of the results at a meeting of the Institution of Chemical Engineers on October 31.

The survey, which covers the period from 1960 to 1966, showed the impressive dominance of American companies in the building of chemical plants. Two thirds of the exported plants by value and one half by numbers had been built by American companies, and the average size of the American contracts was much greater than those undertaken by European and Japanese companies. Unlike the computer market, this dominance was not based on one or two companies of enormous size, but on twelve to fifteen medium sized firms. It is even odder, perhaps, that these firms usually do little research and development—only one or two are research intensive, according to Mr Freeman. Their access to technology seems to be through their client companies. In Europe, the German, Italian and British have 10, 9 and 8 per cent of the world market respectively, while the French firms are very weak.

Mr Freeman went on to discuss the policy implications of the survey. It had been argued, he said, that contractors could manage without domestic innovation, if they were quick enough to imitate foreign technical developments. The survey did not support this point of view; there was good evidence that foreign sales were proportional to the amount of domestic innovation. Furthermore, the study suggests that to be good at imitation the industry must also be good at innovation—the best innovators are also the best imitators. This is shown by the Pilkington float glass process, which was adopted under licence first in the United States, then in Japan, and finally in Europe.

How can Europe improve its performance in this important market? Mr Freeman suggested two ways of improving the flow of technology from client to contractor. One is by vertical integration, in which large chemical or oil companies buy contracting firms and form a larger group—the best example of this approach is ENI and Snam Progetti in Italy. The other approach, followed by American companies, is to collaborate on the exchange of information at a very early stage in the development of new processes. Most people at the meeting seemed to think that this is the best approach, if it can be achieved.

SCIENCE POLICY

Deciding What To Do

THE long-awaited report on Canadian science policy, just published by the Science Council in Ottawa, contains few surprises. It says that applied science in Canada should be organized into a number of major programmes, each of them—in the current jargon—mission-oriented and multidisciplinary and each controlled by a body specially created for the purpose. The first two proposals, which are intended to test the system of organization and coordination, should cover space research and water resources research. According to the report, four other major programmes should be planned immediately—in transportation, urban development, computer applications and scientific and technological aid to developing countries. Once these are launched, attention should turn to planning six more programmes—health care delivery systems (which means health services), the development of the North, the development of energy sources, integrated resource management, oceanography and weather prediction and control.

The council does not conceal the difficulty of relating expenditure on research and development to growth of national prosperity. Because no proper theory yet exists to relate the two, the council has fallen back on its "own informed judgment" in making the recommendations. Moreover, the council does not attempt to estimate how much the programmes are likely to cost. On the one hand, it says that attempts to assess costs would be premature; on the other, it says that it is impossible to set a target figure for scientific expenditure within which the programmes have to be fitted. The council thus exposes itself to charges of political naivety—it is certainly bold, if not foolish, to attempt to determine priorities without counting the costs. It does say, however, that the widely discussed target of 2 per cent of the GNP to be spent on research and development is over-cautious and will be surpassed.

The other weakness of this plan for Canadian research is the council's insistence that each programme should be run by a specially created agency. The space programme, for instance, should be run by a Canadian NASA while the water resources research should be coordinated by a National Advisory Committee on Water Resources. Such organizations, as the report admits, tend to become self-perpetuating and, if no department of government is directly responsible for them, the task of closing them down becomes difficult. Equally, if these organizations have no voice in Treasury discussions, they run the risk of being starved of resources.

But the council has some sensible things to say about industrial involvement in the research programmes. Its general recommendation, now a familiar theme in Canada, is that industry should be given a much larger part in national research programmes. Federal research programmes should be contracted out to industry, and government procurement should be used as a way of "upgrading the technological level of Canadian industry". The council even raises the possibility that research programmes carried out by industry should be entirely financed by the Government.

The council has also drawn up a list of criteria which must be met in selecting new programmes. The objective must be of real importance to Canada, perhaps even unique to Canada; no major programme should duplicate work in progress elsewhere; there must be some demonstrable economic or social benefit; the technology must be challenging, yet realizable within a reasonable time; the programmes must be large enough to produce research groups of above the critical size; and the programmes must be based on a conjunction of need and scientific opportunity.

NATIONAL PARKS

Ford to the Rescue

THIS week the Ford Foundation has announced that it is making $6 million available to the American Nature Conservancy to ensure that tracts of land earmarked by Congress as parks, wilderness or wildlife