

Stranded Gas Hearings (0407281000 Minutes)

In Need of Access: Alaska's Known and Potential Gas Resources

David Houseknecht, Research Geologist, U.S. Geological Survey

Mark Myers, Director, Division of Oil and Gas, Dept. of Natural Resources, July 28, 2004.

MR. MARK MYERS, Director, Division of Oil and Gas, Department of Natural Resources (DNR), acknowledged that the USGS does a lot of cooperative work on resource issues and that Brenda Pierce, Energy Coordinator, USGS, is attending the hearing. USGS assessments are done independent of him, although DNR input is used. Work in the federal government is focused primarily on assessing federal lands, but includes state lands and is on-going.

He said there is a big difference between reserves and resources. The reserve base on the North Slope is known and economic. Undiscovered resources is what you think is there, but don't know for sure. Probabilistic modeling is used for those resources and has a range of outcomes. The North Slope has a known reserve base that he is confident exists predominantly in two fields – Prudhoe Bay and Point Thompson, although there is undiscovered resource potential elsewhere. Access and expansion revolve around whether or not there is sufficient gas potential.

He demonstrated in a slide the known reserves in bright red at around 33 – 36 TCF (trillion cubic feet). The proposed project size, a 4.5 BCF (billion cubic feet) pipeline is only about a 20 – 22 year supply of gas and is insufficient to monetize a 30-year or longer project that Alaska would like. If that undiscovered resource base isn't there, the 4.5 BCF pipeline is too large. Furthermore, expansion of a pipeline bigger than that would not be logical or economic, because a 4.5 BCF pipe expanded through compression-only numbers gets you only 16 – 18 years of life. Then the undiscovered resource is looked at and the question is asked how much undiscovered resource needs to be there to justify the project. If 30-plus years is needed, 50 – 60 TCF of gas are needed – a significant amount. However, if those numbers are greater than 60 TCF, a 5.6 BCF line could produce for 50 – 75 years. Early expansion of that pipeline would be important to maximize both the economics of it and maximize the revenue stream to the state and federal government and encourage oil exploration overall.

The issue of undiscovered resources becomes the critical lynchpin if you're worried about expansion, if you're worried about the economics, in general the pipeline, but also if you're worried about access terms.

MR. MYERS said he used \$1.50 per MCF netback to the North Slope for demonstration purposes. A 4.5 BCF netback to the North Slope would be worth about \$2.4 billion a year or about \$6.6 million per day. Expanding to 5.6 BCF by adding pressure to the line changes the cash flow to \$600 million per year or \$1.6 million per day.

What's important from the state's perspective on one front, at least, is the state will capture part of that differential. So, early expansion, if the gas is there, makes a tremendous difference on the economics of the project and the benefits the state receives.... Also, the earlier you define those reserve bases, the more secure the project is. It is a lot easier to fund and back a project that has 30 to 50 years of reserves than it is for one that has 20.

So, understanding what the resource potential is and how likely you are to achieve that really becomes the critical issue on many of things you'll have to deal with through the Stranded Gas Application process....

MR. MYERS explained that an expansion would lead to an overall lower tariff on the pipeline for all shippers, initial shippers and expansion. If the cost of expansion is more through looping or other means, typically the people expanding the pipeline beyond that bear the full cost of the incremental expansion.

He said that the ability to expand early is almost required if the necessary reserve base is there. Exploration can't occur if gas is stranded for a long period of time, because the economics aren't there for the company to drill the exploration wells until there is capacity in the line.

Under the 4.5 BCF/day proposed scenario for Prudhoe Bay and Point Thompson, the initial gas producer who has the open season will fill the pipeline for the first 12 years. If it take eight years to build, there is a 20-year period before any new gas can come into the line. The state has 10-year leases and companies simply cannot afford to expend huge dollars upfront and wait 20 years to capitalize their investment.

So, it is a chicken or egg situation, unless the rules on expansion are clear and that access is available. Again, that's not an important question unless you believe the gas resources are really there. If they're not there, then there is really no issue with expansion. That's why the technical assessments become critical.

MR. MYERS believed that the gas resources are highly probable to be in sufficient quantities for an expanded pipeline to have a 50-year life.

