

**UNITED NATIONS
CONFERENCE
ON NEW SOURCES
OF ENERGY**

INFORMATION BULLETIN



UNITED NATIONS
New York

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PART I

GENERAL INFORMATION

The United Nations Conference on New Sources of Energy, which will examine practical problems and experience in the utilization of solar energy, wind power and geothermal energy, with especial reference to the problems of the less developed countries, will be held in Italy, probably in Rome, from 21 to 31 August, 1961. Arrangements for the Conference were approved in a resolution of the Economic and Social Council at its session in August 1960 (see page 13).

Prospects for the practical utilization of new sources of energy other than the atom were reviewed in a report by the Secretary-General of the United Nations which the Council had requested and which was published in 1957. In April 1959 the Council considered that research in the utilization of practical applications of solar energy, wind power and geothermal energy had reached a stage at which the pooling of the results achieved could, through an international conference, yield especially interesting results for areas which have a shortage of conventional energy resources.

At three preliminary meetings of experts in Madrid, Grenoble and Rome in May, June and July, 1960, the programme agenda and substantive guide lines for potential contributors of papers to the Conference were drawn up which the Council approved.

PURPOSE OF THE CONFERENCE

Considerable progress has been made in the application of solar energy, wind power and geothermal energy. The Conference aims at bringing together experts in these fields as well as those interested in energy development in general, to provide participants with up-to-date information on progress achieved and to facilitate an exchange of views and experience relating to practical problems, potentialities and limitations in utilizing these three sources of energy, especially in those areas lacking conventional energy sources or facing high energy costs.

The Conference will be devoted solely to the exchange of ideas and experience on these matters. It will not formulate recommendations to Governments nor will it attempt to reach international agreements on policies.

The Conference will focus attention on applications rather than on the discussion of scientific principles and basic research, giving prominence to lines of action which have already led, or are about to lead, to commercial energy applications. This emphasis includes consideration of how techniques could be brought into wider use particularly for the benefit of less developed areas.

In focusing attention on applications, the Conference will keep constantly in view the practical end-uses of the three energy sources and aim at a better understanding not only of the potentialities and limitations of each but also of the possibilities for their combined use, with each other and with other sources of energy.

Theoretical studies will be discussed only if they appear to be closely related to practical developments. The subject of costs will be emphasized. The stress will be laid on the various needs for energy and on specific means for meeting those needs.

CONFERENCE AGENDA AND CALENDAR OF MEETINGS

The Conference agenda and calendar of meetings are set out in part II. In addition to official opening and closing sessions and a general session, the programme provides for two parallel series of technical sessions. One is devoted basically to the utilization of geothermal energy, wind power and solar energy for power purposes, the other to solar energy for purposes other than power. Findings of these technical sessions will be reviewed and summarized in the course of the Conference in plenary meetings. The plenary meetings and a few others of more general interest, including three public lectures, are scheduled so as not to overlap with other meetings. One day is left open for field visits.

PARTICIPATION

Attendance at the Conference will be by invitation only. Invitees will participate in their individual and personal capacities and not as representatives of international, governmental, or non-governmental organizations or societies. Invitees will be selected by the Conference secretariat either to attend the Conference or to participate as contributors of papers on the basis of their qualifications to contribute to the purposes of the Conference.

Participants will be selected from among duly qualified persons nominated by (a) Member States or their governmental services; (b) the United Nations and its specialized agencies; (c) interested international, inter-governmental and non-governmental organizations or societies. The participation will also include individual specialists invited to participate by the Conference secretariat and individual specialists applying to the Conference secretariat for participation who are selected as qualified to participate.

Application forms for the nomination of individuals to participate in the Conference are attached to this paper (see pages 15 and 17).

Conference registration forms will accompany invitations forwarded to individuals selected to participate in the Conference.

CONFERENCE METHOD

The working languages of the Conference will be English and French. Simultaneous interpretation into English, French, Russian and Spanish will be provided from any of the official languages of the United Nations where necessary.

The Secretary-General of the United Nations will appoint the chairmen and the rapporteurs to serve at the Conference.

The rapporteurs will introduce the subjects for which they are responsible, on the basis of papers contributed on that subject and of a general report subsequently prepared by them with suggestions of main lines for oral discussion in the Conference. The rapporteurs will review and summarize problems and findings in the plenary meetings. They will also assist and advise the secretariat in further preparatory work, including preliminary reviewing of contributed papers for competence and pertinence to the subject.

Papers contributed for the technical sessions will not be read verbatim since the complete text will be available and it is assumed that the participants will have read the technical papers in advance. This will allow maximum time for full discussion by the participants.

