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WITH PRUDHOE BAY IN DECLINE, WHAT'S NEXT FOR ALASKA?

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Almost every day, it seems, someone is mentioning Prudhoe Bay-its development activities, the direction of its oil production, and more recently its decline rate.

Almost as frequently, someone is mentioning the number of companies abandoning exploration in Alaska.

The state faces a double-edged dilemma: decline of its most important oil field and a diminished effort to find a replacement for the lost production.

ARCO has seen the Prudhoe Bay decline coming for some time and has been planning for it. We have reduced staff, and ARCO and BP Exploration are finding cost-effective ways to work more closely together through such vehicles as shared services.

At the same time, ARCO is continuing its high level of Alaskan exploration.

This article will assess the future of Prudhoe Bay from a technical perspective, review ARCO's exploration plans for Alaska, and suggest what the state can do to encourage other companies to invest in this crucial producing region and exploratory frontier.

THE PRUDHOE DECLINE

By any definition, Prudhoe Bay is declining and will continue to decline.

Our calculations show the field decline rate will average 8-10%/year through the year 2000. Year to year the rate may be more or less than 8-10% because projects such as the GHX-2 gas handling facility will serve to offset the field's natural decline.

To accountants, Prudhoe decline began during 1988 when the field was no longer able to make its maximum allowable rate of 1.5 million b/d of oil. To engineers, the decline began long before that.

When Prudhoe first met its maximum allowable production rate in 1979, it took only 218 wells to produce 1.5 million b/d. By 1988 it took 916 wells -- some producers, some injectors -- to produce the same amount. Well production had declined by a factor of four, dropping from 7,000 b/d/well initially to less than 1,700 b/d/well.

In other words, to keep production up, the number of wells had to be quadrupled. Between 1979 and 1988, 700 wells were drilled at a cost, including related facilities, of more than \$3.5 billion.

Facility and basic infrastructure improvements also were made, costing about \$9 billion. This includes installation of the central gas facility and the seawater treatment plant.

These outlays were in addition to an original \$9 billion invested to put Prudhoe Bay on line. Investment to date in Prudhoe totals about \$22 billion.

Investment in new wells, facilities, and infrastructure enabled Prudhoe to produce at 1.5 million b/d of oil for 9 years -- 3 years longer than originally forecast, longer than anyone ever thought possible.

FINITE RESERVES

Unfortunately, adding more wells can't keep the oil production rate up forever. We're already past the point where drilling can stave off a falling oil rate. Oil reserves are finite.

Today it takes 1,100 wells, each averaging about 1,200 b/d, to make the current field rate of 1.3 million b/d of oil.

The cost of drilling these wells has not gone down, but production benefits have. That's why we are trying so hard to control costs and to recognize and account for those costs we cannot control -- such as taxes and regulatory compliance costs. All additional costs hurt future investment opportunities.

Water production, effectively nil for the first few years of field life, now exceeds 1 million b/d. By 2000, water production is expected to exceed 1.5 million b/d.

Gas production is more than three times what it was initially -- currently about 5.2 bscfd. GHX-1 helped raise the field gas handling capacity to that level. Following installation of GHX-2 in 1994, gas production will increase again, to 7.5 bscfd, enabling us to produce the higher GOR wells.

But there is an economic limit to adding facilities.

As the field matures, the production facilities reach their maximum capacities to handle produced water and gas. Wells with falling oil rates and increasing produced water or gas volumes have to be shut-in. Total field oil production drops.

The number of wells is going up, and the volumes of water and gas that have to be handled from each well are also going up. These are the three main items that tend to drive costs up in Prudhoe Bay.

Though field oil rates continue to fall, costs per barrel -- including capital investments and operating expenses -- keep on rising.

Profitability is being eroded by the effects of declining production. We are seeing more projects at Prudhoe that have marginal economic returns. We need to find more cost-effective means to do our work so we can keep investing in new projects to develop new reserves.

That's why we're sharing field services with our co-operator, BP Exploration, and why we've entered into an era of partnering with vendors and contractors.

INVESTMENT PLANS

Future development investments fall broadly into four categories: enhancing productivity of existing wells, drilling additional development wells, expanding existing facilities to handle increasing amounts of produced water and gas, and improving and implementing technologies to enhance oil recovery.

Of the field's total production rate, about 85,000 b/d of oil results from ongoing remedial well work.

Each year for the next 5 years we plan 50 fracture jobs, 300 chemical treatments, 200 nonrig workovers, 85 rig workovers, and 35 sidetrack replacement wells. Well work is expected to cost about \$600,000/day for the next 5 years -- about \$1 billion for the period.

In development drilling, 250-400 additional wells are planned for Prudhoe Bay field through the end of this decade, costing a total of \$1-1.5 billion. Currently there are three development drilling rigs working in Prudhoe, and we hope to sustain this level of activity through 2000.

This level of development drilling is expected to increase field recovery by about 175 million bbl.

