

December 1, 2000

Anticipating a Gas Pipeline: *or Great Expectations*

The news is abuzz with the prospect of a Natural Gas Pipeline and all it might bring to our Alaskan future. Nels Anderson Jr. gave us a first menu of the honorable and rural-focused concerns he has in an editorial in the *Fairbanks Daily News-Miner* in late November. I too, think it is time to start thinking about how to better prepare all of us, but particularly policymakers and opinion shapers, for the eventuality. I am fairly sure it will come. And although I agree with most of Anderson's points, I think he is too preoccupied with supplies of energy and their costs. He never mentions the one thing we are doing, not as well as we could, mind you, but we are doing it: building better houses and more efficient transport and appliances. It is difficult to state briefly why this is important, but it is extremely so. How we use energy is just as important as how much, what kind and how expensive it is. A good way to make it clearer, is to point out that any energy service we get from the utilization of energy, will cost less if we use less. By building efficient houses with appliances that are extremely efficient with that energy to give us the light, heat and work that we need for our standard of living, we solve a big part of the problem. Doing more with less enables us to use more of what is locally available for what needs doing. And there is one other aspect of the energy picture: if we are seeking equity, there will never be enough fossil fuel. It is inherently inequitable in its distribution. Renewable energy is about as opposite and as equitable in its availability as we're ever likely to get. Particularly solar energy, is equitably distributed everywhere, with only climatic variables to contend with, and wind is often opportune and doesn't depend on international cartels for its distribution.

It is difficult to find any reason NOT to go with a gas pipeline, and certainly it should be through Fairbanks. It is the natural progression following oil development, and much of the infrastructure and technical skill required and developed by human beings to build the array of things we'll need, puts us in very good position to ultimately go to more renewable non-fossil resources of energy when that becomes necessary. Normally, I am a notorious skeptic on these energy development questions. One reason I am so, is that Alaska didn't do a very good job protecting its interest and getting its fair share of the one-time-only wealth from the first pipeline. Lots of mistakes were made, more because we were naive and inexperienced, but also because we were so willing to rush into the deal to get the money flowing. We were *desperate* to do anything. One of the results was the Exxon Valdez oil spill. In his excellent book "Tales of a Bush Rat Governor," Jay Hammond mentions one ultimate decision we made, which probably cost the state 15 billion dollars in lost revenue¹: simply opting to go to tidewater in Valdez. To the best of my recollection, there was some strange fear and distrust of Canadians at the time which made us choose the less wise (in hindsight) goal of an "All-American pipeline". There was also some complication with Native Land claims which were unresolved in Canada, but regardless, this decision pre-destined the Exxon Valdez spill. And the lost revenue was caused by the lost wellhead value of the oil. This lost value was due to the fact that we had to deduct the transportation costs of the pipeline and the tanker transport from the wellhead value of the oil. Sure hindsight is 20/20, and there is no equivalent of a spill of the Exxon

¹ It would be interesting to know how much the Permanent Fund would be worth if we'd gone with an Alaska Highway route for the Trans-Alaska Oil Pipeline. At least a quarter of the lost \$15 billion would have gone to the Permanent Fund and the accrued interest would be there now. An additional \$10 billion perhaps? We can't afford another mistake of this size with the gas line.

Valdez sort with the gas pipeline, but these shortsighted political blunders should not be forgotten now, of all times. On nearly every level, environmental, safety, economic, community development, investment in our infrastructure, all these are plusses in the context of a gas line. I believe they will all improve if we can pull this off with an aggressive state and local posture to assure we get what we should from this development.

So how? I have a few suggestions, but I certainly welcome wider public dialog and intense scrutiny of the whole picture a gas line poses to us. A good friend has shown me that a very instructive way to look at decisionmaking, is to try to put yourself 20, or even 40 years into the future, and then look backwards to now. By doing this we might realize what would be good to do now to prepare for then. First things this 'hindsight' yields are the realizations that gas might be in decline, and oil will probably be over with. That means fossil fuels will be very expensive, maybe even too expensive to burn, having higher uses as petrochemicals or synthetic materials. If that were so, we'd want cars, houses and energy systems which were reliable, affordable, and perhaps most important, transportable and locally controlled energy and utility systems. This is where I cross paths with Nels Anderson's points. How can we build a future Alaska with equity for both rural and urban residents?

Anderson suggests a fuel cooperative in Rural Alaska which provides alternatives for diesel, and an electrical grid. He also suggests liquefaction of the natural gas to enable barging it to Rural Alaska. We have Rural Electrical and Fuel Coop models in the state, and some work fairly well. It is my intention to see they join the fray in marketing and distributing the natural gas. But I don't see (looking back from the future), that an electrical grid or liquefied natural gas is all that good a road to follow in Rural Alaska. Liquefaction might be fine, if the pipeline does enter the Asian market and is extended to Valdez or to Anchorage and the Kenai. But ultimately this will be exhausted, and leave Rural Alaska out in the cold with an infrastructure which is no longer of use. Today there are no approved docking facilities that the US Coast Guard (which has jurisdiction in these matters) has blessed for unloading diesel, let alone storing and handling natural gas. Propane may be an interim option, but it too will eventually disappear if the gas is depleted. There are still many places where a barge cannot reach, not every year anyway, and you cannot fly in liquefied natural gas or propane. They are too dangerous for aircraft.

