

Predictive Maintenance for Downstream Oil & Gas

How predictive maintenance solutions can transform downstream oil & gas operations and eliminate unplanned downtime



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Leveraging the Industrial Internet of Things

The downstream vertical in the oil and gas industry operates at a high level, with well-instrumented environments and the adoption of human-centric design. However, there's a real opportunity for the downstream industry to integrate sensors, artificial intelligence, and machine learning in new ways to enable truly predictive maintenance. And the benefit will be transformative.

Predictive maintenance, or PdM, is critical in industries that rely on physical assets operating without interruption, the failure of which results in diminished revenue and reduced productivity, while - most crucially - affecting health, safety, and the environment. Downstream fits this bill precisely, from the reactive, corrosive, flammable, and/or toxic chemicals involved to the potentially catastrophic implications of a refinery leak or explosion.

Under PdM, the rate of equipment failure declines. The risk of catastrophic failure decreases. Operation and maintenance costs plummet and productivity increases. Assets stay operational for longer extended periods, no longer subject to arbitrary maintenance schedules that don't reflect the actual condition of equipment. Unplanned downtime becomes the rare exception – not the norm.

Through Industrial Internet of Things (IIoT) innovation, forward-thinking downstream industry leaders will be able to take operational efficiency to its peak. This includes delivering safer, smoother, and more productive operations, from distillation and hydrotreating to cracking or alkylation to storage and transportation.

When predictive maintenance is embraced, transformation occurs. It requires:

- Using existing sensors and/or instrumenting assets with sensors
- Capturing a constant stream of data on asset conditions
- Analyzing that data in real time
- Providing insights and real-time alerting
- Optimizing recommendations for planned maintenance

The pages that follow offer a closer look at the current state of PdM, the way it works, its benefits, and how downstream leaders can harness predictive maintenance.



Taking a Closer Look at Predictive Maintenance

Despite its technical sophistication, the downstream oil and gas sector hasn't yet fully adopted predictive maintenance. Many downstream companies rely on condition-based maintenance (CBM), a technological ancestor to PdM. However, this does not provide the advance warning necessary to carefully orchestrate shutdowns and mitigate cost.

In a recent study, 41% of plant managers still rely on this reactive, condition-based approach to maintenance, which enables diagnostics ("This part is failing") but not proactive planning ("This part has an estimated 180 hours of remaining life."). This represents a missed opportunity to create a sustainable and easily implemented maintenance schedule that minimizes interruption to operations. And for those repairs or replacements that necessitate interruptions, PdM makes it possible to minimize their impact with longer lead times for planning.

In its traditional form, PdM requires relatively large data sets to make accurate predictions of asset health. For many companies, there's plenty of data. It's just a matter of refocusing on asset health (versus process control) – or integrating the data in new ways to achieve more useful insights. In other cases, some downstream companies may not have the rich data that extends back years to help fuel machine learning applications make reliable predictions.



Finally, many PdM solutions don't predict failures with more than a two-week lead time. This may be perfectly fine for some assets (e.g., fans). However, that lead time will not work for elements that require months of planning and preparation or whose failure would pose substantial risk, like repairing corroded pipes or replacing equipment like crude tower overheads. Part availability can also be an issue – many are typically not stocked, requiring a special order, subject to the unpredictability of the supply chain.

What's the incentive for downstream oil and gas leaders to overhaul their maintenance operations with PdM in mind? In a word, efficiency. According to one study¹, less than 25% of oil and gas operators are using proactive maintenance strategies – but those that do save \$36M in unplanned downtime costs as opposed to those embracing reactive maintenance. Other [statistics are equally compelling](#):

- 1% unplanned downtime can cost an oil and gas company over \$5M annually.
- The average offshore oil and gas company experiences almost a month of unplanned downtime annually, with costs ranging from \$38M to \$88M.
- The U.S. Department of Energy is bullish on the benefits of IIoT, saying "solutions for equipment maintenance helps oil and gas companies increase production output by 25%, achieve a 30% reduction in maintenance costs, and a 45% reduction in equipment downtime."

¹ "Prognostics and Health Management in the Oil and Gas Industry – a Step Change," Moir, K., Niculita, O., and Milligan, W. PHM Society European Conference, 4. 2018.

3 Reasons Why the Time is Now for Predictive Maintenance



#1 Make use of what you have

Predictive maintenance takes assets you've already invested in, makes them 'smart', and puts your data to work for you. Sensors transmit health information, physics-based models, and machine learning algorithms do the heavy lifting of analysis and prediction, while an intuitive software interface makes short work of understanding what to do next. Simply use these data-powered insights to create and implement a comprehensive maintenance plan.

