Optimal Scheduling for Demand Response in Energy-Intensive Industrial Processes

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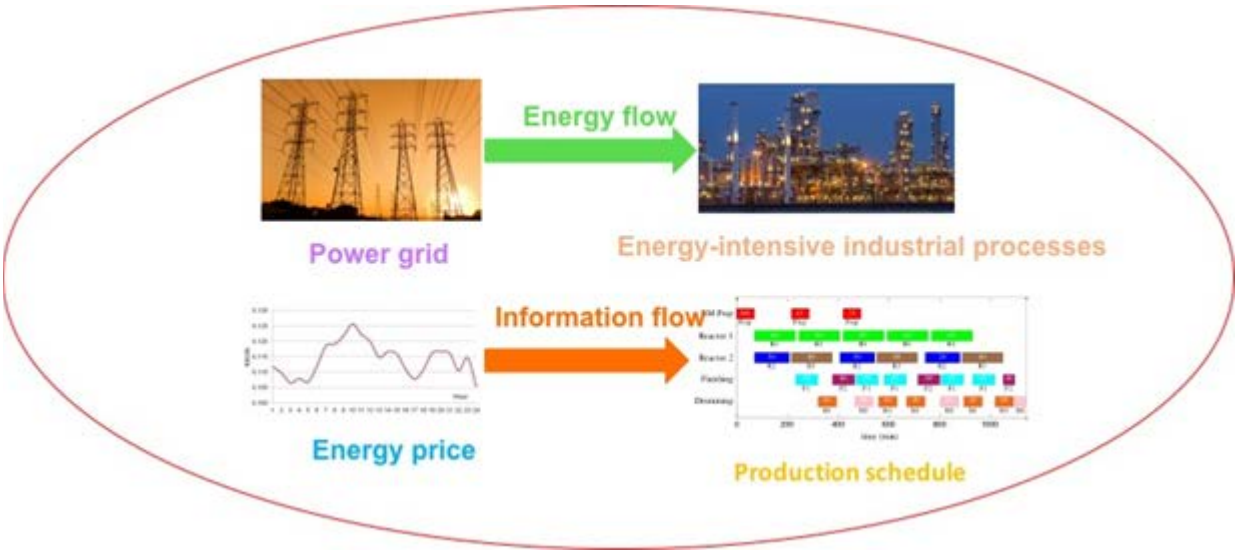
The concept of smart grid has gained considerable attention in process industries. One significant feature of smart grid is demand side management which aims for flexible management of electrical loads. Demand side management or demand response plays a critical role in maintaining the reliability of power systems and in providing additional financial benefits to the participants. Demand response can be provided by residential, commercial and industrial loads. Industrial processes, such as air separation and steel-making processes, have a great potential to provide demand response due to their large energy consumption. Production scheduling is becoming an important way to adjust electrical loads of chemical plants by determining appropriate production level and timing of tasks. Therefore, advanced production scheduling methods and software that take into account varying energy prices as well as complex manufacturing processes are needed.



To tackle this problem, we will develop a large scale mixed-integer linear programming model for the energy-efficient scheduling. The formulation of this model relies on a Resource-Task Network representation. We will also study the impact of renewable energies, such as wind power, on the production schedule. Our case study will come from the steel manufacturing processes, which include electric arc furnaces, argon oxygen decarburization, ladle furnace and continuous caster. In this energy-intensive process, electric arc furnaces consume a large amount of energy. Since the energy consumption rate of this process can be adjusted according to real-time energy price, the goal is to determine the most cost-effective and energy efficient scheduling and production management strategies.