CORTEVA™
agriscience

Corteva Uses Hybrid Models for More Accurate Predictions and Improved Maintenance

aspentech | Case Study

$10M
USD/year
Potential savings from avoided product losses

$1.2M
USD/year
Potential savings from avoided maintenance costs

More Accurate, More Guided
AI/machine learning-powered simulation for improved predictive insights

CHALLENGE

Corteva was experiencing frequent reboiler shutdowns caused by tar adhering to the exchanger tube walls that affected heat transfer and available duty. The shutdowns resulted in increased maintenance costs and production losses.

SOLUTION

First Principles Driven Aspen Hybrid Models™ embedded in Aspen Plus® combined plant data and AI/machine learning to improve the heat transfer coefficient predictions and provide guidance for an improved, more cost-effective maintenance strategy.

VALUE CREATED

The hybrid model, created in less than a day, provides guidance to:

- Prevent unscheduled shutdowns, potentially saving $1.2M USD/year in avoided maintenance costs and nearly $10M USD/year in avoided product sales losses
- Improve maintenance shutdown schedule
- Lower tar levels for smoother operation of upstream solvent distillation columns
- Take a proactive maintenance approach towards exchanger cleaning and tar purging

Introduction

Corteva Agriscience is a major American agricultural chemical and seed company. It provides agricultural solutions, crop protection products, software and services to support farmer productivity and profitability.

Corteva was experiencing frequent reboiler shutdowns due to tar adhering to the exchanger tube walls and affecting heat transfer and available duty. Rigorous process simulation indicated an impact of tar composition on the heat transfer coefficient. Heat transfer and duty calculations, however, did not match observations in the field because fundamental heat transfer coefficient calculations typically require unknown tar physical properties, which are difficult to isolate and measure because of the tar's high viscosity.

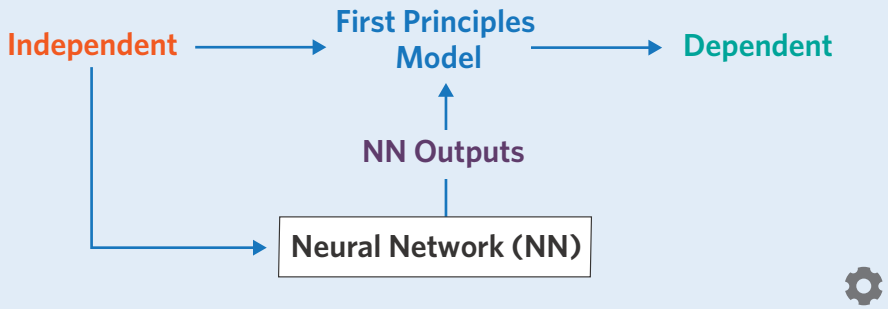
Aspen Hybrid Models, combining plant data and AI within an Aspen Plus model, improved the heat transfer and duty predictions to provide guidance for a better maintenance strategy.

The hybrid model helped identify the tar content threshold in the solvent to prevent unscheduled reboiler shutdowns and reduce tar levels impacting upstream equipment. By enabling accurate estimation of the heat transfer coefficient, Corteva was able to predict the optimum time to purge tar from the system and schedule exchanger maintenance.

Combining AI and First Principles to Provide Guidance for Improved Maintenance and Operations

Aspen Hybrid Models used AI/machine learning to improve the heat transfer coefficient predictions to provide guidance for improved maintenance and operations.

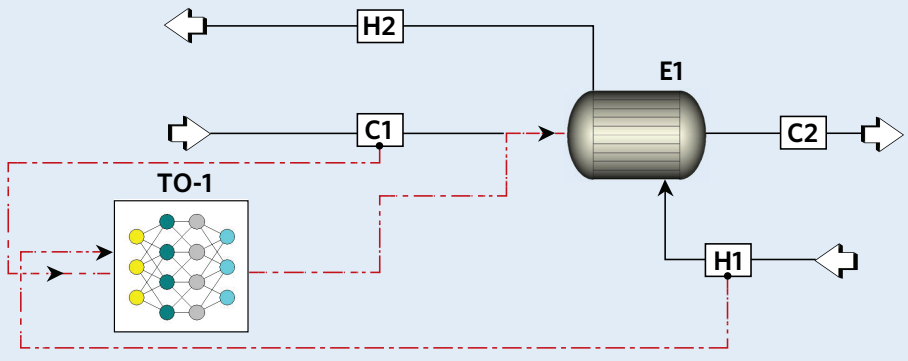
Hybrid Model Architecture



Neural networks improve the prediction of dependent variables in a first principles model.

