Motivating Energy Savings at Small Manufacturing Facilities

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University of Minnesota
Driven to Discover℠

MnTAP

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CEE Program: Energy Intelligence

- **Works with Small-Medium Sized Businesses**
  - Helps businesses understand the distribution of their energy usage at their facility
  - Aims to inform businesses of savings opportunities through energy conservation opportunities
- **Each business installed with smart meters a few months prior to arrival to identify initial trends in consumption**

cee Center for Energy and Environment

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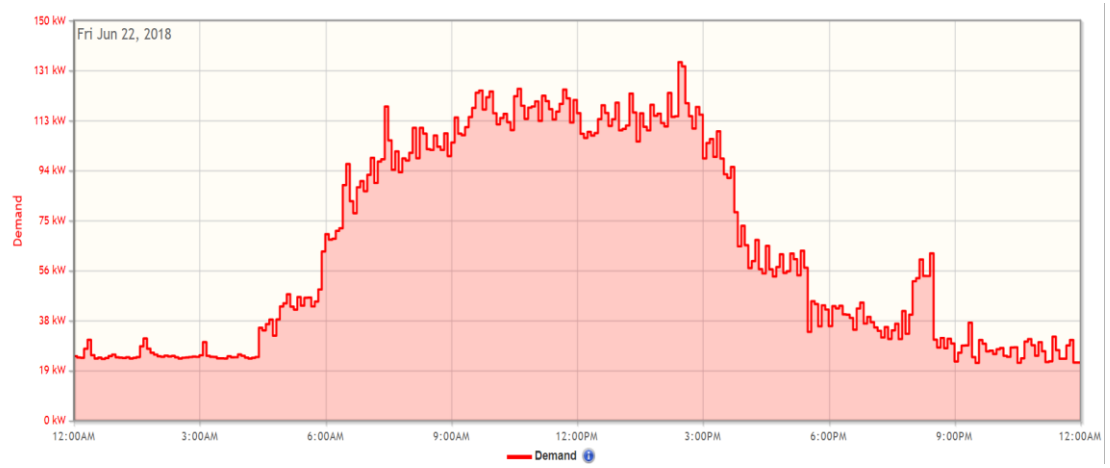
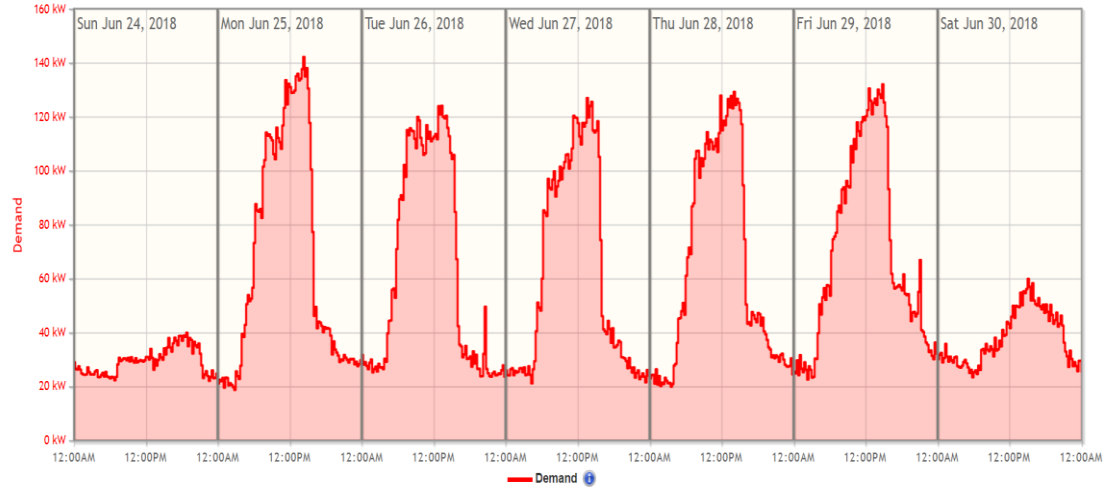
Project Overview

