

Sulzer

Supplies Recirculation Pumps and Offers IoT Analytics for Retrofit

Nordlaks is a Norwegian fully integrated company that produces, processes and sells Atlantic salmon and rainbow trout worldwide. It has recently completed the building of a new smolt facility for fish up to 500 grams at Innhavet in Hamarøy municipality. This RAS (Recirculating Aquaculture System) fish farm is the biggest of its kind in Norway, with a special focus on smolt welfare. The land-based facility has state-of-the-art equipment for optimal biosecurity and sustainability. At the heart of the RAS process, all recirculation pumps were supplied by Sulzer.



New Nordlaks fish farm in Innhavet, Norway.

The challenge

The Innhavet RAS plant has 34 fish tanks of different capacities (350 to 1'000 m³) in 5 separate main sections. Each section is independent from the others and includes its own complete water treatment system in a semi-closed loop (98% recirculation + 2% make-up water). The brackish water from the fish tanks first flows by gravity to a rotating drum filter for the removal of the main suspended solid particles. It then falls into an MBBR (Moving Bed Biofilm Reactor) for TAN (Total Ammonium Nitrogen) reduction. After passing through a countercurrent degasser for the stripping of nitrogen and carbon dioxide, the treated water is finally pumped to some head tanks, prior to oxygenation and return to the fish tanks.

In each fish tank, the water is fully renewed every half an hour. The well-being of the smolts is highly dependent on a constant flow of water through the facility. The reliability of the recirculation pumps is, therefore, of paramount importance.

High overall energy performance of the RAS plant means a better environmental footprint and reduced operating costs. Consequently, the main components of the water treatment loops must have top-class efficiencies, particularly the recirculation pumps.

The solution

As a long-term supplier of equipment (pumps and turbines) to other Nordlaks plants, Sulzer was involved at an early stage of the new project. In collaboration with the Momek Group, a large industrial service provider in Scandinavia, the pumps were carefully selected, not only to fulfil the requirements during the warranty period, but to run optimally and economically during the whole lifetime of the site. For the recirculation of the brackish water, 50 AHLSTAR and BE process pumps in duplex material have now been installed and are operating continuously. In addition, 5 VUPX submersible propeller pumps are used on intermittent duty when the fish tanks are emptied during the transfer of smolts.

Customer benefit

By choosing to work with a trusted partner, the client made sure to get fast and



Five AHLSTAR A43-500 recirculation pumping units for brackish water.

permanent technical support, in addition to the best products. The recirculation pumps have the following major advantages:

Extremely high hydraulic efficiencies that by far exceed the strictest energy regulations for water pumps. This means huge energy savings over time and smaller total cost of ownership.

Duty points close to BEP (Best Efficiency Points), low rotation speeds and rigid baseplates grouted in concrete. The pump units are working smoothly with minimized vibration levels.

Superior-grade material for all wetted parts. For the choice of pump material in contact with brackish water, the long-term perspective favored duplex stainless steel rather than 316SS. Duplex steels have better design strength than austenitic stainless steels, as well as higher corrosion, abrasion and pitting resistance. In the end, maintenance costs and the risk of downtime are reduced.

Sulzer Utilizes Pump Analytics to Optimize Retrofit Solutions

For those in the energy industry, being able to identify pre-failure conditions and anomalous operation can offer a considerable advantage to a repeatable budget and bottom-line margins. Using this intelligence to permanently remove failure modes through retrofit solutions will further extend the service life of rotating equipment.

Seth Tate, technical advisor with Sulzer, looks at how a cutting-edge software solution can analyze existing pump telemetry to reduce downtime and justify engineering improvements.

Around the world, operators of high-energy pumps are well aware of the high running costs and therefore looking for effective and reliable strategies to reduce them. Implementing pro-active maintenance strategies is well-known to have a positive effect on downtime. Now it is possible to use data from existing sources to provide intelligence that will allow system availability and reliability to be improved.

Cost of downtime

The reduction in maintenance costs and equipment repair time are directly linked to corrective maintenance strategies, such as preventative maintenance, discrete predictive maintenance or online predictive maintenance. As the techniques to identify pre-failure conditions become more sophisticated, it is possible to perform the right maintenance task at the most opportune time. In addition, the insight provided can also be used to justify retrofit solutions.

