From: Lagio, Peter
Sent: Wednesday, May 09, 2001 3:31 PM
To: Johnson, Nancy
Subject: Possible FOIA Input

Nancy,

Attached are the ARI Coal Bed Methane/Hydraulic Fracturing presentation and summary report prepared for us.

[Files: vlg0297.wpd, ja01025.ppt]

Peter Lagio
Market Access Program Manager
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peter.lagio@hq.doe.gov

Obtained and made public by the Natural Resources Defense Council, March/April 2002
MEMO

To: Pete Lagiovanne, DOE

From: Jonathan Kelafant, Advanced Resources

Re: Backup of CBM Numbers Used in the Presentation

Dear Pete,

Per your request, I have developed the following memo to support the presentation material provided to you previously on CBM development.

**CBM Production.** Baseline and forecasted CBM production numbers are taken from the unconventional gas model (MUGS) developed by Advanced Resources for the Energy Information Agency (EIA). The MUGS model is the sub-module used by the NEMS system to model CBM and other unconventional gas resources. The MUGS model predicts that CBM production will reach 1,685 Bcf/year by 2010, up from 1,250 Bcf/year in 2000 (Exhibit 1).

**Factors Affecting Future CBM Production.** The MUGS model production forecast assumes that there will be no restrictions on drilling or other impediments to development to reach the 1,685 Bcf/year in 2010. However, several pending regulatory actions could potentially impact the ability of producers to reach this goal. These issues and discussion of how they could impact future CBM production are presented below:

**Land Access.** In 1999, the NPC study determined that for federal lands, nearly 10% of the gas resources are on lands that are inaccessible. With the implementation of the proposed Roadless Areas Initiative, the portion of inaccessible resources would increase an additional 2%. For CBM production over the period 2000-2010, current access restrictions will remove 645 Bcf of reserves and should the roadless initiative take effect, an additional 130 Bcf of reserves would be removed. This estimate uses the following assumptions:

- Only Rocky Mountains basins are affected.
- The acreage in the basins is 50% federal and 50% private/state.
- The amount of CBM reserves removed under current restrictions is derived as follows: 10% x 12.9 Tcf x 50% = 645 Bcf, where the 10% represents the inaccessible gas resource as defined by the NPC, 12.9 Tcf represents the total amount of potentially producible reserves over the period, and the 50% represents the portion of federal land in the basin.
- The amount of CBM reserves removed under the proposed the roadless initiative is derived as follows: 2% x 12.9 Tcf x 50%, where the 2% represents the inaccessible gas resource, the 12.9 Tcf represents the total amount of potentially producible reserves, and the 50% represents the portion of federal lands in the basin.

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Water Disposal/EIS Issues. In the Powder River basin, there is currently a moratorium on drilling on federal lands until a comprehensive EIS study is completed. The EIS will look at water disposal, air emissions from drilling, gas processing and compression, as well as other environmental aspects of CBM production. The current analysis assumes that about one-half the acreage in the Powder River is covered by federal leases. Therefore, the projected reserves of 5.7 Tcf to be produced from the Powder River basin over the next 10 years would be reduced by 50% to 2.8 Tcf.

The analysis also looked at the impact on CBM production in other Rocky Mountain basins should similar drilling moratoriums be enacted. Over the next decade, the other Rocky Mountain basins are projected to produce 7.2 Tcf assuming no moratoriums on drilling. Drilling moratoriums on federal lands in these basins would reduce reserves by 50%, to 3.6 Tcf through the period ending 2010.

Hydraulic Fracturing. In the case of Leaf vs. EPA, the court ruled that the injection of fluids for the purpose of hydraulic fracturing constitutes underground injection as defined in the Safe Water Drinking Act (SWDA), that all underground injection must be regulated, and that the hydraulic fracturing of CBM wells in Alabama was not regulated under Alabama's UIC program. Prior to this decision, EPA did not consider hydraulic fracturing as underground injection because it did not regard production well stimulation as an activity subject to regulation under the UIC program.

