

A glass beaker containing a blue liquid sits on a white lab bench. The beaker has a '500' and '100' marking. To the right of the beaker are two vertical decorative stripes, one blue and one green, with a white border between them. The background is a blurred laboratory setting with bokeh lights.

2024 Critical  
Environments Summit

# Smart Lab Solutions

Control, IAQ, and Energy Initiatives

Tyler Kee 1/17/2024

# What is a Smart Lab?



Smart Labs enable **safe** and **efficient** world class science to occur in laboratories through **high-performance methods**. A Smart Labs program employs a **combination of physical, administrative, and management** techniques to **assess, optimize, and manage** high performance laboratories. A smart lab program designs and operates labs based on **containing ventilation risk** as determined by a ventilation risk assessment.

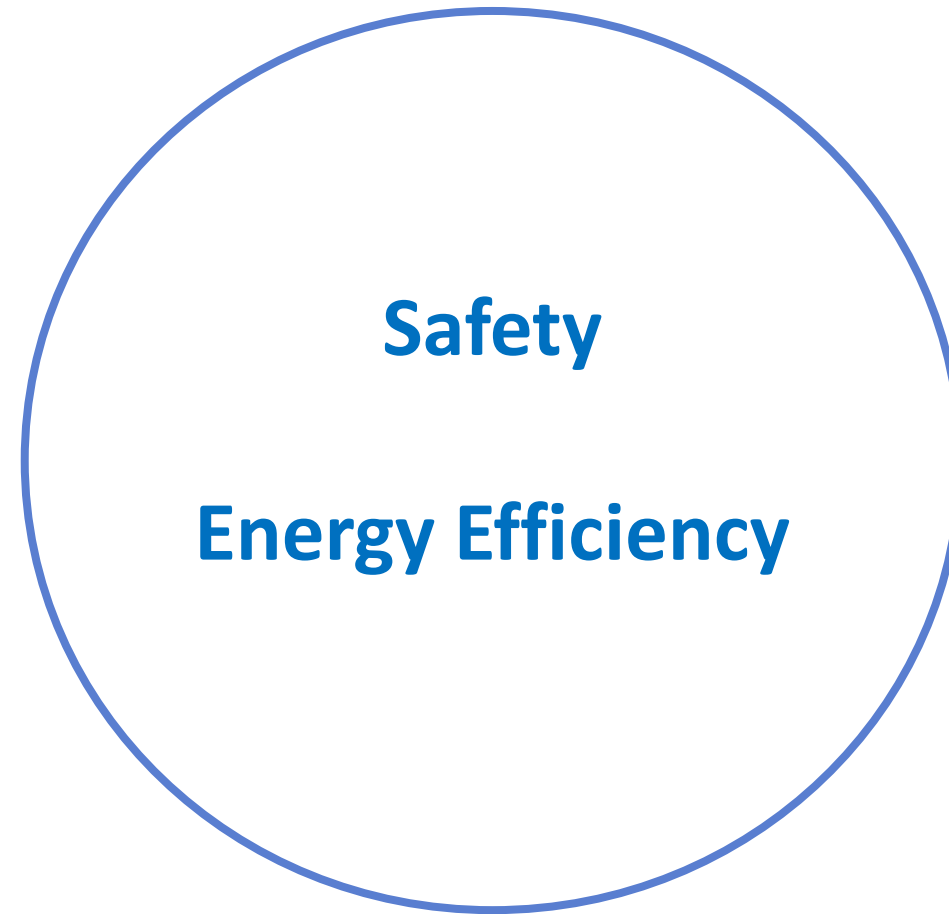
# Occupant Expectations

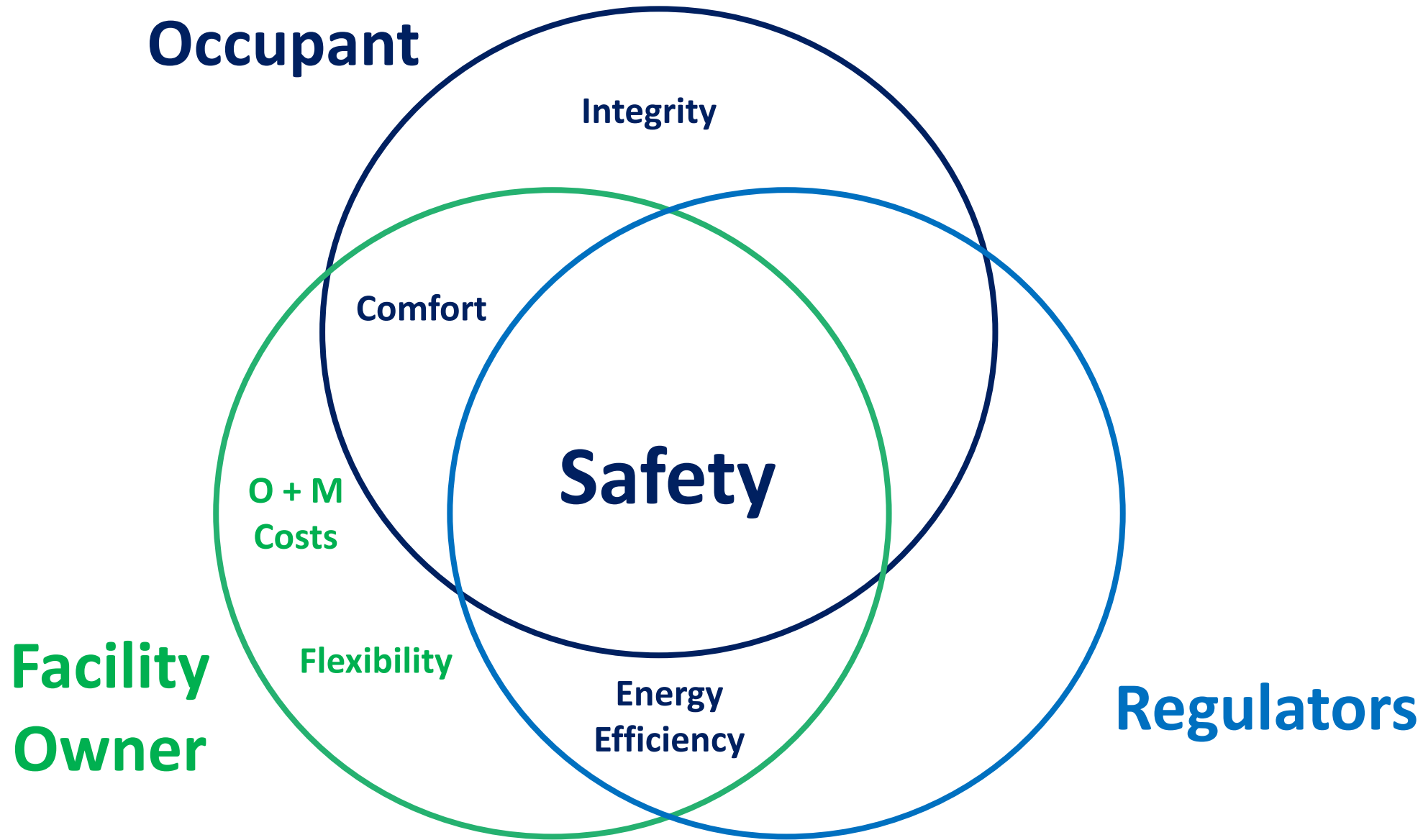