Detailed procedures to be followed, including limitations on the time allowed for each speaker, will depend on the subject and participation at each particular meeting and will be at the discretion of the chairman. Authors of papers will have the privilege, however, and will be encouraged to introduce more recent information and to reply to comments made during the session. In general, speakers will be asked, in so far as possible, to indicate in advance their wish to speak, particularly if they wish to present slides or charts.

PREPARATION AND DISTRIBUTION OF PAPERS

Authors must submit to the Executive Secretary of the Conference, as soon as possible, preferably no later than 31 December 1960, the titles of their proposed papers clearly identified with an agenda item number, together with a tentative abstract, in four copies of not more than 400 words in English or French. Proposals received for the presentation of papers will be subject to review for pertinence to the purpose of the Conference.

If the proposals are accepted the papers themselves must in turn be submitted for acceptance at the earliest possible date, but in any event not later than 1 April 1961. They must not exceed 4,000 words in length.

Papers should preferably be submitted in English or French but may be submitted in the following official languages of the United Nations—Russian or Spanish. They must include, within the 4,000 words allowed, a summary in the original language and must also be accompanied by a translation of such summary in English or French, regardless of the original language in which the paper is written.

Papers accepted for the Conference will be distributed if possible by 1 July, in the original language and in summary form in English and French to participants in accordance with their interest in the subject matter.

In addition, translations of the papers proper into English or French will be provided to the rapporteurs at the earliest possible date. Such translations will be made available as soon as possible thereafter to interested participants in the Conference.

In submitting charts, diagrams or other illustrations authors should keep these points in mind:

To ensure good reproduction, lines in charts, diagrams, maps, etc., should be sharp and well defined;

Lettering and numbers on figures should be large enough to be still legible if it is found that the illustration must be reduced;

Wherever possible, sending ozalid prints of drawings should be avoided, especially those with fuzzy lines and clouded areas;

When photographs are submitted, glossy prints are preferred to those with a matte finish;

Charts and diagrams with curves, etc., in colour must be adapted for black and white reproduction before submission.

Authors are urged to keep in mind the general purpose and objectives of the Conference, notably the emphasis given to practical application in less-developed areas. They are further requested to take careful account of, and to adhere to, as closely as possible, the suggestions made in part III (see page 5).

The United Nations cannot assume any responsibility for the costs incurred by authors in the preparation of papers or pay a fee therefor. Authors are requested not to publish their papers before the opening of the Conference.

ATTENDANCE AT THE CONFERENCE

The United Nations will pay travel allowances and *per diem* for the rapporteurs of the Conference only. It will be unable to meet attendance costs of other individual participants. However, it is hoped that both Governments and others interested might find it feasible to give assistance to selected participants who without such aid might not otherwise find it possible to attend. In this connexion attention is drawn to the possibility that some Governments might request consideration of the granting of fellowships through the United Nations Technical Assistance Programme as suggested by the Economic and Social Council in its resolution attached to this paper.

PRINTED RECORDS

It is planned that the proceedings and the report of the Conference will later be published in English and French and possibly Spanish, as United Nations sales publications.

EXHIBITION OF EQUIPMENT

Included for examination in the arrangements to be made for the Conference is the possibility of the provision of facilities for exhibitions of equipment related to the three sources of energy. Fuller details will be provided later.

COMMUNICATIONS

Requests for further information on the Conference should be addressed to:

Executive Secretary,
United Nations Conference on New Sources of
Energy,
United Nations, New York.

PART II

AGENDA

United Nations Conference on New Sources of Energy Solar Energy—Wind Power—Geothermal Energy

