of all the papers, and it was interesting to note that interpretations in one paper that had been accepted when presented in the United States last year were hotly challenged by Indian colleagues.

Electron microscopy in India is hampered by its relative isolation from communities of high activity, such as Europe and Japan. Securing and maintaining instruments is a major problem. In all of India there are only about 30 electron microscopes and these are scattered over thousands of miles all the way from Madras to Chandigarh and from Bombay to Calcutta, so that the frequent service normally provided by manufacturers is impossible. However, when the previous regional conference was held in 1956, India had only four or five instruments, and there are indications that the rapid rate of acquisition will be continued. At present there is a relatively large number of workers for each microscope, many of them having been trained in Europe, America, or Japan.

The conference was arranged by N. N. Das Gupta, president of the Electron Microscope Society of India, at the request of the International Federation of Societies for Electron Microscopy. The proceedings of the conference, as well as other information about the Electron Microscope Society of India, can be obtained on request from the Secretary, Electron Microscope Society of India, Saha Institute of Nuclear Physics, 92 Acharya Prafulla Chandra Road, Calcutta-9, India.

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Solar Energy

Within the past century, increasing amounts of limited natural resources have been used to produce power and energy. Because such resources are not uniformly distributed around the world, scientific research has been directed toward discovering ways of utilizing the sun's radiation as an alternate source of energy.

A broad spectrum of scientific and engineering activities in the field of solar energy—solar stills, low-temperature solar collectors, low-temperature processes, solar measurements and instrumentation, energy conversion devices, and solar furnace designs—was presented at the annual meeting of the Solar Energy Society in Phoenix, Arizona (15–17 March 1965). Contributions were received from Australia, Canada, England, France, Israel, Japan, Senegal, and the U.S.S.R.

Several authors discussed the operation of solar stills in terms of theoretical determinations of water production, materials, construction, and test results. Farrington Daniels (University of Wisconsin) reported on small, family-sized solar stills on Rangaroa, Guam, and Galapagos. The stills, which are 12 feet long by 3 feet wide (3.6 by 0.9 m) and have water-collecting plastic covers, have been developed with emphasis on simplicity of construction and low cost of materials. The performance of these stills and their suitability were tested under local conditions; the stills produced over 2 gallons of water a day on bright days. Efficiencies ranged from 25 to 40 percent depending upon whether the floor insulation was concrete or butyl rubber. The impact of such stills on an island economy was illustrated in terms of the needs of one family which has to obtain its water from coconut milk. Since coconuts provide about 1 gallon of liquid at a cost of 8 cents, water produced from a solar still at a cost of 1 cent per gallon would make solar stills economically attractive and allow the island's produce to be used for other purposes.

D. W. Tliemat and E. D. Howe (University of California) reported on the effectiveness of solar stills for nocturnal production of water.

C. N. Hodges and co-workers (University of Arizona) noted results achieved with the Puerto Penasco Solar Desalination Plant, Sonora, Mexico. This plant, operated in cooperation with the University of Sonora, relies on multiple-effect operation by separating processes of energy collection, evaporation, and condensation. It produces 0.5 gallon (2 liters) per day of distilled water for every square foot of solar collector area. The solar collectors are inflated plastic units 5 to 10 feet wide and 300 feet long. The evaporator is a packed tower filled with carbon-filled polyethylene pall rings; the condenser is an extended surface heat exchanger. Two large storage reservoirs allow operation of the evaporator-condenser 24 hours per day even though the solar collectors operate only during the 8 hours of maximum solar radiation. On the basis of the operations of the plant since the summer of 1964, a production cost of between $1 and $.50 per thousand gallons is projected for a 1-million-gallon-per-day plant.

H. Tabor (National Physical Laboratory, Israel) described continuing work with solar-heated ponds. Two experimental ponds, about 25 by 25 m, are now in operation near Atlit, Israel. The operation of the solar pond depends on obtaining a concentration gradient of salt in water ranging from a density of about 1 at the top to a density of about 1.3 at the bottom of the pond. The bottom of the pond is covered with black butyl rubber or some other absorbing medium so that the salt layer at the bottom heats up to about 96°C. Through careful control of the concentration gradient, mixing within the pond is prevented, and convection currents are reduced to a minimum. The water with the lower salt content acts as an insulating layer and contributes to the heating of the bottom layer of the pond. Tabor discussed the test results obtained with the pond and the results of hydrodynamic experiments in which portions of the pond water were replaced at desired depths to control the concentration gradients. Studies on the physics of the pond and research on ways of obtaining distilled water, salt, and electric power from the pond are receiving considerable attention. Projections of the capabilities of solar ponds indicate that electric power in the range from 500 to 5000 kw could be produced at less than 2 cents per kw-hr and that salt could be obtained at a cost of $5 to $6 per ton, depending upon the concentration of salt in the water supplied to the pond. The water distilled from the pond can be recycled and portions of it used for drinking purposes.

