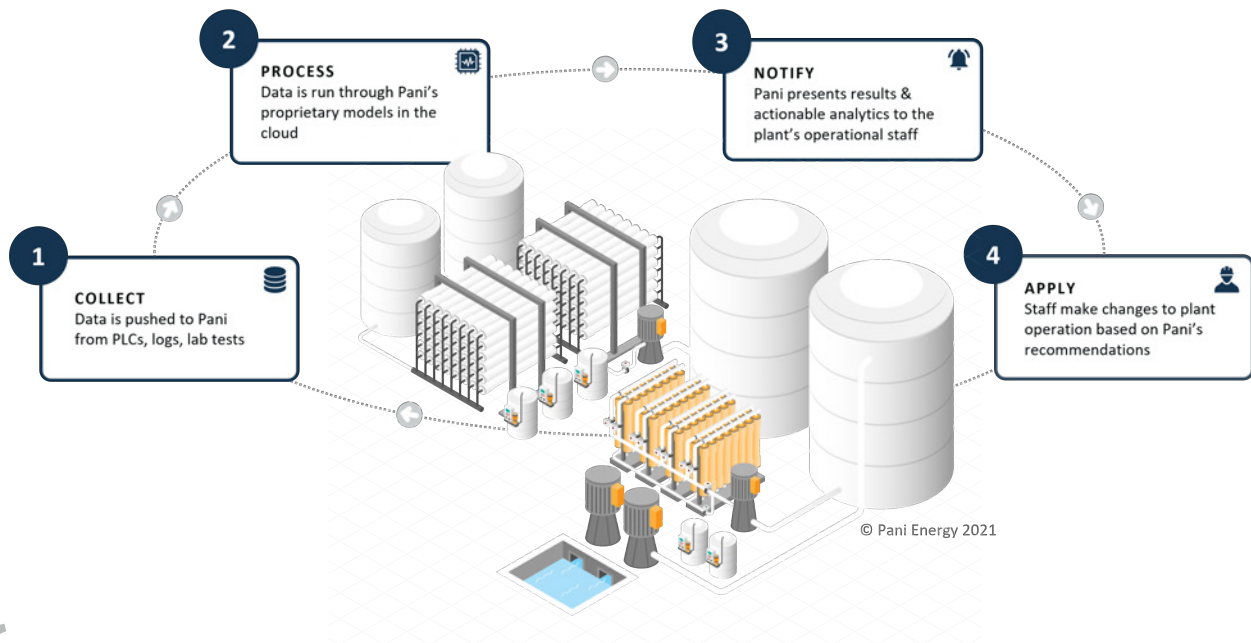


Pilot: RO Facility, North East USA

Overview

A multi-billion-dollar international water company (who has asked to remain anonymous at this time) invited Pani to do a pilot study demonstrating the capabilities of Pani’s software product, Pani Zed™ which uses Pani’s proprietary artificial intelligence technology. Pani Zed™ is a tiered product; in this pilot, the Consult plan was chosen and deployed as an offline software assessment. The facility was a 6 MLD (1.3 MGD) reverse osmosis (RO) plant in Northeastern USA that treats variable river influent for industrial use. This study served as an historical analysis and comparison between the plant’s operational status quo versus operating with Pani Zed™ optimization software.



“

“We have looked at many software providers in the IIOT space that do some of what Pani is capable of doing. There isn’t one that can do all of what Pani can do. Their complete feature offering is highly differentiated from competitors and their team is one of the best I’ve seen.

We pushed their software capability through test after test, even through scenarios it wasn’t necessarily designed to do, and it held up to a high level of scrutiny.”