Monday, 21—Thursday, 31 August 1961

- Saturday 19:* Registration of participants
1. *Monday 21:* Registration of participants
4 p.m.—
2. *Tuesday 22:*
10 a.m.—
- OFFICIAL OPENING SESSION
- I. GENERAL SESSION : NEW SOURCES OF ENERGY AND ENERGY DEVELOPMENT
- II. TECHNICAL SESSIONS ON NEW SOURCES FOR POWER PURPOSES
- III. TECHNICAL SESSIONS ON SOLAR ENERGY FOR PURPOSES OTHER THAN POWER
- A. *Geothermal energy*
- 3 p.m.—
- A.1. Prospection of geothermal fields and investigations necessary to evaluate their capacity:
- (a) Description of known fields
 - (b) Preliminary prospection
 - (c) Investigation for evaluation
- A.2. Harnessing of geothermal energy and geothermal electricity production:
- (a) Methods and equipment for harnessing geothermal energy
 - (b) Utilization of geothermal energy for power generation
- A.3. Utilization of geothermal energy for heating purposes and combined schemes involving power generation, heating and/or by-products:
- (a) Utilization for heating purposes
 - (b) Combined schemes and by-products
- A.4. Review and summary of geothermal energy problems and findings: Plenary session
- B. *Wind power*
- 3 p.m.—
- B.1. Studies of wind behaviour and investigation of suitable sites for wind-driven plants:
- (a) Wind measurements
 - (b) Selection of favourable sites
- B.2. The design and testing of wind power plants:
- (a) Design
 - (b) Testing
- 8.30 p.m.—
- Public lecture
3. *Wednesday 23:*
10 a.m.—
- 3 p.m.—
4. *Thursday 24:*
10 a.m.—
- 3 p.m.—
5. *Friday 25:*
10 a.m.—
- A. Solar energy availability and instruments for measurements:
Radiation data—Networks—Instrumentation
- B. New materials in solar energy utilization: Plastics, metals, glass, selective surfaces and other materials
- C. Use of solar energy for heating purposes:
- 1. Water heating
 - 2. Space heating
- C. Use of solar energy for heating purposes (*cont'd*):
- 3. Solar drying
 - 4. Solar cooking
 - 5. Heat storage
- D. Use of solar energy for cooling purposes:
- 1. Food preservation by refrigeration
 - 2. Space cooling and dehumidification

- 3 p.m.— B.3. Recent developments and potential improvements in wind power utilization:
 (a) For household and other individual uses
 (b) For community purposes (isolated units and units in combination with conventional power sets)
 (c) For use in connexion with electrical networks
- E. Use of solar energy for production of fresh water:
 Small and large scale distillers
6. *Saturday 26:* Open for field visits
7. *Monday 28:*
 10 a.m.— B.4. Review and summary of wind power problems and findings: Plenary session
- C. *Solar energy*
- 3 p.m.— C.1. Use of solar energy for mechanical power and electricity production:
 (a) By means of piston engines and turbines
 (b) By direct conversion to electricity:
 (i) by means of thermo-electric converters
- 8.30 p.m.— Public lecture
8. *Tuesday 29:*
 10 a.m.— C.1. Use of solar energy for mechanical power and electricity production (*cont'd*):
 (b) By direct conversion to electricity (*cont'd*):
 (ii) by means of photoelectric cells
- F. Use of solar energy for high temperature processing (solar furnaces):
 Equipment—research—potential uses
- 3 p.m.— D. Combined use of various energy sources and energy storage problems:
 1. Combined use of various energy sources
 2. Energy storage problems
9. *Wednesday 30:*
 10 a.m.— G. Review and summary of solar energy problems and findings related to purposes other than power: Plenary session
- 3 p.m.— C.2. Review and summary of solar energy problems and findings related to power purposes: Plenary session
- 8.30 p.m.— Public lecture
10. *Thursday 31:*
 10 a.m.— CLOSING SESSION

PART III

SUBSTANTIVE GUIDE LINES FOR CONTRIBUTORS OF PAPERS

II.A.1. Prospection of geothermal fields and investigations necessary to evaluate their capacity

Papers under these headings might deal with the following points:

(a) *Description of known fields*

These should include not only those which have been fully investigated but also those which have been the subject of only a preliminary appraisal.

(b) *Preliminary prospection*

Indications of possible presence of a geothermal field, such as

natural emission of free steam, or natural occurrence of hot water, or the presence of boron, hydrogen sulphide or other substance normally associated with hydrothermal activity.

Papers should deal both with theoretical considerations and quote actual examples.

Initial studies to be made before deciding to undertake full scale survey, such as

geological studies including attention to the presence or absence of fracturing and/or impermeable capping structures, temperature measurements, estimation of total natural flow of fluid, and chemical measurements.

Papers should describe in fair detail the accepted methods of making such measurements, the likely cost of the surveys and give examples of actual surveys made.

(c) *Investigation for evaluation*

Geophysical methods, investigation drilling, study of hydrothermal alteration of rocks, analyses of the fluids discharging naturally and obtained by drilling, study of the ratio of constituents (such as Na/K, Rb/Ce etc.), and gas content measurements for sound decisions on the number, type and location of power plants and on the size and number of connecting pipes.

Special attention should be given to description of methods used for measuring the output characteristics of the wells (which in the case of large wells with two-phase outputs presents numerous practical difficulties). Attention should also be directed to problems of corrosion and the deposition of silica, calcite or other chemicals whether in the aquifer surrounding the hole or in the casing.

