The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

It's not going to be cold enough in Siberia to...

Posted by Heading Out on March 5, 2007 - 11:45am
Topic: Supply/Production
Tags: east siberia, greenland, ice roads, iditarod, permafrost, yellowknife [list all tags]

Yesterday I was discussing some of the political problems that are likely to make gas and oil supplies an ongoing news story for a few years yet. There is, however, also a potentially growing physical problem that might also impact the logistics of supply somewhat faster than we might think.

This other problem is actually related to reading some of the conditions of the Iditarod which started this week. Because of the changes in snow patterns there are parts of the course that have almost no snow

> Where an avalanche last year killed Richard Strick, Jr. -- a well-liked, longtime volunteer trailbreaker for the Iditarod Trail Sled Dog Race -- there is little snow this year. Efforts have been under way for days to cut a trail through thickets of alder and willow that would normally be buried in white, said pilot Barry Stanley of Denali Flying Service in Willow.

UPDATE: I have added a small addition at the end of the post, following comments.

This is not because it is warmer out there -

> Winds have been howling in the Alaska Range, and temperatures have dipped as low as 40 degrees below zero. Runners in the Iditarod Invitational have been holed up for days at Rainy Pass Lodge at Puntilla Lake, waiting for the weather to break.
>
> Stanley, who flew to Rainy Pass Lodge on Thursday, said it was impossible to check conditions in the pass because a raging ground blizzard smothered everything in white for about 200 feet above the ground.
>
> The National Weather Service is forecasting that the winds will die down as the Iditarod rolls north, but there is no substantial snow in the forecast.

Lack of snow, or in many cases a shorter frozen season can have a significant impact on the

logistics of operations up in the Far North. And here the problems of global warming are likely to have an effect. There is a story in February's Popular Mechanics about the problems of supplying the North-West Territories of Canada, where the main supply road, some 370 miles runs up the lakes from Yellowknife to the Tahera Diamond Mine. It can only be built after the ice gets to be about a foot thick, since it is planed and graded using heavy equipment, and then, after the ice gets to be 40 inches thick it can carry 70-ton trucks. Last year that did not happen until March, and because the mechanics of the ice road limit speed, it reduces the volume of supplies that can be sent.

> The basic mechanics of ice roads have been known for decades. As a laden truck moves over ice, it creates a shallow depression all around it — a sort of bowl in the ice, several inches deep and many yards across. The greater the speed, the deeper the depression. Above a critical velocity that varies with local conditions, a truck can damage the roadbed so severely that the next vehicle to come along will break through the ice. For this reason, the top speed on the Tibbitt to Contwoyto route is usually about 22 mph. In some stretches, as on Waite Lake, the maximum is just a few miles per hour.

When the road cannot carry them then, as the Washington Post noted

> Last winter, one of the warmest on record, the road opened late and melted early, stranding tons of needed supplies. Mining companies spent $100 million trying to airlift the cargo. Diavik cut a 500-ton excavating shovel into pieces and rented the world's largest helicopter from Russia to lift the pieces to its mine site.

This year, however, the road opened earlier – on January 28th, and so supplies are more assured.

Yet this potential shortening of the season, and the difficulties in establishing the supply roads to rigs as well as mines, are likely to add to costs, particularly in localities, such as Eastern Siberia, where the major arteries are not well established, and must be driven over permafrost. As permafrost warms it loses this bearing capacity with a lowering of the ground strength by up to 70%.

(Note - I added the black trend line on the right just as a guide to illustrate the point)

Now if we recognize that the world is getting warmer, and look at the curve about the English Mean Temperature for the past 200 years (Parker, D.E., T.P. Legg, and C.K. Folland. 1992. A new daily Central England Temperature Series, 1772-1991. Int. J. Clim., Vol 12, p317-342) one sees that the temperature has been following a steady rise since about 1880, except for that drop-off that started in 1940, and which we also see in the temperatures of the Central US. So it seems reasonable to assume that the Arctic will get warmer in the short term, and so we should go back to the beginning of the Medieval Warming Period. At present, in Greenland it is, for example, not possible for wheat to grow.

Reading the Last Viking one can find out about the times of Eric the Red and the arrival of the Vikings and he takes us to the records of Ivar Bardson, who wrote

> "On the mountains and lower down grow the best of fruits, as big as apples and good to eat. There also grows the best wheat that exists."