Virtually all CBM wells require some type of stimulation treatment to improve production. As currently defined, the regulations would affect not only hydraulic fracturing, but cavitation techniques as used in the San Juan basin and “water enhancements” as used in the Powder River basin. It is our understanding based on a review of EPA's proposed study methodology, that the regulations would govern the injection of all fluids. Given the scope of this ruling, this would affect virtually every CBM well drilled in the U.S. Under the “worst case” scenario (i.e., all CBM wells affected), only a limited development would take place. Therefore, current production would gradually decline over the next 10 years to 700 Bcf with little or no replacement drilling. The net effect would be a shortfall of about 1 Tcf/year in the year 2010, representing the difference between the projected 1.685 Bcf of production and the declined current production of 700 Bcf (Exhibit 2).
Exhibit 1
Coalbed Methane Production 2000 through 2010

<table>
<thead>
<tr>
<th>Basin</th>
<th>Production Bcf</th>
<th>Projected Wells Drilled 2000 Through 2010</th>
<th>EUR Per Well (Bcf)</th>
<th>Reserves (Bcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Juan</td>
<td>880 670</td>
<td>1,645</td>
<td>2.35</td>
<td>3,864</td>
</tr>
<tr>
<td>Warrior</td>
<td>110 60</td>
<td>282</td>
<td>0.40</td>
<td>114</td>
</tr>
<tr>
<td>Uinta</td>
<td>72 250</td>
<td>1,598</td>
<td>1.60</td>
<td>2,550</td>
</tr>
<tr>
<td>Powder River</td>
<td>147 475</td>
<td>13,160</td>
<td>0.43</td>
<td>5,657</td>
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<td>Raton</td>
<td>26 75</td>
<td>405</td>
<td>1.65</td>
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<td>Piceance</td>
<td>1 5</td>
<td>134</td>
<td>1.15</td>
<td>154</td>
</tr>
<tr>
<td>C. Appalachian</td>
<td>50 150</td>
<td>2,836</td>
<td>0.65</td>
<td>1,835</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>1,250 1,685</strong></td>
<td><strong>20,060</strong></td>
<td><strong>1.18</strong></td>
<td><strong>14,842</strong></td>
</tr>
</tbody>
</table>

- The San Juan and Warrior basins, which currently constitute 80% of CBM production, will account for only about 40% of production by 2010.
- 85% of the growth in CBM production will come from Rocky Mountain basins, which have the greatest regulatory concerns.
Exhibit 2
Regulating Hydraulic Fracturing Would Cut Forecasted CBM Production by Over 50% by 2010

Projected CBM Production Under Current Regulations

Projected CBM Production Decline with Restrictions on Hydraulic Fracturing

Obtained and made public by the Natural Resources Defense Council, March/April 2002
Coalbed Methane

Prepared for:
Peter Lagiovanne
U.S. Department of Energy

Prepared by:
Advanced Resources International, Inc.

March 2001
Overview

Coalbed methane production is projected to increase by over 35% by the year 2010, to 1.7 Tcf/year from the current 1.2 Tcf/year.

However, several current and pending regulatory actions could limit the ability for producers to reach the 1.7 Tcf/year goal:

- Land access
- Environmental issues (water disposal, EIS)
- Hydraulic fracturing (LEAF vs. EPA)
## Coalbed Methane Production 2000 through 2010

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- The San Juan and Warrior basins, which currently constitute 80% of CBM production, will account for only about 40% of production by 2010.
- 85% of the growth in CBM production will come from Rocky Mountain basins, which have the greatest regulatory concerns.
Land Access

- Land access is a topical issue attracting much attention by the Cheney Energy Task Force.
- The 1999 National Petroleum Council* study determined that, for federal lands:
  - Nearly 10% of gas resources (including CBM) are on lands that are inaccessible
  - 32% of gas resources are on lands that are specifically subject to the restrictions that delay development
- With implementation of the Roadless Areas Initiative, the portion of inaccessible resources will increase an additional 2%

*National Petroleum Council, Meeting the Challenges of the Nation’s Growing Natural Gas Demand, 1999.
Impacts of Land Access on CBM Production

