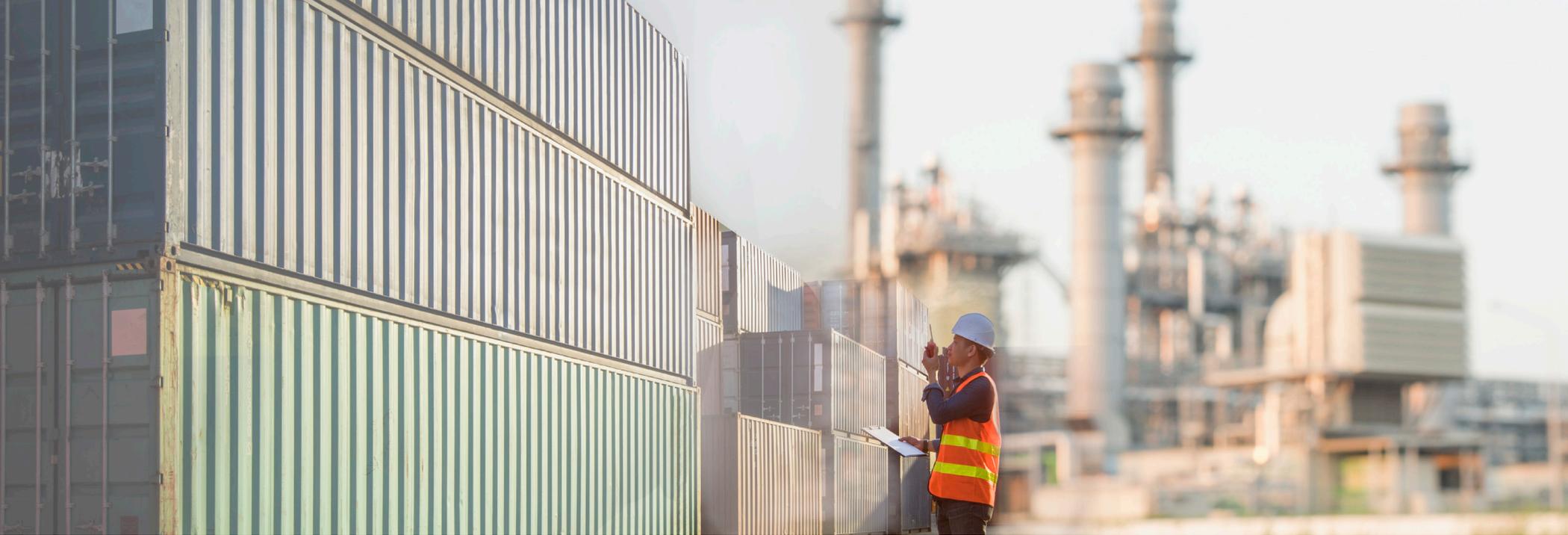




Predictive Maintenance Takes on Operational Risk

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As companies manage increased risk that transcends the entire organization, digital transformation provides a way to tear down siloes and understand how each change impacts every aspect of the business. With advanced technology that enables deep insight into risk factors across the enterprise, companies can significantly increase safety, profitability and sustainability performance.

Introduction

In the wake of the COVID-19 pandemic, the “double whammy” of supply-side and demand-side shocks sent producers scrambling to evaluate new business models and quickly align production with the new market realities.

This global shift is driving a series of rapid changes to production slates and rates for companies around the world. These shifts are creating more safety and environmental risks that must be anticipated and managed,

along with the obvious economic concerns. Put another way, everything is changing — and in production environments, change means increased risk. Plants are being operated in ways they haven’t been before, and that makes safety a greater concern than ever.

At the same time, operating companies have been shouldering more of this risk, as insurance coverage is not as readily available, and even when it is, the cost of coverage has doubled in some cases. Those price increases come on the heels of a dramatic rise in the rate of accidents in refining (a 4x increase over the rates in 2015, with more than 2,000 total incidents recorded in 2019).

