

## Oil & Natural Gas Projects

### Exploration & Production Technologies

#### Natural Gas Long Term Sustainability

DE-AT2601NT20205

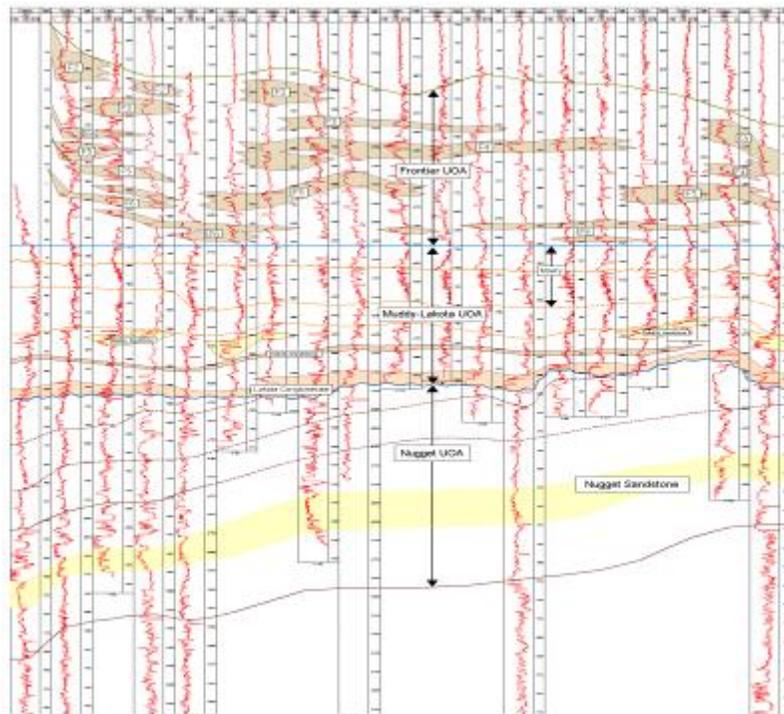
##### Goal:

To enhance DOE natural gas modeling capabilities in order to better define and defend the role of advanced exploration and production technology research and development (R&D).

##### Background:

The Long-Term Sustainability of Natural Gas Supply effort was initiated largely in response to recommendations presented by the National Petroleum Council (NPC) in their 1999 report, "Meeting the Challenges of the Nation's Growing Natural Gas Demand". NPC specifically noted the benefits of 1) improved knowledge of the size and nature of the resource base, 2) an accurate inventory of resources in the Rocky Mountain region and the impact of federal land access restrictions on them, and 3) efforts to define and prioritize R&D opportunities that will expand the resource potential of both producing and unexplored areas.

The initial phase of this effort focused on producing an assessment of marginal gas-in-place resources in the Rocky Mountain region. Specifically, marginal resources of the Greater Green River (GGRB) and Wind River basins (WRB) including tight, basin-centered gas, and deep gas resources were investigated. Gas-in-place (GIP) characterization is based on a volumetric, play-based methodology. Data collected includes aerial extent, thickness, porosity, saturation, depth, pressure, temperature, and others. Basins chosen for characterization during phase two, the Anadarko Basin (AB) of Oklahoma and Uinta Basin (UB) of Utah, continue to focus on characterization of the Rockies gas resource base while broadening the work to areas of critical interest elsewhere in the United States.



West-East cross section through the Nugget, Muddy-Lakota, Frontier UOA's in the Wind River Basin.

These new Basin-Centered Gas Assessments will be integrated with model improvements and ongoing assessments of industry related technology advances, critical information will be added to the difficult task of planning DOE's exploration and production R&D program.