# Facility Owner Expectations



# Regulatory Expectations





**Occupant**

**Integrity**

**Comfort**

**Safety**

**O + M  
Costs**

**Flexibility**

**Energy  
Efficiency**

**Facility  
Owner**

**Regulators**

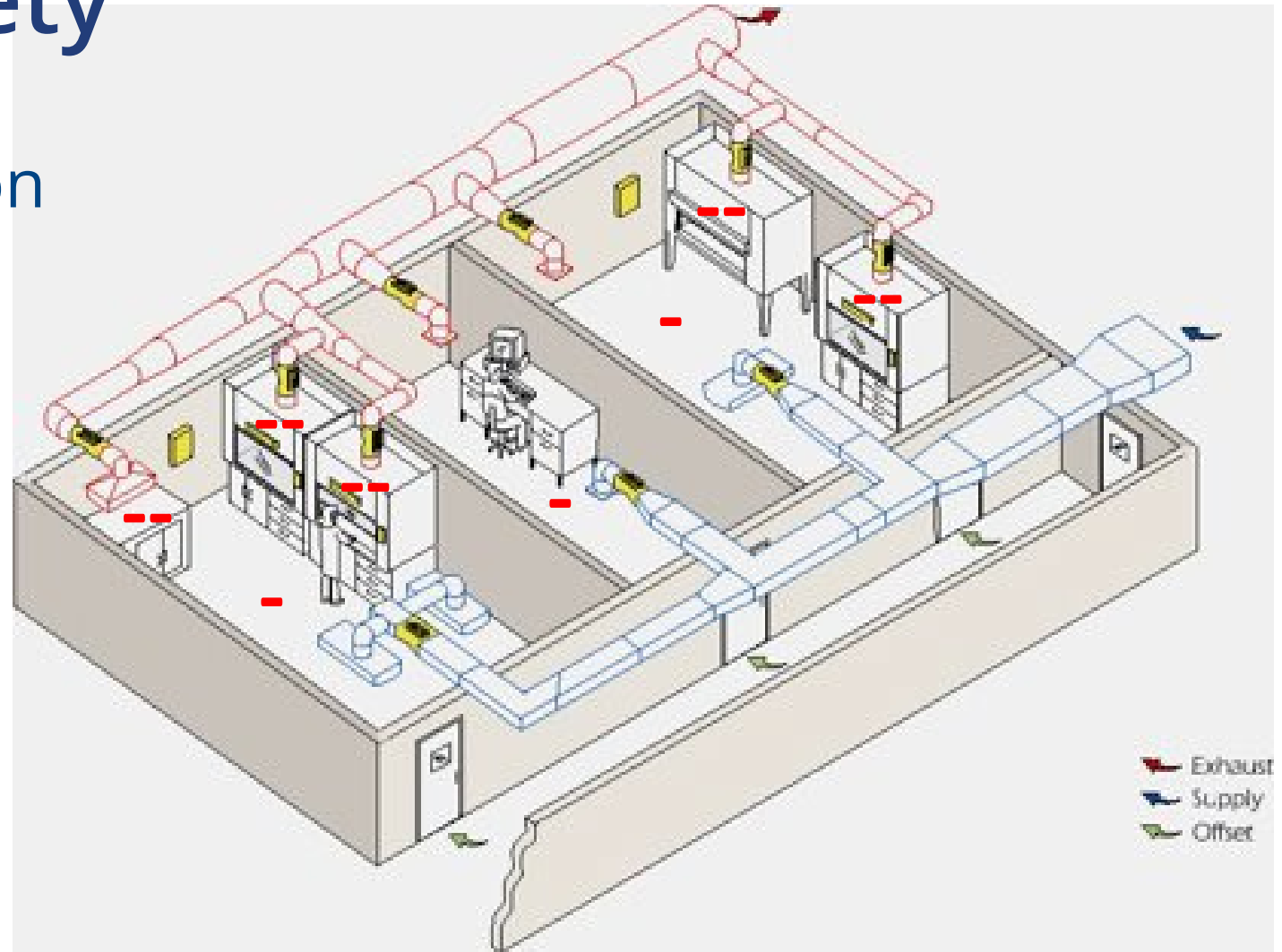
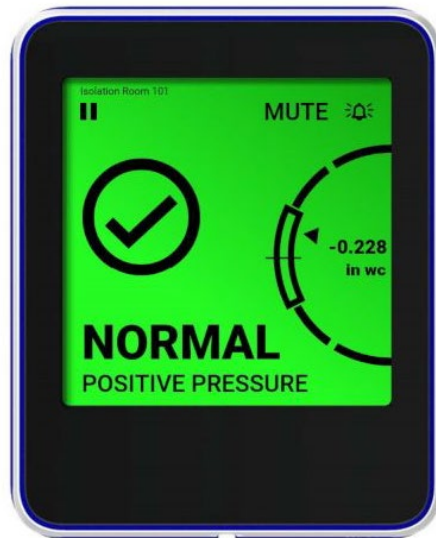
# Occupant Safety



*ANSI Z9.5 – 2022 Section 3.8 Excessive airflow with no demonstrable safety benefit other than meeting an arbitrary air change rate can waste considerable energy.*

