Industry
Agriculture
Food & Beverage

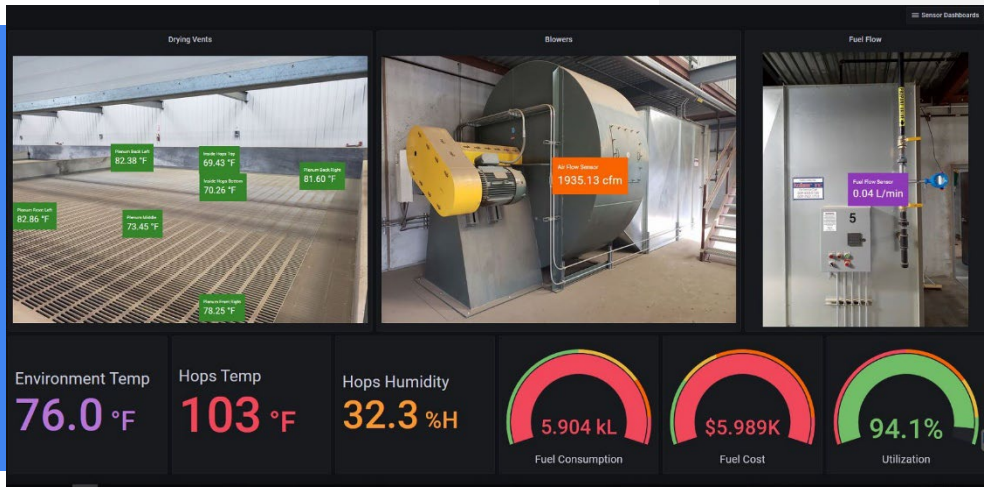
Technologies
Connectivity
Machine Learning
Predictive Modeling

Solutions
Quality Improvement
Energy Efficiency

CESMII
THE SMART MANUFACTURING INSTITUTE

PROJECT CASE STUDY

Reduction of Energy Consumption in Brewing Hop Drying



PROJECT LEAD

Oregon State University

PROJECT TEAM

Ectron

PROJECT OBJECTIVE

The objectives of this project are to identify the energy saving potential of dynamic drying protocols driven by real time process parameter measurements, that also maintain product quality, and to develop SM Profiles for batch agricultural drying processes that can be made available in the SM Marketplace.

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Smart Manufacturing Practices in Agricultural Produce Drying Improve Economic and Human Health

BENEFITS TO OUR NATION

Reducing energy consumption in the US agricultural sector would contribute significantly to lowering US greenhouse gas emissions and combatting climate change. Additionally, energy savings for farmers would allow them to pass cost savings on to consumers, reducing food prices and lowering inflation in the overall economy. The collective efforts to reduce agriculture energy consumption would contribute to a more robust American economy and healthier populace.

BENEFITS TO INDUSTRY

According to the US Department of Agriculture, the agriculture sector consumed 1.9 trillion BTUs of energy in 2016, accounting for 2% of total US energy consumption. The drying of agricultural produce is a significant contributor to agricultural production energy consumption. Crop drying is an energy intensive process that requires careful control to maximize product quality (physical, chemical, and sensory) and prevent spoilage. The drying techniques studied in this project can be applied across the agricultural industry to improve product quality while reducing energy consumption and increasing productivity.

At an average cost of $4 per BTU, even a 1% reduction in energy consumption would save American farmers $76 Billion in annual energy costs.

PROJECT DESCRIPTION

TECHNICAL APPROACH

- Develop and use process models of typical kilns to identify drying protocols that can reduce energy consumption and increase productivity
- Instrument manufacturing process and measure energy consumption for baseline and proposed kilning process at different grower sites

ACCOMPLISHMENTS

- Developed machine learning model for batch time forecasting
- Developed hop drying physical model
- Instrumented hop farms with sensors and developed system for real time performance monitoring and dashboard display
- Tested alternative drying regimes, including temperature and time variation and thin layer drying
- Collected data from over 4,600 drying batches from 2021 and 2022 harvest seasons

DELIVERABLES

- Developed agricultural batch drying reusable SM profile
- Delivered complete data sets for instrumented kiln baseline and experimental drying protocols. Data included machine learning model training data.

REUSABLE OUTCOMES / SM MARKETPLACE

- Predictive models for agricultural produce drying
- Agricultural batch drying reusable SM profile

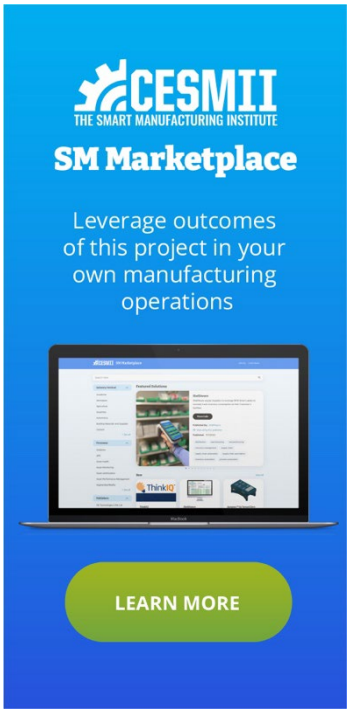
RESULTS

↓ 14%

Demonstrated a 14% reduction in hop drying process time by implementing smart manufacturing tools at multiple farms.

↓ 10%

Demonstrated a 10% reduction in hop drying energy consumption by implementing smart manufacturing tools at multiple farms.



PROJECT DETAIL
Budget Period: BP4 – BP5
Submission Date: 3/19/2023
Sub-Award (contract) Number:
4550 G ZA041
SOPO: 2332

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