

Congress of the United States, House of Representatives  
Committee on Oversight and Government Reform

**American Energy Future, Part II: A Blueprint for Domestic Energy Production**

Jack H. Stark  
Senior Vice President Exploration  
Continental Resources, Inc.

July 14, 2012

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Chairman Issa and committee members, I am honored to speak with you today about the prolific Bakken oil field of North Dakota and Montana.

I am a geologist by degree and serve as Senior Vice-President of Exploration for Continental Resources, Inc. based in Oklahoma City, Oklahoma. Continental Resources is the 9<sup>th</sup> largest producer of petroleum liquids in the Lower 48 and the number one oil producer in the Williston Basin where the Bakken oil field is located. Continental Resources has been a leader in the development of the Bakken oil field and remains the largest leasehold owner and the most active driller in the Bakken field with 940,000 net acres under lease and 26 rigs drilling in the field.

The Committee asked that I provide some perspective on the size and the geology of the Bakken field to gauge the impact of this discovery on the nation and America's energy independence. I will begin by stating that evidence suggests the Bakken oil field could be the largest oil field discovered in the world over the last 40 years. Current estimates of technically recoverable reserves for the Bakken field vary from a low of 3 – 4.3 billion barrels by the United States Geological Survey (USGS) to a high of 24 billion barrels by Continental Resources (figure 1). The North Dakota Industrial Commission estimates between 4 – 11 billion barrels of oil are technically recoverable from the North Dakota portion of the field alone.

Note, these reserve estimates are classified as “technically recoverable” and reflect the technology and geologic knowledge available at the time of the estimate. As technology improves, the volume of technically recoverable reserves typically grows. In fact, technology is advancing so rapidly in the Bakken field that the USGS is already updating its 2008 reserve estimate for the Bakken field and expects to announce revised estimates in 2013.

For perspective Prudhoe Bay, the largest oil field in the United States, has produced approximately 12.3 billion barrels of oil and is estimated to contain 1.3 billion barrels of remaining recoverable oil. A more striking perspective is that the U.S. Energy Information Administration currently estimates the recoverable reserves for the United States at 21 billion barrels. Should the high side reserve estimate for the Bakken oil field prove true, the Bakken could double the proved reserves for the United States.

The Bakken currently produces over 575,000 barrels of oil per day and has almost doubled in the last 12 months. Many project the Bakken will be producing from 1.0 - 1.5 million barrels of oil per day by 2015. For comparison, Prudhoe Bay produced approximately 1.5 million barrels of oil per day at its peak.

The Bakken oil field is an unconventional resource reservoir and the template for tight oil production worldwide. Resource reservoirs like the Bakken are a totally new class of reservoir that have emerged over the last 10 years thanks to advances in horizontal drilling and fracture stimulation technology. Resource reservoirs are typically very large, continuous accumulations of oil and gas that are locked up in an assemblage of low porosity and low permeability reservoir rocks, inter-bedded with organic rich shales. Often referred to as tight oil or shale gas plays, these resource reservoirs contain the thermally mature, organic-rich source rocks that generated the oil and gas that has been produced from conventional reservoirs over the years. However, a vast majority of the oil and gas generated remains in these resource reservoirs and until recently this oil and gas has been considered “immobile”. Using horizontal drilling and fracture stimulation technologies, we are now able to produce a small percentage of the vast accumulations of “immobile” oil and gas that remain in these resource reservoirs. For example, the Bakken and underlying Three Forks reservoir rocks which make up the Bakken Petroleum System are estimated to contain some 900 billion barrels of oil based on volumetric calculations (figure 2). Given current recoverable reserves estimates of between 3-24 billion barrels of oil, only 0.3% to 2.5% of oil held within the Bakken reservoir rocks will be produced. With further advances in technology, we anticipate significantly more oil will ultimately be recovered from the Bakken reservoir. Each 1% increase in recovery translates to 9 billion barrels of oil.

The Bakken oil field is located in the core or the “kitchen” of the Bakken petroleum system (figure 3). Unique geologic conditions have prevented oil generated from the organic rich Bakken shales to escape. These conditions created an over-pressured cell of oil up to 375’ thick, covering approximately 9 million acres, or an area about the size of Massachusetts, Connecticut and Rhode Island combined. The over-pressuring is significant as it helps improve the oil recovery, since oil is more difficult to move through the micro pores and capillaries of the tight rocks than natural gas (methane). This is one of the reasons most of the active resource plays in the United States today are natural gas. Out of more than 20 active resource plays in the United States, only a few can be classified as primarily oil (figure 4). In fact the Bakken oil field is unique in that it does not have a continuous gas phase in the reservoir.

