

## GUEST EDITORIAL

### Science Based Technologies for Sustainable and Adequate Energy for India

Energy is an indispensable prerequisite to do work. The word “energy” comes from the Greek word *energeia*, meaning operation or activity. It plays a fundamental role in human existence and life processes, since energy is the key to advancement of civilization through improvements in quality of life. India today faces a challenge to realize increasing energy demand for our growth with equity, quality of life and sustainability. Realising this challenge, the Indian National Science Academy entrusted us to bring out a thematic issue of the *Proceedings of Indian National Science Academy* on “**Science Based Technologies for Sustainable and Adequate Energy for India**”, focusing on the international and national status of energy harvesting and utilization, current status of research and technology, future trend of development of pilot plants and policy, and training of human resources needed. A primary purpose of the collection of the articles in this issue is to provide valuable information on the subject to the policy makers, researchers, students, journalists and all those who are interested in and concerned with energy.

The scope of the contributions was chosen based on the diversified aspects of energy generation, application, storage and distribution, transmission and materials. Most experienced professionals of our country with significant expertise have prepared the Chapters on the following topics: Clean Heat and Power from Solid Fuels – Modern Approaches; Low Grade (Waste) Energy Conversion: Science and Technological Challenges; Emerging Biomass Conversion Technologies for Obtaining Value Added Chemicals and Fuel from Biomass; Biofuels and Hybrid Fuel Sector; Materials Research and Opportunities in Solar (Photovoltaic) Cells; Materials Research and Development Opportunities in Fusion

Reactors; Electrochemical Energy Storage Devices; Hydro Energy Sector in India – The Past, Present and the Future Challenges; Geothermal Energy; High Temperature Fuel Cell; Proton Exchange Membrane Fuel Cell Technology; Solar Thermal Power Sector; Advances in Thermoelectric Materials and Devices for Energy Harnessing and Utilization; Materials Research and Opportunities in Thermal (Coal-based) Power Sector including Advanced Ultra Super Critical Power Plants; Solar Photovoltaic Energy Harnessing; Electrical Power Transmission and Energy Management System; Biofuels – Engineering and Biological Challenges; Science based Technologies for Sustainable and Adequate Energy for India Wind and Tidal Energy Sector; Hydrogen Energy in India: Storage to Application; Ocean Energy; Materials Science Research and Challenges in Nuclear Power Sector (fission) including Fast Breeder Technology; Methane Recovery from and CO<sub>2</sub> Disposal In Hydrate Reservoirs; Simulation, Modeling and Design of Hydrogen Storage Materials; Overview of Beneficiation, Utilization and Environmental Issues in Relation to Coal Processing.

These topics are covered in a lucid and readable manner with precise and requisite details. We believe that this thematic issue will be a treasure to all those who are interested in understanding and pursuing the energy aspects as profession, career and subject of study. We thank INSA for proposing to us to edit such a valuable publication. We are indebted to all the authors and reviewers for their contributions and advice.

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## ABOUT THE GUEST EDITORS

**Dr Baldev Raj** is Director of National Institute of Advanced Studies, Bangalore, was distinguished scientist and former Director of the Indira Gandhi Centre for Atomic Research, Kalpakkam. He is well known for materials technology, energy, cultural heritage, medical technologies, nano science and technology and education, with more than 1000 papers in journals and 75 books. Dr Raj has received many prestigious awards and honours including the Padma Shri from Government of India, the Life Time Achievement Award of Indian Nuclear Society, National Metallurgist Award by Ministry of Steel, Homi Bhabha Gold Medal, Distinguished Materials Science Award, Distinguished Alumnus Award of Indian Institute of Science. He is a Fellow of all the Science and Engineering Academies of India, German Academy of Sciences and the World Academy of Sciences.

**Dr. U Kamachi Mudali** is an Outstanding Scientist and Associate Director of Corrosion Science and Technology at IGCAR, Kalpakkam. He is currently the Head, Reprocessing R&D Division, and Convener, IGCAR

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**Professor Indraneel Manna** is a renowned materials engineer with research interests in structure-property correlation in nano-metals/ceramics, laser/plasma-assisted surface engineering, nano-fluid and bainitic steel. Currently, he is Director of IIT-Kanpur. He was Director of CSIR-CGCRI, Kolkata (2010- 2012) and a faculty at IIT-Kharagpur for 25 years (1985-2010), besides working as a guest scientist in different institutions abroad. Professor Manna has over 250 publications and is a recipient of TWAS prize (2014). He is the current Vice President of the Indian Institute of Metals and the Indian National Academy of Engineering.