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Energy Efficiency at a Flour Mill
ConAgra Foods

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Minnesota Technical Assistance Program

UNIVERSITY OF MINNESOTA
Driven to Discover℠

Company Overview

- Leader in Commercial and Consumer food products

- Hastings Mill

  - Wheat flour and food products

  - Sold in commercial sized bags and bulk to consumer food processing companies

Hastings Mill

Motivations for Change

- Cost savings from efficiency improvements

- Delivers information to drive improvement

- Advances company goal for continuous improvement

Reasons for MnTAP Assistance

- Achieve a 2.5% reduction in energy consumption
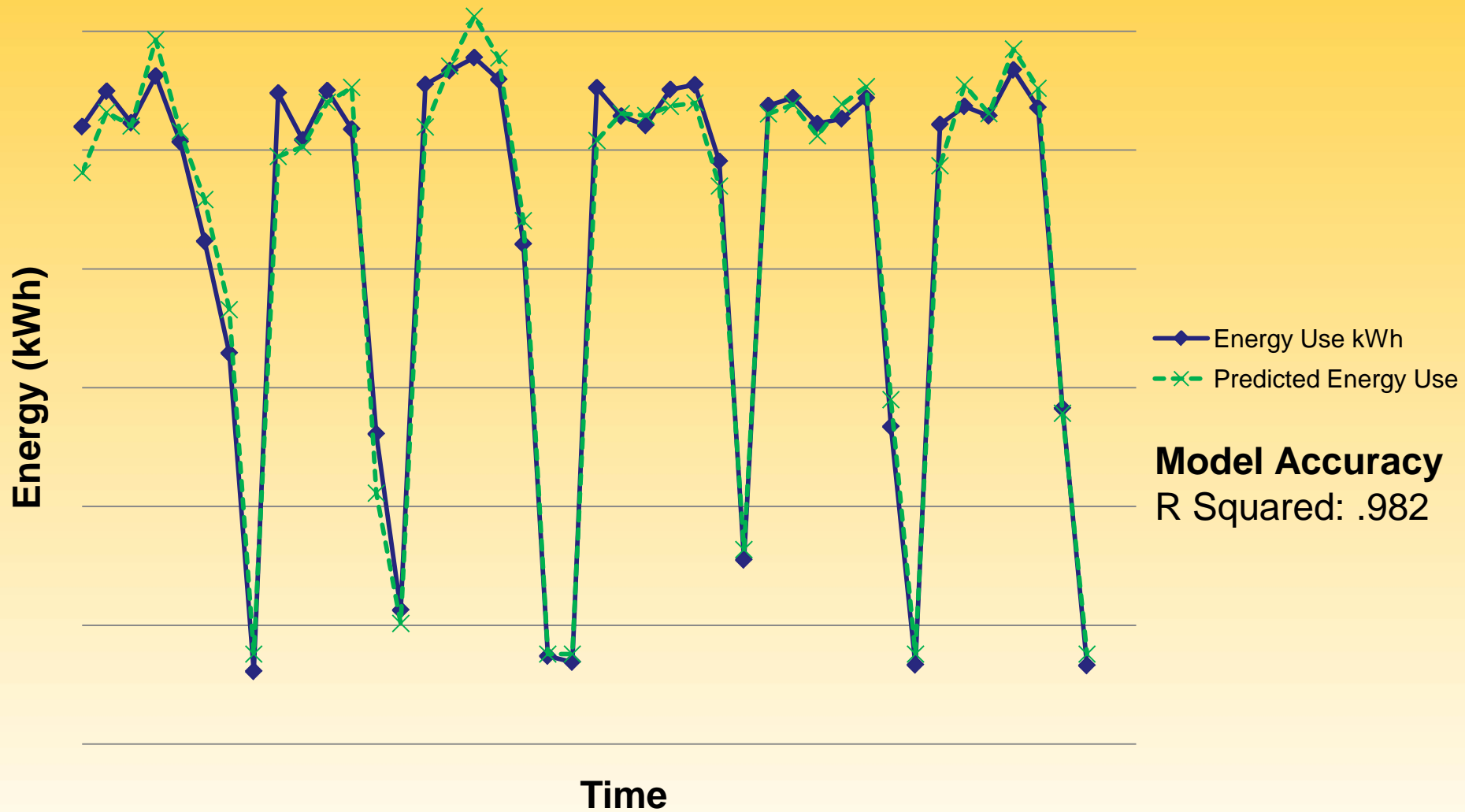- Make energy management easier