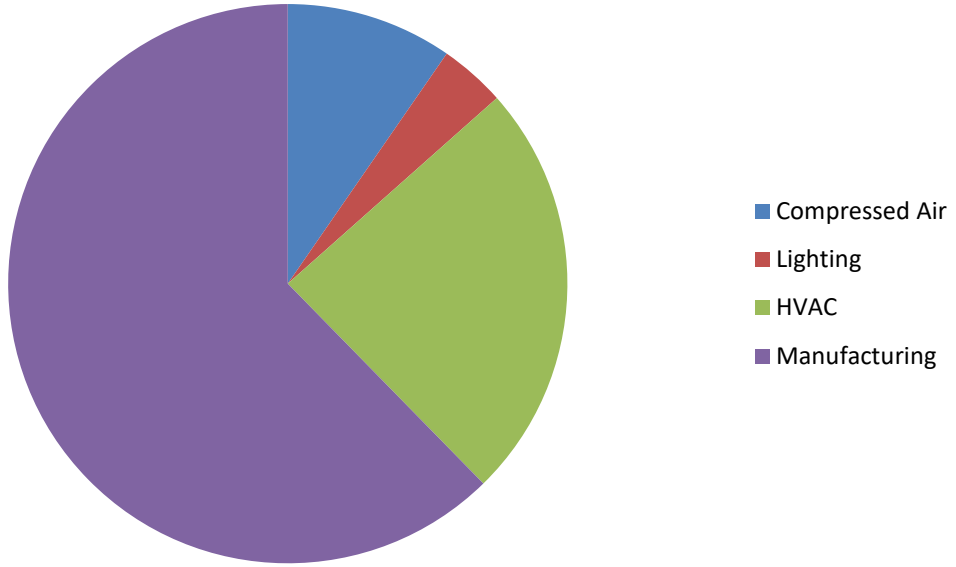
- Visited four small industrial sites and recommend energy improvements
- Three weeks per site: two weeks on-site and one week at CEE
- Identified major areas of savings at each site





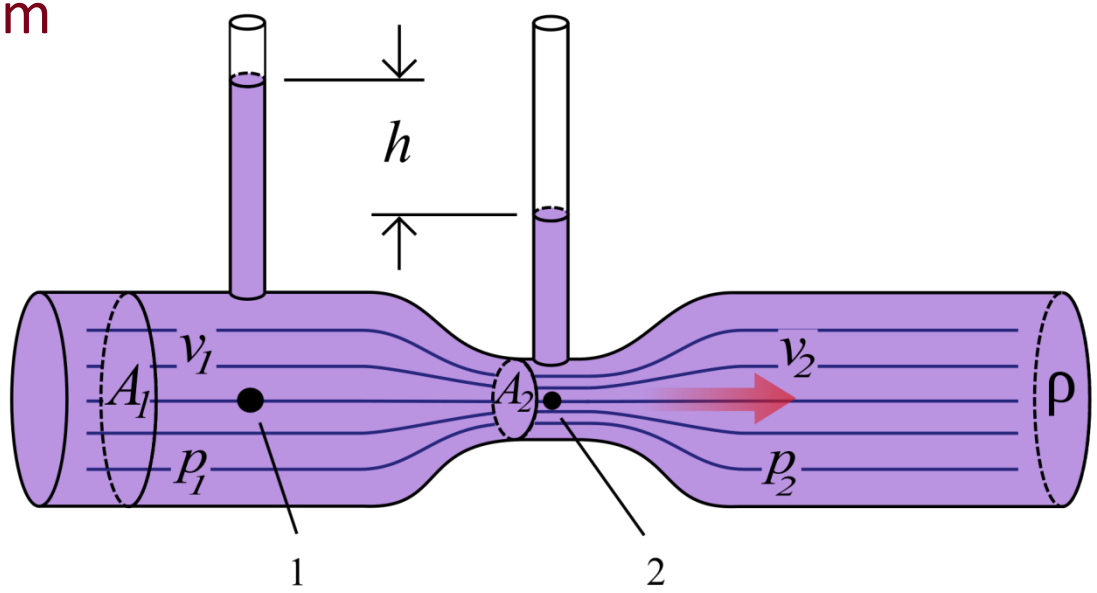
LOFTON
Label & Packaging

- **Founded in 1981**
- **Designs and prints labels for a variety of industries**
  - Wide array of potential applications
- **Helps customers find labeling and packaging solutions to fit their needs**
- **Layout**
  - Flexo-printing
  - Digital Printing
  - Warehouse and Shipping
  - Office



