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" Decarbonization, AI and Digital Transformation for Sustainability in Process Industries "

Presenter's Biodata & Abstract

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Title of Presentation : HERO("Advance Pinch") Project on Collaboration between GC and TOYO

Presentation Abstract :

The petroleum refining and chemical industries are widely recognized as energy-intensive, and in recent years, the energy-saving there has become increasingly important to the reduction of greenhouse gas (GHG) emissions reduction. While typical approaches such as pinch analysis and steam balance optimization are widely used for energy-saving, however, they propose local solutions focusing on process units or utility units individually and not a global optimal solution.

To address this limitation, TOYO has developed a Hybrid Energy system Re-Optimization (HERO), which solves the problem for the entire system including process units and utility units through the application of mathematical optimization. HERO offers two key features. Firstly, HERO considers changing operating conditions. In a pinch analysis, the heat integration is considered for the point where externally supplied energy can be minimized under a GIVEN process condition, which is heat duty and temperature, the so-called "composite curve". Therefore, energy-saving is governed by a fixed composite curve and must be limited. In contrast, HERO can optimize the composite curve itself to find the most energy-saving solution. For the distillation column, the change of operating pressure, meaning the change of operating temperature, and all possible heat integration (e.g., reboilers and condensers) are examined. Secondly, HERO can optimize the entire system of process units and utility units. Conventional energy-saving approaches handle the process units and the utility units separately thus it is impossible to derive an optimal energy-saving solution (e.g., steam balance optimization takes place under the fixed steam consumption in the process units). Oppositely, HERO derives the steam balance minimizing the steam import to the plant with changing operating conditions. With these features, HERO can propose an optimal solution that could not be obtained through conventional approach.

HERO has been provided to commercial services in PTTGC, which is aiming for net-zero GHG emissions in 2050. Their action plan for it consists of 3 pillars which are "Efficiency-Driven", "Portfolio-Driven", and "Compensation-Driven", thus HERO is contributing to the action "Efficiency -Driven". In this presentation, it will be demonstrated why and how HERO could provide effective solutions in referring to examples in the project for PTTGC's aromatics plant and phenol plant. Additionally, we will share how much HERO can contribute to PTTGC's GHG emissions reduction.