Power Use Model

- Objectives
  - Predict energy use for certain mill and pack output
  - Report and discuss days of high or low energy at Review & Response meetings
  - Use abnormalities to identify root cause and find solutions.
  - Measures effectiveness of solutions

$$kWh = Kj*(Mill\ cwt\ output) + Ki*(Pack\ bags) + Ko$$

Actual vs. Predicted Energy Use

Energy (kWh) (y-axis)

Time (x-axis)

Legend:
- Energy Use kWh
- Predicted Energy Use

Model Accuracy
R Squared: .982

Approach

Correct Energy Behaviors → **Fix and Tune** → **Replace**

Determining Inefficient Processes

- Observed Energy Saving Opportunities
    - Compressed air
    - Lighting overuse
    - Incomplete shutdown
    - Conveyors

Determining Inefficient Processes

- Took baseline measurements to find current system efficiencies
- Voltage
- Amperage
- Flow rates
- Static Pressures

Energy Behavioral Training

- Background
  - Energy Awareness
  - Knowledge of cost
- Problem
  - Inefficient energy practices

Energy Behavioral Training

- Solution
  - Change Culture
  - Educate
  - Verify follow through

Vacuum System

- Background
  - 4 vacuum systems (200hp total)
  - Mill Sanitation

Vacuum System

- Why is it a problem?
  - Continuous operation
  - 2nd and 3rd shift demand
  - Simplicity for operators
- Solution
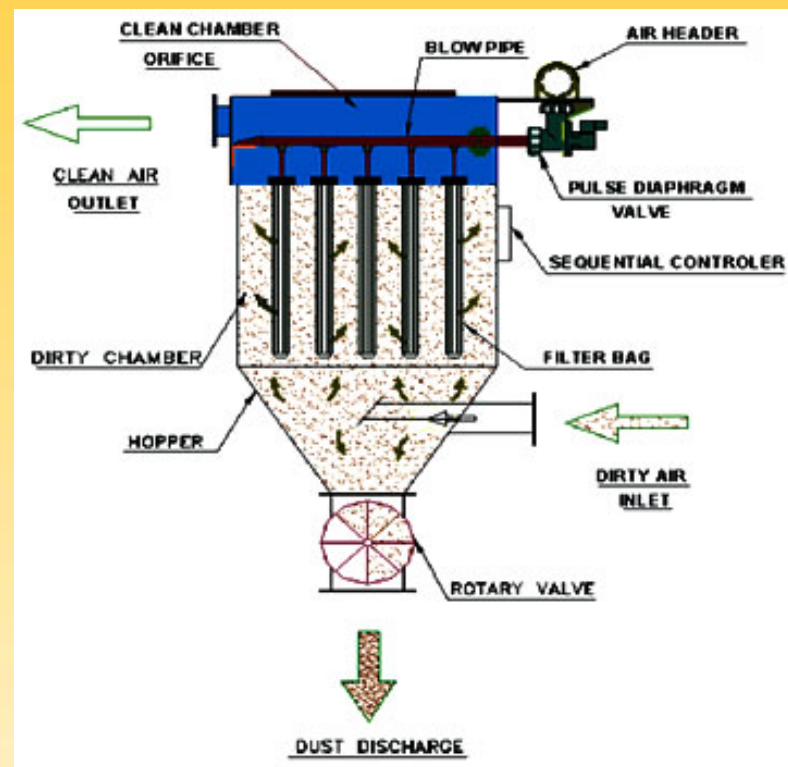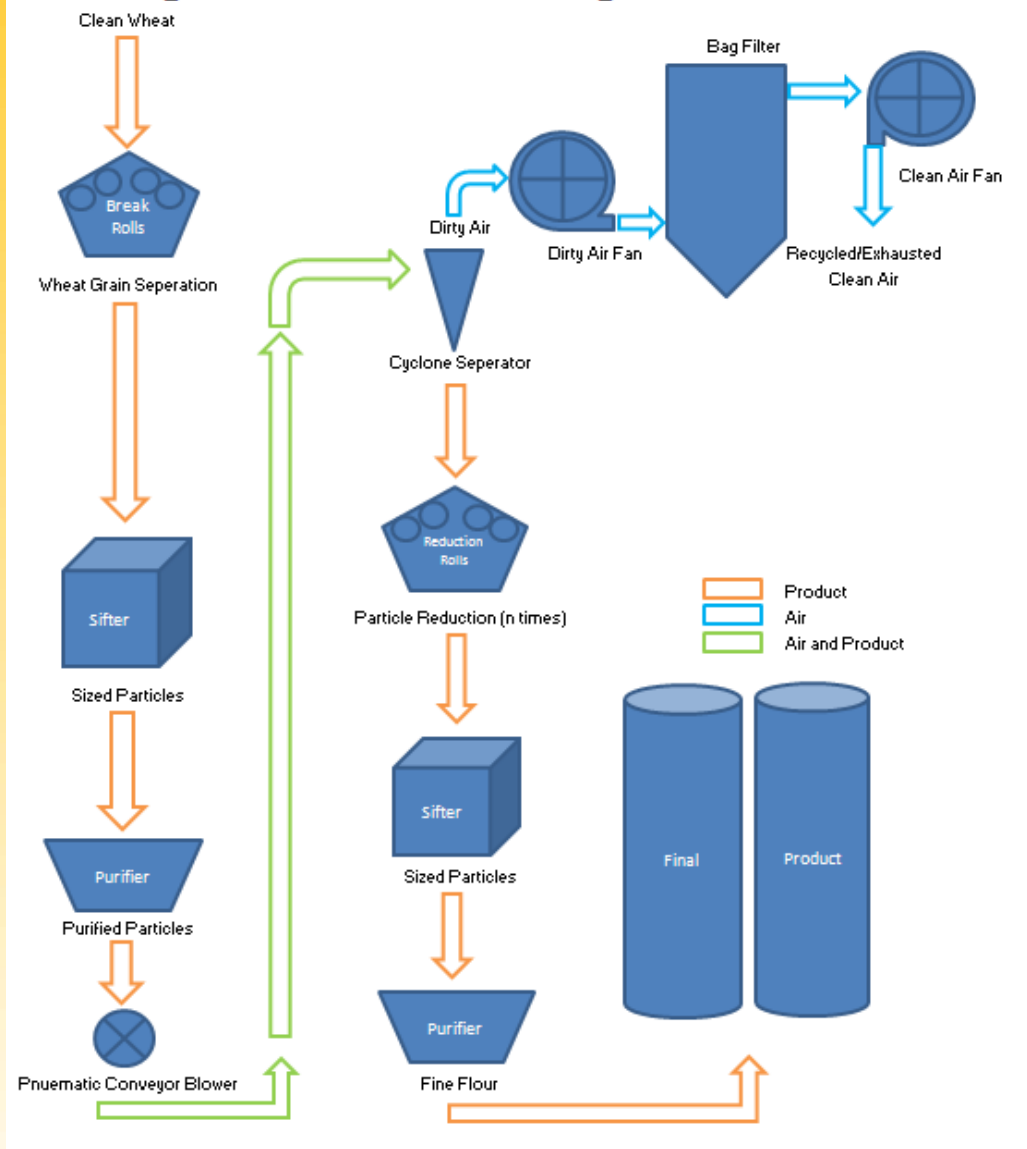 - Remotely-accessible, on-demand system
  - 3 month payback

