

O. V. Nandimath (National Law School University of India, Bengaluru) gave a talk on the legal considerations in medical ethics. He cited studies that indicated low morale of doctors, loss of professional ideals, especially in the case of youngsters who step into the profession and greater sense of insecurity about professional growth. He mentioned that the reason for this is the loss of autonomy that the profession is facing because of interference by players such as Governments, insurance companies, entrepreneurs and lawyers. He also felt that doctors defined and understood ethics in a simple manner which did not convey the spirit of ethics and cover the grey areas. He also felt the need for doctors to innovate and sharpen their communication skills when it came to ethics in order to create an impact on youngsters in the medical profession. He also stressed on the need to talk about the core ethical values, rather than ethical dilemmas.

He mentioned that there was confusion among the medical fraternity on the difference between morality and ethics. Morality is an universally accepted, inalienable, ultimate truth or a value, while ethics is something that needs transformation each time it is applied to a particular situation. This makes it difficult

to bring ethics into a codified format. In 2002, MCI brought about the Indian Medical Council Professional Conduct Etiquette and Ethics Regulation. According to Nandimath, the very attempt by a professional body to bring ethics into a codified format is an indicator of the confusion that existed with respect to morality and ethics. He finally urged the medical fraternity to exercise their autonomy in the area of ethics in the absence of a defined law.

Next, a panel discussion on medical ethics in disorders in women and children was conducted. Case studies on surrogacy, medical termination of unwanted pregnancy in the case of minors, termination of pregnancy when the mother is a carrier of a disease and donation of organs in the case of brain-dead persons were presented before the panel for discussion on the ethics involved. The panel also briefed the audience on informed consent, assent and permission in paediatrics.

A third panel discussion involved ethical practices in surgery. The panelists talked about surgical consent, counselling and ethics involved; ethics involved in ensuring that right surgeries were done on the right patients; ethics behind organ transplantation, and imparting education and ethics to the next generations.

While concluding the discussion 'Who is to blame and what is to be done?', the last panel came up with the following suggestions.

(1) All stakeholders are to blame if the medical fraternity does not self-regulate. They concluded that accreditation, which is a voluntary mechanism, should be the way forward.

(2) Bringing ethics into the curriculum of medical students in India is something that started a decade ago. The panel considered that it does not serve the purpose unless it becomes a part of the assessment criteria and felt that similar to the West, ethical training should be made a part of certification. In India, the ground reality is that students still look at role models for ethical guidance and in the present context, positive role models are hard to find.

(3) Responding to cases when the law seeks ethical advice from the medical fraternity, the panel members concluded that it is only when the medical fraternity shows some amount of maturity and consensus, can it take a call on disputable cases.

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## MEETING REPORT

### Wind energy systems in India\*

An international workshop on the performance and potential of wind energy systems in India was held in Bengaluru recently. It included participants from industry, research organizations, academic institutes and decision-makers from India and the USA. The two-day workshop began with a welcome address by S. K. Sathesh (Chairman, Divecha Centre for Climate Change, IISc, Bengaluru) who highlighted the need for examining the performance of existing

power plants and address the challenges to meet the ambitious target of 60 GW of installed wind power capacity by 2022.

In his introductory talk, V. Rao Kotamarthi (Argonne National Laboratory (ANL), USA) described various areas of expertise related to energy at ANL. In the area of wind energy, his group is studying wind energy forecasting under complex terrain, optimal location of turbines, the role of wind shear and micro grids. He concluded with a list of issues that the workshop should address.

On the first day of the workshop, issues related to offshore wind potential and performance of existing wind power plants were discussed. The first session started with a presentation on progress in

the wind energy sector by the Ministry of New and Renewable Energy (MNRE, Government of India). This was followed by a presentation on the offshore wind development in India by M. V. Ramana Murthy (National Institute of Ocean Technology (NIOT), Chennai). The assessment of offshore wind potential in Kanyakumari, Tamil Nadu, and Gulf of Khambhat, Gujarat was discussed. The main policy challenges in offshore wind sector are clearance, data availability, supply chain, port infrastructure, grid connectivity and economics. Harsh Pandit (Suzlon Energy Limited, Ahmedabad, India) added the developer's perspective to this discussion. The estimated potential of offshore wind was around 36 MW

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\*A report on International Workshop on the 'Performance and Potential of Wind Energy Systems in India' held at Divecha Centre for Climate Change, Indian Institute of Science, Bengaluru on 22–23 August 2017.

per kilometre of coastline in the coastal waters of India. With approximately 3000 km of coastline, the total potential is around 11 GW.

