

# Preface

Energy demand has been rising remarkably due to increasing population and urbanization. Global economy and society are significantly dependent on the energy availability because it touches every facet of human life and its activities. Transportation and power generation are major examples of energy. Without the transportation by millions of personalized and mass transport vehicles and availability of  $24 \times 7$  power, human civilization would not have reached contemporary living standards. The first international conference on ‘Sustainable Energy and Environmental Challenges’ (SEEC-2017) was organized under the auspices of ‘International Society for Energy and Environmental Sustainability’ (ISEES) by the ‘Center of Innovative and Applied Bioprocessing’ (CIAB), Mohali, from February 26 to 28, 2017. ISEES was founded at IIT Kanpur in January 2014 with the aim of spreading knowledge in the fields of energy, environment, sustainability and combustion. The society’s goal is to contribute to the development of clean, affordable and secure energy resources and a sustainable environment for the society and to spread knowledge in the above-mentioned areas and awareness about the environmental challenges, which the world is facing today. ISEES is involved in various activities such as conducting workshops, seminars and conferences in the domains of its interest. The society also recognizes the outstanding works done by the young scientists and engineers for their contributions in these fields by conferring them awards under various categories.

This conference provided a platform for discussions between eminent scientists and engineers from various countries including India, USA, South Korea, Norway, Malaysia and Australia. In this conference, eminent speakers from all over the world presented their views related to different aspects of energy, combustion, emissions and alternative energy resource for sustainable development and cleaner environment. The conference started with four mini-symposiums on very topical themes, which included (i) New Fuels and Advanced Engine Combustion, (ii) Sustainable Energy, (iii) Experimental and Numerical Combustion and (iv) Environmental Remediation and Rail Road Transport. The conference had 14 technical sessions on topics related to energy and environmental sustainability and a panel discussion on ‘Challenges, Opportunities and Directions of Technical

Education & Research in the Area of Energy, Environment and Sustainability' to wrap up the three-day technical extravaganza. The conference included 2 plenary talks, 12 keynote talks, 42 invited talks from prominent scientists, 49 contributed talks and 120 posters. A total of 234 participants and speakers attended this three-day conference, which hosted Dr. V. K. Saraswat, Member, NITI Aayog, India, as a chief guest for the award ceremony of ISEES. This conference laid out the road map for technology development, opportunities and challenges in this technology domain. The technical sessions in the conference included Advances in IC Engines and Fuels; Conversion of Biomass to Biofuels; Combustion Processes; Renewable Energy: Prospects and Technologies; Waste to Wealth—Chemicals and Fuels; Energy Conversion Systems; Numerical Simulation of Combustion Processes; Alternate Fuels for IC Engines; Sprays and Heterogeneous Combustion of Coal/ Biomass; Biomass Conversion to Fuels & Chemicals—Thermochemical Processes; Utilization of Biofuels; and Environmental Protection and Health. All these topics are very relevant for the country and the world in the present context. The society is grateful to Prof. Ashok Pandey for organizing and hosting this conference, which led to germination of this series of monographs, which included 16 books related to different aspects of energy, environment and sustainability. This is the first time that such a voluminous and high-quality outcome has been achieved by any society in India from one conference.

The editors would like to express their sincere gratitude to the authors for submitting their work in a timely manner and revising it appropriately at short notice. We would like to express our special thanks to Prof. Akhilendra Bhushan Gupta, Prof. Ankur Gupta, Mr. Pankaj Singh Chauhan, Dr. Rishikant and Prof. Shantanu Bhattacharya who reviewed various chapters of this monograph and provided their valuable suggestions to improve the manuscripts. We gratefully acknowledge the support received from various funding agencies and organizations for successfully conducting of the first ISEES conference SEEC-2017, where these monographs germinated. These include Department of Science and Technology, Government of India (special thanks to Dr. Sanjay Bajpai); TSI, India (special thanks to Dr. Deepak Sharma); Tesscorn, India (special thanks to Sh. Satyanarayana); AVL, India; Horiba, India; Springer (special thanks to Swati Mehreshi); CIAB (special thanks to Dr. Sangwan).

At this stage of technology development, environmental pollution has become the greatest threat to the mother nature with rising level of pollutants in air, water and soil specifically due to industrial growth and increasing population. A significant amount of contaminants are being discharged into the environment and major percentage of this is discharged into water every day, causing a grave danger to all the water inhabitants and dependent living entities. The industrial effluents are discharged into the water streams of different rivers, ponds and canals instead of strict legal enforcement and directives, and this forms a major polluting source for the existing water resources. The water is being used for different industrial purposes like cooling, processing, transportation and heat treatment. The water gets mixed with various harmful chemicals, organic and inorganic compounds, acids, etc., during these processes and forms a highly contaminated effluent which is

directly discharged into water streams by industrial houses. The wastewater contaminates the groundwater and also the inland water resources and soil and affects in a major way human, animal and plant life on a large scale. This critical issue compels the researchers to use technical and scientific skills in the field of wastewater treatment/remediation.

The current monograph is intended to spread knowledge to readers regarding the issue related to water pollution in recent times. This book describes various physical, chemical and biological methods, which are being utilized to provide a complete remediation or remediation to an extent where wastewater could be discharged safely into inland waterbodies or could be possibly reused for agriculture or other purposes. The main objective of this monograph is to provide the complete explanation of all the reasons, difficulties and processes to counter the water crisis with their advantages as well as disadvantages.

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