The discovery of the Bakken oil field was made possible through advances in horizontal drilling and fracture stimulation technology. This technology has revolutionized the oil and gas industry and unleashed huge reserves of oil and gas across the country that were not on our radar screen just 10 years ago. The discoveries that have followed have reversed the decline in domestic oil production and identified natural gas reserves counted in centuries. Since 2008 domestic oil production has increased over 15% and imports now stand at 45%, down from a high of 60%. Various scenarios run by IHS CERA (Cambridge Energy Research Association) show tight oil reservoirs could add

another 3-5 million barrels of oil per day to United States onshore oil production by 2020. Extrapolating from a study conducted for the Independent Petroleum Association of America, IHS Global Insight estimates that for each 1 million barrel per day increase in United States oil production, approximately 430,000 direct and indirect jobs are created. With this renaissance in technology and new found reserves, some project North America will be energy independent by 2020. This truly remarkable achievement by the oil and gas industry helps secure America's energy future, creates jobs and keeps our dollars at home.

## Figure 1

### Continental Resources, Inc.

#### Bakken Tight Oil Field Estimated Recoverable Reserves

2/4/2011

Continental Resources, Inc., announced October 2010 that the Bakken Tight Oil Field could potentially contain recoverable reserves of up to 24 billion barrels of oil equivalent. This includes 20 billion barrels of oil and 4 billion barrels of oil equivalent from associated natural gas. This estimate is based on the following facts and assumptions derived from technology available to the industry today.

#### Assumptions

- 1) 500,000 barrels of oil equivalent recoverable per well based on Continental's average results to date.
- 2) Middle Bakken and Three Forks act as separate reservoirs ( i.e. 500,000 Boe per reservoir)
- 3) Dual-zone development (both Middle Bakken and Three Forks reservoirs)
- 4) 320-acre spacing per well (4 wells per zone, therefore 8 wells per 1280-acre spacing unit)
- 5) Estimated area of continuous oil reservoir
  - a. Area 1: 10,314 square miles (6.6MM acres) thermally mature
  - b. Area 2: 4,357 square miles (2.8MM acres) marginally mature/migrated

#### Risk factors

- 1) Area 1- the Middle Bakken risked at 100% and the Three Forks at 70%
- 2) Area 2- the Middle Bakken risked at 90 % and the Three Forks at 60 %

(Area 1 and Area 2 are shown on Figure 1, and reserve calculations based on the assumptions outlined above are shown on Table 1)

The fact that Continental's estimate is 5 times larger than the 4.3 billion barrel estimate published by the USGS in April 2008 has been a source of some concern and question by those not familiar with the Bakken Field.

Continental believes the USGS estimate was fair and reasonable given the data available at the time of its report. Like Continental, the USGS utilized existing producing Bakken wells to estimate ultimate oil recoveries per well and the effective drainage area. The difference between the estimates is that recoveries on a per-well basis have increased substantially since June 2007, which is the cutoff date for wells used by the USGS in its analysis. Since June 2007, approximately 1,680 new horizontal producing Bakken wells have been drilled, and these wells have been completed using almost exclusively single leg horizontal and multi-staged fracture stimulation technology. This improved completion technology has produced higher EURs across the Bakken field. Likewise, testing has shown the Three Forks acts as a separate reservoir, which in effect doubles the recoverable reserves in the Bakken Tight Oil field. The North Dakota Industrial Commission has recognized the improved well performance and added Three Forks potential and in January 2011 announced that recoverable oil reserves from the Bakken- Three Forks reservoirs could reach 11 billion barrels in North Dakota alone. This is over 5 times the NDIC's original estimate of 2.1 billion barrels in the ND Bakken, which was published in 2008.