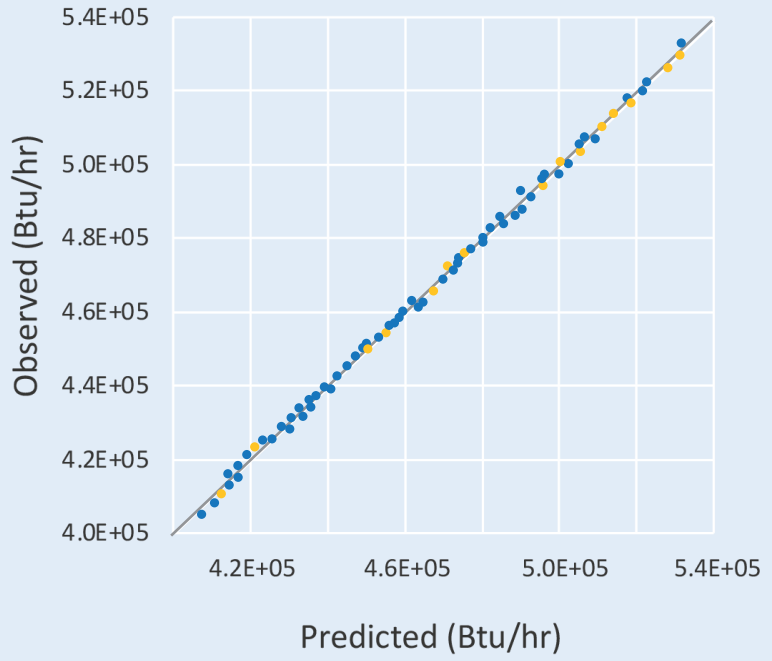
The heat exchanger was modeled in Aspen Plus, with an alkane used to represent the tar. First Principles Driven Hybrid Models were used to quickly improve the calculations, combining plant data and AI within the Aspen Plus model.

Deployment of Neural Network in Aspen Plus Heat Exchanger Model



The neural network is deployed inside Aspen Plus to improve model predictions.

Observed vs Predicted Duty



Duty calculations with hybrid models have a 99.9% accuracy rate compared to plant data.

The hybrid model used multiple plant data sets and plant tags mapped to simulation variables to train a neural network model and calculate the heat transfer coefficient. Because the overall heat transfer coefficient was not a constant value, the model validated the predictions at different operating conditions, identifying an almost perfect match of 99.9% between predicted and observed duties.

Conclusion

In less than one day's time, Aspen Hybrid Models helped Corteva identify conditions to avoid excessive maintenance costs and product sales losses while allowing smoother operation of upstream columns. The models enabled the company to determine that when tar content was greater than 5%, the heat transfer coefficient (U) and duty (Q) dropped significantly.

By identifying this threshold, when tar mass fraction was above 5%, the DCS can send the solvent to the tar flash system to purge out tar and prevent the unscheduled reboiler shut down, potentially saving $1.2M USD/year in avoided maintenance costs and nearly $10M USD/year from avoided product sales losses.

Machine learning enabled better prediction and a proactive maintenance approach for exchanger cleaning and tar purging. By accurately estimating the heat transfer coefficient, Corteva could compare the operational data with the clean heat transfer coefficient calculations, predicting the best moment to clean the exchanger and providing advice to schedule a reboiler maintenance shutdown.

Read more on **Aspen Hybrid Models**.

About Aspen Technology

Aspen Technology (AspenTech) is a leading software supplier for optimizing asset performance. Our products thrive in complex, industrial environments where it is critical to optimize the asset design, operation and maintenance lifecycle. AspenTech uniquely combines decades of process modeling expertise with machine learning. Our purpose-built software platform automates knowledge work and builds sustainable competitive advantage by delivering high returns over the entire asset lifecycle. As a result, companies in capital-intensive industries can maximize uptime and push the limits of performance, running their assets safer, greener, longer and faster.

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