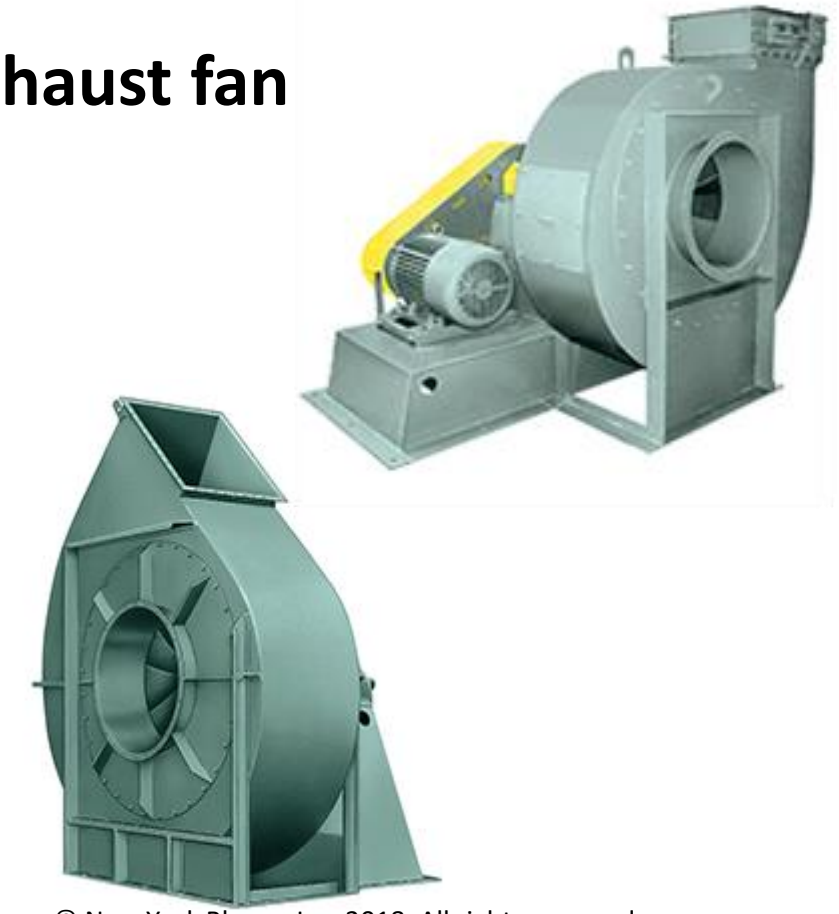
Highlights: Waste Disposal System

- **Disposal system operated on compressed air via Venturi effect**
  - Large percentage (~80%) of compressed air usage dedicated to system
  - Often left on during breaks and stops in production
  - Cost of ~$9,000 annually to run the system
  - Creates difficult-to-dispose-of waste
  - Exhausts conditioned air outside



Highlights: Label Disposal System

- **New disposal system operated using blower/exhaust fan**
  - No reliance/load on compressed air system
  - Reduces web waste
  - Higher capacity; offers room for expansion
  - VFD; Operable at a range of fan speeds
  - Predicted to Cost $800 to run annually
  - Savings potential of over $12,200 annually



Findings: Savings Opportunities

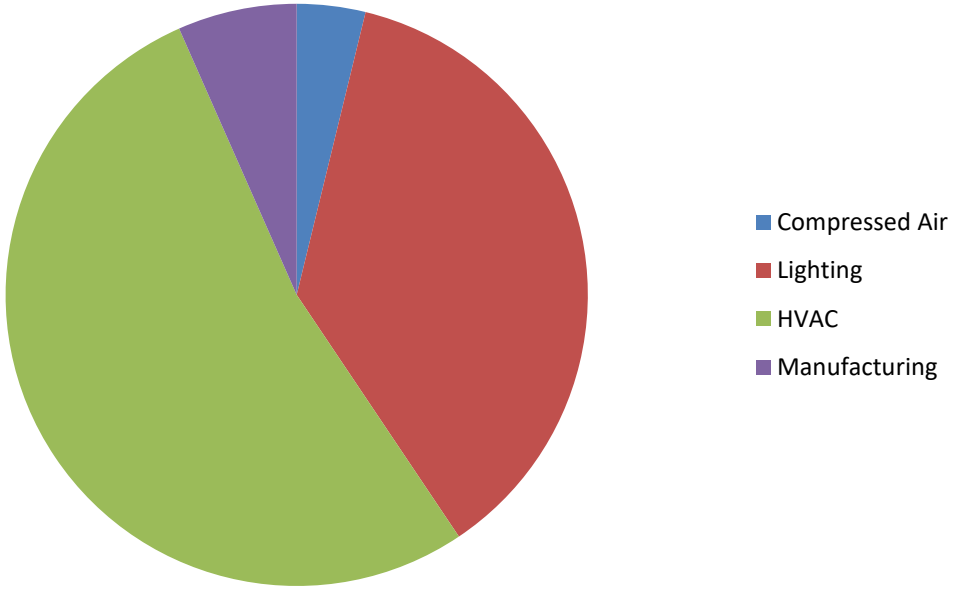
- **Total Savings Identified: $19,300**
  - 227,200 kWh of energy consumption savings
  - 58 kW of energy demand savings
  - 1,800 Therms of gas consumption savings