II.A.2. Harnessing of geothermal energy and geothermal electricity production

(a) *Methods and equipment for harnessing geothermal energy*

This section is concerned with the bringing of steam or hot water to the surface in production wells and

papers under this heading should deal with the following points:

Planning of drilling operations:

Selection of the number of wells, well sites, well spacing, depth and character of well.

Drilling problems and methods:

Types of drilling equipment in various types of geological formation in geothermal areas, foundation of drilling platform, mud and blowout equipment, directional drilling, safety measures and prevention of blowouts.

Well completion:

Number and depth of casing strings, needed in the various geological formations, casing perforation, well head equipment, dust or water separators, and special requirements because of steam or hot water.

Maintenance of steam or hot water wells:

Problems arising from scale formation in geothermal wells and methods in cleaning the wells. Corrosion of wells and well head equipment.

Well production costs:

Cost of the items in the well construction, including location of wells, drilling mud, casing strings, cementing, bits, drilling rig time, and any special difficulties and equipment. Depreciation and amortization.

(b) *Utilization of geothermal energy for power generation*

Papers under this heading might deal with the following points:

Examination of factors leading to decision on how to utilize geothermal energy for production, including:

Choice of machinery in relation to the characteristics of the fluids.

Selection of appropriate sites and sizes of power plant or plants in relation to the wells.

Design of pipe lines.

Water and air pollution problems.

Simple non-condensing plants:

Experience gained and possible improvements.

Description of equipment.

Consumption of steam.

Maintenance problems.

Capital cost.

Possibility of local fabrication of plant.

Condensing plants:

Description of existing plants.

Recent development and foreseeable improvements concerning turbines, condensers and compressors.

Problems arising from chemicals in the fluid.
Selection of appropriate methods for removing gas.
Capital cost per kW installed.

Estimation of total costs per kWh:
Depreciation of well investment.
Piping costs.
Generating costs.

II.A.3. Utilization of geothermal energy for heating purposes and combined schemes involving power generation, heating and/or by-products

Papers under these headings might deal with the following points:

(a) Utilization for heating purposes

In general, the factors to be considered should be the following:

The heat flow available in the thermal area.
Temperature to be chosen for the heating fluid.
Corrosion, scaling and purification problems.
Diameter of the main pipe lines.
Insulation.
Design of the pumping plants and the distribution system.

Process heating, space heating and refrigeration:
Experience gained and foreseeable possibilities, advantages and limitation.

(b) Combined schemes and by-products

Combined schemes—Experience gained in combined utilization for power and heat: engineering problems encountered; economic advantages and limitations.

By-products—Experience gained concerning the following points:

Chemical substances associated with the various thermal fluids such as: hydrogen sulphide, ammoniac, boron, rare gases, carbon dioxide, lithium, fluorine, mercury sulphide, methane, etc.

Technical problems encountered in the recovery of chemical substances such as: washing the steam with minimum loss of temperature, corrosion problems, separation of associated chemical substances.

Economic aspects of the recovery processes.

II.B.1. Studies of wind behaviour and investigation of suitable sites for wind-driven plants

The papers for this section should deal with the following points:

(a) Wind measurements

(i) General information:

Observational information already obtained by meteorological organization, airport and other meteorological stations on annual average wind speeds in the various countries and details on the measuring methodology used (whether synoptic observations, estimates, continuous charts, etc.).

(ii) Methods of obtaining wind information especially suited to wind power use:

Simple cup anemometers as the standard for worldwide application in the study of local energy distributions in the area where wind energy is to be used;

Automatic energy integrating devices which may give a useful indication of the obtainable energy, especially where low average wind speeds have to be harnessed;

Chart registration with sufficiently high chart speeds to show clear details together with possibility of applying automatic evaluation methods;

Frequency spectra (frequencies from fractions of seconds up to months) to answer special questions of the designers of wind power machines and storage devices;

Standardization of measuring methods to enable comparisons of wind data to be made wherever they have been obtained.

(b) Selection of favourable sites

In choosing such sites certain phenomena are most important:

The wind velocity, additional increase of speed as a result of compressed streamlines, phenomena resulting from the average roughness and other characteristics of the surrounding terrain;

Local conditions around the place where instruments, and plants, are to be installed;

Economic consequences of the gain of power at a favourable site and cost for transmission of power.

II.B.2. The design and testing of wind power plants

(a) Design

The subjects of the papers on design problems can be divided into two groups—those dealing with economic designs based on an assessment of the requirements for particular cases, and those concerned with the principal factors in detailed designs. In both cases, particular attention should be paid to economic aspects, such as cost of construction, installation, maintenance and operation.

