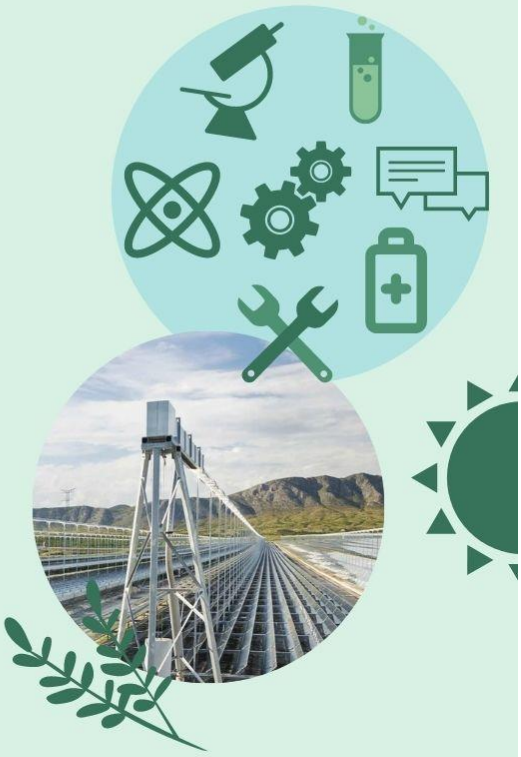
Consultation Workshop on "Research & Innovation priorities for Solar Thermal in India"

Organised by the Delegation of the European Union to India with support from Ministry of New and Renewable Energy (MNRE)

28th October 2021



Proceedings

Webinar: Stakeholder consultation workshop on “Research & Innovation priorities for solar thermal in India”

On 28th October 2021, the European Union (EU) - India Clean Energy and Climate Partnership (CECP) project conducted online stakeholder consultation workshop on “Research & Innovation priorities for Solar Thermal in India”. The workshop was attended by various stakeholders including European Commission, EU Member States, Ministry of New and Renewable Energy (MNRE), Solar project developers, EPC, Financial Institutions, Manufacturers & System integrators, Research bodies, Academia, not for profit, etc.

1.1. Inaugural Session

Mr. Edwin Koekkoek, Counsellor, Energy and Climate Action, Delegation of the EU welcomed the participants to the stakeholder consultation workshop on “Research & Innovation priorities for Solar Thermal in India”. He briefed about the EU-India CECP project which was agreed at the highest level between the Hon’ble Prime Minister of India, Mr. Narendra Modi and President of European Commission and President of European Council in 2016. He mentioned the recent visit of the Executive Vice President, European Commission Mr. Frans Timmermans to India, who met the Minister of New and Renewable Energy, Minister of Environment, Forest & Climate Change, Minister of Petroleum and Natural Gas, Minister of Finance, Minister of External Affairs. In all these meetings the importance of EU-India cooperation in the areas of clean energy transition was discussed. Both India and the EU have ambitious targets for RE. He set out the work undertaken under the EU-India CECP project in the areas of energy efficiency, renewable energy, smart grid, power market design, sustainable finance, etc. Solar energy is one of the key priorities. The EU has worked with India on solar parks, rooftop solar, floating solar and has assessed possible research and innovation priorities on solar thermal. Inputs of stakeholders would be important to improve the study that will be presented at the consultation workshop. Another meeting will be organized later to bring in more European and Indian enterprises and research institutes to launch the study and discuss the possible follow-ups.

Mr. Anil Kumar, Scientist D, MNRE, addressed the audience on behalf of the MNRE. He mentioned that MNRE has recently approved research and development (R&D) scheme whose administrative approval is expected in a month or so. This scheme will support R&D projects for technology development and demonstration in RE, including solar thermal systems. The aim is to make India clean and self-sustainable to fulfil energy needs. He mentioned that the solar thermal is one of the most important thrust area for MNRE. He discussed various initiatives undertaken by the ministry such as sanction of 1 MW solar thermal power plant, super critical carbon dioxide turbo machinery project to Indian Institute of Science (IISc) Bangalore, development of dryers through National Institute of Technology (NIT) Agartala and subsequent distributed in north- eastern region of India. The central tasar training institute has also developed solar thermal based tasar post cocoon technology operations. While discussing the renovation of the scheme on R&D, MNRE undertook brainstorming and found that grid integration of solar thermal projects is required. Further, MNRE is looking at thrust areas like commercial scale PV-CSP hybrid, solar thermal with cooling and industrial application. To catalyze R&D, ministry is also providing 100% funding to government and 50% to private institutions.

1.2. Presentations on Solar thermal

Mr. Pedro Dias, Secretary General, Solar Heat Europe delivered a presentation to share the status of solar thermal in the EU. In his presentation he:

- Highlighted that solar thermal lacks due recognition and is considered more of an energy efficient measure than an energy generation system since it generates heat and not power.
- In Europe with a population of 500 Million, over 10 Million systems are installed currently, constituting about 37GWth energy generation capacity. In Europe, about 1.6GW solar heat capacity was added in the year 2019, which is double of total capacity of Concentrating Solar Power (CSP) in the continent.

