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Energy Security: A Global Challenge

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The Emerging Petroleum and Natural Gas Economy

Ft. McNair, Washington, D.C.

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Sept 30, 2009
Topical Focus

• Peak Oil
• Technology Developments
• NOCs & IOCs
• Game Changers
  • Climate
  • Natural Gas
Beyond Peak Oil: Global Resource Endowment is enormous, but conventional distribution is uneven and unconventionals have environmental challenges.

Source: Based on 2008 proved reserves (BP Stat Review) and 2006-2030 demand trends (EIA)
Geopolitical & governance risks are accumulating

- **Canada**: climate policy
- **US**: Climate Policy, access, storms
- **Europe**: Gas Supplies
- **Caspian**: Transit Security
- **Russia**: Policy
- **Iran**: Nuclear Ambition
- **Iraq**: Instability
- **Pakistan**: Political Turmoil
- **Nigeria**: Civil Unrest
- **Aden, Malacca**: Piracy
- **Latin America**: Resource Nationalism
- **China**: Demand increase
- **N-Korea**: Nuclear Ambition
Non-OPEC Oil Production Looks Flat

(change from previous year)

Million barrels per day

Source: EIA, STEO September 2009
OPEC Surplus Production Capacity

Surplus Capacity, by Country
Total Current (est.): 5.5 mmb/d

Saudi Arabia
UAE
Iran
Kuwait
Libya
Qatar
Angola
Algeria

Note: Shaded area represents 1998-2008 average (2.8 million barrels per day)

Source: EIA STEO September 2009, Bloomberg, IEA OMR
Replacing Global Liquids Supply Will Be Challenging

Source: CSIS, EIA
15 of the Top 20 Largest Oil Companies are NOCs; NOCs control 80-90% of conventional oil and gas reserves; Will play an increasing role in managing resources going forward.
All NOCs are NOT alike, but they share certain priorities and objectives:

- Agents of host governments
- Protectors of the National Resource Patrimony
- Source of Revenues needed to fund other programs
- Responsible for Social development & infrastructure
- Role in International relations
- Stakeholders are Political
- Management practices, operating standards and agendas different from IOCs
A Word on Technology Advancements

- Better diagnostics, intelligent wells
- GeoSteering
- Improved reservoir simulation
- Pre-salt experience
- Maximum Reservoir Contact Wells
- Sub-sea completions
- Rez “Bots”
- Horizontal drilling (shales)

Bottom Line: Significant new discoveries (BB fields), improved accessibility & increased recovery rates
Game Changers

• Climate Change and Regulation of Carbon & GHG Emissions

• Exploitation of Unconventional Shale Gas Reserves
Climate Change as a Game Changer

• Affects supply & demand
• Alters fuels choices, increases prices
• In the extreme, raises security concerns
• New investment & technologies applied on a global scale
• Implications of a fractured vs. unified response
• Concept of “Sustainable Development” challenges traditional view of economic prosperity
• Requires long-term global policy solutions and trade-off balances
Climate Change as a Threat Multiplier

- Water Scarcity
- Demography
- Crop Decline
- Hunger
- Coastal Risks
- Recent Conflicts
Conventional Global Natural Gas Reserves

trillion cubic feet

Source: BP Statistical Review 2009
Global Gas Supply Dilemma

- Global gas demand to grow, especially in a carbon constrained world
- Conventional supply sources become more concentrated geographically
- Concentration can affect leverage, supply and prices, geopolitics, etc.
- Delivery system under greater stress
- Price rise + increased import dependence recreates balance of payments concerns
What’s New?: Substantial growth in U.S. natural gas production through 2030 led by unconventionals…

 trillion cubic feet

History

Projections

Onshore Unconventional

Nonassociated
Onshore Conventional

Non-associated Offshore

Associated/Dissolved

Alaska

Source: EIA Annual Energy Outlook 2009
Conventional vs. Continuous Resources

Source: USGS
Game-Changing Potential: Estimates of US Shale Gas Resources

EIA Annual Energy Outlook 2009: 267 tcf undiscovered technically recoverable shale gas resources (mean)
  • Based on 2007 U.S. Geological Survey assessment and 2006 Mineral Management Service data

Navigant Consulting Inc. 2008: 274 tcf undiscovered technically recoverable shale gas resources (mean)
  • Based on aggregated data from numerous studies

Navigant Producer Reports 2008: up to 842 tcf undiscovered technically recoverable shale gas resources (max reported)
  • Ascertained by Navigant in 2008 study (accounts for Marcellus and Haynesville)

Potential Gas Committee 2009: 616 tcf undiscovered technically recoverable shale gas resources (mean)
  • Estimated total U.S. gas resources of 2,074 tcf (mean undiscovered tech recoverable + reserves)
Shale Resources and Natural Gas Pipeline Network

Source: R Hefner
New US Domestic resources mean less imports (pipeline gas and LNG) and more supply choices for the world!

Source: EIA Annual Energy Outlook 2009
Implications of Global Shale Gas Exploitation

- Development of US shale formations would free up LNG for use elsewhere
- Significant shale prospects likely in China, Turkey, Australia and Europe
- Development of indigenous gas sources, coupled with LNG, efficiency, renewables and interconnects could reduce EU reliance on Russian gas
- Global gas surplus could revamp price/contract structures
BUT …realizing the full promise of shale resources is not a certainty and US domestic policy is important!

Technical/Economic Challenges

• All shales are not alike; application of drilling/reservoir fracturing technology & operational experience matters
• Steep decline rates require ongoing investment and drilling; and repeated fracturing
• Up front investment (lease acreage and pilot wells) not insignificant vs. cost basis relative to commodity price/value

Environmental/Regulatory/Societal Challenges

• Uncertain regulation (hydraulic fracturing, water, land use, permits), “industrialization” of areas unfamiliar with development plans and associated impacts
• Location, location, location – shale resources are, at times, proximate to and distant from delivery infrastructure and demand centers – both present problems
Strategies to Enhance Oil U.S. Security Count

- Moderate demand
- Diversify supplies
- Maintain/expand domestic oil output

Source: EIA Reference Case / NPC Global Oil and Gas study survey.
Policy Model

Economic Objectives
- Affordable/Accessible
- Reliable and Secure

Environmental Objectives
- Supports Economic Growth & Employment
- Environmentally Benign
- Low/no emissions

Security & Foreign Policy Objectives
- Defensible
- Renewable Energy
- Nuclear
- Carbon Capture and Storage
- Energy Efficiency
- Oil
- Coal
- Promotes/Supports Sustainable Environment