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Research programme for solar energy

By

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RESEARCH PROGRAMME FOR SOLAR ENERGY

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Dr. Syed Wajahat Ali*

1. The work of Solar energy Centre, Hyderabad a nucleus for the proposed Institute of Renewable Energy, will comprise the development and dissemination of Solar Energy Technology and also Launching large scale Integrated System for Power Generation and Water Desalination to fill in the short fall in Energy Sector on the one hand and providing drinking water to remote/arid zone/desert area and, possibly, initiating limited scale energy plantation and crop production. Product development and dissemination of Solar Energy Technology in context of the above enunciation would relate to Solar devices and technologies which may be categorised for convenience according to the form of energy utilized after conversion of the primary Solar inputs as:

(1) Devices and Technologies for Solar Heat
(2) Devices and Technologies for Solar Electricity
(3) Devices and Technologies for Solar Fuel
(4) Miscellaneous Applications of Energy including Wind, Tidal, Low Head Hydel and Salt Gradient.
(5) Solar Architecture and Solar Passive Systems.

2. DEVICES AND TECHNOLOGIES FOR SOLAR HEAT

2.1 Solar Water Heater

Several Solar Water Heaters, fabricated on simple thermosyphon design have been evolved over the past five years and have now, been improved in design with alternate materials of construction.

The acquired know-how of Solar water Heater Technology which was based on thermosyphon and open loop systems, have been extended to forced circulation and closed loop systems. A few Solar Water Heaters based on these systems have been constructed for Quetta.

Installation of hot-water supply, pre-heater for boiler feed water, for various laboratories, hospitals and industries will be undertaken in future.

2.2 Solar Water Desalination Plant

Previously constructed Solar Stills are being redesigned on the basis of the evaluation results. A 12 gallon per day capacity potable plant is being fabricated for demonstration. A successful demonstration of obtaining potable water from brackish water has already been done.

Solar desalination is an accepted process for converting brackish or saline water for drinking purposes. The Gwadar desalination is not in use for a long time due to technical problems, and Coast Guard authorities have desired it to be handed over to the PCSIR for recommissioning. The plant will be repaired or, if necessary, relocated at some other suitable site.

A PC–1 for this project has already been approved. Fabrication and Installation of Solar Stills at Hospitals, Laboratories, etc. will be undertaken.

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2.3 Solar Crop Dehydrator

Several units constructed on different designs, have been successfully tried for dehydration of vegetables. At present the effectiveness of this dehydrator is being evaluated for some new food products.

Improvements in design in Solar dehydrators fabricated for vegetables and fruits, will continue. Large scale units will also be designed and fabricated. Some bio-chemical aspects will have to be looked into to improve the taste of the products.

2.4 Solar Cooker

Solar Cookers of concentrating and non-concentrating designs are being evaluated for various kinds of cooking performances. The present units are being improved to include several new desirable features.

New designs will incorporate (i) optical concentration (ii) heat transport and (iii) thermal storage.

2.5 Solar Bowl For Power Generation

A hemispherical system commonly known as the Solar bowl fitted with multiple plane reflectors, all focussing on a heat exchanger mounted on a structure that can move/adjust aceording to the movement of the sun and the point of focussing. The main advantage is that the radiation concentrating system is stationary and is thus relatively trouble free. Two different designs, namely, the Base line solar bowl and the shallow-bowl, will be installed.

2.6 Application of Salt Gradient Solar Pond and Helio-Hydro — Gravity For Power Generation.

The concept of obtaining industrial process heat or to produce electricity from salt gradient solar pond is a new technology and has also considerable importance as a system of energy storage from Solar radiation or of industrial waste heat. The process can be very competitive with conventional process in providing low-quality process heat for the industry.

Various models of Solar ponds and their design/technical aspects will be studied on a pilot plant scale first and then tried on actual size as a part of an integrated system, comprising other Solar Energy systems.

The helio-hydro-gravity technology, an interesting and promising technology for low-helio hydro power generation is based on the phenomenon of surface evaporation of water from a large enclosed-system reservoir at seaside or other suitable site, resulting thereof in fall of water level in the enclosed area. The water head thus produced is utilized in turning of turbines.

A survey for a suitable site for a demonstration unit will be carried out in the first stage. Based on the survey report and the data of the demonstration unit, a full scale plant proposal will be prepared.