- Cooking is a common application of solar thermal in India but not in Europe.
- Focus of solar thermal in Europe is mainly in residential for space heating, commercial services – heating and cooling system, solar district heating and cooling which has grown a lot in last decade or so.
- Solar thermal heating has picked up pace in the Europe in last decade; for example, Denmark has deployed the largest solar thermal plant with a capacity of 120MWth in Europe which is connected to the city network.
- Solar thermal has witnessed steady growth in Europe in terms of capacity in last two decades, without the need for Feed-in-Tariff. Solar thermal sector is also witnessing exports in recent years, to the tune of Euros 1 Billion, with Austria and Greece being the key exporters.
- Half of Europe’s energy needs are mainly for heating and cooling of which 19% is contributed by RE, whereas 29% of electricity needs are fulfilled by RE. However, the actual contribution of RE in heating in cooling in terms of energy is higher at 1,197TWh, compared to electricity which is 1,050TWh. Thus the focus should be on increasing the share of RE in energy mix.
- Energy consumption in EU households is mainly for space heating (64%), space cooling (0.3%), water heating (15%), cooking (6%) making it about 85% for heating and cooling, with just 15% for lighting and appliances. In Industries, 74% demand is for heating applications, and balance for electricity.
- EU faces a challenge in terms of usage of gas for heat demand and subsequent variation in usage, whereas average demand for power has less variation. Power storage is a key thrust area in EU, connected with a discussion on hydrogen to handle variability.
- Solar thermal storage stands at 180GWh per annum and power electricity storage at 5GWh per annum, and there is further opportunity in solar thermal storage.
- European Commission has carried out an analysis of European countries to assess potential for increased ambition in terms of RE targets and CO_2 reduction.
- The cost of replacing existing energy sources with RE such as solar PV, solar thermal, wind, geothermal, etc. is negative, highlighting that the replacement would result in cost savings.
- Levelized cost of energy of direct heating from RE is cheaper from the other electricity solutions, including electricity from RE.
- Solar thermal has higher energy density of 40-83% whereas solar PV has 17-23% and CSP has 7-25%, and in industries where land is limited, solar thermal makes a considerable difference in energy output.
- Key solar collector type technologies available in Europe include Flat plate, Parabolic, Evacuated tubes, High-vacuum flat plate, and Fresnel.
- The large majority of solar thermal systems used in Europe are manufactured within. In addition, more than half of the investment remains locally, in terms of installation and commercialization activities.

A video developed by MNRE on concentrated solar thermal sector for institutional and industrial applications was played during the session to highlight the potential work undertaken by MNRE, including a case study of an operational solar thermal plant.

Vaibhav Singh, Director, PwC India, and Team Member- CECP Project, made a presentation to discuss advanced solar thermal technologies to address the challenges of Indian market:

- India’s energy consumption stood at about 32,514 PJ in the year 2019-20. Of this, more than half was contributed by industries; similar is the trend in electricity consumption as well where industries consumed more than 50% of total electricity consumption.
- The characteristics of electricity consumption for various processes in industries like textile, automotive, food processing, chemical, dairy, etc. match the energy supplied by solar thermal applications.
- Solar heat has been effectively deployed to generate hot water, air, steam, as well as cooling through vapor absorption machines, etc.
- Concentrating Solar Thermal (CST) technologies find application in applications such as cooking, process heating, cooling, etc.

- RE electricity generation capacity targets are clearly defined but for solar concentrators, a specific target was missing. Later, a study undertaken by MNRE brought about a target of 20 Million sq. meter of solar thermal collector area by the year 2022.
- There is a need for collaboration between EU and India since there is a high degree of overlap in terms of research areas, solar thermal applications, etc.
- Benefits which solar thermal can offer include GHG emission reduction, manufacturing opportunities, increased employment opportunities across the value chain, R&D, and commercialization, etc.
- Specific areas covered in the study undertaken as part of the CECP project are:
    - Relevance of R&I in solar thermal which includes efficiency improvement, improvement in customer experience, application range, etc.
    - R&D collaboration between academia and industry.
        - Thermal storage is one of the key areas which can help reduce intermittency and provide higher temperature for heating/cooling applications.
        - Improve design, which is one of the most important area, to reduce losses and improve efficiency,
        - Digitization of performance monitoring,
        - R&D for other constituents of value chain such as for metal glass seal, etc. to meet the need of the application.
    - Other recommendations which include:
        - R&D in financing models, similar to Power Purchase Agreement for electricity.
        - Demand creation measures such as integration with thermal power plants, strategy on heating and cooling and trajectory beyond 2022.
        - Attract investors by forming partnership between EU and India, technology partnerships and knowledge transfer agreements.
        - Standards for design and operations for solar thermal technologies.
        - Need to increase focus on awareness and training through manuals, technology deployment, partnership between academia and industries, skilling, and capacity building areas, etc.
- Way forward to finalize the study by seeking inputs and recommendations from stakeholders. The project would later undertake B2B meetings to explore opportunities for collaboration.

