School gets high quality solar parabolic troughs

Photo: Parabolic trough cooking system, courtesy: Oorja Energy Systems

Devnar School for the Blind has installed a new parabolic trough based solar cooking system for meeting heating needs of cooking for residential students. They have used two Parabolic Trough Concentrators (PTC) each of 18 m2 gross area and 16 m2 aperture area supplied by Oorja Energy Engineering Services Pvt Ltd., Hyderabad. The receiver tubes used are tested and certified by DLR (German Space Agency) that clearly characterise the heat loss at different temperatures.

The school has a steam cooking system using LPG that caters 100 kgs of rice cooked for lunch and dinner along with 20 kgs of *dal* (pulses) catering to close to 500 students. The school was satisfied with the energy savings using solar water heater and solar PV hence decided to consider reducing the usage of LPG for cooking thus settled for a solar thermal system.

The solar grade curved mirrors 4 mm thick with optical efficiency above 94% ensure that there is greater accuracy in the parabola shape when compared to an arrangement of flat mirrors with chances of human error. According to Madhusudhan Rao of Oorja Enegry "the design used for these parabolic troughs is RP3 design that is an international standard for curved mirrors. We are the first manufacturer to start using these CSP-grade mirrors. Further for greater precision in tracking an IP67 rated slew drive using a simple DC motor is used".

Thermal fluid is used to capture heat from the solar field by circulating it in the evacuated tubes. A double jacketed vessel was specifically fabricated that acts as solar boiler as well as steam accumulator. The system has been designed in this manner as the total cooking time is not more than 3 hours during the day but heat is being captured for 8 hours in a day (8AM-4PM). All the heat captured is used to convert water to steam that is stored in the accumulator until required for cooking.

The total project cost of the system was Rs. 14 lakhs and also benefitted with central capital subsidy of 30% on the solar component besides applicable GEF-UNDP support. It will provide annual savings of 5,500 kgs of LPG nad payback in less than 4 years

http://www.devnarfoundationfortheblind.org/

Amul Dairy acquires eco-friendly Solar thermal generation

Photo: Parabolic trough process heat at Amul Dairy, Gandhinagar

AmulFed Dairy (AFD), Gandhinagar is the largest dairy in Asia with milk handling capacity of 3.5 million liters per day. Its present annual energy consumption is about 54 million kWh electricity and about 12 Million Cubic Meters Natural Gas. With the objective to acquire eco-friendly generation, eight Single axis parabolic trough each of 6.41 m^2 collector area are commissioned in the roof at an estimated cost of Rs. 1,60,00,000/- that will yield annually close to 650 tons of steam at 17.5 kg/cm^2. The boiler is generating the steam at 17.5 kg/cm2 pressure and steam is injected in main steam grid. From this, it is used for all applications like pasteurization/sterilization of milk, CIP of pipelines and tanks etc.

The parabolic trough have aluminium coating with reflectivity >92%. A receiver tube with selective coating, encompassed by a glass tube is installed at focal point of parabola to concentrate the reflected heat on the water.

Feed water is first injected in three parabolic troughs in series. and the hot water is further taken to second array of three parabolic troughs in series. At this end of second array, water is converted into steam and passed through a moisture separator to convey dry steam to the steam header. Separated water is recycled back to the feed tank through heat exchanger to pre-heat the feed water. The pressure on the plant steam header is maintained at 15 kg/cm2 to inject the steam into main header.

The system starts automatically every morning and is also shut off in the evening time in auto mode. It is regulated through programmable logic controller and all the real time data are stored.

To ensure safety, steam safety valves are installed on each boiler steam outlet line and also on the common steam header. Wind speed is also continuously monitored and the interlocking is made to bring the troughs into stow position in the event of high wind speed.

http://www.amul.com/

Tea industry offers potential for solar thermal

Photo courtesy: GEF-UNIDO India project

India is one of the largest tea producers in the world with close to 12 million kg production. Arijit Rana, Secretary General, India Tea Association informed during processing of tea 27% of energy is using electricity and the rest 73% is thermal. The thermal energy is for weathering and drying operations requiring from 50 ^{O}C up to 150 ^{O}C. The industry consumes coal worth 1,000 million tons annually. These statistics were shared at the workshop on Concentrating Solar Thermal Technologies for Industries held on 15th July 2016 at Kolkata.