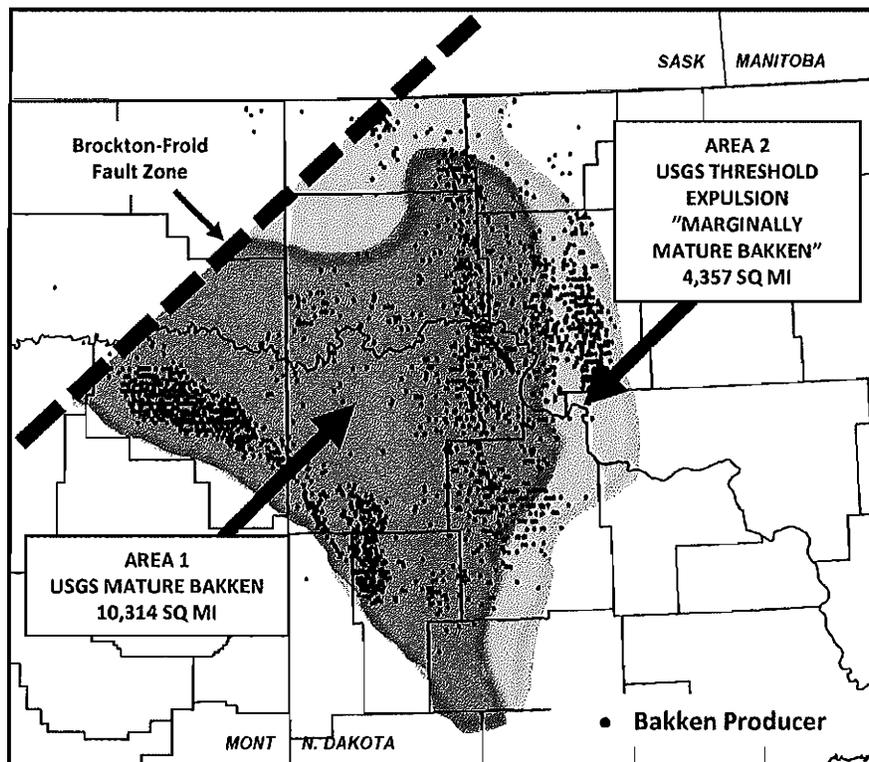
It is a natural evolution for resource plays to grow over time through innovation and technology, as demonstrated by the growth of the Barnett, Fayetteville, Marcellus, Haynesville and Eagleford resource plays. As a play grows, it becomes necessary to re-assess and adjust reserve estimates based on new results and information. The Bakken Tight Oil field is no different. Production results and reserve estimates for Bakken and Three Forks wells have

improved and continue to improve in line with advancing technology. Based on these results, an upward revision of the 2008 estimates of recoverable reserves for the Bakken Tight Oil field is warranted. The growth of the Bakken is yet another testament to the ingenuity of the oil and gas industry.

Table 1

Bakken Field Estimated Potential Recoverable Reserves						
AREA 1						
	Area (sq.mi)	Acres (millions)	320 Acre Well Count	Estimated Reserves Per Well (Mboe)	Risk	Estimated Reserves Recoverable (Mboe)
MB	10,314	6.6	20,628	500	100%	10,314,000
TF	10,314	6.6	20,628	500	70%	7,219,800
		<u>13.2</u>				<u>17,533,800</u>
AREA 2						
	Area (sq.mi)	Acres (millions)	320 Acre Well Count	Estimated Reserves Per Well (Mboe)	Risk	Estimated Reserves Recoverable (Mboe)
MB	4,357	2.8	8,714	500	90%	3,921,300
TF	4,357	2.8	8,714	500	60%	2,614,200
		<u>5.6</u>				<u>6,535,500</u>
<b>TOTAL:</b>		<b>14,671</b>				<b>24,069,300</b>

Figure 1



# Bakken Petroleum System

## Volumetric Oil in Place Estimate

- 🔦 2010 estimate
- 🔦 577 BBO OOIP
- 🔦 24 BBOE Recoverable
  - (20 BBO & 4 BBOE gas)
  - 320 spacing, 500 Mboe/well, Bakken and Three Forks
  - ~4% recovery

- 🔦 2012 estimate
- 🔦 903 BBO OOIP
  - 🔦 Includes Lower Three Forks reservoirs
  - 🔦 27 BBO @ 3% recovery
  - 🔦 36 BBO @ 4% recovery
  - 🔦 45 BBO @ 5% recovery

