



**Report on Meeting of MI-India Workshop on Clean Energy Material
Innovation Challenge on 17th August, 2017 at TERI University, New Delhi**

The event started with the welcome remarks by Dr. Rajiv Sharma, Head TMD, DST and Dr. Rajiv Seth, Pro Vice-Chancellor, TERI University. The event was inaugurated by Prof. Ashutosh Sharma, Secretary, DST. Inaugural address was followed by keynote address by Dr. Debashish Bhattacharjee, Vice President, Tata Steel.

The event was attended by scientists, industry, utilities and other stakeholders together to discuss & deliberate on the work done in area of Clean Energy Materials and exploring collaboration opportunities under Mission Innovation. The list of participants is attached in **Annexure- I**.

This was followed by thematic presentation and discussions on Clean Energy Materials: Indian Experience and perspective. The presentations were made by five experts in five major areas under Clean Energy Initiative to discuss the R&D gaps and current developments in the specified field. The details of experts and the topics of discussion is enclosed in **Annexure II**.

The group discussed the presentations of the experts and identified R&D activities and National Research Priorities.

The following points were made:

1. Energy security is a critical requirement for India to become a global super-power. There has been a consistent focus in the area of “Green Energy revolution” in India wherein the vision is to increase the country’s renewable energy capacity to 175 GW by 2022. With continued thrust in this area, India is expected to meet all its energy requirements through completely renewable energy sources by 2050.
2. India, as one of the participating country in Mission Innovation Clean Energy Materials Challenge is committed to accelerate the innovation process for high-performance, low-cost clean energy materials and automate the processes needed to integrate these materials into new technologies.
3. India’s INDC is to use 40% non-fossil-based power by 2030 and the emission intensity is to go down by 33-35% from 2005 by 2030. Indian government has taken various initiatives to increase the use of renewable energy resources.
4. Indian initiative has been to meet these challenging goals through consistent focus on three main domains:
 - Development of materials for energy generation
 - Development of materials for energy storage
 - Computational approach for materials screening and shortening the time-scale of invention-innovation-commercialization cycle.
5. Innovation Challenge on Clean Energy has specific plans to double clean energy R&D investment by intensifying research efforts on setting up of technology platforms led by industry for Clean Energy Technologies and Scaling-up of funds to academic and R&D



institutions as well as R&D units in industry for research on identified topics relevant to clean energy.

The R&D areas and priorities identified and expected outcome is enclosed in **Annexure III** and **Annexure IV** respectively.

In the subsequent session Prof. Subhasis Ghosh, JNU and Prof. Ajit Kolar, IIT Madras summarised the outcomes of deliberations in the area of Clean Energy. The event concluded by concluding remarks by Dr. Sanjay Bajpai, AH TMD and Future Steps & Vote of thanks by Dr. Ranjith Krishna Pai, Sc'D'.

Annexure I: List of Participants

1. Dr. Anil Verma, IIT Delhi
2. Dr. C. Subramaniam, IIT Bombay
3. Dr. M.M. Shaijumon, IISER Thiruvananthapuram
4. Dr. Tarun Kumar Kundu, IIT Bombay
5. Dr. Sandip Kumar Saha, IIT Kharagpur
6. Dr. Subhasis Ghosh, JNU, New Delhi
7. Dr. Ajit Kolar, IIT Madras
8. Dr. Basab Chakraborty, IIT Kharagpur.
9. Dr. Indrajit Mukhopadhyay Petroleum University, Gujarat
10. Dr. Sujin Jose, Madurai Kamaraj University
11. Dr. C. Naveen Kumar, CSIR-CECRI Karaikudi
12. Dr. Ch. Subrahmanyam, IIT Hyderabad
13. Dr. Viswanath Balakrishnan, IIT Mandi
14. Dr. H. B. Muralidhara, CIIRC, Bangalore
15. Dr. Dipankar Mandal, Jadavpur University, West Bengal
16. Dr B R Sankapal, VNIT, Nagpur
17. Dr. Yogesh K. Sharma, IIT Roorkee



18. Dr. A. Sreekumar, Pondicherry Central University
19. Mrs. Nidhi Agrawal, Pluss Advanced Technologies Pvt. Ltd.
20. Dr. A. Vadivel Murugan Pondicherry Central University
21. Shri Arun K Raj, NIT Calicut, Kerala
22. Shri Shirish Garud, TERI. New Delhi
23. Er. Paltu Acharjee, TERI. New Delhi
24. Dr. Hema Chandra Reddy, JNTUA, AP
25. Dr. E. Anil Kumar, IIT Indore
26. Dr. Rajendra Kumar Singh BHU, Varanasi
27. Dr. Ramendra Sundar Dey INST, Mohali, Punjab
28. Dr. C.R. Mariappan, NIT Kurukshetra, Haryana
29. Dr. Mahesh S Padaki, Jain University, Bangalore
30. Dr. Sangita M. Kasture, DBT
31. Dr. Deepak Tuli, DBT -IOC Centre for Advanced Bio-Energy Research
32. Dr. S. Raghu, Vels University
33. Dr. R. A. Kalaivani, Vels University
34. Dr. Rajiv Sharma, Head TMD, DST
35. Dr. Sanjay Bajpai, Associate Head TMD, DST
36. Dr. Ranjith Krishna Pai, DST



Annexure II: List of Experts and topics for Thematic Presentation and Discussion

1. Computation Modelling of Energy Material by Dr. Tarun Kumar Kundu, IIT Kharagpur
2. Title: Batteries by Dr. M.M. Shaijumon, IISER Thiruvananthapuram
3. Supercapacitors by Dr. C. Subramaniam, IIT Bombay
4. Fuel Cells and Devices by Dr. Anil Verma, IIT Delhi
5. Thermal Energy Storage by Dr. Sandip Kumar Saha, IIT Bombay



Annexure III: R&D areas and National Research Priorities

R&D Goals:

1. To ensure the recognition of the critical enabling role that Advanced Clean Energy Materials play in making low-carbon energy & energy efficiency technologies competitive with conventional energy technologies.
2. Make an impact on and help guide public policy makers' long-term priorities in advanced clean energy materials for low-carbon energy & energy efficiency.
3. Be a key catalyst in building low carbon energy & energy efficiency value chains in India (involving various Funding Schemes).
4. Facilitate and develop competitive manufacturing of Clean Energy Materials in India.
5. Support demonstration and deployment of low carbon energy technologies (energy harvesting & storage, efficiency).

National Research Priorities:

1. Materials for affordable energy storage in the form of hydrogen, methane etc
2. Materials for harvesting solar energy with higher efficiency.
3. Materials for integrated storage technologies in the electrical grid.
4. Environmental friendly materials for durable solar coatings, high performance and safety.
5. Materials for weight reduction and improved corrosion resistance of structural and functional components in energy technologies.



Annexure IV: Expected Outcome

1. A country status report is being prepared giving details on research, development, demonstration and deployment of Clean Energy Materials in India.
2. Announce and Launch of MI- centric and national funding opportunity for development of MI network of leading industry & research organisations by 2017-18.
3. Initiation of the MI-India projects by 2018-19.
4. Documentation of case studies and lessons learnt from these projects, consolidation of outcomes, best practices document and sustained research for addressing by 2019-10 and Innovation Challenge goals will be prepared.
5. Development of a platform for computational materials for energy applications.