Goodricke, one of the market leaders in tea in West Bengal has successfully commissioned a 700 m2 Compound Parabolic Concentrator (CPC) at their factory near Jalpaiguri for meeting hot water requirements during infusion. The system heats 5,000 litres of water up to 90°C and is integrated to the existing coal fired boiler.

Concentrating solar thermal technologies have the capability to deliver heat in this temperature range hence a major conclusion drawn was to explore this sector. Tarun Kapoor, IAS in his address assured complete support from Ministry of New and Renewable Energy, government of India and also urged the industry participants to undertake a study tour at successful installations in the country. He called on the manufacturer's national body Solar Thermal Federation of India to coordinate the study tours.

Dr. Anil Misra, National Project Manager highlighted the GEF-UNIDO programme. The project has been conceived aiming to contribute to the GEF Climate Strategic Change objective of promoting investments in renewable energy technologies by transforming he market for solar energy for industrial heat applications in India through investment, market demonstration, development of appropriate financial instruments, development of technical specifications, capacity building and contributions to establish favourable policy and regulatory environment. Apart from capital 30% subsidy, there is also interest subvention of 5% on loan from Indian Renewable Energy Development Agency (IREDA). The minimum loan amount should be Rs. 50,00,000/-. The repayment period is 6 years with 1 year moratorium.

Alok Mookharjea Past Chairman of CII, Kolkata said "The history of solar thermal applications goes back a long way, dating back at least as far as Archimedes' use of a concave mirror to heat water in 214 BC". He admired the fact that it offers potential to store heat energy and called upon the industry to capitalise upon.

http://www.mnre.gov.in

Pilot success at NIOT leads to commercialisation

Photo: Solar-biomass hybrid thermal desalination plant at NOIT, courtesy: NOIT

The Solar-Biomass thermal multi effect distillation (MED) sea water desalination system developed as a part of Research & Development under Department of Science and Technology (DST) in February 2013 is successfully operating at National Institute of Ocean Technology (NIOT). The desalinated water produced has total dissolved salts less than 5 ppm and is designed to meet the potable water requirements of the 7,500 people in Narippaiyur village of Ramanathapuram district. The system is designed by KGDS Renewable Energy Private Limited, Coimbatore.

It is made up of single axis Linear Fresnel Reflector (LFR) of 1,404 m^2 collector area with multiple absorber tubes and solar grade low-iron glass. The system delivers 800 kg/hour of 21 bar saturated steam. This steam is stored in a 12 m^3 steam accumulator for meeting the heating needs during non-sunny hours.

India faces a growing challenge in providing water to its industrial and domestic consumers and many desalination plants have been established to meet the demand particularly in coastal areas. The direct radiant solar energy offers potential to supplement the use of fossil fuel.

This First Generation solar MED having showcased the success is attracting several commercial applications. One such case example is National Thermal Power Corporation's Simhadri 4 X 500 MW super thermal power station in Andhra Pradesh. They have conceived a flue gas based cooling tower water desalination system for the critical application of de-mineralized water for boiler replenishment. The work is likely to be completed by the end of year. This pilot indigenous offers solution for to meet current and future water requirements in rural coastal villages as well for industrial process.

Further DST has sanctioned financial support to improve performance and durability of the pilot NIOT solar thermal desalination system and extend the solution by utilising the reject sea water for algae cultivation to produce biogas.

https://www.niot.res.in/

Finally BIS standards for evacuated tube collectors and components

The Bureau of Indian Standards (BIS) has released standards for all glass evacuated solar collector tubes intended for non-concentrating type solar collector and the storage tanks associated with it. The Indian Standard 16543: 2016 is for All Glass Evacuated Solar Collector Tube – Specification and Indian Standard 16544: 2016 All Glass Evacuated Solar Water Heating System.

