SARAS

Smarter Refining:
How Saras Improved FCC Operations and Planning with AspenTech Industrial AI™

aspentech | Case Study

Deploying AspenTech Industrial AI Solutions provided Saras with accurate FCC product yield and quality insights, enabling improved operational decision-making, planning and profitability.

CHALLENGE

Saras faced operational challenges at its Sarroch refinery. The engineering team was having difficulty consistently predicting FCC product yields and qualities due to the complexity of the refinery and the variability of feedstock.

SOLUTION

- Saras developed a high-fidelity hybrid model of its FCC unit using the Industrial AI capabilities integrated within Aspen HYSYS®.
- The team also leveraged Aspen AI Model Builder™ and Aspen Simulation Workbook™ to refine and deploy the solution.

VALUE CREATED

- Significantly improved prediction accuracy for product yields and quality
- Reduced model update effort
- Enabled faster, more informed decisions
- Supported profitability through better planning and performance monitoring

Saras Looking to Improve Visibility and Predictive Insights into FCC Operations

Saras S.p.A. is an Italian multinational energy company headquartered in Milan. Its main refining operations are conducted at the Sarroch refinery, located on the southwest coast of Sardinia, Italy. The Sarroch refinery is one of the largest single-site refineries in the Mediterranean basin, with a processing capacity of approximately 300,000 barrels per day (equivalent to 15 million tonnes per year).

The refinery handles nearly 150 crude oil cargoes annually, sourced from over 30 countries, processing more than 40 different crude types each year.

Over 87% of the Sarroch site's output consists of medium and light distillates (net of consumption and losses), along with high-value petrochemicals totaling approximately 0.3 million tons per year.

FCC Production Critical to Maximizing Profitability

A critical contributor to the refinery's profitability is the Fluid Catalytic Cracking (FCC) unit, which has a capacity of 90,000 barrels per day (BPD). The unit processes a complex feedstock blend, including topping residue (IBP > 380°C) and desulfurized heavy vacuum gas oil (max FBP 560°C).

Moreover, the FCC unit is highly sensitive to feed quality and the overall complexity of the refinery, which processes a wide variety of crude types. This variability makes it challenging to consistently predict product yields and quality.

In light of these challenges, the refinery's engineering team sought a solution that would provide accurate visibility and predictive insights into FCC operations—particularly around product yield and quality—to support better decision-making and maximize profitability.

Leveraging AspenTech Industrial AI Solutions

To improve operational decision-making, the refinery team developed a high-fidelity simulation of the FCC reactor using AspenTech Industrial AI solutions. They employed Aspen HYSYS, leveraging its latest AI-powered hybrid modeling technology, along with Aspen AI Model Builder, to create a hybrid model of the FCC unit. This model was designed for deployment in both Aspen HYSYS and Aspen PIMS-AO, enabling enhanced monitoring and planning capabilities.

Additionally, the team used Aspen Simulation Workbook to deploy the solution and make it accessible to a wider audience within the refinery. This no code hybrid modeling approach, enabled by AspenTech's Industrial AI solution, used neural networks to dynamically calibrate reactor parameters, enabling accurate process simulation, operations monitoring, and planning across both Aspen HYSYS and Aspen PIMS-AO™, without requiring any coding expertise.

The hybrid modeling approach was selected to:

- Improve plant monitoring and planning decisions through higher model accuracy
- Reduce the time and effort required for model updates

The team developed a kinetic simulation model of the FCC reactor using the conventional FCC template available in Aspen HYSYS. Unlike traditional approaches that rely on static calibration factors derived from limited plant data, the team leveraged Aspen HYSYS's hybrid modeling capabilities, which integrate neural networks to dynamically calculate calibration factors based on a broad range of operational data. The model was trained on 126 historical datasets and validated with 25 additional sets, ensuring robustness across diverse operating conditions and significantly reducing the frequency and effort required for updates. Users did not need to write any code, as the AI technology is fully integrated within Aspen HYSYS.