In the former group, important points are the influence of the purpose of utilization upon the design of the machine, upon its power capacity and unit size and upon the actual method of construction taking into account the needs for easy replaceability of parts, easy transport, minimum maintenance and for withstanding risks of destruction in high winds.

In the second group, such questions may be covered as the choice of rated wind speed and of rotational speed in relation to the wind régime at the intended site, the height and type of tower, the number and form of the blades, mechanical power transmission from the wind rotor to the electrical machine, the type of electrical generator, speed controls, starting mechanisms, automatic disconnecting devices, problems of mechanical vibration and of oscillations in the power output, materials of construction giving low cost and long life under difficult climatic conditions and the minimum spacing of wind power plants to avoid mutual interference.

Attention should also be paid to the experience gained with existing simple wind mills and to the possibility of constructing, in under-developed areas, effective machines of this type from locally available materials and with local labour.

(b) *Testing*

Papers on the testing of wind-driven machines should be based on (i) precise, short period tests to obtain the power-output/wind-speed relationship, and (ii) long period tests to relate the energy output to the wind régime at the site. The question of standardization of testing methods and measurements should be considered.

II.B.3. Recent developments and potential improvements in wind power utilization

In considering the utilization of wind power plants classification under three headings, according to their size and purpose, may be recognized, taking into account in each case recent developments, potential improvements and limitations including cost of machine, cost of batteries (where applicable) and resulting energy cost.

(a) *For household and other individual uses*

This category refers to small machines, associated with full battery storage, for electricity supplies to individual households or other isolated premises. Attention should be paid to the type, voltage and size of the generator and battery in relation to the frequency and duration of calm spells. Actual and potential uses may include, for example, domestic amenities (such as for lighting and radio) and small power uses (such as grinding, mixing, small refrigeration) and special applications such as lighthouses and telecommunication stations. Non-electrical machines, such as for water-pumping, could also be considered, when involving new developments.

(b) *For community purposes (isolated units and units in combination with conventional power sets)*

This category mainly refers to medium-sized machines (or combination of several smaller machines) intended for use by larger establishments, or by communities, when only limited battery storage can be envisaged and when some stand-by plant, of conventional type, might be used. Papers in this category should deal with the types of machines and of control equipment needed for operation in conjunction with stand-by plant. Emphasis should be put on the degree of storage required, methods of utilizing random power to the best advantage and the purposes for which plants could be used. The economy of supplying loads which have inherent storage, e.g. water pumping of water heating, should be considered. Distinction may be made between uses which are essential and must be continuous, uses essential only at certain times and uses which can coincide with intermittent supply. Consideration of co-operative financing and operation of community wind power plants would also be relevant.

(c) *For use in connexion with electrical networks*

A different category is formed by large machines intended for connexion to electrical networks fed by thermal or hydro-power plants when the purpose of the wind power plant is to reduce fuel consumption or to conserve water. Important problems to be dealt with include the choice of the total power capacity of the wind power plants in relation to that of the conventional power plants supplying the network, the relative economy of wind power as influenced by wind régimes at sites close to the network, operating problems relating to the combined wind-power/conventional-power system and the choice of size and type of the individual power units.

II.C.1. Use of solar energy for mechanical power and electricity production

(a) *By means of piston engines and turbines*

The Conference will put emphasis on practical application (present and future) and it is suggested that the following points be given special attention:

Types of collector used or needed, fixed or moving, temperature of operation, improvements therein.

Types of engine or turbine particularly suitable for solar energy application; power output of units considered; test results, reliability, etc.; economic evaluation (distinguish between cost per kW installed and cost per kWh).

Cold sink used or suggested.

New thermodynamic approaches to the subject.

The question of intermittent or continuous use (energy storage).

Most suitable applications, such as water pumping, lighting, local industry.

Suggestions for further progress, including indication of expected limitations either technical, economic or arising from local factors.

(b) *By direct conversion to electricity*

(i) *by means of thermo-electric converters*

Emphasis should be given to developments which may lead to applications of this system to power needs in less developed and isolated areas where electricity is either unavailable or prohibitively expensive.

Substantial advances should be mentioned concerning:

Thermo-electric materials;

Solar collectors suitable for this use;

Thermopile assembly and configuration;

Appropriate storage facilities;

Methods for handling the variable heat supply rate;

Methods for heat removal from the cold junctions; and

Complete solar thermo-electric units under design or test.