- Company’s lead evaluator

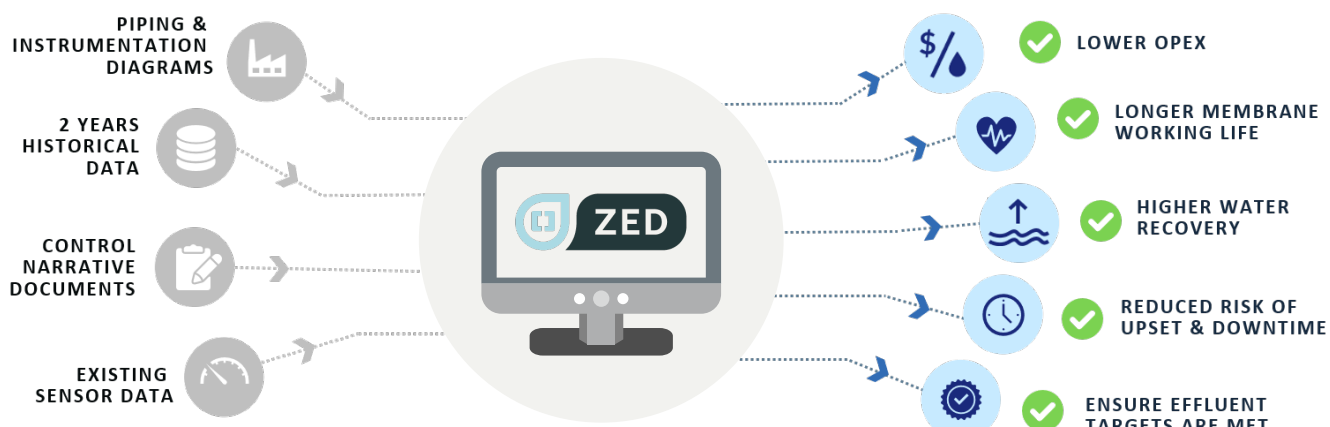
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Specifications

Pani’s cloud-based models were trained and calibrated using the plant’s P&ID information and two years of historical data from the plant’s instrumentation. This provided the foundation for Pani Zed™ to “learn” how each asset and process is connected, such as how upstream ultrafiltration (UF) pre-treatment affects the reverse osmosis (RO) process that follows. Pani Zed™ then provided optimization reports as well as predictive and prescriptive recommendations. The system, tools and recommendations were evaluated extensively in this study for accuracy and robustness across a range of testing scenarios.



Finding Opportunities with Digital Twin Optimization

Pani creates a proprietary digital twin of the water treatment plant, which then enables Pani Zed™ to “learn” how processes affect one other. After running thousands of simulations in near real-time, Pani Zed™ finds opportunities for improvement (ie. recovery, costs, energy use) and solutions are presented to the operations team advising them on actions to perform to yield the optimal Total Cost of Ownership (TCO) without compromising effluent quality. In this study, Pani Zed™ found the opportunities shown below, demonstrating the benefits of acting on its recommendations:



2.6% improved water recovery

Status quo: 81%
Optimized: 83.6%



100m³ less water used daily

Saving 36.5 million litres of water/year



6.3% lower cost per m³

Status quo: \$1.74
Optimized: \$1.63



More than \$160,000 in savings

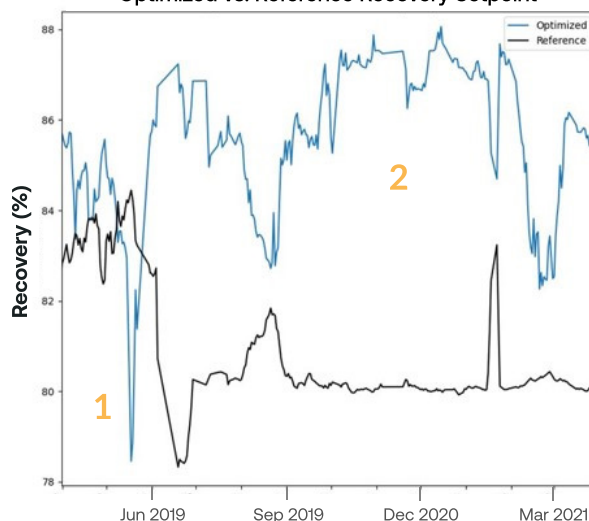
Over 2 years



When applied

For a 5x200GPM food & beverage plant, a **2.6% increase in recovery (26GPM) could equate to 6.5 million gallons less water** purchased per year or more water converted into product

Optimized vs. Reference Recovery Setpoint



1. Membranes were in poor condition and reference operation exceeded product water quality limits. Pani Zed™ respected the quality limits and recommended reducing recovery further to meet them.
2. When conditions were normal, Pani Zed™ found that recovery could be increased without exceeding the plant requirements, physical membrane limits, or chemical saturation limits that would scale the membrane faster.

