Industrial AI: Purpose-Built to Deliver Value and Competitive Advantage

Heiko Claussen, Co-Chief Technology Officer, Aspen Technology, Inc.
Ron Beck, Senior Solution Marketing Director, Aspen Technology, Inc.

aspentech | Point of View

Introduction:
Industrial AI Creates Value With Greater Insight

Executives at today's leading industrial companies are investing in harnessing artificial intelligence (AI) where it can benefit their operations, and that trend is gaining momentum. A recent survey shows that **50% of industry executives expect AI to drive transformation** in their organization, and these same executives **will be investing more than 25% of their total budgets** on AI solutions by 2025.[1]

While AI is crucial to achieving competitive advantage, leaders at industrial companies are also grappling with key AI adoption challenges: the risk of inaccurate results, perceived shortage of high-quality data and the need for better transparency and explainability of AI results.

How can companies capture the potential value of AI for their business while overcoming the risks and challenges presented by rapid adoption of new AI solutions?

The answer is **AspenTech Industrial AI™**, which places guardrails based on engineering and science around the power of data and algorithm-based AI. This all can be enhanced by an operational technology (OT) data fabric, which connects to diverse plant-level data and operational measurements and provides a bridge to IT and the cloud.

Industrial AI provides value today—while also addressing AI concerns—by seamlessly delivering AI embedded in models based on domain expertise. AspenTech Industrial AI combines the speed and power of AI algorithms with the efficiency and parameters of real-world domain expertise (engineering fundamentals, asset operational insight and industry knowledge). These solutions address the risks of AI via guardrails, robustness and trusted results.

[1] Execs Double Down on AI, EY, June 2024

The unique advantage of AspenTech's models (such as those developed in Aspen HYSYS®, Aspen Plus®, Aspen Unified PIMS™, Aspen DMC3™, Aspen SeisEarth™ and Aspen Digital Grid Management) in the AI journey is that they generate simulated data that leverages laws of chemistry and physics while filling gaps in the range of scenarios needed to extrapolate insights. They augment historical and real-time asset data. Also, by seamlessly integrating AI applications into existing optimization software already in wide use, Industrial AI applications become easy to adopt by both experienced users and the next-generation workforce.

Delivering AI applications within the framework of engineering fundamentals and domain knowledge provides specific guardrails for the AI algorithms to keep results within the real-world constraints of chemistry, physics, electrical engineering and asset operating norms—such as enforcing material balances across a chemical process—and to stay within process safety envelopes. Incorporating AI throughout the broad portfolio of AspenTech solutions across the value chain also enables and drives the cross-fertilization of AI innovation between multiple operating disciplines.

Where Does AspenTech Industrial AI Create Value?

AGILITY: Enabling you to adapt faster to dynamic business conditions and seize market opportunities.

GUIDANCE: Upleveling your workforce to guide them to decisions faster and with greater insight.

AUTOMATION: Optimizing everyday tasks and complex tasks to drive higher levels of efficiency.

Generative AI and Industrial AI: An Example

Generative AI is just one of several available AI methodologies that AspenTech makes use of in Industrial AI solutions. Both large language models and small language models will be useful in industrial contexts, and there are many applications for small language models. Generative AI has already been incorporated into **AspenTech Strategic Planning for Sustainability Pathways**™ (SPSP), a solution that has been brought to market through co-innovation between AspenTech and **Aramco**.

In the SPSP solution, which optimizes investments in carbon capture and utilization technologies, a generative AI application identifies candidate groupings of process units, or pathways. Then alternative investment strategies are ranked by the broader solution based on economics and carbon emissions avoidance. In this case, the proprietary workflow that governs the retrieval pathway insights from the large language models provides guardrails to the generative AI application. In addition, expert review is a part of the workflow.