The case is even more convincing for NOT building a Rural electrical grid. First, as we know from the Healy plants with GVEA, at least 7-10% of the electricity is lost in transmission, and the farther you transport electricity, the worse the losses. A much better option is to pursue on-site electrical development, integrating solar photovoltaic into housing facades (walls and roofs), and for coastal sites with adequate wind, look to wind electrification, as is the case with the Kotzebue Electric Association. A wind/solar combination is quite sensible for coastal villages, because these resources are complimentary: Wind is most available and powerful in winter, and of course the solar option is most useful in summer. And, these local resources are not subject to grid failures, cost inflation, or international market influences. They are safe and very secure, and becoming more so each year. They produce primarily DC electricity, which is very difficult to transport for long distances, another reason to keep the communities locally supplied with local resources. This is where Rural Electrification money and infrastructure should go. With the prospect of fuel cells using hydrogen a very good possibility for the future, both these natural energy sources could produce the hydrogen the fuel cell uses, to in turn produce heat and electricity. The University of Alaska is pursuing research toward this fuel cell prospect.

This won't be cheap, but nothing regarding Rural Electrification is. Electricity is the highest and most valuable form of energy there is, and its production and costs reflect that. It is a natural economic reality, which research cannot change. What can change is the way we look at the problems and the way that informs our decisions. A solution here will be political and technical, if it is to achieve equity. Possibly an energy trust of sorts can be set up to distribute the benefits of the gasline and remaining oil income, to achieve equity

investment in regional or local solutions for energy supplies, which are climatically suitable, and sized for the appropriate scale of the community.

To gain the best future, we should first look from the future right back to where we live: our homes. Building a housing stock which is matched to our often-severe climates, which is healthy for our children, while still being very affordable and energy efficient, all these things are possible today. Nothing could be more foolish and squander our precious resources more unwisely than to build wasteful, unhealthy, and shoddy homes. And wasteful homes are unhealthy, and burn down more often. We know how to build good durable housing. Unfortunately, we don't always do it. It is a travesty to realize that the most resource-rich state in the wealthiest country in the world, still doesn't have an enforceable housing standard, and still argues about physics and building science, like reality is debatable. We really do know how to build correctly, and we can do so, not absolutely perfectly in all the climatically difficult situations of Alaska, but we know what wrecks buildings and the lives of their inhabitants. That is where our priorities must focus. Who can look back from the future and *not* realize they will want a warm, comfortable, safe, healthy home for all time?

The housing stock of Alaska is already the second most valuable asset that we, the people of Alaska own. It is worth about eight billion dollars, and is second only to the oil infrastructure (which we don't own) in capital valuation. And it is a generally non-depreciating asset. This is a pretty wonderful arrangement. The oil industry valuation is about 17 billion dollars (and doubtless more each year), and of course our most valuable asset is the Permanent Fund. In this light, we should guard against abuse, and develop a strong and technically competent housing policy for financing Alaskan homes through one of our state resources, the Alaska Housing Finance Corporation (AHFC). AHFC is also a multi-billion dollar enterprise, and is an entity of the state, so is politically vulnerable to cash raids to balance the budget, and other undesirable financial and political pressures. While no one expects miraculous and flawless policy, we could go a long way toward building our collective futures if we ensured, rather *demand*ed, that our housing was second to none in affordability, technical quality, durability, and provided a healthy, safe and comfortable indoor environment with minimal cost and environmental damage. Everything we can do to ensure that our housing is of the highest quality, and our energy resources and technologies secure and non-polluting are clearly worth doing, and worth doing *a lot!*

This leads right into some of the demands we should have on the table for how we use gas line royalties and the gas itself to improve our lives throughout Alaska. A given is that one fourth of the income goes to the Permanent fund from our royalty share. No problem there, but what about the other three fourths? And three fourths of what? Our present royalty share is one-eighth: 12.5% of the wellhead value of the oil. What should we demand for the gas royalty share? I would love go with the Norwegian model, and get twice the oil royalty: 25%. But the Royalty share is already set for North slope gas, along with the oil Royalty share, at 12.5%. Although it is possible to 'modify' this, it is not likely that this will be re-negotiated before the line is agreed to. There is also a 10% severance tax, which is now a major source of state revenue. There are options out there we need to have a dialog about, to ensure we make wise decisions for our near term and long-term interest. This is likely to be our last large fossil fuel option. We can't settle for less than the best for our last "golden eggs". Our policy should be an extremely hard line, the hardest ever from the state, to get the best and wisest advantage, and invest it in the infrastructure and an equitable future well-being for all citizens of the state. The very quality of future life in Alaska could very much depend on it.

Here are some other considerations which are very worthy in devising a strategy for gas line development and maximizing wellhead value. What is crucially important to realize with the gas line, is that we are at a point in our development where we are in transition to a non-fossil fuel world. This has huge implications for decisions at this time in our history.

