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Simplifying Progress

Success story

MSU Uses Data Analytics to Reduce Emissions, Improve Efficiency and Identify Cost Savings

Michigan State University (MSU), one of the largest public research universities in the United States, operates its own large-scale power supply with multiple industrial steam boilers and turbines. The University's Infrastructure Planning and Facilities Division of the Department of Power and Water was looking for a way to improve efficiency and reduce energy costs.

Using Multivariate Data Analysis to create unique models, the university staff was able to uncover operational changes that could save more than $1 million USD a year in fuel costs and capital expenditures, while also gaining insights to extend the lifetime of equipment, reduce carbon emissions and support operator training.

University balances environmental standards and cost control

MSU operates its own large-scale power supply with multiple industrial steam boilers and turbines, some more than 50 years old. The university spends over $20 million USD a year on fuel (natural gas), and has a team of skilled operators that finesse efficiency out of the system based on decades of hands-on experience (and knowledge that is not easily replaced).

Government environmental regulations place pressure on the university to continue compliance with strict emissions standards – allowing little margin of error for equipment failure. In order to optimize their power production while maintaining a fiscally responsible equipment budget, the power department was looking for new ways to increase operational efficiency using data analytics.

Multivariate data analytics reveals influential factors

The facilities team worked with Sartorius data scientists to develop advanced data-based models of their processes and uncover opportunities to improve specific elements of their operations and equipment management using multivariate data analysis (MVDA).

Using historical data, the MSU team was able to discover and predict the factors that have the greatest impact on emission rates, fuel usage, operating efficiency and expected length of service for equipment. Some of the results were surprising. For example, the data uncovered a link between boiler pressure and NO_x (when pressure is high, NO_x is low), as well as gas temperature and emissions (warmer gas means less NO_x), and revealed that air temperature affects CEMS sensors, so keeping the equipment room cool helps keep emissions levels compliant. .

"Using historical data, MSU was able to see the impact, for example, of how the room temperature of a monitoring system affects emissions or how turning the combustion turbine off and back on would increase fuel efficiency without having to run months of real-world experiments. "

"MSU found simple adjustments in operating processes that have the potential to save more than $750,000 USD a year just in fuel costs."

The data also pointed to other factors that affect fuel usage and operational efficiency, such as shutting off a gas turbine periodically actually increases its overall efficiency. Simple adjustments in processes such as these could result in potential fuel cost savings of more than $750,000 a year. Other surprising insights revealed that certain pieces of equipment needed immediate replacement, that some units can be run harder even if it means more frequent replacement (since the fuel efficiency gains outweigh the cost of parts), and that the specific lifetimes of various pieces of equipment can be accurately calculated based on multivariate data. This means that, in some cases, the lifetime of the equipment can be extended beyond basic reference timelines.

Analyzing data models leads to cost savings

The insights from the data analysis models created savings worth over $1 million USD per year. The return on investment was realized in less than one month. The benefits achieved were:

- Fuel cost savings in the range of 2–6 % annually
- Reduced emissions in compliance with environmental regulations
- Predictive maintenance for equipment that saves time and money
- Increased equipment lifetime (3 to 5 years for several units)
- Efficiency improvements without new equipment purchases (or permits)
- Ability to transfer data-based insights to next generation of operators

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The customer:

Department of Power and Water, Michigan State University

The challenge:

Reduce fuel costs and environmental emissions from power production, and improve efficiency of operations

The solution:

Develop multivariate models using data from CEMS, monitors, boilers, and turbines to identify key factors influencing fuel usage, NO_X emissions and equipment efficiency

The result:

Uncovered surprising relationships between gas temperature, air temperature, pressure, on-off schedules, flame geometry, and other factors that affect NO_X emissions, fuel usage and equipment lifespan, with a potential savings of more than $1 million USD per year in fuel costs and equipment replacement

SIMCA® from Sartorius Data Analytics
SIMCA is a Multivariate Data Analysis Solution with an intuitive graphical interface. It gives you the flexibility to handle complex data in many forms.

SIMCA is part of the Umetrics® Suite of Data Analytics Solutions, a family of proven data analytics solutions that work seamlessly together.

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