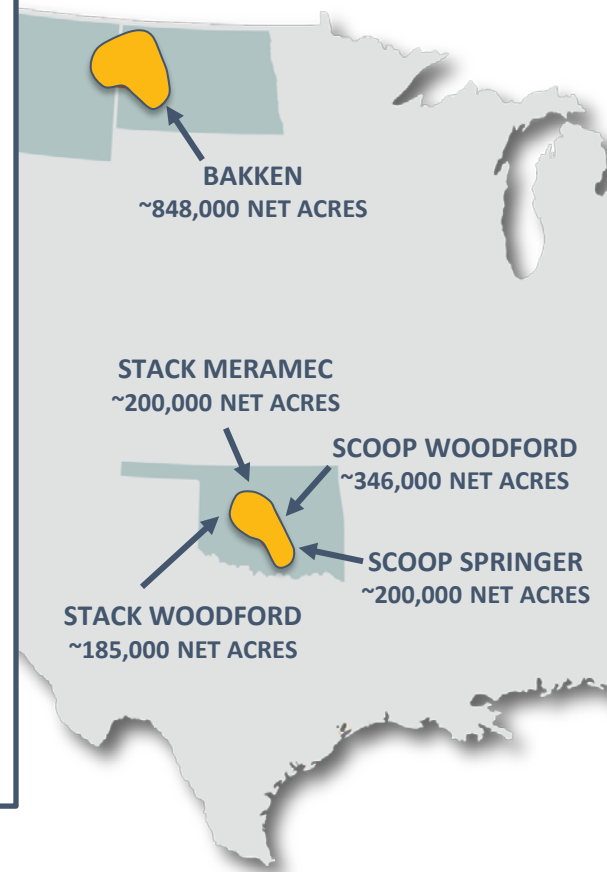
82% of CLR 2017 D&C Capital Allocated to Top Two U.S. ROR Oil Plays

Single Well Rate of Return @ \$60 WTI & \$3.50 HH

Source: Bank of America Merrill Lynch, December 2016



~1.78 Million
Net Reservoir Acres



History of Technology Advancements Oklahoma Oil & Gas

Powering America with Home-made Crude!

**OPEC Underestimated the Resiliency of
Horizontal Shale & American Ingenuity**



YEARS