Try simply imagining, with the 20-40 years future view, what we are in transition to. Better put, what do we want our world to be 20 or 40 years from now? How can we use the natural gas, both in-state and as an export, to facilitate our transitional economy? What do we need to do?

We Alaskans need to consider the gas line from the point of view that it is our key to a transition to the future we desire. We must also get some agreement on what we are in transition to. Is it a non-fossil-fuel future? I believe so. In that circumstance, the general decline of the fossil fuels is only 20-40 years away. Then how best should we invest in our future? What are our priorities for an economy after the gas and oil are gone? The real question is: "Can we imagine what the future of Alaska is beyond the fossil fuel era?" Additional questions like, 'What are we moving toward?', and 'What sort of Alaska do we want to hand to our grandchildren?' are the ones worth asking now.

There are very concrete issues we should be aware of. For the past 25 years, the North Slope production policy has been to maximize oil recovery. With a gas line, that suddenly doesn't work so well for us. But there is a means whereby we can improve the wellhead value of the gas, and still enhance the remaining oil recovery. Here's how that can happen. Much of the remaining oil, particularly in the Kuparuk Formation on the North Slope, is heavy oil. This is slightly less economic to produce. To get it thinner and more easily recoverable, a process known as hydrogenation is commonly used. The source of the hydrogenation is steam reformed natural gas. The steam reforming is simply a high temperature process to separate hydrogen from natural gas, and it is the most economical means to produce hydrogen. The hydrogen can have wellhead value in increasing the oil recovery, particularly in the first years of the heavy oil production. Everything depends on which of the resources, oil or natural gas is more valuable to produce and deliver. Until the gas pipeline is a reality, this has always been oil, and that's how we've managed the field, virtually wasting gas, since it has little value if you can't get it to market. That will change as soon as the gas line is built. Then gas will have several values. It can enhance oil recovery in two ways. It can hydrogenate heavy oils, and it can be steam reformed to produce hydrogen and carbon dioxide, and the carbon dioxide can then be re-injected into the oil reservoir for enhanced recovery. The hydrogen stripped from the natural gas in steam reformation is then able to be added to the natural gas in the pipeline and enhance its value as a higher quality fuel, called hythane. This would be the case as the oil recovery becomes less efficient with time and depletion. The optimization of these alternatives is complex and the realm of good engineers and oil reservoir specialists. The key though is to ensure that this maximization of the wellhead value of the gas is part of the development plan. A contract with the gas line developers and oil leaseholders to ensure this, should be a hard demand of the gas line agreement the state makes.

Even more exotic and interesting options are possible. Consider that eventually we might even want to use the well known wind resource on the North Slope to produce hydrogen for adding to the natural gas, say a few years down the road, to keep its value high. This can be done by using wind-generated electricity to electrolyze water into hydrogen and oxygen. This enriches the natural gas without depleting the fossil methane or expending the energy to steam reform it. Adding hydrogen not only increases the value of the fuel, it makes it more valuable to burn, since less carbon dioxide is produced. The closer we can make the fuel in the gas line to pure hydrogen, the cleaner and more valuable and more environmentally friendly it is. It should be a basic part of the development plan for gas production, because it will maximize value and consequently maximize royalties.

So here's the win-win equation. The state and the producers, oil companies, pipeline owners, all get together and develop a plan, contributing royalties and profits where it makes optimum sense to achieve these goals, and we build a facility for sending hythane down the gas line. That facility steam reforms the gas for reinjection of carbon dioxide on the slope, maximizes the last years of oil recovery, while using the hydrogen to enrich and increase the value of the gas going down the line. Now that's a plan. And in balance, everyone will win.

The keys here are the long-range view, learning from the oil pipeline mistakes, and ensuring a better share of the resource for the state and its citizens. Remember the last gasp bumper sticker? “Please Lord, just give us one more pipeline...”, and you know the rest. Well let’s do it right this time. Because sure enough, there actually looks like there *will be one more pipeline!*

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Chapter 2 Some Avenues for a Better Future through the Gas line

Well , time to put up some real concepts we can get our teeth into. First thing that we need to get clear is our menu of options. Here are some ideas which are on the table:

1. The Port Authority Pipeline Project. Still not clear are the finer details of how this would all work out. Three pipeline corridor communities , Valdez, The North Slope Borough , and the Fairbanks North-Star Borough have created a Port Authority to be able to bond and finance, and eventually own a gas pipeline from the North Slope, essentially along the existing Alyeska Pipeline right-of-way, to tidewater at Valdez. There are interesting and complicated means devised by the mayors and other planners of this concept to pay off the debt, get the permits, and share the income with the rest of the state in a new and original community-based revenue sharing concept. All sounds very interesting, and has several good points in its favor:

a. publicly owned and financed, with tax implications accordingly. But income is controlled by Alaskans for Alaskans.

b. requires full disclosure of financing, and full public disclosure of accounting and income. No back room details and deals with big oil for special taxes, favors and royalty give-aways. (How can that be bad?)

c. Is all-Alaskan which may or may not be a good idea

Some disadvantages and questions are:

a. Can this really be done with public financing?

b. Can we agree to an appropriate revenue sharing scheme to give equity to all Alaskans?