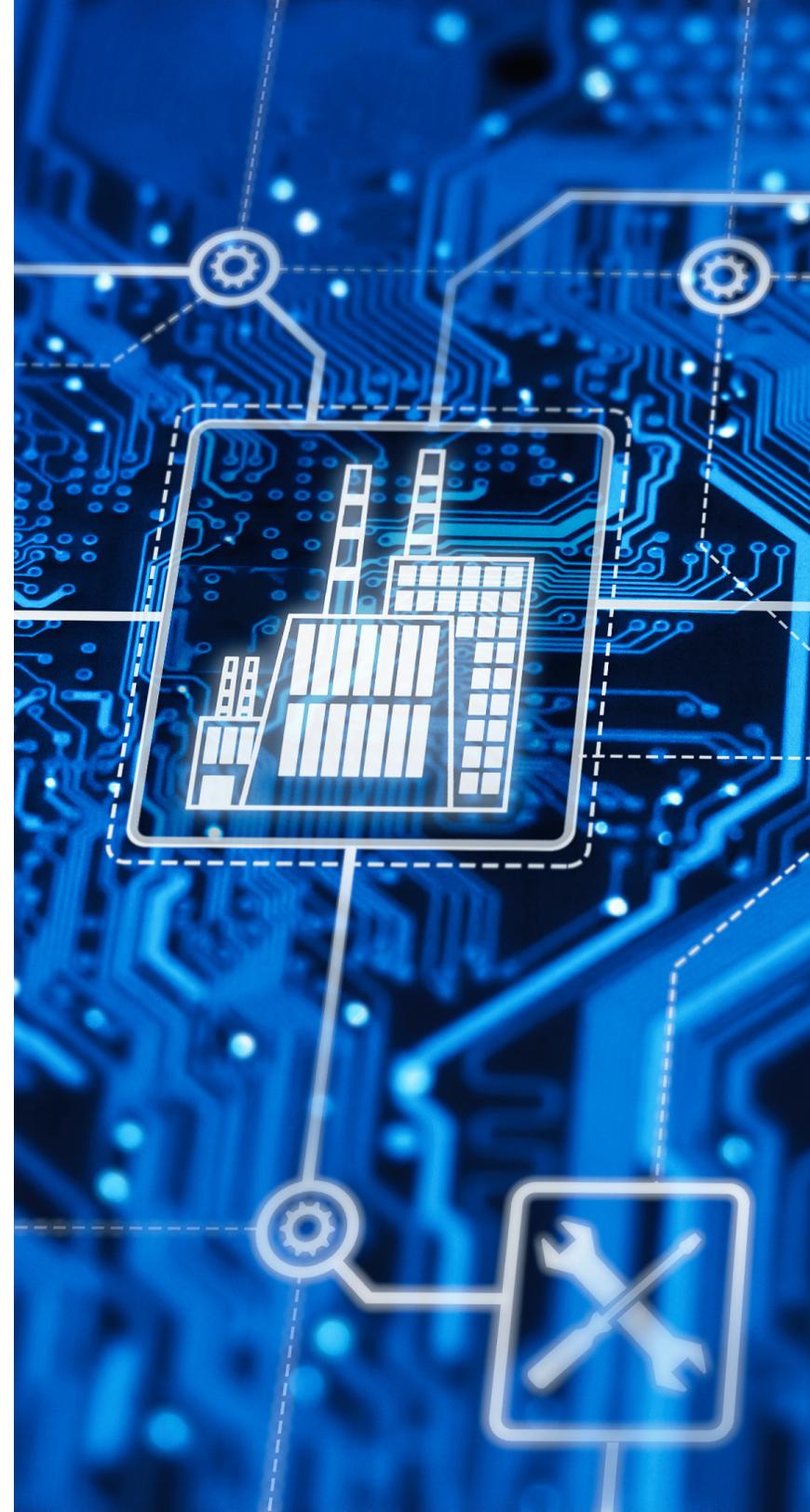
All of this is putting a magnifying glass on how companies monitor and manage production processes.

