environments

MDPI

Editorial

Development and Deployment of Green Technologies for Sustainable Environment

Shu-Yuan Pan *, Chihhao Fan and Yu-Pin Lin

Department of Bioenvironmental Systems Engineering, National Taiwan University, Taipei 10617, Taiwan; chfan@ntu.edu.tw (C.F.); yplin@ntu.edu.tw (Y.-P.L.)

* Correspondence: sypan@ntu.edu.tw

Received: 21 October 2019; Accepted: 22 October 2019; Published: 24 October 2019

1. What Is Green Technology?

The definition of green technologies should be any process, product or service that reduces negative environmental impacts while protecting human health and ecosystem quality. Green technologies sometimes also refer to cleaner technologies or environmental technologies. They generally feature five characteristics: (1) high efficiency energy and resource use, (2) low cost, (3) do not generate secondary pollutants, (4) use of renewable energy and/or materials, and (5) are beneficial to human health and ecosystems. The development and deployment of green technologies should be a viable method toward a sustainable environment in order to address a number of critical issues, such as climate change mitigation and adaptation, increasing energy and resource demands, and sustainable waste management. Green technologies could assist in decreasing the carbon intensity, promoting energy and resource efficiency, and avoiding serious environmental degradation. This would result in improving environmental quality, human welfare and social equity, while reducing the risk of resource scarcities, and move toward Sustainable Development Goals (SDGs) [1]. Deployment of green technologies could also provide great opportunities to support the promotion of a green economic system [2]. It is noteworthy that both the fundamental considerations and practical applications play imperative roles in facilitating the development and deployment of green technologies

2. Design for Sustainability

For the fundamental considerations, green chemistry principles should be considered and designed for green technology R&D at the early stage. The 12 principles of green chemistry include: (1) waste prevention, (2) atom economy, (3) synthesis with less hazardous chemicals, (4) design of safer chemicals, (5) use of safer solvents and auxiliaries, (6) design for energy efficiency, (7) use of renewable feedstocks, (8) avoidance of derivatives, (9) use of catalysis, (10) design for bio-degradation, (11) real-time pollution prevention, and (12) safer chemistry for accident prevention [3]. The synergies of green chemistry, such as energy- and resource-efficient designs, inherently safer molecules and sustainable processes, could be realized in a wide range of contexts. For instance, the energy and resource sustainability could be strengthened by building an intelligent recycling system based on smart devices, the internet of things (IOT), big data, and intelligent systems.

3. Comprehensive Performance Evaluation (CPE) Programs

For the practical applications, the comprehensive performance evaluation (CPE) programs emphasizing engineering, environmental, and economic aspects should be established to assess the feasibility of developed green technologies in different regions. The CPE programs should also consider the fundamentals of ecology together with the principles of green eco-design, sustainable consumption/use, and energy-efficient recycling. Efforts should be placed to manage materials and

products on a life-cycle basis, while adopting the extended producer responsibility (EPR) policy for multi-scale system analysis in different sectors.

4. Business Models for Green Industries

Apart from the fundamental and practical considerations, innovative business models for achieving a green economy are essential to support the transition to green industries. Establishment of smart circular economy parks would be a good example of developing innovative business models for green technologies, such as green manufacturing processes with high value-added products, low carbon emissions and risk reduction (hazard prevention and emergency response) technologies. For instance, cost-effective green technologies for waste valorization, water reclamation, and energy recovery should be developed to address the waste-water-energy nexus. The prevention of accidents and wastes via integrated management and innovative technologies is also important in developing business models. By doing so, the development and deployment of green technologies could reduce the use/generation of hazardous substances, while ensuring engineering performance, cost and safety.

5. Green Science, Technology and Engineering

To facilitate research integration and meet the need for comprehensive education on sustainable development, this special issue covers a broad range of sectors of major concern in the development of green technologies, such as green agriculture, tourism, building, transportation, energy, infrastructure (engineered natural systems), and advanced water treatment, smart technology, waste bio-refining for the circular bio-economy, and the food-water-energy-land nexus. We believe this special issue will attract a wide range of readers such as researchers, students, policy makers as well as entrepreneurs, since it provides readers with the emerging challenges, new concepts, innovative methodologies, and resolving strategies regarding development and deployment of green technologies. This special issue also allows policymakers to clearly understand state-of-the-art technologies for designing future sustainable development policies, introducing innovative management frameworks, and utilizing holistic evaluation tools.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. UN. *Transforming our World: The 2030 Agenda for Sustainable Development*; United Nations: New York, NY, USA, 2015; p. 41.
2. Barbier, E. *A Global Green New Deal*; United Nations Environment: Nairobi, Kenya, 2009.
3. Anastas, P.T.; Warner, J.C. *Green Chemistry: Theory and Practice*; Oxford University Press: New York, NY, USA, 1998.