

FIPSE-6 Short Presentation 3b

Process Electrification and its Cross-Dependencies with the Power Grids.

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ABSTRACT

Along with increased process electrification, we can expect higher and more volatile electricity consumption from processes that were earlier mainly driven by other energy sources, for instance, fossil fuels. Electrification of a process can be done in two main ways:

- 1) directly, by using electricity to drive the process, e.g., high-temperature process heating (for example, Coolbrook), with many applications from hydrocarbon cracking to cement production.
- 2) indirectly, by producing hydrogen through electrolysis, ammonia, or other energy carriers, which are then used in processes replacing earlier use of fossil fuels, for instance, in the steel industry, resulting in significantly lower CO₂ emissions.

The first approach will directly affect the dynamics of power demand and require a stronger link between the process and power grids, whereas the second option could provide necessary buffers to decouple the electricity consumption from the direct process, thus leaving more flexibility to the balancing of a power grid. The electricity markets of today have mainly been constructed to balance between dispatchable power sources and well-plannable industrial primary users and lack certain flexibility that stronger electricity-driven processes may need.

Process electrification will increase both the electricity consumption as well as the volatility on the demand side. This requires a stronger emphasis on demand-side management and better incentives to ensure that both the process industries and utilities are operated in a collaborative manner, i.e., supporting each other. So far, this has mainly happened in continuous processes, but with the expected substantial development, batch processes will also face the same problem. Open problems are, among others:

- 1) How do we ensure a sufficient energy supply to maintain stable production processes continuously in all situations?
- 2) How do we create mechanisms to increase collaboration across various demand-side actors (even competitors)?
- 3) How can we renew or redesign the electricity markets to provide stronger incentives for electricity users to support the stability of the power grids?

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