For an example of the money at stake, the losses from the 2019 fire that shut the Philadelphia Energy Solutions refinery (previously the largest oil refinery on the U.S. East Coast) are estimated to total \$1.25 billion USD. Globally, the refining and petrochemical losses during the last three years have amounted to over \$12.5 billion USD, which is more than double the premiums paid to insurers over the same period.

So while capital-intensive organizations have traditionally used insurance as a tool to transfer risk, it's no longer such a simple option. Insurance capital won't allow risk to be transferred at current premiums, and because insurance coverage isn't as easy to obtain, operators now have to own balance sheet risk that they could previously offload. Given this dynamic — and the challenges that are coming with a volatile, uncertain, complex and ambiguous (VUCA) global market — operating companies need to implement mitigation approaches that enable them to minimize risk regardless of conditions.

Today's advanced technology offers a way to mitigate equipment problems across the enterprise, delivering a full spectrum of benefits that **maximize the safety and reliability of operations to reduce risk, improve productivity and achieve sustainability goals.**

By reducing risk, an effective technology implementation strategy could literally pay double dividends: **lower insurance premiums and improved margins** (achieved by reducing unplanned downtime and associated events). And with the implementation of technologies like the industrial internet of things (IIoT) and advanced analytics, newer types of insurance coverage could also become possible. By accurately estimating the size of any loss due to downtime, along with identifying the root cause, premium payouts could actually be accelerated so that they occur in the fiscal period in which an incident occurs.



There is also another potential payoff for implementing risk mitigation technologies, as institutional investors are increasingly incorporating environmental, safety and governance issues into their investment decisions. Technology that works to eliminate the surprise of unplanned downtime enables companies to minimize the most dangerous plant conditions and reduce the amount of gases released into the environment.

“We watch the environmental side of the portfolio. For us it’s a risk framework,” Marcie Frost, CEO of the California Public Employees’ Retirement System (CalPERS), told CNBC.¹ “We need to understand the risks our capital is taking on through the long term. That’s through engagement, that’s through disclosure and transparency about data that we can make evaluations on whether those companies are managing those risks appropriately and whether we should be continuing to invest in those companies.”

Essentially the technology can make the unknown, known. All of these capabilities are available through purpose-built solutions that operate together and enable seamless risk management across the entire plant.

Next-Generation Predictive Maintenance: What Does it Deliver?

- Quantified analysis of exactly how much an event impacts revenue, providing a clear target for the technology
- Significant safety and sustainability improvements by avoiding unsafe conditions
- Optimized margins via improved reliability that significantly reduces unplanned downtime
- Continuous improvement opportunities around operational risks from unplanned downtime.





A Changing Work Environment Increases Operational Risk

In the new work environment, the significant reduction in on-site staffing means there are fewer personnel available to watch for signs of trouble at production facilities. As a result, many companies have scrambled to implement systems to support remote workers — which means digital solutions are becoming increasingly critical for looking at and managing data to achieve production goals.

With fewer eyes on the process, operators need the earliest possible warning that a process is drifting or a machine is failing. They need guidance — real guidance — on actions to take to correct the drift or mitigate the machine downtime.

But even without the pandemic crisis, significant risk issues would still exist. The risk profiles of companies operating today had already become radically different than they were just a few years ago. Many factors have driven the changes, but the underlying reasons can be attributed to global VUCA conditions that have been building for several years.

The increasing level of risk that companies are shouldering means they need to think about risk management in new ways, and leading organizations are finding the answers through technology.

Creating a Better Way to Monitor Operational Risks

Erwann Michel-Kerjan, managing director of Wharton's Risk Management and Decision Processes Center, has long seen a new risk architecture emerging for organizations. "Things are getting faster, and therefore we need to make decisions faster, but based on information that we often don't have," he said.²

Advances in analysis and modeling can provide a complete, accurate system-level assessment of current risks and underlying costs.

