of 5 years it is expected that some 20 teaching companies will have been selected and the program will by then be costing £2 million a year.

The idea of the scheme is for graduates, selected jointly by the companies and the academic departments, to work in industry under research grants provided by the SRC and the Department of Industry. The companies will get the benefit of access to the techniques of the academic department in return for providing the graduates with a taste of industrial life. Each individual graduate can be supported in this way for up to 4 years—at the end of which, it is hoped, he or she will have found the experience so interesting that he will immediately take a job in industry.

If the program works—and previous attempts to inveigle British engineering graduates into industry have not—then it could become a permanent part of engineering research and training.

German Breeder Program Put on Hold

West Germany, whose nuclear investment plans have been stalled by a series of court actions and by strenuous opposition from environmental groups, has announced a halt on spending on fast breeder reactor development until Parliament has had time to discuss safety issues connected with the program. The halt was suggested by Social Democratic politicians and is likely to be only a temporary one, since the West German government has not weakened in its support for the fast breeder.

The announcement came 2 weeks after the publication of West Germany's medium-term energy research program, which puts by far the greatest weight on nuclear power. Of the total budget of 6200 million DM* to be spent between 1977 and 1980, three quarters is to be spent on nuclear power development, principally on fast breeders and high-temperature reactors. In a concession to antinuclear sentiment, the Research and Technology Minister Herr Hans Matthoefer said that a principal concern of the program will be to improve safety standards and to devise methods of disposing of highly active waste.

The government is also intending to spend between 90 and 100 million DM a year on fusion research and around 30 million DM on solar energy, which it believes will be useful for space heating. Coal technology, including gasification and liquefaction, will cost 140 million DM a year.

The temporary halt on fast breeder development involves 122 million DM earmarked for fast reactor development but not yet firmly committed. None of this money will be spent, Herr Matthoefer has promised, until Parliament has had time to discuss the program. But official spokesmen were pointing out that last year a similar block had been placed on 75 million DM earmarked for high-temperature reactor development and that this block had since been lifted. It is likely, therefore, that Herr Matthoefer's gesture is more a piece of political prudence than a genuine interruption in West Germany's nuclear planning.

—NIGEL HAWKES

* One Deutsche mark is equivalent to $0.41.

Alaskan Gas: NEPA Brings Out a Strong New Pipeline Applicant

Deciding how the oil and natural gas resources of the Alaskan North Slope will be delivered to the lower 48 states has been a difficult and at times decidedly frustrating learning experience for the U.S. government. Certainly the government cannot be pleased at the current evidence that critics of the trans-Alaska pipeline system (TAPS) project may very well have been right—that, in the absence of either a West Coast market for the North Slope oil or of pipelines to move it from the West Coast to the Midwest and East where it is needed, TAPS may wind up delivering the oil to tankers bound for Japan.

Yet, if the decision-making with respect to transporting the oil has left much to be desired, the government is quite clearly doing better at deciding how the North Slope gas should be transported. For the final decision on this matter will not be made until a wide range of possible choices has been carefully considered. The improvement seems to stem largely from the fact that the National Environmental Policy Act (NEPA) requirement for a searching analysis and review of alternatives is being faithfully met in the case of the gas, whereas in the case of the oil it was not.

A final decision on how the North Slope gas shall be delivered to the "lower 48" is due either late this year or in early 1978. Unlike the situation that existed with respect to the oil, there are three—not just one—serious proposals on the table. Moreover, one of them—the "Alcan" proposal for a 48-inch pipeline to be built along the TAPS corridor from Prudhoe Bay to Fairbanks, then along the Alcan Highway corridor into Canada and across the Yukon Territory—actually came about as the direct result of recommendations in 1975 and 1976 by the environmental staff of the Federal Power Commission (FPC). The Northwest Pipeline Corporation of Salt Lake City, Utah, together with three Canadian companies, put forward this proposal after a Fairbanks–Alcan corridor pipeline was recommended as an alternative in environmental impact statements which the FPC had prepared as required by NEPA.

