ETF DispElec

Techpaper #2 – Optimized Dynamic Dispatching for a Chlor-Alkali Electrolyzer: A Case Study

This case study explores the use of a dynamic dispatch tool to improve the operational efficiency of a chlor-alkali electrolyzer. The electrolyzer, with a nominal power of around 10 MW, produces chlorine, hydrogen, and caustic soda. For this case, it was not possible to store the produced Chlorine and hydrogen, requiring immediate consumption in downstream processes, which limits operational flexibility. The goal of this study is to optimize the dispatch of the electrolyzer in response to fluctuating day-ahead energy prices, aiming to achieve significant financial savings.

In this case, several subsequent processes are involved, resulting in multiple marketable end products, each with unique storage requirements and demand characteristics. These subprocesses, along with associated storage constraints, add complexity to the dispatching process.

The study was conducted in iterative steps:

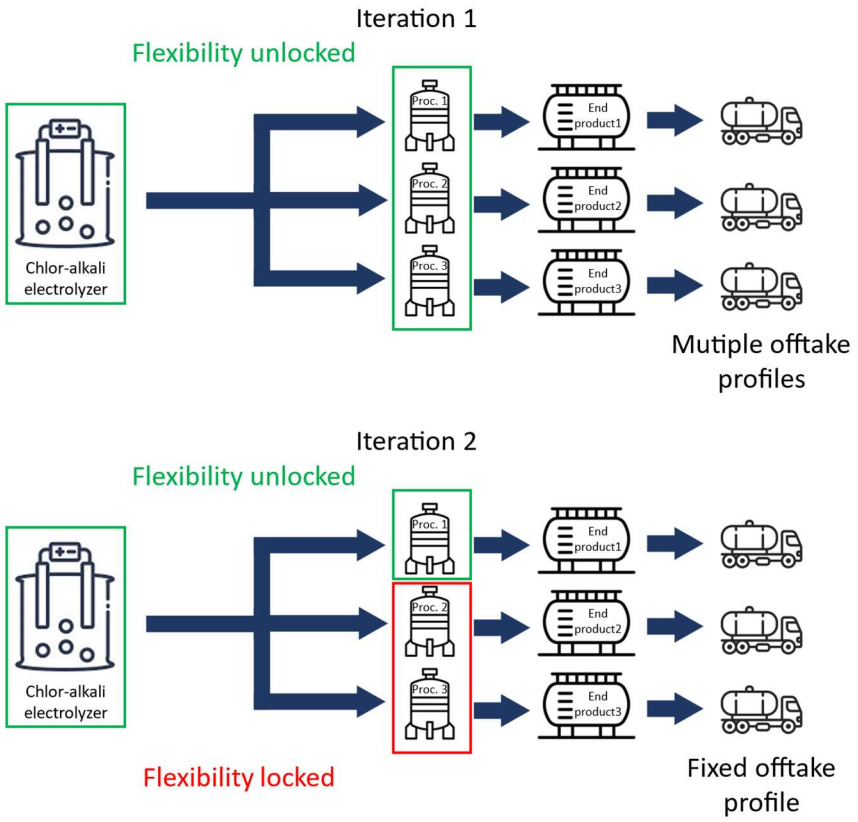
- Data Gathering: Collection of energy system data, production profiles, energy prices and cost structures.
- Model Building and Simulations: Development of a simplified model to simulate production profiles and energy consumption patterns. Optimized dispatch strategies were developed which were used on the system model.
- Results Analysis: Results of the optimal dispatch were compared to the benchmark baseload case to evaluate potential cost reductions

Two simulation runs were conducted:

The first iteration with flexible subprocesses operated within their operational boundaries, with different values for the operational load.

A second iteration was done with only one subprocess operated in a flexible manner, and a predefined load throughout the year, which would represent the forecasted production schedule.

The difference between these two scenarios is represented in the following figures:



Graphical representation of the system and differences between the two iterations

The results indicate that dynamic dispatching can yield substantial cost savings, especially at reduced loads (60%). The impact of operating all or just one subprocess in a flexible manner was very significant, since it would effectively increase/decrease the potential flexibility of the electrolyzer itself.

For the first case, the following savings could be obtained, depending on the load profile:

- 60% operational load: An average reduction of cost between 5€/MWh and 40€/MWh can be achieved, depending on the volatility of the electricity prices for that specific month.
- 90% operational load: Savings between 3€/MWh and 15€/MWh could still be achieved.

In the second iteration, important savings could still be achieved. The average operational load was around 85%:

- Total savings between 200k€ and 600k€/year could still be achieved, or between 2€/MWh and 7/€MWh.

Overall, the dynamic dispatch tool shows strong potential for enhancing the flexibility of chlor-alkali electrolyzers.