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CASE STUDY

Leading Steel Manufacturer Reduces Energy Costs with AI Energy Forecasts

A leading steel manufacturer is one of the world's top producers of crude steel, with production facilities in more than 12 countries worldwide. Steel manufacturing is a highly energy-intensive process, and the company spent nearly a quarter of its production costs on power and strove to improve energy efficiency.

To minimize energy costs, the company generated most energy needed for its facilities and manufacturing operations through onsite generation, using manufacturing byproducts such as recycled gas and waste heat. However, the company still spent tens of millions of dollars per year on purchased energy due to the company's limited ability to forecast energy needs.

Before partnering with C3 AI, the company utilized an internal energy monitoring solution to track energy use. The tool provided plant-level energy use analytics but could not predict energy needs. To meet unanticipated energy needs in its plants, the company frequently purchased external energy from the power grid. As a result, the company was often exposed to demand charges and energy costs surged. To limit cost exposure, the company often abruptly halted production, which directly impacted throughput and revenue. The company needed a predictive solution to enable accurate and granular planning.

The company partnered with C3 AI and deployed C3 AI Energy Management to forecast facility-level energy demand in near real-time and enable product-level energy use analytics. With C3 AI Energy Management, the company could predict energy consumption in advance, enabling them to reduce reliance on purchased power, optimize onsite generation, and avoid production disruptions.

By scaling out C3 AI Energy Management across a single integrated steel mill, the company can reduce energy costs by $14 million per year, from increased use of onsite power and avoided demand charges. The company can also increase throughput by 0.05% from fewer production disruptions, equivalent to an $8 million increase in annual revenue.

Project Objectives

- Provide near real-time visibility of energy use down to equipment and product levels.
- Forecast facility and equipment-level electricity use to reduce energy costs from purchased power.
- Optimize production schedules to reduce energy intensity during high-cost hours, avoid production interruptions, and maximize throughput.
- Configure C3 AI Energy Management application to provide ML insights in a user-friendly interface.

Results

$14M

annual energy cost savings at one steel mill from increased onsite power use and fewer demand charges

$8M

increase in annual revenue from 0.05% increase in mill throughput

1.8%

increase in use of onsite power, reducing purchased energy costs

40 MW

reduction in utility demand charges per month

Challenges

The steel manufacturing company previously used an in-house energy monitoring solution to monitor plant energy consumption and costs. A dedicated 20-person energy management team observed the tool continuously to track aggregate energy demand, onsite generation availability and use, and purchased energy costs.

The energy management team received meter measurements from across the plant and onsite generation data in near real-time. However, the internally developed tool could not model or forecast energy requirements for individual facilities or pieces of equipment at scale. As a result, the plant often unexpectedly exceeded onsite power generation limits and was exposed to high purchased energy rates, including additional demand charges when plant energy consumption peaked above specific thresholds.

When faced with unanticipated high energy rates, the energy management team defaulted to abruptly requesting that plant and facility managers halt steel production to avoid energy cost peaks. As a result, the plant faced lower throughput and revenue.

The company sought other options to reduce energy costs, including adjusting production schedules to avoid energy consumption peaks and replace purchased energy with onsite power. However, the internal energy monitoring tool lacked the required product-level energy disaggregation, facility and equipment-level modeling, and predictive capabilities to forecast energy consumption based on production schedule data.

In turn, the company looked for an energy management solution that could integrate with its internal tool to expand visibility at the facility and equipment level, predict energy use, and support production schedule optimization.

About the Company

- $50+ billion annual revenue
- 2 integrated steel mills
- 40+ million metric tons of crude steel production annually
- 30,000+ employees

Project Highlights

- 5 months from project kickoff to production-ready application
- 1 year of historical data integrated, including production data on 180,000 manufactured steel rolls
- 3 ML models configured and tested to disaggregate and forecast energy use
- Configured the C3 AI Energy Management application user interface

Approach

In a 5-month production pilot, C3 AI partnered with the manufacturer to configure and deploy C3 AI Energy Management to monitor a hot roll mill at one of the company's largest plants. The team started by ingesting 1 year of operational and energy data, including asset hierarchies, sensor data, product specifications, planned and executed production schedules, time-of-use rates, and demand charge rates, to create a unified data model that provides a complete view of the company's steel manufacturing process.