The hybrid model used the same input variables as conventional FCC kinetic models in Aspen HYSYS and Aspen PIMS sub-models, including 12 key process variables:

- Feed preheat temperature (Riser)
- Riser outlet temperature
- Feed mass flow
- Feed properties (Sulfur, Conradson Carbon Residue [CCR], Specific Gravity, Nitrogen)
- Vapor catalyst cooler duty
- D86 95% temperatures for LCN, MCN, HCN, and LCO

The model predicted yields for FCC products including fuel gas, propylene, butylene, LCN, MCN, HCN, LCO, slurry and coke, along with quality metrics such as Motor Octane Number (MON), Research Octane Number (RON), sulfur content, Total Vapor Recovery (TVR) and more.

To calibrate the model, the team conducted a sensitivity analysis and identified 35 reactor kinetic parameters with the greatest impact on yield and quality predictions. These parameters were computed using the neural network model.

The team used Aspen Multi-Case™ to run nearly 1,000 Aspen HYSYS simulation cases, generating a rich dataset to build a nimble model suitable for performance monitoring and operations planning. This streamlined model was developed using Aspen AI Model Builder and deployed within Aspen HYSYS and Aspen PIMS-AO, supporting both performance monitoring and planning applications.

To broaden accessibility, the team created a Microsoft Excel® interface (see diagram below) using Aspen Simulation Workbook, allowing users without Aspen HYSYS expertise to interact with the FCC simulation. Excel enabled users to input data, view results and monitor simulation status—all while Aspen HYSYS ran in the background.

The team benchmarked the AI-based hybrid model against the conventional kinetic reactor model using identical datasets. The hybrid model consistently outperformed the traditional model in predicting both yields and product qualities, as demonstrated by significantly lower Root Mean Squared Error (RMSE) scores when compared to actual plant data.

