Industrial AI From Aspen Technology Inc. Accelerating Decarbonization & Operational Excellence With Safe and Responsible AI

Ron Beck, Senior Director, Solutions Marketing



TnCHE 2024, Pattaya, June 21, 2024

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Impact of AI on Industry

"79% of leaders in industry say they expect generative AI to drive substantial transformation in their organization and industry over the next three years * "

- Deloitte, January 2024

* 2800 leaders surveyed

Defining Artificial Intelligence for Industrial Spaces

Artificial Intelligence (AI) is defined as technology that allows software to perform tasks that normally require human intelligence, including learning, problem solving and decision making.

Industrial AI is the combination of AI with domain expertise in engineering fundamentals, asset and industry knowledge to provide guardrails, robustness and trusted results.

AspenTech focuses on Industrial AI to drive improved agility, guidance and automation capabilities across its products and solutions.

Data Insights

Advanced Analytics, AI – ML, Deep Learning, Generative AI

Domain Expertise

Engineering Fundamentals, Asset Knowledge, Industry Experience

Industrial AI

Agility | Guidance | Automation

AspenTech Industrial AI Strategy

Customer Value Focus

Adapt to Business Conditions &

Opportunities

Agility

Enable Users to Perform at a Higher Level Guidance

Advance User Productivity

Automation

Industrial AI

Leveraging Engineering Fundamentals, Asset Knowledge and Industry Experience

Guardrails

Performant as Required for Applications and Enables Extrapolation to New Operational States **Robustness**

Explainable so Users Understand What Actions are required; Expert Guided Creation of Models

Purpose-Built AI

- Leverage Industrial Data Scientists
- Use simplest suitable method for each problem
- Broad Coverage of Machine
 Learning Types, Technologies &
 Tools

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Ki Industrial AI Key Areas of Focus

Agility: Al helps Organizations quickly adapt to business conditions and opportunities to achieve higher levels of value

Guidance: Al uplevels the workforce to guide them through everyday and complex decisions faster

Automation: Al frees up engineers for more critical activities by optimizing everyday and complex tasks to drive higher level efficiencies





Exam

(Hybrid Models)



Value Created by Industrial Al

Guidance

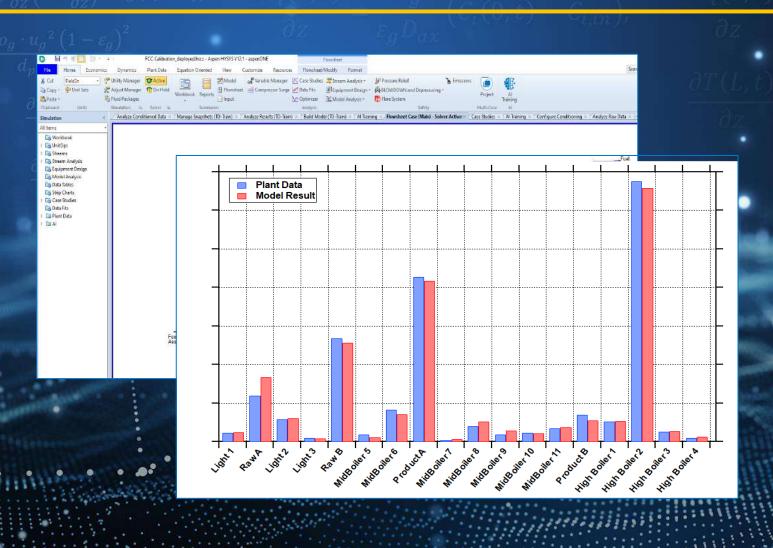
Agility

Automation

Benefits

AI helps Organizations quickly adapt to business conditions and opportunities to achieve higher levels of value

Hybrid Models



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Before

- 1st Principles Model
- Simulation-Reality Gap
 - Caped Optimization

Benefits

Adapt to Changing Conditions
Improve Economics
Enable Next Gen Users
Solve Complex Problems