- By the year 2010, CBM production from Rocky Mountain basins should average 1.48 Tcf/year (4 Bcf/day), assuming no access restrictions. Total CBM reserves added over the next 10 years in the Rocky Mountain basins will be 12.9 Tcf under current assumptions.
  - Inaccessible areas will remove 645 Bcf of reserves;
  - Should the Roadless Areas Initiative take effect, this would remove an additional 130 Bcf of reserves.
  - These two stipulations would remove a total of 0.8 Tcf of reserves; based on the NPC study, a 1 Tcf shortfall in production in 2010 would result in a nearly $1.00/Mcf increase in gas prices.
Water Disposal

Most CBM wells require the production of water in order to lower reservoir pressure and initiate gas production. The ability to cost effectively dispose of produced water significantly impacts the economics of a CBM project. Current water disposal/treatment options are:

• River/stream discharge (Warrior and N. Appalachian basins)
• Underground injection (San Juan and C. Appalachian basins)
• Surface application/ponding (Powder River basin)
• Reverse osmosis
• Electro dialysis

Water disposal issues are particularly important in the Rocky Mountain basins because of the relatively arid climate.
EIS and Permitting Issues

In the Powder River Basin, there is currently a moratorium on drilling on federal lands until a comprehensive EIS study is completed. The EIS will look at water disposal, air emissions from drilling, gas processing and compression, as well as other environmental aspects of CBM production.
Impact of Water Disposal/EIS/Environmental Restrictions

- In the Powder River basin, about one-half of the area is covered by federal leases. The inability to drill on these lands would lower Powder River basin reserves over the next decade to 2.8 Tcf from 5.7 Tcf.

- Similar restrictions in other Rocky Mountain basins would cut 3.6 Tcf of reserves through 2010.
Hydraulic Fracturing

In the case of Leaf vs. EPA, the court ruled that the injection of fluids for the purpose of hydraulic fracturing constitutes underground injection as defined in the Safe Water Drinking Act (SWDA), that all underground injection must be regulated, and that the hydraulic fracturing of CBM wells in Alabama was no regulated under Alabama’s UIC program. Prior to this decision, EPA did not consider hydraulic fracturing as underground injection because it did not regard production well stimulation as an activity subject to regulation under the UIC program.
Hydraulic Fracturing (Cont’d)

The oil and gas industry is concerned that the court’s decision may be applied nationwide and, more broadly, to hydraulic fracturing for all wells, not just CBM wells.

Virtually all CBM wells require some type of stimulation treatment to improve production. As currently defined, the regulations would affect not only hydraulic fracturing, but cavitation techniques as used in the San Juan basin and “water enhancements” as used in the Powder River basin. This is because the regulation would govern the injection of all fluids. Given the scope of this ruling, this would affect virtually every CBM well drilled in the U.S.
Regulating Hydraulic Fracturing Would Cut Forecasted CBM Production by Over 50% by 2010

Projected CBM Production Under Current Regulations

Projected CBM Production Decline with Restrictions on Hydraulic Fracturing

Year

CBM Production (Bcf)

1,685 Bcf

700 Bcf

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

Advanced Resources International
Meeting the Challenges of the Nation's Growing Natural Gas Demand

PRESENTATION FOR

THE VICE PRESIDENT'S ENERGY POLICY TASK FORCE

U.S. DEPARTMENT OF ENERGY

NATIONAL PETROLEUM COUNCIL

MARCH 27, 2001

6681

Obtained and made public by the Natural Resources Defense Council, March/April 2002
OVERVIEW

- Introductions
- NPC Background
  - 1992 NPC Report
  - 1999 NPC Report
- 2001 DOE Workshop
  - 23+ TCF in 2000
  - 1999 NPC Report still valid
  - Short-term trends confirm urgency of addressing critical factors and recommendations
U.S. Natural Gas Demand:
Comparison of 1992 and 1999 NPC Reports
Growth in Reference Case Demand (1998-2010)

