



A DIGITAL TRANSFORMATION JOURNEY: FROM VIBRATION DATA TO CAPEX WITH THE PI SYSTEM™

In 2016, Uniper embarked on a journey towards digital transformation. With numerous power plants and assets scattered across multiple locations in Europe, it was critical to use data to prevent catastrophic outages and make informed maintenance and repair decisions. A PI System user since 2000, Uniper opted to leverage the solution for everything from understanding vibration data to maintenance strategies for CAPEX planning. With this newfound visibility, the organization used operational data and the PI System to move closer to digital transformation—and achieve great results.

GOOD VIBRATIONS

In the world of energy generation, equipment failures are dangerous events that result in unplanned outages and leave customers out in the cold. Manually detecting performance issues across a wide range of assets before they become catastrophic is no small feat. However, assets are continually sending out health indicators in the form of vibrations. To capture those vibrations, Uniper uses a suite of vibration analysis tools called Tiresias. Vibration boxes scattered across sites gather data and send it back to Uniper's servers. But tuning into vibration data is not enough, and context is needed to understand the root cause of any deviations.

Using the PI System and a propriety anomaly detection algorithm called SpheriCAL, Uniper mapped pressure, temperature data, and more

out of the PI System and into Tiresias. By looking at vibration data in the context of other operational data from the PI System, engineers could understand root cause of any deviations and predict failure points. This condition monitoring solution was so successful that it was rolled out across all business units, including gas, coal, and solar. "We implemented the [PI System with SpheriCAL] everywhere because every time we implemented it, we got immediate value back," said Ty Burrige-Oakland, Product Manager at Uniper, at PI World London 2017.

A MODEL OF COMMUNICATION

As Uniper deployed the PI System and SpheriCAL company wide, they needed to account for variances in equipment and instrumentation. No models were identical.

CHALLENGE

Needed context around vibration data to optimize maintenance strategies.

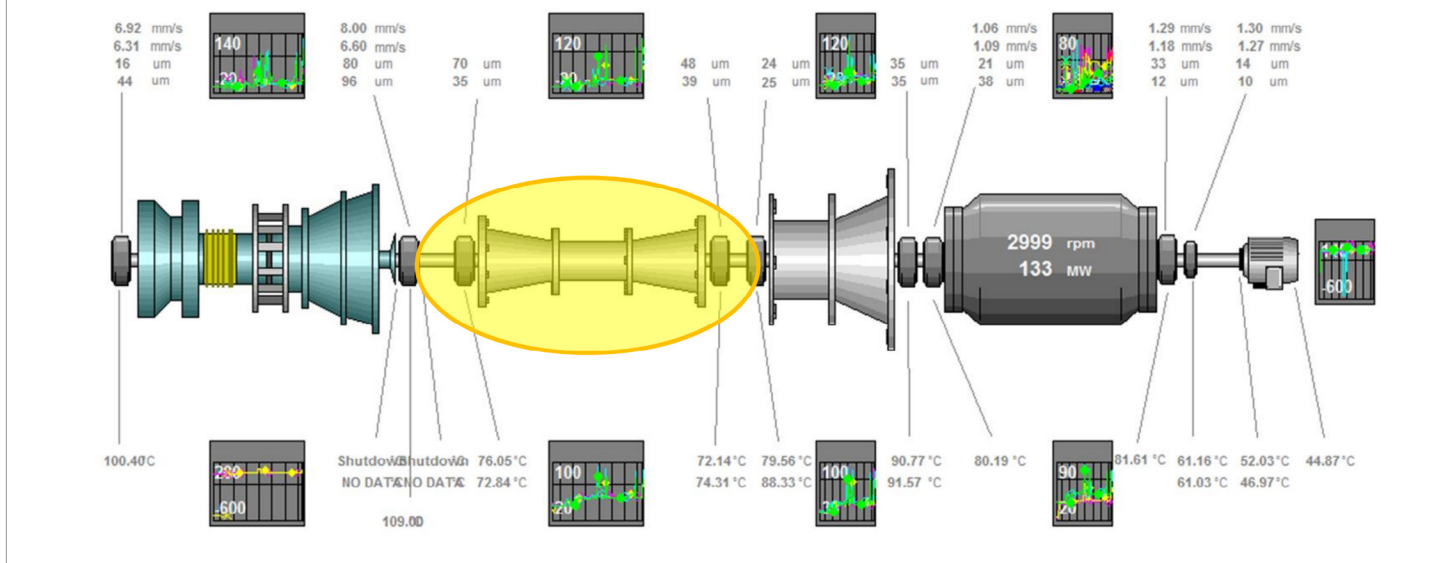
SOLUTION

A single data infrastructure that delivered enterprise-wide operational visibility across all plants.

BENEFIT

Performed a critical turbine repair and reduced CAPEX expenses by 16%.

DYNAMIC OPERATION



As part of Uniper's SpheriCAL solution, the PI System captures and contextualizes vibration data from turbines to detect performance issues and prevent unplanned outages.

To predict failure points across assets, the team built the SpheriCAL VirtualAnalyst system to normalize data and surrounding metadata and make the models talk to each other. As the number of models grew, the system began to learn and change, creating an artificially intelligent program. "We built a system that is getting smarter as we are getting smarter," said Burrige-Oakland at PI World Barcelona 2018.

Next, the PI System and SpheriCAL were connected with Beran, a diagnostic monitoring platform that uses vibration and pressure sensors for turbines. Using this combination of solutions, Uniper detected that something was out of balance in a single shaft thermal turbine. Immediately, PI System data indicated the shaft on the rotor was bent. The team attempted a repair, but vibration levels increased and data showed the rotor was beginning to permanently bend. Faced with a six-month repair cycle, they used PI System data and SpheriCAL insights to perform an in-situ trim balance to temporarily get the unit back online. Over the next several months, they continually monitored the unit's condition in the PI System, keeping the turbine online until the OEM could make a permanent repair.