3. DEVICES AND TECHNOLOGIES FOR SOLAR ELECTRICITY

3.1 SOLAR ELECTROLYTIC DEBACTERIFICATION

Some preliminary expoerimental work was carried out to determine the effectiveness of Solar Electrolytic Debacterification. The Electrolytic cell is powered by Solar Electricity.

3.2 Application of Photovoltaic Devices

Small scale photovoltaic systems have been tried for energizing water lift pumps, electric fans, radios, electric bulbs, T.V. etc.

Heavy duty Solar battery chargers will be developed for domestic and commercial purposes with locally manufactured electrical subsystems, for use especially in remote and isolated areas where normal power supply system is not present.

4. DEVICES AND TECHNOLOGIES FOR SOLAR FUEL

4.1 Solar Hydrogen

The Solar Electrolytic cell designed and fabricated for the production of ten litres of hydrogen gas by photovoltaic Electrolytic of water is being evaluated with different materials of construction for electrodes, the evaluation work would continue, to obtain data and expertise in storage handling of the explosive gas.

New semi-conducting materials which hold good prospects, will be tried for Electrodes to achieve higher efficiency.

Metal hydride systems will be developed for safe handling of hydrogen in the domestic and transport sectors. The development of the hydride system could form a part of long-term project for large scale use of an alternate energy source.

4.2 Solar Airconditioning and Solar Refrigeration

The research work on Solar airconditioning and refrigeration is in the preliminary stages to establish the optimum parameters to suit our climatic and environment conditions.

Investigations into the Libr absorption cycle chiller would need fresh studies with the possibility of introducing new systems. It is likely, that the present lb absorption system will be replaced by ammonia water system. Alternatively linear parabolic cylinderical concentration will be employed to achieve the required heat at appropriate temperature.

4.3 Solar Passive System

Progress in this field leaves much to be desired. Collaboration and/or consultation of reputed local civil engineering firms and the Council of Building and Housing Research and also the Engineering Universities will be solicited to make significant headway.

An important modification was incorporated some time back, instead of passive night cooling of the thermal mass an active spray ttowerl is being employed. It has yielded encouraging results.

For winter Active Solar Water Heating will be introduced to achieve comfort zone conditions.

4.4 Solar Architecture

Not much progress has been made in this sector.

The programme comprising installation of domestic photovoltaic appliances, Solar Cooker, Solar Water Heater, etc. may be adopted to make an energy independent house.

5. APPLICATION OF WIND ENERGY

Wind mill coupled with Solar thermal power generation system forms an ideal combination for remote and isolated areas. However, successful operation of wind mill essentially require a

survey of the yearly pattern of the wind speed and direction and also the daily variations.

Solar desert chimney and the sail-wind-mill technology both are potential cheap sources of power generation and would compare favourably with Solar thermal power.

6 WORKSHP FACILITIES

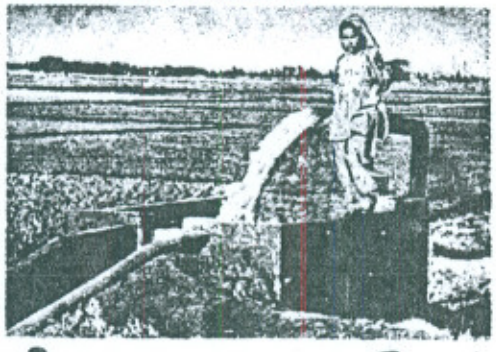
A full-fledged electrical/electronic laboratory will be established at the centre for design and construction of electrical/electronic equipment for monitoring and control of the renewable energy products/plants.

A thermophysical properties measurement facilities will also be established to evaluate materials used in the products/plants, the measurement facilities will include thermal conductivity specific heat, reflectance and emissivity.

The workshop facilities at the centre will be strengthened to enable it to construct prototype units/plants and embarking on limited scale production of the renewable energy systems.