Distribution of 7 TCF Increase by Sector

1999 NPC Report

- Industrial 23%
- Electricity Generation 47%
- Commercial 11%
- Residential

- Natural gas can make an important contribution to the Nation's energy portfolio
- Reliability is key -- 14 million new customers by 2015
- Conservation and energy efficiency still needed
Factors Behind Increased Gas Demand

2001 DOE Workshop

**Faster GDP Growth**
(2000)

- **Actual**
  - +5.0%
- **NPC 1999 Study**
  - +2.5%

**Increased Gas/Oil-Fired Electric Power Capacity**
(1998-2000)

- **Actual**
  - 38 GW
- **NPC 1999 Study**
  - 30 GW

- Natural gas for electricity -- 4 years ahead of NPC projection

*EIA, Short Term Energy Outlook, Jan 2001.
**EEA
Actual vs. Expected Sources of Natural Gas Supply (2000)

2001 DOE Workshop

Source: EIA
U.S. Lower-48 Natural Gas Resource Base Estimates

1999 NPC Report

<table>
<thead>
<tr>
<th>Total Resource Base (TCF)</th>
<th>1,466</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proven Reserves</td>
<td>157</td>
</tr>
<tr>
<td>Total Unproven Resource Base</td>
<td>1,309</td>
</tr>
<tr>
<td>Exploitation of Existing Fields</td>
<td>305</td>
</tr>
<tr>
<td>New Fields to be Discovered</td>
<td>633</td>
</tr>
<tr>
<td>Nonconventional Sources (Coalbed Methane, Tight Gas, Shale)</td>
<td>371</td>
</tr>
</tbody>
</table>

Known with some level of certainty

Requires:
- Additional drilling
- Technology evolution
- Accessibility

Entails a higher degree of risk

NPC
Growth in Reference Case Supply (1998-2010)

Distribution of 7 TCF Increase by Source

1999 NPC Report

- Gulf of Mexico: 33%
- Rockies: 14%
- Net imports from Canada: 11%
- LNG imports: 6%
- S.Ark / N.La / E.Texas: 13%
- All other areas: 23%
CRITICAL FACTORS

1999 NPC Report

➢ Access
➢ Technology
➢ Financial Requirements
➢ Skilled Workers
➢ Rigs
➢ Lead Times
➢ Requirements of New Customers
UPDATE ON CRITICAL FACTORS +/-
2001 DOE Workshop

Access
- Forest Service Roadless Policy (- 7 TCF)
- Sale 181 (- 9 TCF)
- Destin Dome (- 2 or more TCF)
- OCS Bright Spots
- Transmission and Distribution (siting constraints)

Technology
- Smaller Footprint, More Efficient -- recent downward trend (+/-)
- Reduced R&D Expenditures by Producers
- Unique Needs of Independent Producers -- 73% of U.S. production

Capital / Infrastructure
- Rigs and Skilled Workers in Short Supply
- $1.5 Trillion Through 2015 -- includes $781B for capital investments

NPC
UPDATE ON CRITICAL FACTORS +/-
2001 DOE Workshop

Lead Times / Regulatory Climate

- Expedited Permitting -- further progress needed, onshore and offshore
- Transmission and Distribution Pipelines -- 300,000 new miles still needed by 2015 with related permits/approvals

Changing Customer Needs

- New Pipelines to Reach Supplies in Frontier Areas
- Expansion of Existing Pipelines to Meet Regional Demand
- New Laterals to Serve Electricity Plants
- Unique Service Requirements
Natural Gas Demand will Increase in All Regions

(1999 NPC Reference Case)

% 2015 Percent Increase
1999 Gas Demand

Pacific Northwest +47%
West North Central +40%
Mountain +55%
Southwest +32%
Central +37%
South Central +35%
Upper Midwest +49%
Midwest +30%
Middle Atlantic +38%
South Atlantic +98%
East +30%
South +44%
Fl