Economic, sociological and other factors related to practical use should be included where possible. The suitability of the system for meeting particular needs is considered important. Prospects for future technical improvements will be of major interest.

Although based on a different principle, thermionic generation is considered a potential method for producing electricity from solar energy, and advances in this field, where promise for use in less developed areas is indicated, should be discussed.

(ii) *by means of photo-electric cells*

It is recommended that the following points are among those to be included in papers prepared for the Conference:

Ways to increase the output by use of new materials, by use of solar concentration, by improving the capture of photons, by any other means.

Present costs and the possibilities for cost reduction.

Best suited methods of storage (accumulation).

Present and future applications in the field of tele-

communications and in covering other needs, in particular, in less developed countries.

Possible new lines of approach.

II.D. Combined use of various energy sources and energy storage problems

The subject of this section, which is divided into two parts, is applicable to both solar energy and wind power.

1. Combined use of various energy sources

Papers should deal with possibilities of using solar and wind energy in combination for remote areas characterized by different solar and wind régimes: arid areas, areas with temperate climate, and humid tropical areas.

Consideration should also be given to possibilities of combining solar and wind energy with simple power plants run from local waste materials, conventional fuels or small-scale water power.

Contributors should deal with technical, economic and social aspects of such combined use, including problems raised by readjustment of existing customs and training facilities.

2. Energy storage problems

As far as storage for subsequent electrical power supply is concerned, papers could include the following, with special emphasis on economic aspects:

Pumping of water for storage at higher elevation;

Compressed air;

Storage based on electrolytic processes and fuel cells;

New developments in storage batteries (accumulators);

Chemical storage.

III.A. Solar energy availability and instruments for measurements: radiation data—networks—instrumentation

The interest of the Conference in radiation data and instruments is primarily that of gearing data collection to prospective solar application rather than data collection for scientific comparisons. Within this broad general framework it is expected that the papers prepared for the Conference will emphasize the following points:

Networks and surveys and available data

Existing networks of meteorological and other stations disposing of instruments for the measurement of solar radiation. Brief description of the instruments available and used. Degree of reliability of data obtained. Suggestions for increasing the network density where micro-climatic conditions are prevalent. Surveys of solar radiation that have already been made or are about to be made. Review of data presently available to help delineate areas of greatest interest for solar energy utilization.

Simplified instrumentation

Existing and suggested simple instruments, capable of being used by unskilled operators and distributed in large numbers, which could provide a knowledge sufficient for solar energy utilization in a particular area.

Applicability of such instruments for different utilizations of solar energy.

Standardization of such instruments and use of simple, common measurement units.

III.B. New materials in solar energy utilization: plastics, metals, glass, selective surfaces and other materials¹

Increasing attention is being given to new materials particularly suited for use in solar equipment. Participating in this search for suitable materials are leading plastics manufacturers and firms producing aluminium, glass and other materials.

Among the points on which it would be desirable that papers presented at the Conference give specific details, the following may be mentioned:

Report on field experience—present and expected cost—technical comparison with other materials used for the same purpose—durability and life expectancy and related operating costs—temperature limitations—possibilities of local manufacture—portability—anticipated further improvements.

III.C. Use of solar energy for heating purposes

1. Water heating

Design studies, manufacture and installation of solar water heaters are proceeding at a quick pace in a number of countries. The economic value of solar water heating in semi-tropical areas is well established; in temperate climates it may help diminishing appreciably the use of electricity or of fuels when an alternative exists.

It is suggested that the following points be given special attention in papers prepared for the Conference:

Most recent developments concerning solar water heaters—performance curves of new solar heating systems and methods used for testing—present investment cost per unit of capacity, production cost expressed in dollars per gallon per day and prospects for reducing this cost—expected life time and possible means for increasing it—type of servicing normally expected.

Suggested technical improvements and standardization of the different elements of a solar water heating system and foreseeable effects on the heater performance and cost.

Increased dependability obtained through the combination of solar heating and other heat sources and economic consequences.

Methods of storage used, their performance, temperature drop over the working period.

Extent to which solar water heating systems fill the social requirements of the consumers.

Experience obtained with solar water heating systems in small or medium scale industrial plants.

2. Space heating

Although space heating in many of the under-developed regions is of less importance than space cooling for example, there are large areas, especially at higher altitude, where it is needed. Systems now being experimentally investigated are rarely in such localities, but their design and performance are important in the development of this application.

Of particular interest are the performance figures on the several existing solar-heated buildings, including such considerations as

solar collection efficiency,

¹ Thermo-electric and photo-electric materials will be dealt with under item II.C.1(b): Direct conversion to electricity.

heat storage effectiveness,
auxiliary heat requirements,
control system operation,
maintenance requirements, and
the architectural adaptations and limitations of the designs.