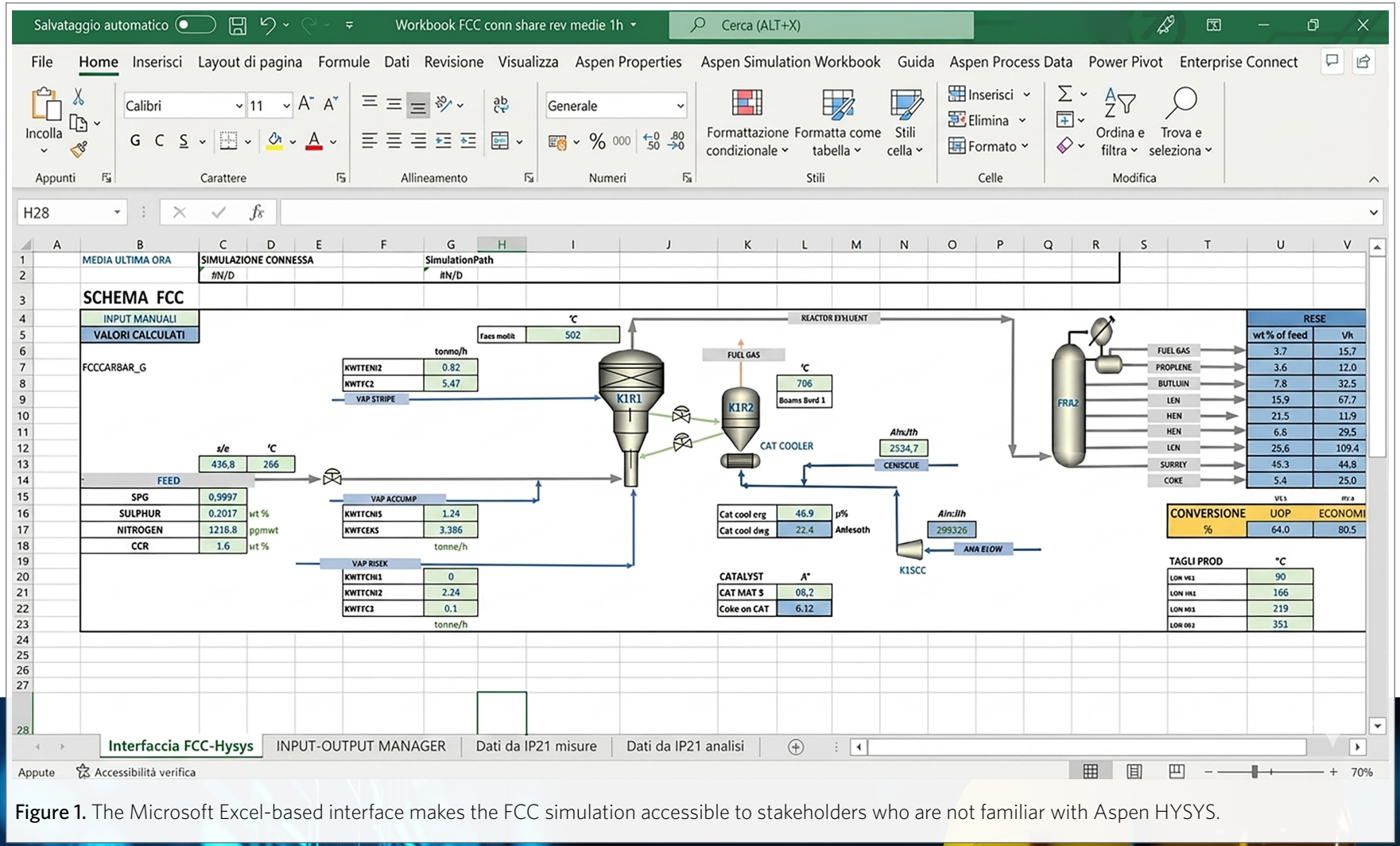
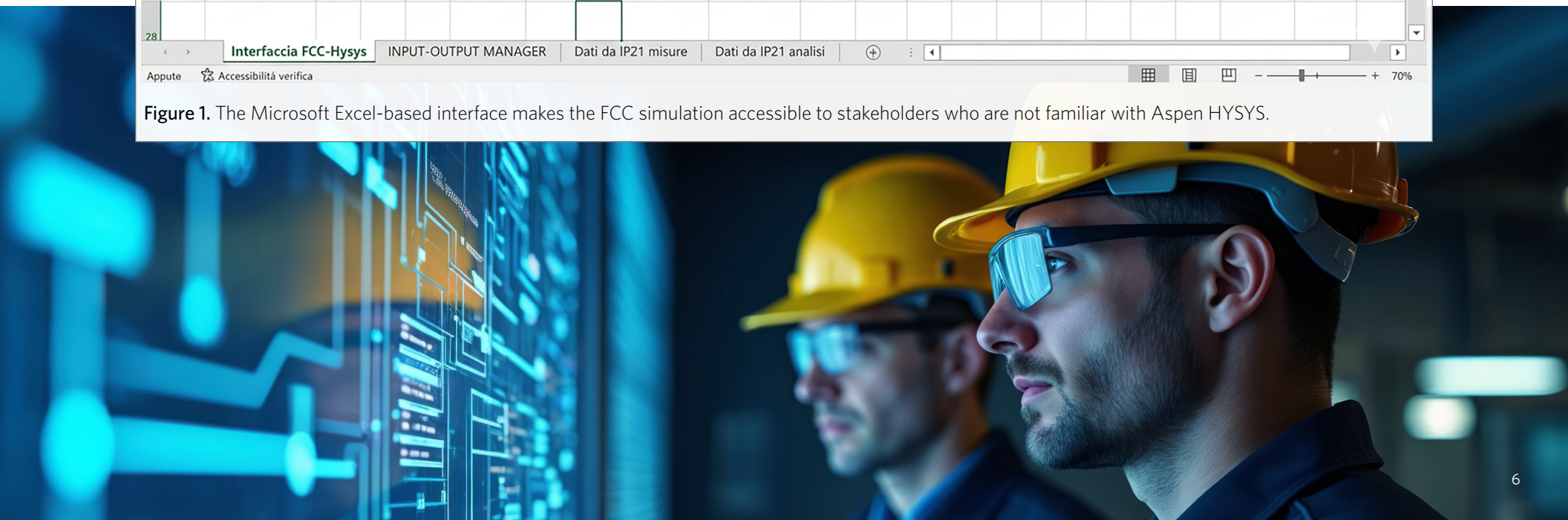