Jane Jose (Southern Regional Load Dispatch Centre, Karnataka) discussed the need for forecasting, scheduling and imbalance handling in the renewable energy sector. She added that with increase in the share of wind energy in the energy mix of India as planned by MNRE, grid integration will become increasingly important. The remote location of wind power plants, intermittency in wind power generation, and low voltage cascade tripping of wind mills were identified as the main challenges related to wind power plants from a grid operator's perspective. S. B. Chandrashekharaiah (State Load Dispatch Centre, Karnataka) explained that in Karnataka hydro electricity contributes to the grid flexibility and helps in handling the variability of wind power generation. Zakir Rather (Indian Institute of Technology Bombay) discussed the challenges as well as opportunities in the wind sector. At higher penetration level, wind poses a wide spectrum of challenges from short-term frequency, voltage, transient and small signal stability to long-term scheduling issues and curtailment. On the other hand, wind integration provides a range of opportunities, including job creation and the creation of new ancillary service products. Malolan Cadambi (Greenshore Energy Pvt Ltd, Bengaluru) spoke about remote sensing of Indian offshore wind resources and the possibility of cost reduction by combining offshore wind plants with water desalination plants. The panel discussion on the performance and potential of wind energy mainly highlighted the requirement for strengthening the grid, storage and reliable wind generation forecasting. The advantage of locating wind power plants to balance the load on the grid was highlighted.

The afternoon session discussed the challenges in wind speed and wind energy forecasting in India. Raghavendra Ashrit (National Centre for Medium Range Weather Forecasting, Noida) discussed the role of data post processing and bias correction in wind speed forecasting using various weather forecast models. Amresh Khosla (Manikaran Analytics Limited, New Delhi, India) explained the post-processing method used for wind speed forecasting to arrive at the wind energy forecast. The panel

discussion on wind forecasting discussed the need for combined use of weather model and machine learning to forecast wind generation. The need for quality-controlled data assimilation and bias correction in the weather model was also underlined. The participants pointed out that it is difficult to predict winds when the wind speed is low and the terrain is complex. The use of machine learning and data assimilation from different sources can help in increasing the accuracy of the forecast.

The discussions on forecasting of wind energy continued on the second day. The session started with a talk by Neeraj Kuldeep (Council on Energy, Environment and Water, New Delhi). He looked at wind energy sector from a market perspective and advocated the possibility of having wind plants in the states having low wind potential. Sue Haupt (National Center for Atmospheric Research, USA) presented her work on short-range wind power forecasting, where she emphasized the need for higher accuracy level in wind energy prediction instead of wind speed prediction. She mentioned that a model called Dynamic Integrated Forecast System (DIFS) was used by them for forecasting wind energy, which assimilates hub-level data from wind turbines along with wind speed forecast from various models to provide a better wind energy forecast. She also explained the need for bias correction in the forecast and building high-resolution regional model. She suggested blending physical modelling with machine learning for achieving better accuracy in wind energy forecast. Rao Kotamarthi highlighted the need for advanced sophisticated machines for wind forecasting. ANL is performing large eddy simulations (LES) on resolutions of 10–20 m with nested models and with high-resolution multiscale simulations of wind fields involving continuous mesh refinement. The work merges extensive observations and data products for locations with complex terrain. SODAR (sonic detection and ranging) and radar wind profiles are merged to obtain vertical wind profiles, and uncertainty estimates are obtained using hybrid combinations of data assimilation and simulation. Major research areas that were identified included optimization of wind production systems, management of micro grids, development of methods for load restoration following disruptions and creation of reconfigur-

able advanced distribution systems. Jim Wilczak (National Oceanic and Atmospheric Administration (NOAA), USA) discussed the Wind Forecast Improvement Projects (WFIP) through assimilation of data and model parameterizations. As a part of WFIP, NOAA has an hourly updating model making wind power forecasts up to 15 h in advance, based on WRF and using data assimilation. Better modelling and assimilation have reduced the mean squared error of this model. Generally it is difficult to make further improvements to a given forecast model, and here improvements have been made through improved model physics as well as assimilation of observations. NOAA has also created a tool to forecast wind ramp events, where data assimilation helps make better forecasts. Considering the effects of grid averaging, forecasting error decreases on longer spatial scales where more averaging occurs. The second phase of WFIP uses multi-scale observations, addresses the effects of complex topography, models cold pools in the boundary layer and makes changes to the model physics (e.g. newer parameterization and inclusion of a nested grid). NOAA has started to test the model offshore, especially in regions of strong wind-speed gradients. P. Mukhopadhyay (Indian Institute of Tropical Meteorology, Pune) discussed recent initiatives by his institute in forecasting high-resolution wind and solar energy generation. He highlighted the need for extensive site-level validation of critical model parameters to achieve better accuracy in forecasting. Vinayak Mamodkar (ILAB-E Renewables Pvt Ltd, India) talked about holistic approach and collaborative framework to deliver reliable energy to the customer. J. Bastin (National Institute of Wind Energy, Chennai) discussed onshore and offshore wind potential of India. He spoke about the evolution of Indian wind potential assessment programme. He mentioned that 812 weather stations have been established all over India under the National Wind Monitoring Scheme and the recorded data can be used by the wind industry. Indradip Mitra (Indo-German Energy Program, India) spoke about large-scale integration of renewable energy in India and green energy corridors. He discussed the concept of virtual power plants to manage grid stability with higher renewable penetration and initiatives related to the same in India. He also spoke about