The FPC staff wanted this alternative to be considered by the commission along with the projects that had been proposed by the Alaskan Arctic Gas Pipeline Company and the El Paso Alaska Company, then the only applicants seeking FPC certification. The Arctic Gas proposal is to build a 48-inch pipeline from Prudhoe Bay east across the Arctic National Wildlife Range and the northern Yukon to the Mackenzie River delta in the Northwest Territories, then south down the Mackenzie Valley into Alberta. A particular advantage seen for this project is that Canadian gas from Mackenzie delta reserves—reserves still too modest to justify a pipeline for them alone—could be transported along with the Alaskan gas.

The El Paso proposal is to build a 42-inch pipeline from Prudhoe Bay along the TAPS corridor to a liquefaction facility at Point Gravina on Prince William

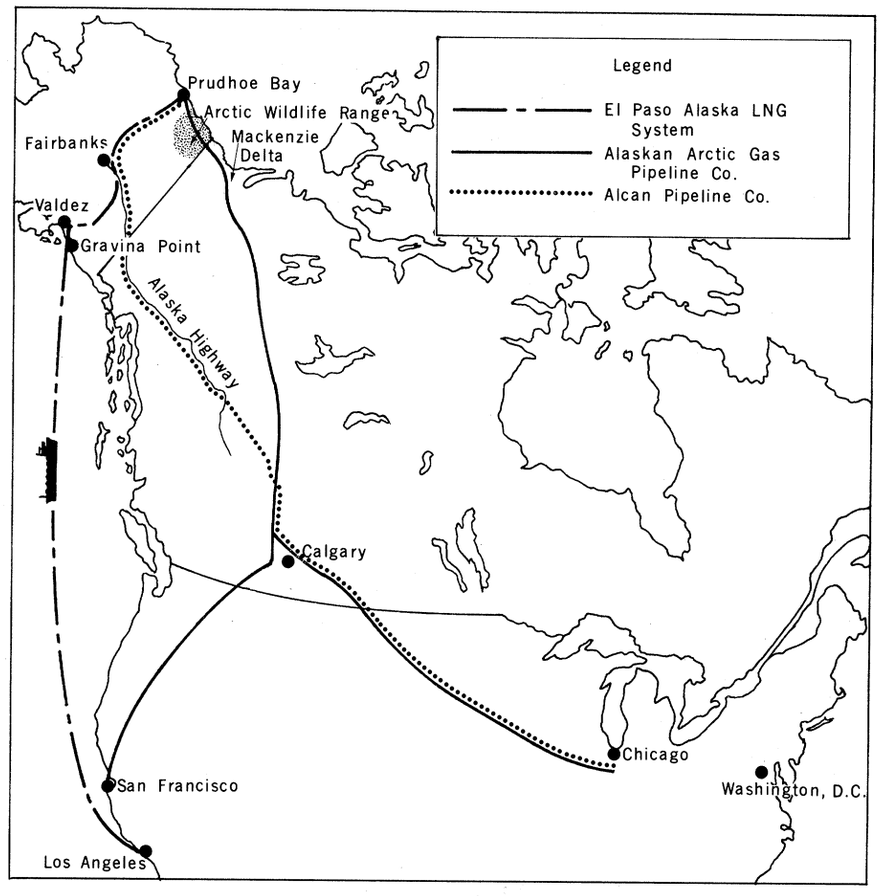
Sound, in southern Alaska. From Point Gravina the liquefied natural gas (LNG) would be carried by a fleet of eight huge tankers to California, where it would be regasified. Whichever project is built, it is sure to cost more than $7 billion (present estimates, expressed in 1975 dollars, range from $6.5 billion for the El Paso proposal to $6.7 billion each for those by Alcan and Arctic Gas).

Compared to the two cross-Canada alternatives, the one great advantage of the El Paso project is that it would be an "all-American" endeavor that would not require the concurrence of the Canadian government. Some major disadvantages are that the combination pipeline–LNG system is considered less reliable and energy-efficient than an overland pipeline system. Also, the gas would not be delivered to the markets in the Midwest and East where it is most needed; instead, those markets would benefit only indirectly by an elaborate system of "displacement," with the entry of the Alaskan gas into the national distribution system allowing other gas to be assigned to them.

