

ganization of conferences, and through innovations in education—would contribute to progress in energy-related technology.

The second study, "Technical aspects of energy conservation," would seek to identify unresolved technical problems of energy conservation, as well as to bring to light available technologies that, for one reason or another, have not become widely used. It would also provide for critical review of recently proliferating "systems" studies of energy use, and for the preparation of new curricular materials for physics courses at all levels. Although the committee's proposal recognizes the widely held view that energy conservation depends primarily upon curtailment of demand—a solution that is a function of social and economic, not scientific, factors—the study would actually focus on the technical aspects of conservation *at the point of use*. Development of more efficient phosphors for fluorescent lighting, for example, could result in substantial energy savings on a nation-wide scale.

The study on the technical aspects of nuclear safety would make no attempt to resolve the numerous technical issues. Instead, its goal would be to define the unanswered questions, to analyze their potential significance and to describe an experimental program to answer them. The committee felt that this study could be of considerable benefit to the physics community because, unlike similar studies in the past, which have not always been conducted in a manner to command public confidence, this study provides an opportunity for the APS to sponsor a definitive and a trustworthy report.

The nation is currently experiencing a tight energy situation complicated by two related factors: the substantial delay in operation of nuclear power plants and the passage of the Environmental Protection Act of 1970. In 1966 the nation's power companies had estimated that 31 nuclear plants, producing an average of 800 megawatts each, would be on line by the end of 1972. But only ten of them were actually in operation by that time. Further compounding the energy shortage is the Environmental Protection Agency's ruling prohibiting the burning of high-sulfur coal by power companies. Over the last five years this has caused their consumption of fuel oil to skyrocket, from approximately 1.5 to 10 per cent of the nation's total annual oil consumption. Although the committee recognized the need for quick solutions to this problem, throughout their deliberations they took the point of view that it would not be feasible for an organization such as the APS to attempt short-term answers.

All three proposals call for both



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physicists and non-physicists to participate. Staffs for the studies on the

physics of energy and on energy conservation would be composed of senior and junior members working together during an initial month-long session. A shorter meeting at the end of summer would provide for preparation of the final reports. The junior staff members would continue their investigations during the interim summer period and possibly after the conclusion of the summer study proper. These continuing studies might take the form of postdoctoral fellowships.

The staff for the nuclear safety study, which would last from six to twelve weeks, would be assisted by a group of visiting consultants. These consultants would give briefings during the first two weeks and would later assist in the analysis of specific technical areas such as fuel-rod failure, flow phenomena and computer code analysis.

If the proposals are approved by the Council, funding would be obtained and final proposals submitted by January 1974 so that staffs could be selected and other necessary preparations completed before the start of summer. —JC

1972 statistics reveal trends and attitudes

In an effort to reveal the strengths and weaknesses of US science and technology, the National Science Board has released *Science Indicators 1972*. The 145-page report is the fifth annual report of the board and should, according to board chairman Herbert E. Carter, "assist in improving the allocation and management of resources for science and technology, and in guiding the nation's research and development along paths most rewarding for our society."

On the international scene, the US and the UK spent less of their GNP on R&D in 1971 than in 1963; West Germany, Japan and the USSR have increased their proportion of R&D spending. By 1971 the US was spending 2.6% of its GNP on R&D as compared to an estimated 3% in the USSR, 2% in the UK and West Germany and 1.8% in Japan and France. The proportion of the US population engaged in R&D has remained constant from 1963 to 1971 (25 per 10 000 population) while it has increased in other major scientific countries (the proportion increased from 19 to 37 per 10 000 in the USSR for the same period).

In seven of eight scientific areas under study, the report shows, the US publishes a larger share of the literature than any other country, including 42.4% of the world's physics and geophysics literature in 1971. The US share in most areas has remained nearly constant from 1965 to 1971. In addition US scientific literature is the most frequently cited in most scientific

areas including physics and geophysics.

The US "patent balance" continues to be favorable, but the proportion of foreign patents awarded in the US is growing in comparison to the number of patents of US origin granted overseas. The US, however, has increased its sale of "technological know-how" from 1960 to 1971. Since 1967, Japan has been the largest customer. Overall, the trade balance for high-technology products for the US has been favorable, with developing countries and western Europe being the largest purchasers. Since the mid-1960's, however, more high-technology goods have flowed from Japan to the US than from the US to Japan.

Changes in US science and engineering personnel took place during the 1960's. The number of active scientists and engineers rose to 1 731 000 in 1970, about 50% more than in 1960. Over the same period the number of PhD scientists and engineers has almost doubled (to 171 800 in 1970). From 1960 to 1970, the proportion of scientists and engineers employed by private industry dropped from 74% to 70%, while the percentage employed by universities and colleges increased from 10% to 14%.

Declines in federal funding per investigator have hit most of the sciences in during the period 1968 to 1972. Hardest hit was physics with a \$16 073 allotment per scientist or engineer in 1972, down 32% from 1968.

Two surveys included in the report

provide interesting comparisons between the attitudes of scientists and the public on research, technology and R&D. The first uses a Delphi technique to solicit and synthesize the judgments of 81 scientists representing a cross-section of the scientific and technological community. When the Delphi panel of scientists was asked to identify problem areas warranting major increases in R&D funding, they most often chose the areas of pollution, power and energy resources, adequacy of natural resources, and the high cost and ineffectiveness of health services.