Figure 1. The Microsoft Excel-based interface makes the FCC simulation accessible to stakeholders who are not familiar with Aspen HYSYS.



(Note: In the diagrams below, 'HM' denotes the hybrid model of the FCC in Aspen HYSYS, and 'FP' denotes the conventional first-principles based kinetic reactor model in Aspen HYSYS).

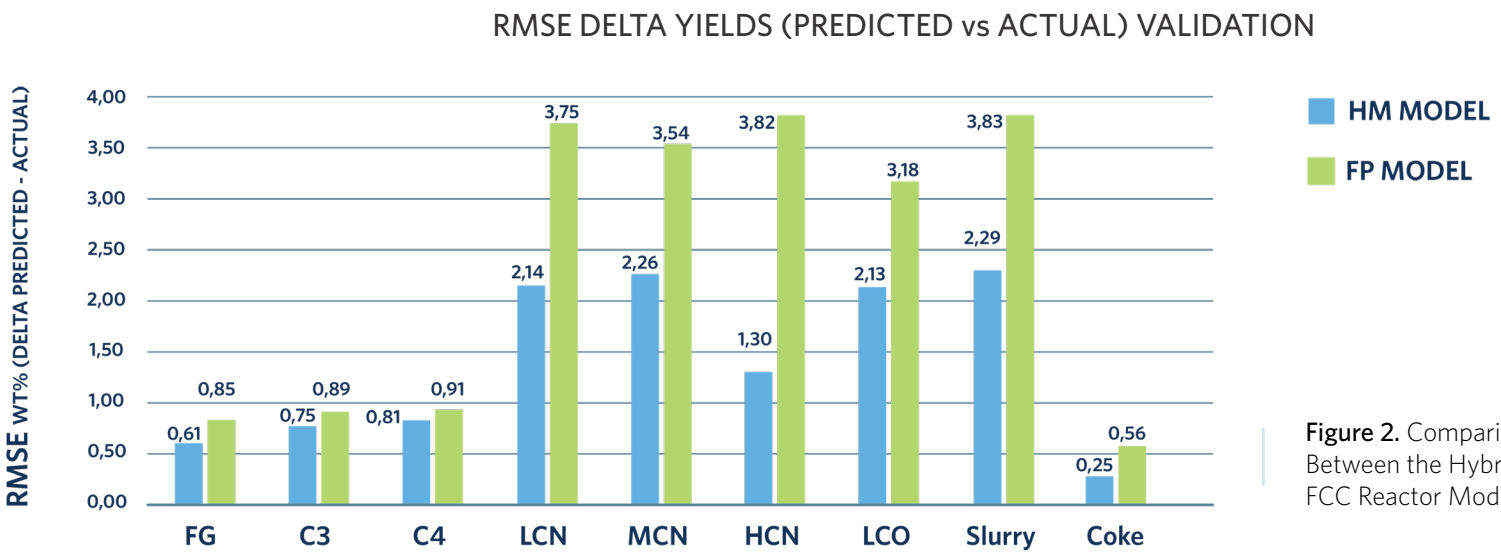


Figure 2. Comparison of Yield Predictions Between the Hybrid Model and Conventional FCC Reactor Models in Aspen HYSYS.