c. The permits are all held now by Yukon Pacific Corporation, an Alaskan Company which has been working to get them in place for more than a decade. These permits would save years of work were the Authority to start from scratch to get them independently. The Y-P Corporation recently announced it is for sale, which means it will sell its permits to the highest bidder. They have already said the Port Authority doesn't have enough money to buy them. Bummer.

d. The uniqueness of this concept may be its undoing, as the learning curve is challenging and enormous. There may be just too many pitfalls and the competition has all the money. Inexperience in this realm is an obvious disadvantage.

e. Sometimes when hearing the backers of this concept, one has the distinct impression they are only doing it to leverage motivation to get the big oil companies to do it. Sincerity is in question.

f. If the Valdez terminus is the only option, then liquefaction of the natural gas is a big question, and affects negatively, in most scenarios, the value of the gas. It simply takes more energy to liquefy the gas than if it could be left as gas in a pipeline to the lower forty eight. This problem is similar to why it wasn't a smashingly good idea to terminate the oil pipeline in Valdez.

2. The Big Oil Threesome's plan. The three kings of Alaskan Oil: Exxon-Mobil, BP, and Phillips, the remaining big players in Alaska, have recently clearly indicated they are interested in building a gas line, but they are not sure of the routing. Apparently the big price rises in the lower forty-eight have not gone unnoticed. What are the advantages?

a. They finance the line with their own money at their own risk or through normal private financing. No public risk is taken. They also have the bulk of leases and could do all this faster than any other alternative, probably.

b. We all go with the existing royalty (12.5%) and severance taxes (10%), with no dickering (maybe). This is a set agreement which doesn't need to be re-negotiated (This is not to say that isn't worth doing however!)

c. Almost certainly they would do an all-gas line, perhaps with options for a line to Valdez too. But the all-gas line is more flexible and desirable from an environmental and

infrastructure perspective. It gives us more of what we need for a future in Alaska after the line and gas are spent for natural gas.

Some disadvantages and questions are:

- a. No control over where the line goes or the revenue stream.
- b. Little negotiating power over the maximization of well-head value on the slope (see my first chapter) , as these folks control virtually everything if they build the line.
- c. No certainty as to whether maximum Alaska benefit (such as an Alcan Highway route with Fairbanks use options) would be achieved.

Another aspect of the gasline is the revenue stream, and what it means for the long term growth of the Permanent Fund. It has always amazed me that Alaskans are so willing to come to blows over the development of the very limited resource, (which is not even firmly known), which is touted to be available by developing the Arctic National Wildlife Refuge (ANWR). Make no mistake: development of the Arctic Refuge is a one-way journey which would leave this singular piece of world heritage forever changed. Those who argue otherwise are lying, or have simply written off the value of wilderness and natural ecosystems. Most politicians, and development interests in the state which have no vested interest in the natural landscape or subsistence, have been urging development of this wilderness for decades. But the mid-range estimate of resources isn't half what the prospect of a gasline would be, and the gas line is remarkably less controversial and portends much less environmental threat and damage. But the most powerful argument of all is the economic return which could flow from the gas line, which in my perception makes the development of ANWR utterly foolhardy, a bad deal even in an economic sense, when the gas line is ready for much more reliable and estimable resource development. Let's run through some numbers:

First some ANWR numbers: If 3.5 billion barrels are recoverable at \$25 per barrel, that is about 11 billion dollars in royalty, of which 25% about \$2.8 billion goes to the Permanent Fund. This first number is probably a mid-range estimate of recoverable oil, although no one can know for sure. In the worst case, perhaps 500 million barrels are recoverable, yielding by the same calculation path, one seventh the Permanent Fund income or 3-400 million dollars, and less than a year's supply of oil for the United States.

The gas line has the same royalty rate of recovery: 12.5%. Already known is that the reserves are at least 26 trillion cubic feet, which at \$10 per CCF (a bit high, but close to the late year 2000 price) would yield \$26 billion, and a royalty share of ~\$3.75 billion. But since most exploration of the North Slope has sought oil, we really haven't even looked for gas all that much. So there is a fairly sound reason to expect production to be more than this over the life of a gas line. This is a low-end number, not a high estimate. The ultimate gas line royalties could easily be equal to or greater than the rather optimistic ANWR royalties. Although not an overwhelming argument, it is nonetheless a point well taken considering the difference in risk and environmental repercussions, let alone the political efforts which must be made to overcome the negative aspects of exploiting ANWR. The numbers for ANWR, if they are ultimately in the low end, would be a tragic outcome for the loss of the refuge. We would have lost the refuge in its wilderness state forever, and have little to show for it if the resources don't prove to be there.

As you can see, there are many questions, and many scenarios to investigate and think through. Best we get on with, don't you think?

Chapter 3: Looking at Some Difficulties

One of the major problems I see with trying to justify the abandonment of developing the Arctic National Wildlife Refuge for oil production is the very simple fact of profitability. One of the less appreciated aspects of oil development is the logic of getting the best oil first. It is presumed that is the case for ANWR, that it contains oil which is of high quality and easy to extract, yielding a very high ratio of profit to investment, called in the industry and economics jargon, the *Energy Profit Ratio*. This has historically been in the order of 30-50 fold for large fields in their prime, but it is decreasing with time as older fields are drained, and the easy oil is extracted. The cream is gone, so to speak. This EPR is still very high in places where the reserves are huge, especially the Middle East, because they still have good quality, easily extractable oil left, and will have for decades. For most of the world however, and particularly for North America, ANWR may be the ONLY place where this easy oil is still available.

