The Woodford Shale in Oklahoma has produced hydrocarbons since 1939; however, it was not until 2004 that drilling and completion activity increased from an average completion of 2 wells per year to 35 Woodford completions. In 2007 over 200 horizontal Woodford wells have been drilled and completed. The majority of activity is in the Arkoma Basin with the most successful wells being drilled in Hughes and Coal Counties where the shale is 150' thick. The average maximum month daily rate is reported at 2.5 MMCFG/D and the expected ultimate recovery is estimated to be 3.0 BCFG/Well. The average cost of drilling and completing a horizontal well in the Arkoma Basin is $4.5MM. True vertical depths (TVD) range from 7,500’ to 8,500’ and the laterals average 2,500’ in length. The wells are completed with multi-stage high volume slick-water fracs and casing is cemented to TD. There are six pilot projects underway to determine if this area will be developed on either 80 or 40 acre spacing. In 2007 there are forty-two (42) drilling rigs active in the play in the Arkoma Basin, all drilling horizontal wells. The play is now being extended into two additional basins, the Ardmore and the Anadarko. In the Ardmore Basin the initial concern is that it may not be in the dry gas window. In the Anadarko Basin there are two concerns. The first is the thermally maturity and the second is the depth of burial, TVDs of 12,000’ or more. Vertical and horizontal wells are being drilled and completed in both of these basins and these questions should be answered by the time of this presentation in 2008.
WOODFORD SHALE GAS IN OKLAHOMA, 2008

CHARLES W WICKSTROM

SPYGLASS ENERGY GROUP TULSA, OK
MID-CONTINENT SHALE GAS TRENDS
WOODFORD “SHALE”

Caney Shale
400’ Gross / 290’ Net

“False”

“Main”

Mayes/Sycamore

Woodford Shale
150’ Gross / Net
TODAY'S PRESENTATION

• HISTORICAL OVERVIEW
• PRESENT ACTIVITY
• ECONOMICS
  – EUR
  – SPACING
  – DRILLING AND COMPLETION
  – COSTS
HISTORICAL OVERVIEW

- FIRST WOODFORD SHALE PRODUCTION WAS IN 1934, POTT. Co. 7N-4E. CUMM 96,000 BO
- TOTAL NUMBER OF WOODFORD WELLS DRILLED AS OF 2005: 129
- CUMM. PRODUCTION FROM ALL OF THESE WELLS; 48 BCFG 3.8MMBO
- HISTORICAL AVERAGE IS 2 WELLS/YR
HISTORICAL GAS WELLS

Oklahoma Gas Shales

- No of Wells
- IP
- Avg IP

Year

No of Wells

IP MCF / Per Day

0 10 20 30 40 50 60 70

OKLAHOMA AREAS
WITH
WOODFORD SHALE GAS

• ARKOMA BASIN
  – HUGHES, COAL, PITTSBURG AND MC INTOSH COs.

• ARDMORE BASIN
  – CARTER, JOHNSTON, MARSHALL AND BRYAN COs.

• ANADARKO SHELF
  – CANADIAN CO.
OKLAHOMA AREAS WITH WOODFORD SHALE GAS

• ARBUCKLE UPLIFT
  – GARVIN CO.

• OZARK UPLIFT
  – WAGONER AND MAYES COS.
WOODFORD PRODUCTIVE AREAS
PRESENT ACTIVITY MAP

BOYD, Dan. T. OGS 2008
PRESENT ACTIVITY MAP

BOYD, Dan. T. OGS 2008

EXPLANATION
- Woodford Shale Gas Production/Drilling
  - A-I: Notable Woodford Wells
  - Red: 2007 Completions

