state & society

HEPAP subpanel recommends funding for three machines

The 1975 subpanel on new facilities of the High-Energy Physics Advisory Panel has recommended construction of two major new facilities during fiscal year 1977—an electron–positron colliding-beam device at the Stanford Linear Accelerator Center, and a proton–proton colliding-beam device at Brookhaven. In addition, the subpanel recommended development funding for a fixed-target accelerator that will reach 1000 GeV or more, to be built at the Fermi National Accelerator Laboratory (NAL).

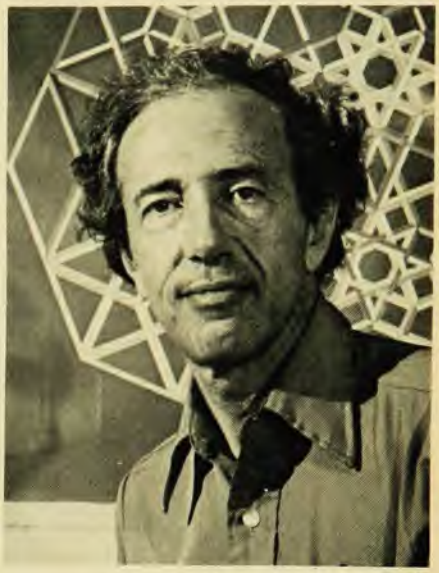
The subpanel, headed by Francis E. Low of the Massachusetts Institute of Technology, met at Woods Hole, Massachusetts, during 15–21 June to undertake an updating of the 1974 Weisskopf subpanel report (see PHYSICS TODAY, September 1974, page 77), to make specific recommendations within a long-range context for fiscal year 1977 and to consider these recommendations in the light of various funding levels.

The subpanel recommended that funds be appropriated in fiscal year 1977 for three new high-energy facilities in support of a three-pronged high-energy research effort. They are:

- PEP, an electron–positron colliding-beam facility designed to operate from 5 to 18 GeV in each beam, with a luminosity of 10^{32} cm^{-2} sec^{-1} at 15 GeV, proposed by the Lawrence Berkeley Laboratory and the Stanford Linear Accelerator Center (see PHYSICS TODAY, August 1974, page 20)
- ISABELLE, proposed by Brookhaven National Laboratory, a proton–proton colliding-beam facility designed to operate from 30 to 200 GeV in each beam, with a luminosity of up to 10^{33} cm^{-2} sec^{-1} (see PHYSICS TODAY, August 1974, page 20)
- Energy Doubler/Saver, a superconducting synchrotron with alternative uses as a proton energy doubler or an electrical energy saver, designed to produce proton beams with energies up to 1000 GeV, at a rate of up to 10^{12} protons per second, proposed by NAL (see PHYSICS TODAY, July 1974, page 19).

The 1975 subpanel reaffirmed the 1974 subpanel's recommendation that PEP be authorized in 1976, and that construction of the new facility begin in 1976 if possible. If not, PEP should have highest priority in 1977. The subpanel also recommended authorization for construction of ISABELLE in 1977, and continued research and development funding for NAL's fixed-target accelerator. These recommendations are in agreement with the report of the 1974 subpanel on new facilities, headed by Victor Weisskopf of MIT. The 1975 subpanel endorsed the Weisskopf subpanel's view that "the energy frontier should be pushed forward with positron–electron colliding beams, with proton–proton colliding beams, and with a fixed-target proton accelerator of at least 1000 GeV."

The subpanel also considered a fourth proposal, an electron–positron colliding-beam facility sponsored by Cornell University, designed to operate from 4 to 8 GeV in each beam, with a luminosity of 10^{32} cm^{-2} sec^{-1} at 8 GeV. It was not recommended for funding because the Low subpanel felt that under their budgetary restraints a second electron–positron colliding-beam facility would not produce a balanced national program, in view of the pressing other needs of that program. In making this choice, the subpanel felt that the higher energy of PEP was critically important.



LOW

continued on page 72

Soaring cost of power hits high-energy accelerators

All areas of physics have felt the sting of inflation, but high-energy accelerators have been especially affected by the fastest rising cost of all—electrical energy. The increased cost of energy, together with the rising costs of labor and materials, have resulted in an underutilization of these machines.

The effects of power costs on accelerator operations are difficult to isolate, expecially at a time when all costs are rising faster than funding. The power costs represent a relatively small fraction of the budget at each of the major US accelerators: about 5% at SLAC, 13% at Brookhaven's Alternating Gradient Synchrotron (AGS), more than 15% at Argonne's Zero Gradient Synchrotron (ZGS) and at the Fermi National Accelerator Laboratory (NAL) and about 9% at the Los Alamos Meson Physics Facility (LAMPF). Yet in the last two years the cost of power at each of these installations has increased more than 30%, well above the percentage increase of costs due to other inflationary factors. (See table.)

According to William Herrmannsfeldt of the High-Energy Physics Program at ERDA, a key effect of the rising price of energy is to reduce accelerator utilization by what he called the "leverage factor." Because many items in a budget are basic costs that must be met independent of the amount of time the accelerator is actually in operation, any increases in the budget can go directly to increased running time. For example, Herrmannsfeldt estimated that a million dollars would increase the AGS budget by 4% but would boost its utilization by 12%.