On the web page of the Northern Alaska Environmental Center (Fairbanks) a case is made for developing the West Sak formation, located west of the Prudhoe Bay major development, in place of invading the Arctic National Wildlife Refuge. This formation is closer to the surface than the Prudhoe Bay formation, but it contains oil which is much heavier, and it is classified as a tar sand formation. While definitely oil, it is thick and difficult to get out of the ground and even requires heating or hydrogenation, or both to make it feasible, let alone profitable to get it to the pipeline. This is currently being done in Northern Alberta (Canada). Having to add heat and other treatment to the oil radically diminishes the profitability of the oil extraction process. So it is fairly easy to see that this is a MAJOR factor in why there is really no choice here for a profit-motivated company. The choices are not equal or comparable on many levels, even if the resource is more clearly understood and quantified in the West Sak case. This by no means decreases my resolve to urge protection of ANWR, it merely helps to make it clear why oil interests are so dogged in their pursuit of access to these spoils.

Another comparative disadvantage is the simple difference in value of the gas resource, which I believe we *should* focus upon, versus that ever-tempting plum of oil in the ANWR prospect. A billion barrels of oil is the energy equivalent of 5.5 trillion cubic feet of natural gas. Just running the numbers (similar to what I did in chapter two), if we have known reserves (now keep in mind they are probably not the *total recoverable* reserves by any means) of 26 trillion cubic feet of natural gas, that is the equivalent of a bit less than 5 billion barrels of oil. This is nothing to scoff at, and represents about 12 or 13 years of oil production at a million barrels a day, and somewhere between a quarter and a third of what we've extracted from Prudhoe Bay. But if we had 4.75 billion barrels of oil, we could probably sell it for \$25 a barrel over the next ten years and get about \$12-13 billion in royalty for it. If the equivalent amount of gas, 26 Tcf, were sold for \$10 per thousand cubic feet, we'd get only 12.5% of \$26 billion or \$3.25 billion in royalties. So the difference in the actual value of the gas compared to oil is very significant in this discussion. It is only about one fourth as valuable as the energy equivalent amount of oil to both the state and the oil companies for investment recovery and profit. However gas is much easier to produce than the heavy oils, and this is where it excels in the comparison. Clearly it is in the best interest (which I equate to the state's *long term* interest) of Alaskans to push then for the gasline to preserve the state of the Arctic Refuge, and still position itself as a player and royalty recipient for a profitable, environmentally more desirable, and beneficial resource: natural gas, and the gas line to bring it to market. And let's not forget the very real possibility of using some of the stripped carbon dioxide at the wellhead to increase the profitable recovery of oil, probably in the West Sak formation, the most likely place to use it, and where it is needed.

Let me reiterate what I mean by *beneficial*. As I stated in chapter one, gas and a gas line is the best way for preparing our state for the necessary transition and infrastructure development we'd require as we become more dependent on renewable energy to produce

hydrogen for our energy use in-state. Whatever we require to make efficient use of natural gas on a more statewide basis will also yield a professionally skilled labor force to support that infrastructure, and the infrastructure is already very similar if not the precise type of distribution network and handling facilities we'd need in our next evolution of energy resource use: the hydrogen economy. While to some this may seem far-fetched and far off, I believe it is neither, and is perhaps only 25- 40 years away. The Trans-Alaska pipeline has already been with us for 25 years. And in those 25 years we have now come to a steadily declining oil production rate, whose end is not that far off, and neither is the end of gas!

What I have presented in these pages are overviews of the realities and prospects as I see them for Alaska and its citizens. If we care to look, the future is not only promising, it is interesting and challenging. If we want to retain the Alaska we love as a home and live well and sanely upon our land, we need to consider the sustainability of what we are doing now, but especially how we apply our insight to the future. If I can provide anything crucial to this discussion we need to have, I believe it is insight.

To quote a poem by Hayden Carruth entitled, *California*:

“....No longer do we need an insane president to end us by pushing a button. People need only go on living as they are, without change, the complacent and hard-eyed, everywhere. At the airport, after dark among the hard lights with the massive proportions of human energy surrounding them, two old people embraced in love of the injured and the poor, of poetry, of the world in its still remaining remote possibilities, which were themselves.”²

It is clearly and ultimately up to us.

Richard Seifert

January 1, 2001

Chapter Four: More explorations of the Gas Line and Alternatives

² Poem from “ Scrambled Eggs and Whiskey, Poems 1991-1995” by Hayden Carruth (1996), Copper Canyon Press, P.O. Box 271, Port Townsend ,Washington, 98368, p. 16.

source: The Coming Global Energy Crisis

Perth, Western Australia •• Jan. 12, 2001 •• SolarQuest® iNet News Service ••

by Brian J Fleay
revised 22 January 2001

OVERVIEW

The USA is in a major electric power crisis, partly a consequence of the deregulation agenda. Peak power demand is exceeding reliable generation and transmission capacity, especially in California. The industry is trying to overcome the crisis by installing gas turbines just when the supply of natural gas in North America is reaching a peak. Gas supply for winter heating is being compromised.