18% Total Energy Savings

Table 1 Summary of Recommendations, Savings, and Cost

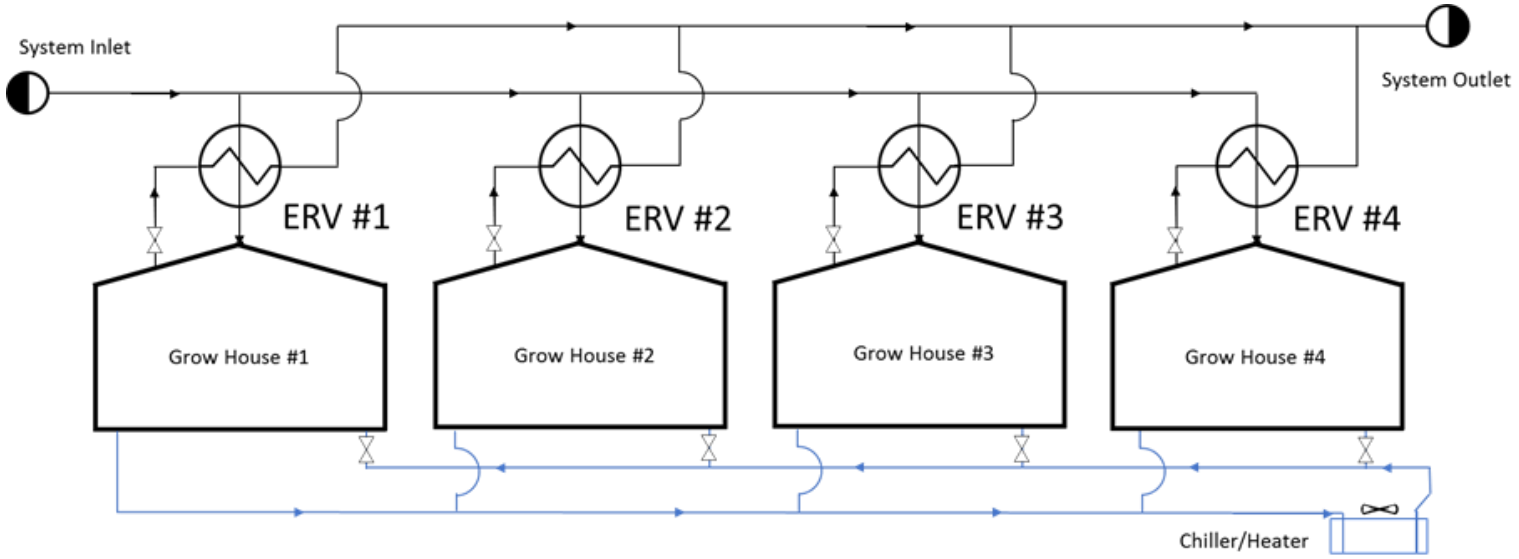
Recommendation	Cost of Implementation	Savings Per Year	Energy Savings Per Year (kWh)	payback Period (Yr.)
Implement New Waste Disposal System	$310,000	$12,200	128,000 (1,800 therms)	≤ 2.0
Fix Compressed Air Leaks	$1,600	$4,400	69,400	0.4
Implement Lighting Changes	$2,800	$1,700	13,500	1.7
Heat Tunnel Management	$0	$700	11,000	Immediate
Install Line Controls	$300	$300	5,300	1