Finally, one of the key things to recognize is there will be folks who tell you that expansion isn't that important and that it will happen naturally. Well, it won't with enough certainty to get the early exploration going. Again, from DNR's perspective, it's critical to the state to see that we have good access terms, that expansion is available for parties that wish to explore. That confidence, then, leads to exploration and valuation of state lands and will ultimately lead to accelerated revenue stream; it will lead to more oil and gas being produced. Because along with that gas, a significant amount of oil will be produced, as well.

SENATOR CON BUNDE asked him to explain why expansion might not be advantageous for some companies.

MR. MYERS replied:

If you have down-stream markets that can take a limited amount of gas and you're selling into that market, you're competing with other gas coming from the basin. If you own the pipeline and also own the gas infrastructure, there may be cases where you have two profit centers and those two profit centers come in conflict, if there's more gas coming in and competing with your gas.

So, there are natural competitive forces, that depending on the ownership and alignment of the pipeline, make your individual companies' economics different. I'll just say, if a lot of gas comes off the North Slope, it could have an effect on the value of gas say at the Acho Hub. In which case, the companies that have a lot gas in the Acho Hub now will see an overall lowering of that gas price for a short period of time until the market recalibrates, but it will affect their market position and other gas they own within other basins that are affected by the same markets. So, there's lots of complications in here....

He said the state wants all the gas to come because it helps our economics, but the individual company may have a slightly different set of economics. Much of today's discussion will be on the areas in the southern part of the basin that are in the North Slope Foothills and the NPRA (National Petroleum Reserve – Alaska).

In addition to known fields at Prudhoe Bay and Point Thompson, there are unconventional gas resources. Gas hydrates are basically gas that is frozen in a lattice that sits under much of the existing infrastructure. Current reserve estimates exceed that of Prudhoe Bay and Point Thompson combined, about 37 – 44 TCF. He would not talk about gas hydrates today, because they haven't been demonstrated from an engineering standpoint to be commercial, although drilling intervals have determined that they are geologically present.

SENATOR FRED DYSON asked a question about the chart, which Mr. Myers explained. He said there is a lot more unconventional gas between coalbed methane and gas hydrates.

MR. MYERS further explained that access and expansion issues affect other basins on the way to the North Slope - the Yukon Flats and the Nenana Basin, in particular, whose economics would be dramatically improved if it could not only serve the local market for gas, but could have export capacity all through the gas line. The Nenana Basin has a significant quantity of gas present; it's a question of whether it's present in commercial quantities and how it can be maximized. The access issue is important here in terms of development of rural energy strategies. Certainly, the best markets are local, but additional capacity could be exported making the project much more economic.

The Copper River and Cook Inlet Basins have exploration licensing that will benefit through access and expansion. A larger pipeline gives more options for marketing gas in multiple locations and companies are actively exploring in these basins specifically for gas.

MR. DAVID HOUSEKNECHT, Research Geologist, US Geological Survey (USGS), said he would summarize the work it has done to characterize the resource base of the entire state of Alaska and the North Slope, in particular. Part of the USGS's mission responsibility nationwide is to do assessments of undiscovered and other resources that may be added to the nation's energy base in the future. The USGS systematically work across the entire nation with a particular emphasis on federal lands. The work is restricted to the on-shore and state waters areas and his colleagues in the Department of Interior, Minerals Management Service, work in the OCS, the federal off-shore division. Their work compliments each other.

MR. HOUSEKNECHT emphasized that their assessments are reported in terms of probabilities. In frontier areas like the North Slope Foothills, relatively few exploration wells have been drilled and there is a range of uncertainty associated with their estimates.

Associated versus non-associated gas is an important concept on the North Slope, especially. Associated gas occurs in association with oil, such as a gas cap above an oil accumulation. Prudhoe Bay has a huge gas cap. Non-associated gas occurs in the absence of oil and that's what is in the Brooks Range Foothills.

Worldwide, the largest gas resources and reserves typically occur in those geologic provinces of non-associated gas rather than associated. So, it's really important to understand that we really don't know very much about the non-associated gas on the North Slope, because as wells were drilled and non-associated gas encountered, the companies simply moved on and didn't delineate those accumulations because they were looking for oil. I'll come back to that point as we go along.

