

VATIS UPDATE

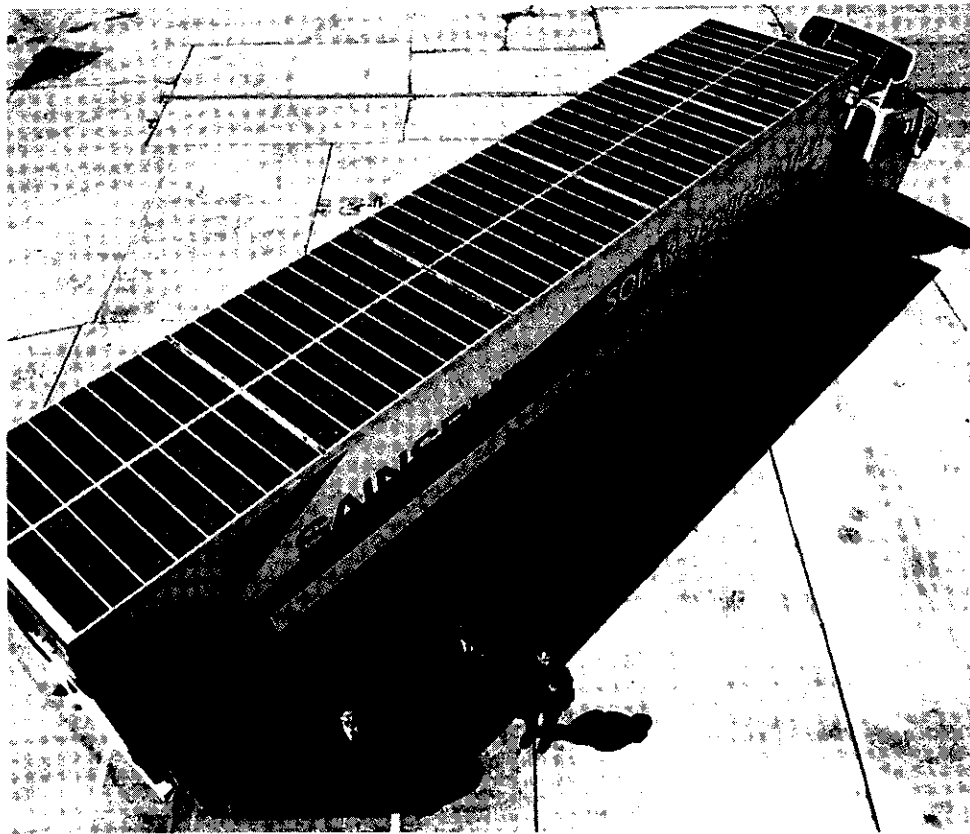
Non-conventional Energy

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Highlights

- WIRE activated
- Solar equipment from Budapest
- Sun-powered cooling
- Green car project
- Eco-friendly solar absorbers
- Medium-size wind turbines



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VATIS* Update
 Non-conventional Energy
 is published 6 times a year to keep the
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IN THE NEWS

Wind-driven power generation facility installed in Sri Lanka

The International Development Association (IDA) and the Global Environment Facility (GEF) have partly funded a project to install a wind-powered electricity plant in Sri Lanka. The 3 MW facility, to be installed at Hambantota, will be the country's first wind-powered plant. The pilot plant will have five windmills, each measuring 180 feet in height, installed over twenty-five acres of bare land with shrub vegetation. The contract for this project has been awarded to Asian Wind Turbines of India. (News Digest, 20 July 1998)

International standards for renewable energy equipment

The following standards concerning renewable energy equipment were recently issued by the International Electrotechnical Commission:

IEC 61345 (1998-02): Ultraviolet (UV) test for PV modules – This standard is to determine the ability of a photovoltaic (PV) module to withstand exposure to UV radiation of 280-400 nm.

IEC 61363-1 (1998-02): Wind turbine generator systems - Part 12: Wind turbine power performance testing – Specifies a procedure for measuring the power performance characteristics of a single wind turbine generator system (WTGS). Applicable for testing all types and sizes of WTGS connected to the electrical network. *Contact: IEC Central Office, 3 rue de Varembe, Box 131, CH-1211, Geneva, Switzerland. Tel: +41 (22) 9190 126; Fax: +41 (22) 9190 300.* (Renewable Energy World, July 1998)

WIRE activated

The Worldwide Information System for Renewable Energy (WIRE) was officially activated on 3 June this year at Freiburg, Germany. The activation was carried out by the President of the International Solar Energy Society (ISES) and the President of the EUREC Agency.