As the FPC environmental staff indicated, a pipeline built along the Fairbanks–Alcan corridor would offer the special advantage of not intruding upon either the Arctic Wildlife Range, a splendid wilderness of 9 million acres which groups such as the Sierra Club and Friends of the Earth hold dear, or the adjacent and quite similar wilderness region in the northern Yukon. This advantage could be compelling in a comparison with the Arctic Gas proposal if the Canadian government should choose not to allow early recovery of the Mackenzie gas reserves.

In fact, two recent developments have made the Alcan proposal look like a very strong contender for approval. First, there was the recommendation made to the White House on 1 May by the four FPC commissioners, acting pursuant to the Alaska Natural Gas Transportation Act of 1976, which leaves the ultimate choice to the President and Congress. All three proposals were held to be economically and environmentally acceptable, but the commissioners unanimously favored an all-overland pipeline system to the El Paso pipeline–LNG tanker system, provided of course the Canadian government consents to it. As between the Arctic Gas and Alcan proposals, the commissioners split 2 to 2, but with all four favoring Alcan in the event that Canada elects not to proceed with early development of its Mackenzie gas reserves.

Second, there was the report issued on 9 May by Justice Thomas R. Berger, a member of the Supreme Court of British Columbia, whom Canadian Prime Minister Pierre Trudeau appointed to head an extensive inquiry into the environmental and socioeconomic impacts that construction of a gas pipeline would have on the Canadian north (*Science*, 25 March). Berger recommended that no pipeline be built in the Mackenzie Valley for 10 years. In his view, this would allow time for settlement of native land claims and development of programs and institutions to permit the natives to adjust to the intrusion without loss of their culture and traditional way of life. He recommended further that no pipeline ever be built across the northern Yukon, a region which he said should be designated as a "national wilderness park."



Berger noted that the Alcan project would take an alternate route, across the southern Yukon. "Some of the concerns about wildlife, wilderness, and engineering and construction that led me to reject the corridor across the northern Yukon do not appear to apply in the case of the Alaska [or Alcan] Highway Route," he observed. "It is a route with an established infrastructure. In my view, the construction of a pipeline along this route would not threaten any substantial populations of any species in the Yukon or in Alaska."

But, as Berger also pointed out, it was not for him to endorse the Alcan project, as others would have to assess the socioeconomic and native claims issues to which it might give rise. Two other special inquiries, commissioned by the Trudeau government, will be made into the Alcan project and its possible impacts over the next several months.

Nevertheless, taken together with the report of the FPC commissioners, the Berger report gave the Alcan project a strong push. Some serious observers believe that it virtually killed Arctic Gas. The Berger inquiry was heavily publicized in the Canadian press last year and is reported to have generated widespread sympathy for the natives of the North and their attempts to preserve a distinct cultural identity.

Canada's National Energy Board (NEB) is to make its recommendation on the Arctic Gas and Alcan applications by 1 July, and the Trudeau government is supposed to take final action by early fall, thus allowing President Carter to make his own decision in a timely manner. Prime Minister Trudeau has indicated, as recently as this past March, that for Canada to leave the United States no option other than the El Paso proposal would not be in Canada's national interest. In the event Canada did so, all possibility of a pipeline financed

by U.S. consumers being used either in part or in whole for the delivery of Mackenzie gas would be eliminated.*

In any case, once the Canadians have made their decision, President Carter will know whether the Arctic, Alcan, and El Paso options all remain alive, or whether only one or two of them do. Whatever choices left open, and whatever the President and Congress may decide, the U.S. government will not be behaving in the arbitrary way it did in approving the TAPS project. In that case, the decision was made without fully exploring the possibility of delivering the oil to the Midwest (where a hungry market was assured) by way of an overland corridor across Canada that could eventually accommodate both an oil and a natural gas pipeline.

A huge and costly environmental study was prepared by the Department of the Interior for TAPS, but the analysis made of the trans-Canada alternative was a pro forma effort which everyone knew would not upset the commitment of the North Slope oil companies and the Nixon Administration to an all-Alaskan pipeline and tanker system. In fact, much worse things have been said about it. Charles J. Cicchetti, now an economist and energy official for the state of Wisconsin who several years ago authored the book *Alaskan Oil: Alternative Routes and Markets*, recently told a Senate committee that the Interior study's conclusions that the trans-Canada alternative did not offer a clear advantage over TAPS on either economic or environmental grounds were "totally fabricated deceptions."

