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I am Dr. Peter Morton, Resource Economist in the Ecology and Economics Research Department for The Wilderness Society, a 175,000-member national conservation group that focuses on public land issues. I appreciate the opportunity to testify today regarding methods for assessing oil and gas resource and the potential access restrictions on extracting those resources.

I will begin by endorsing the methods recommended in the recent RAND report "Assessing Gas and Oil Resources in the Intermountain West: Review of Methods and Framework for a New Approach." I think the authors have done an excellent job evaluating the strengths and shortcomings of past assessments of oil and gas (e.g. Department of Energy 2001, National Petroleum Council 1999), in order to provide the basis for developing an improved methodology for assessing the "economically viable resource". It is important to note that the RAND report is not a condemnation of past assessments or of the utility of quantitative modeling for policy development. Rather, reviewing methods, identifying shortcomings, and making recommendations are a healthy part of the scientific process.

As the RAND report correctly points out, much of the potentially restricted oil and gas resources would never be developed because they are inaccessible for other reasons. The oil and gas leasing stipulations that dictate where, how, and when exploratory drilling may be conducted in order to protect wildlife and the environment are not, in many cases, binding constraints on energy production. Economics, terrain and technology may in fact play more important roles in determining the "economically viable resource". I strongly agree with RAND's recommended improvements to base assessment on the oil and gas that is economically recoverable, include reserves, include private land, account for stipulations waived, include directional drilling, consider pipeline access and multi-season drilling. These recommendation are consistent the ones I made with respect to improving the Department of Energy's Green River report released last year (Morton 2001). As the RAND report noted, including wellhead cost, infrastructure costs, and environmental costs in the assessment of viable resource will likely have the greatest impact on the amount of oil and gas estimated to be economically viable. Accurately assessing these costs is the key, and these proposed methods will make an important contribution to the debate.

In the rest of my testimony I will expand on the above points, focusing on what I see as the key variables or parameters in the debate over oil and gas assessment methodologies. These include:

- the land and resource base assessed should include private and public land, as well as discovered reserves;
- the assessment should utilize USGS mean estimates for economically recoverable oil and gas (rather than technically recoverable), estimated using a range of prices;
- the assessment methods should use a directional drilling distance of 3-4 miles, consider multi-season drilling opportunities and consider the increased access that will be available with future technology; and
- account for the market and non-market economic costs including those associated with increasing the scale of production beyond the assimilative capacity of communities and ecosystems.

Resource Assessments Should Include Private and Public Land.
When accessing oil and gas resources it important to account for the entire resource base, including private and public lands. In the Rocky Mountains, for example, approximately 35 percent of the gas lies under non-federal land (RAND 2002). A narrow focus on public lands will overestimate the oil and gas resources subject to access restrictions. Because non-federal lands are not subject to federal lease stipulations, oil and gas resources underlying them are subject to standard lease terms that are not necessarily restrictive. Using the total land as a basis would therefore reduce the fractions of resources subject to potential access restrictions. For example, based on an analysis of data in the National Petroleum Council report on natural gas (1999), when non-federal lands are included in the analysis, the percent of gas in the Rocky Mountain Region subject to potential access restriction drops from 56 percent to 35 percent. While we are critical of the recent Green River study by the Department of Energy, similar results can be derived. When non-federal lands were included, the percentage of access-restricted gas drops from 68 percent to 38 percent (RAND 2002).

Including private land in the assessment is needed to address the ability of industry to access federal resources located underneath private lands (i.e. split estates). Split estates are lands where the surface rights are privately owned and subsurface rights are federally owned and can be leased to private companies. An assessment of federal resources should certainly include these private lands with federal subsurface resources. Split estates are a huge challenge in the west, and the relatively open access to these resources – despite the objections from private landowners -- should be included in the resource assessment.[1]

Private lands should also be included in the assessment because they hold a majority of the undiscovered gas that is economical to extract. Analysis of government data indicates that private lands have a large share (51 percent) of the undiscovered economically recoverable natural gas in the U.S. (USGS 1998, MMS 2001). In contrast, federal lands nationwide are expected to contribute just 12 percent of America's economically recoverable undiscovered gas.[2]

Figure 1 – Undiscovered Economically Recoverable Natural Gas at $3.90 per Mcf (onshore) and $2.11 per Mcf (offshore), (Tcf)