Accuracy of Pani’s optimization models

Historical data model accuracy: 97.8%
(tested over 2 years of data)

What this means: Pani’s models are accurate even during peak conditions (temperature, conductivity) and soon after cleaning or replacing membranes

Edge case model accuracy: 94.9%

What this means: Pani’s AI models are more robust than standard pure machine-learning models which are typically closer to 20% accuracy during edge cases

Predicting Membrane Performance & Life-cycle Optimization with Predictive Analytics

Pani Zed™ supports proactive operations by providing warnings in advance of projected failure or reduced efficiency. Membrane cleaning and replacement are examples of such proactive operations. In this study, the Pani software predicted product quality, flowrate and pressure drop issues up to 45 days in advance, giving personnel plenty of time to plan logistics. Pani Zed™ also ran cost optimizations in the background to advise operators when to clean and replace. In this study, Pani Zed™ was successful at predicting the optimal time to clean and replace with a consistently high degree of accuracy over the historical plant data. The following are estimated benefits for implementing the recommendations from Pani Zed™ retrospectively:



Up to 30% more successful cleanings

Which would lead to increases in membrane working life & performance

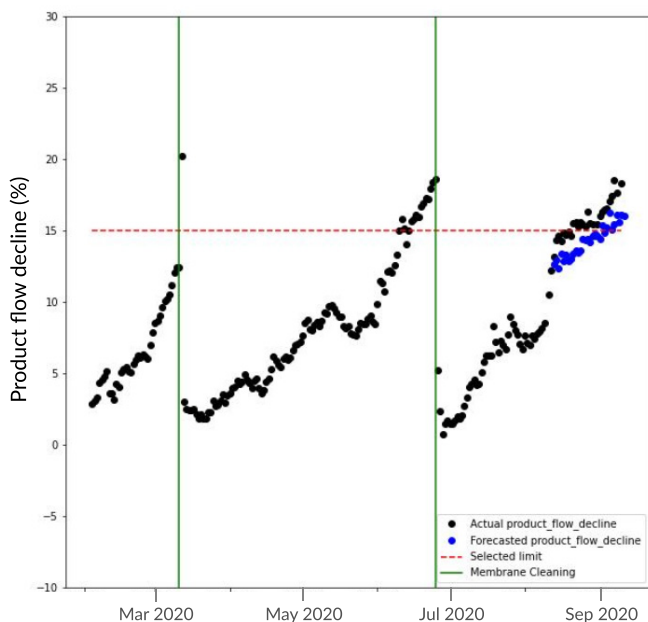


Clear reporting, analytics and alerts keep operations team informed



16% more time in healthy operating conditions

Extending asset life, reducing OPEX



Actual plant data (black points) and the predicted data by Pani Zed™ (blue points) for membrane performance.

Pani Zed™ was able to predict with high accuracy- when the flow was going to cross the cleaning limit and therefore increase costs, giving operators time to respond and plan.



Prevent reactivity

Downtime in a food & beverage facility can reach up to 500 hours/year, and cost \$20,000-\$30,000 per hour. Plus, unplanned cleaning & replacements incur additional costs for expedited shipping and labour/overtime etc.

