

Energy, Environment, and Sustainability

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Air Pollution and Control

 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 major examples of the energy. Without the transportation by millions of personalized and mass transport vehicles and availability of 24×7 power, human civilization would not have reached contemporary living standards.

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 26–28 February 2017. The ISEES was founded at IIT Kanpur in January 2014 with an aim to spread 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 spread awareness about the environmental challenges, which the world is facing today. The ISEES is involved in various activities such as conducting workshops, seminars, conferences, etc., 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.

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 of 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 days technical extravaganza. The conference included two plenary talks, 12 keynote talks, 42 invited talks from prominent scientists, 49 contributed talks and 120 posters. Total 234 participants and speakers attended this three days conference, which hosted Dr. V. K. Saraswat, Member NITI Ayog, India, as a chief guest for the award ceremony of the ISEES. This conference laid out the roadmap 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 and chemicals—thermochemical processes; utilization of biofuels; and environmental protection and health. All these topics are very relevant for the country and the world in 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 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 a short notice. We would like to express our special thanks to Dr. Varun Goel, Dr. R. Anand, Dr. M. Udaya Kumar, Prof. R. S. Bharj, Dr. Shijo Thomas, Dr. Niraj Kumar, Mishra, Dr. T. N. Verma, Dr. Pravesh Chandra Shukla, Dr. Chetankumar Patel, Dr. S. K. Verma, Dr. Akhilendra Pratap Singh, Dr. Joonsik Hwang, Dr. Rohit Singla, Paramvir Singh and Nikhil Sharma who reviewed various chapters of this monograph and provided their valuable suggestions to improve the manuscripts. We acknowledge the support received from various funding agencies and organizations for the successful conduct 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 Mehershi); CIAB (Special thanks to Dr. Sangwan).

This volume covers the practices and technologies that are applied to the prevention of air pollution and control. Greenhouse gas emissions, urban air quality and growing petroleum consumptions are the three challenges faced by the society anywhere in the world. This book covers all aspects related to air pollution including major sources of air pollution, measurement techniques, modelling studies and solution approach to control air pollution. This book also emphasizes on vehicles as major source of air pollution and shows the quantitative analysis of engine exhaust emissions. Focus on particulate matter as major pollutant from engines and coal-fired power plants is another important aspect of this book. Few

chapters are also based on emission control techniques using different aftertreatment devices. This monograph aims to strengthen the knowledge base dealing with air pollution. This monograph is intended for air pollution practitioners, and we hope that the book would be of great interest to the professionals, postgraduate students involved in environmental studies.

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Kanpur, India
Basildon, UK
Kanpur, India
Kanpur, India

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Avinash Kumar Agarwal
Peter Eastwood
Tarun Gupta
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About the Editors



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Prof. Avinash Kumar Agarwal joined IIT Kanpur in 2001. His areas of interest are IC engines, combustion, alternative fuels, conventional fuels, optical diagnostics, laser ignition, HCCI, emission and particulate control, and large bore engines. He has published 230+ international journal and conference papers. Prof. Agarwal is a Fellow of SAE (2012), ASME (2013), ISEES (2015) and INAE (2015). He received several awards such as Prestigious Shanti Swarup Bhatnagar Award-2016 in Engineering Sciences, Rajib Goyal prize-2015, NASI-Reliance Industries Platinum Jubilee Award-2012; INAE Silver Jubilee Young Engineer Award-2012; SAE International’s Ralph R. Teetor Educational Award-2008; INSA Young Scientist Award-2007; UICT Young Scientist Award-2007; INAE Young Engineer Award-2005.



Dr. Peter Eastwood has been associated with the technology of motor vehicle pollution control for nearly thirty years, with posts research in research and development. He was a Royal Society Post-Doctoral Research Fellow at the Institute for Physical and Theoretical Chemistry, Tuebingen, Germany, where he continued his doctoral work on exhaust sensors. He was a visiting researcher in the Physics Laboratory at Ford Motor Company's corporate research centre in Dearborn, Michigan. He is currently employed in diesel aftertreatment development at Ford Motor Company in England.



Dr. Tarun Gupta Professor and P K Kelkar Research Fellow at the Department of Civil Engineering, IIT Kanpur, Kanpur, India. He holds Doctor of Science 2004, Environmental Health, Harvard University (USA) and Master of Technology 2000, Environmental Science and Engineering, Indian Institute of Technology-Bombay (9-month research at TU-Dresden, Germany). He is teaching and carrying out research at IIT Kanpur since June, 2006. He has graduated 6 PhD and 31 M.Tech. students. He has published more than 90 articles in ISI indexed journals, 4 book chapters and filed 4 applications for Indian Patent. He is a member of INYAS (2016), PK Kelkar Research Fellowship (2015), NASI Scopus Young Scientist (2015), INSA Young Scientist (2011), INAE Young Engineer (2009), IEI Young Engineer (2008).



Dr. Akhilendra P. Singh received his Masters and PhD in Mechanical Engineering from Indian Institute of Technology Kanpur, India in 2010 and 2017 respectively. Dr. Singh has worked as a CSIR Pool Scientist at Indian Institute of Technology Kanpur from 2014 to 2017. His areas of research include advanced low temperature combustion; optical diagnostics with special reference to engine endoscopy and PIV; combustion diagnostics and engine emissions measurement. Dr. Singh has published more than 20 international journal papers and 10 international and national conference papers.

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