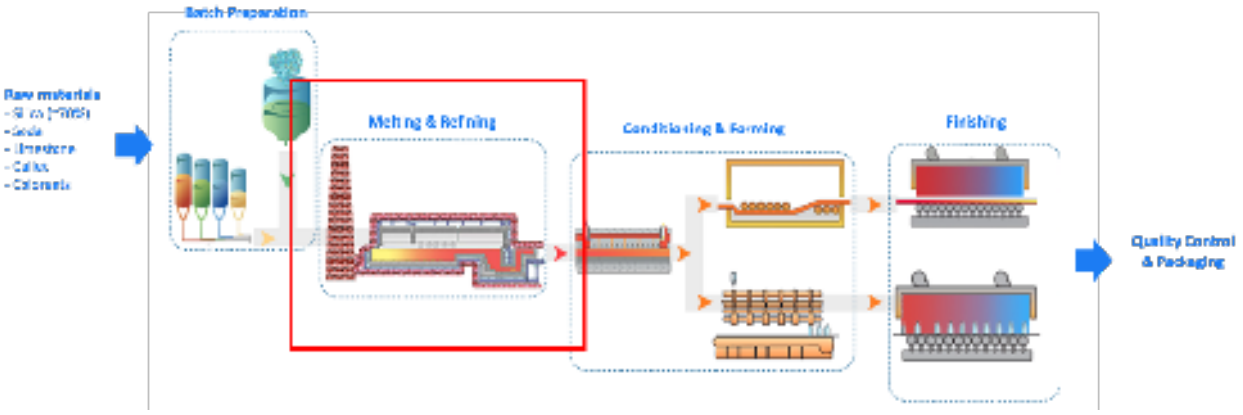
CASE STUDY

Glass furnace optimization with Performance 360™

Glass is a highly versatile product that is used in everything from packaging to construction but its manufacturing process has highly energy intensive steps that are often difficult to control. Getting the balance of quality, throughput, and energy consumption right is the key to running a successful glass manufacturing operation. However, in practice, this is difficult to do due to the complex, everchanging dynamics of the process coupled with variability in inputs and process conditions. This use-case shows how Performance 360™ is used to optimize glass melting furnace operations while adhering to quality, throughput, and emissions requirements.



Melting is the most energy intensive step in the glass manufacturing process.

Problem

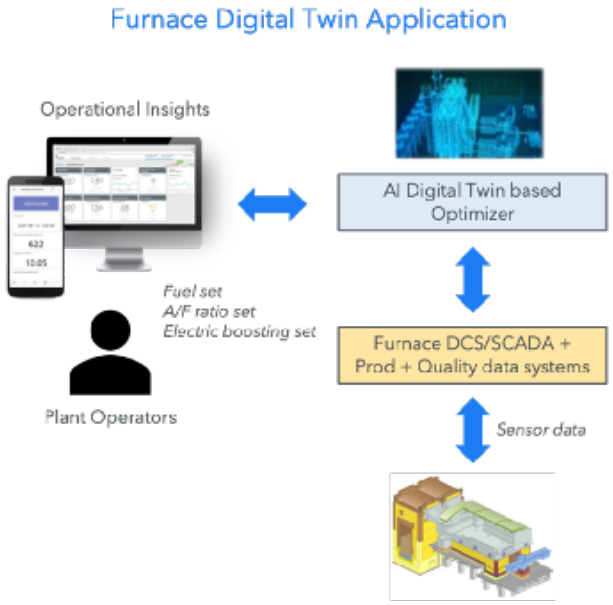
Container glass is commonly used for packaging products in various industries such as pharmaceuticals, cosmetics and perfumery, and specialty food and beverage. And its manufacturing process is extremely energy intensive and demands high quality standards. The slow melting and refining of silica sand, soda ash, limestone, and other ingredients in a furnace consumes the majority of energy used by the manufacturing process. The process is also complex due to numerous sources of variability such as raw material composition, moisture content, quality, cullet ratios, glass pull rates, and furnace ageing. In addition, it is common for the thermal energy required for the furnace to be produced by a combination of natural gas combustion and electric boosting. Therefore, the variability of the natural gas also contributes to the complexity of maintaining high quality and operating in an energy efficient manner.