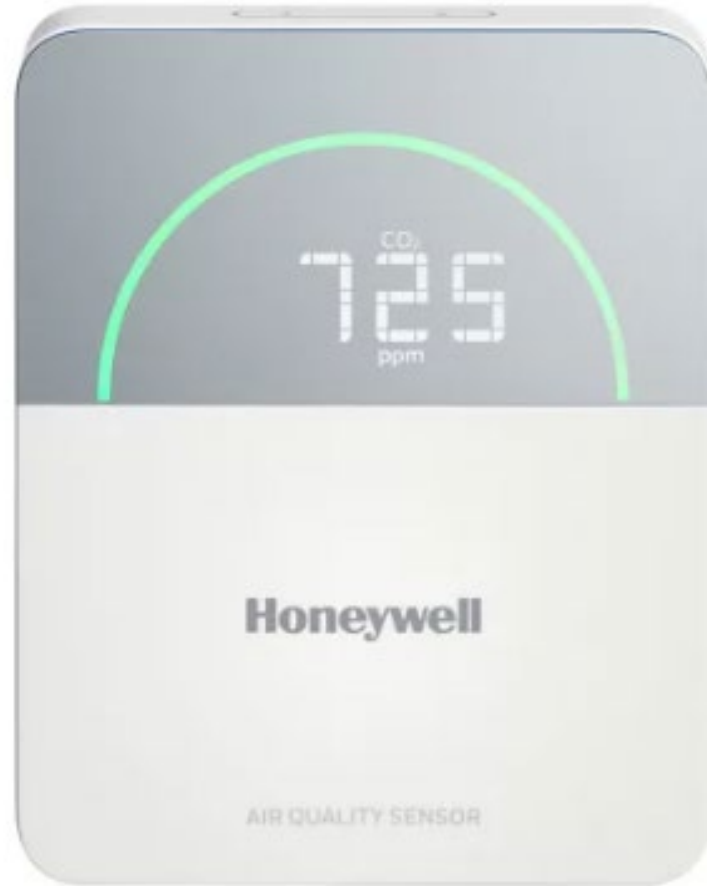
# Occupant Safety

- Space Pressurization





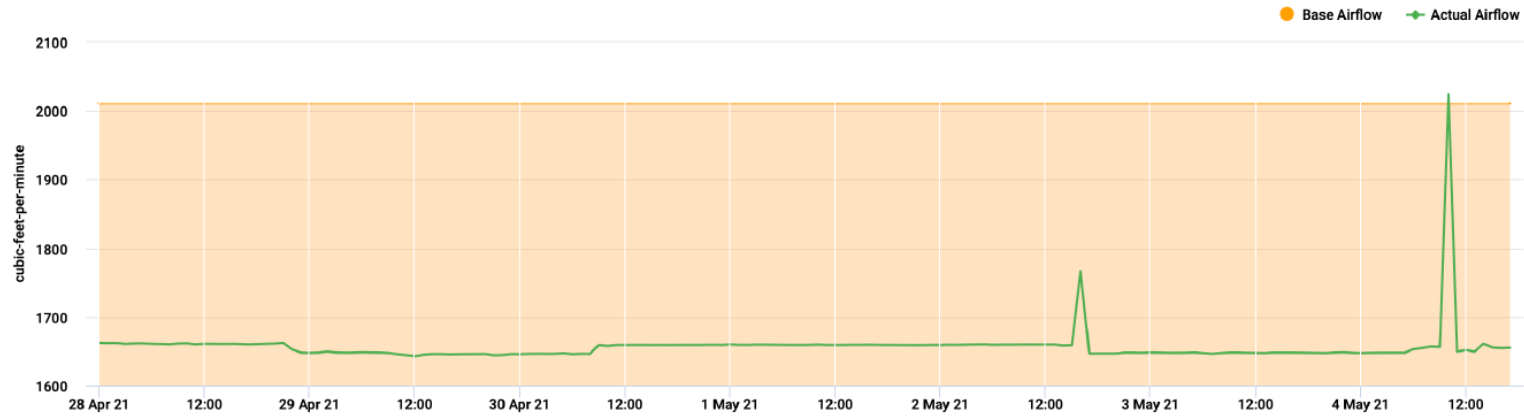
# Occupant Comfort



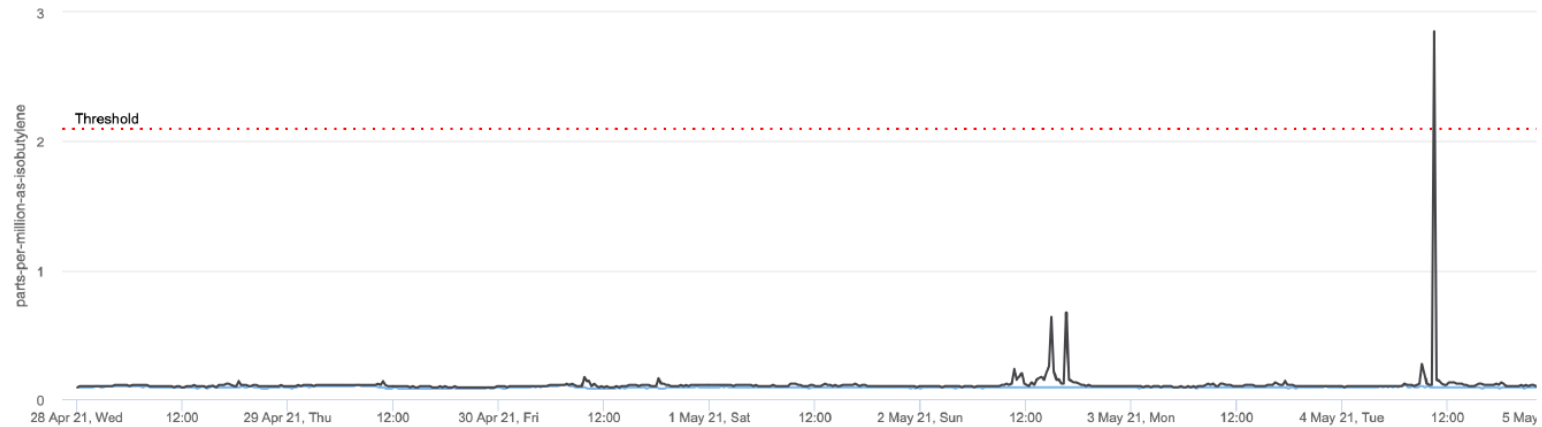
