Fero Labs

Industrial Use Case Playbook

Induced Draft Cooling Tower Energy and Water Minimization

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Introduction

Welcome to the **Industrial Use Case Playbook**, crafted by Fero Labs for the forward-thinking professionals dedicated to enhancing factory production optimization.

Whether you're a Data Scientist, Process or Production Engineer, Quality or Plant Manager, this playbook is tailored to equip you with the strategies, insights, and tools necessary to drive transformative change within your organization.

In today's rapidly evolving industrial landscape, maximizing production efficiency and minimizing operational costs are imperative for maintaining competitiveness and sustainability.

Within each of our industrial playbooks, we present a curated collection of use cases designed to address the specific challenges faced by modern manufacturing facilities. Each use case is meticulously crafted to deliver tangible outcomes, ranging from increased productivity and quality to reduced waste and energy consumption to help achieve sustainability goals.

Featured within these pages is a use case which spotlights **Induced Draft Cooling Tower Energy and Water Minimization for chemicals plants.** This case exemplifies how to tackle complex production optimization challenges head-on, leveraging data-driven approaches to drive measurable improvements in operational efficiency and cost-effectiveness.

As you embark on this journey for operational excellence, we encourage you to approach each Fero Labs use case scenario with curiosity, a willingness to embrace innovation and change.

By harnessing the power of your production data, domain knowledge, and collaborative problem-solving, we believe that you can unlock the full potential of your factory's production capabilities.

Together, let's redefine what's possible in industrial manufacturing and pave the way for a future of unprecedented productivity and sustainability.

Welcome aboard,

Fero Labs

Industry Overview

In the realm of chemical manufacturing, where efficiency and sustainability are paramount, optimizing energy and water usage is essential for maintaining competitiveness and environmental stewardship. Chemical manufacturing processes often involve heat exchange operations, where cooling towers play a critical role in dissipating excess heat and maintaining optimal operating conditions.

The global chemical industry serves as a cornerstone for various downstream sectors, including pharmaceuticals, agriculture, automotive, and consumer goods. With increasing emphasis on resource conservation, cost reduction, and regulatory compliance, chemical manufacturers face mounting pressure to optimize their operations while minimizing environmental impact.

However, the operation of cooling towers presents unique challenges for chemical manufacturers, particularly in terms of energy consumption and water usage. **Induced Draft Cooling Towers**, in particular, are prevalent in chemical plants due to their efficiency in removing heat from process streams. However, inefficient operation or suboptimal design can lead to **excessive energy consumption and water wastage**.

One critical aspect of optimizing cooling tower operations lies in **Induced Draft Cooling Tower Energy and Water Minimization**. This approach involves implementing strategies to improve the efficiency of cooling tower operations, reduce energy consumption, and minimize water usage while maintaining process reliability and product quality.

By leveraging advanced control algorithms, real-time monitoring systems, and data analytics, chemical manufacturers can optimize cooling tower performance, adjust operating parameters dynamically, and identify opportunities for energy and water savings.

Induced Draft Cooling Tower Energy and Water Minimization not only enhances operational efficiency and sustainability but also contributes to cost reduction and regulatory compliance. By optimizing cooling tower operations, manufacturers can achieve significant savings in energy costs, reduce water consumption, and minimize environmental impact, thereby improving their bottom line and corporate reputation. At Fero Labs, we refer to this as Profitable Sustainability.

Industry Challenges

In Industry 4.0, the promise of digital transformation often gets stuck in **"pilot purgatory,"** with **70% of initiatives failing to progress beyond testing phases**. McKinsey's research highlights that the choice of use case significantly impacts this phenomenon.

Selecting use cases that lack strategic alignment, clear value propositions, or encounter technical barriers contributes to pilot initiatives' failure.

Pilot purgatory not only wastes resources but also risks eroding confidence in digital transformation efforts. To navigate this challenge, organizations must strategically select use cases closely aligned with their objectives, offering clear pathways to value creation and scalability.

In each **Fero Labs Use Case Playbook**, we explore industrial use cases designed to address modern manufacturing challenges. Leveraging advanced analytics, AI, and machine learning, these use cases aim to drive tangible improvements in operational performance, cost-effectiveness, and sustainability.

By focusing on strategic and transformative use cases, organizations can break free from pilot purgatory and unlock new opportunities for growth and innovation.

Use Case Description

Background

Many large-scale chemical plants and refineries involve the operation of equipment that is often jacketed with flowing water to remove heat. For such types of equipment, induced draft cooling towers are often used to cool the recirculated water and regulate the temperature of the operating units. These cooling towers operate by evaporating parts of the hot water in cooler air facilitated by fans that circulate air within the tower.