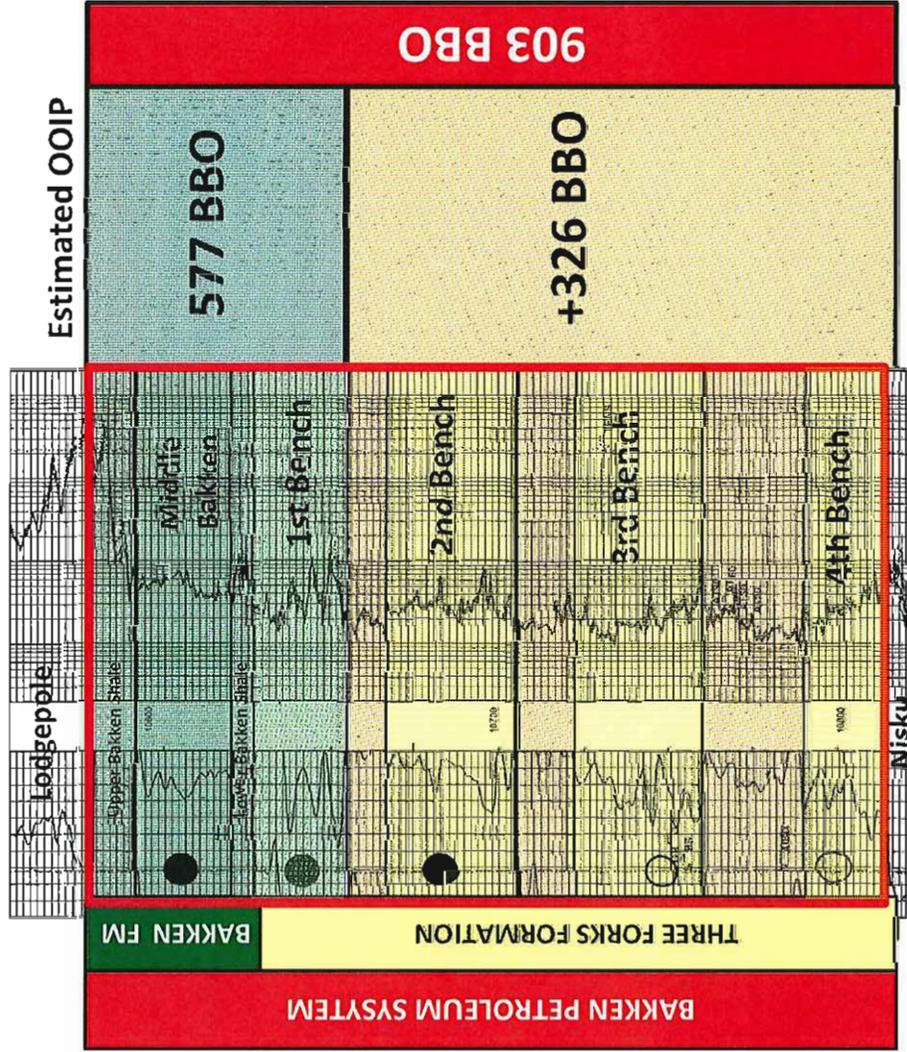


Figure 2

# Bakken Tight Oil Field North Dakota and Montana

- 🔥 Estimated to contain 3 billion to 24 billion barrels\* of recoverable oil with today's technology
- 🔥 Largest continuous oil accumulation ever assessed by U.S. Geological Survey
  - ~14,700 square-miles  
~9 million acres
  - Largest ever assessed by USGS
- 🔥 ~4,500 horizontal producing wells
- 🔥 224 active rigs as of 7/2/2012
  - Adding ~ 2,500 new producing wells per year

\*Includes 20 billion barrels of crude oil and 4 billion of equivalent natural gas

