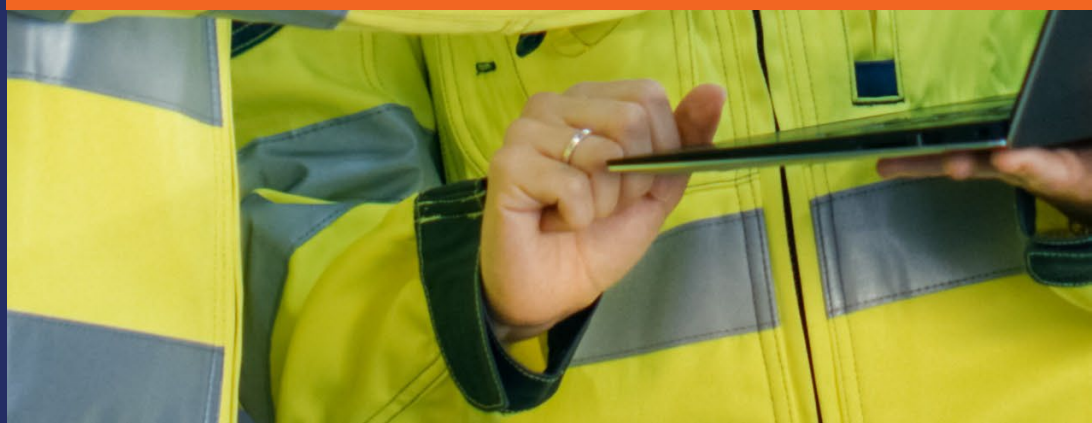
novity™

Novity TruPrognostics™ Engine – a path to Zero Unplanned Downtime



WHAT ARE IoT AND PDM?

The Internet of Things (IoT) has transformed life as we know it. Through connected networks of sensors, software, and other technologies, everything from our homes to our cities has become "smarter" because they can transmit and receive information as well as act on it. The power of IoT is rapidly making its way into industrial enterprises and providing greater capacity to the chemical and oil and gas sectors. Through Predictive Maintenance (PdM) solutions, previously inanimate objects that teams of engineers and plant operators had to continuously check can now provide the information needed to make assessments and plan maintenance accordingly.

With unplanned downtime costing industrial manufacturers an estimated $50 billion annually, according to Deloitte, the field of PdM is poised to catapult the sector into the ever-promised era of Industry 4.0. The convergence of multiple technologies such as real-time analytics, big data, machine learning, commodity sensors, and embedded systems is leading to less downtime, more productivity, and higher profitability.

A recent survey by Novity found that while interest in PdM is growing, the majority of process industry companies are still very behind. In fact, three-quarters of respondents said they had no IoT or predictive maintenance in place, and are still using antiquated maintenance practices such as visual inspections which rely heavily on an inspector's expertise or instrument readouts. However, many forward-looking companies are looking to deploy advanced analytics to become more efficient in asset utilization, with almost 50% of organizations planning to increase their adoption of PdM in the next 2-3 years.

Uptime improvement is the #1 driver for adopting predictive maintenance initiatives. Better prognostics accuracy reduces the frequency and duration of unplanned downtime events, leading to increased profitability and mitigating environmental and safety risks.

ASSET MONITORING

Condition Based Monitoring (CBM) is the most common type of asset monitoring method used in the industrial world. It is a type of maintenance practice that uses sensors to measure the status of an asset over time while it is in operation. Manufacturers can use this data to establish trends and make maintenance recommendations.

Another commonly used method for managing asset health is Reliability Centered Maintenance. RCM comprises a set of best practices that establish safe minimum equipment upkeep levels in the context of specific operations. However, both methods fall short, with RCM only recommending maintenance actions on a preset schedule and CBM recommending maintenance based on asset health status and historical trends. Neither method is able to predict failures or estimate remaining useful life in the context of specific operations.

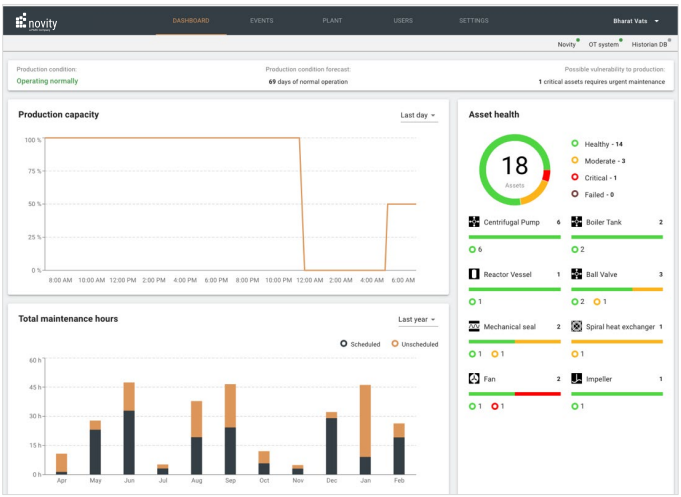
PdM does everything that RCM and CBM do, but also calculates a health index and predicts the expected life under different load conditions. Utilizing advanced machine learning and prognostics, PdM can deliver major breakthroughs for process industries such as oil and gas, and chemicals.