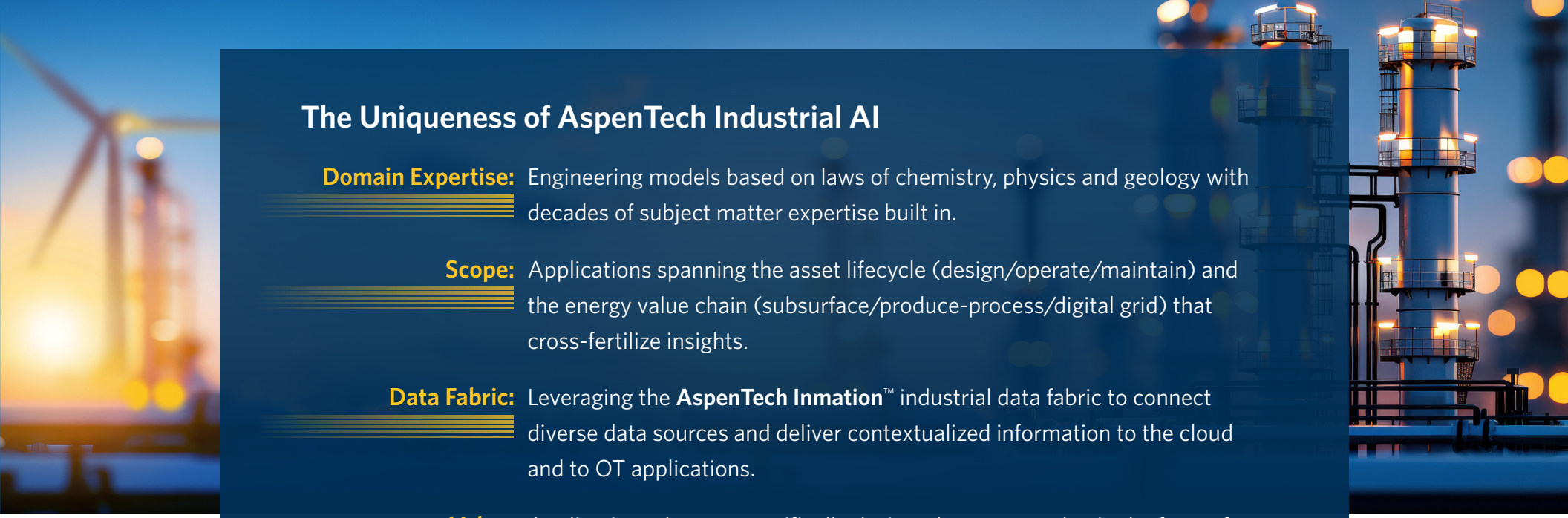
aramco

Industrial AI models are more efficient than pure data-based models (in terms of data, computation and time-to-value), as they are constrained by first principles to a subspace of physically meaningful solutions—and therefore require fewer parameters and less data to build. This results in more efficient training and operation of AI, ideal in industrial settings that often don't yield data for all scenarios of interest (for example, all possible failure types of particular equipment).

Typically, industrial companies are leveraging only a small percentage of their available data for decision-making purposes. Seamless access to the right categories of data can be enabled by a scalable OT data fabric that connects the plant and technical systems with enterprise IT environments and ensures flow, contextualization and broad access to the data wherever it is sourced from.

Training on rarely occurring operating conditions, adding unobserved scenarios, enabling use cases without access to data or just kickstarting a model are all enabled by AspenTech's proprietary, domain-rich engineering models (including process, equipment, planning, digital grid and geological models). These can create simulated data that is leveraged to supplement operating data, ensuring robustness and accuracy and reducing the need for potentially large data sets to train the AI applications.

Proven and purpose-built solutions for industrial problems—such as digital twins, production optimization, grid management and subsurface optimization—are empowering organizations to reach new levels of effectiveness by leveraging the Industrial AI incorporated into them.



The Uniqueness of AspenTech Industrial AI

Domain Expertise: Engineering models based on laws of chemistry, physics and geology with decades of subject matter expertise built in.

Scope: Applications spanning the asset lifecycle (design/operate/maintain) and the energy value chain (subsurface/produce-process/digital grid) that cross-fertilize insights.

Data Fabric: Leveraging the **AspenTech Inmation**™ industrial data fabric to connect diverse data sources and deliver contextualized information to the cloud and to OT applications.

Value: Applications that are specifically designed to create value in the form of agility, guidance and automation.

Purpose-Built for Industry

In complex, safety-relevant, capital-intensive industrial operations, there has typically been some resistance to adopting AI. McKinsey's 2023 Global Survey on AI[2] identifies the top AI adoption risks cited by executives, including:

- **Inaccuracy** – Guarding against incorrect predictions and ensuring that the answer always fits safety standards, regulatory compliance, engineering principles and operating experience.
- **Cybersecurity** – Safeguarding proprietary information (such as batch chemical recipes) and intellectual property (such as process details), as well as protecting operations from cyber threats.
- **Explainability** – Providing transparency and ensuring trust by keeping the operator in charge of the process.

Industrial AI addresses these concerns by combining domain expertise with AI based on operational data into productized solutions. This combination maximizes the accuracy and safety of the results provided by AI applications.