In the second survey the public (2209 participating) most frequently stated they wanted their science and technology tax dollars spent on improving health care, reducing and controlling pollution, reducing crime, and finding methods for preventing and treating drug addiction.

Science Indicators 1972 is available from the US Government Printing Office, Washington, D.C. 20402 for \$3.35.

New staff and programs for NSF education group

The education directorate of the NSF has undergone changes in leadership, organization and programs. Lowell J. Paige from UCLA has been nominated to be Assistant Director of the NSF for education, succeeding Lloyd G. Humphreys, who resigned in September 1971. While at UCLA, Paige was dean of physical sciences and professor of mathematics.

The education directorate has been reorganized to help increase the effectiveness of science teaching. Directors have been appointed for the three divisions of the directorate: Lyle W. Phillips is the division director for the recently created Office of Experimental Projects and Programs, Howard J. Hausman heads the Division for Pre-college Education in Science and Francis G. O'Brien will direct the recently established Division of Higher Education in Science.

The restructured directorate, according to NSF Director H. Guyford Stever, "will attempt to develop new and innovative approaches to the implementation and conduct of science education at all academic levels."

The NSF has also announced the specifics of their education activities. These activities will be structured around five major themes:

- ▶ Improvement of education for careers in science.
- ▶ Development of science literacy (development of materials for elementary and secondary-school use).
- ▶ Increasing efficiency of educational processes.
- ▶ Experimental projects and problem

assessment regarding science education.

▶ Graduate student support.

The emphasis of the education programs at the elementary and secondary level will be more toward problem solving and practical science. College-level programs will stress self-paced and self-directed study in interdisciplinary and traditional fields. Emphasis will also be placed on programs offering degrees that will enable scientists to tackle the problems that face society more effectively.

Schardt to head physics and astronomy at NASA

Alois W. Schardt will direct the Physics and Astronomy Programs in NASA's Office of Space Science after being deputy director since 1970. He succeeds Jesse L. Mitchell, who is retiring after 26 years with NASA, the last seven as physics and astronomy chief.

Schardt, who joined NASA in 1963 as Chief of Particles and Fields, will have responsibility for programs that use spacecraft and sounding rockets to explore the earth's environment, to study the sun and make other astronomical observations.

Before coming to NASA, Schardt held positions with the Advanced Research Projects Agency, the Department of Defense, Los Alamos, Brookhaven and Cal Tech.

NSF to help support Virginia space lab

NASA's Space Radiation Effects Laboratory at Newport News, Virginia has been given another year of life by a \$261 000 NSF grant. \$145 000 is also forthcoming from the College of William and Mary to support the laboratory, which has one of the largest synchrotrons in the US.

In its announcement NSF said it considers the laboratory to be an important intermediate-energy facility for the next year until other newer accelerators become fully operational. It will be used for basic research in intermediate-energy physics. Originally the accelerator was built to simulate conditions in outer space.

Brookhaven Tandem users form discussion group

The outside users of the Brookhaven Tandem Van de Graaff Facility have established a formal organization called the Tandem Users Discussion Group. At the organizing meeting held recently at BNL an executive committee was elected for a one-year

term, with Lee Grodzins of the Massachusetts Institute of Technology as chairman. This committee will plan future meetings and consider the long-term organization of the group.

Among the topics discussed at the meeting were the new capabilities to be realized from the upgrading now in progress at the facility, the QDDD spectrometer and heavy-ion recoil mass spectrometer under construction, the present capabilities and future development of the on-line computer system and ideas about a booster accelerator. Anyone wishing to join the Group should write Lee Grodzins, Physics Dept., Bldg. 26, Rm 421, MIT, Cambridge, Mass. 02139.

in brief

Physics Manpower 1973: Education and Employment Studies, an analysis of physics manpower for the 1972-73 academic year, can be obtained by writing the Back Numbers Dept., American Institute of Physics, 335 E. 45th Street, New York, N.Y. 10017, for \$10.00 a copy (see *PHYSICS TODAY*, April, page 84).

Two \$1500 awards for small-college science-teaching programs are available through the R. K. Scott Memorial National College Grants Award Program. Direct proposals (due 7 January 1974) and inquiries to Joseph R. Ryan, Chairman, R. K. Scott Memorial National College Grants Award Program, Harbison-Walker Refractories, Garger Research Center, PO Box 98037, Pittsburgh, Pa. 15227.

William A. Anders, Apollo 8 lunar-module pilot, has been confirmed by the Senate to be a member of the Atomic Energy Commission. Anders was the Executive Secretary of the National Aeronautics and Space Council from 1969 to June 1973.

Thomas A. Nemzek, formerly AEC Richland Operations Office Manager, is the new Director of the AEC Division of Reactor Research and Development, succeeding Milton Shaw.

Energy Policy, a new quarterly journal, edited by John A. G. Thomas, is published by IPC Science and Technology Press Ltd, IPC House, 32 High Street, Guildford, Surrey, UK. Subscriptions are £14.00 (\$36.40) a year.

In an effort to consolidate federal earthquake-research activities, the NSF has taken over funding and policy responsibility for the Seismological Field Survey, which was formerly held by the National Oceanographic and Atmospheric Administration of the Commerce Department.