Prudhoe Bay field's first major gas handling expansion project, GHX-1, was installed in late 1990. By yearend 1990, GHX-1 was contributing about 100,000 b/d of oil to the field rate. Additional GHX-1 gas compressor upgrades remain in progress.

Field production did not increase 100,000 b/d in 1991 when compared with 1990. The field rate was essentially flat year to year. GHX-1 with its 100,000 b/d additional rate merely offset the decline from the rest of the field.

Our largest project under way is the second major phase of gas handling expansion, called GHX-2.

This \$1.4 billion project enables wells that are producing high gas volumes to continue producing oil. In addition, GHX-2's gas handling process is designed to recover natural gas liquids from produced gas. The NGLs will be shipped by the pipeline and sold along with the oil.

GHX-2 is also expected to contribute 100,000 b/d of production by 1995, again helping to offset the 8-10%/year field decline.

Taken together, GHX-1 and GHX-2 are expected to boost field recovery by about 800 million bbl over the life of the field. Work on GHX-2 has begun at Prudhoe Bay.

EOR work received a boost recently when the Alaska Oil and Gas Conservation Commission approved the operators' request to double what already is the world's largest miscible injection EOR project. Planned expansions will increase recovery by 150-220 million bbl. Facility modifications being implemented with GHX-2 are an integral part of these projects.

These four projects -- well work, drilling, GHX-2, and EOR -- total \$3.54 billion in planned investments during the next several years. We hope that more projects can be added to this list over time.

FUTURE PRODUCTION

Prudhoe Bay was found with 22 billion bbl of oil in place. Recovery of 9.6 billion bbl of oil from the field was initially forecast back in 1977.

However, continued development has increased expected recovery to more than 12 billion bbl of oil.

We've already produced about 7.5 billion bbl of oil, leaving about 4.5 billion bbl of reserves and 10 billion bbl in place as a target for the future, an incentive for new projects and improving technology. Still, investment decisions are getting tougher.

With the reality of Prudhoe's declining production, sustaining Alaska's oil production and revenues will require opening up new fields and new areas for exploration.

New reserves need to be brought on line on the North Slope if the TransAlaska Pipeline's rate is to be maintained.

New fields would help Prudhoe Bay by lowering transportation costs from where they otherwise would be -- and perhaps even extend Prudhoe's productive life.

EXPLORATION OVERVIEW

For these reasons, and in view of the fact that more than 85% of the state's income comes from royalties and taxes on oil production, it is disturbing to see that the Alaskan rig count ended 1991 at its lowest level in 17 years. There is not much promise of improvement in 1992.

If Alaska and the Alaskan oil industry are to remain healthy over the long term, we must continue to explore for new sources of oil -- and we must be successful.

In terms of exploration, ARCO plans to spend \$600 million in Alaska during the next 5 years. In 1992, we expect to see 15-25 exploration wells drilled in the state, with ARCO participating in 75-80% of them.

In Cook Inlet last year, ARCO and its partner Phillips Petroleum Co. announced an oil discovery at the Sunfish prospect. A jack up rig is drilling a follow-up well to further evaluate the discovery.

Last winter ARCO operated five drilling rigs on exploration prospects, the most activity of any company in Alaska.

This included the BLT well north of Anchorage, which found natural gas but did not flow at commercial rates -- a real disappointment to us. The BLT was a unique well for Alaska in that the mineral ownership included private land.

The local economy benefitted from 37 local people who were employed at the rig site and more than \$1.5 million spent locally for services and supplies.

ARCO and partners also drilled the Cabot prospect in federal waters off Barrow, the third western Beaufort Sea exploratory well.

We recently completed a four well exploration program in the Colville area, west of Kuparuk on the North Slope.

ARCO has completed negotiations in putting together a group of companies to drill an exploratory well this summer at the Kuvlum prospect in the eastern Beaufort. ARCO will hold the largest interest in the group of six companies.

ARCO is the only company active in the interior basins. We have an agreement with Doyon in the Nations River basin, near the Canadian border, where we have completed extensive geological studies and seismic and other geophysical studies.

We are researching new drilling systems for work in this area that are less costly and have less impact on the environment. We are looking for a partner to help us drill the prospects that have been identified.

This exploratory activity is aimed at preserving ARCO's future in Alaska.

COMPETITION NEEDED

Other oil companies, including many that do not have production in Alaska, have announced in recent months they are giving up their exploration efforts in the state and intend to invest their exploration dollars in foreign countries.

This is disturbing news because it is in both the state's interest and ARCO's interest that Alaska maintain an aggressive exploration program, with a vigorous service industry supporting it.

Why does ARCO want competition in Alaska?

First: Given the high cost of exploration and the low chance of commercial success, we need partners to share the risk. Onshore, it costs \$5-10 million to drill a single well. Offshore, the cost can range from \$20 million to \$50 million or more.

The only way to stay within a reasonable budget and still participate in a significant number of wells is to team up with other companies.

Second: Because of the way land is traditionally leased, in relatively small blocks, companies must form partnerships to create a leasehold large enough to justify an exploratory well.