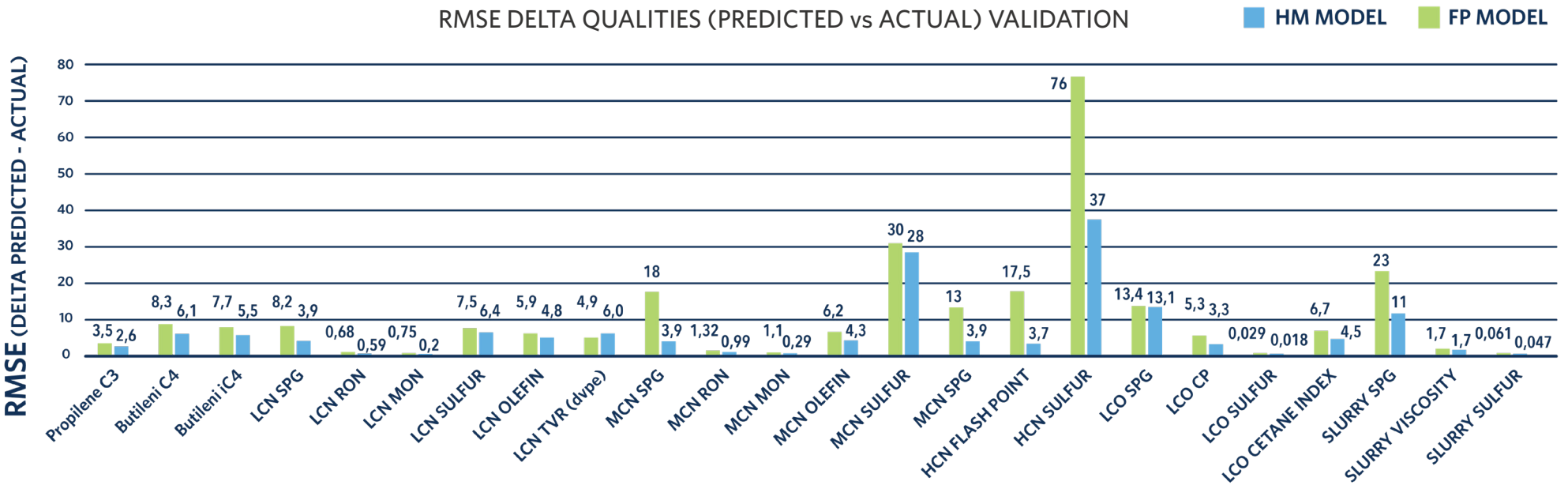


Figure 3. Comparison of Quality Predictions Between the Hybrid Model and Conventional FCC Reactor Models in Aspen HYSYS.

Industrial AI-Powered FCC Simulations Deliver Tangible Benefits for Sarroch Refinery

By deploying AspenTech Industrial AI solutions, Saras successfully transformed FCC reactor modeling at its Sarroch refinery. The hybrid model developed using Aspen HYSYS and Aspen AI Model Builder delivered substantially improved accuracy in predicting product yields and qualities, even under highly variable feed conditions.

Key results and takeaways:

- Enhanced decision-making through more accurate and dynamic FCC simulations
- Reduced model maintenance effort with AI-driven calibration across a broad range of operating conditions
- Improved accessibility via a user-friendly Microsoft Excel interface, enabling broader stakeholder engagement
- Superior performance of the hybrid model over conventional approaches, validated by lower RMSE scores against actual plant data

The digital Industrial AI approach provided by AspenTech has empowered Saras to optimize FCC operations, improve planning and drive profitability—demonstrating the tangible value of integrating AI with process simulation.

About Aspen Technology

Aspen Technology, now part of Emerson, is a global software leader helping industries at the forefront of the world's dual challenge meet the increasing demand for resources from a rapidly growing population in a profitable and sustainable manner. AspenTech solutions address complex environments where it is critical to optimize the asset design, operation and maintenance lifecycle Through our unique combination of deep domain expertise and innovation, customers in asset-intensive industries can run their assets safer, greener, longer and faster to improve their operational excellence.

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