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ENGIE

MACHINE LEARNING SAVES ENERGY FOR LARGE SWRO IN THE MIDDLE EAST

Turing, a Gradiant company, was able to use machine learning to apply its patented SmartOps AI technology to save up to 5% energy, the equivalent of hundreds of thousands of dollars, at a large seawater reverse osmosis plant in the Middle East, while remaining within strict design limits. An international performance measurement and verification protocol was applied to confirm testing results.

The Challenge

Our client, ENGIE, a French multinational electricity utility, faced challenges of high energy consumption at a large-scale seawater reverse osmosis (SWRO) desalination plant in the Middle East. Desalinating seawater is energy-intensive for a few key reasons. Desalination typically requires a significant amount of energy to pump seawater, pressurize it, and force it through filtration or membrane systems to remove salt. The energy cost is a major contributor to the overall expense of desalination. Optimizing the performance of multiple reverse osmosis (RO) trains also presents a daunting challenge for operators as it is virtually impossible to determine the best operating parameters and membrane replacement frequency to maximizes energy savings.

The Solution

Gradiant's SmartOps AI technology is a powerful software platform that uses machine learning to optimize plant performance and manage assets efficiently. The technology takes into account various input and output parameters, ensuring that facilities meet operating design standards and mechanical limitations, while reducing energy consumption and maintaining water quality and production targets. It's particularly effective in optimizing the flow of water across reverse osmosis trains with varying efficiencies.

By harnessing the power of machine learning AI algorithms, SmartOps can enhance and predict plant operations, leading to immediate improvements in productivity, cost savings, and reduced carbon and water footprints.

A historical data audit showed that the SmartOps AI technology could achieve energy savings of up to 5%, with a maximum recovery rate of 48% for a plant using a Pelton wheel and manual feed control valve.

SmartOps AI

Middle East

Fast Facts

Location:	Middle East
End-User:	ENGIE
Solution:	Seawater Desalination
Industry:	Municipal & Infrastructure
Feedwater Source:	Seawater
Technology:	SmartOps AI
System Configuration:	25 + 1 trains, Pelton wheel
System Capacity:	>200,000 m³/day
Online Date:	2021
Delivery Model:	Software-as-a-Service (SaaS)

> "
> Engie is accelerating our transition towards a carbon-neutral economy, including sustainable desalination solutions. Leveraging machine learning algorithms for large SWRO to reduce energy use, while meeting KPIs, is an exciting part of this strategy."
> "
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> —Pascal Renaud, Chief Operating Officer, ENGIE Middle East, South and Central Asia, Turkey and Africa

Up to 5% Energy Savings

48% Maximum Recovery Rate

>200,000 m³ Daily System Capacity

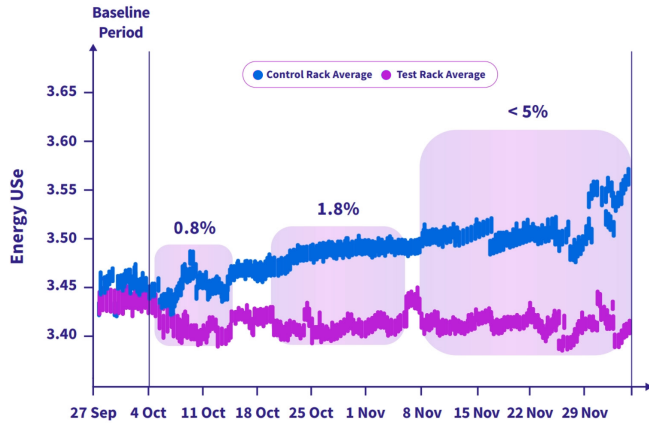## <5% Differential Pressure increase
in test versus control trains

99.95% Uptime set point recommendations to operators

12M tonnes CO₂
can be saved every year using machine learning to optimize reverse osmosis

(equivalent to the electricity use of 2.5 million homes each year)

To verify these energy savings, Gradiant's Turing employed a simulation model based on ISO International Performance Measurement and Verification Protocol (IPMVP®) to predict what the energy use would have been under standard conditions. This confirmed the energy savings with the client.
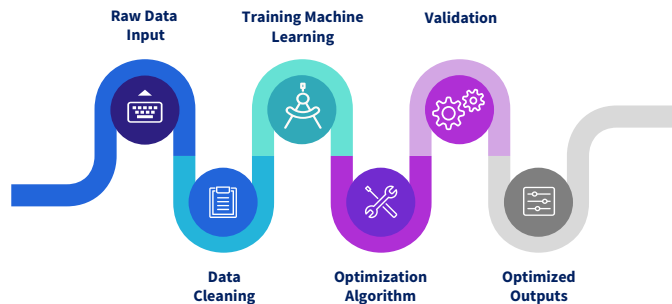

Chart: Baseline Period — Energy Use over time (27 Sep to 29 Nov). Control Rack Average, Test Rack Average. Markers: 0.8%, 1.8%, < 5%. Y-axis Energy Use: 3.40, 3.45, 3.50, 3.55, 3.60, 3.65.

The Benefits

Machine learning is a game-changer for plant owners and operators, helping them efficiently control systems and make decisions based on data. Simple daily recommendations for settings allow operators to easily input the best values, so they can focus on providing high-quality water to the ENGIE facility's 600,000 end-users. Achieving these savings doesn't require any extra equipment or hardware investments.

ENGIE's large-scale (SWRO) facility remains a leader in machine learning technology adoption. Its success has become a model for many plants worldwide, allowing them to replicate these benefits. Machine learning integration not only saved a lot of energy, but also improved system control and data-driven decision-making, benefiting both plant operators and managers.

Gradiant's SmartOps AI technology continues to revolutionize the seawater desalination industry, leading the way for other plants around the world to save energy and gain similar advantages.

How it works: supervised machine learning

Raw Data Input → Data Cleaning → Training Machine Learning → Optimization Algorithm → Validation → Optimized Outputs

Learn More at gradiant.com/technologies/smartops-ai/

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