Energy Savings at
Brandon Noel
MnTAP Advisor: AJ Van den Berghe
On-Site Supervisors: Bill Groboski and Andy Rustand

University of Minnesota
Driven to Discover™
Company Overview

- Employees and investors bought the Bloomington site in March 2017
- Designer and manufacturer of semiconductor products for a wide variety of applications
  - Military
  - Consumer Goods
  - Automotive
- 24/7 365 Operation
Motivation

• Commitment to the Environment
  • “SkyWater Technology Foundry is committed to the prevention of pollution and continual improvement of its environmental systems and controls.”
    – Gary Obermiller, CEO

• Improved Maintenance

• Financial Savings
  • Electricity costs are the largest cost after labor
Motivation

Electricity Usage vs. Time

Annual Electrical Consumption (GW\*hr)

- 2011
- 2012
- 2013
- 2014
- 2015
- 2016

76 to 98 GW\*hr
Goals

• Improve energy efficiency of air handling systems and related components
• Develop a regular maintenance schedule for make-up air unit coil cleaning
Approach

• Use previously made energy footprint to prioritize the largest opportunities
• Research ways to improve the efficiencies of those systems
• Determine feasibility
  • Talk with facility engineers, technicians, vendors
• Implement
Make-Up Air Unit (MAU)

- Pre-Filter
- Carbon Filter
- Heat Transfer Coils
  - Supply 153° F
  - Supply 43° F
  - Supply 36° F
  - Supply 153° F
- Vane-Axial Fan
- Final Filter
- High Pressure Humidification
Make-Up Air Unit (MAU)

Pre-Filter  
Carbon Filter  
Final Filter  
Vane-Axial Fan  
High-Pressure Humidification
Make-Up Air System

Make Up Air

Strubbed Exhaust

General Exhaust

PRESSURIZED PLENUM

69°F

73°F

SUB-FAB

Chilled Water to Trim Coils
Make-Up Air Energy Savings: Coils

- Coils transfer heat between the cold/hot water and the air
- Dirty coils increase the pressure drop and lower heat transfer efficiency
Make-Up Air Energy Savings: Coils

- Reduced Fan Speed
- Reduced Cold/Hot Water Pump Speed
  - Signal to noise ratio is too high
  - Need longer term data collection
Make-Up Air Energy Savings: Charcoal Filters

- Designed to adsorb volatile organic compounds (VOCs) and odors
- Typical expected lifetime 5 years
- 15 years old
- Reduced Fan Speed

Outside Air Damper
Pre-Filter 30% Efficient
Carbon Filter Pre-Heating Hot Water Coil
Fan Pre-Cooling Chilled Water Coil
Re-Heating Hot Water Coil
Final Filter 95% Efficient
HEPA Filter 99.99% Efficient
High Pressure Water Injection
Humidification
Mist Eliminator

Air Temps
Water Temps
HP INJ
OFF
Sup - 155°F
Ret - 148°F
Sup - 46°F
Ret - 56°F
Sup - 34°F
Ret - 44°F
Chiller Energy Savings: Condenser Pump

Forced Draft Cooling Tower

Evaporator

Condenser

Refrigerant (Freon 123) Loop

Centrifugal Compressor

Compression ↑

# of Fans ↓

Temp ↑

Heat →

Condenser Water Loop

Condenser

Heat →

Hottest

43°F

36°F

Coldest

Evaporator

↓ Heat

Building/Process Heat Load

Chilled 70% Water 30% Glycol Loop

Temp ↑

# of Fans ↓

Speed ↓
Fab Air Handling Cost Metric

- Estimated per unit cost of air handling
  - Make-Up Air Fans
  - Exhaust Fans (General and Scrubbed)
  - Chillers
  - Boilers

- Estimated Annual Cost
  - $765,000 @ $0.068/kWh

- Estimated Annual Cubic Feet of Air Handling
  - 125 billion cubic feet

- Can be used to estimate cost savings from reducing exhaust
## Summary of Recommendations

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Annual Energy Savings</th>
<th>Annual Cost Savings</th>
<th>Implementation Cost</th>
<th>Payback Period</th>
<th>Status</th>
</tr>
</thead>
</table>
| Clean MAU C1,C2,A,B Coils                         | 41,000 kWh            | $2,700              | $2,900 + 50 Technician Man Hours | w/out Technicians: 1.05 years  
with Technicians: 1.87 years | Implemented             |
| Remove Charcoal Filters                           | 44,000 kWh            | $3,000              | 30 Technician Man Hours | w/out Technicians: Immediate  
with Technicians: 6 Months | Implemented, Under Review |
| Reduce Condenser Water Pump Speed in Fab C         | 520,000 kWh           | $35,600             | 60 Engineer Man Hours + Four Flow Meters | 5 Months | Recommended                |
| Total                                              | 605,000 kWh           | $41,300             | $2,900 + 140 Man Hours | 4 Months                                 |                         |
Personal Benefits

- New areas of expertise
- Practice communicating with co-workers and vendors
- Experience solving real world problems
Future Work

• Look into pressure sensor that controls fab differential pressure
• Clean 3 remaining MAU A, MAU B coils in the winter
• Reduce remaining condenser/chilled water pump speeds
QUESTIONS?