Problem

The effectiveness of cooling and the rate of evaporation are controlled by several factors: the speed of the fans in the towers, the air temperature, humidity, and air flow rate. Additionally, to compensate for water drift loss due to evaporation, the system requires the addition of makeup water. Optimizing the fan speeds of cooling towers is essential for **reducing both energy** and **water consumption**, while also ensuring precise control of equipment set-point temperatures across various heat loads and environmental conditions.

Typically, manual intervention is necessary to adjust the cooling tower fan settings to achieve a desirable temperature, which can be both time-consuming and labor-intensive, especially if the cooling tower operates with multiple fans and at various efficiencies. In most situations, **process engineers** operating a plant or refinery are not available to manually adjust the settings to simultaneously achieve the temperature set-point and minimize energy and water usage.

Problem Summary

Minimize the cost of energy and water consumption while maintaining set-point temperatures of an induced draft cooling tower.

Process and control engineers can resort to integrating their cooling towers with a control system, such as a PID control, that automates fan tuning. However, in general, PID controls are typically configured to only achieve the desired set-point temperatures using a single input, without necessarily trying to operate the cooling tower efficiently.

Fero Labs Solution

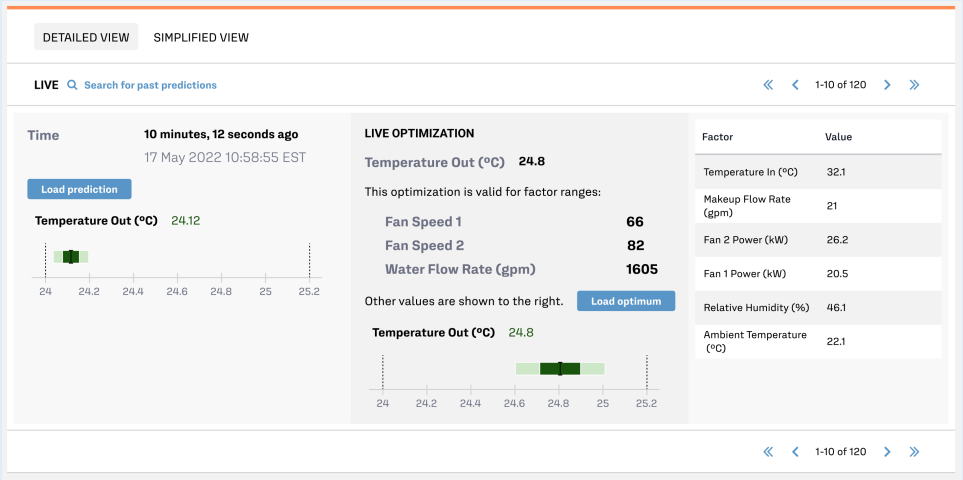
Plant operators can employ Fero Labs to optimize the fan speeds and air flow rates of cooling towers, while ensuring that the necessary set-point temperatures are met and the cost of energy and water consumption is minimized. Fero's real-time optimization solutions can determine the most

efficient operational parameters. Moreover, once the optimal settings are identified, they can be directly communicated to a control system that automatically adjusts the control settings.

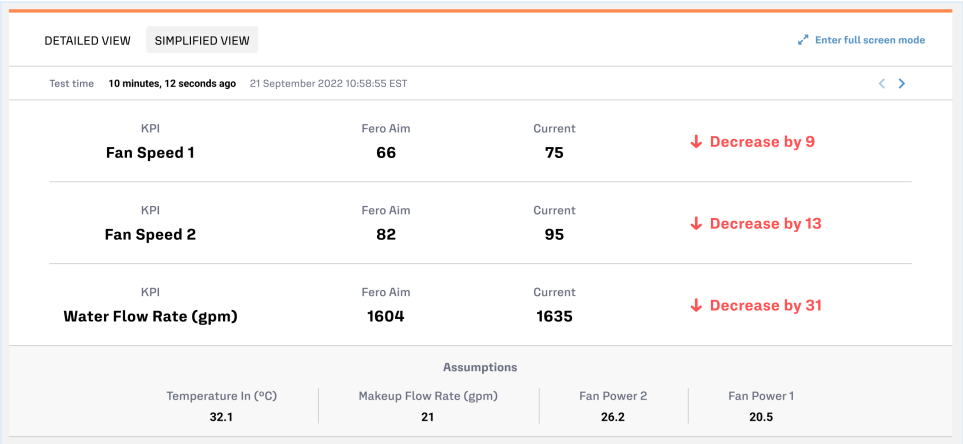
For control systems that incorporate temperature PID controllers, which are already integrated with the cooling tower fan speeds, a solution like Fero can be implemented to fine-tune the fan speed adjustments. Essentially, Fero can be configured to modify the fan speed offsets in relation to the initial fan speed settings determined by the PID controller. These adjustments are introduced as disturbances to the PID controller, providing an additional layer of control that allows for more precise management of cooling tower operations.