[2] The State of AI in 2023: Generative AI's Breakout Year, McKinsey, August 2023

Key Differentiators of AspenTech Industrial AI

GUARDRAILS

Industrial AI application use cases are built within the parameters of engineering fundamentals, asset knowledge and industry experience. AspenTech Industrial AI solutions leverage engineering models (across multiple disciplines) and over 40 years of expertise. With this intellectual property built into the models, less operating data is needed to effectively train the AI. The results achieve higher accuracy and ensure assets stay within safe operating limits.

ROBUSTNESS

Industrial AI leverages both real-world datasets and simulated data derived from rigorous models that represent science, operating conditions and experiential context. This enables the AI to effectively extrapolate to new and unexpected operational states and predict performance and behavior in new situations. This reliability and versatility come from having access to the right breadth of data, reflecting a range of conditions.

TRUSTED RESULTS

Industrial AI is developed and delivered with explainability built into the user interface. That is, it transparently explains the recommendation and basis of analysis to users, asset operators and company decision-makers. The human end user can clearly understand and assess what the AI app is recommending and why—and the operator and user are always in control of responding to the advice.

In short, today's Industrial AI applications are both trustworthy and effective, providing accurate and actionable advice to drive operational excellence. Industrial AI, when applied correctly, is efficient in terms of data consumed and compute time, and therefore energy-efficient as well.

What Do You Get With AspenTech Industrial AI?

Laws of Chemistry and Physics:
AI techniques such as unsupervised learning, sequential learning and cognitive computing are applied within the context of engineering models. These domain models provide guardrails to put the AI results within the real-world constraints, such as a heat and material balance derived from the laws of chemistry and physics (process simulation), electric power flows governed by the laws of physics (digital grid management), or the principles of rock conductivity and porosity (subsurface science & engineering).

Simulation-Based Data:
Synthetic data from first-principles simulation models can enrich AI training with hard-to-measure parameters and infrequent scenarios. Industrial AI can keep all models current through a scalable data fabric that aggregates and contextualizes incoming operating data and provide it near real time in a form that can be quickly consumed.

The Right Tool for the Right Problem:
Industrial AI employs a broad spectrum of machine learning types, technologies and tools, selecting the right and simplest tool that will solve each particular use case. For instance, if the relationship behind the technical or business problem being solved is linear, deep neural networks are not beneficial, as the higher number of parameters would require more training data, resulting in lower explainability and limited extrapolation. Other types of problems will yield advantages from different AI tools and methods. Purpose-built Industrial AI incorporates the most appropriate technology to achieve the best solution most efficiently.

Agility, Guidance & Automation: The Drivers of Value

Industrial AI solutions are strategic for businesses to thrive in today's dynamic conditions, as they enable faster and smarter action based on the most current information. A number of early-adopter industrial companies are achieving value by deploying AspenTech Industrial AI to improve their agility, guide decision-making and drive greater efficiencies through automation.

AGILITY

In an environment of rapidly changing macroeconomics, supply chain re-shoring, regulatory uncertainties and industry convergence, the ability to quickly adapt business strategy is critical. Industrial AI keeps models current and accurate based on incoming operating data, which enables immediate and confident decisions that positively impact yield, margins and emissions.

Leading companies are already using Industrial AI-based hybrid models to model new and complex chemical reactions in a far better way to rapidly improve performance, giving them a key competitive advantage.