1.3. Questions and Answers, and feedback from participants

There were few suggestions and questions from the participants to the panelists.

- **Feedback from Mr. Pankaj Kumar, National Technical Coordinator, UNIDO (MNRE-GEF-UNIDO project on “Promoting Business Model for increasing penetration and scaling up of solar energy”) –** India has a considerable potential for solar thermal projects. Research and innovation is one of the most important component which can help achieve the target. Further, it is important to look at high efficient technologies which can be deployed for industries like process engineering.
- **Feedback from Mr. Ronanki Gopalakrishn, Zenith Energy Services –** Mr. Gopalakrishn Had installed a solar water heating system in the building about 15 years back and the same is operating satisfactorily, except for a minor damage to the storage tank which was replaced. However, some other systems faced issues related to high water leakages, and hence water wastage was high, so the systems were shut down. He highlighted that there is no mechanism to resolve such issues effectively. He suggested that it is important to spread awareness around usage of solar thermal technology.
- **Mr. Nilesh Dessai, Zuari Agro Chemicals (Fertilizer manufacturer) –** It is important to tie-up with process licenses and the integration of solar thermal systems with boilers for steam requirement can be helpful and expand the reach of solar thermal technologies. There is a need for support such as feeding excess electricity from the solar units during the day to the grid and draw during non-sunny hours, and hence grid reliability is the key to ensure this exchange.

- **Question from Ms. Shruti Kulkarni, Energy Researcher, Indian Institute of Science, Bangalore –** Ms. Kulkarni sought inputs on the reasons behind EU supporting solar thermal as availability of sunlight in most of the Europe is limited. Further, she sought inputs if the focus is towards solar heat for industrial process or also towards domestic sector. What is the plan for industry-academia partnership in India, as in the EU the partnership is very strong with support from the governments in form of funding, etc.
    - **Response from Vaibhav:** There is a need to strengthen collaborate industry and academia, especially to commercialize new technologies and for performance improvement in existing technologies. Further, India has considerably higher sunny days (compared to EU) and thus solar technologies offer substantial potential to be tapped. The focus towards industries is due to the fact that the segment is one of the key consumers of energy and hence offers a considerable potential to be tapped for heat-to-heat conversion through solar thermal technologies.
    - **Response from Pedro Dias:** On the query around EU’s interest, Mr. Dias shared that the cost of solar thermal is competitive with conventional sources and the challenges faced in India are similar to ones faced by EU such as integration with industries is complex in existing systems; however economically and sustainability wise, it offers the best solution. On the query around lower sunny days in Europe, Mr. Dias highlighted that if solar thermal can be competitive in Europe which has lesser solar radiations and lower temperatures than India, then it offers a considerable value for India. He also sighted the example of solar thermal plants setup in Denmark which fulfil the needs for heating. He further shared that thermal storage could help integrate various technologies and adapt variability, and hence solar thermal storage supplied through a heat pump can be useful. The utilization, monitoring of systems, improvement of components, etc. with higher temperature are the challenges in India similar to those faced in Europe in terms of research and innovation for industries. He further highlighted the issue around industrial sectors since all sectors have different requirements, based on the processes adopted. Hence, each sector such as textile, paper, chemical, etc. requires a specific solution and hence a barrier for faster deployment.
- **Remarks from Prof. Anagha Pathak, Solar thermal programme coordinator and In-charge of Test Centre at Savitribai Phule Pune University**: Appreciated conducting the workshop on solar thermal technologies as solar PV is usually a preferred choice over this. She highlighted that the major issue is around operations and maintenance of solar thermal systems and needs to be addressed. Further, there is a need for plug and play CST technology which would be easy to deploy, similar to solar PV panels. The technology is available, however there is a need to focus on maintenance aspects of these projects. Prof. Pathak further added that tracking is the main issue where maintenance is a concern, and hence needs trained professionals to ensure systems are operational.

1.4. Closing remarks

Mr. Joel Fernandes, Regional Director, European Business and Technology Centre (EBTC), summarized the online consultation workshop:

- Thanked all the speakers and the participants for sharing key insights around solar thermal in Europe and India.
- Going forward, technology sessions and B2B meetings would be conducted to facilitate business to business and research to research collaborations.
- Requested participants to visit the CECP website www.cecp-eu.in to access key information, proceedings, and presentations from the session.
- Suggested participants to share inputs and recommendations to the draft report, which can be incorporated to further strengthen the research on solar thermal technologies.