Preface

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Biographical notes: Sunil Kumar is a Senior Scientist in Solid and Hazardous Waste Management Division of the Council of Scientific and Industrial Research-National Environmental Research Institute (CSIR-NEERI) located at Nagpur, Maharashtra, India. He has been working in the domain of solid and hazardous waste management since quite some time and has published numerous research papers in this field.

Rakesh Kumar is a Chief Scientist in Mumbai Zonal Laboratory of Council of Scientific and Industrial Research-National Environmental Research Institute (CSIR-NEERI) located at Mumbai, Maharashtra, India. He has been working in the domain of environmental science and engineering since the last 25 years. His contribution in the domain of solid and hazardous waste management is significant. He is one of the eminent personalities in the field of environmental engineering.

With the fast depletion of the conventional resources and the growing awareness and concern regarding the environmental effects of their utilisation, there has been a major thrust in the recent past to identify and develop alternate energy sources. Of many sources to be considered, municipal solid waste (MSW) could be an alternative and attractive option as an energy source. India, with its large population densities in urban centres, generates enormous amounts of MSW, which when converted to multiple types of fuel generating sources, have appreciable calorific value. The cost of such fuel source could be an area of concern and needs economic assessment along with techno-commercial viability. On the other hand, hinterland produces agriculture biomass which is being used as an energy source by villagers, though in an energy in-efficient way. Organic MSW is identified as one of the potential sources of biomass energy.

Biomass is a renewable resource that has a steady and abundant supply, especially those biomass resources that are by-products of agricultural activity. It can displace fossil fuels and also helps in reducing greenhouse gas (GHG) emissions while closing the carbon cycle loop. As the debate on food versus fuel intensifies, biomass can provide added income to farmers without compromising the production of main food and even non-food crops. Energy recovery from wastes is consistent with and complementary to modern integrated waste management practices. Efforts to prevent and minimise the generation of waste are clearly the most effective use of scarce resources and avoid environmental issues associated with waste handling, treatment and disposal. Energy recovery precedes the final and least favoured option, which is the land disposal of residual wastes.

Every year, there are 69 million tons of solid wastes generated in 366 Indian cities with a population of 377 million. MSW generation ranges from 0.25 to 0.66 kg/person/day with an average of 0.5 kg/person/day. Most of the generated wastes find their way into land and water bodies without proper treatment, causing severe water pollution. They also emit GHGs like methane and carbon dioxide, and add to air pollution. The problems caused by solid and liquid wastes can be significantly mitigated through the adoption of environment friendly waste-to-energy technologies that will allow treatment and processing of wastes before their disposal. Waste-to-energy technology involves converting various elements of MSW, such as paper, plastics, and woods to generate energy by either thermo-chemical or bio-chemical processes. The thermo-chemical techniques consist of combustion, gasification, and pyrolysis that produce high heat in fast reaction times. The bio-chemical processes consist of anaerobic digestion, hydrolysis, and fermentation using enzymes that produce low heat in slow reaction times.

A waste-to-energy plant is an excellent alternative to developing a solid waste disposal plant if the landfill option becomes too expensive. A waste-to-energy plant can reduce the volume of waste by as much as 90%. If there is a rapid increase in refuse disposal costs to a point at which it is no longer cost effective to continue off-site landfilling, waste-to-energy application should be considered. By reducing the waste volume down to only 10% of the original volume, one can save 90% of the disposal costs. According to actual operating data collected by the US WTE industry, on an average, combusting 1 metric ton of MSW in a modern WTE power plant generates a net of 600 kWh of electricity, thus avoiding mining a 1/4 ton of high quality US coal or importing one barrel of oil. WTE is the only alternative to landfilling of non-recyclable wastes, where the decomposing trash generates carbon dioxide and methane, potent GHGs, at least 25% of which escapes to the atmosphere even in the modern sanitary landfills that are provided with a gas collection network and biogas utilisation engines or turbines. The on-captured methane that escapes before a landfill is capped so that the landfill biogas can be collected which has GHG potential of 21 times that of the same volume of carbon dioxide.

The current status of experience and knowledge across the world need to be debated and analysed to understand how one could use the option of energy generation from the waste. Taking into account the benefits associated with waste-to-energy option and in view of rising awareness about WTE option in India, Council of Scientific and Industrial Research-National Environmental Engineering Research Institute (CSIR-NEERI) in association with Earth Engineering Centre, Columbia University, New York organised an International Brainstorming Workshop on Waste to Energy under the aegis of CSIR's mission of Wealth from Waste at Mumbai, India between August 24–25, 2012.

This workshop was the first major event organised by WTERT – India after its inception in June 2010. WTERT – India is the result of an association between the Earth Engineering Center (EEC) at Columbia University and National Environmental Engineering Research Institute (NEERI). It aims to address the rising interest, increasing investments, and to funnel important decisions related to SWM in India in the right direction. WTERT – India is included in Global WTERT Charter (GWC) where it would function as India's window to the world on the entire spectrum of SWM issues. WTERT – India is setup with the same guiding principle as GWC that "responsible management of wastes must be based on science and best available technology and not on ideology and economics that exclude environmental costs and seem to be inexpensive now but can be very costly in the future". All sister organisations in WTERT's global charter understand that solutions vary from region to region and work together towards better waste management around the world. WTERT – India is setup with the understanding that solutions vary from region to region and is committed to researching locally.

This event was successfully brought together leading academic scientists, researchers, scholars, business persons, corporate professionals and engineers to exchange and share their experiences and research results about a number of aspects of environmental engineering, energy engineering and resource management, and discuss the practical challenges encountered therein. We run short of words when expressing our thankfulness and admiration for the sustained support, collaboration and contribution, several pieces of advice and constructive suggestions received from all our esteemed advisory board members, organising committee colleagues, invited speakers and authors. They have all been pivotal in the present being and shape of this workshop. We hence extend our heartiest words of gratefulness to all those minds and hands who have collaborated unanimously to make happen this event. We equally wish to convey our sincere regards of appreciation to Er. Ackmez Mudhoo (Department of Chemical and Environmental Engineering, Faculty of Engineering, University of Mauritius) for his gracious support in producing this document and contributing in the organisation of this event. The selected papers on different aspects of waste management are presented in this special issue.

We wish this special issue will be very much useful for scientists, engineers, academicians and policy makers dealing with waste management issues.