Funded by the German Ministry for Education, Science, Technology and Research, the WIRE initiative is aimed at creating an extensive information management infrastructure for distribution throughout the world. It provides the technology foundation to enable cooperative document creation and editing, extensive searching and reporting, document reviewing, and rapid information base expansion. *Contact: E-mail: wire@ises.org; Internet: http://wire.ises.org.* (Renewable Energy World, July 1998)

Rural electrification appraisal project completed

IT Power India recently completed an appraisal of a proposal, to support rural electrification in Rajasthan through solar photovoltaic (PV) power, for the Swedish International Development Agency (SIDA). IT Power completed the project with the cooperation of the Centre for Scientific Research, Auroville, India.

The Rajasthan Energy Development Agency (REDA), a state level renewable energy agency, had applied for funds in the form of a grant from SIDA to electrify remote and inaccessible villages with PV energy. With emphasis on the sustainability of such a programme, the appraisal addresses all aspects of the PV rural programme feasibility including technical, financial, service and management infrastructure. (IT Power News, June 1998)

China's first commercial wind farm

China installed its first commercial wind farm near the city of Shantou in late July this year. The 24 MW wind farm comprising 40 NEG Micon 600 kW turbines was put up by Dutch and Chinese developers. It is also the largest wind farm in Asia to be financed entirely on a commercial footing without any subsidy. The new plant, which represents 25 per cent of the nation's total wind capacity, is expected to provide electricity for 60,000 households. An annual growth rate of 9.3 per cent means that the Chinese energy market is expanding at three times the world average. (Wind Power Monthly, September 1998)

Danish wind know-how for sea-based windmills

During 1997, windmill technology from Denmark was recognized as one of the best in the industry. Danish manufacturers and service companies now account for 65 per cent of the world market. NEG Micon is working with experts in the United Kingdom to double the capacity of large windmills at sea. But various technical problems such as infrastructure, service, logistics, etc., have to be solved first.

Recent research into wind energy has shown that wind blowing over the sea is more stable than on land. In the latter case, wind gets affected by the shape of the landscape and is subjected to a great deal of turbulence. As wind speeds are stronger and stable over the sea, wear and tear experienced by windmills is reduced, thereby increasing the life and efficiency of sea-based windmills. (Denmark Review, April 1998)

Large-scale solar heating in the United Kingdom

A project to install solar water heating systems on a large-scale has been launched in the United Kingdom with the help of IT Power. This programme is a part of the THERMIE Project, which aims to install up to 3,000 solar systems in different European countries. Till date, 72 solar systems have been installed at two building sites in South Wales and 28 more will be installed by the end of this year. Installing systems in large numbers on each site and incorporating them into the properties during the designing stage has substantially reduced the costs per system.

The new project differs with other similar projects implemented earlier, in that the systems are installed by local plumbing and electrical contractors. As these contractors were new to this field, they were trained to install as well as maintain the solar water heating equipment. Another feature of this project is that the systems are installed in rented properties, which means that the users did not actually opt for these systems. IT Power has been

providing information to the tenants on how to get the most out of their systems. Detailed monitoring of eight properties will be conducted during the first year of operation to assess the effect of this project. (IT Power News, No. 21, June 1998)

Wind energy in Australia

Wind powered water pumps are widely used in Australia and, in some instances, small wind generators are used as stand-alone power systems. A 2 MW wind farm situated at Esperance was the first such project to be established in the country. Very often, the wind generators were found to be operating at their maximum output, with some of them having to be turned off during the night as the power production was more than the local requirement.

More recently, there have been several small developments. Two 225 kW units at Thursday Island and a 600 kW unit at Kooragang Island have been installed, while three 250 kW units on King Island and a 5 MW farm at Crookwell are in the process of being installed. A Green Energy scheme in New South Wales has enabled consumers to purchase renewable energy, even though the price is slightly higher than coal-produced energy. *Contact: Mr. Geoff Thomas, Advanced Wind Technologies, Cairns, Australia. Tel: +61 (740) 531 255; Fax: +61 (740) 321 209; E-mail: wind@iig.com.au.; Internet: <http://www.midcoast.com.au/~wind>.* (Renewable Energy World, July 1998)

Degree course in alternate hydro energy systems

The University of Roorkee, Uttar Pradesh is the first Indian university to offer a Master's degree course in Alternate Hydro Energy Systems. The course is conducted at the Alternate Hydro Energy Centre, which was established in 1982 to promote the development of small hydro in hills and plain areas, and the development of decentralized integrated energy systems together with renewable energy sources.