Accuracy of Pani's predictive analytics

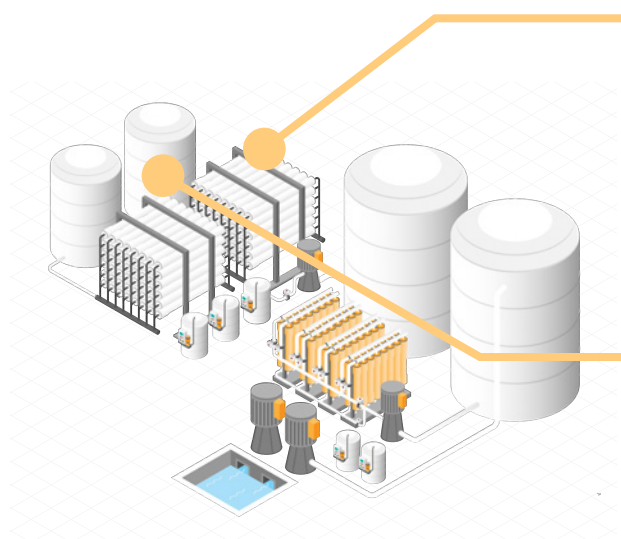
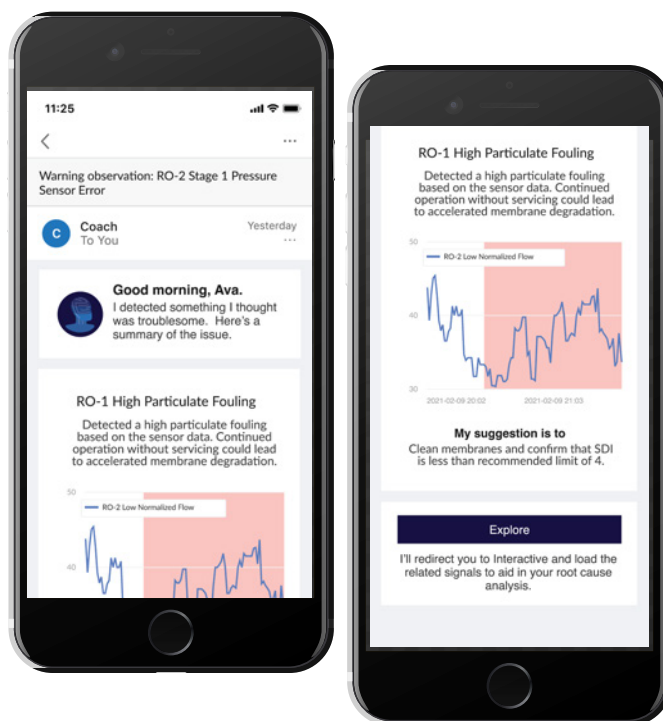
21 of 24 cleaning and replacement predictions were accurately detected within 30-45 days in advance, giving operators time to order chemicals and schedule maintenance, enhancing membrane performance and health

Minimizing Operational Risk with Prescriptive Analytics

Pani Zed™ automatically detects faults, anomalies, and process inefficiencies, and runs analyses of trends and signals in near real-time to find problems at the plant, then prescribes solutions to the plant's operations team. Pani Zed™ can also break down these prescriptive analytics into a cause, consequence, and recommended action.



Pani Zed™ found 38 different problems & inefficiencies in the historical data that could have been prevented



Situation: High particulate fouling. Pani Zed™ determined the right type of fouling and discarded organic fouling and scaling as root-cause.

Prescription: Check SDI is <4 and service membranes

Benefit: Membranes last longer, perform better

Situation: High product conductivity

Prescription: Consider cleaning membranes & inspect feed conductivity for upstream anomalies

Benefit: Reduced loading of softeners and lower frequency of regenerations

Accuracy of Pani's prescriptive analytics

36 out of 38 detected problems were confirmed to be correctly diagnosed with accurate isolation and mitigation suggestions, when evaluated by professional process analysts

Summary

In this pilot study, the capabilities, accuracy and value of Pani's flagship product Pani Zed™ were thoroughly tested at this RO plant, which was assumed to have no optimization gains. Pani Zed™ found multiple significant improvement opportunities in membrane performance, recovery, and water usage that could be achieved with the plant's existing equipment. Using two years of historical data,

Pani Zed™ was able to demonstrate numerous opportunities to reduce water usage and save costs, predict membrane performance up to 45 days in advance with high accuracy, and discover 38 unique problems that were otherwise undetected. Overall, the test demonstrates that if actioned properly, then Pani Zed™ would significantly improve plant performance, efficiency, and reliability.



“The system was able to find optimization gains in a plant where we had assumed there were none, and proved to have an uncanny ability to detect, diagnose, and accurately prescribe action. Pani has placed a marker in the sand with this application and are the ones to beat!”

- Company's lead evaluator




Get Pani Zed™ for Your Plant

Getting started is simple: historical data and essential plant documents like P&IDs are gathered by the plant's operations team and sent to Pani's implementation team.

Once set up, Pani Zed™ continuously monitors plant data, and recommends actions and setpoints to improve the plant's efficiency and reliability.

Operators access the platform's user-friendly analytics tools, and receive notifications on their smart devices on what Zed™ detects and recommends, so they can spend less time calculating and more time taking action. Finally, a tool that helps operations teams save time and do more, with less.

**Optimize your plant
without the guesswork.**

Explore plans 

Get started 