Renewable Power Forecasting



Aspen OSI Monarch™

Before

- Limit Renewable Sources
- Reactive, Inefficient Process

Benefits

Higher Renewable Utilization
Improved Efficiency
Enhanced Grid Stability

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Industry: Bulk and Performance Chemicals Model Accuracy and Sustainment with Aspen Hybrid Models & Aspen Plus



"

Aspen Hybrid Models are a breath of fresh air. Al alone cannot solve this kind of operating challenge. By placing the Al model within the complete Aspen Plus simulation, we achieved a fantastic, practical result. " - Dr. Reza Haghpanah, Process Engineering Fellow, Dow Chemical

10% Yield improvement

"

- CHALLENGE

- Reactor processing high value chemical hard to control
- First principles models alone can't solve operating challenge
- Model of Balance of plant available in Aspen Plus
- Operating data available across a range of conditions

- SOLUTION

- Cleaned Historical data from several years of operation and different conditions
- Built hybrid model of challenging reactor with Aspen AI Model Builder
- Optimized Process, with full balance of plant model
- Achieved 10 % incremental product yield of high value product

Product(s): Aspen Plus, AIMB, Hybrid Models Industry: Bulk and Performance Chemicals Rapidly Optimize Ammonia Plant With Steam Methane Reforming, Using Industrial AI Hybrid Models



"

Using the Industrial AI Hybrid Model, with a native AI builder, we created a model that reproduces the real plant more accurately than the conventional reformer model. By creating a highly accurate model in a short period of time, we solved a difficult operating challenge. – Mr. Takuto Nakai, Production Dept, Nissan Chemicals

2% reduction in steam use 1% costs

CHALLENGE

- Economically crucial reactor is hard to model
- Accurate Steam Reformer(SMR) Model will improve ammonia economics
- Conventional rigorous modeling for SMR requires difficult-to-measure process fluid temperatures
- Objective is accurate prediction of furnace temperature

- SOLUTION

- Native-builder Industrial AI Hybrid Models combines:
 - Aspen Plus first-principles model
 - Synthetic correlations for unknown phenomena
- Reaction rates calculated using a neural network AI learning method
- Model with excellent correlation coefficient created 50% faster
- Accurate operator guidance

Product(s):

Aspen Plus (Aspen Industrial AI Hybrid Models)

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Value Created by Industrial Al

Agility

Guidance

Automation

Benefits

Al uplevels the workforce to guide them through everyday and complex decisions faster

Aspen Virtual Advisor

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Aspen AVA for DMC3/Unified PIMS

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Before

- Potential Optimization Gap
- Higher Learning Curve

Benefits

Planner Productivity Better Plan Outcomes: Higher Margins Reduced Emissions Improved Yields Reduced Complexity

Industry: Renewable Power Generation Early, accurate detection of degradation improves productivity of wind farm



By providing six months warning of equipment degradation—via Aspen Mtell prescriptive maintenance—power production is increased by scheduling maintenance during lower wind periods, and equipment replacement and repair costs are reduced through advanced planning.
 Giuseppe Citterio, Chief Energy and Sustainability Officer, Saras SpA

Reduction of maintenance costs of up to 10% per year

- CHALLENGE

- Gearbox and generator failures frequently happen in high wind period resulting in a long downtime and high loss of production
- Extend lifetime and reduce maintenance costs of wind farm
- Lead time-to-failure prediction must be sufficient to plan up-tower maintenance work

- SOLUTION

- Aspen Mtell[®] determines early signs of mechanical failure to avoid catastrophic damage
- Provides up to 6 months of advance warning of issues providing guidance needed to schedule maintenance during low-wind periods
- In one year, Mtell was deployed across 48 assets through Maestro & transfer learning capabilities

Product(s): Aspen Mtell

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Value Created by Industrial Al