WELL-LAID PLANS WITH THE PI SYSTEM

While vibration data was a critical part of Uniper's digital transformation journey, the overarching goal was always operational excellence, particularly in relation to CAPEX planning. Operational excellence is rooted in asset management, which starts with effective maintenance strategies. In 2017, Uniper created D@G, or digitalizing at generation, to enable digitalization of asset management. Ultimately, this would allow them to use operational data for maintenance strategy planning, but first Uniper needed to do some housekeeping.

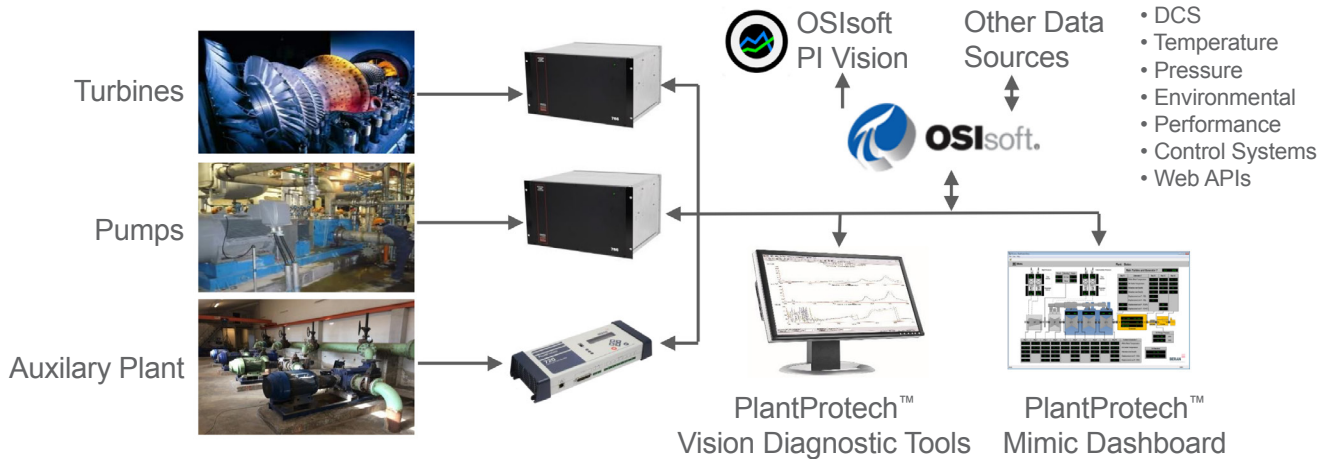
Initially, Uniper migrated its sensor-based data across its entire organization into a single PI System, standardizing all data streams into a single data model by leveraging [Asset Framework](#) (AF), the contextualization layer of the PI Server, across all sites. Using smart sensors and mobile solutions to mitigate costs, the team installed sensors in old power plants to wirelessly bring plant data into the PI System. Through standardized KPIs and the PI System acting as the single IIoT solution, Uniper was ready for the next step: optimization.

PARTNER:

BERAN



BERAN PLANTPROTECH™ SYSTEM



Uniper coupled its SpheriCAL solution with Beran, a diagnostic monitoring platform that uses vibration and pressure sensors for turbines.

MAINTENANCE STRATEGY PLANNING DRIVES CAPEX REDUCTIONS

Planning is a critical part of optimizing maintenance processes and ensures that Uniper is only spending what's truly needed. "We only change the tires of our car when they really need to be changed," said Stephan van Aaken, Vice President of Asset IT at Uniper, during PI World San Francisco 2019. Relying on the PI System, the team introduced a maintenance strategy planning (MSP) tool. Within MSP, each piece of power generation equipment has a specific maintenance strategy as determined by various inputs, such as age, reliability needs, and live risk. Data is streamed into the PI System in real time and combined with commercial data from Uniper's data lake to map to overarching power plant strategies.

As part of the MSP setup, Uniper configured the top 100-150 components that are major CAPEX drivers within the power plant, including capacity, maintenance needs, and more, creating baselines for every major asset. The team defines maintenance drivers, such as time-based or operating hours, while

historical data supplies maintenance time and cost. All operating hours are fed into the solution as data is continuously updated in the PI System. Users can instantly see the remaining lifetime of components, know when maintenance is due, and predict how much downtime is needed. If a power plant changes its run strategy, accelerating or decelerating maintenance needs, Uniper engineers can immediately see deviations and make adjustments along the way.

By planning which assets must be maintained at a particular time, not only can managers bundle maintenance needs and plan downtime efficiently, they can change maintenance strategies to ensure the company is getting the most lifetime out of its equipment.

The results? Uniper's implementation of the MSP solution based on the PI System has helped to reduce CAPEX planning by 16 percent.

For more about Uniper and the PI System, watch the full presentations here: [PI World 2017](#), [PI World 2018](#), and [PI World 2019](#).



It shows in one spot... the total cost and duration of the maintenance."

— Dr.-Ing. Stephan van Aaken, Vice President of Asset IT at Uniper



Watch this [2-minute video](#) to learn more about Uniper and the PI System.

Van Aaken, Stephan. "How OSIsoft PI Supports Uniper's Maintenance Strategy Planning"
<https://www.osisoft.com/Presentations/How-OSIsoft-PI-Supports-Uniper-s-Maintenance-Strategy-Planning/>