Filtration System

- Background
  - Bag Filters
  - Air makeup
  - General suction

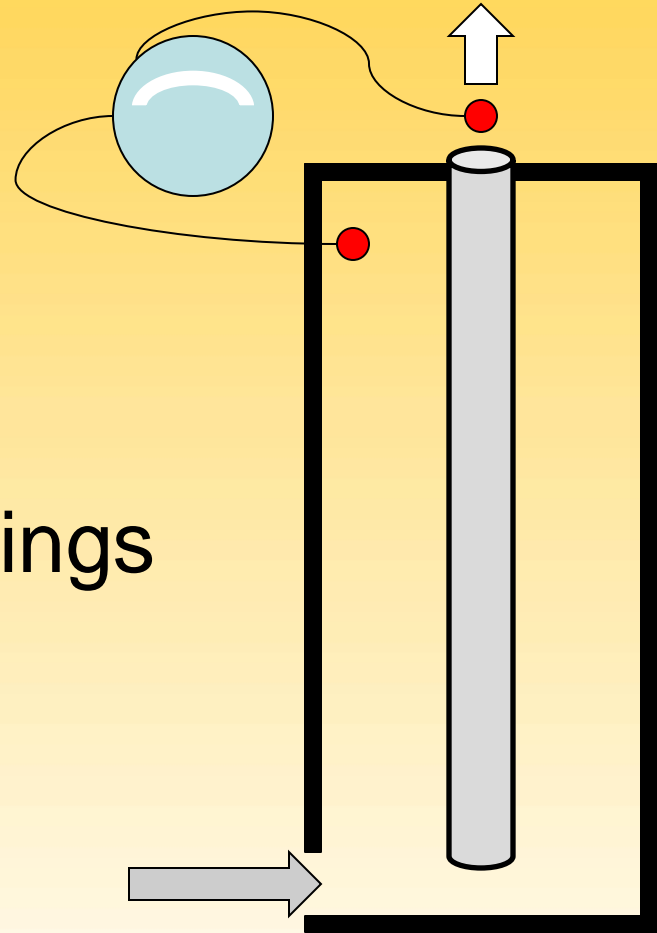# Milling and Air Cleaning Process Flow

Filtration System

- Why is it a problem?
  - Sock cleaning pulse rate control
  - Dirty socks compared to clean socks
  - Flow rate effects

Filtration System

- Solution 1
  - Control sock pulse
  - Delta P control
  - Sock life
  - Compressed air savings

Filtration System

- Solution 2
  - Airflow Controller
  - Controls fan speed based on pressure differential
  - Designed flow rate

Lighting

- Background
  - High bay fixtures are Class 2 Division 2
  - Group G for combustible grain dust
  - High-intensity discharge (HID) metal halide lamps

Lighting

- Why is it a problem?
  - Inefficient metal halide lamps
  - Low quality of light
  - Low bulb life
  - Lumen loss (45% MH, 6% fluorescents)
  - Excessive use

Lighting

- Solution 1

  - Retrofit with T5 High Output (HO)

  - Quick start

  - 13 Watts less /fixture

  - 4,000 more lumens /fixture

  - 29 year payback

Lighting

- Solution 2
  - Occupancy Sensors (non production areas)
  - Simple solution
  - Rebates make them economical (10 month payback)

Successful Process Changes

- 1,030 MWh feasible savings so far
- 1.87 million lbs CO_2 savings
- $66,890 in energy savings identified
- More opportunity with continued study

Recommendations Overview

Waste reduction option	Waste reduced (per year)	Cost	Cost savings (per year)	Payback period
Occupancy Sensor Installation	71,100 kWh	$3,950	$4,622	10 months
Energy Behavioral and Procedural Training Program	223,190 kWh	$0	$14,580	Immediate
Vacuum System Automation	735,000 kWh	$14,000	$48,800	3 months
Sock Clean Delta P Control		$1,100 per unit	*more study needed*	
Bag Filter Airflow Controller System		*more study needed*		

Personal Benefits

- Gained project management skills
- Grew personally and professionally
- Felt success
- Trip to ConAgra corporate headquarters