# Demand Controlled Ventilation

Supply Flow

CFM



MOS TVOC



# Operating Costs



**DID YOU KNOW**



**ONE FUME HOOD  
=  
THE SAME ENERGY AS  
3.5 HOMES PER YEAR**

MRB  
Cullen Trust KU  
KANSAS UNIVERSITY

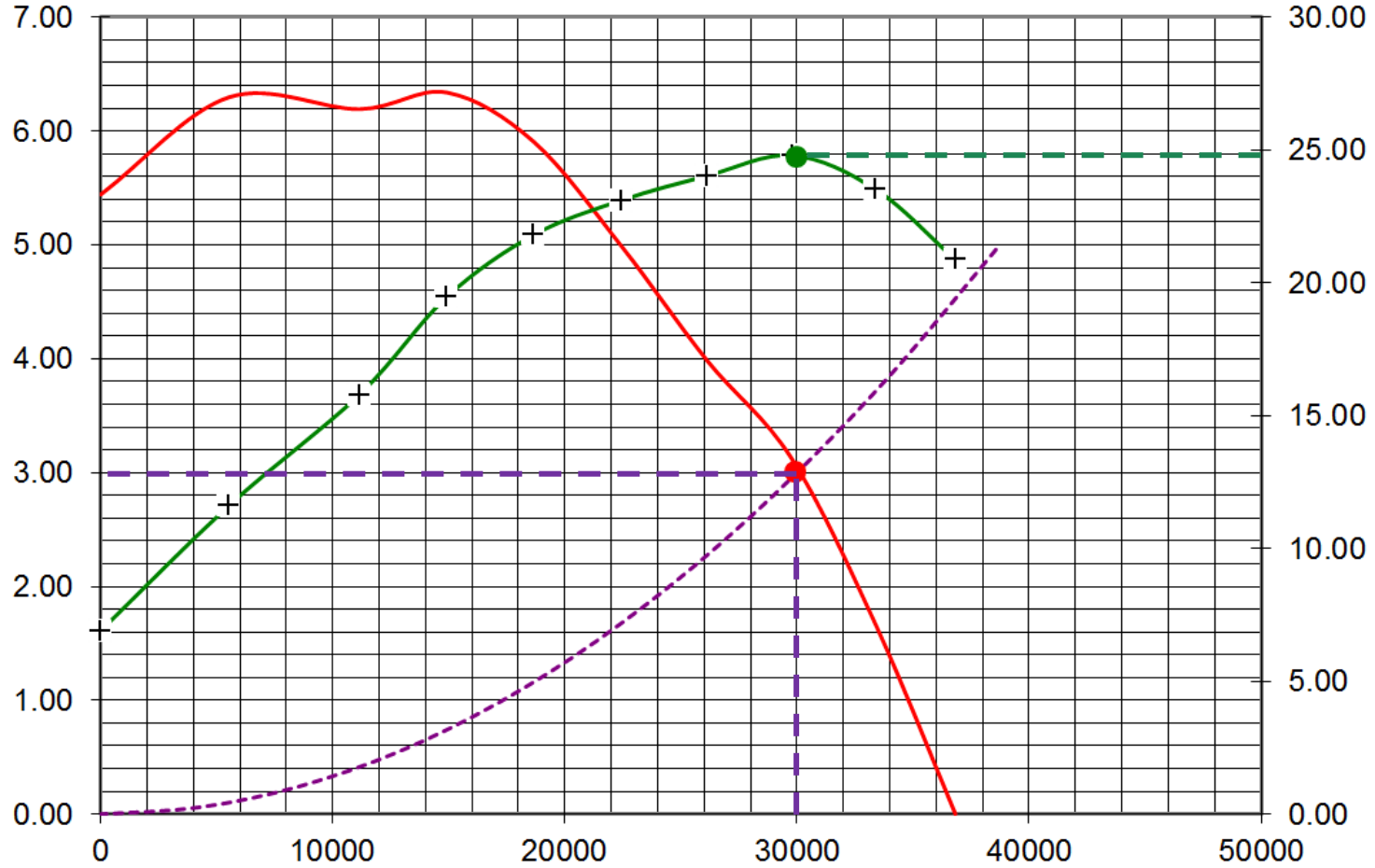
SAVE ENERGY,  
**SHUT THE  
SASH**



sustainability **Tufts**  
Supporting a university-wide commitment



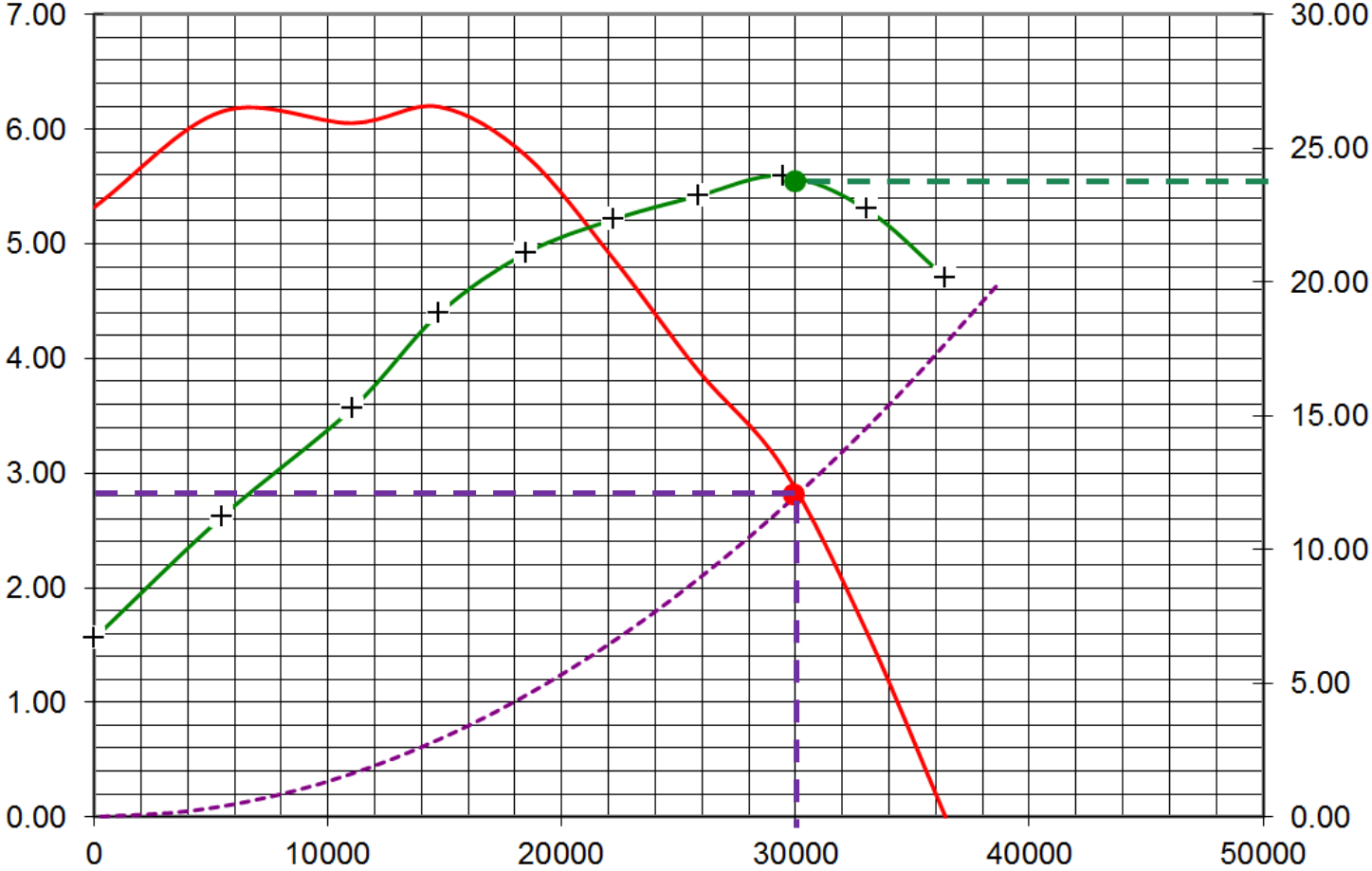