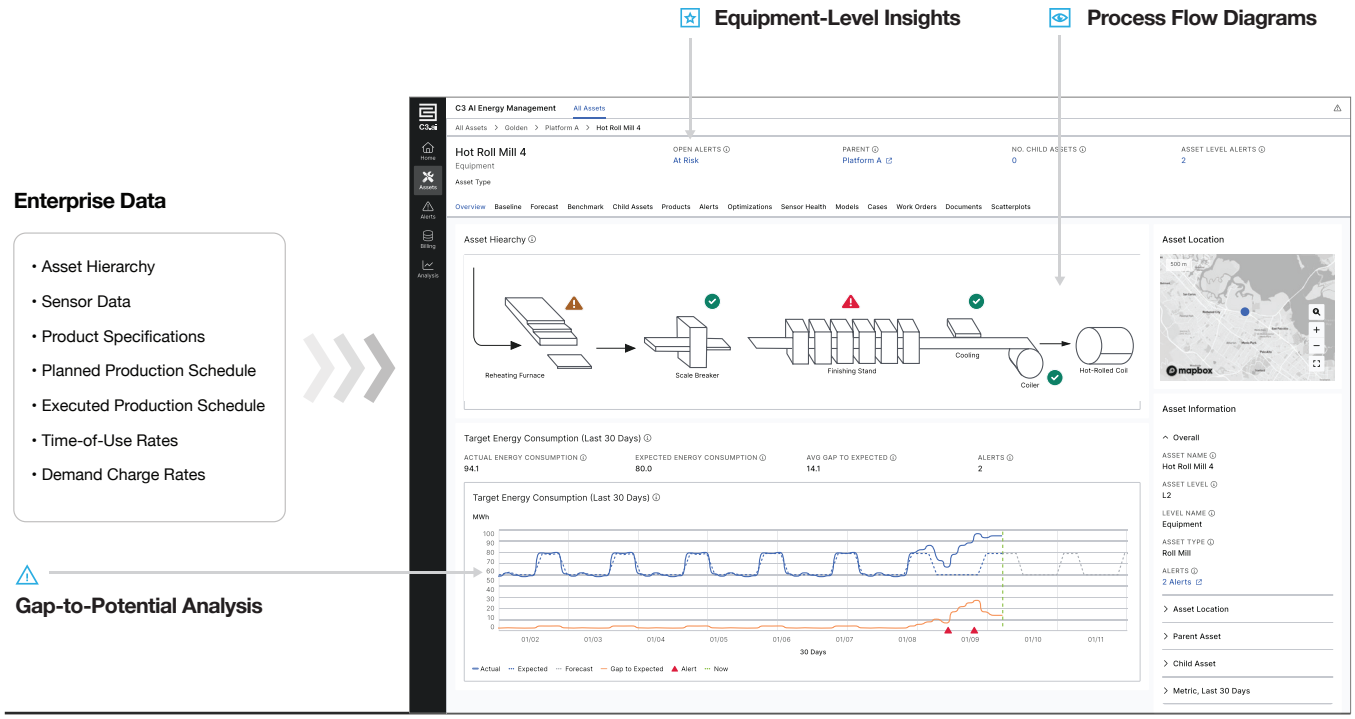
The joint team applied advanced ML techniques and analytics on top of the unified data model to forecast plant energy usage at the facility and equipment level. The application modeled physical systems and product movement through those systems to predict energy demand for planned production schedules. The team also configured a deep learning model to learn the historical deviations between executed and planned schedules to provide recommendations to optimize production schedules based on energy costs. By incorporating energy costs into production planning, the energy management team can better collaborate with plant and facility managers to proactively manage energy costs and reduce production interruptions.

The C3 AI Energy Management application user interface was configured to meet the manufacturer's workflow needs, with the ability to accurately predict the company's energy consumption and identify energy efficiency opportunities at the plant, facility, and equipment levels.

With C3 AI Energy Management, the central monitoring team and operators could predict energy cost peaks in advance to avoid demand charges and increase use of onsite power, identify actionable energy efficiency opportunities down to the equipment level, and optimize production schedules to reduce energy consumption without disrupting production.

Solution Architecture

C3 AI Energy Management



Benefits

Save

$14 million in annual energy costs at one integrated steel plant by increasing onsite power use and reducing demand charges

Grow

annual revenue by $8 million via a 0.05% improvement in throughput

Increase

use of onsite power generation by 1.8%, reducing external energy procurement costs

Reduce

demand charges by 40 megawatts per month by avoiding energy cost peaks

Monitor

energy consumption in near real-time at the plant, facility, and equipment level

Predict

facility and equipment-level energy consumption in advance to optimize production schedules

Proven Results in 6-Month Pilot

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