Bcf/yr
3,000
2,000
1,000

NPC
New Gulf Coast Gas Fired Electrical Capacity

1999 NPC Report

- Texas
- Florida
- Southeast U.S.
- Other Lower 48

Capacity, MW

0
25,000
50,000
75,000
100,000
125,000
150,000

Impact of Size of Resource Base and Access on U.S. Natural Gas Production

1999 NPC Report

Increased access and a larger resource base are closely linked.
Impact of Size of Resource Base and Access on U.S. Natural Gas Price

1999 NPC Report

Increased access and a larger resource base are closely linked
ACCESS ISSUES FOR
TRANSMISSION AND DISTRIBUTION

1999 NPC Report

➤ Acquisition of Right-of-Way on Public Lands
➤ Encroachment on Existing Right-of-Way
➤ Increasing Community Awareness and Resistance to New Infrastructure
➤ More Restrictive Permitting Driven by Environmental Concerns

Obtained and made public by the Natural Resources Defense Council, March/April 2002
Capital Required for Expansion
1999 NPC Report

Obtained and made public by the Natural Resources Defense Council, March/April 2002
RECOMMENDATIONS

1999 NPC Report

➤ Establish a Strategy – at the Highest Level – for Natural Gas in the Nation’s Energy Portfolio

➤ Form a White House Interagency Work Group

➤ Establish a Balanced, Long-Term Approach for Responsibly Developing the Nation’s Resource Base
  - Assess Impact of Existing Restrictions
  - Prioritize Restricted Areas
  - Develop Supply in Selected Areas
  - Plan for Long-Term Sustainability
OTHER RECOMMENDATIONS

1999 NPC Report

- Drive Research and Technology Development at a Rapid Rate
- Plan for Capital, Infrastructure, and Human Resource Needs
- Streamline Processes that Impact Gas Development
- Assess the Impact of Environmental Regulation on Natural Gas Demand and Supply
- Design New Services to Meet Changing Customer Needs
POTENTIAL ENERGY POLICY ACTIONS

- Institutionalize Interagency Coordination (building on work of Vice President's Energy Task Force)
- Establish a Strategic Plan for Natural Gas
- Increase Access to Resources and Rights-of-Way (Federal Lands Inventory, Sale 181, Destin Dome, OCS Bright Spots) (Regional Supply for Regional Demand)
- Streamline Permitting and Approval Processes for Supply and Transmission and Distribution (including NEPA decisions, applications for permits to drill on Federal lands, and Coastal Zone Management Act reviews)
- Consult with States (maintaining a national perspective)
- Maintain View of North American Gas Market and International Sources of Supply
- Encourage Technology Development
- Evaluate Royalty Relief and Other Financial Incentives (onshore, offshore, and infrastructure)
- Monitor Progress on the 7 Critical Factors
Peak-Day Natural Gas Deliverability and Demand
U.S. Gulf of Mexico Natural Gas Production
Gulf of Mexico Deepwater Profile

 NPC Projection  Existing & Scheduled Fields

Bcf/Year


NPC
Projected Florida Gas Demand
Domestic Natural Gas Production for 2000 is Below Expectations, Except Unconventional Gas

Domestic Production (Tcf in Yr 2000)

- Total Domestic Production: 19.9
- Onshore: 9.4
  - Conventional/Other: 8.7
  - GOM Offshore: 5.3
  - Unconventional Gas: 5.1

Source:
- Total – EIA Monthly Energy Review, Jan 2001 (0.4 Tcf of Difference Due to Calibration Differences, NPC vs EIA).
- Offshore – ARI estimates.
- Unconventional – ARI estimates.
NATIONAL PETROLEUM COUNCIL
an advisory body to the Secretary of Energy

GROWING U.S. NATURAL GAS DEMAND

1992 Report
  ➢ 19 TCF (1990)

1999 Report
  ➢ 22 TCF (1998)
  ➢ 23+ TCF (2000)
  ➢ 29 TCF (2010)
  ➢ 31 TCF (2015)

2001 Department of Energy Workshop
  ➢ 1999 NPC Report still valid
  ➢ Short-term trends confirm urgency of addressing critical factors and recommendations