# Duct Static Pressure



**30,000 CFM**  
**3.0" s.p.**  
**24.73 BHP**



# Duct Static Pressure – 10% s.p. reduction



**30,000 CFM**

**2.7" s.p.**

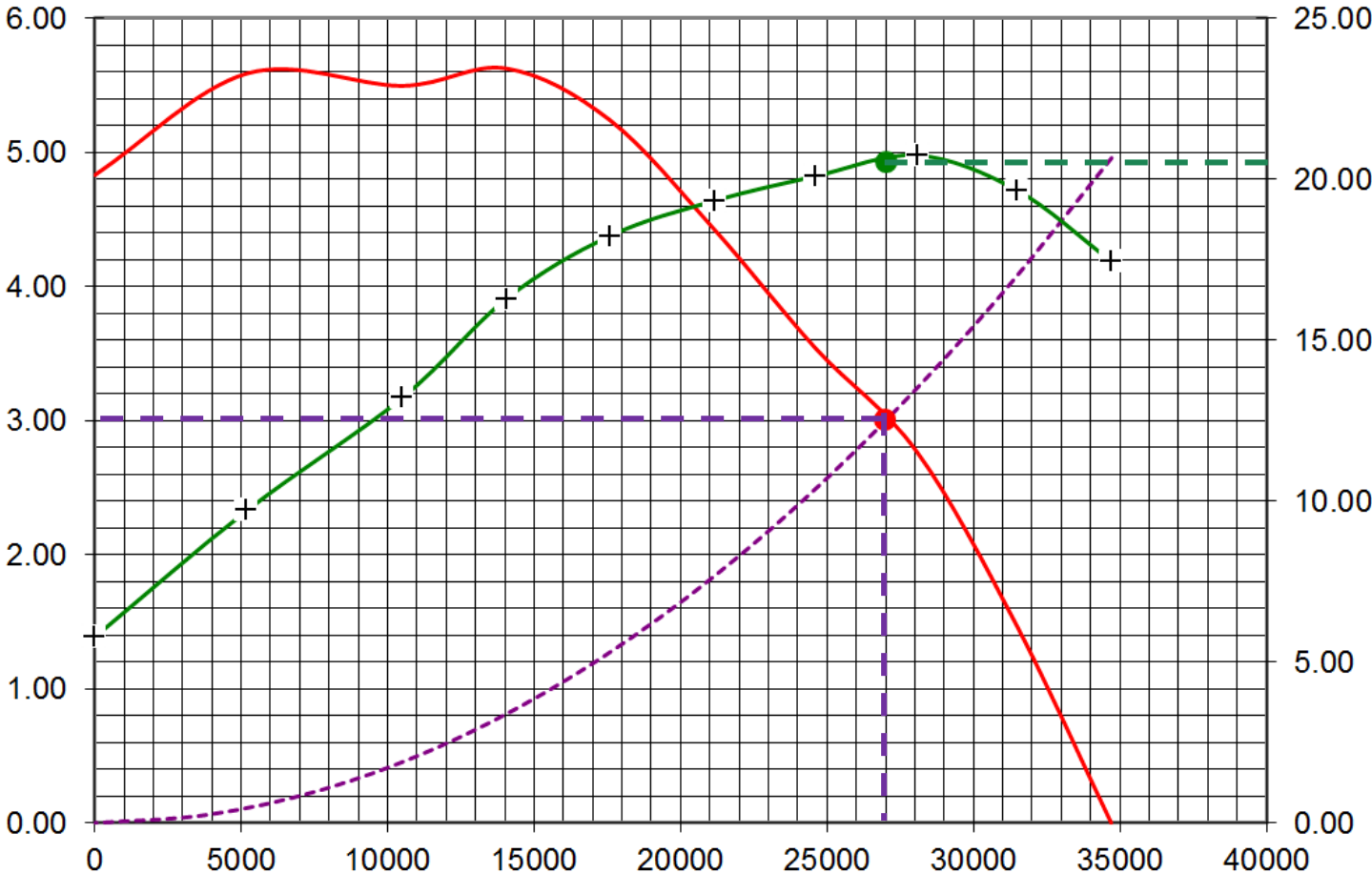