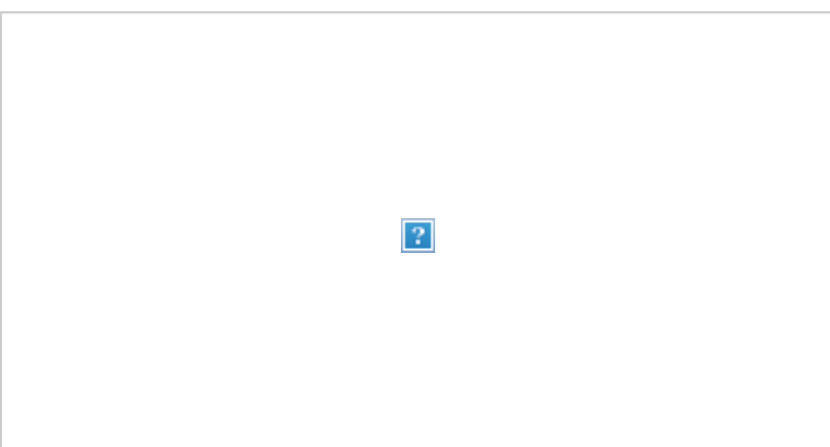


Figure 1 shows the relative contributions of undiscovered economically recoverable natural gas reserves from onshore federal and non-federal lands, and from offshore federal lands. Economically recoverable natural gas from onshore federal lands is about 12 percent of the estimated total undiscovered gas resource of 313 Tcf. Non-federal onshore lands likely hold, at most, 51 percent, and offshore lands hold at least 37 percent of total undiscovered economically recoverable natural gas (Source: Goerold 2001).

Resource Assessments Should Include Oil and Gas Reserves.
Oil and gas reserves are important to include in the assessment as they play significant roles in both long-term and short-term supply. Quite simply, most of our oil is located where we have already found it – in or near existing reserves. Oil and gas reserves are by definition economically feasible to bring to market.[3] "Reserve growth"

refers to the increase in economically recoverable oil or gas as fields are developed. Reserve growth is perhaps THE major component of remaining U.S. gas resources (USGS 1996). Since 1977, 79 percent of the oil added to America's reserves came from development drilling in mature oil fields, while only 21 percent came from exploratory drilling in new areas (DOE 2002). Since 1990, the vast majority of reserve additions in the U.S. – 89 percent of oil reserves additions and 92 percent of gas reserve additions – have come from finding new reserves in old fields (DOE 1999). These trends will continue as USGS estimates that the majority of economically recoverable oil and gas in America will come from already discovered reserves and growth of those reserves – in other words, oil and gas fields already developed and near existing infrastructure.

The dominant role played by our oil and gas reserves is clearly illustrated in Table 1. Assuming America were completely dependent on domestic production (we currently import 56 percent of our oil), we currently have about 15 years of oil and 21 years of gas in reserves and growth of those reserves. If, through investment in conservation and efficiency, we reduce our dependency on imported oil to 50 percent for example, our oil reserves will last twice as long as indicated in Table 1. Existing reserves and growth of those reserves, when combined with public and private investments in conservation and efficiency, provide us with 20-40 years to make a transition to a more efficient economy based on alternative energy sources such as hydrogen fuel cells, wind, and solar.

Table 1. Economically Recoverable Oil and Gas in the United States

	Economically Recoverable as a Portion of Total U.S. Consumption	
	Oil	Gas
Reserve and Reserve Growth (existing wells and fields)	14.6 years	21.4 years
Drill All Onshore Federal Lands (undiscovered resources)*	222 days	1.7 years
Drill Arctic Refuge (undiscovered resources)	162 days	None
Drill private and state lands (undiscovered resources)	2.6 years	12.9 years

Source: USGS 1998, Mineral Management Services 2000. *Totals do not include Arctic Refuge

In contrast to reserves, the USGS estimates that only a small portion of undiscovered oil and gas resources can be recovered with a profit. As shown in Table 1, drilling the Arctic Refuge and other public wildlands will not significantly increase our energy supply or transition time. Drilling for undiscovered resources on federal land, including national parks, national forests, lands managed by the Bureau of Land Management, and national wildlife refuges, would only meet U.S. demand for oil and gas for 222 days and 1.7 years respectively (USGS 1998)—with the Arctic Refuge adding an additional 0-6 months of oil. While the flow of oil and gas would obviously take place over longer periods of time, the results clearly show why we cannot drill our way to energy independence. Our demand is simply too high while our remaining undiscovered resources are too small.

Table 2 shows the location of our reserves and indicates that approximately 24 percent of our oil and gas reserves are located in Texas, with significant quantities in Alaska and offshore in the Gulf of Mexico. Somewhat surprising is that nearly 4 billion barrels of oil (about 20 percent of our reserves) are in reserves currently not in production (EIA 2001). Texas and Alaska together have around 1.3 billion barrels of oil in non-producing reserves. Significantly, non-producing reserves in the US have more oil than USGS estimates will be economically recoverable from the Arctic National Wildlife Refuge.

In addition to the significant contribution reserves make to long-term supply, reserves play an important role with respect to short-term supply, because reserves are most immediately available for injection into underground storage. And, the amount of gas in underground storage is a major supply factor influencing short-term market price and market instability (DOE 2001). With relatively inelastic demand for energy in the short-term, lower levels of working gas in storage (short-term supply) will, in general, lead to higher energy prices. Figures 2 and 3 clearly illustrate the recent inverse relationship between gas in storage and gas prices -- the lower the storage levels the higher the price. From January 2000 through September 2001, working gas in storage was significantly below the 5-year average, resulting in the increased price volatility, which is reflected in the spike in natural gas wellhead price. Gas inventories were not the only inventories that were low; similar inventory shortages occurred in all the major energy markets.[4]

Table 2. Location and Totals for U.S Oil and Gas Reserves as of December 1999.