The operating funds for the total high-energy physics program in terms of constant-value dollars have decreased over the past few years primarily because of inflation. Herrmannsfeldt told us that the total power bill for FY75 of $11 million is much less than the erosion in support due to inflation over the past few years. Thus power

HEPAP reacts to energy crisis

A study of the relation between energy and high-energy physics is just being completed by a subpanel of the High-Energy Physics Advisory Panel that was led by Jack Sandweiss (Yale University). One task of the subpanel was to document the consumption of energy by high-energy research. They found that the major laboratories use only 0.015% of the total energy consumed in the US. Although the labs have always tried to minimize their use of power, the subpanel felt that investment in new equipment would now be necessary for the accelerators to increase utilization without substantially raising the energy consumed.

The subpanel reviewed various projects for conserving energy, chiefly applications of superconductivity. They found in all of them the inevitable trade-offs between capital investment vs. long-range savings, cost vs. physics potential, and so on, but saw several promising approaches. Finally the study summarized the contributions that high-energy physics has made to energy research and forecast that basic research may result in yet more valuable, although still unseen, applications.

costs do not dominate the picture, although they do influence it in terms of the leverage factor. Over the past few years, all the inflationary factors have caused the accelerators to cut down on their running time. The utilization of such machines is difficult to estimate; one must take into account their full potential in terms of running time, beam energy, multiplicity of experiments, and so on. However, an estimate by the High-Energy Program at ERDA indicates that the utilization has declined in recent years to a present level of about 50% of maximum possible utilization.

The energy crisis has affected the different accelerators to varying degrees, but it has encouraged all to initiate measures to reduce energy consumption and costs. SLAC has been affected the least because its power costs are considerably lower than those at the other laboratories. A portion of its power is available at a lower rate as public power from the Bureau of Reclamation. At the opposite end of the country, Brookhaven must pay five times as much for the power to run the AGS. It is responding, as are all accelerator centers, by taking conservation measures such as installing superconducting magnets where possible, automating various functions of the magnets so they may easily be turned on and off, and arranging experiments to save power. In addition all big accelerator centers run several experiments simultaneously to maximize research output.

Thomas Fields, Associate Laboratory Director for High-Energy Physics at Argonne, felt that the escalating power rates have had a major restrictive effect on particle physics there. They have attempted to economize by such tactics as avoiding operation in summer periods of high demand charges and scheduling accelerator operations on a strict calendar-month basis to minimize demand charges. Still, because of budget cuts and cost increases, they have had to reduce personnel by 40% since 1969. Their polarized proton beam, a unique facility, is run at 6 GeV rather than at its full 12 GeV, and the accelerator is likely to operate only six months next year.

NAL, still in its growth period, has to try to reach higher beam energies without greatly increasing its consumption of power, and this effort necessarily involves some compromise. For example, as the machine went from 300 to 400 GeV the repetition rate was cut nearly in half, partly to save power. In the past year the accelerator was not run continuously but was shut down for more than a week each month. The accelerator will follow a similar schedule in the coming year. The power consumption in the experimental areas has been minimized by installing superconducting spectrometer magnets. However, the power required for conventional copper–iron magnets increases rapidly for the higher fields needed for higher energy operation. According to Richard Orr, assistant laboratory director of NAL, the staff is frankly worried about escalating energy costs. They are pushing hard for the Energy Doubler/Saver project (see page 69), which calls for installation of superconducting magnets in the same tunnel with the main ring. It would save a substantial fraction of the energy currently used by the accelerator. —BGL

Accelerator Power Use and Cost

	Fiscal Year	Use (GWh)	Cost (millions of dollars)
AGS	70	74.38	0.665
	71	134.05	1.254
	72	111.08	1.252
	73	130.45	1.452
	74	122.17	2.127
	75	121.7	3.250
	76 (est)	120	3.6
ZGS	70	209.4	1.644
	71	170.1	1.628
	72	182.6	1.962
	73	159.9	1.699
	74	157.3	1.885
	75	138.1	2.212
	76 (est)	135	2.5
SLAC	70	214.3	0.918
	71	243.6	1.028
	72	240.4	1.049
	73	231.7	1.046
	74	230.0	1.011
	75	212.7	1.065
	76 (est)	214	1.3
NAL	72	86.9	1.313
	73	239.3	2.194
	74	341.8	3.346
	75	414.0	4.349
	76 (est)	500	7.0
LAMPF	76 (est)	250	2.0
Total	74	851.3	8.369
	75	886.5	10.876
	76 (est)	1219	16.4

ERDA report finds merit in solar-energy schemes

Three solar-energy technologies, developed as practical alternatives to fossil and nuclear fuels, have the potential to supply 7% of the nation's energy needs by the year 2000 and up to 25% by 2020. This is the conclusion of the Energy Research and Development Administration's *Definition Report for the National Solar Energy Research, Development and Demonstration Program*, submitted to Congress in response to the Solar Energy Research, Development and Demonstration Act of 1974.

The report outlines three different

continued on page 72