MR. HOUSEKNECHT next presented a map of the State of Alaska that summarized the estimates of undiscovered conventional natural gas that was prepared by the USGS for onshore in-state waters and by the Minerals Management Service (MMS) for offshore. The point to be made is that first he shows a range for each province. For example, in northern Alaska NPRA he shows a range of 40 – 85 TCF, which represents a range of 95% probability to 5% probability.

In other words, the USGS says there is a 95% probability of 40 TCF of conventional, undiscovered, technically recoverable natural gas resources in the National Petroleum Reserve in Alaska (NPRA). On the upside, there's a 5% chance of 85 TCF. So, again, that range is quite large because of the lack of drilling data that exists in those gas prone areas of the North Slope and other basins of Alaska.

The single number listed behind the mean is the statistical average or expected value of our probabilistic distribution. So, if you must use one number, and certainly legislators and the media tend to use one number whenever they can, we estimate 61 TCF of conventional natural gas that is undiscovered and technically recoverable in the NPRA, alone.

MR. HOUSEKNECHT summarized that in southern Alaska there are 2 TCF of known reserves in the Cook Inlet and the USGC onshore and MMS offshore mean estimates add up to about 20 TCF of undiscovered conventional resources. In central Alaska, there are no known reserves to date and a mean estimate of about 9 TCF. In northern Alaska, there are more than 33 TCF of existing reserves and a mean estimate of more than 150 TCF of undiscovered resources. This shows the importance of the North Slope in the natural gas resource base of the state of Alaska and why northern Alaska is really the driver in terms of the undiscovered resource base under discussion.

He emphasized that the estimates in northern Alaska do not include the Native lands. That study is under way right now and will be released later this year.

MR. HOUSEKNECHT said he would give a mini overview of the geology and exploration history on the

North Slope. The white dots that are clustered along the coastline near the Barrow Arch are the over 400 exploration wells that have been drilled to date. That's where the industry has found oil and that's where exploration has been focused. He also showed the pipeline system and a subsurface regional feature indicating oil migration and accumulation during geologic history. Areas where the state and USGS would agree are more favorable for oil versus gas exploration are on the northern part of the North Slope. In the southern half of the North Slope, or the Foothills, there's a greater probability of encountering gas than oil. The Foothills province is where the oil industry in the early years of exploration drilled wells, encountered gas, and said oh, shucks, this isn't what we're looking for and moved north. For that reason, there is a lack of drilling data in the Alaska North Slope Foothills that increase the uncertainty of the estimates that are made. That's why there is such a wide range between the 95% and 5% probabilities in the numbers he quoted on the NPRA.

The next slide focuses on the nature of the gas resources that are present. The big red bubbles are known gas accumulations that have been discovered as a by-product of oil exploration. Some of the red bubbles have green rims around them and those represent associated natural gas, occurring either as a gas cap above an oil accumulation or as dissolved gas within the oil. The red bubbles with white circles are non-associated gas, gas accumulations that have been discovered where the exploration tested gas at significant rates that signify an accumulation is probably present, but where delineation of those resources did not take place because the industry was not interested in natural gas. The only non-associated gas resources that have been delineated are the relatively small resources or reserves that have been developed around Barrow for local consumption. All of those accumulations that have been discovered in the Foothills have not been delineated in any substantial fashion and their size is not known.

SENATOR FRED DYSON asked what DST and RFT mean.

MR. HOUSEKNECHT replied that DST means drill stem test and RFT means repeat formation tester.

As a well is drilled, when the well encounters an interval of rocks in the subsurface and either oil or gas shows are detected in the cuttings that are coming up, the well is sealed off and actually a measurement of the oil or gas flowing out of the formations in that interval is measured. So, the DST and RFT tests are the most direct indication that we have during exploration drilling of a significant gas or oil accumulation that may be present.

