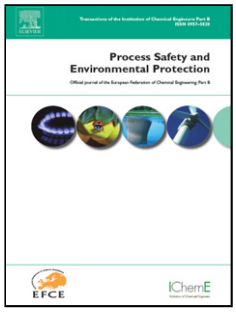

Title: Special Issue: Process Integration

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Special Issue: Process Integration

Process Integration (PI) emerged in the 1970s as a sub-area of chemical engineering based on the innovative use of thermodynamic principles to design optimal heat recovery systems (Hohmann, 1971; Linnhoff and Flower, 1978; Umeda et al., 1978). The global energy crisis of the latter half of that decade stimulated rapid growth and industrial interest in early PI methodology, which culminated in the publication of a classic IChemE guidebook (Linnhoff et al., 1982). The next three decades thereafter saw a diversification of PI in terms of methodology, domain of application and geographic scope; the most important developments in terms of both methodology and industrial applications during this period are summarized in a recent handbook (Klemeš, 2013). Another interesting development as the field of PI matured was the evolution of mathematical programming and pinch analysis into complementary approaches to problem solving, as compared to being competing schools of thought in past decades (Klemeš and Kravanja, 2013).

Process Safety and Environmental Protection has a long history of publishing systematic techniques for planning and design of various measures to enhance the sustainability of industrial processes. For example, a Scopus search using the keywords "Process Integration" and "Pinch Analysis" yields 24 articles published in this journal in just the past decade, with a notable upward trend in recent years. These statistics are clear evidence of the increasing relevance of PI methods and applications to *Process Safety and Environmental Protection* readers. While the high cost of energy was the main driving force behind the rapid growth of PI in the late 1970s and early 1980s, after four decades interest in this area is now being driven by sustainability issues, in particular because of the strong link between energy consumption and emissions which was first highlighted in PI literature by Dhole and Linnhoff (1993). Thus, enhancement of energy efficiency through systematic PI methodology creates opportunities to reduce the carbon footprint of industrial processes, which in turn creates opportunities for significant contributions to the global effort to mitigate climate change. Furthermore, other aspects of PI will become essential as climate change adaptation measures. For example, water reuse/recycling can be used to ensure that process plants can operate viably, even as climatic shifts cause water resources to dwindle in some parts of the world. Thus, it can be seen that PI can potentially address two of three main issues of the so-called food-water-energy nexus (Finley and Seiber, 2014).

This special issue of *Process Safety and Environmental Protection* features thirteen articles from contributors based in twelve different countries across five continents, which represent a cross-section of the global state-of-the-art in PI research. The papers cover a broad range of topics, including heat integration, mass integration, water integration, applied to different industrial problems – e.g., waste heat recovery, carbon-constrained energy planning, CO_2 capture, and biobutanol production. Both mathematical programming and insight-based pinch techniques are also represented in these articles. Furthermore, many of the papers also come from developing countries, which is a promising development in terms of both the geographic broadening of the global PI research community, and the adoption of PI methodology at a relatively early stage in the industrialization of emerging economies throughout the world. Thus, we envision this special issue of *Process Safety and Environmental Protection* to be a milestone that marks renewed growth in PI research, as a distinct part of the global scientific community's concerted response to sustainability challenges of the 21st Century.