The main objective of this Centre is to design and develop various non-conventional energy

technologies and to impart training to field engineers in the field of renewable energy technology in the country. The three-semester course is best suited for those who are working in organizations and institutions related to the implementation, planning and execution of non-conventional energy sources. *Contact: Alternate Hydro Energy Centre, University of Roorkee, Roorkee 247 667, Uttar Pradesh, India. Tel: +91 (1332) 74254/65213; Fax: +91 (1332) 73517/73560; E-mail: ahec@urkiu.ernet.in.*

Joint ventures for wind energy production

In India, the government is studying a proposal to set up wind power estates in the country with the cooperation of the private sector. The Industry Ministry has supported this proposal and a final decision by the Cabinet is awaited on the planned joint ventures. The proposed equity structure being formulated by the government envisages the Indian Renewable Energy Development Agency holding 24 per cent stake, the state government having 25 per cent stake and the controlling 51 per cent with the private sector. (TERI Newswire, Vol. IV, Issue 6, 16-31 August 1998)

Solar dehydration unit installed in Sri Lanka

In Sri Lanka, a solar dehydration unit has been installed by the Social Mobilization Foundation at its premises in Rathupasgodella Hambantota. The new system provides dehydrated vegetables and fruits to the market as value-added commodities, and has a daily output of 25 kg. The main advantages of solar dehydration technology include:

- Hygienic drying process;
- Value addition to agro-products;
- Reduction of post-harvest losses;
- Storage of agro-products for use during the off-season;
- Easy transportation of agro-products; and
- Drying time reduced by 50 per cent.

(News Digest, Vol. 11, No. 24, 12 July 1998)

INVENTIONS/ NEW PRODUCTS

Solar equipment from Budapest

A Hungarian company Dunasolar Photovoltaics Inc., based in Budapest, is a leading manufacturer of amorphous silicon PV modules. The new thin-film modules are produced utilizing high-quality glass-to-glass encapsulation methods. Thin film modules have inherently lower manufacturing costs but superior performance-to-cost ratio. Special aluminium "I" channel mounting rails are provided at the back for easy installation and maximum wind resistance. Hermetically sealed leads attached to the modules offer highest reliability and facilitate easy access. Four versions of the PV modules are available with the following power ratings; DS40 - 40 W; DS20A - 20 W; DS20B - 20 W; and DS10 - 10 W.

The company has also developed a lamp that combines PV technology and portable lighting. Spector Lamp provides 4-5 hours of continuous illumination with 360° uniform lighting. It offers AC/DC charging options and can also serve as a 12 V power source. Its components include a 12 volt 3 or 7 Ah battery, a 7 W fluorescent bulb and a 10 or 20 W PV module. The lamp can be hung upside down to provide illumination in various applications.

Another product, the Dunasolar Post Lamp, is an independent lighting system that is cost-effective and environmentally friendly. The one-piece unit can be easily installed without the need for wires or an electrician. It can be mounted on a pole or attached to any building structure. The lamp is available in two basic models, DSPL25 and DSPL12. The Post Lamp has an integrated motion detector and light sensor. Once dark, the light will come on when it senses motion and automatically shuts off 30-60 seconds (adjustable) after motion ceases. *Contact: Dunasolar Inc., H-1108, Budapest, Kozma u.7., Hungary. Tel: +36 (1) 2642 635; Fax: +36 (1) 2642 637; E-mail: sales@dunasolar.hu.*

New solar-powered cooling system

In Germany, EG Solar e.V and Zeo-Tech have together developed a new cooling system which is cheap, reliable and easy to maintain. The system consists of a refrigerator powered by solar energy, with a built-in evaporator, one or more zeolite containers and a parabolic concentrating solar collector. A hand-driven vacuum pump is supplied for removing air from the adsorption system.

For refrigeration, a zeolite container – with about 4 kg of zeolite – is connected with the evaporator. Once air is removed, making the system airtight, the cooling process begins within seconds. Temperatures between 0-6°C can be maintained for about 72 hours. When the zeolite is saturated with water, the container is separated from the evaporator and a new desorbed zeolite container is connected. Using the vacuum pump, air is removed to allow the cooling process to continue.

Water from the saturated zeolite is removed by placing the container at the solar collector focus, where it is heated to a temperature of 250°C in about 4 hours. The container can be reused after a few hours.