- Keep plant operative and maximize revenue
- Know equipment failure in advance through higher prediction accuracy
- Improve production and product quality (improved OEE)
- Reduce unplanned downtime
- Improve plant safety and minimize risks – employees and plant assets
- Reduce inventory (standby assets and their spare parts)
- Integration of IT Systems (servers, protocols, history) and OT Systems (SCADA, DCS, PLC)

WELCOME TO ZERO UNPLANNED DOWNTIME – COURTESY OF NOVITY

With four industrial chemical plants in operation across the United States, Xerox has felt the pain of unplanned downtime firsthand. We've taken this experience and our research expertise from our Palo Alto Research Center (PARC) in AI, sensors, and manufacturing to develop a solution that provides exceptionally accurate predictive maintenance to the market. Novity TruPrognostics delivers on this vision with a combination of machine learning and physics-based models of equipment.
By using our library of pre-built models, Novity is making predictive maintenance accessible even to those who lack the massive amount of historical data required by traditional solutions.

The Novity Dashboard



ASSET CLASSES

Across a diverse group of industries, the critical components of plant operations fall into a common set of electrical, mechanical, and electromechanical types. These include pumps, valves, fans, reactors, vessels, heat exchangers, filters, and homogenizers, typically in addition to a small number of highly custom pieces of equipment.

During operations, these assets are subjected to high pressures, large temperature variations, mechanical stresses, and corrosive environments that limit their useful life.

Novity's TruPrognostics engine is focused on these asset classes and using advanced algorithms to lead detection of potential failures such as corrosion, fouling, leaks, and other common equipment issues.

ASSET CLASSES	FAILURE MODES	IMPACT
Reactors	Leaks, explosions, fouling	Safety hazards; process interruption; cleanup; product quality impact
Pumps	Bearing failures, blade failures, leaks, cavitation	Safety hazards; process interruption; cleanup
Fans	Bearing failures, blade failures	Process interruption
Valves	Sticking, leaks, cavitation	Process interruption
Heat exchangers	Fouling	Process interruption; product quality impact
Filters	Clogging	Process interruption; product quality impact
Pressure seals	Leaks	Process interruption; product quality impact
Compressors	Bearing faults, valve faults, mechanical problems	Process interruption; product quality impact

ADVANCING PREDICTIVE MAINTENANCE

The PdM solutions of today have made great strides in helping plant operators plan for equipment maintenance. However, they are still not where they need to be. At best, existing solutions only give a few days' lead time to act on their predictions. Yet PdM failure predictions of one or two weeks in advance are not adequate for most chemical plants. To extend the time horizon on failure predictions, Novity has developed a hybrid approach, which is a major advancement for the field.

Novity TruPrognostics is a predictive maintenance solution developed by the world-class PdM scientists at PARC. Our unique hybrid approach blends physics-based models with advanced sensors and delivers industry-leading prediction accuracy (often 90% + more than three months ahead of failure), even under circumstances where minimal failure data is available. Our always-on, real-time decision support tool informs users exactly when a piece of critical equipment will fail, saving potentially millions in lost production.

TruPrognostics leverages:

- Physics-based models that target specific fault mechanisms to calculate hidden damage parameters
- Deployment of advanced sensors to allow observation of very early signs of damage that are not identifiable using analysis with ordinary process control sensors

A PDM SOLUTION THAT DELIVERS RESULTS

With these advances, Novity's TruPrognostics engine can predict critical asset failures months in advance, providing operators ample time to procure spares and schedule downtime to minimize the impact on production.