The federal courts, which environmental groups used to delay the TAPS project for a few years, might have demanded a more rigorous analytical effort except for the fact that, with the energy crisis coming on in 1973, Congress simply declared that all NEPA requirements had been met and gave TAPS the go-ahead. As a concession to the critics who were saying that the North Slope oil would wind up being sold to Japan, Congress did provide that no domestic oil could be sold abroad without a special presidential finding that the sales are in the national interest and will not reduce U.S. oil supplies. In the absence of such a finding, the North Slope producers may be reduced to an awkward, makeshift scheme for domestic deliveries, such as one that would involve the transfer of Alaskan pipeline oil from larger to smaller tankers at the Panama Canal.

In contrast to what has happened with respect to TAPS, the decision-making scenario that has thus far unfolded with respect to the gas delivery system seems to offer a hopeful lesson. It is that, if the government shows that its examination of alternatives is in earnest, industry will take the exercise seriously. In announcing the Alcan project in May 1976, John G. McMillian, board chairman of the Northwest Pipeline Corporation, specifically acknowledged that this project had its "genesis" in the draft environmental impact statement prepared by the FPC staff.

As it turned out, the Alcan proposal suffered from being hurriedly put together. This past February an FPC administrative law judge held, in recommending in favor of the Arctic Gas proposal, that the information offered in support of Alcan was so skimpy that that project could not possibly be approved on the basis of it. That Alcan is now back in the ball game, and with a vengeance, is probably due to the fact that the proposal was drastically amended just before the FPC commissioners had to pass on it—for instance, as now designed, Alcan would be a 48-inch express line instead of the more modest 42-inch system first proposed.

Yet, no matter how the final decision on the North Slope gas delivery system turns out, there is reason to think that it will have been arrived at rationally, and in a way vastly superior to the big put-on that seems to have characterized the decision-making in the case of TAPS. The Council on Environmental Quality is currently holding public hearings on the adequacy of the impact statements and will make its own recommendations to the White House by 1 July, as will other agencies such as the Department of the Interior. Once President Carter has heard from the Canadians and made his own decision as to which project to approve, Congress will have 60 days in which to confirm his choice or toss it back to him for another go-round. The final outcome should be known before the year is out.—LUTHER J. CARTER

*Also pending before the NEB is an application by Foodhills Pipe Line Ltd., a partner in the Alcan project, to build a "Mapleleaf pipeline" from the Mackenzie delta down into Alberta. Foothills has acknowledged that there are not enough proved reserves in the delta to justify early construction of this line. But in response to NEB inquiries the company has submitted preliminary studies which suggest that, if the Mapleleaf pipeline were routed across the Yukon Territory along the Dempster Highway, instead of down the Mackenzie Valley, it could be tied in with the Alcan system. The resulting cost savings, Foothills has said, would be such that Mackenzie gas could be delivered to Canadian consumers at prices competitive with those possible with an Arctic Gas pipeline.

Contract Archeology: New Source of Support Brings New Problems

Until recent years, American archeology has been a highly individualistic pursuit, conducted for scholarly ends rather than to serve national interests.

But federal environmental laws and new measures designed to preserve cultural resources are rapidly expanding the scope of the profession. Government agencies involved in land management and public construction projects are hiring archeologists right and left. States have been creating and expanding offices for historic preservation and archeological survey work. And academic archeologists are finding themselves, in the words of Charles Cleland of Michigan State University, in the midst of "politicizing and businessizing of what had traditionally been a real esoteric ivory tower profession."

"Contract archeology" is what it's all about. It is the fast-growing arm of what, these days, is called "cultural resource management." It involves hiring archeologists to survey land destined for disruption by federal construction projects and, if the sites are thought to contain important information about human history and prehistory, to take measures to preserve the sites or excavate them.

In the past couple of years enough federal money has been available to rescue many ancient artifacts that otherwise would have been destroyed or inundated, or lost to the world of knowledge through the rapacity of looters. In New Mexico, for example, the government has put $30,000 into the salvage of several 17th-century Navajo settlements which otherwise would have been flooded when it became necessary to raise the level of a reservoir created by the Abiquiu Dam. In Tennessee, University of Tennessee archeologists are engaged in a $100,000 project to preserve