**Performers:**

Energy & Environmental Solutions, LLC (E2S)

**Location:**

Morgantown, WV 26505

**Potential Impact:**

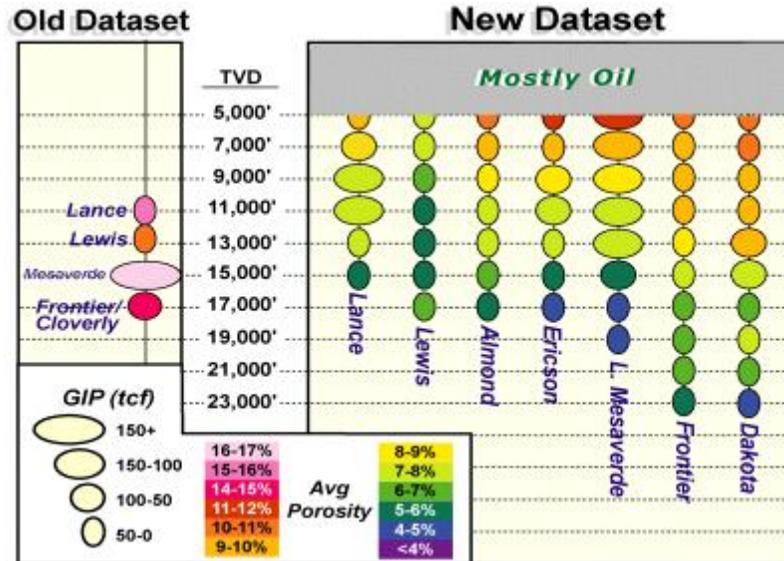
These resource characterizations will be subjected to numerous analyses using DOE's analytical models to determine how recoverability of these resources relate to various scenarios of future technological progress. In addition, NETL will continue to support efforts that analyze the impact of federal land access stipulations, recognizing the potential of future technology/cost/policy scenarios to significantly expand the technical and economic recoverability of this resource. This approach helps NETL identify R&D requirements needed to provide both, incremental technology advances that steadily increase the recoverability of the known resource base, as well as technological "leaps forward" that result in the addition of vast resources that were previously unknown, overlooked, or undervalued.

**Accomplishments:**

Phase I: In general, this study confirms past accounts of vast volumes of natural gas existing in these two basins. Specifically, we estimate approximately 3,635 trillion cubic feet (tcf) of in-place gas resources in the GGRB and 1,169 tcf in the Wind River basin. The majority of these resources lie within the thick, dominantly fluvial sections of the Lance, Ericson, and Mesaverde UOAs of the GGRB and the Fort Union, Lance, Mesaverde-Meeteetsee UOAs of the WRB. Totally, approximately 900 tcf lies at depths below 15,000 feet. The technically recoverable assessment, based on the state of today's technology, predict that nearly 360 tcf is recoverable in the GGRB. This analysis indicates that significantly more gas may be technically recoverable than has been previously reported. The technically recoverable assessment for the WRB indicates that over 120 tcf of recoverable resource are available in this basin.

Phase II: The resource assessments completed during phase two indicate that there is ~2,530 tcf of in-place gas resources in the Anadarko basin and 1,719 tcf in the Uinta basin. Of these in-place resources, approximately 1,493 tcf in the Anadarko basin and 243 tcf in the Uinta basin, exist at depths greater than 15,000 feet. Based on the current state of technology, assessments indicate that nearly 462 tcf of gas in the Anadarko basin and 125 tcf of gas in the Uinta basin is technically recoverable

All of these assessments illustrate the significant GIP resource base that exists in these basins. However, both technically and economically recoverable estimates are very sensitive to technology advances and gas prices. Technology-sensitivity analyses show that modest reductions in drilling costs or gains in recovery efficiency, which should be obtainable with continued advances in technology, lead to appreciable gains in the recoverable resource. With major technological advances, which could be obtained with an aggressive research and development (R&D) program, significant amounts of GIP could be added to the economically recoverable resource base.



Schematic comparison of previous and new datasets relative to the distribution of resource with depth in each UOA, GGRB. Previous datasets had less stratigraphic detail and placed all resources in each unit at a single depth. New datasets distribute depth among more units and across the full natural range of depth. Similar improvement is found relative to other parameters, including pressure, porosity, permeability, and water saturation.

**Current Status and Remaining Tasks:**

The assessments of the Greater Green River, Wind River, Uinta, and Anadarko Basins have been completed. A final report, including maps and cross sections of the GGRB and WRB assessments are available on [CD-ROM from NETL](#). A preliminary CD-ROM containing maps, cross sections, and analyses produced during the Uinta and Anadarko basin assessments is also available from NETL.