The only short term solution is to reduce consumption of both electricity and natural gas, to pursue energy efficiency as new gas supply would take 5 -10 years to bring on-stream. Pursuing efficiency requires a more co-operative environment between energy providers and consumers, away from the almost religious worship of competition characteristic of the world-wide movement to deregulate the electric power industry. This US crisis coincides with an emerging world oil supply crisis as production of cheap oil outside the Persian Gulf countries reaches its peak. The focus of oil supply is shifting to the latter countries who are not ready to invest in stabilizing and expanding their production capacity to meet demand growth through to 2005 and beyond. Rising oil prices reflect this scenario. The US consumes 26% of the world's oil and imports nearly 60% of that at a cost of some US\$100 billion in 2000.

US ELECTRIC POWER CRISIS

US base load electric power is provided by coal fired and nuclear plants plus some hydroelectric, while peak power is increasingly being met by gas turbines. Consumption has grown by 3% annually since the mid-1980's driven by population increase, air conditioning and by the internet since the mid-1990's. New style computer server centers typically require 2-40 MW and need high power supply reliability.

Deregulation of the electric power industry began in 1996 led by California with 23 states now participating, each with its own rules. Interstate power transfers come under Federal jurisdiction. There is a transition regime while the major utilities sell off their power stations and become distributors and retailers, ending the vertically integrated monopolies and introducing competition among the generators. During the transition retail prices in most jurisdictions are capped until fully "competitive" markets emerge between generators and consumers.

Independent electricity traders are emerging in this market. The public was told deregulation would lead to cheaper electricity. Utilities need a 20% generator capacity margin over peak summer demand to ensure supply security - electricity cannot be stored. However, investment in power stations and transmission lines was cut back due to the uncertainty introduced by deregulation. By 1998 generator capacity margin in the US was below 10% - and worse in California where utilities import 25% of their peak power load from other states. There were over 40 emergencies in California last year with repeated incidents of blackouts and brownouts - and these continue. The spot market for electricity in California at the peak has reached US\$1.50/kwh for some utilities whereas their sale price was capped at 6.5c/kwh. Their average purchase price last year was around 30c/kwh. The price of natural gas has increased as well from US\$2.20/100 cu. ft. in late 1999 to spot prices over US\$9 in December - see below for a discussion on natural gas supply. Merchant generators in this market have made huge profits by exploiting the futures market

in both electricity and natural gas. Similar situations exist in the US northeast and elsewhere, but not on the scale of California.

US NATURAL GAS SHORTFALL

Underlying this electric power crisis is a shortage of natural gas. US installed generating capacity was some 743,000 MW in 1998. 90% of new capacity to 2010 is planned to be natural gas fired, with 22,000 MW added in 2000. (Western Power's installed capacity on the SW grid is just over 3,000 MW). Power generation is the major contributor to the 2.6% pa growth in US natural gas consumption, forecast to grow by 40% over 10 years.

Natural gas is the principal fuel for winter heating in North America, winter consumption is 50% higher than in summer. Consumption has exceeded US production since 1985 and Canadian imports now supply 15% of US consumption. However, US production has declined since 1997 with new gas wells unable to offset a doubling of production well decline rates in the 1990's. A similar pattern has emerged in Canada. Running faster and faster just to stand still! There is no way US production and imports from Canada can grow at 2.6% per annum.

Summer gas production is stored in depleted onshore oil and gas fields to meet 20% of winter heating demand. However, gas turbines used to meet summer power loads are rapidly eroding the capacity to recharge these storages. The current winter is a cold one and consumption is being met by drawing them down. Leading analysts believe they could be depleted during the 2002/2003 winter.

US GAS SUPPLY OPTIONS

There are three options. Import liquid natural gas (LNG), develop gas resources on the Alaskan and adjacent Canadian Arctic Ocean coastline, develop gas resources at depth in the lower 48 states and in presently embargoed areas offshore. Billions of dollars are needed and significant supply would only become available from 2005 at the earliest.

New LNG production capacity would be needed, most likely in Venezuela and Nigeria, plus a fleet of LNG tankers and expanded US port facilities. Alaskan sources require a minimum investment of US\$10 billion and several thousand kilometers of pipelines on a minimum 6-7 year time frame. Gas prices of over US\$3/1000 cu.ft. are required to justify these investments.

Two-thirds of lower 48 states gas potential is thought to be east of the Rocky Mountains in deep formations, the remainder offshore. Drilling costs will be double or more because of the greater depth and the time to drill a well will more than double. A massive number of new and specialist drill rigs are required that is beyond the capacity of the rig manufacturers to build. 40-50% of experienced staff in the US upstream petroleum industry will soon retire and few new ones are in training. Years of low oil prices have taken their toll on the exploration and development industry world-wide, but especially in the USA.

The constraints to exploiting new hydrocarbon resources are in the physical resources and skilled personnel required to do the job. Such constraints cannot be overcome quickly and require a sustained increase in energy prices.