- NFX #4H-22 (A)
- 22-5N-12E
- 2,500’ LATERAL
- 5 STAGE FRAC
- IP 11mmcf/d
- 2 Mn AVG 10mm
PRESENT ACTIVITY MAP

NFX #4H-22 (A)
22-5N-12E
2,500’ LATERAL
5 STAGE FRAC
IP 11mmcf/d
2 Mn AVG 10mm

NFX #3H-22 (B)
27-4N-10E
4,366’ LATERAL
9 STAGE FRAC
12MMCFG/D

BOYD, Dan. T. OGS 2008
PRESENT ACTIVITY MAP

DEVON #1-36H  (C)
36-13N-10W
TVD 12,000’ +
DRLG & COMP

NFX #4H-22  (A)
22-5N-12E
2,500’ LATERAL
5 STAGE FRAC
IP 11mmcf/d
2 Mn AVG 10mm
PRESENT ACTIVITY MAP

DEVON #1-36H (C)
36-13N-10W
TVD 12,000’ +
DRLG & COMP

CIMAREX #4-8H (D)
8-1N-2W
1770’ LATERAL
IP 1.53MMCFG 67BO

NFX #4H-22 (A)
22-5N-12E
2,500’ LATERAL
5 STAGE FRAC
IP 11mmcf/d
2 Mn AVG 10mm

BOYD, Dan. T. OGS 2008
PRESENT ACTIVITY MAP

BOYD, Dan. T. OGS 2008

DEVON #1-36H (C)
36-13N-10W
TVD 12,000’ +
DRLG & COMP

CHESAPEAKE #4-12H (E)
12-3S-1E
1.6 MMCF/D
DRLG OFFSET

NFX #4H-22 (A)
22-5N-12E
2,500’ LATERAL
5 STAGE FRAC
IP 11mmcf/d
2 Mn AVG 10mm
PRESENT ACTIVITY MAP

DEVON #1-36H (C)
36-13N-10W
TVD 12,000’ +
DRLG & COMP

BNK (F)
VERT 26-3S-3E
900 MCFG/D
HZ 35-3S-3E

NFX #4H-22 (A)
22-5N-12E
2,500’ LATERAL
5 STAGE FRAC
IP 11mmcf/d
2 Mn AVG 10mm
PRESENT ACTIVITY MAP

BOYD, Dan. T. OGS 2008

NFX #4H-22 (A)
22-5N-12E
2,500’ LATERAL
5 STAGE FRAC
IP 11mmcf/d
2 Mn AVG 10mm

DEVON #1-36H (C)
36-13N-10W
TVD 12,000’ +
DRLG & COMP

RANGE PRODUCTION (G)
#1-21 Davy Jones Vert
21-5S-6E
217 MCFG 60 BW
PRESENT ACTIVITY MAP

BOYD, Dan. T. OGS 2008

NFX #4H-22 (A)
22-5N-12E
2,500’ LATERAL
5 STAGE FRAC
IP 11mmcf/d
2 Mn AVG 10mm

DEVON #1-36H (C)
36-13N-10W
TVD 12,000’ +
DRLG & COMP

WALTER O&G #1-15H (G)
15-5S-6E
TVD 6,200’ MD 9,000’
5 STAGE FRAC
IP 725MCFG 225 BO 120 BW

BOYD, Dan. T. OGS 2008
PRESENT ACTIVITY MAP

DEVON #1-36H
36-13N-10W
TVD 12,000’ +
DRLG & COMP

CIMAREX #4-81 H
36-13N-10W
9-1,000’ VERTICAL WELLS
17N-18E IPs 6-54 MCFG/D
#1-27H 3,000’LATERAL
NO RESULTS REPTD

WALTER O&G #1-15H
15-5S-6E
TVD 6,200’ MD 9,000’
5 STAGE FRAC
IP 725MCFG 225 BO 120 BW

CORONADO (H)
9-1,000’ VERTICAL WELLS
17N-18E IPs 6-54 MCFG/D
#1-27H 3,000’LATERAL
NO RESULTS REPTD

BOYD, Dan. T. OGS 2008

NFX #4H-22 (A)
22-5N-12E
2,500’ LATERAL
5 STAGE FRAC
IP 11mmcf/d
2 Mn AVG 10mm
PRESENT ACTIVITY MAP

CORONADO #21-2H (I)
21-22N-18E
NO REPORT

BOYD, Dan. T. OGS 2008

NFX #4H-22   (A)
22-5N-12E
2,500’ LATERAL
5 STAGE FRAC
IP 11mmcf/d
2 Mn AVG 10mm
ARKOMA BASIN ACTIVE OPERATORS

• NEWFIELD EXPLORATION
• DEVON ENERGY
• CONTINENTAL RESOURCES
• CHESAPEAKE OPERATING
• PABLO
• ST. MARY
• XTO
• PETROQUEST
ARDMORE BASIN ACTIVE OPERATORS

