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Editorial

Pollution Prevention/Environmental Sustainability for Industry

Bruce Dvorak

Department of Civil and Environmental Engineering, University of Nebraska-Lincoln, Lincoln, NE 68588, USA; bdvorak1@unl.edu

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It has been 30 years since, in the United States, the Pollution Prevention Act of 1990 focused attention on reducing pollution through cost-effective changes in production, operation, and raw materials use. The pollution prevention approach was novel in focusing on increasing the efficiency of a process and reducing the amount of pollution generated at its source. Worldwide, industrial organizations embraced cleaner production approaches that result in reducing pollution at the source. Governmental bodies are exploring the best prevention and control polices for pollution and energy management. Since that time, the industry has successfully applied the three pillars of sustainability—economic, environmental, and social—to minimize waste and emissions, reduce negative social impacts, improve profitability, and gain a competitive edge.

This Special Issue on 'Pollution Prevention/Environmental Sustainability for Industry' presents advances related to novel methods for the analysis of material and energy flows, innovative processes and technologies, applications of life cycle assessment, assessment of barriers to implementation within industry, analyses of policies to increase pollution prevention, and case studies highlighting pollution prevention and energy efficiency applications.

There is a growing interest among the operators of municipal wastewater treatment facilities to improve the sustainability profile by increasing the benefited use of on-site biogas production from anaerobic digestion of waste sludge. Riley et al. (2020) in "Techno-Economic Assessment of CHP Systems in Wastewater Treatment Plants" analyze the potential of utilizing combined heat and power (CHP) systems that use on-site biogas [1]. This study compares common technologies applied within the plants, including micro turbines, fuel cells and reciprocating engines, and evaluates the long-term savings capabilities of a CHP installation. A case study is used to illustrate the payback, annual savings, and initial costs associated with the installation of a CHP system. The overall result yields a payback period of less than 6 years, which often is attractive for publicly owned institutions.

With concerns about global warming, there is a need to a transition industry to lower energy use and zero-carbon production processes. One example of such an industry is the pulp and paper industry. Soderholm and Soderholm (2020) analyzed the Swedish pulp and paper industry for the period 1980–2010 and showed how changes in the sector innovation system influenced research and development activities [2]. This study highlights the importance of joint, industry-wide research and development activities, industry relationships, governmental research and development expenditures, and the importance of information sharing by all actors. This study highlights the importance of strengthening bridges between research institutions that provide basic knowledge generation and the industry that applies that knowledge.

As part of pollution prevention assessments, frequently there are trade-offs in energy use, solid waste production, and transportation impacts between the different process options. Life cycle assessment has been found to be an effective tool for evaluating environmental tradeoffs. Ghormley et al. (2020) use a combination of an economic analysis and life cycle assessment (LCA) to compare three secondary sand-reclamation options for a Nebraska (USA) foundry [3]. The LCA found that all three options reduced the life cycle environmental impacts, and that the transportation distance for both the source of the virgin sand and the ultimate disposal location could make a difference in terms of which option resulted in the lowest cost and lowest environmental impact. Since electricity use is a small part of the energy mix for sand reclamation, greening the electric grid had a minimal impact of the LCA results.

In some cases, unique waste products can be beneficially reused to address other waste streams. This is the focus of Murray et al. (2020) that examined the potential for using several different possible adsorbents, including dog fur and human hair, as compared to more commonly applied peat moss and polypropylene sorbents to extract oils from spills [4]. Crude oils spills were simulated, and contaminant adsorbance was measured. This study found that sustainable materials that are sometimes waste products, in this case dog fur and human hair, was as effective as more conventional adsorbents in extracting crude oil from non- and semi-porous land surfaces. In sandy environments, the polypropylene sorbent was significantly better than the other sorbents tested.

Since many forms of pollution and waste materials can cross governmental boundaries. In some cases, regional governments may or may not collaborate to address these waste management and pollution issues. This leads to the policy question of the approaches to best formulate policies by a central government to minimize overall pollution and provide social benefits. Lee et al. (2020) applied dynamic game theory to analyze the environmental policy (recycling fee and treatment subsidy) formulation of the central government by two local governments [5]. They observed that the cross-border pollution will have negative impacts, but the intervention of a central government to adopt appropriate policies will improve overall social welfare for both regions.

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