	Oil in Reserve	Gas in Reserve
	Millions of Barrels --	Billion Cubic Feet-
Texas	5339	40157
Alaska	4900	9734
California	3934	
Federal offshore	3297	2387
New Mexico	718	25987
Oklahoma	621	15449
Louisiana	600	12543
Wyoming	590	9242
Utah	268	14226
North Dakota	262	3213
Montana	207	416
Colorado	203	841
Kansas	175	8987
Alabama	49	5753
Other states	602	4287
Totals	21,765	14184
		167,406

Source: Energy Information Administration 2001.

Figure 2. During the last half of 2000 and the first half of 2001, gas inventories were at historic lows.

Figure 3. Very low levels of working gas in storage contributed to the price spike.

The following text from monthly reports from the Department of Energy underscore the important role that underground storage has on gas prices.

"For the month of December [2000], the spot wellhead price averaged an unheard of $8.36 per thousand cubic feet. Never have spot gas prices at the wellhead been this high for such a sustained period of time….. the predominant reason for these sustained high gas prices was, and still is, uneasiness about the winter supply situation. For much of the summer, low levels of underground storage raised concerns about the availability of winter supplies. Now that the winter has really started, the most severe assumptions about low storage levels have come true. The low levels of gas storage have put the spot market in an extremely volatile position…Underground working gas storage levels are currently 31 percent below year-ago levels and a remarkable 23 percent below the previous 5-year average (emphasis added)." EIA Short-Term Energy Outlook, January 2001.

"The duration of these high gas prices is unprecedented… it will be a while (if ever) before prices at the wellhead return to the low level of $2.00 per thousand cubic feet….One factor keeping those prices relatively high is, once again, concern over the adequacy of injections into underground storage. The gas supply situation this injection season bears close monitoring" (emphasis added)." EIA Short Term Energy Outlook, April 2001

"Underground storage levels set records last month…For the end of November [2001], the storage level is estimated to have been about 29 percent above last year's level. We project that natural gas wellhead prices will generally stay below $2.40 per thousand cubic feet through the winter." EIA Short-Term Energy Outlook, December 2001.

The shortage in underground storage was perhaps the dominant causal factor in the spike in gas prices, the market instability, and the ephemeral energy crisis of 2001. Given the language included in the 1999 Energy Policy and Conservation Act (EPCA), that emphasized reserves, combined with the importance of reserves for long-term supply as well as short-term supplies for injection into underground inventories, we recommend that the resource assessments include an analysis of the location and accessibility of gas and oil reserves.

Resource Assessments Should Rely on USGS Data.
Section 604 of the Energy Policy and Conservation Act Amendments of 2000 requires an inventory that identifies United States Geological Survey reserve estimates of the oil and gas resources. While we recommend the use of USGS data, it is important to note that there is considerable uncertainty involved when making estimates of the undiscovered quantities of oil. There is geologic uncertainty as to whether any oil-gas even exists, and there is market uncertainty with respect to future oil prices. To stress the significance of this uncertainty, the USGS describes quantities of oil in terms of probabilities (Figure 4). Quantities of oil that might be economically recoverable are stated in terms of the 95th percentile (19 in 20), expected mean value, and 5th percentile (one in 20) probabilities of exceeding a stated quantity. Using Figure 4 as example, there is a 95% chance of at least volume V1 of economically recoverable oil, a 50% chance of at least volume V3, and a 5% chance of at least V2 of economically recoverable oil. We believe that the USGS expected mean estimates provide the best, unbiased point estimate of the expected value of undiscovered oil and gas resources.[5]

While we support the use of mean estimates, we express considerable skepticism when it comes to quantities of undiscovered oil or gas estimated with only a 5-percent probability. Estimates with just a 5-percent probability can be expected to be wrong 19 out of 20 times. Predictions that are wrong 19 out of 20 times are rarely relevant in policy debates. To emphasize this point, consider the following example. If an environmental group ran a computer model that estimated global temperatures would increase 15 degrees in the next 10 years if we keep emitting carbon dioxide at current rates, but the model prediction was wrong 19 out of 20 times -- would anyone take the estimate seriously? Would decision-makers, scientists, or the press give the estimate any credibility? Pro-drilling forces would certainly scoff at the scare tactics and pseudo-science behind a dire environmental prediction that may be correct only 5% of the time. With this in mind, we believe that quantities of oil and gas, estimated with just a 5-percent probability, should be heavily discounted, if not ignored, by decision-makers.

Resource Assessments should be based on the Amount of Oil and Gas Economically Recoverable.
We believe that economically recoverable amount of oil and gas -- not the technically recoverable amount -- is the correct measure of the opportunity costs of protecting the environment. The concept of opportunity costs is the appropriate construct for valuing both benefits and costs of public policies. Opportunity costs equal the net benefits foregone as a consequence of the policy or action. One of the common mistakes made when evaluating regulations or decisions to limit access, is the use of gross revenues when estimating opportunity costs, rather than net revenues. The opportunity costs of leasing stipulations should equal the net benefits of the oil or gas foregone. If the full cost of extracting a resource is greater than market price, the net benefits are negative, the resource is not an economic resource, and there are no opportunity costs from protecting the environment.

