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Tarun Gupta · Swatantra Pratap Singh ·  
Prashant Rajput · Avinash Kumar Agarwal  
Editors

# Measurement, Analysis and Remediation of Environmental Pollutants

 Springer

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# 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 activities. Transportation and power generation are two major examples. 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 International Society for Energy, Environment and Sustainability (ISEES) was founded at Indian Institute of Technology Kanpur (IIT Kanpur), India, in January 2014, with an aim to spread knowledge/awareness and catalyze research activities 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, spread knowledge in the above-mentioned areas and create awareness about the environmental challenges, which the world is facing today. The unique way adopted by the society was to break the conventional silos of specializations (engineering, science, environment, agriculture, biotechnology, materials, fuels, etc.) to tackle the problems related to energy, environment and sustainability in a holistic manner. This is quite evident by the participation of experts from all fields to resolve these issues. ISEES is involved in various activities such as conducting workshops, seminars and conferences. in the domains of its interests. 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.

Third International Conference on “Sustainable Energy and Environmental Challenges” (III-SEEC) was organized under the auspices of ISEES from December 18 to 21, 2018, at Indian Institute of Technology Roorkee. This conference provided a platform for discussions between eminent scientists and engineers from various countries including India, USA, Norway, Finland, Sweden, Malaysia, Austria, Hong Kong, Bangladesh 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 presented five high-voltage plenary talks from globally renowned experts on topical themes, namely “The Evolution of Laser Ignition Over more than Four Decades” by Prof. Ernst Wintner, Technical University of Vienna, Austria; “Transition to Low Carbon Energy Mix for India,” Dr. Bharat Bhargava, ONGC Energy Center; “Energy Future of India,” By Dr. Vijay Kumar Saraswat, Hon. Member (S&T), NITI Aayog, Government of India; “Air Quality Monitoring and Assessment in India” by Dr. Gurfan Beig, Safar; and “Managing Large Technical Institutions and Assessment Criterion for Talent Recruitment and Retention” by Prof. Ajit Chaturvedi, Director, IIT Roorkee.

The conference included 24 technical sessions on topics related to energy and environmental sustainability including 5 plenary talks, 27 keynote talks and 15 invited talks from prominent scientists, in addition to 84 contributed talks and 50 poster presentations by students and researchers. The technical sessions in the conference included advances in IC engines, solar energy, environmental biotechnology, combustion, environmental sustainability, coal and biomass combustion/gasification, air and water pollution, biomass to fuels/chemicals, combustion/gas turbines/fluid flow/sprays, energy and environmental sustainability, atomization and sprays, sustainable transportation and environmental issues, new concepts in energy conservation, waste to wealth. One of the highlights of the conference was the rapid fire poster sessions in (i) engine/fuels/emissions, (ii) renewable and sustainable energy and (iii) biotechnology, where 50 students participated with great enthusiasm and won many prizes in a fiercely competitive environment. Two hundred-plus participants and speakers attended this four-day conference, which also hosted Dr. Vijay Kumar Saraswat, Hon. Member (S&T), NITI Aayog, Government of India, as the chief guest for the book release ceremony, where 14 ISEES books published by Springer, Singapore, under a special dedicated series “Energy, Environment and Sustainability” were released. This was second time in a row that such significant and high-quality outcome has been achieved by any society in India. The conference concluded with a panel discussion on “Challenges, Opportunities and Directions for National Energy Security,” where the panelists were Prof. Ernst Wintner, Technical University of Vienna; Prof. Vinod Garg; Central University of Punjab, Bhatinda; Prof. Avinash Kumar Agarwal, IIT Kanpur; and Dr. Michael Sauer, University of Natural Resources and Life Sciences (BOKU), Austria. The panel discussion was moderated by Prof. Ashok Pandey, Chairman, ISEES. This conference laid out the road map for technology development, opportunities and challenges in energy, environment and sustainability domain. All these topics are very relevant to the country and the world in the present context. We acknowledge the support received from various funding agencies and organizations for the successful conduct of the Third ISEES Conference, III-SEEC, where these books germinated. We would, therefore, like to acknowledge NIT Srinagar, Uttarakhand (TEQIP) (special thanks to Prof. S. Soni, Director, NIT, UK); SERB, Government of India (special thanks to Dr. Rajeev Sharma, Secretary); UP Bioenergy Development Board, Lucknow

(special thanks to Sh. P. S. Ojha); CSIR; and our publishing partner Springer (special thanks to Swati Meherishi).

We would like to express their sincere gratitude to a large number of authors from all over the world for submitting their high-quality work in a timely manner and revising it appropriately at a short notice. We would like to express our special thanks to various academicians who reviewed different chapters of this monograph and provided their valuable suggestions to improve the manuscripts.

Individual access to the clean water, food and air becomes one of the most critical challenges around the world owing to the presence of various toxic pollutants in various media. Although many pollution abatement efforts have been taken up and burgeoning expenditures made, no comprehensive solution has been implemented for the masses. A comprehensive discussion on the latest developments in the detection and analysis of contaminants that have enabled the scientists to understand the evolution of these pollutants in real time and that led to more accurate source apportionment of these pollutants has also been attempted in this work.

Kanpur, India  
Mumbai, India  
Kanpur, India  
Kanpur, India

Tarun Gupta  
Swatantra Pratap Singh  
Prashant Rajput  
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## About the Editors

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**Dr. Swatantra Pratap Singh** is Assistant Professor at IIT Bombay in the Centre for Environmental Science and Engineering. Before this, he was Postdoctoral Scholar in the Zuckerberg Institute of Water Research at Ben-Gurion University, Israel. He is Environmental Engineer with training in pollution control and has received his Ph.D. and M.Tech from the Indian Institute of Technology Kanpur, India. His research focuses on the low-cost membrane-based treatment units for water and wastewater treatment, and the generation of catalytic membranes with high flux and better selectivity and the use nanomaterials to address environmental challenges. He has published 14 articles in reputed journals and 2 chapters and holds 3 patents.

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