- **Grows organic mushrooms year-round**
- **Layout**
  - Office space
  - Four grow houses
  - Inoculation chamber
  - Warehouse



Highlights: Energy Recovery Ventilation System

- **Designed Air-Air Heat Recovery System**
  - Utilizes four, 130 CFM energy recovery ventilators (ERVs)
  - Exchanges humidity and heat with incoming air
  - Saves 32,400 kWh annually from reduced air reheating costs



Findings: Savings Opportunities

- **Total Savings Identified: $18,800**
  - 212,800 kWh of energy consumption savings
  - 21 kW of energy demand savings
  - 5,100 gallons of Propane

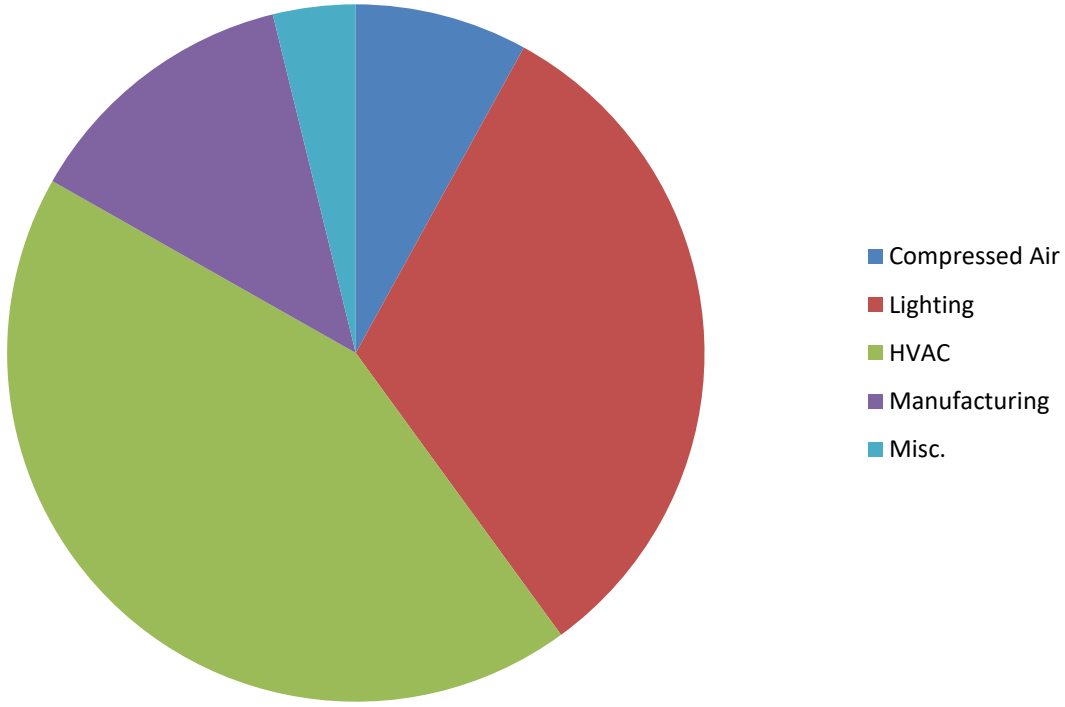
48% Total Energy Savings

Table 2 Summary of Recommendations, Savings, and Cost

Recommendation	Cost of Implementation ($)	Savings Per Year ($)	Energy Savings Per Year (kWh)	payback Period (Yr.)
Lighting Changes	TBD	$11,430	167,200	≤2.0
Steam Trap Replacement	$450	$2,900	(5,100 gal Propane)	0.2
ERV Implementation	$3,400	$2,400	32,400	1.4
Insulating Ventilation	$1,000	$1,600	25,300	0.6
Compressed Air Leak Repairs	TBD	$1,100	13,100	TBD
Reducing Mixer Motor	$980-$1,130	$950	100	1-1.2

Company C: Diesel Engine Repair

- **Services diesel engines and generators**
- **Layout**
  - Office space
  - Parts distribution
  - Truck service area
  - Warehouse