Agility

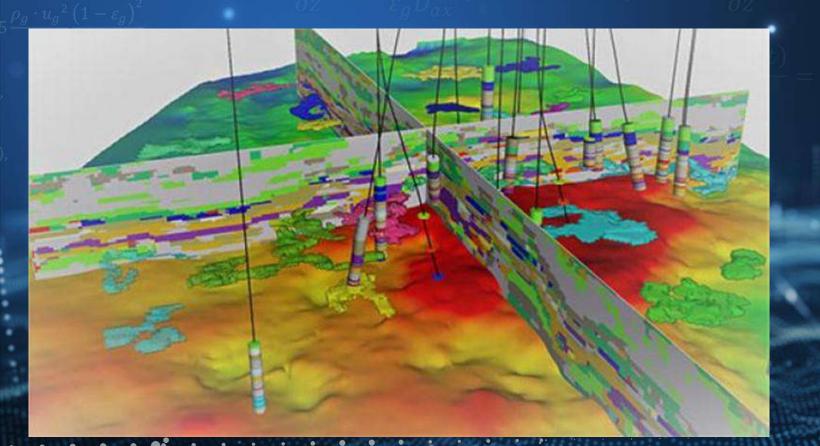
Guidance

Automation

Benefits

Al frees up engineers for more critical activities by optimizing everyday and complex tasks to drive higher level efficiencies

Subsurface Workflows



Aspen SeisEarth and Geolog

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Before

- Manual Qualitative AnalysisIncreased Drilling Complexity
 - Increased Risk of Emission

Benefits

Improve Productivity
Predict Rock Properties
Accelerate CO2 Permitting
Subsurface H2 Storage

Industry: Upstream Facies and Rock Type Prediction in Heterogeneous Zones

Enhanced the decision-making process for determining drilling locations by delivering accurate images of the subsurface

• Optimized the value of seismic data for predicting reservoir facies away from wells

Rapid High-Potential Zones Identification and Targeting

— CHALLENGE -

- Highly heterogeneous play
- Understand the geological settings to optimize well placement
- Extract maximum information from seismic data
- Prediction of rock types distribution throughout the reservoir

SOLUTION

Pan American

ENERGY

- Ensemble of neural networks for identifying connections between rock type at wells and seismic
- Volumes of lithology and probability were obtained
- Integration of geological & geophysical interpretation info
- Detailed prediction of target areas in 3D

Product(s):

Aspen SeisEarth, Aspen Geolog

NDUSTRIA





More Sustainable



Higher Margins



Improved Reliability

The Self-Optimizing Asset

The Path to Greater Operational Excellence

SELF-LEARNING SELF-ADAPTING SELF-SUSTAINING

AspenTech Leadership in Industrial AI



Forbes Technology Council



Emerson Exchange Europe



Economist Sustainability Week

(aspentech





Reservoir Characterization; RH Petrogas & AspenTech

Hybrid Modeling: Al and Domain Expertise Combine to Optimize Assets mediate areas where they will create value, and sloev to help the process industry navigate

Executive Summary

Aspell Technology, Inc. (Aspen/Tech0 has invested a nieth process simulation models and domain experision with N and availation algorithms. The multilagraph election software is a hybrid modeling system that achieves more than either first precipies odeling of A could plane

Ensighted for their accurate modeling of chemical and hydrocattor memory. Assers Deall and Assemble 2029, the work's service chemical second simulation pteres, have an accounty and predictive rapidality validated, when on the internet and interpreted an over their makes of any to industry, espandence, and scientists. Their models and first principles relativeship arcleds of years of monetance by the world's best prars and eperators



Hybrid Models Point of View Paper



Best Modeling Technology

Hydrocarbon Processing names Aspen Hybrid Models as "Best Modeling Technology" for 2021 Aspen Hybrid Models embed Industrial Al in the leading process

simulators Aspen Plus[®] and Aspen HYSYS[®], by combining process data, Al and first principles to match models to plant performance. Hybrid models were honored for bringing the Application of AI to the process industry to increase safety sustainability and profitability across design operations, and maintenance.

Hybrid Models HP Magazine Award





Mtell **Multiple Industry Awards**

Data Science Methods; Sven Serneels

Our Mission

Accelerate the digital transformation of the industries we serve by optimizing their assets to run safer, greener, longer and faster



Thank You!