



Influence of Clouds and atmospheric Aerosols on Solar energy in India and Finland (ICASIF)

ICASIF is a joint project between the Finnish Meteorological Institute (FMI, Finland) and The Energy and Resources Institute (TERI, India). The project is funded by the Academy of Finland and the Department of Science and Technology in India.

Solar electricity production is growing worldwide. In India, as a part of the National Action Plan for Climate Change, the government is targeting a total of 20 GW of grid connected solar capacity by year 2022. As a result, the installed capacity of solar energy has increased from a mere 2 MW in 2008—09 to more than 2,200 MW by Jan 2014. Similarly, also Finland's national climate and energy strategy is aiming for a clear increase in solar energy production, with a combined target for wind and solar electricity of 9 TWh in 2025.

Solar energy is a renewable source, which varies with prevailing weather conditions from minute to minute and from day to day. Therefore, the above mentioned development plans call for better information on the present solar resource potential, and also for tools for forecasting both solar radiation conditions and solar energy production. Such tools will help optimize smart energy solutions and ease maintaining the electricity grid. In addition, there is also a need to assess the future behavior of solar radiation reaching the surface with respect to changing climate conditions.

The overall aim of the ICASIF project is to answer to these needs through:

- i. understanding atmospheric aerosols (pollution/haze) and their effect on the solar radiation spectrum reaching earth's surface;
- ii. improving satellite algorithms for estimating the solar shortwave radiation in India;
- iii. measuring and understanding variations in the solar spectrum and how these variations influence solar electricity production;
- iv. providing forecasted solar radiation for a few hours ahead based on satellite-observed clouds;
- v. forecasting the solar radiation for 1—2 days ahead based on forecasted aerosol fields;
- vi. modeling solar electricity production based on knowledge of the incoming solar radiation;

In practice, this means that we will measure the spectral solar radiation both in India and Finland together with prevailing aerosol conditions, model the transfer of solar radiation through the atmosphere to understand how the solar spectrum varies depending on the prevailing conditions, utilize satellite observations of clouds and aerosols to create solar forecasts, monitor the output of solar panels to understand the connection between incoming solar radiation and electricity

output, and, finally, use climate model projections of the future climate to evaluate how the solar energy potential may change over the coming decades.

The work will be done as collaborative research between FMI and TERI. This project adds a new theme, solar energy, to a long line of joint projects between the two institutes.

The project team is as follows:

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PICTURE: TERI staff in the process of erecting a weather station at the Mukteshwar station in the Himalayan foothills. The picture was taken in January 2015, when FMI researchers visited TERI and the Mukteshwar measurement station for the kick-off of the ICASIF project.