While that is true in certain situations, there are also specific areas where the information available can be improved. For insurance underwriters, they typically rely on actuarial tables that are constructed using large amounts of data that provide the information they need to calculate risks. However, estimating risks to industrial assets requires a totally different approach.

That's because there are only just over 700 refineries operating in the world today, and of those 700, there are several varieties — from simple topping refineries to the more complex cracking and coking refineries. So there are simply not enough “similar” refineries in this pool to construct meaningful risk tables.

This is where advanced technology comes into play. A number of operating companies are now addressing their risks with **predictive maintenance software that enables early detection of potential equipment failure and downtime events**, so they can avoid the startup and shutdown periods where most accidents happen. This intersection of big data, IIoT and advanced analytics also gives insurers a real-time, empirically based risk profile of a refinery, which they can use to calculate premiums.

Asset	Reformer
Consequence	Shutdown & significant downtime
Impact on Personnel Safety	Highly significant
Impact on Environment	Significant
Impact on Reliability Productivity & Financials	Aspen Mtell activity protects the asset, avoiding downtime which would typically result in 7 days of lost production.

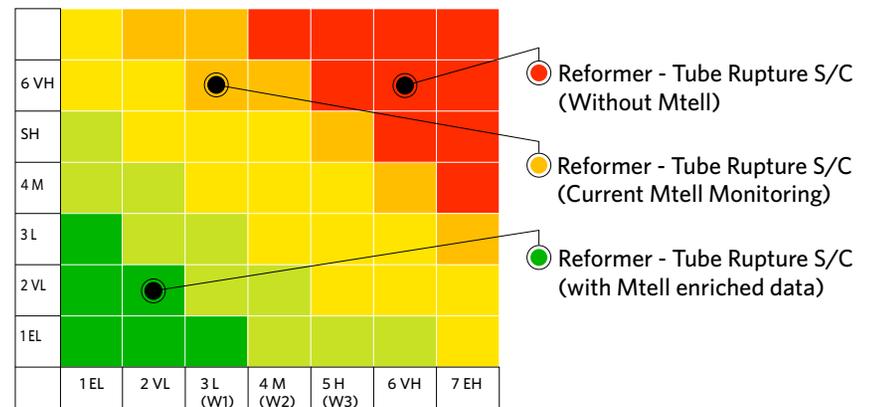


Figure 1: Moving risk down and to the left with predictive maintenance

Companies that have adopted this technology are taking advantage of the longer warning period to change how they respond to potential downtime. They are gaining the flexibility to choose when to do the maintenance based on the overall economic projections, which consider the operating, maintenance and supply chain implications of any potential asset downtime.

Importantly, those implementations are actually paying for themselves in operational and maintenance savings. Companies that have deployed predictive maintenance — even across hundreds of assets and multiple sites — are recouping their investment within just a *few months*.

Advanced Technology Offers a New Approach to Risk

What companies need in today's environment is a holistic, integrated view of risk to understand how an adjustment or change to one area of the facility can have a wider impact on other parts of the business.

Advanced technology solutions allow operators to make changes to improve plant safety and increase profit — with full confidence that they're not increasing risk.

Predictive maintenance provides more advance warning, but that's just a single piece of the risk puzzle. With each new alert, operators, engineers and managers need to determine its potential impact — they need a complete understanding of the urgency with which they have to act. That means having a quantitative view of the impact on production, environmental compliance, safety and asset effectiveness.

Using technology that leverages flow-based Monte Carlo simulations and provides a rich interface for parametrizing the simulations, personnel can almost immediately begin remediation of an event at its earliest detection. The predictive maintenance solution provides metadata about the alert to the production simulation system, which, in turn, produces an estimate of the impact to all stakeholders.



Advances in analysis and modeling can provide a complete, accurate system-level assessment of current risks and underlying costs (OPEX and CAPEX). Simply stated, the software can predict the future performance of any complex system and figure out how to keep it running at the highest levels.