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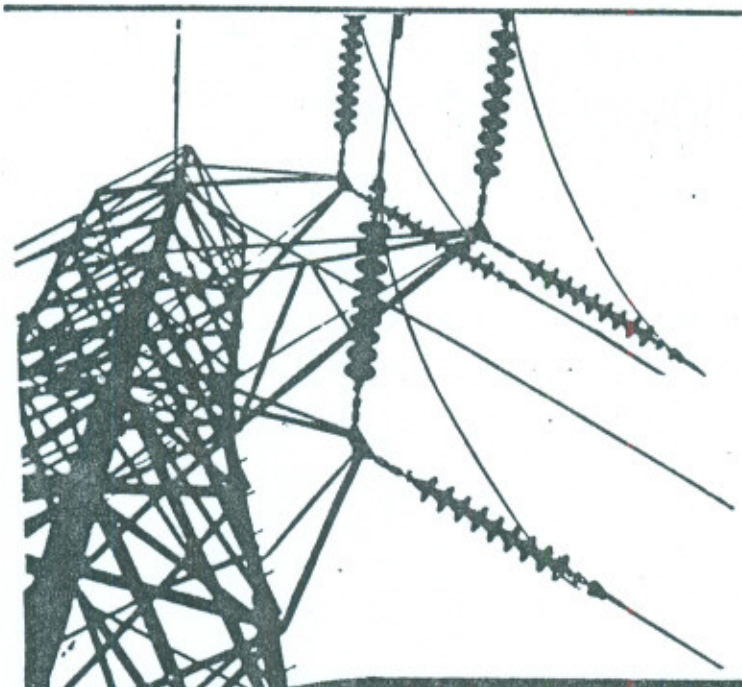
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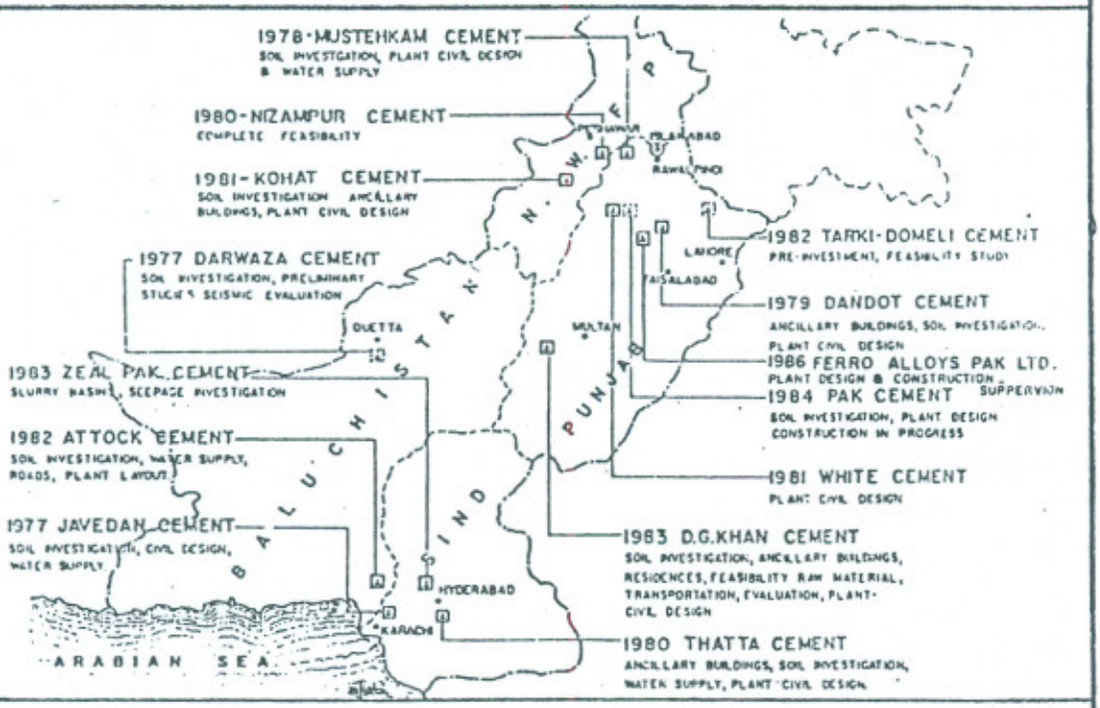
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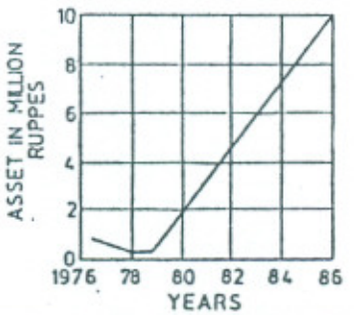


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