The vacuum tubes can be of diameters 47 ,58 and 70 millimeters and their lengths can be 1500, 1800, 2000 or 2100 millimeters depending on the capacity of hot water to be delivered. Each tube will have to carry the standards mark apart from manufacturer's trade mark or logo and batch number or date of manufacture.

The selective coating of the tube shall have absorptivity minimum 0.92 and emissivity less than 7% when tested. The material of glass tubes shall be of borosilicate glass conforming to ISO 3585. The solar transmittance ratio of glass tube shall be $\tau^3 > 0.89$ (at air mass 1.5, that is AM 1.5). The material of glass tube shall be of Borosilicate glass 3.3 conforming to ISO 3585. The Solar selective absorbing coating shall be three target coating having three layer - absorption layer (Aluminum nitride), bonding agent cum absorption layer (Aluminum nitride – stainless steel) and anti-reflection layer (copper). The systems will have to undergo following tests:

- Stagnation performance parameter
- Stagnation solar irradiance
- Average thermal loss coefficient
- Vacuum performance
- Resistance to thermal shock
- Resistance to impact
- Resistance to internal pressure
- Absorptivity and emissivity of the selective coating

Each system shall have manufacturer or recognised trademark, Serial No. Month and year of manufacturer, Collector area in m^2, tank capacity in litres per day, number of tubes Outer diameter and length of tubes durably marked on a plate attached to the system at visible place. It will be mandatory to mark Indian Statistical Institute (ISI) on every part of the system.

BIS has also provided with a simple formula on the number of tubes required for a given capacity of hot water in litres for various diameters and lengths.

As per statistics available from Central Board of Excise and Customs India imports close to 40 lakh tubes annually including those used also in the complete system also. Considering the surge in growth of Evacuated Tube Collectors (ETC) systems in the country the need was felt for having standards in order to keep check on the spurious items from being used in the systems in order to ensure customer confidence.

The BIS standards for storage tank are in final stages and should also be released shortly

Commenting on the achievement Sanjay Jinturkar welcomed this development as this will help considerably control the spurious imports.

"It was a long pending demand of the industry to have a BIS for ETC systems. Now is the time for Ministry of New and Renewable Energy to make it mandatory to get all systems BIS tested" said R. S. Sethuraman of Bengaluru based Solar Hi-tech Geysers.

http://www.bis.org.in/

Researchers to increase temperatures to 850 ^{O}C for Molten salt technology

Photo: UniSA Associate Research Professor, Frank Bruno

A collaborative research funding partnership between the University of South Australia, the South Australian and Western Australian governments and Centrex Metals Limited is funding cutting edge molten salt technology that will significantly reduce energy and water usage, and therefore the cost of mineral processing using molten salts.

The University of South Australia (UniSA) has formed a collaborative research funding partnership with Centrex Metals Limited in a bid to use the cutting-edge technology to significantly reduce energy and water usage, and therefore the cost of mineral processing using molten salts.

"Currently, molten salts are being used commercially in the solar and nuclear industries at temperatures up to 600°C and while molten salts are used commercially at higher temperatures for batch style minerals roasting processes this project will develop novel technology for reaction, separation and purification processes in molten salts above 850°C" said Associate Research Professor Frank Bruno. He further added the research could have broader implications for mineral refinement in the mining industry and provide valuable insights for its further development in the solar and nuclear industries.

South Australian company Centrex Metals Limited will use the technology to be the first commercial and cost competitive manufacturer of bulk potassium chloride fertiliser from potassium feldspar ore. Their CEO, Ben Hammond says the technology will take advantage of the unique liquid properties of molten salt to not only convert metals within silicate ore to an extractable form, but also separate and purify them without the need for aqueous processing, saving energy, water and reducing the overall project footprint. "It will allow us to look at competing in the bulk fertiliser space for our globally unique large scale potassium feldspar deposit at Oxley, creating more long-term jobs in Australia's currently struggling mining industry," Hammond says.

The University of South Australia is a world leader in molten salt technology, which has focused on applications for thermal energy storage for the past four years. The UniSA team received a Eureka Award last year for Innovative use of Technology.

http://www.unisa.edu.au/Media-Centre/Releases/2016-Media-releases/Molten-salt-technology-to-benefit-mining-industry-/

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