Technically recoverable oil represents the quantity of oil in place that is recoverable using current technology but without regard to costs or profits. Economically recoverable oil as estimated by the USGS (2001) is the quantity of technically recoverable oil that can be recovered based on exploration, production and transportation costs, plus a 12 percent profit margin. The Congressional Research Service concludes that a useful analysis for policy purposes should focus on estimates of oil resources that are economically recoverable (Corn, Gelb and Baldwin 2001).[6] Virtually every report on gas supply over the last 20 years has reported results in terms of economically recoverable resources (Environmental Law Institute 1999). Since policymakers should be concerned about the actual impacts -- not the hypothetical impacts -- from lease stipulations, economically recoverable resources, as estimated by USGS scientists, are the policy-relevant measure and should be the basis for the EPCA studies.[7]

When economic criteria are considered the amount of oil and gas actually recoverable drops significantly (USGS 1998). Within the Rocky Mountains and Northern Great Plains, 81 percent of the undiscovered gas is in unconventional deposits. Of this, the USGS estimates that only 8 and 4 percent is economically viable at $3.34 and $2 per mcf, respectively (RAND 2002) – underscoring the drop in accessible resources due solely to financial constraints on production. In the Green River study area, 90 percent of the technically recoverable gas is continuous-type, tight gas (DOE, Table 2, p. 10, 2001). The high costs associated with extracting continuous-type gas from low permeability geologic strata result in only a small percent of the technically recoverable gas being profitable for a company to extract. USGS scientists (1998) estimate that between 7 and 15 percent of technically recoverable, continuous-type, tight gas in the lower 48 is economically recoverable. The actual impacts on gas supplies from lease stipulations are therefore much less than estimated in the DOE Green River report.

Similar financial constraints apply to coal bed methane (CBM). Papers presented at a recent coalbed methane conference indicated that CBM below 5000 feet, while technically recoverable, is not economical to extract. CBM located 10,000 feet underneath a roadless area, for example, would therefore have an opportunity cost of zero -- even without roadless area protection, no one would drill for the CBM as it is not an economic resource. In such cases, roadless area protection would not be the binding constraint on production; the binding constraint is the financial cost associated with extracting gas 10,000 feet below the surface.

We remain concerned that if the EPCA access studies continue to ignore economic constraints on production they will overestimate the quantity of oil or gas potentially off-limit, and, therefore, overestimate the opportunity costs associated with lease stipulations that protect the environment. To reiterate, if the gas is not economically feasible to extract, there are no adverse impacts on gas supply or prices from lease stipulations designed to protect wildlife, archeological sites, recreation sites and other public resources. The use of technically recoverable oil-gas rather than economically recoverable, is similar to incorrect use of gross revenues rather than net revenues when evaluating the opportunity costs of policies. It is for these reasons that we recommend resource assessments be based on economically recoverable oil and gas, not technically recoverable. When estimating economically recoverable oil and gas, market price is a key factor. To account for the economic uncertainty inherent in price forecasts, we recommend using the USGS high and low expected mean estimate of oil and gas that is economically recoverable.[8]

Resource Assessments should fully account for the Non-market Costs Associated with Resource Extraction. The USGS economic analysis for the lower 48 only includes the financial costs of oil and gas production, including items such as the direct costs of exploration, development, and production. Not included in the USGS calculus are non-market costs such as the off-site ecological costs and cumulative negative environmental impacts that might result from drilling. The USGS economically recoverable analysis more closely resembles a financial analysis than an economic analysis. A financial analysis only examines costs and benefits as measured by market price; it is the viewpoint of private industry and is more concerned with profits or losses. In contrast, an economic analysis of benefits and costs must account for non-market benefits and costs, as well as those more readily observed and measured in market prices. An economic analysis is conducted from the viewpoint of society, which should also be the viewpoint of politicians and managers of the public estate.

While many non-market costs are difficult to estimate, academic and federal agency economists have made great advances in developing methods to value non-market costs (e.g. erosion, noxious weeds, pollution) and benefits (biodiversity conservation, ecosystem services, passive-use; Morton 2001)[9]. Many heretofore-unquantifiable wildland benefits and costs are now quantifiable and available to agency officials responsible for developing the policies and procedures for guiding public land management. We therefore recommend that the resource assessment include full consideration of these costs. RAND (2002) recommendation for utilizing spatial indices of areas with vulnerable environments is a creative technique and, at least on the surface, has the potential to be an excellent method for internalizing the difficult-to-quantify, non-market environmental costs associated with energy development. The development of an appropriate environmental vulnerability index based on, for example riparian areas, steep slopes, archeological sites, critical habitat, roadless areas, wilderness study areas, etc., will be an important factor in the success of the methods proposed.