. I recognize that this differs from the history given of Greenland by Jared Diamond in Collapse but bear in mind that when he was quoting contemporary writers he was more focused the time that the Greenland society collapsed. For example in History of America before Columbus they write of orchards, and quote Bardson. Although Bardson was writing towards the end of the 350 years of the Greenland Settlement and and some 150 years after the temperatures had started to fall.

It is interesting, for those of us just naturally curious, to read the second part of the Last Viking since it includes a description of sea water freezing and creating what was known as "sea-lung." It is also interesting to see, from his maps and aerial photo, where the Vikings went in their boats, relative to the current ice between the islands of North-East Canada.

The other curiously interesting thing I found was this passage from Professor Mandia's writing.

> Lamb (1995) describes a passage from Landnámabók, a book written in Iceland in the year 1125, that catalogs the settlement of Iceland. It was recorded that Thorkel Farserk, a cousin of Erik the Red who founded the colony, having no boat at hand, swam out across a fiord to fetch a sheep from the island of Hvalsey. The distance was over two miles. Lamb (1995) cites a medical endurance expert who established 10oC (50oF) as the coolest possible water temperature for a very strong man to survive swimming that distance. Given that the normal water temperature at present for that fiord in August is 6oF, the story suggests a much warmer climate than present. Lamb (1995) and Tkachuck (1983) both refer to old Norse burial depths being much greater in the past than today which suggests the permafrost was deeper (warmer climate) than at present.

Well this is all interesting stuff (it's what happens when you follow a Google trail), but has taken me a fair way from where I wanted to go, which was essentially to inject a little concern that the warming of the permafrost is likely to have significant impact on the difficulties in developing the resources of the Eastern Siberian region, and may cause further delay, and increasing costs for those operations, at a time when their more rapid development may well, in light of European and American needs, be more helpful.

Changes in the permafrost, the behavior of the ice-pack and ice floes, and the possible re-opening of the Northwest Passage, which Viking ruins suggest occurred back in those days, will all both allow greater access to possible resources and potentially significantly increase the difficulty and cost in extracting those resources. When one puts these physical problems in with the political problems that I discussed yesterday, somehow I am not as confident of timely future supplies as others might be. UPDATE: I am grateful to Nick Rouse who drew my attention to the National Research Council Report Surface Temperature Reconstructions for the Last 2,000 Years which discusses the Medieval Warming period and the Little Ice Age, and with diffidence let me quote from page 78

> For central Greenland (Cuffey et al. 1995, Cuffey and Clow 1997, Dahl-Jensen et al. 1998), results show a warming over the last 150 years of approximately 1°C ± 0.2°C preceded by a few centuries of cool conditions. Preceding this was a warm period centered around A.D. 1000, which was warmer than the late 20th century by approximately 1°C. An analysis for south-central Greenland (Dahl-Jensen et al. 1998) shows the same pattern of warming and cooling, but with larger magnitude changes.

While there is not that much evidence to show that this was a global event (which requires matching temperatures, I suppose, in the Southern Hemisphere), there is the odd bit of evidence that the Roman Warming Period might have been global (ibid)

> A borehole from Law Dome (Dahl-Jensen et al. 1999), in coastal East Antarctica, reveals a warming of approximately 0.7 °C from the middle 19th century to present (uncertainty of approximately 0.2 °C). This was preceded by a period of comparable warmth centered on 1500– 1600, a 1°C cooler period centered on 1300, and consistently warmer conditions prior to this (with temperature at A.D. 1 being approximately 1°C warmer than late 20th century). There is no apparent warming during medieval times at this site.

The relevant references are:

Cuffey, K.M., G.D. Clow, R.B. Alley, M. Stuiver, E.D. Waddington, and R.W. Saltus. 1995. Large Arctic temperature change at the Wisconsin-Holocene glacial transition. Science 270:455-458.

Cuffey, K.M., and G.D. Clow. 1997. Temperature, accumulation and ice sheet elevation in central Greenland through the last deglacial transition. Journal of Geophysical Research 102(C12):26383- 26396.

Dahl-Jensen, D., K. Mosegaard, N. Gundestrup, G.D. Clow, S.J. Johnsen, A.W. Hansen, and N. Balling. 1998. Past Temperatures Directly from the Greenland Ice Sheet. Science 282:268-271.

Dahl-Jensen, D., V. Morgan, and A. Elcheikh. 1999. Monte Carlo inverse modelling of the Law Dome (Antarctica) temperature profile. Annals of Glaciology 29:145-150.