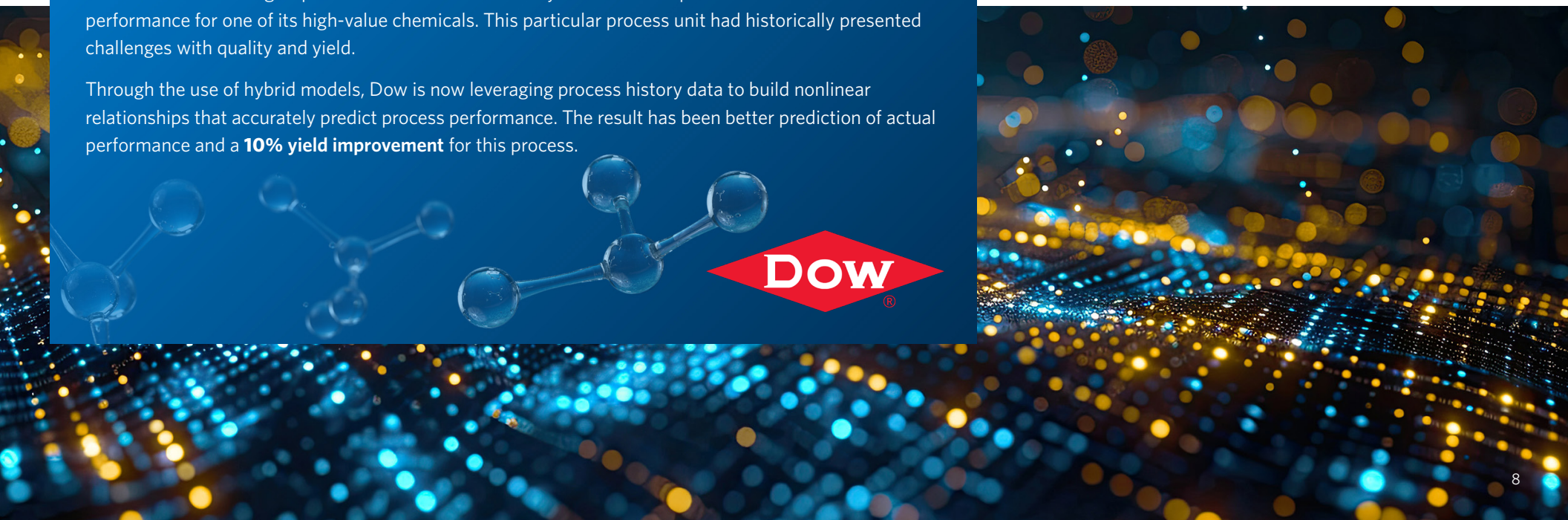
Hybrid models are one of the most powerful Industrial AI applications and provide a breakthrough in value creation, employing AI in both design and operating contexts. Because the AI is placed within the guardrails of rigorous process models, the models inherently incorporate first principles. As a result, operators and technical analysts know that mass balance and other laws of chemistry and physics will always be adhered to, ensuring both process safety and expected results.

This is the critical difference between luck and trust in an industrial setting.

Dow Uses Industrial AI to Improve Model Accuracy

Dow Chemical is using AspenTech Industrial AI-based hybrid models to profile the reactor unit performance for one of its high-value chemicals. This particular process unit had historically presented challenges with quality and yield.

Through the use of hybrid models, Dow is now leveraging process history data to build nonlinear relationships that accurately predict process performance. The result has been better prediction of actual performance and a **10% yield improvement** for this process.



GUIDANCE

As higher levels of operating complexity and more operating tradeoffs become the norm, Industrial AI delivers guidance to the workforce so they can make accurate decisions faster. The technology can provide insights and advice as to why a particular outcome is not being reached, as well as how the person directing operations can adjust the asset to achieve the desired results.

The advanced control and planning domains are areas where the generational change in technical teams has led to a loss of organizational and domain knowledge. To replace that experience, Industrial AI can be integrated into control and planning software to provide the guidance users need in setting up and tuning these solutions.

As another example, Industrial AI applications can enable maintenance teams to know 30-60 days earlier what alternative actions are available, allowing them to plan and execute maintenance with minimal impact on production. Industrial AI utilizes anomaly and failure agents on operational data to provide an advisory tool for maintenance and operations, helping personnel make the best decisions and accelerate the process of learning on the job.

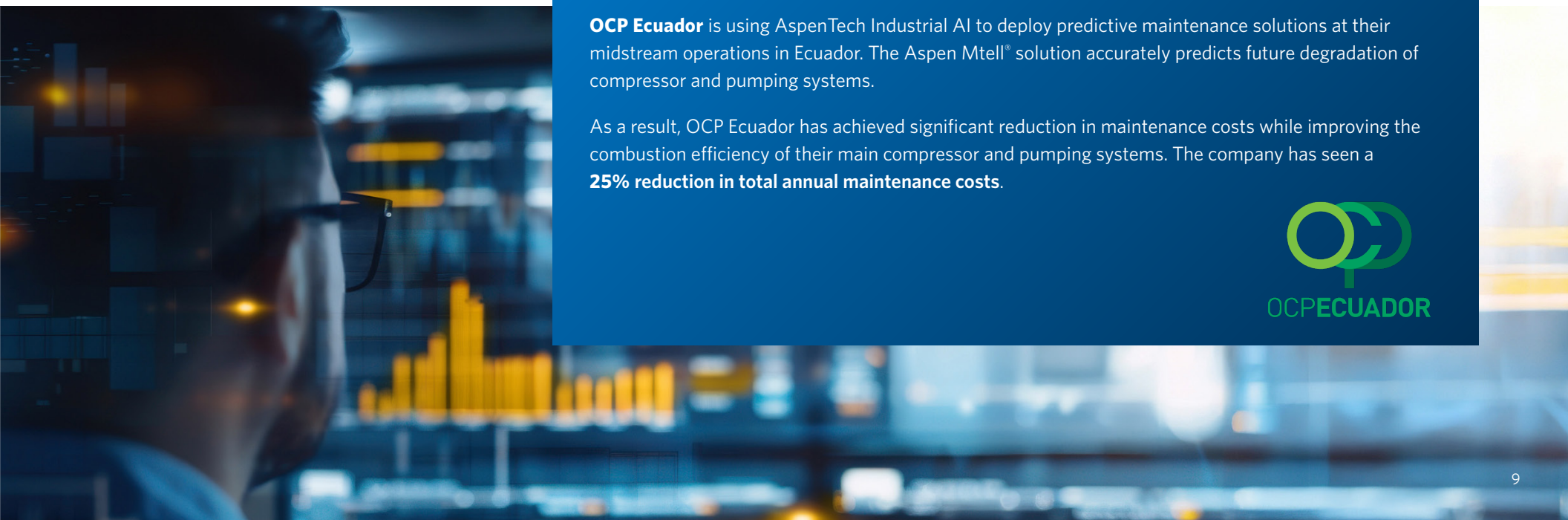
A number of companies are using Industrial AI in this context, enabling better and more insightful maintenance decisions, lower maintenance costs and increased revenue from improved uptime. With a rapidly increasing quantity of data and business complexity from interdisciplinary work processes, automating the repeatable steps for turning data into insights is critical to accelerating business decision-making.