We also encourage the USGS to internalize non-market costs into future cost functions developed for estimating economically recoverable resources. If the economic analysis fully accounted for the non-market costs associated with oil and gas extraction, the quantities of oil and gas estimated to be economically recoverable would be less than reported by USGS scientists.

Public Land Agencies Should Consider the Socio-Economic Costs Associated with Resource Extraction.
While in past testimony we have focused on the environmental and ecological costs from oil and gas production (Morton 2001), here we would like to focus on the costs to communities from accelerated resource extraction. An historic emphasis on resource extraction industries has resulted in repetitious cycles of socio-economic distress for rural communities in the west. However, in the last 15 years, the economies of the Rocky Mountain states have diversified and are not dependent on resource extraction. For many of these states and communities, service jobs, retirees, recreation and hunting are the mainstays of the economy. In the new economy, public lands have an indirect role in attracting non-recreational businesses and retirees. There is a growing body of literature suggesting that the future diversification of rural western economies is dependent on the ecological and amenity services provided by public lands in the west (Power 1996, Rasker 1995, Haynes and Horne 1997). These services (e.g. watershed protection, wildlife habitat, and scenic vistas) improve the quality of life, which in turn attracts new businesses and capital to rural communities. Public lands in the west represent natural assets that provide communities with a comparative advantage over other rural areas in diversifying their economies. As such, it is important to recognize and analyze the potential negative impacts of oil and gas exploration on the service and recreation industries, as well as on retirees and other households with investment income.

Past research indicates significant social costs (e.g. seasonal employment, higher unemployment rates) associated with economic specialization and dependency on resource extractive industries. In essence, resource extractive communities have an inherent economic instability associated with them. This instability, in income and employment, for example, is a result of laborsaving technological improvements, business cycles sensitive to interest rates and housing starts, and fluctuations in world resource markets -- macroeconomic forces outside local control.

Economic instability is of concern to community leaders because if a local economy is unstable, economic development plans are more likely to fail. The economic instability created in the "boom and bust" economies associated with resource extraction increases the risk associated with capital investment in linked industries. As such, resource specialization and the resulting economic instability can prevent the formation of forward and backward economic linkages in the local and regional economy and can negatively impact workers.

Resource extractive workers tend to get stuck in a vicious cycle of relatively high paying jobs with frequent layoffs and unemployment. This cycle is what Freudenburg (1992), a sociologist, calls the "intermittent positive reinforcement regime;" one of the most effective of all behavioral reinforcements (Freudenburg and Gramling 1994)
While resource extractive workers develop high skills, such skills are not readily transferable to other jobs and the workers become overspecialized (Freudenburg and Gramling, 1994). Investment in education and job retraining is low because "the potential return on their investment in their education is either too low or too uncertain to justify sacrifice (Humphrey et al. 1993). The resultant pattern of "rational under-investment" in the development of skill and other forms of human capital can result in reduced economic competitiveness in resource-dependent and specialized communities.

The current emphasis on oil and gas exploration is pushing rural communities into another boom-bust cycle, and there are indications that the bust is already here. Between November 2001 and February 2002, New Mexico lost 900 jobs in oil and gas industry (New Mexico Department of Labor 2002). In Wyoming, over 1500 workers in oil and gas extraction lost their job between September 2001 and February 2002 (Wyoming Department of Employment Research and Planning 2002). The primary cause of the employment bust is the significant drop in gas prices over the last year.

The current boom-bust cycle has also generated significant costs to communities in the Powder River Basin of Wyoming – costs that must be considered by public agencies rapidly promoting energy development. Many landowners are spending thousands of dollars on attorneys in order to negotiate a surface damage agreement to protect their property (i.e. the split estate problem). Other landowners have seen dramatic declines in property values.[10] The City of Gillete has experienced a 12 to 15 percent increase in truck traffic plus a 26 percent increase in traffic violations between 1999 and 2000 (Pederson Planning Consultants 2001). As a result, the expected life of city streets has decreased, while road operation and maintenance costs have increased. Dust from poorly constructed access roads causes health problems with horses, reduces the grass available for cattle, and negatively impacts air quality and visibility. County officials and residents area concerned that they will have to pay for clean up and restorations costs as the bonds posted by CBM companies for plugging and abandoning a well are inadequate.

As a result of recent coalbed methane boom, Campbell County has seen an increase in larceny, traffic accidents, destruction of private property, family violence, and child abuse – resulting in the county spending money to add 36 cells to its existing jail. The fire department has seen a 40 percent increase in emergency calls between 1997 and 2000 (Pederson Planning Consultants 2001). Similar trends have occurred in other counties in the Powder River Basin. There has also been a shift in the labor force. County workers have left for CBM jobs, resulting in instability in the labor force and making it more difficult to hire public workers (e.g. policemen, firemen) at a time where the counties and cities are stretched thin to handle the increased work load. The accelerated energy development has left many counties and communities unable to pay for or finance the increase in public service costs. We have every reason to believe that similar costs and burdens will be placed on other communities where public and private land is threatened by energy development. The socio-economic risks and costs associated with energy development, while perhaps beyond the scope of EPCA, should be acknowledged as part of the NEPA process involved with current energy development in the west.

