PLENARY SPEAKER

ABSTRACT

Wednesday, October 4th 14:30 –15:30 - Main Auditorium

Title: Challenges and Opportunities for Chemical Engineering in an Emerging Solar Economy

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For most of its existence, humankind lived off solar energy that was harnessed over the same timescale as its use. Only in the last two centuries, has it become dependent on fossil resources. The ability to store energy in a dense form and its ease of use led to unparalleled growth in science, technology and commerce, leading to a lifestyle for a common person that could not be imagined before. Chemical engineering saw an unprecedented growth as use of oil, natural gas and coal became dominant for transportation, production of chemicals and other human needs. However, as the world population rises from 7 billion to 10 billion and lifestyle improves in most parts of the world, the rapid rise in demand for energy will put tremendous pressure on the availability of fossil resources. Solar irradiation is the only power source that can meet daily needs for any foreseeable future. The question before us is – as we bid farewell to fossil fuels to reembrace solar power, how will chemical engineering adapt? Will its future be as bright as its past and present have been?

In order to understand the roles that chemical engineers could play, we will begin by exploring the great challenges that emerge due to the dilute nature of solar irradiation, the low efficiencies at which it is

harnessed and its intermittency in availability. When on a daily basis, solar irradiation becomes the main supplier for food, energy, water, chemicals and other human needs, the chemical engineers will have changed opportunities. We will have to learn how to harness solar irradiation as electricity, heat, biomass, H2, etc. and transform some of these into usable forms such as fuels, fertilizers, chemicals, purified water. Moreover, there are challenges related to large-scale storage of energy at GWh levels to mitigate the impact of intermittent availability.

In this lecture in honor of P.V. Danckwerts, we will discuss all the above aspects related to harvesting of solar power and its subsequent conversions and use that can be impacted by chemical engineers. While rooted in chemical engineering fundamentals, the tackling of these new challenges will require the addition of new tools to our traditional chemical engineering arsenal. We will illustrate this through examples from our own research in energy and systems analysis, solution-processed solar cells, biomass conversion to liquid fuels and energy storage at GWh levels. If the emerging challenges are properly addressed, the future of chemical engineering is indeed as bright and exciting in the sustainable solar powered world as it has been in a fossil resource driven world.