A "Live Fero Analysis" for this use case presents two screens:

- Detailed View: for **plant operators** to monitor cooling tower performance and take action at any moment. Here, Fero recommends how the cost of energy and water consumption can be minimized while the temperature is maintained. Restrictions can be placed on the maximum or minimum allowed values for water flow rates, enabling engineers to safely explore cost minimization objectives.



- Simplified View: for **plant operators** to know exactly what action to take to reduce energy and water consumption while maintaining the cooling tower outlet temperature.



Process & Business Outcomes

Precise set-point control and stability

Fero providing optimal recommendations for fan speeds will ensure the cooling tower desired temperatures are achieved under various heat loads and environmental conditions without additional hardware. Moreover, Fero can act as a **software layer on top of existing PID control systems** allowing for more precise management of cooling tower operations.

Energy and water cost minimization

Fero's optimizer enables cooling towers to minimize the cost associated with the energy and water consumed during production while ensuring that the desired set-point temperature is within a desired tolerance. This can reduce energy and water usage costs by up to **12%** of nominal costs.

Commensurate Scope 2 carbon minimization

Reducing energy consumption directly reduces the Scope 2 carbon footprint of cooling towers. With full adoption of Fero, plant operators can also expect up to a commensurate **8% reduction** in Scope 2 emissions. Fero can provide reporting capabilities that directly track and account for this reduction.

Fero Adoption Timeline

Plant teams can collaborate to set up and deploy Fero Labs. Below is a timeline highlighting typical steps. With Fero's easy-to-use, no-code interface, this can be achieved in a matter of weeks, not months or years.

Time	Process & Quality Engineers	Data Scientists / IT	Operators	Management
Week 1	Pull data	Pull data		
Week 1	Upload to Fero			
Week 1	Configure Fero	Configure Fero		
Week 2	Corroborate results	Receive example report showing accuracy		
Week 2	Set up Fero Prediction	Set up Fero Prediction		Receive example report showing savings
Week 3	Live data connection	Live data connection		
Week 3	Live Prediction screen		Live Prediction screen	
Going forward	Monitor deployment	Monitor deployment	Follow Fero Optimization recommendations	Receive regular reports showing savings
Going forward	Run "what-if" scenario simulations, spot check production, run root cause analyses		Follow Fero Optimization recommendations	Receive regular reports showing savings

Use Case Data Requirements

The Fero Labs Platform has convenient integrations into common process information management systems, such as Aveva PI System, AspenTech, Wonderware, and SQL databases, as well as laboratory information management systems, such as SAP, Oracle, and other ERP systems. Initial data exploration can be done either through direct integration into these services, or data file uploads in Excel and CSV data formats.

The data requirements for this use case typically involve the following sources:

Cooler Process Data

- Source: typically PIMS (e.g., PI system, Aspen)
- Content: fan speeds, fan power usage, inlet temperature, outlet temperature, ambient temperature, relative humidity, air flow rates, makeup water flow rate, evaporation loss
- Index: Indexed by time

Index	Fan Speed 1 (%)	Fan Power Input 1 (kW)	Temperature In (ºC)	Outlet Temperature (ºC)	...
timestamp 1					
timestamp 2					
timestamp 3					

Activating This Use Case

Consider our **Industrial Use Case Playbooks** as inspiration and tactical ideas for your team to align on to maximize the efficiencies of your plant. Each Playbook has a matching **Use Case Blueprint** which provides detailed steps to activate each use case within the Fero Labs platform.

If you're curious to see these in action please book a use case demo with our team!

Together, let us continue to push the boundaries of what's possible, driving towards a future where industrial manufacturing is not just efficient and sustainable but truly transformative in its impact on society and the world at large.

Thank you for joining us on this journey, and we look forward to continuing to partner with you in your pursuit of excellence.

Sincerely,

Fero Labs

About Fero Labs

Fero Labs helps factories work better together by bridging the gap between the disconnected goldmine of production data and industrial knowledge inside every plant.

The Fero Labs Profitable Sustainability Platform collects data and knowledge, and augments it with powerful Fero ML so factories can make more confident changes that drive profit and sustainability.

Harnessing Fero Labs, a factory creates an augmented workflow which allows for better use of raw and recycled materials, production time, and energy utilization. Teams can work 90× faster, using Fero's AI powered simulated predictions or live optimizations. They can run root cause analyses in minutes, and make continuous process improvements that drive Profitable Sustainability.

Fero Lab's white-box explainable ML makes decisions clearer by showing the context and confidence levels behind every prediction and recommendation. This expands a plant's production knowledge and drives better production results for manufacturers, all while minimizing emissions. Together we'll build a sustainable tomorrow.