W. A. Beckman and co-workers (University of Wisconsin) reported on a photovoltaic power system which uses concentrated solar energy to obtain radiation intensities of 25 watts/cm^2. By means of an auxiliary-cell cooling system, the power system could provide an output of 1.5 watts/cm^2. To permit operation at the high flux levels, a new circuit, including a distributed diode, a distributed series-resistance, a single–shunted-series di-

ode, and with series resistance, was devised. With experimentally determined constants, this circuit can be used to predict current characteristics of the cell voltage as a function of grid spacing at high fluxes. The cells were maintained below 100°C by mounting them on a forced-circulation, water-cooled, pinned heat-transfer surface. Beckman presented data on an operating system which produces 50 watts using 36 cm^2 of close-gridded cell area under various ambient conditions.

T. Noguchi (Government Industrial Research Institute, Nagoya, Japan) discussed the results of fundamental research on refractory systems with a solar furnace. He explained a method of measuring temperature by means of a brightness pyrometer. These measurements established the freezing point of metal oxides by a specular reflection method. The freezing points of zirconia, hafnia, alpha-alumina, and high-purity lanthanide oxides were determined. The data on the 11 lanthanide oxides extended the data which heretofore have been available. Noguchi further investigated the melting behaviors of the ZrO_2-CaO system, and observed an anomaly of the liquidus curve with a composition of 70 percent CaO. Noguchi suggested that the formation of a new cubic-like phase might be expected.

P. J. Sheehan and T. S. Laszlo (Avco Corporation) reported on the results of high-temperature emittance measurements and ablation tests in a solar furnace. Excellent correlations were obtained between the heat flux and the recession rate of the ablating sample. The recession rate was measured by means of a camera viewing the sample surface through a 12-foot light pipe.

H. Masson and J. P. Giradier (Faculty of Science, University of Dakar, Senegal) reported on activation by a solar motor of a pump capable of supplying about 40 m^3 of water per hour for 4 or 5 hours per day. The water, withdrawn from a well at a depth of 10 m, supplies the approximate daily requirement of a community of 500 persons. The area of the solar collector is 300 m^2. E. A. Farber discussed the results obtained with a solar hot-air engine (1/3 horsepower, closed-cycle), which is portable and is cooled by a water-cooled radiator. L. F. Yissar (Tucson, Arizona) reported on the performance of a liquid-piston solar prime mover. The mover uses a self-feeding inverted siphon loop with an

inert liquid piston whose oscillations transmit the power output to a driven device. Solar energy, collected by a flat collector, supplies useful mechanical output.

A. J. Drummond and co-workers (Eppley Laboratory) described the instruments used to measure the components of solar shortwave and terrestrial longwave radiation. Drummond stressed the advantages of coated-receiver (thermopile-type) pyranometers over those employing photoelectric detectors such as selenium and silicon photovoltaic cells. Because the selenium or silicon cells are selective with regard to the wavelength of the incident energy when exposed to sources of varying spectral emission, they require careful calibration to account for the shortwave reflectance of terrestrial surfaces and for radiation from the sun and sky. The pyranometers are particularly useful when accuracy of better than 10 to 15 percent in hourly values and of 5 to 7 percent in daily summations are desired. Drummond considered the major problems associated with the determination of the transfer of longwave (terrestrial) radiation within the earth atmosphere system; he reviewed the principal characteristics of ventilated and unventilated radiometers in common use in recent years. He also described a new instrument, with very short time response, which is used for precise evaluation of shortwave and longwave components and net flux radiation near the ground. The design of the instrument is based on thermopile principles. Drummond pointed out the errors in the measurement of the solar constant outside the earth's atmosphere, and outlined experiments designed to measure the effect of the absorption of the atmosphere on the solar constant over the range of wavelengths of interest.

L. P. Gaucher (Texaco) forecast the pattern of energy consumption up to the year 2200. After accounting for the different sources of energy capable of filling the gap between increasing demands from increases in population and in per capita consumption, he projected that beginning about two generations from now the United States should become more and more dependent upon electrical energy derived from central solar-powered stations. By the year 2200 the stations could account for approximately 30 percent of all of the energy consumed in this country. Gaucher estimated that a satellite solar collector about 35 km in

diameter would be adequate to supply the energy of 48 × 10^{15} Btu (12 × 10^{15} kcal) per year presently required by this country.

The attendees at the meeting were informed of the efforts of Congressman Schmidhauser (D–Iowa) to introduce a bill (H.R. 3434) designed to provide support for research on and development of means for utilizing solar energy.

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Forthcoming Events

May

27–29. American **Gastroenterological** Assoc., Montreal, Quebec, Canada. (D. Cayer, 2240 Cloverdale Ave., Winston-Salem, N.C.)

27–29. American **Ophthalmological** Soc., Hot Springs, Va. (S. D. McPherson, Jr., 1110 W. Main St., Durham, N.C.)