#2 Lead, don't follow

Predictive maintenance is the future de facto standard for maintenance in industries reliant on manufacturing and processing. McKinsey's report on the Internet of Things² puts annual cost savings as a result of predictive maintenance between 10% and 40%, with a yearly economic impact of up to \$600B across sectors. Plus, a [recent survey](#) showed that one in five companies have started deploying advanced solutions while nearly half are developing implementation plans.

As sensors get better and cheaper and algorithms get increasingly sophisticated, it's just a matter of time before PdM becomes table stakes for companies focused on improving uptime, supporting environmental health and safety, and reducing costs. Why not be among the first to lead the way?

#3 Eliminate your most common challenges

At best, unplanned downtime is a costly hassle that sends productivity down the drain. At worst, it's the consequence of an incident that severely impacts human lives and environmental health and safety while eroding the public's trust in your brand, inviting regulatory scrutiny, and causing long-term reputational damage.

² "The Internet of Things: Mapping the value beyond the hype." McKinsey Global Institute, 2015.

The Novity Difference

Novity takes a different approach to predictive maintenance, marrying physics-based equipment modeling with machine learning to achieve a more than 90% accuracy rate, well above the standard industry range of 50% to 75%.

Novity is powered by our TruPrognostics™ engine, which is designed to transform PdM and offers three key advantages:

- **Predict near-term threats to industrial production.**
What merits your immediate, most urgent attention?
- **Understand the health status of all your monitored assets – in real-time all the time.** From fluid catalytic distillation units to furnaces and heat exchangers, you'll know precisely how every asset, large and small, is functioning.
- **Plan operational maintenance on your timetable.**
The path to eliminating unplanned downtime starts with this accurate forecasting and subsequent intelligent maintenance schedule.



Overcoming Barriers to Deploying Predictive Maintenance in Downstream Operations

Leveraging a foundation of discovery to understand your operations at a new level

Analysis and predictions aren't possible without a clear, comprehensive understanding of precisely what downstream operations entail, down to the most fine-grained detail. Whether it's pressure vessels or fired heaters, regenerative heater exchangers and evaporators, or flue gas turbines and petroleum pumps, every safety- or mission-critical asset must be identified. We can help you build upon your existing foundation with an initial discovery effort to confirm what's known, while identifying opportunities that offer a more expansive understanding of your assets.

Evaluating key foundational elements as a crucial first step

We closely review:

- Potential failure risks and consequences for production
- Maintenance and failure histories for each critical asset
- Existing maintenance processes
- Redundancies
- Failure modes that cause the ultimate equipment failure
- Installed sensors to see which failure modes are presently observable – and which require additional sensors

This investigatory effort results in a diagnostic report that is the bedrock for a Novity predictive maintenance plan, ultimately driving downstream companies much closer to zero unplanned downtime.

No need for massive historical data sets

Most PdM solutions leverage machine learning in a way that necessitates massive data sets, gleaned from identical assets, to build predictive models.

While we use advanced machine learning, Novity leverages physics-based models of essential assets that enable accurate prediction of asset health without requiring substantial amounts of data. We also instrument critical assets with new, more sophisticated sensors. By using three disparate – but related – technical approaches, we're able to increase prediction accuracy and give customers the data-backed insights needed for reliable operation.

Advance warning in months, not weeks

The typical PdM approach gives failure predictions in short, fast-approaching increments – typically, a few days before failure occurs. However, complicated repairs or part replacements sometimes take months to plan and source. External events, like a global pandemic or natural disasters, can add an unwelcome, [additional layer of complexity](#), with tangled supply chains impeding parts delivery. Thus, it's more important than ever before to maximize advance warning – before critical parts failure occurs.

Novity makes it possible to plan maintenance, procure parts, and schedule downtime on an extended timeframe through:

- Physics-based models that can quantify asset damage using specific fault mechanisms
- Advanced sensors that pinpoint early signs of damage that would otherwise be undiscoverable through standard process control sensors

Definitive data security

If downstream clients want to protect intellectual property data from competitors, Novity can enable it. Built on a leading-edge web services architecture, our solution makes it simple to protect and scale as new assets come online for monitoring and as more end users access the system. This ensures information is constantly updated – and security is assured as the system is tested regularly against all known cyber threats.

Next Steps

Novity – a company born out of PARC, the innovation arm of Xerox – brings a team with substantial expertise and a powerful history of developing model-based reasoning and artificial intelligence that captures the subtleties of real-world environments. An extensive library of pre-built, physics-based models ensures a fast ramp-up for those companies that are starting fresh from a data perspective, without legacy data to draw from. And we bring a unique perspective, with a parent company that – like downstream clients – has extensive logistical experience developing and moving products around the world.

It's experience that, combined with our depth of innovation, gives us a uniquely supportive lens to truly partner with downstream industry leaders as you leverage deeper asset management to enter a new era of predictability, cost savings, and consistent productivity.

To start your journey to zero unplanned downtime, contact us at: info@novity.us





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