Outline

• Background on the Natural Gas Markets
• Background on Coalbed Methane (CBM)
• Overview of Kansas CBM Activity
  – Role of Geological Survey
• Impact on Kansas
  – Economy
• Potential Issues
  – Supply Problems
  – Severed Minerals vs. Surface
  – Enhanced Coalbed Methane Recovery
  – Carbon Sequestration
Kansas Profile

Kansas national population and energy use rankings:

- **Population** – 32\textsuperscript{th} (2002)
- **Total per capita energy** – 18\textsuperscript{th} (2000)
- **Natural Gas Consumption** (2002)
  - Residential – 71,002 MMcf
  - Commercial – 38,812 MMcf
  - Industrial – 105,400* 
  - Electric Power – 23,126 MMcf
- **Natural Gas Production** (2002) – 453,417 MMcf

*Estimated.
Natural Gas Prices Continue to Be Volatile

- Industrial Price
- City Gate Price
- Wellhead Price

$/MCF

Jan-90, Jan-91, Jan-92, Jan-93, Jan-94, Jan-95, Jan-96, Jan-97, Jan-98, Jan-99, Jan-00, Jan-01, Jan-02, Jan-03
Recent Energy Prices

Natural Gas Prices - Henry Hub Spot Market Price
Crude Oil - WTI Cushing
Propane - Conway, Kansas

Peak $19.05 on 2/25/03.
Coalbed Methane Production from U.S. Basins

CBM represents approximately 10% of US gas reserves

Emerging Basins
Appalachian Basin
Warrior Basin
San Juan & Raton Basins
Coalbed Methane Activity

Kansas Coal Bed Methane Wells

Total Number of Wells = 1300+

* 2003 Incomplete

Year


Wells

0 50 100 150 200 250 300
Kansas Coalbed Methane Activity

**Number of Wells Drilled for Coalbed Gas by County (through mid-2003)**

- Douglas: 25 mi
- Franklin: 25 km

**OIL & GAS FIELDS and major gas pipelines (8")**
Methane Production from Micropores

**Desorption**

Coal Surface

Decreased Fluid Pressure

**Replacement**

Coal Surface

Decreased Fluid Pressure

- Methane Molecule
- CO₂ Molecule
Conventional Gas and Coal Bed Gas

PRODUCTION DECLINE

- coalbed gas
- conventional gas

Adapted from Rice, 1997
Production Stages of a Coalbed Gas Well

Dewatering Stage

Stable Production Stage

Decline Stage

Time

Volume

–Gas

–Water

Adapted from Rice, 1997
Kansas Coalbed Methane Monthly Production

Includes Wells That Average More than 50MCF/Day For at Least 3 Years (N=22)
Neosho County CBM Production

2003 Production Through November
2003 Value through September 3,585

Estimated Annual Value Assumes
Constant Production and Price for
Remainder of Year

Production Million Cubic Feet
Estimated Annual Production
Value
Estimated Annual Value

Production (mmcf)
Estimated Annual Production
Value
Estimated Annual Value

Estimated Annual Value Assumes
Constant Production and Price for
Remainder of Year

Year
Estimated 2003 Annual Value Assumes Constant Production and Price for Remainder of Year

Includes Gas Production for Labette, Montgomery, Neosho and Wilson counties

2003 Production Through November
2003 Prices through September

Production (Bcf)
Value

Billion Cubic Feet


Year

Dollars Millions Wellhead

0 5 10 15 20 25 30 35 40 45 50

9.06
Kansas Gas Production

Production Through November 2003
Wellhead Prices through September 2003
Coalbed Methane Program
Coalbed Methane Program
Weir-Pitt Coal
United States Carbon Dioxide Emissions

By Source & Sector:

- Transportation: 33%
- Residential: 20%
- Commercial: 16%
- Industry: 31%
- Natural Gas: 21%
- Coal: 37%
- Oil: 42%
- Other: 29%
- Electricity: 38%

EIA AEO2002
Southeast Kansas

Partially miscible and immiscible CO₂ EOR

- El Dorado
- Salyards Trend,

Enhanced Coalbed Methane (N₂ and CO₂)

Cement plant gas stream may be best suited for ECBM
Cement Production

Dry Kiln Portland Cement Process

Calcination Process
\[ \text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2 \]
0.51 tons CO2 / ton cement

CO₂ and N₂ kiln gas mix may be suitable for ECBM with little processing.
Landfill Gas

Landfill Gas (LFG)
CH₄, CO₂, NMOC

Pipeline
Kansas CBM Summary

• Expect CBM Production Increase to Continue
• Continued Exploration Expected
  – Extent Dependent on Outcome of Pilots
    › Geological Survey Working to Provide Information
  – Northward Spread
  – Significant Impact on SE Kansas Economy
  – Potential Significant Impact on Kansas Economy
• A Substantial Boost in US Supplies will take Time
  – US Market Controls Kansas Gas Price
  – Kansas is Vulnerable to Energy Price Spikes