OIL SUPPLY SCENARIOS

Since the mid-1980's over half world oil supply growth has come from Persian Gulf countries turning on wells shut down in the early 1980's, when world consumption fell. The remainder has come from developing expensive sources in ever smaller fields outside the Persian Gulf. Low oil prices since 1985 have decimated industry profit margins

and eroding the accumulated wealth of the OPEC oil producers, forcing a downsizing of the oil exploration and development industry. The upstream petroleum industry has been consuming its capital, both fixed and human. And in the USA not developing its electric power infrastructure as well. In 2000 the last of the spare oil production capacity from the 1980's was turned on - only Saudi Arabia has limited spare capacity left.

IMMEDIATE SOLUTIONS

Suddenly the upstream petroleum industry has to run more than twice as fast to keep pace with demand for both oil and natural gas, especially in the US where circumstances have also conspired to produce a major electric power crisis. A triple whammy!

The only immediate solution for the US is to systematically reduce consumption of electric power, natural gas and oil. It takes time and dollars to overcome physical constraints such as rigs, tankers and skilled personnel. Attempts to massively expand energy production diverts energy from the general economy to achieve this task, just as existing hydrocarbon supplies are declining. There are limits to the rate at which the energy industry can be expanded under these circumstances. In the jargon of economics, there is an "opportunity cost" of no small proportions.

So President George W. Bush has the USA's greatest energy crisis in its history on his agenda. He will of necessity have to preside over a contraction of oil, gas and electricity consumption - shortly after the US refused to do so at last year's conference at The Hague to reduce Greenhouse gas emissions! The nuclear industry is hoping for a boost. The USA has hit an energy supply ceiling, economic growth in the old way is no longer possible. In California energy efficiency measures to get more service by consuming less energy are on the agenda, Governor Gray has proposed reducing electricity consumption by 7% through energy efficiency.

The above article from Brian Fleay, is one of several to recently appear (Feb. 2001) which tries to make clear what the immediate future is for energy supplies, and its relation to the natural gas market. It is from the Ecotopia web page, and is riveting in its review and rather frightening in its implications. A fundamental conclusion which is easy to draw from all this discussion in this latest chapter, is that it may be close to the point in history when cheap oil, and therefore most cheap other energy options are quickly evaporating. There is little in the previous paragraphs which is difficult to believe or obviously a doomsday prophecy. In other words, I find it quite reliable. This is not to say it is a clear map of the future, but the implications of all this for an Alaska gas line are huge, and rather optimistic. In fact, things get rather testy from an energy supply perspective rather soon, (especially ominous for next winter) and the political pressures which could come to bear may be unstoppable for a small state. A reaction is to proceed ahead at good speed and gamble on the prices being adequate for the gas to make it profitable when it comes on line, generally agreed to be about 2005-6. With Fleay's analysis, this seems quite probable. A worse scenario would be to have the political pressure of lower forty-eight energy crises drive the construction, rushing it and taking all political influence away from Alaska.

With this article in mind, I wrote the following guest editorial and submitted it to the *Fairbanks Daily News-Miner* on February 4, 2001. Here is the text of the editorial:
Dear Editor;

I read with much interest the article in Feb. 4 Sunday FDNM by Dermot Cole, regarding the multifarious ways Alaskans (Nic Jans) and former Alaskans (Joe LaRocca) beat each other up over the ANWR oil drilling controversy.

While I doubt I can bring us all together on this very divisive issue, I'd like to ask readers a few questions which I feel are enlightening and helpful toward understanding the situation better.

First Question : How many Alaskans know that right next to the Prudhoe Bay field there is an oil reservoir, the West Sak/Kuparuk formation, which has a known content of 20 billion barrels (about half the recoverable reserves from the original Prudhoe bay discovery) of crude, as tar sands? This is important information and it was mentioned very clearly by outgoing Secretary of the Interior Bruce Babbitt as an alternative to opening ANWR to drilling. This formation is closer to the pipeline than is any prospective oil in ANWR, yet it is never mentioned as a very large and accessible oil resource to be exploited. It is in an area unprotected by wilderness status, and not even as deep in the earth as the main Prudhoe Bay reservoir. There are NO MAJOR impediments to drilling it, and the amount of oil is probably enough for ten more years of million-barrel-a-day production.

Next question: Why haven't we gone ahead and produced this, since there is more accessible oil here with less restrictions and political warring than in ANWR?

As with many things in life, the answer is complex, but I'll try an answer from my knowledge, which is not as complete as that of the oil companies. Basically we beat each other up over ANWR exploitation because that's where oil companies want to drill. Why, when they could go to the West Sak without much ado? My pretty good guess is simply : PROFIT! ANWR oil differs from West Sak oil in one crucial way: it is likely very good crude and highly profitable to produce, maybe the last such deposit in North America, whereas the West Sak is heavy oil (in tar sands) and therefore not nearly as profitable to produce.

Another good question: If this isn't a major factor in the decision and political battling going on about ANWR, please, oil companies, set me straight. The fact of the much greater profitability of ANWR is just never mentioned among the patriotic calls for squeezing the last American oil out of ANWR. Why is this?