OCP Ecuador Uses Industrial AI Prediction of Asset Failure for Maintenance Guidance

OCP Ecuador is using AspenTech Industrial AI to deploy predictive maintenance solutions at their midstream operations in Ecuador. The Aspen Mtell® solution accurately predicts future degradation of compressor and pumping systems.

As a result, OCP Ecuador has achieved significant reduction in maintenance costs while improving the combustion efficiency of their main compressor and pumping systems. The company has seen a **25% reduction in total annual maintenance costs**.

OCPECUADOR



AUTOMATION

In subsurface engineering, companies are using Industrial AI to automate the iterative steps needed in assembling and interpreting seismic and well data. This can turn a multi-week interpretation project into a several-hour task of generating visual representations of the data that can yield geophysical interpretation in areas with complex formations. Other organizations are using Industrial AI automation tools to deploy advanced process control solutions across a broad range of equipment and asset types. This greatly improves their ability to scale deployment of the solutions across large assets and the enterprise faster.

BASF Uses Industrial AI to Quickly Deploy New APC

BASF needed to upgrade their advanced process control implementation to reduce energy use and increase yield predictability in Ethylene Oxide production, they turned to AspenTech Industrial AI-based tools seamlessly built into Aspen DMC3 to re-build, calibrate and tune the controllers.

As a result, BASF was able to upgrade the system without relying on specialized technical experts. They quickly implemented a more capable system—**in less than 50% of the expected time**—achieving full return on investment in less than six months.

Continuing this approach, BASF can further automate the control and adjustment of controllers with load and condition changes, reducing operator intervention and improving operational excellence. More broadly, they can confidently adopt the most advanced APC across more units and sites, increasing utilization and yield of their assets.

BASF

Conclusion:
Industrial AI is Ready to Make an Impact Now

Industrial AI is creating value for leading industrial organizations by seamlessly integrating with the asset optimization software solutions that have been driving efficiencies for decades. Rooted in first principles and deep domain expertise—but also fully taking advantage of the growing sophistication and power of AI technology—Industrial AI is providing the guardrails, reliability and trusted results that are crucial for the process industries, thereby opening the door to new levels of operational excellence.

AspenTech Industrial AI uniquely incorporates first principles to drive the creation of data-efficient models. Moreover, engineering models are used to simulate the necessary range of plant operating conditions as training data to ensure required coverage. This proprietary combination gives Industrial AI a level of accuracy and robustness far beyond purely data-driven AI apps, delivering the reliability that is crucial for asset-intensive and safety-critical industrial settings.

The capabilities of Industrial AI—whether it's modeling design and operations more accurately, quickly enabling prescriptive analytics across assets or automating key tasks—are enhanced by a rich OT data fabric that mobilizes, aggregates, contextualizes and delivers the data to adapt Industrial AI models and close the simulation-reality gap. Also, this OT data fabric ensures integration with both operational technology and enterprise systems.

Industrial AI is purpose-built technology that delivers on the promises of AI while providing the safeguards that the process industries require. We are only at the beginning of this journey, and there is an ongoing acceleration of Industrial AI functionalities and high-value use cases. Organizations that are leveraging this opportunity are building differentiation today and positioning themselves to realize even greater benefits in the years to come.

About Aspen Technology

Aspen Technology, Inc. (NASDAQ: AZPN) 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.

aspentech.com