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Integration of P2X process to grid: needs for plant models for a smooth transition

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Abstract

The installation of big scale projects to produce decarbonized materials such as green ammonia, green methanol or e-fuels require the incorporation of large amounts of renewable energy. If these new energy sources have variable and non-programmable availability patterns (such as wind energy or solar irradiation), the production facilities will have to cope with additional costs. These costs may involve the installation of energy storage (like batteries), installation of storage for intermediate products (for instance, hydrogen), and faster degradation due to unsteady operation and/or idle installed capacity. The relative impact of these costs will rely on whether the strategy is to prioritize the operation of the process at its designed-capacity (through strategies like energy storage or grid support), or to prioritize flexible operation by utilizing the resources when they are available (which implies non-steady operation).

Relying on the electric grid to provide part of the energy supply has other implications. On the one hand, CO2 emissions of the final product will depend on the emissions associated to the production of energy. On the other hand, the required energy may or not be available from the grid. This last point is of particular interest in cases where the projected facilities imply big loads in comparison to the electric grid. For example, in Uruguay current electric power production capacity is 5.3 GW (24% from fossil fuels), and some of the announced projects imply 2 and 3 GW of new generation capacity.

In this talk, we will go through the analysis of two examples of Power-to-X (P2X) processes: ammonia and methanol production. Based on case studies from “conventional” (not green)

processes, and the available data on electrolyzer systems, the technical flexibility of each P2X process and its subsystems can be obtained. Then, relevant information can be obtained for different scenarios: the amount of energy that should be available from the grid in a scenario of plants connected to the grid, or the requirement of storage options for an isolated plant.

These analyses, based on the models of the chemical plants, are required to understand the costs associated with the usage of variable energy sources, and its implications in the trade-offs when balancing the reduction of CO2 emissions and the final production costs of green ammonia or methanol.

Topic: Role of infrastructures: electricity, heat, gas, H_2 grids, etc.