The advantages of this system include:

- The simple design makes maintenance easy and repairs can be performed locally;
- The solar collector can also be used for cooking, baking, sterilization and drinking-water preparation;
- Water and zeolite are both natural substances that are not harmful to either humans or animals;
- Compared to a solar-driven compressor system – powered by electric solar cells – of an equivalent capacity, the investment for this system is lower; and
- As energy can be stored in the zeolite containers, continued operation during bad weather is possible.

Contact: EG Solar e.V., Neutottinger Str. 64c, D-84503, Altotting, Germany. Tel: +49 (8671) 969 937; Fax: +49 (8671) 969 938.

Electricity from potable water

Mini hydropower stations have been installed by Swiss researchers in mountainous regions to generate electricity. Sulzer Hydro AG has developed power stations which utilize the high pressure of water flowing down from high-level catchment areas to reservoirs at lower levels. Normally, a difference in altitude of about 100-800 m between the catchments and reservoirs can be found. This results in an increase in pressure, which gets reduced before the water is routed to the reservoirs.

The hydro stations convert the potential energy of water, which is otherwise lost in pressure-breaking shafts and pressure-reducing valves, into electricity. Sulzer Hydro has installed about 40 hydro stations which have an average annual energy output of 19 million kWh. To protect the quality of drinking water, the housing, intake and pipework can be made from stainless materials. Electric servomotors and water hydraulics can replace oil hydraulics. While coatings suitable for use with drinking water protects against corrosion, the bearings can be lubricated using biodegradable oils and greases. (PTI Science Service, 1-15 September 1998)

Sun-powered cooling

At the Gippsland Campus of the Monash University, Australia, researchers have developed a new solar thermal-powered refrigeration unit, based on an eco-friendly technology – solid absorption-cooling cycle using a non-CFC refrigerant. The Solar Ice-Maker does not utilize any PVs, batteries or electrical equipment and is devoid of moving parts.

A working prototype has been built which consists of a 1 m² solar collector capable of producing 2 kg of ice, starting from water at 20°C, over a 24 hour period. Production cost for this system is estimated to be about 20 per cent of the investment for manufacturing a comparable solar electric refrigerator. Contact: Dr. Eric Hu, Senior Lecturer, Gippsland School of Engineering, Monash University, Australia. Tel: +61 (3) 9902 6833; Fax: +61 (3) 9902 6500; E-mail: Eric.Hu@eng.monash.edu.au. (Australian Energy News, September 1998)

PRO IDEAS

Generation of hydrogen from sunlight and water

Researchers at the National Renewable Energy Laboratory (NREL) in Colorado, the United States, have developed a new device which can directly generate hydrogen from water and sunlight. Conventional photo-electrochemical cells can breakdown water into its components using sunlight, but only with the help of external potential.

The new all-in-one device is a unique combination of gallium indium phosphide photo-electrochemical cell and a gallium arsenide photovoltaic cell. Hydrogen generated by this device can be used in hydrogen powered fuel cells to supplement renewable energy from non-renewable sources. It is a more advanced alternative to conventional systems and has an efficiency of 12.4 per cent. NREL is experimenting with other materials to obtain even more greater efficiency. (Chemical Weekly, 11 August 1998)

New cathode for lithium batteries

Scientists at the Massachusetts Institute of Technology, the United States, have developed a family of economical and potentially superior replacements for the cathode material presently used in lithium cells. The team has designed, synthesized and tested replacement materials that incorporate aluminium into the commonly used lithium-cobalt-oxide cathode.

In lithium batteries, lithium ions travel from the anode to the cathode, inserting themselves in the crystal structure of the cathode material. Energy comes from electrons that flow to the cathode to balance the positive charge carried by the lithium ions. But just as lithium ions need to be accommodated in the cathode material, similarly the electrons should be provided some place. It was thought that transition-metal oxides or mixtures of them could be used as cathode materials to accommodate

the electrons. When the researchers found out from quantum mechanics that electrons are largely accommodated in oxygen, the group started to experiment with aluminium-containing lithium cobalt oxides. (Journal of Scientific and Industrial Research Vol. 57, September 1998)

Green car project

Cambridge Consultants Ltd., the United Kingdom, has made a crucial contribution to the development of a hydrogen-powered fuel cell engine being designed in the United States. The United States government has launched a project to manufacture a passenger car which can travel 100 km on only 3.5 litres of fuel. This programme is supported by the Department of Energy and a consultancy firm Arthur D Little. The British company has developed computer controls that are critical for the successful creation of a fuel cell automobile.