Highlights: Lighting

- Business worked with Onestop Lighting, recommended type B LED replacement for the whole facility
- Too long of payback
- Able to create a shorter payback by mixing use of type A and B LED based on differing operating hours (1.8 yrs)
- $10,200 savings annually

Findings: Savings Opportunities

- **Total Savings Identified: $26,000**
  - 329,000 kWh of energy consumption savings
  - 27 kW of energy demand savings
  - 7,700 Therms of gas consumption savings

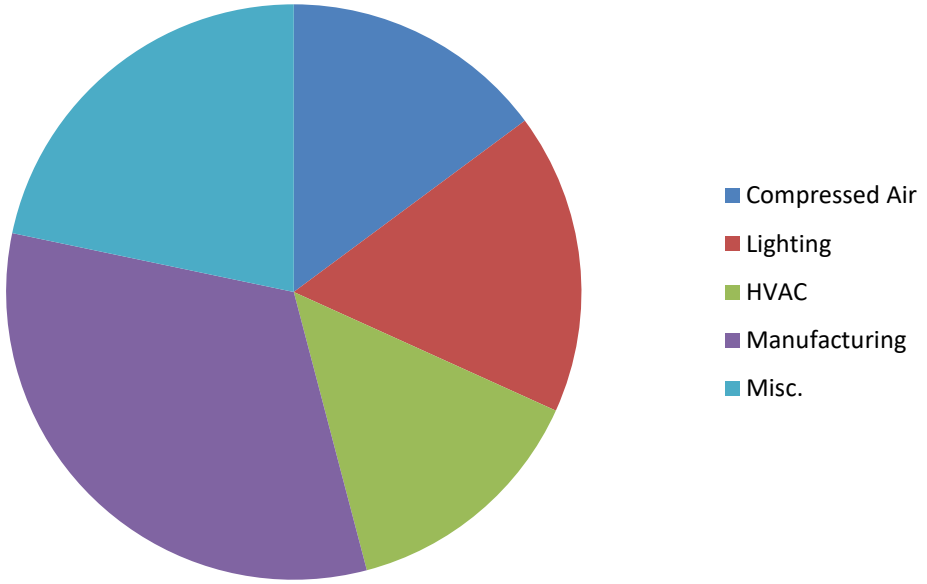
38% Total Energy Savings

Table 3 Summary of Recommendations, Savings, and Cost

Recommendation	Cost of Implementation ($)	Savings Per Year ($)	Energy Savings Per Year (kWh)	payback Period (Yr.)
Implement Lighting Changes	18,200	10,200	133,900	1.8
HVAC System Changes	4,300	9,400	95,000 (7,700 Therms)	0.5
Fix Compressed Air Leaks	300	2,900	45,900	0.1
Implement Computer Power Management	0	2,000	31,500	immediate
Change Compressor Idle	0	1,400	22,800	immediate

Company D: Medical Devices

- Design and Manufacturing of Medical Devices
- Specializes in improving current treatment options
- Goal to improve quality of life for patients



Highlights: Clean Room Optimization

- **Clean Room Certified to ISO Class 8**
  - Clean room over circulated, had significantly fewer contaminants than the level the room was certified
  - Maintained rate of 63 air changes per hour
  - Opportunity for reducing air exchange rate

Highlights: Clean Room Optimization

- **Looked into Industry Standards on Clean Room Circulation**
  - Found that ISO 8 certified clean rooms require 5 to 48 air changes per hour
  - Used nameplate data on circulation equipment to determine power draw of the clean room
  - Reducing air exchanges from 63 per hour to 48 saves $2,300 annually over the current settings (30,000 kWh)
  - 50% reduction in operating costs for cleanroom

Savings Overview

Table 4	Summary of Savings		
Site	**Energy Savings Annually (kWh)**	**Natural Gas Savings Annually (Therms)**	**Savings Annually ($)**
Lofton Label	227,200	1,800	$19,300
Mississippi Mushrooms	212,800	(5,100 gal Propane)	$18,800
Site C	329,000	7,700	$26,000
Site D	68,000	N/A	$5,400
Total	**837,000 kWh**	**9,500 Therms**	**$69,500**

Personal Benefits

- Developed new tools for analysis and quantification of energy use
- Able to sample a wide array of differing industries
- Built relationships with employees at each site, learned from experience
- Opportunity to look into energy management capabilities

Thank You!