- RANGE RESOURCES
- ANTERO RESOURCES
- WAGNER AND BROWN
- ORACLE RESOURCES
- BANKERS PETROLEUM
- CONTINENTAL EXPLORATION
- GLB EXPLORATION
ARDMORE BASIN ACTIVE OPERATORS CONTINUED

- MAGNUM HUNTER
- CIMAREX ENERGY
- FINLEY RESOURCES
- XTO
- WALTER OIL AND GAS
ANADARKO SHELF WOODFORD HORIZONTAL WELLS OPERATORS

- DEVON ENERGY
- CIMAREX
- CHESAPEAKE
ARKOMA BASIN WOODFORD HORIZONTAL WELLS
ECONOMICS: ARKOMA

• EUR ARKOMA BASIN
  – 4,000’ LATERAL 8 STAGE FRAC 4.5 BCFG
  – 2,500’ LATERAL 5 STAGE FRAC 2.5 BCFG

• SPACING CATTLE TEST WELLS
  – 80 ACRES
  – 40 ACRES

• DRILLING AND COMPLETION
  – ALL HORIZONTAL WELLS 2,500 TO 4,000’
  – COMPLETIONS FIVE TO NINE STAGE FRACS

• COSTS
  – 2,500’ 5/STAGE $4,750,000 DRILL AND COMPLETE
  – 4,000’ 8/STAGE $7,750,000 DRILL AND COMPLETE
SPACING LATERALS

STG 1
STG 2
STG 3
STG 4
STG 5

NEWFIELD Cattle #3H-8
NEWFIELD Cattle #2H-8
NEWFIELD Cattle #1H-8

660’
SPACING PILOT

- Excellent “Picture” of Frac Patterns
- All Rock Volume “Broken”
- Can Reduce Number of Stages and Size of Fractures
- Lower Unit Metrics

Cumulative Production (MCF - PRS Data)

Normalized Production (Day)
DRILLING PRACTICES

• ALL WELLS NOW HORIZONTAL
• LATERAL IN MIDDLE OF FORMATION
• CASING
  – SURFACE 9 5/8”
  – INTERMEDIATE 7”
  – LONG STRING 4 ½ AND/OR 5 ½”
COMPLETIONS

- CASE AND CEMENT LATERAL
- PERFORATE 300’ ZONES
- ACIDIZE PERFS W/ 15% HCL
- MULTI-STAGE FRAC
  - 18,000 BW
  - 200,000 # SAND
FRACTURE TREATMENT

• TREATING PRESSURES
  - AVG 5,600-5,800 PSI
  - MAX 8,600-8,900 PSI
  - AVG RATE 60-95 BPM
INITIAL PRODUCTION TESTS

- 2.5 MMCFG/D 2100 BW/D
- FLOWING 64/64 CHOKE
- FCP 700 PSI
- RECOVERING LOAD (40%)
ECONOMIC ASSUMPTIONS
ARKOMA BASIN MODEL

- ROYALTY 19.0%
- LOE ($/MCFG) $0.45
- SEVERENCE TAX 7.09%
- GAS PRICING ($/MCFG) HH-$0.75
- FUEL GAS 8%
- PRODUCTION TAX CREDIT 1.09% (48Mn)
INTERNAL RATE OF RETURN
ARKOMA BASIN MODEL

- NET 3.6 BCFG/WELL
- F & D COSTS $2.15/ MCFG
- NYMEX FLAT $8/MCFG
- BTAX IRR 32%
CONCLUSIONS WOODFORD SHALE GAS:

• IS A VIABLE GAS RESOURCE
• HAS MULTI-TCF POTENTIAL
• IS IN ITS INFANCY OF DEVELOPMENT
• COULD BE AS GOOD AS OR BETTER THAN THE BARNETT
CONCLUSIONS FOR WOODFORD SHALE OIL:

• THIS MAY BE THE TOPIC OF ONE OF NEXT YEAR’S SESSIONS

• AAPG MID-CONTINENT SECTION MEETING OCT. 10-14, 2009. TULSA, OK. WOODFORD FORMATION SESSION AND FIELDTRIP

• THANK YOU FOR YOUR ATTENTION