In conventional IC engines the efficiency is maximum at high speeds, while in fuel cell motors the efficiency increases with decrease in speed, thereby making the latter ideal for city driving. The fuel processor includes a partial oxidation zone, a catalyst clean-up bed, an integrated air preheater and a steam generator. An important feature of the fuel processor is a partial oxidation reactor, where the fuel is broken down for further processing before hydrogen can be produced. Carbon monoxide is not eliminated in the fuel cell process, but is greatly reduced by virtue of doubling the fuel economy currently achieved by IC engines. Carbon monoxide emissions in exhaust gases is less than 0.01 per cent.

Another aspect is the processor's fuel flexibility – it can convert a variety of hydrocarbon fuels into hydrogen. This aspect presents the possibility of the so-called "closed carbon cycle", leading to the re-absorption of carbon dioxide. A compact desulphurization bed is included in the system when fossil fuels such as petrol and natural gas are used. *Contact: Cambridge Consultants Limited, Cambridge Science Park, Milton Road, Cambridge CB4 4DW, the United Kingdom. Tel: +44 (1223) 420 024; Fax: +44 (1223) 4233 373; E-mail: Richard.Stobart@camcon.co.uk.* (Spectrum, July-August 1998)

REFLECTIVE ENERGIES

Reflective Energies, California, the United States, is designing a small, portable, microturbine power plant that can produce electricity from biomass. Currently available microturbines run on natural gas, diesel, gasoline or other high-energy fuel, but cannot run on low-grade fuels such as biomass gas. Utilizing new technology, the Flex-microturbine will generate electricity that can compete with energy produced using fossil fuels, but without the harmful effects of the latter. This programme was initially funded by EPRI and is now supported by the National Renewable Energy Lab and the Great Lakes Regional Biomass Energy Association.

The term microturbine refers to a small, high-speed turbine generator power plant, including the turbine, compressor, generator, all on a single shaft, and includes the power electronics to deliver the power to the grid. Microturbines have only one moving part, use air bearings and need no lubricating oil, and are expected to be much more rugged than IC engines. Flex-microturbine being developed will run on low pressure, low-BTU biomass gas without using a fuel gas compressor. Catalytic combustion ensures that neither NO_x nor VOCs are produced.

The microturbine is expected to be available within the next three years and will conform to the most stringent air quality requirements. Biomass can then be utilized to generate energy at the source point itself, thereby eliminating transport charges, reducing forest fires, manure damage to streams and smoke from open field burning. The global potential for CO₂ reduction is in the range of 50-100 million tonnes a year. Unlike solar or wind, biomass is nature's storage, available 24 hours a day and can be depended upon for continuous operation without back-up or storage. Remote islands and villages can become self-sufficient with improved use of biomass power without diesel back-up, something that is not possible with solar or wind systems. *Contact: Mr. Edan Prabhu, Reflective Energies, 22922 Tiagua, Mission Viejo, California 92692-1433, the United States. Tel: +1 (949) 3804 899; Fax: +1 (949) 3808 407; E-mail: edanprabhu@msn.com.*

SOLAR ENERGY

Eco-friendly solar absorbers

In Germany, the Fraunhofer Institute for Solar Energy Systems ISE, Freiburg, and Interpane Solar Beschichtungsgesellschaft have together developed a sputtering process to coat rolls of copper sheets. Each roll is more than 1,000 metres in length, and environmentally friendly solar absorbers for solar hot water collectors are manufactured from these sheets.

The new technology developed is a sophisticated ceramic-metal structure, which combines 95 per cent absorption with only 5 per cent loss by emission. Compared with conventional black chrome deposition, the new process is emission-free, does not pollute the waterways and saves considerable processing energy. The coating quality is comparable to that of galvanic black chrome. *Contact: Dr. Klaus Heidler, Solar Consulting. Tel: +49 (761) 4016 685; Fax: +49 (761) 4016 681; E-mail: wolf-gang.graf@ise.fhg.de.* (Renewable Energy World, July 1998)

Growing solar cells

Researchers at the Australian National University (ANU) have developed novel silicon wafers, suitable for solar cells, which can be cultured in a manner similar to the way crystals are grown from a solution. When a silicon wafer, the seed/parent, is immersed in a solution containing a small amount of purified silicon, a new wafer is born. The baby wafer then detaches itself from the parent, leaving behind the original to be reused. The new layer is removed using an etchant.

In this method, microscopic holes are created in the layer, which are not visible to the naked eye and make the layer transparent. The thickness of the wafer varies with the time allowed for the process, whereas the shape of the material depends on the shape of the seed. Solar cells just 100 micrometres thick can be produced. This technology does not involve cutting or trimming of the wafers using costly pure silicon, thereby drastically cutting