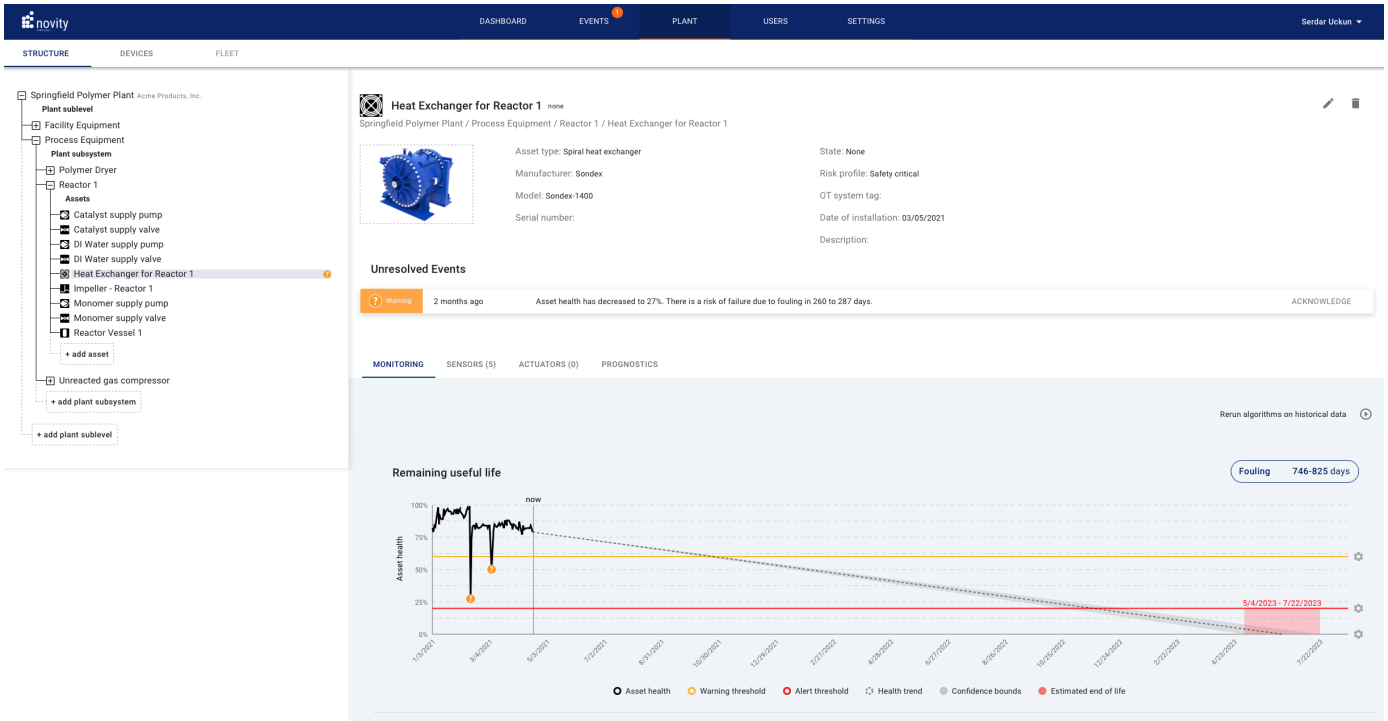


Image shows the remaining useful life of heat exchanger

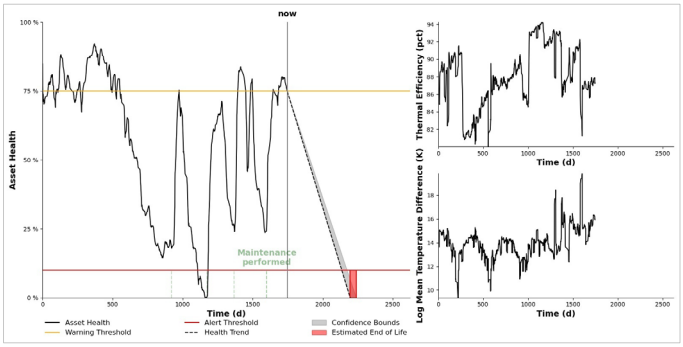
Our growing library of pre-developed models captures the most common failure modes and operational attributes of critical production asset classes, enabling accurate prognostics very soon after the deployment.

A XEROX CASE STUDY: HEAT EXCHANGER FOULING

As a global leader in workplace technology, toner is a critical component of Xerox's business. One of the key pieces of equipment used in the production of toner is the spiral heat exchanger, which is often subject to fouling. A major challenge is that fouling is not directly observable in a sealed heat exchanger system; instead, only becoming apparent through observation of long-term trends in process parameters and end-product specifications. While cleaning cycles generally help reduce fouling, finding the right cleaning regimen for each cleaning cycle might require several trial-and-error runs.

To address the heat exchanger fouling problem, Novity scientists devised a physics-based model to estimate the fundamental properties of the heat exchanger using external observations such as slurry temperature and flow rates. When historical data is analyzed, the estimated internal process parameters, the progression of fouling, as well as the impact and relative strength of cleaning cycle regimens are immediately apparent to operators. With our TruPrognostics engine, Novity helps plant operators determine an ideal cleaning regimen for spiral heat exchangers while keeping product quality at the forefront.

In the chart below, each dot represents an estimated thermal resistance for a heat exchanger, which is calculated for each product batch. As the chart shows, the fouling metric increases with the number of batches and allows extrapolation to an upper threshold where the process no longer meets quality criteria.



Thanks to TruPrognostics, the calculated fouling level can be predicted far in advance, and plant managers can schedule cleaning at a time of their convenience. By giving plant managers the ability to see into the future, Novity optimizes inefficient processes, eliminates excess and unnecessary downtime, and ultimately delivers better bottom line business metrics.

BETTER PROGNOSTICS ACCURACY LEADS TO LESS DOWNTIME, MORE PRODUCTIVITY, AND PROFITABILITY.

Ready for Zero Unplanned Downtime? Head over to Novity and connect with us. https://novity.us/
info@novity.us

novity™