

## CSIR-NPL establishes facility for efficiency validation of solar cells

In India, the research on solar cells is being pursued in various scientific laboratories and industries; however, there is no facility for the validation of solar cell efficiency. Globally there are three recognized centers available for validation of solar cell efficiency, namely National Renewable Energy Laboratory (USA), Fraunhofer Physikalisch-Technische Bundesanstalt (Germany) and Institute of Advanced Industrial Science and Technology (Japan). In order to validate the efficiency of the fabricated solar cells, these have to be sent to one of the above-mentioned centers and this process is not only expensive but also time consuming. For the validation of efficiency of such devices, it requires calibration of various individual parameters involved in measurement of efficiency, such as, light source, current/voltage source-meter, temperature sensors and active area of device. Constructing a system meeting all the required criteria for any standard

solar simulator is difficult and expensive, moreover, such systems require periodic calibration to maintain the standard. Even the commercially available highest class solar simulators (these are classed from most to least accurate as A, B or C) require careful setting up, so that measurement be performed at an accurate estimation of a solar cell's efficiency. Being 'National Metrology Institute' (NMI) of India, CSIR-National Physical Laboratory (NPL) has standards and traceability to all units used in solar cell efficiency measurement. Thus, CSIR-NPL has taken up an initiative for setting up a 'National Facility' for validation of solar cell efficiency with the maximum possible accuracy. The facility will be a potential service to nation, including the academic institutions and research laboratories and industries across the country. CSIR-NPL is in the process of establishing efficiency validation facility for all kinds of solar cells. The individual para-

meters involved in the efficiency measurement of a solar cell have been traced. To begin with, CSIR-NPL dedicated the efficiency measurement facility of organic and other excitonic solar cells to nation on World Metrology Day, i.e. 20 May 2016. The major source of error in estimating the efficiency of these solar cells mostly comes from a large uncertainty in the measurement of active area. The area of solar cell is measured using displacement laser interferometer with associated measurement uncertainty of 0.1 micron. Thus, it is important to have protocols of a laboratory to adopt good measurement practice and verify their measured efficiency of a solar cell by an external party.

**Sushil Kumar\*** and **D. K. Aswal**, CSIR-National Physical Laboratory, Dr K.S. Krishnan Marg, New Delhi 110 012, India.  
\*e-mail: skumar@nplindia.org

## MEETING REPORT

### Technology Vision 2035

Technology Information, Forecasting and Assessment Council (TIFAC), the Government of India's autonomous technology think-tank under the Department of Science and Technology (DST) directs technology trends and makes an effort to delineate possible technology trajectories that India needs to take. TIFAC has made significant contributions to the Indian S&T system by bringing out technology vision documents, technology assessment and foresight reports besides supporting technology innovation, technology infusion in the micro, small and medium enterprises sector and patent facilitation.

Recently, TIFAC has been engaged in a vast consultative exercise of formulating the Technology Vision 2035 (TV 2035) document, an outcome of an extensive visionary exercise involving about 5000 people across 12 key sectors of national importance. The Prime Minister of India released the document on 3 January 2016 at the 103rd Indian Science Congress held in Mysuru.

The document captures the needs and aspirations of Indians in the year 2035 and enunciates them in the form of 12 prerogatives – six individual and six collective – in addition to a set of 10 grand challenges. Several technologies at different stages of evolution have been identified as enabler in this context in order to achieve these prerogatives. The document generates 12 sectoral roadmaps, a brief of which is captured as 'Technoscape'.

To create public understanding of TV 2035, a conference was organized to facilitate interaction between the TIFAC

think-tank team and selected stakeholder groups for diffusion and dissemination of the essence of the document. In this one-day event, four sectoral areas – education, information and communication technologies (ICT), energy, and medical sciences and health care were discussed.

Suhas B. Naik-Satam (National Centre for Science Communicators, Mumbai) coordinated the event. Shivaprasad Khened (Nehru Science Centre, Mumbai) and A. P. Deshpande (NCSC) welcomed the guests. A. P. Jayaraman (NCSC) delivered the opening remarks. He gave an insider view about how the idea to hold the conference was conceived.

India needs to give highest priority to technological growth in the coming years to increase its gross domestic product (GDP), according to nuclear scientist Anil Kakodkar (TIFAC and mentor TV 2035). Kakodkar pointed out that in AD 1700, India had the highest GDP in the world and expressed confidence that

\*A report on the National Conference 'Technology Vision 2035', jointly organized by the National Centre for Science Communicators, and Technology Information, Forecasting and Assessment Council and the National Council of Science Museums on 18 April 2016 at the Nehru Science Centre, Mumbai.