The other thing I will point out here is that among the exploration wells, I've assigned a color code with yellow being the most significant test, DST or RFT indications. A glance across the Slope notices a significant number of the exploration wells, especially in the Foothills, have encountered natural gas shows during drilling, either significant shows in the tests that we just discussed, or moderate or weak gas shows indicating more diffuse gas accumulations that may be present. So, the bottom line here is that most accumulations of associated gas are up on the coastal plane near the Barrow Arch and most known accumulations of the non-associated gas are in the Foothills farther south, but significant gas shows are pervasive in the wells that have been drilled, especially in the Foothills. What the USGS believes that this really defines is what we refer to as a natural gas province that has great potential in the Brooks Range Foothills. I have outlined that province in yellow on this map.

Data on sizes of accumulations that are known on the North Slope is taken from the DNR annual report. Prudhoe Bay and Point Thompson are the largest known reserves at 24 TCF and 8 TCF respectively. The sizes of the other known accumulations are also shown. The table on the right shows the possible sizes of some of the non-associated accumulations that have been discovered in the Foothills and a couple in the federal offshore. Size is difficult to estimate, because in most cases the accumulations have been encountered by a single well or one or two delineations wells – because industry was focused on oil.

Finally, in terms of known resources, he pointed out new discoveries in the NPRA. The Alpine play represents exploration for the type of geology that exists in that field. Lease sales in the NPRA during the last five years indicate that industry believes there are significant potential reserves extending westward

across NPRA. The blue areas of the map show where the USGS has mapped the extent of the Alpine-type geology using seismic and well data.

Results from new discoveries in that area indicate that approximately 500 million barrels of oil will be recovered at a 40 degree API gravity (American Petroleum Institute measure for the lightness or heaviness of oil). Forty-degree oil is very light or watery as opposed to a thick oil. GOR is simply gas oil ratio per cubic foot of gas per barrel. Eight hundred is a very low value. Westward, a test of the discovery at Spark indicated 55 degree oil, a much lighter oil than at Alpine, probably a condensate (a petroleum compound that is a gas in the reservoir and precipitates to a liquid at the surface) and a GOR of 10,000. The Rendezvous Discovery reports 60-degree gravity and a GOR of almost 17,000.

This is an astoundingly rapid increase in the gravity of oil and the GOR over a very short lateral distance, and frankly, our scientists are struggling to understand this.... This does lead to the question - is the big play, or plays, in the NPRA really going to be predominately oil or will there be a very substantial gas resource that...industry been treating primarily as an oil play.... So, what I'm really saying here is that there are lots of unknowns and every well that is drilled and the data from every well that is released gives us additional information to help us constrain how much oil and gas may be present on the North Slope and these results certainly indicate that there may be more gas present in NPRA than we estimated just two years ago.

The estimates we've made over the last five or six years are limited to federal lands. What I'm showing here are the gas volumes that we estimate to be present as technically recoverable conventional resources in NPRA and in ANWR. Bear in mind that we have not yet released our estimates for the state and Native lands that are adjacent to the pipeline and those results will be released later this year.

In addition to the range of numbers listed there, 40 – 80 TCF in NPRA and 0 – 11 TCF in ANWR, these histograms show you the sizes of gas accumulations that we estimate to be present.... So, what we are saying is that the largest accumulations that we expect in NPRA are approximately the same size as the known gas reserve in Point Thompson field – pretty substantial accumulations....

I want to emphasize in red in those little inset maps in NPRA are the areas we expect the largest gas resources to exist and the point here is that every one of those gas plays extends eastward across the Coleville River and extends all the way eastward across the stated Native lands to the pipeline corridor.... So, although I can't give you specifics, the geology is essentially identical to the NPRA and it would not surprise me if a few months from now we are releasing numbers that are in the same order of magnitude as the NPRA estimates we've made and those would be in addition to the numbers that I've already reported to you here this morning.

MR. HOUSEKNECHT summarized that northern Alaska already has significant reserves that are already known, more than 30 TCF, and an undiscovered resource base of at least 150 TCF when combining onshore and offshore estimates. The onshore numbers will grow significantly when they are released for state lands later this year. There is also a huge non-conventional resource base that is not being discussed because of the engineering uncertainties in its development. A certain portion of the resources is located within easy access to existing infrastructures.

Central and southern Alaska, in contrast, have relatively modest accumulations, but resources that could add icing on the cake to the resource base in the state.