These solutions look at the entire operation holistically and give stakeholders a “confidence value” as to chances of meeting selected goals. Using these tools, decision-makers can maximize the economics and safety of business decisions by going beyond the equipment level and accurately predicting future asset performance of the whole system. And in the event of unplanned downtime, the technology can also be used by insurers and operators to calculate losses so they can agree on how much was actually lost and determine the right payout.

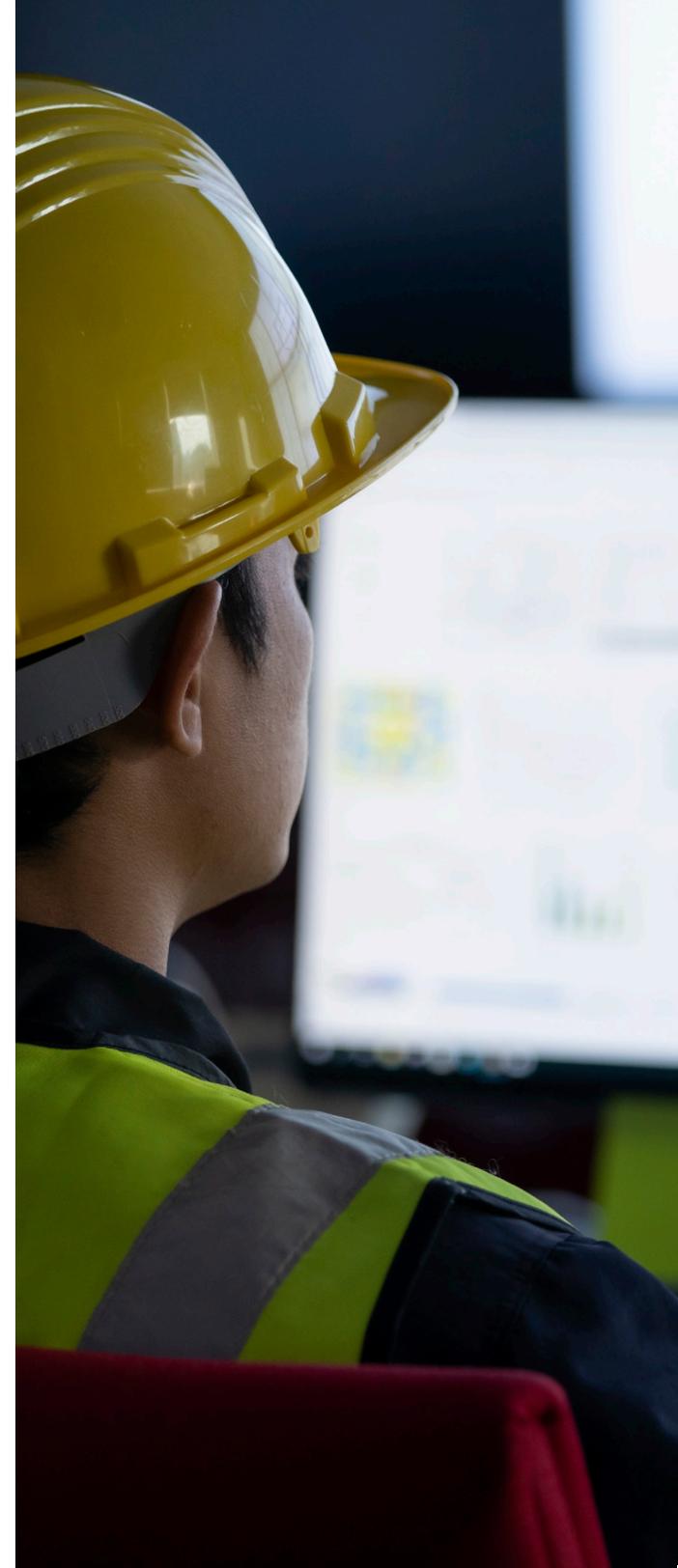
With this system-wide view, management can prioritize work and resources based on a comprehensive understanding of the risks. The goal is to transform risk from a static and sparse view to an engineering- and logistics-based view that is updated in near-real time.