Environmental Stipulations in Oil and Gas Leases Protect Public Resources.
While recognizing that stipulations have the potential to reduce access to oil and gas, it is important to recognize the benefits of the environmental stipulations. Public and scientific concerns for protecting sensitive lands and resources are the justification for including environmental protection stipulations in drilling leases on public land. These stipulations are designed by agency professionals to protect multiple public resources, including water quality, critical winter range for elk and antelope, sage grouse leks, archeological sites, and recreation sites. Seasonal closures, necessary to protect raptor nest sites, elk populations, and the quality of the outdoor recreation experience, may slow down the rate of gas exploitation but protect the wildlife and other multiple uses under which public land is managed, as well as the quality of life for local residents. Such protection is warranted economically, as watershed protection, hunting, fishing, and recreation generate significantly more economic benefits to all Americans, including affected residents and businesses in the Rocky Mountain Region, than do oil and gas extraction. Legislative intent and public sentiment indicate that public lands should not be for the exclusive use of the oil and gas industries and that managers must attempt to balance the many uses that occur on public land. Leases with environmental protection stipulations help internalize the environmental and ecological costs associated with oil and gas extraction by protecting other multiple uses enjoyed by the public.

Resource Assessments Should Include the Potential Access Available with Directional Drilling.
The Green River EPCA study utilized a directional drilling distance of just 0.25 mile (1/4 mile) when examining access to resources, even though industry officials have repeatedly asserted that contemporary drilling technology enables operators to reach oil and gas resources at considerable distances from a drilling site.[11] For example, the National Petroleum Council (1999, page 15) states that “extended reach drilling allow access to resources 5 to 6 miles from the drill site”. In addition, a 1999 DOE report titled “Environmental benefits of advanced oil and gas exploration and production technology” states that “resources…can now be contacted and produced without

disrupting surface features above them" (page 13). We recommend that the EPCA studies assume a slant drilling distance that is more consistent with current technology and industry statements regarding the efficacy of, and advances in, slant drilling. For example, a 3-4 mile slant drilling distance would be reasonable to analyze.[12]

Resource Assessments Should Consider the Potential to Increase Access with Future Technology. Technological improvements are often cited as the reason that predicted costs of compliance often turn out to be less than actual costs (OTA 1995). Trends in technological improvements should be incorporated into the resource assessment because technological improvements will, in general, increase access and reduce the amount of oil or gas estimated to be inaccessible with today's technology. History has shown that advances in drilling technology, such as remote sensing methods, have increased industry's ability to access resources in an environmentally friendly manner. Advances in remote sensing technology, for example, will improve the accuracy of drilling and will make slant drilling economically feasible from greater and greater distances, perhaps 6-10 miles or more.

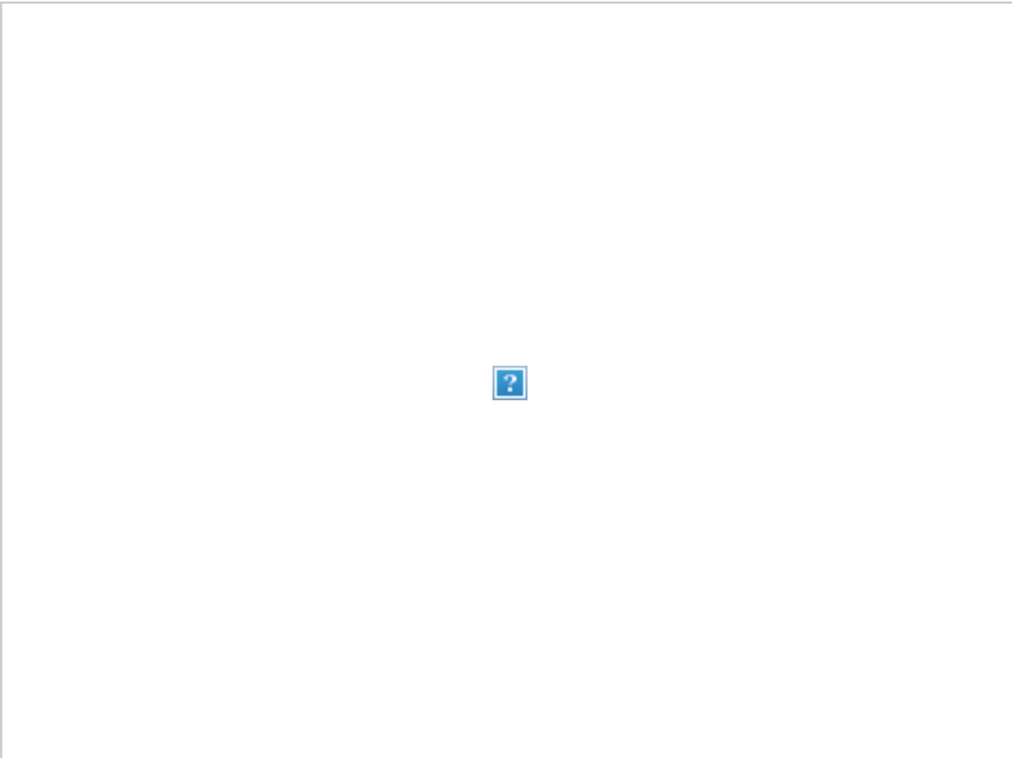
Advances in drilling technology (e.g. improved drill bits) will also reduce drill times, reducing any impact seasonal wildlife stipulations may have on the ability of industry to access resources. For example, a 15,000-foot well in Oklahoma takes about 39 days to drill, a decrease from 80 days in 1970 (DOE 1999). Technological advances will reduce the quantity of oil and gas estimated to be inaccessible due to current leasing stipulations. We therefore recommend that the EPCA studies include a sensitivity analysis of the increasing access to resources on public land that results from technological innovations by the oil and gas industry. Information on the marginal increase in accessible resources from advances in technology will provide industry an incentive for investing in such technology.