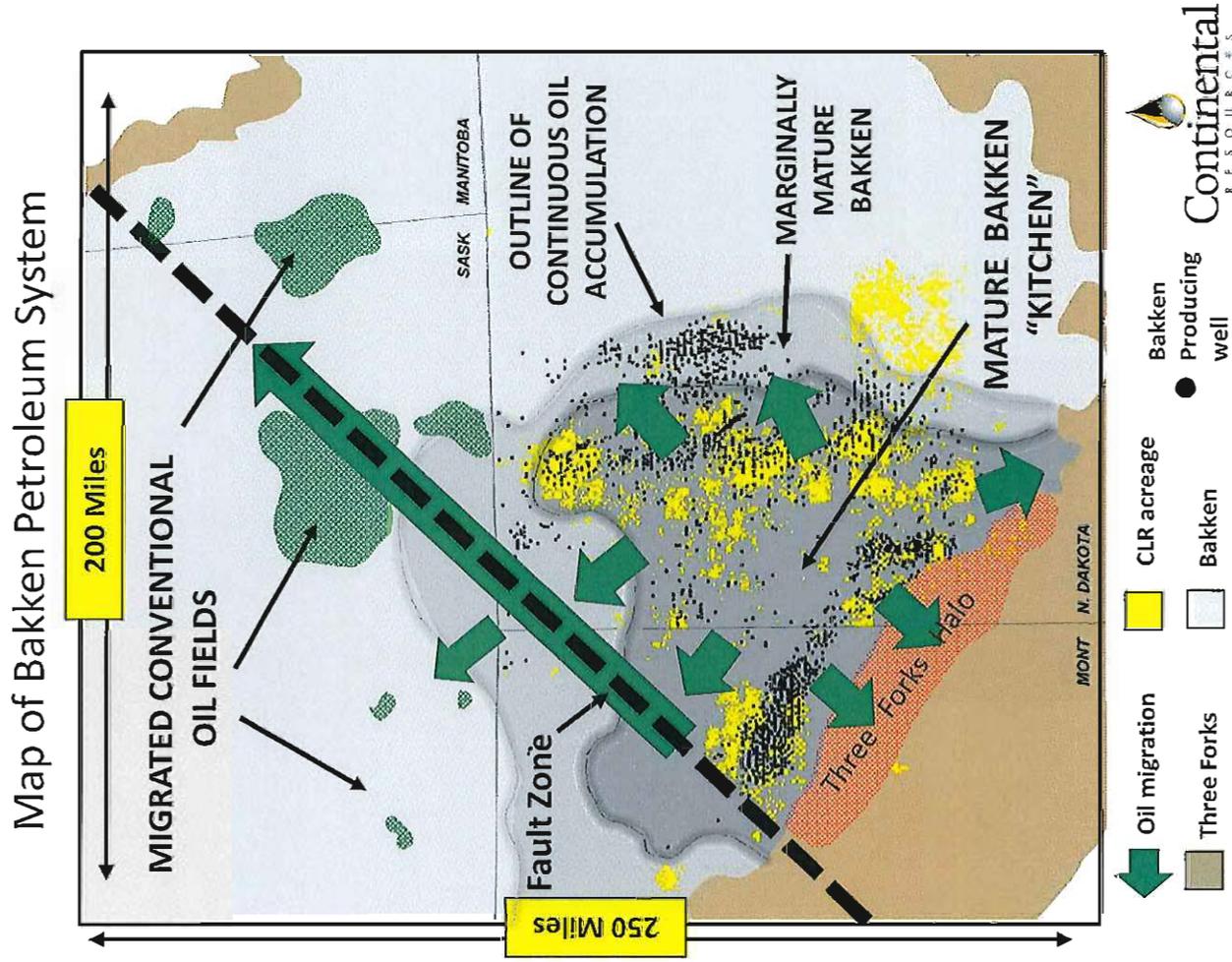


Figure 3



## **Biography of Jack Stark**

Jack Stark is Sr. Vice President of Exploration with Continental Resources, Inc. He joined Continental in 1992 and served on the Board of Directors from 1998 to 2008. As the Company's senior exploration officer, he helped lead the discovery and development of the Company's Red River Units, North Dakota Bakken, Montana Bakken and Oklahoma Woodford fields. Prior to Continental, Stark was Exploration Manager of the Western Mid-Continent Region for Pacific Enterprises and held various staff and middle management positions with TXO Production Corp. and Cities Service Co. from 1978 and 1992. Stark holds a B.S. degree in geology from Bowling Green State University and a M.S. degree in geology from Colorado State University.

Committee on Oversight and Government Reform  
Witness Disclosure Requirement – “Truth in Testimony”  
Required by House Rule XI, Clause 2(g)(5)

Name:

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1. Please list any federal grants or contracts (including subgrants or subcontracts) you have received since October 1, 2009. Include the source and amount of each grant or contract.

None

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2. Please list any entity you are testifying on behalf of and briefly describe your relationship with these entities.

Continental Resources, Inc.  
Oklahoma City, OK

I serve as Senior Vice President of Exploration

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3. Please list any federal grants or contracts (including subgrants or subcontracts) received since October 1, 2009, by the entity(ies) you listed above. Include the source and amount of each grant or contract.

None

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I certify that the above information is true and correct.

Signature:



Date:

7/12/12