**Project Start Date:** February 13, 2001

**Project End Date:** February, 2005

**DOE Contribution:** \$2,560,622

**Performer Contribution:** \$0

**Contact Information:**

NETL - Jim Ammer (304-285-4383 or james.ammer@netl.doe.gov)

EG&G Services, Inc. - Ashley Douds (412-386-5355 or ashley.douds@netl.doe.gov)

**Additional Information:**

AAPG Hedberg Conference Presentation [PDF-3421KB] - April 28, 2005

Two CDs are available through the NETL CD ordering system.

Phase 1, Final Report & CD, "Natural Gas Resources of the Greater Green River and Wind River Basins of Wyoming" - overview

Phase 2, Data CD, "Natural Gas Resources of the Uinta Basin, Utah, and the Deep Anadarko Basin, Oklahoma and Texas"

**Journals:**

Rose, K.K., J.A. Pancake, A.S.B. Douds, H.R. Pratt, III, R.M. Boswell, "Assessing Sub-Economic Natural-Gas

Resources in the Anadarko Basin”, Unconventional Energy Resources of the Southern Midcontinent, 2004 Symposium, Oklahoma Geological Survey Circular 110, 2005, pgs. 123-129.

Boswell, R.M., Douds, A.S.B., Pratt, H.R.S. III, Bruner, K.R., Rose, K.K., and Pancake, J.A., “Assessing Technology Needs of Sub-Economic Gas Resources in Rocky Mountain Basins”, Gas TIPS, Summer 2002, pgs. 4 - 12

Rose, K.K., A.S.B. Douds, J.A. Pancake, H.R. Pratt, III, R.M. Boswell, “Assessing Technology Needs of “Sub-Economic” Natural Gas Resources: Phase II - the Anadarko and Uinta Basins,” GasTIPS, Fall 2004, vol 10, number 4.

Boswell, R.M., Douds, A.S.B., Pratt, H.R.S. III, Rose, K.K., Pancake, J.A., Kuuskraa, V., Billingsley, R., Bank, G., and Koperna, G., “Assessing the Technology Needs of Sub-Economic Resources, Phase 1: Greater Green River and Wind River Basins”, Final Report & CD, DOE/NETL, Winter 2003.

**Online Publication:**

Rose, K.K., A.S.B. Douds, J.A. Pancake, H.R. Pratt III, and R.M. Boswell, “Assessing Sub-Economic Natural Gas Resources in the Anadarko and Uinta Basins,” Search and Discovery.

**Abstracts:**

Boswell, R.M., Douds, A.S.B., Pratt, H.R.S.III, Rose, K.K., Pancake, J.A., Dean, J.H., and Bruner, K.R., “Assessing Subeconomic Natural Gas Resources: Phase I – Greater Green River and Wind River Basins”, AAPG Abstracts with Programs, May 2003.

Douds, Ashley S.B., Pratt III, H.R., Rose, K.K., Pancake, J.A., and Boswell, R.H., “Gas-In-Place Resource Assessments of Selected Rocky Mountain Basins: Results from the Greater Green River, Winder River, and Uinta Basins”, RMR AAPG/COGA Joint Conference Abstracts with Programs, August 2004.

Rose, Kelly K., Douds, Ashley S.B., Pancake, James A., Pratt III, H.R., and Boswell, Ray, “Assessing Subeconomic Natural Gas Resources in the Anadarko and Uinta Basin”, AAPG Abstracts with Programs, April 2004.

Rose, Kelly K., Douds, Ashley S.B., Pancake, James A., Pratt III, H.R., and Boswell, Ray, “Assessing Subeconomic Natural Gas Resources in the Anadarko Basin”, Oklahoma Geological Survey Workshop Proceedings “Unconventional Energy Resources in the Southern Midcontinent”, March 2004.

Rose, K.K., J.A. Pancake, A.S.B. Douds, H.R. Pratt III, and R.M. Boswell, "Assessing Subeconomic Natural Gas Resources in the Anadarko Basin," Oklahoma Geological Survey Circular 110, in press.