

Solar energy

continued from page 70

programs for developing solar energy as a commercially viable and environmentally acceptable energy source.

► Direct thermal applications, which include solar heating and cooling of buildings and the use of solar heat for agricultural and industrial purposes, are expected to become energy producers before 1985 and to increase significantly between 1985 and 2000.

► Solar electrical systems, which convert solar radiation to electricity, could permit the production of essentially inexhaustible electric power and are thus accorded high priority for long-term development, along with nuclear fusion and the breeder reactor. These systems have the capability of producing electricity which may be supplied to an electric utility grid or used directly. Four subprograms have been set up to utilize a variety of potential electrical sources. Wind energy conversion units are modular systems that may be mass produced in a large number of sizes. The wind-energy investigation will emphasize technical problems in large-scale experimental units (100-kW and MW scale) and systems composed of clusters of MW-scale units. The solar photovoltaic subprogram plans one- to four-megawatt demonstration plants to be in operation by the mid-1980's. Because of the high cost of this type of energy conversion, R&D emphasis will be placed on reducing systems cost by the use of automation and the lowering of materials cost. In the solar thermal electric conversion subprogram, research will be done on the central receiver and distributed collector systems used in the production of thermal and electrical energy. The research should provide information necessary for the construction of total energy systems in the 200 kW–5 MW electric range and 5–50 MW thermal range by the mid-1980's. The ocean thermal energy conversion subprogram includes research and development on components, corrosion and fouling problems and studies in environmental impacts. Critical component tests, in particular on heat exchangers and deep water pipes, may require test facilities before 1980.

► Fuels from so-called "biomass" is a project that involves the production of useful fuels such as methane, methanol and hydrogen from organic materials. These fuels are expected to make a major contribution to the nation's energy supply by the year 2020.

Development of the three solar-energy technologies will be supported by the Solar Energy Research Institute, a federal agency established under the Solar Energy Research, Development and Demonstration Act. ERDA will coordinate federal efforts with state and local

agencies to boost widespread use of developing solar technologies.

Copies of the report are available from ERDA Technical Information Center, PO Box 62, Oak Ridge, Tennessee 37830.

HEPAP subpanel

continued from page 69

The above recommendations were understood to be contingent upon appropriations equal to the constraints given the Weisskopf subpanel (\$245 million per year for operations and equipment, \$50 million per year for construction in FY 1976 dollars.) The subpanel was charged with modifying their recommendations under the following funding levels, also expressed in FY 1976 dollars:

Level B: About midway between the constraints given to the Weisskopf subpanel (Level A) and those of Level C defined below (\$250 million per year total)

Level C: FY 1976 total funding plus \$20 million per year for construction (\$190 million annually for operations and equipment, \$20 million for construction)

Level D: A level that the subpanel would recommend as closer to optimum for the needs and promise of the field. (Due to time limitations, the subpanel did not attempt to put a dollar figure on this level.)

If funding were appropriated at Level B, the subpanel indicated that \$50 million of the \$250 million total would be allocated for construction of new facilities, and PEP and ISABELLE would proceed at the same schedule as at Level A. This would necessitate cutting back on the operations budget in order to finance the new construction, thus limiting ongoing programs. Subpanel chairman Low emphasized the vital importance of the new facilities to the growth of the US high-energy physics program. He stressed that the framework for all the recommendations of the subpanel was the hope that the physics program could move forward with colliding electrons, colliding protons, and very high energy fixed-target accelerators. Cutting back on operations and equipment in the present would be a necessary evil in order to safeguard the future of the high-energy program.

At Level C, only PEP would be authorized for construction in 1977. PEP would be given priority over ISABELLE for three reasons, according to Low: the proposal has been tested and the facility has been ready for construction for a year, interest in its research potential is extremely high and its price is moderate (\$58 million for construction of PEP, compared with ISABELLE's \$160 million). Low described Level C

funding as "almost a disaster level" and noted that such a funding level would be a severe setback to the high-energy physics program. At Level C only research and development work could continue for ISABELLE and the Energy Doubler/Saver for the next several years.

The President's budget for the 1976 fiscal year contains appropriations for the high-energy physics program in amounts below Level C, Low pointed out, but some funds for construction of PEP may be included in the 1976 budget. The House of Representatives has appropriated \$2.9 million for construction of PEP in FY 1976. PEP has been authorized by the Senate, but appropriations are still being discussed in committee. According to Low, appropriations below Level C would endanger the high-energy physics program to such an extent that "the program could not tolerate such a budget for long."

The subpanel also considered Level D, the optimum budget for the short- and long-range goals of the high-energy physics program. The subpanel noted that the US program has produced a number of fundamental discoveries, including last year's discovery of the J particle. This, the subpanel members felt, was ample justification for a budget that would include all the recommendations of Level A plus the construction of the Cornell facility in 1977. In addition, operating budgets would be increased beyond Level A, and research and development funding would be appropriated for a multi-TeV fixed-target accelerator or a multi-TeV proton-proton colliding-beam facility in or about 1980.

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in brief

Undergraduate Education in Science: A Rationale for Program Structure, an overview of NSF activities in this area, is available on request from Central Processing Section, NSF, Washington, D.C. 20550.

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