

FIPSE-6 Short Presentation 3d

Operating Process Plants without Fossil Fuel Combustion: Challenges and Opportunities from a Control Systems Perspective.

Mehmet Mercangöz
Imperial College London

ABSTRACT

Achieving global net-zero targets necessitates transitioning away from fossil fuel combustion in process plants. Presently, many plants rely on combined heat and power generation boilers. These centralized systems efficiently respond to internal and external disturbances thanks to readily available fossil fuels. Since combustion provides heat at a high temperature, this heat can be transferred to lower temperatures easily. In a decarbonized future where the primary energy is coming mostly from intermittent renewable electricity, the provision of energy for process operation must take a different form. For electricity provision, process operation will depend on the power grid and could require on-site electrical energy storage to provide a buffer. For the provision of heat, direct conversion of electricity to heat is energetically inefficient, especially for the provision of heat to lower temperature ranges. For this purpose, heat pumps or cogeneration with fuel cells using green synthetic fuels can be used, but achieving high efficiency requires tailoring solutions to the temperatures at which these heat users operate. The resulting heat provision solutions are, therefore, likely to be decentralized systems using either electricity or fuels whose availability could depend on locally stored energy or the state of the power grid. As the storage of heat is both economically and thermodynamically preferred compared to the storage of electricity, the result will be a highly heterogeneous and decentralized mix of different energy conversion and storage technologies interfaced with highly variable primary sources.

The context described above leads both to a challenge for fast transient control as power grid conditions change or tripping and starting units rapidly alter the energy demand, but also to another challenge for longer duration operation where the energy provision and use need to be balanced over time considering the scheduling of industrial operations as well as the different storage options. The talk will highlight these emerging control and optimization problems in the decarbonized industrial power and energy management landscape and argue for (a) closer integration of process and electrical system modelling and control and (b) development of advanced control and optimization solutions which can be executed in fast time scales to handle the emerging complexity.

To go back to the FIPSE-6 Scientific Program, click [HERE](#).