Making an Impact on the Bottom Line

The insurance industry is now also recognizing the value of reducing risk. AON, a global insurance underwriter that provides operating policies, business interruption insurance and other products for capital-intensive businesses, has started promoting technology solutions for predictive maintenance and decision support as a way for companies to improve their risk profile — and lower their insurance premiums.

Essentially, they’re offering the equivalent of the “better driver discount” for making operations inherently more safe and reliable. And with annual premiums costing tens of millions of dollars in some cases, even a small-percentage discount represents significant savings.

These technologies also deliver capabilities to optimize margins via improved reliability that significantly reduces unplanned downtime, which costs oil and gas companies an average of \$38 million a year — and up to \$88 million a year in the worst-case scenarios.³



At chemical plants, The cost of unplanned downtime ranges between \$10,000 to \$250,000 *per hour*,⁴ so there's a considerable opportunity available by investing in reliability.

Just eliminating a portion of the abnormal events that rob an operation of productivity can add millions of dollars to the bottom line. And when companies are able to quantify exactly how much any particular event affects revenue, they know exactly where to target their technology strategy for maximum impact without increasing risk. And this is all in addition to the safety and sustainability improvements that come from avoiding unsafe conditions.

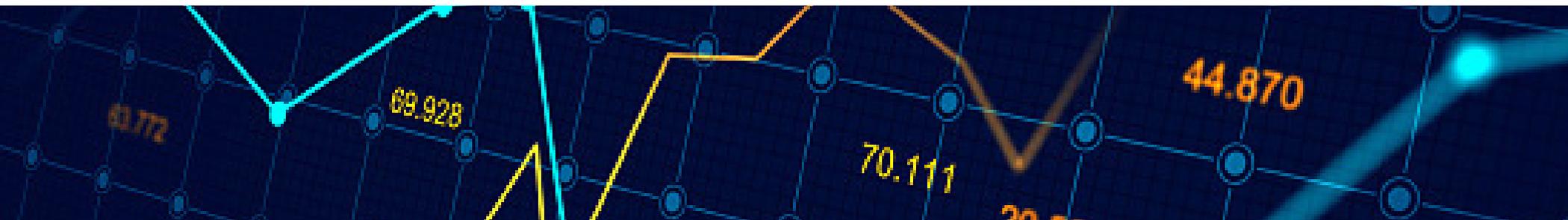
Companies today find themselves in uncharted waters, and the only certainty is that life will be different in this VUCA world. Predictive technologies will play a central role in managing the risk that comes with this new environment while also giving companies the financial advantages they need to thrive even in the most challenging market conditions.

Through the use of predictive maintenance solutions, companies can not only reduce the risks to human life, but they can also reduce the risks to the environment. And by taking those early-intervention actions, they reduce the risks for shareholders and stakeholders as well. With the trifecta of benefits — reduced lost production opportunity, decreased compliance risk and improved safety — this is technology that represents a true investment in the future.

Reducing Risk, Reaping Rewards in the Real World

These are a few examples of how companies are getting results from their investment in predictive maintenance:

- A mining company deployed the technology on assets across 7 mines, and has **identified savings opportunities of \$3M USD** at one site alone.
- A major energy producer deployed the technology on over 250 assets across 12 refineries and 6 pipelines and **saved \$35M USD in production loss and environmental impact** by preventing a pipeline rupture.
- A global pharma company is rolling out the technology across 30 facilities and has already **identified \$16 M USD in benefits** at the first 10 sites.
- A metals and mining company **avoided over \$2M USD in costs** in just one year, while also improving safety and environmental performance.



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. Visit [AspenTech.com](https://www.aspentech.com) to find out more.

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¹“Squawk Box,” CNBC, June 18, 2020
²Re-thinking Risk Management: Why the Mindset Matters More Than the Model, Knowledge@Wharton, April 15, 2009
³The Impact of Digital on Unplanned Downtime, Baker Hughes, October 2016
⁴Asset Performance Management: Blazing a Better Path to Operational Excellence, Aberdeen Group, November 2017