Where possible, system investment and operating expense, exclusive of experimental costs, should be indicated.

The importance of conventional fuel costs in evaluating solar-heating systems should be included, particularly as involved in limiting areas of potential application.

Data on space cooling incidental to solar space heating, will be of interest where available (as by night radiation or day-night exchange).

Fundamentally new collector designs, materials, and complete systems which show promise for wider use of solar heating, particularly in the under-developed areas, are also invited.

3. Solar drying

Solar energy has been used for centuries in the drying of agricultural products, almost invariably by the simple process of spreading the material on the ground and directly exposing it to sunshine. Relatively little use has been made of solar heated air in the drying of materials in more or less conventional drying equipment.

It is not intended that conventional direct solar drying be included in the discussions, but if there are some basically new systems or quantitative evaluations of direct solar drying, particularly of materials not hitherto processed by this method, these may be included.

Papers on solar drying should normally be restricted to new developments, primarily in processes and equipment for drying materials by solar-heated gases and liquids.

Technical developments, economic factors, applicability to local conditions, seasonal factors, results of testing where available, and related topics will be of interest.

4. Solar cooking

Most important factors in the development and utilization of solar cookers are their adaptability to the cooking and eating habits of peoples who might benefit from their use and economic factors such as: cost of fuel replaced (measured in units of money or of man-hours for gathering wood), cost and method of financing solar cooker purchase, and the value of the fuel replaced, if used for other purposes (e.g. animal wastes for fertilizer rather than fuel).

Furthermore, the technical requirements related to cooker design and performance, including degree of concentration, thermal output, heat loss rate, capacity for cooking (quantity of food, rate of cooking) must be adequately met.

In addition to the above factors, subjects of interest and importance to the Conference, as related to cookers already in use, or in broad field testing, include:

- fundamentally new designs and materials, particularly those by which cost reductions can be achieved,
- improvements in present designs,
- possibilities for short-term (few hours) heat storage,

- integration of cookers with other heating requirements,
- relationship to cooking vessels and their improvement for solar heat supply,
- portability of cookers, particularly as related to nomadic living, and to the extent possible,
- market regions and quantities envisaged.

It is felt that the economic, sociological, and statistical data on solar cooker use are of exceptional importance, and that one of the most important purposes of this session will be the exchange of reliable information in this field.

5. Heat storage

For the utilization of solar energy the problem of the storage of heat energy in some form or other is a vital issue, since this source of energy is available for a limited period and only during the day.

While considering this problem two questions may immediately arise: Firstly, the locality or the region, for this will determine the number of hours of sunshine available and its intensity; and secondly, the end use of the energy, since it will determine whether the storage desired has to be at a comparatively higher or lower temperature.

For certain uses, again, the period over which storage is desired may be short as, say, storing during the day and using it over the night, while for some other purposes as, for instance, house heating the storage period for certain regions may extend over the entire winter months. In either case, perhaps, it is equally important that the economic factors involved are clearly brought out.

In this connexion the consideration of the nature of the material and the way it stores energy assumes some importance—whether the heat is stored in the form of sensible heat only or as heat of fusion or crystallization or any other manner.

In order that the performance of different types of materials and methods of storage may be compared, the method for measuring performance may be stated as heat capacity per unit volume (with temperature range indicated) and per unit of cost.

III.D. Use of solar energy for cooling purposes

1. Food preservation by refrigeration

Several research groups are engaged in developing solar refrigerators. Similarly, ice-making machines based on absorption refrigeration have been constructed.

Owing to the importance refrigeration and ice-making may have in tropical and semi-tropical areas for the preservation of perishable foodstuff, it would be important to review:

developments which have already resulted in some practical application of a commercial or semi-commercial character;

potentialities for further development: theoretical studies and other lines of investigation closely related to practical development; and

limitations—present and expected—of the use of solar energy for food preservation by refrigeration.

As to the economic factors it may be found that they would in many cases be more favourable if food preser-

vation is envisaged in a central place for the benefit of a community than if devised for individual households.

2. *Space cooling and dehumidification*

Tests conclusively show that air conditioning increases human efficiency, even if used part-time. Its application in less developed areas, especially in such public places as hospitals, schools and factories, may at some time be advantageous. This may be the case particularly in those areas where conventional sources of energy are lacking.

In that connexion it would be of interest that recent developments be described as regards absorption refrigeration devices as well as humidification and dehumidification processes which have recently been tried.