German experience with grid management, where renewable energy penetration is very high. Krishna Kumar Swaminathan (GE Global Research, Bengaluru) discussed wind energy forecasting from machine learning perspective. He mentioned that creating a digital twin for the wind plant can result in a better level of accuracy in forecasting. Anasuya Gangopadhyay (Divecha Centre

for Climate Change, IISc) spoke about the impact of spatial variation in wind generation in Karnataka. She presented data on wind generation in Karnataka and highlighted the potential for geographical smoothing.

In the concluding session, the need to bridge the gap between academia and industry was emphasized. The importance of greater interaction between different

research institutions to improve the forecasting of wind energy was mentioned. A long-term plan to assess the offshore wind potential in India was highlighted.

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## MEETING REPORT

### Indian Science and Technology Enterprise Partnership\*

Science and Technology (S&T) have emerged as major drivers of innovations and enterprise at present. Thus a systematic and focused effort to utilize S&T in enterprise holds the promise of revolutionizing the economic and industrial landscape of country. However, this potential of S&T-driven enterprise has not yet been realized in India, primarily because a complete ecosystem for such a Science and Technology Enterprise Partnership (STEP) has not yet been identified, let alone established. With the increasing role of S&T in all aspects of society and economical activities, there is an urgent need to develop a comprehensive framework and policy for S&T-driven enterprises. It is clear that such an effort must identify all components, and integrate them in an effective framework for a successful STEP, beginning with a clear statement of vision and goal.

A workshop on Indian Science and Technology and Enterprise Partnership (ISTEP) was organized for characterization of S&T-driven enterprise and to develop a roadmap for realizing the partnership. The primary goal of the workshop was to examine the necessary components for a successful ISTEP and to generate recommendations and a roadmap for its implementation.

Realization of ISTEP would require sustained, significant and synergetic efforts systematically involving thought leaders, established researchers as well as young researchers. Accordingly, the

invitees and the participants in the workshop (through open call) included thought leaders, policy makers, S&T experts, economists, social scientists, industry leaders and young researchers.

The absence and the need for a precise narration of ISTEP as a clearly defined entity with clear and precise agenda was highlighted in the opening remarks. The focus was put on an ecosystem around a product for its development into a marketable asset. It was pointed out that there was a need to complement conventional discipline-driven R&D with product-oriented R&D; such an approach can provide another route for extraordinary science, while seeking enterprise solutions.

Among other issues, the workshop also discussed designing policy interventions, capacity-building challenges by looking at individual and institutional success stories to make India ready for successful STEP. The meeting noted that at the international level also, the importance of S&T-driven enterprise is being realized. A notable development is the BRICS S&T Innovation and Entrepreneurship Partnership (BRICS-STIEP). According to Baldev Raj (NIAS, Bengaluru), NIAS and CSIR-NISTADS have played both pioneering and leadership roles to ensure India's leadership in BRICS-STIEP. However, India being the lead country in BRICS-STIEP, there is an urgent need for developing S&T-driven enterprise leadership. ISTEP is the beginning in this context. An effective BRICS-STIEP could enable pooling of their resources to create a platform for improved quality of life, better techno-

logical leadership, improved innovation index, higher human development index, social security, health care, etc. ISTEP could provide the national initiative.

A discussion session followed a presentation by P. Goswami (Technology and Development Studies, New Delhi) on vision, goal and structure of ISTEP. The session witnessed lively exchange of ideas on STIEP. It was pointed out that connecting science to product has been often crippled due to gaps such as lack of entrepreneurship and that an integrated systems approach of enterprise including education, science, technology, politics and society was required. P. S. Goel (NIAS, Bengaluru) highlighted the need for a mechanism to enhance risk-taking capabilities in decision making on new ideas and their implementation along with an enabling financial policy.

S. Bhattacharya (CSIR-NISTADS) emphasized the importance of model and parameters to ensure success of entrepreneurial framework. Three basic steps for recognition of enterprise were recognized: the nature of consumer demand, creation of product and innovation. It was observed that innovation in India was more driven by technology creation instead of market demand; the need for making market-sensitive products was emphasized by Narendra Pani (NIAS, Bengaluru). The need for strengthening connection between educational institutions and entrepreneurs for a successful ISTEP was also emphasized by M. H. Balasubramanya (IISc, Bengaluru).

Creation of a successful S&T enterprise requires exchange of wisdom of scientists and entrepreneurs in a sharing

\*A report on first workshop on Indian Science and Technology Entrepreneurship Partnership (ISTEP).