Wind Power Generation Impact on Profit and CO2 Emissions on a Chemical Process Network

**Abstract**

Renewable energy sources percentage in the energy mix have been increasing in the past years, leading the way to the chemical’s industry electrification and decarbonization. However, renewables often face challenges that may affect their optimal utilization. Wind and solar power generation is highly variable, which can lead to a mismatch between demand and output. Modeling this variable power generation and incorporating it with chemical manufacturing networks can help in quantifying the benefits to profit and emissions in the chemical industry. In this work we aim to identify optimal ways of more efficiently using wind-generated power through integration with chemical manufacturing. Wind power generation is modeled by sampling a Weibull distribution, a distribution that is usually employed to model wind. We are using a supply chain superstructure, involving chemical manufacturing processes that can use natural gas and/or natural gas liquids as raw materials (e.g., processes for propylene and acrylic acid), and that are candidates for efficient integration with renewable energy. The network of gas processing, wind energy and chemical manufacturing is optimized to determine the best selection and configuration of the technology represented in the supply chain superstructure. Additional variables considered include the size of the wind farm, sales to the electrical grid, and the usage of batteries as energy storage technology. CO2 emissions are also calculated for the different case studies considered in this work and, the scenario of assigning a cost to these emissions is also studied. Results showcase the benefits of incorporating renewable energy in chemical manufacturing, but also identify that battery storage may not have significant impact on profit and CO2 emissions reduction.