Details are invited on performance and costs of both systems of air conditioning. Information may also be added on the experience made with reflective roofs reducing the average temperature inside the dwellings.

III.E. Use of solar energy for the production of fresh water: small and large scale distillers

The expansion of agriculture and industry throughout the world parallel to the increase of its population call for a considerable increase of fresh water available. Conversion on a vast scale of sea and brackish water pro-

duced at acceptable prices would have a great bearing on the economy of many areas.

To reach this result it is necessary to reduce the cost of the equipment, which could be expected especially from the use of new materials.

Among the questions of special interest for the Conference, the following may be stressed:

New concepts of distillers, portable distillers, multiple-effect distillers;

Comparison of cost of individual units widely distributed and of centralized large units accompanied with water distribution networks.

Special emphasis should be put on the output obtained, the cost of fabrication and the life expectancy of the distillers (progressive wear).

III.F. Use of solar energy for high temperature processing (solar furnaces): equipment—research—potential uses

Although there is a paucity of industrial applications at present, it is hoped special emphasis will be given to potentialities for industrial applications and productive processing, with possible utilization in less developed countries, along with description of equipment and research uses of solar furnaces.

ANNEXES

Annex I

RESOLUTION

ADOPTED BY THE ECONOMIC AND SOCIAL COUNCIL DURING ITS THIRTIETH SESSION

779 (XXX). United Nations conference on new sources of energy (solar energy, wind power, geothermic energy)

The Economic and Social Council,

Considering the importance of harnessing new forms of energy, with a view to their application especially in the less developed countries lacking conventional energy resources for their economic development,

Bearing in mind that considerable progress has been made in the application of solar energy, wind power and geothermic energy,

Recalling its resolutions 653 III (XXIV) of 26 July 1957 and 710 A (XXVII) of 17 April 1959, including its decision to convene a United Nations Conference on Solar Energy, Wind Power and Geothermic Energy,

Having considered the report of the Secretary-General on preparatory action for the holding of a United Nations Conference on New Sources of Energy,¹

Having heard the offer of the Government of Italy to provide host facilities for the conference,

1. *Commends* the Secretary-General for his report and notes with satisfaction the results of the meetings of experts on solar energy, wind power and geothermic energy;

2. *Approves* the arrangements proposed by the Secretary-General for a United Nations Conference on these forms of energy, to be held from 21-31 August 1961;

3. *Accepts, with appreciation,* the offer of the Government of Italy to provide host facilities;

4. *Draws the attention* of Governments of Member States, especially those of the less developed countries, to the facilities under the United Nations Technical Assistance Programme for the granting of fellowships and other assistance enabling them to benefit from the Conference;

5. *Requests* the Secretary-General to report to the Council at its thirty-third session on the proceedings and results of the Conference.

*1132nd plenary meeting,
3 August 1960.*

¹ E/3371/Add.1.

Annex 2

UNITED NATIONS CONFERENCE ON NEW SOURCES OF ENERGY

Application for participation by an individual

Executive Secretary,
United Nations Conference on
New Sources of Energy
United Nations,
New York

Within the framework and conditions set out in the information bulletin concerning the Conference on New Sources of Energy I should be interested to receive an invitation:

- To attend the United Nations Conference on New Sources of Energy being held in Italy, 21-31 August 1961.

- To submit a paper on
(approximate title)

For Agenda Item
(number and topic, e.g. III.C.5, "Heat Storage")

for which a preliminary abstract is attached herewith.

(date).....

Name:
(please print)

Street Address:

City and country:

Position:
(and any other qualifications such as authorship of relevant publications)

Note I: Please type or print the information requested.

Note II: This application must be submitted at earliest possible date, but not later than 1 January 1961.

Annex 3

UNITED NATIONS CONFERENCE ON NEW SOURCES OF ENERGY

*Application for participation by a nominee of a governmental
or non-governmental organization*

Executive Secretary,
United Nations Conference on
New Sources of Energy
United Nations,
New York

On behalf of
(name and address of governmental or non-governmental org.)

the undersigned requests that an invitation be sent to:

Name:

Address:

Position in the Organization:

To attend the United Nations Conference on New Sources of Energy being held in Italy, 21-31 August 1961.

To submit a paper on
(approximate title)

For Agenda Item
(number and topic, e.g. III.C.5, "Heat Storage")

(date)

Name and title:

Signature:

Note I: Please type or print the information requested and return this application as soon as possible.

Note II: If it is desired to nominate more than one person, please provide similar information on each nominee.

Note III: It is desirable that an abstract of the paper to be submitted by the nominee be enclosed.

