CEP Chemical Engineering Progress

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Editorial

ChEs' Vital Societal Role — Today, Tomorrow...

When thinking about the chemical engineering profession of the future, it is helpful to first examine the past, specifically for the purpose of identifying the core developments that collectively defined the field. The seeds of the chemical engineering were planted in the 18th and 19th centuries, and can be described as a growing interest in the basic sciences and in mathematics. This trend was complemented by the infusion of industrial chemistry and economics in the 1850s, and continued to evolve until the recognition of unit operations in the 1920s formalized the chemical engineering discipline. The next significant enhancement materialized through the focus on rate processes and concurrent attentiveness to mathematical analysis.

With the advent of computers, it was foreseeable that the profession would adopt computational science as one of its most valuable tools. This prediction was manifested in the late 1970s (1975–1980), when process simulation made its debut in the chemical engineering industries. The level of sophistication that this software continues to achieve is a testament to its crucial role in today's process and plant design efforts —and an indication that simulation will remain a valuable asset.

The 1980s and 1990s witnessed significant growth in the chemical engineering portfolio — growth spurred by developments in the molecular and surface sciences and the successes of chemical engineers in using these advancements to our industry's advantage. At the turn of the century, chemical engineering began nurturing the innovations of biological- and nano sciences. It has gained strength from every technology it has encountered, each of which continues to be further improved.
Where the core chemical engineering technology is headed is anyone's guess — But I expect our profession to remain vital and flexible, continuing its tradition of adding new functional building blocks. There are two [complementary] considerations that justify this optimistic prediction: (a) the critical needs of human society in the coming decades, and (b) the fundamental nature of the chemical engineering profession, particularly the practitioners' capabilities to address such needs.

As an example, consider the need to meet society's energy demand, which, on a worldwide basis, is expected to increase by 290% to 1,500 quads/year (1 quad = 10^{15} Btu) by 2050 (from 2000). Complicating this issue is a concern for environmental sustainability— *e.g.*, preventing global warming by controlling CO_2 emissions. Technology must be developed, proven and implemented to either sequester CO_2 or convert it into some non-gaseous form. Chemical engineering, which unites reaction kinetics, separation processes, transport phenomena, heat transfer and process design and control, is ideally suited to play the key role in this endeavor.

But, what about other societal needs and potential technical solutions? Would the chemical engineering profession be pertinent to their fruition?

Not only would our profession be pertinent, it could be a powerful catalyst for positive change. Unlike other engineering disciplines, chemical engineering is broadly based upon many sciences, including physics, chemistry, and more recently, biology. This diverse foundation makes chemical engineers extremely versatile and resourceful — able to seek out and apply vital information to create short- and long-term solutions. There is no doubt that by the very nature of our profession, we are well positioned to confront the complex challenges of today and and tomorrow.

A more detailed discussion of these observations will be published in a forthcoming issue of *CEP*.

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