I can understand the difference in profitability for the oil companies. They are for-profit companies, and have to answer to stockholders. But this is a very important insight for the public dialog. As Alaskans, we can have it both ways. We can keep ANWR protected and supply a considerable amount of crude from West Sak, and 25% of the royalties go to the Permanent Fund and the oil goes down the TAPS pipeline. And perhaps more positive for Alaska, to develop and produce the West Sak heavy oils, it is necessary to develop gas production, to ENHANCE the oil recovery from West Sak. So using West Sak is a three way win for Alaska. We don't waste ANWR, we get a mandate for a gasline and we produce oil for another 10-15 years at a good rate. It is just not cheap oil. And most important of all, there is a mutual dependence between the oil and gas developments which strengthens both and gives economic value to both which is not just market driven. Developing the gas production makes the oil recovery easier and more economical than doing either development by itself.

This confirms my belief that a gasline is a way for Alaskans to come together on future development of our resources, and there are even more future-oriented reasons why this is good, and which I don't have the space to elaborate here. But we can stop beating each other up over ANWR if another option looks better in many ways. I welcome answers to my questions . They'd help us all. (see www.sustainalaska.org--Gasline Futures)

The following guest editorial appeared in the *Fairbanks Daily News-Miner* on February 10, 2001:

Global Aspects to Alaska Gas Plan by William Sackinger (PH.D.)

For many years, gas in America was subject to price controls. Today, this is no longer the case, and we can see the free market acting to raise the price of gas to the level commanded by energy-equivalent amounts of oil.

Investment decisions on gas exploitation thus hinge on the perceptions and forecasts of the oil prices controlled by OPEC, and the estimates of America's political will to avoid gas price controls, over a 20-year period of project investment payback. Average world prices for oil depend on demand and supply. Demand is increasing at 1.8 percent to 2.8 percent per year, driven by population increases, increased automobile use in the third world, and demand for more electricity in nearly all countries. Forecasts by OPEC, the oil suppliers, and IEA, representing many energy consuming nations, agree that demographics of population growth will cause this growth to persist for at least twenty years.

On the supply side, the world's existing oil fields are depleting at about 7 percent per year, on average, and new oil fields, producing a total of 4.5 million to 5 million barrels per day of production must be brought on stream each year to compensate. Added to the 2 percent growth, this means 6 million to 6.5 million barrels per day of production, in oil or natural gas must be added each year.

A large new oilfield and pipeline can add 0.5 to 0.7 million barrels per day, but there are simply not ten such projects being completed each year, worldwide. Except for Saudi Arabia, which has a spare capacity of 2.5 million barrels per day of medium and heavy oil ready to produce, on call, the other oil producing nations have on average, been producing at or near present capacity. Oil prices will thus follow the will of OPEC and of Saudi Arabia, until about 2005, when conventional oil production capacity growth will be more than offset by depletion, and demand growth. At that point, replacement of oil by natural gas will be a major trend in electric power production, and the price of oil will be dominated by the cost of synthetic oil produced from natural gas and from tar sands. Synthetic oil is produced today from the tar sands of Alberta at a cost of about \$13 per barrel, comparable to the costs of deep-water offshore oil and new North Sea oil. Canada and Venezuela have large tar sands resources. Natural gas has been changed to synthetic oil in demonstration plants, with competing technologies from Exxon, Mobil, Shell, Sasol, Syntroleum, and one or two others, all showing production costs of about \$15-18 per barrel.

Shell has stated that their plant making synthetic oil from natural gas is economically equivalent to using LNG to deliver gas. Each oil company needs about \$10 per barrel of revenue to operate the company and keep it growing, so a world price of \$25 to \$30 per barrel is high enough to trigger the production of synthetic oil from natural gas, in locations where an oil pipeline or a tanker can deliver it to market. This includes the North Slope of Alaska (and many other places).

Synthetic oil from Alaskan natural gas can be kept separate from the normal crude oil in the pipeline, by moving it in segments for a few days at a time, and can be loaded in tankers separately at refineries, and blended, with no actual refining, into consumer fuels. Synthetic oil is essentially sulfur free, and meets new Federal requirements for low-sulfur motor fuels. North slope gas resources are more than the 36 trillion cubic feet found in the Prudhoe Bay reservoir. If one includes Point Thompson and other near-offshore gas fields, and the gas fields in NPR (Naval Petroleum Reserve No. 4) to the west and the ANWR to the east, there are on the order of 55 to 60 trillion cubic feet of natural gas resources. Developing these, to make synthetic oil in world-scale plants located on the North Slope, could keep the trans-Alaska pipeline operating at capacity for twenty years.

This option, the production of high quality synthetic oil, priced about \$4 above the world crude oil market price, avoids the risk of government-caused changes in natural gas

pricing, and the risk of building and operating a natural gas pipeline in the Arctic, which, according to Russian experience, is not trivial.

Both synthetic oil production and conventional pipelines are alternatives for North Slope gas exploitation, but a synthetic oil plant may be built first.

William M. Sackinger, president of Obelisk Hydrocarbons, has been involved in the oil industry since working for the family's drilling firm in 1942.