These extend the normal operating conditions of high value assets. At the same time, predictive maintenance strategies can leverage existing data sources and maximize their efficiency by applying big data analysis principles.



Five BE325-2532 recirculation pumps offer a huge energy savings and smaller total cost of ownership.

This enables operators to achieve maximum availability and throughput and when high-value commodities are involved, this can amount to a lost profit opportunity (LPO) of USD 200'000 per day.

In terms of performance and efficiency, a 4'000 hp (3'000 kW) pump operating at 43% of its best efficiency point (BEP) flowrate will present an LPO of approximately USD 300'000 per year. Looking at how reliability affects outcome, chronic seal failures in high-energy equipment can cost USD 18'000 per occurrence but including lost production can see costs rise to USD 144'000 per failure.

Therefore, being able to implement remedial actions during planned maintenance periods before component failure occurs as well as understanding the root cause of an issue can deliver considerable value for the business.

Pump data acquisition

In order to translate equipment performance data into actionable intelligence, the related sensors as well as a conduit between the sensors and software must exist. Many pumping systems already have the necessary resources to satisfy data acquisition needs. The historical performance data that is already being stored can provide insights that are essential for the active monitoring process. By making better use of this stored data, it is possible to accelerate the journey to realizing value.

Advanced pump analytics

By developing a software solution that integrates with existing data platforms, the opportunity already exists to conduct big data analyses. Equipment that is designed using advanced physics can be monitored under the same principles. Sulzer's solution, known as BLUE BOX™, creates a prediction map of equipment operation using both Sulzer's expertise in failure mode and effects analysis (FMEA) modeling and machine learning intelligence.

What if operators were informed that equipment is running

below minimum continuous stable flow? What advantage is there to knowing that a bearing is failing?

Using the gathered data, this advanced analytics approach goes beyond just a digital twin to detect pre-failure conditions and optimization opportunities. Key to the added value are an out-of-the-box readiness, false positive prevention, advanced physics and an operational dashboard.

At the same time as identifying future maintenance interventions, there is a requirement to derive the most effective solution and justify the cost in terms of lost performance or downtime that can be saved. This enables engineering managers to assess potential solutions and provide a cost analysis, all before the predicted issue has an impact on production.

Retrofit to improve existing assets

Having identified the issue, retrofit solutions can be used to permanently remove causes of failure through improved engineering, design, maintenance or operation. The best course of action can be identified through gap analysis – comparing the current solution, which is experiencing reliability issues, to the best-in-class design. Today, the latest engineering technology can do more than just remove specific failure causes on legacy equipment.

In addition, retrofits can be implemented to address new or updated hydraulic needs. Having identified the performance topography, a new hydraulic profile can be manufactured without disturbing the footprint of the pump installation by applying computational fluid dynamics (CFD) and an original equipment manufacturer's (OEM's) considerable hydraulic experience.

Total cost of ownership

In a world where downtime can be measured in hundreds of thousands of dollars per day, even modest improvements in availability can have a significant improvement in operat-



A well-organized pump repair workshop reduces downtime and minimizes costs.



Experienced machine tool operators are key to setting up and operating precision equipment for extensive repairs or retrofits.

ing costs. For instance, an improvement of 0.08% in the performance of a high-energy pump will equate to 72 hours per year of uptime that would have otherwise been lost. This can potentially deliver an improved annual income of approximately USD 650'000.

In the example of pump performance, the data analysis solution can illuminate tangible opportunities for effective improvements. In addition, removing the residual effect with off-BEP performance can eliminate failure modes and extend the service life of the pump, promoting uptime and reducing the total cost of ownership (TCO). Putting this into numbers, recovering 32 efficiency points equates to approximately USD 290'000 in running costs.

Expert pump support

As an original equipment manufacturer (OEM), Sulzer has combined its expertise in pump engineering and extensive experience in pump operation to create BLUE BOX, an advanced analytics solution that can deliver expert insight into any pumping system.

Simple integration, with no additional hardware and a secure interface, BLUE BOX uses existing telemetry and communication protocols to analyze the data. It is designed to grow with future technological changes and provide continuous visualizations through a customized operator dashboard. Now, it is possible to predict the future of maintenance operations and use this information to optimize business performance. **PTE**

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