27–29. American Assoc. of **Physical Anthropologists**, annual, Pennsylvania State Univ., University Park. (F. E. Johnston, Dept. of Anthropology, Univ. of Pennsylvania, Philadelphia 4)

27–30. **Neuro-Ophthalmology and Neurogenetics**, intern. congr., Albi, France. (M. Amalric, Congrès Intern. de Neuro-Ophthalmologie et Neuro-Génétique, B.P. 79, Albi, Tarn, France)

27–30. German Bunsen Soc. for **Physical Chemistry**, 64th general assembly, Innsbruck, Austria. (Deutsche Bunsen-Gesellschaft für Physikalische Chemie, Varrentrappstr. 40–42, 6 Frankfurt am Main, Germany)

27–11. World **Meteorological** Organization, 17th executive committee session, Geneva, Switzerland. (WMO, 41 avenue Giuseppe Motta, Geneva)

28–1. Canadian Assoc. of **Geographers**, annual, Vancouver, B.C. (Local Arrangements Committee, Dept. of Geography, University of British Columbia, Vancouver)

30–2. Recent Advances in **Adrenal Steroid Metabolism**, symp., Montreal, Quebec, Canada. (Chemical Inst. of Canada, 48 Rideau St., Ottawa 2)

30–2. Canadian **Dental** Assoc., conv., Quebec. (L. Bernier, 1024, avenue des Erables, Quebec)

30–2. American **Thoracic** Soc., Chicago, Ill. (F. W. Webster, 1790 Broadway, New York 10019)

30–2. National **Tuberculosis** Assoc., Chicago, Ill. (S. Wicker, 1790 Broadway, New York 10019)

30–3. **Medical Library** Assoc., annual, Philadelphia, Pa. (MLA, 919 N. Michigan Ave., Chicago 11, Ill.)

31–2. Canadian **Museums** Assoc., annual, Ottawa, Ontario. (Mrs. H. Downie, Royal Ontario Museum, Univ. of Toronto, 100 Queen's Park, Toronto 5)

31–2. **Chemical** Inst. of Canada, 48th conf., Montreal, Quebec. (Chemical Inst. of Canada, 48 Rideau St., Ottawa 2)

31–2. **Spectroscopy**, 5th Australian conf., Perth. (A. J. Parker, Dept. of Chemistry, Univ. of Western Australia, Nedlands)

31–2. **Pharmaceutical Industry**, intern. conf., Baden-Baden, Germany. (J. Laar, Karlstr. 21, Frankfurt am Main, Germany)

31–3. Canadian **Public Health** Assoc., annual, Edmonton, Alberta. (E. J. Young, 1255 Yonge St., Toronto 7, Ont.)

31–4. **Exchange Reactions**, symp., Brookhaven Natl. Laboratory, N.Y. (J. H. Kane, Intern. Conferences Branch, Div. of Special Projects, U.S. Atomic Energy Commission, Washington, D.C.)

31–4. Institute of **Hospital Administrators**, annual conf., London, England. (Secretary, 75 Portland Pl., London, W.1)

31–4. Society of **Physical Chemistry**, 15th annual, Paris, France. (G. Emschwiller, Société de Chimie Physique, 10, rue Vauquelin, Paris 5°)

31–4. Group for Advancement of **Spectrographic Methods**, 27th congr., Paris, France. (1, rue Gaston Boissier, Paris 15°)

June

1–3. **Tissue Culture** Assoc., Miami Beach, Fla. (M. M. Sigel, Univ. of Miami, Department of Microbiology, Coral Gables, Fla.)

1–4. Nordic **Medical Rehabilitation** Congr., Oslo, Norway (Chief Physician B. Rogan, Socialmedisinsk Avdeling, Aker Sykehus, Oslo, Norway)

1–4. **Water Studies**, 18th intern. conf., Liege, Belgium. (Belgian Center for the Study and Documentation of Waters, 2, rue A. Stevart, Liege)

1–8. **Fruit Virus Diseases**, 6th European symp., Belgrade, Yugoslavia. (Prof. Sutic, Institutza Zastitu Bilja, T. Drajzera 7, Belgrade)

2–3. Diagnosis and Semeiology of **Cerebral Vascular Diseases**, European symp., Modena, Italy. (Segreteria della Clinica Oculistica, Policlinico Universitario, Modena)

2–3. **Endemical Struma**, symp., Prague, Czechoslovakia. (K. Silink, Národní 8, Prague 1)

2–3. **Quality Control of Engineering Materials**, conf., Kenilworth, England. (Inst. of Production Engineers, 10 Chesterfield St., Mayfield, London, England)

2–4. International Federation of **Consulting Engineers**, annual, Copenhagen, Denmark. (Consulting Engineers Council, 1155 15th St., NW, Washington, D.C. 20005)

2–4. Canadian **Phytopathological** Soc., annual, University of Guelph, Guelph, Ont. (R. Stace-Smith, C.D.C. Research Station, 6660 NW Marine Dr., Vancouver 8, B.C.)

2–4. Nordic Congr. of **Surgeons**, Oslo, Norway. (F. Hauge, Sophies Mindle, Trondheimsveien 132, Oslo)

2–5. **Acoustical** Soc. of America, 69th meeting, Washington, D.C. (ASA, 335 E. 45th St., New York 10017)

3–4. **Endemic Goiter** and allied conditions, symp., Prague, Czechoslovakia. (J. Blahoš, Výzkumný Ústav Endokrinologický, Národní tr. 8, Prague 1)

3–5. Canadian Soc. of **Plant Physiologists**, 6th annual, Univ. of New Bruns-