Resource Assessments Must Consider Cumulative Impacts and the "Diseconomies of Scale." When examining the economically viable resource, it is important to recognize the cumulative negative impacts from increasing the scale of production. While increasing the scale of production typically decreases the financial costs to a producer (i.e. economies of scale), larger scale projects will, in general, increase the non-market economic and community costs – resulting in what we will call the "diseconomies of scale". As a result, the socio-economic and environmental constraints on the scale of oil and gas production will increase costs and may limit full development of technically recoverable resources.

While oil and gas development on a small scale may have limited negative impact on communities and ecosystems, as the scale of production increases, the ability of those systems to assimilate the impacts is jeopardized. For example, as the scale of coalbed methane increased in the Powder River Basin of Wyoming, the increase in traffic, crime and immigrants overwhelmed the capacity and budgets of communities and counties for handling these problems. While the CBM may be financially recoverable, local community concerns over the cumulative negative impacts from future production will increase the cost and may prevent the development from actually occurring.

Similarly, the cumulative negative impacts of CBM production on clean air and clean water may be a constraining factor on the scale of production -- irrespective of whether the CBM is financially or technically feasible to extract.

The amount of CBM wells drilled in Wyoming have increased dramatically (Figure 5). As a result, the amount of water discharged from CBM wells in Wyoming has skyrocketed in recent years, increasing from approximately 98 million gallons (300 acre feet) per year in 1992, to 5.5 billion gallons (17,000 acre feet) per year in 1999 (Wyoming State Engineer's Office cited in Darin 2000). The water discharged from oil and gas wells is highly saline with a very high sodium absorption ratio (SAR) – a ratio that affects how water interacts with soil. Water with a high SAR can permanently change chemical composition of soils, reducing water permeability and thereby decreasing native plant and irrigated crop productivity. To be sustainable and to maintain water quality, the increase in SAR water should not exceed the SAR assimilative capacity of the regional river systems. As the scale of CBM production increases, it is more likely that the cumulative quantities of SAR will exceed the assimilative capacity of regional watersheds.



Similar arguments can be made with respect to the negative impacts of CBM production on air quality. Based on an analysis by Bob Yunke of the Environmental Defense Fund (2002), the total emissions associated with developing the more than 50,000 wells expected in the Powder River will exceed Clean Air Act limits in the surrounding Class I airsheds (Northern Cheyenne Reservation in Montana and the Badlands National Park in South Dakota). As a result of CBM development in the Powder River, there could be a 60 percent decrease in visibility in the Badlands on peak air pollution day. The loss of clear skies will reduce the quality of life for local residents and decrease the quality of the recreational experiences in nearby wilderness areas and national parks – all of which will translate to negative economic impacts on local communities.

In summary, the assimilative capacity of communities and ecosystems represent constraints on oil and gas production that may limit future production, even though the oil-gas may be financially feasible for a corporation to produce. Cumulative impacts and constraints on the scale of production should therefore be considered when assessing economically viable resource,

Conclusions

Based on analysis of USGS data, it is clear that drilling public wildlands in the west will do little to affect our energy future. Public lands provide greater benefits to society when left in their wild and roadless condition for current and future generations to enjoy. The marginal benefits from wildland conservation are, in most cases, much greater than the marginal costs in the form of the undiscovered, economically recoverable energy resources foregone.

The current fixation on access to undiscovered resources in remote wildlands overestimates the importance of undiscovered resources in reducing market instability and reducing the energy prices paid by consumers. Decision-makers concerned about high energy prices and price volatility (the main components of the energy "crisis") would be better served by focusing on transporting gas from existing reserves into short-term storage. In addition, requiring industry to maintain a higher minimum underground storage level will reduce price volatility and the cause of high energy costs for consumers and businesses. In contrast, drilling public wildlands will do little to address the root causes of the 2001 “energy crisis”, nor will it reduce the energy costs for families – despite claims to the contrary made by industry officials.

