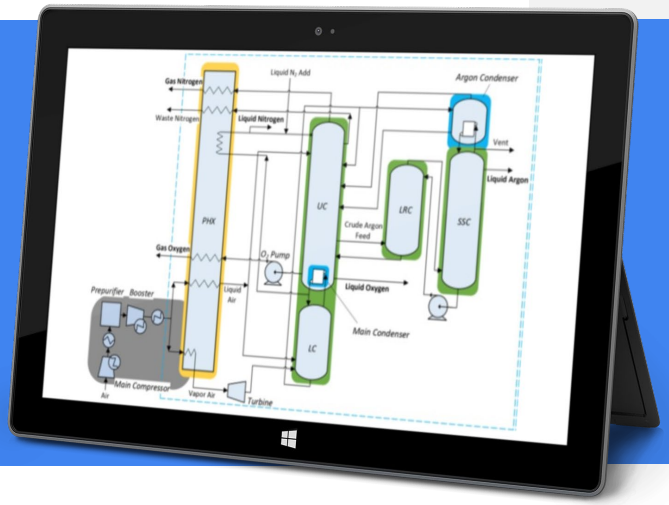
Industry
Chemical
Energy (Oil & Gas)
Industrial Gas
Petrochemical
Refining

Technologies
Data Contextualization
Predictive Modeling
Advanced Control

Solutions
Asset Performance
Schedule Optimization
Energy Efficiency

PROJECT CASE STUDY

Smart Manufacturing for Chemical Processing: Energy Efficient Operation of Air Separation Unit



PROJECT LEAD

Texas A&M Engineering Experiment Station (TEES)

PROJECT TEAM

Texas A&M Energy Institute, Linde (Praxair), PSE, University of Texas, AspenTech, Rensselaer Polytechnic Institute, Emerson, OSIsoft

PROJECT OBJECTIVE

The goal of this project is to develop energy efficiency and analytic tools and deploy them via the Smart Manufactuing Innovation Platform™ on Praxair's commercial Air Separation Unit.

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Predictive Modeling and Fault Detection Improves Operational Efficiency of Air Separation Unit

BENEFITS TO OUR NATION

Linde owns and operates approximately 100 large cryogenic Air Separation Units (ASU) distributed across the United States, and approximately twice that number globally. An ASU is a complex and energy intensive process accounting for more than 2.5% of all the electricity consumption in the U.S. manufacturing sector. Often, these plants perform sub-optimally, resulting in a loss of energy efficiency. For Linde in the U.S., each 1% in suboptimal operation is worth about ~$10 MM/yr., with potentially similar impact to other manufacturers with similar ASUs. Improving the operational efficiency of ASUs nationwide has the potential to save the U.S. millions in energy productivity.

BENEFITS TO INDUSTRY

The project contributes to CESMII's energy reduction and energy productivity goals and the project, through data acquisition, contextualization and apps will contribute to the SM Platform™, providing manufacturers within the chemical processing industry with the ability to leverage these solutions. Additionally, the project team includes students who will become part of the Smart Manufacturing workforce of the future.

PROJECT DESCRIPTION

TECHNICAL APPROACH

Create data acquisition tools, asset templates and predictive tools for the air separation units and demonstrate their application in an integrated environment.

ACCOMPLISHMENTS

- Surrogate Modeling for Planning & Scheduling resulted in 10% improvement in energy efficiency
  - Predictive surrogate models for the optimal scheduling of production rate and quantification of its economic and energy usage benefits are developed from plant data
  - Developed model for scheduling demand response (DR) operation of the ASU process
- Developed surrogate modeling for ASU model predictive control
- Developed data driven algorithms to detect ASU Process Faults more effectively

DELIVERABLES

- Developed complete data model templates for the air separation unit to enable integration between data acquisition and modeling & control environments across on-premise and cloud implementations.
- Configured and populated necessary cloud data historian infrastructure using wired and wireless data streams required by the ASU plant models and asset monitoring analytics. Asset models will be developed and integrated into a workflow environment for remote monitoring.
- Developed complete analysis and process benchmarking tools; process monitoring tools; optimization tools; advanced process control tools; planning and scheduling tools for the efficient monitoring and operation of the Air Separation Unit.

REUSABLE OUTCOMES / SM MARKETPLACE

- Apps for analysis and process benchmarking for Air Separation Units: including process monitoring, optimization, advanced process control, planning and scheduling
- Information model/data template for creating an Air Separation Unit SM Profile

RESULTS

↑ 10%

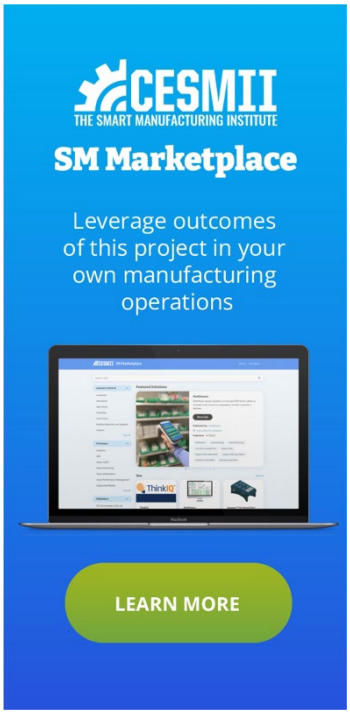
Improvement in energy efficiency through surrogate modeling for planning & scheduling

↓ 98%

Reduction in model size & associated computational costs through surrogate modeling

↑ $200k/yr

Potential savings for each ASU in operating costs by leveraging surrogate modeling application



PROJECT DETAIL
Budget Period: BP4
Submission Date: 05/14/2022
Sub-Award (contract) Number:
4550 G WA324
SOPO: 2310

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