Due to this complexity, controlling the process to maintain required quality and minimise energy consumption is often difficult. And as a result, glass manufacturing operations rely on large investments in cutting-edge equipment to stay competitive. In order to manufacture glass in the most cost-effective way, companies must not only focus on cutting-edge control systems but also ensure that their equipment is functioning optimally. Ageing of equipment over time has significant impacts on energy consumption and environmental performance.

Therefore, a solution is needed that can adaptively learn the everchanging dynamics of a manufacturing process and provide real-time performance optimization advisories that safely maintains process and business constraints.

Solution

SymphonyAI Industrial's Performance 360™ solution is built exactly for these types of use-cases where large amounts of data have to be processed with AI models to produce real-time, adaptive forecasts and advisories for performance optimization while satisfying process and business constraints such as quality, throughput, and emissions.



Performance 360™'s digital twin for furnaces gathers data from multiple data sources and provides real-time advisories and decision support for plant operators.

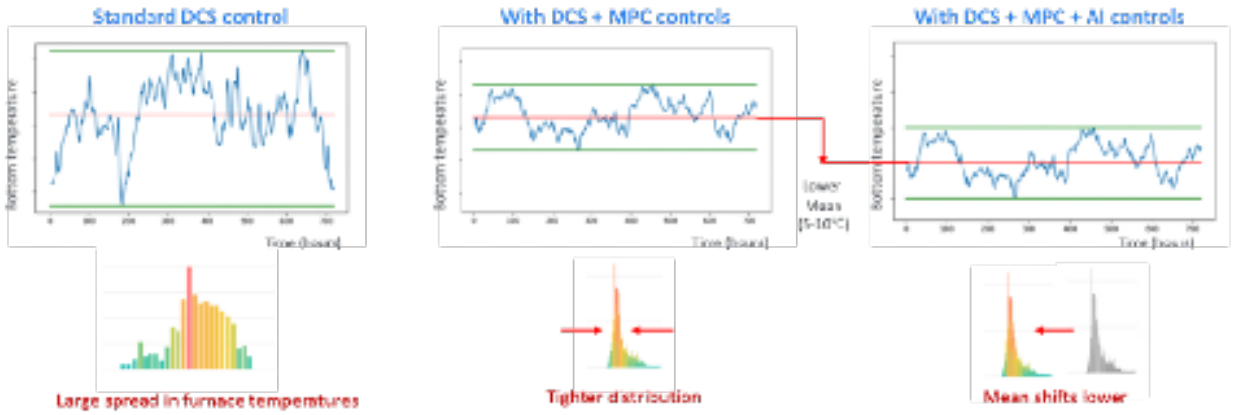
Performance 360™ uses AI-driven predictive models that can assess machine health, provide real-time monitoring, prescriptions, and recommend predictive maintenance for furnaces, compressors, pumps, and forming machines. It leverages IIoT, AI, and FMEA to provide anomaly detection, automated cause analysis, and action recommendations to ensure increased reliability, uptime, and performance. And its AI digital twins forecast scenarios into the future with high accuracy and recommend the most optimal paths for the evolution of the process through the use of MPC and AI-based control algorithms.

Outcomes and Impact:

- Energy savings of 1-3%
- Throughput increase of 3-5% while maintaining quality standards
- Increased revenue of $1-3MM per 60TPD plant

In this particular use case, the data used for building the digital twin included independent variables such as fuel flow setpoint, air-fuel ratio, electric boosting setpoints, dependent variables such as furnace temperatures, furnace pressures, oxygen levels, and disturbance variables such as natural gas composition, glass draw, cullet ratio, moisture content etc. The output of the digital twin included predictions of future furnace temperatures and pressures, oxygen levels, specific energy consumption, quality parameters, and emissions levels. In addition, Performance 360™ also used an optimizer that could translate forecasts into optimal setpoints that could be used to achieve the required process and business targets.

Overall, the impact of using this system led to fuel savings and increased glass production while maintaining the required quality of glass. For a typical 60TPD glass manufacturing plant, this translates to $1-3MM of increased revenue.



The melting furnace temperatures' distribution is tightened, and the mean temperatures are shifted lower to reduce energy consumption while maintaining quality of the end-product.