Regardless of whether there is high access to resources or high investment in drilling technology, the downward trend in America’s crude oil production will continue. In other words, we have already discovered the best reserves America had to offer. Of the 4.6 million oil wells worldwide, 3.4 million have been drilled in the U.S and a majority of America’s wells were dry wells. Why subsidize the drilling of more dry wells? Rather than propping up old industries, increasing profit margins for corporations, and sacrificing America’s remaining wildlands, taxpayer subsidies would be far better spent promoting new markets in alternative energy, efficiency and conservation. The bottom line is that the first country to wean itself from oil wins.

References (partial list).

U.S. Office of Technology Assessment 1995. Gauging control technology and regulatory impacts in occupational safety and health. Cited in OMB draft report

U.S. Department of Energy, 1999. Environmental benefits of advanced oil and gas exploration and production technology. Office of Fossil Fuel

U.S. Office of Management and Budget, 1996. Economic analysis of federal regulations under executive order 12866.

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[1] Much of the land in the Powder River Basin of Wyoming is split estate land. An assessment of resource that focuses only on public land, ignoring split estate land, would mischaracterize the current situation by dramatically underestimating the access industry has to oil and gas in the Powder River. This underscores the need to include private land in resource assessments.

[2] The relative endowment of economically recoverable natural gas from offshore lands is likely to be very underestimated relative to onshore estimates. Offshore resource estimates from MMS assume a gas price of just $2.11 per Mcf gas. In contrast, the USGS onshore resource estimates assume a gas price of $3.90 per Mcf gas.

[3] The USGS (1998) defines reserves as “estimated quantities of crude oil, natural gas, or natural gas liquids which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions.”

[4] In late 2000 and early 2001, the short-term inventories of major fuels were significantly below normal ranges, contributing to higher prices and hence the perception of an energy “crisis.” An energy plan focused on drilling wildlands does nothing to remedy the causes of the recent energy crisis. A question for further investigation: What were the circumstances that allowed inventories – short-term storage levels – of all major energy markets, to be at such low levels during late 2000 and early 2001?

[5] The mean is technically an average for the mathematically derived probability distribution that is generally close to the 50-percent probability. However, the statistical procedure used to arrive at mean estimates tends to produce a figure that is greater than one estimated with a 50 percent probability (Economic Associates, Inc. 1983).

[6] Corn, M.L., B.A. Gelb and P. Baldwin. 2001. The Arctic National Wildlife Refuge: The Next Chapter. Congressional Research Service. Updated August 1, 2001

[7] In fact we believe that EPCA requires economics to be considered. Section 604 of the Energy Policy and Conservation Act Amendments of 2000 is titled Scientific Inventory of Oil and Gas Reserves. Section 604 requires an inventory that identifies United States Geological Survey reserve estimates of the oil and gas resources underlying these (federal) lands. Reserves are by definition economically feasible to recover.

[8] Economists at the USGS estimated economically recoverable resources using two price scenarios ($18 and $30/barrel of oil, $2.00 and $3.34.tcf of gas – all prices in 1996 dollars).

[9] Morton, P. 2001. Testimony before the Subcommittee on Forests and Public Land Management Committee on Energy and Natural Resources, United States Senate, April 26, 2001.

[10] This is particularly true on the western side of the Basin, near Sheridan and Buffalo, where land values are based not on the agricultural values but on scenery and wildlife values (Jill Morrison, personal communication). One ranch, a high dollar ranch and hunting retreat, went up for sale for around $9 million. The ranch was under contract for purchase, but the buyer found out the minerals were leased and slated for CBM development. The buyer wanted to back out, but the seller agreed to a $3 million dollar reduction in the price and the buyer purchased the ranch for about $6million.

[11] Based on a discussion with BLM officials, the 0.25 mile drilling distance used in the Green River study was selected as being the distance that is feasible for industry to drill. The dominating factor in determining the feasibility of slant drilling is economics, as slant drilling can be expensive. The consideration of economic factors in determining the feasible distance for slant drilling underscores the need to also include economic factors when estimating oil and gas resources affected by lease stipulations. While there might be significant oil and gas resources in the Green River Basin, if they are not economically feasible to extract, they should not be considered inaccessible due to leasing stipulations. The implicit inclusion of economic factors when determining the feasibility of slant drilling distances is inconsistent with the exclusion of economic factors when estimating the feasibility of recovering resources. These methodological inconsistencies must be addressed in order to improve the reliability of the findings in future EPCA reports.

[12] With over 400,000 miles of road on the national forests alone and a backlog of over $8 billion dollar in road maintenance, lack of access to oil and gas on public lands is not really an issue. On average, the annual maintenance cost of a mile of road is about $1,500 per mile (USDA FS 1999). Each new mile of road added to the FS transportation system competes for limited road maintenance funding, as Congressional funding is less than 20% of the funding necessary to maintain the existing road infrastructure. One must seriously question the wisdom of building more roads when current roads can’t be maintained, and each year's unmet maintenance needs increase the backlog as roads deteriorate and the costs of repair increase over time.