While we need such partnerships, coming to agreement on when a well will be drilled, and how costs and production will be shared, is difficult, especially if the companies have differing views of Alaska.

Third: A single company cannot alone support a viable service industry.

Now to a key question: Why is Alaska, like the U.S. in general, losing the battle for exploration capital?

Uncertainty over taxation and regulation is one of the reasons the industry is exploring less in Alaska and the Lower 48 and investing those dollars overseas.

Lack of access to land -- in particular large blocks of land -- is another.

And in Alaska the lack of exploration success on the Outer Continental Shelf is yet another reason.

Industry has spent \$10 billion exploring the Alaskan OCS through 1990, including 75 dry holes. More than \$6.5 billion of that went for lease sale bonuses and rentals. Only \$3 billion went for actual drilling costs.

The majority of companies conducting Alaskan OCS exploration have had little participation in onshore drilling.

Given the record of dry holes offshore, it should come as no surprise that these companies are reassessing their positions and looking elsewhere.

AIRCO'S PLANS

Why isn't ARCO taking its exploration dollars out of the state?

Two good reasons: We are exploring onshore as well as offshore. And we have had exploration success.

Since the late 1980s we have had an exploration program balanced between the onshore and the offshore. With the lack of success in the OCS, ARCO, unlike some of its competitors, was able to easily redirect efforts onshore.

Over the past 4 years, ARCO has invested more than 250 man-years in basic regional studies of Alaska. This summer marks the 37th consecutive year that ARCO has had geologic field parties in Alaska. No other company matches that record.

We believe these investments give us an edge over our competitors. This understanding has led us to aggressively invest in both state and federal acreage.

In addition, our people live and work in Alaska and are able to communicate routinely and in a timely way with state agencies. But the most important reason ARCO maintains an aggressive exploration program in Alaska is that ARCO has had exploration success.

We made the discovery at Swanson River in 1957 that helped achieve statehood for Alaska. We also discovered the Prudhoe Bay, Kuparuk River, Lisburne, and Point McIntyre fields. Last fall we announced the Sunfish discovery in Cook Inlet.

We believe that Alaska offers a resource base that is as prospective as anywhere in the world, especially in view of continually evolving technology. If we didn't, we would not be Alaska's most active explorer.

COMPETING COUNTRIES

But Alaska competes with countries that offer a business environment compatible with the exploration process and that encourage exploration.

Those countries grant concessions on large contiguous blocks of acreage. Exploration rights are valid for a period appropriate to the process. Stipulations are known up front, including terms of operations, environmental requirements, and development requirements.

In addition, partnerships are known ahead of time as they are developed prior to joint bidding for the concessions.

Of course there are work requirements. But no company bids on these types of concessions unless it plans to conduct activities.

So what can the state do to reverse the trend to overseas investment?

For one thing, the state must be a strong advocate of a stable and truly area-wide OCS lease sale program in Alaska.

The state should also support the opening of the Arctic National Wildlife Refuge Coastal Plain -not only for the bonuses it would receive but also because a good discovery in ANWR would also justify construction of a pipeline to connect with the TransAlaska Pipeline and perhaps open up added opportunities.

The state also must do more to entice explorers back to Alaska and onshore. While the state has done a good job in allowing access to state lands and has provided reasonable stability in administrative processes, there is room for improvement.

We see a continual escalation of permitting requirements. Each additional permit is more stringent in its stipulations.

The value of this escalation is doubtful, both from an environmental perspective and certainly from a cost/benefit viewpoint. As an example, it recently took 3 years to permit a new drill pad in Kuparuk field.

There is also opportunity to streamline the permitting process. More than time is lost in the maze of paperwork. ARCO employs 35 people full time, and others spend part of their time to handle the permits required to drill about a dozen exploratory wells each year, as well as for development projects. If some of those people could be redirected to identifying exploration prospects, we could have a much better chance of finding the reserves that both Alaska and ARCO need.

EXPLORATION UNITS

Another way the state could help is in actively encouraging the formation of exploration units.

The exploration unit concept is a powerful way for the state to level the playing field in competition with other countries. It allows the combining of tracts with different expiration dates and different owners into a unit held together beyond individual lease expiration dates, as long as expected work is done.

We see the current process of forming units becoming more burdensome. What should take a week for administrative review by the state is now taking many months.

We are happy to hear that the state is now considering a form of the concession arrangement. The state and native corporations could and should work together in the interior basins to offer large blocks of land for exploration.

The completion of the state's land selections, which the Department of Natural Resources has identified as a top priority, offers a unique opportunity to aid the exploration process.

Lands can be selected to preserve access to prospective oil and gas resources and for transportation corridors for pipelines, if exploration is successful.

It would be difficult to restore Alaska to previous high levels of exploration activity. But with these improvements, the state can at least stem the tide of retreating exploration dollars.

Such new life to Alaskan exploration is essential as production from the old giant Prudhoe Bay continues its long, steady decline.

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