**23.78 BHP**

**3.8%**

**Fan Energy Savings**



# Duct Static Pressure – 10% flow reduction

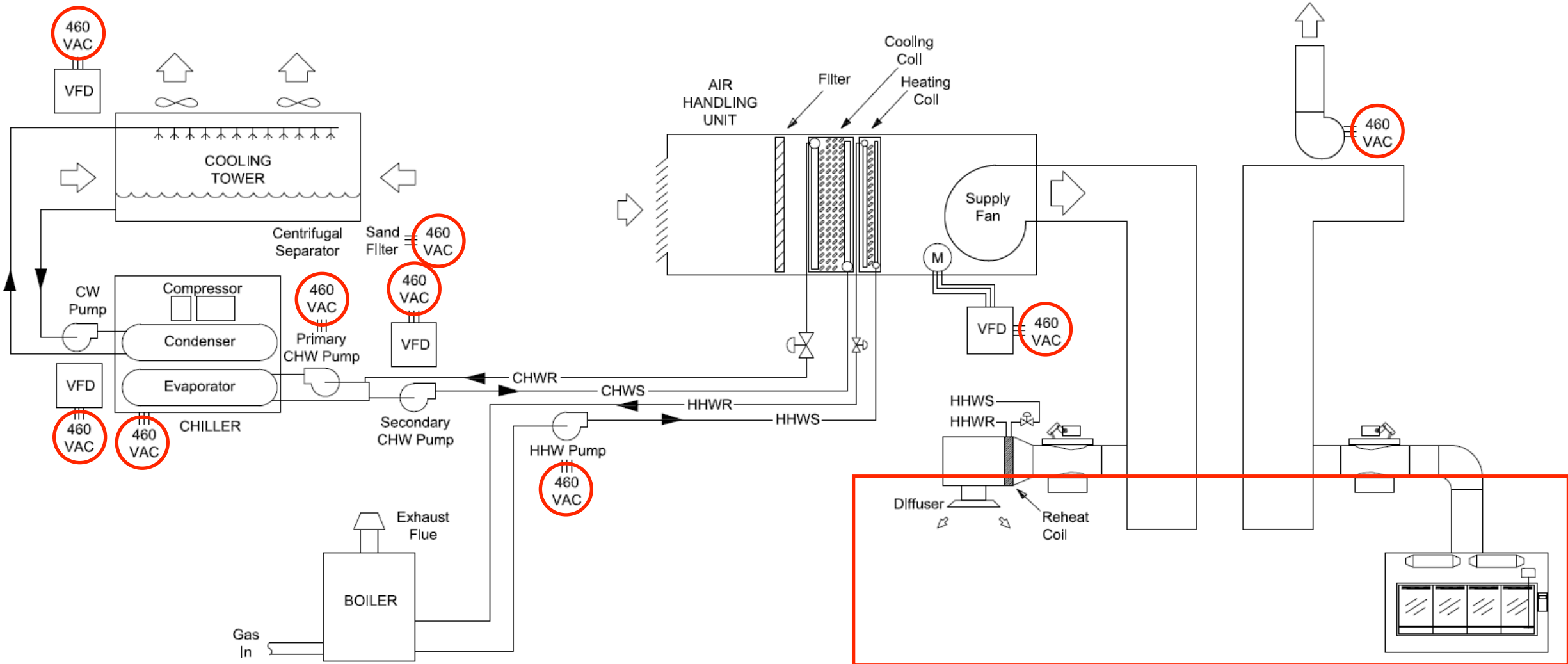


**27,000 CFM**  
**3.0" s.p.**  
**20.55 BHP**

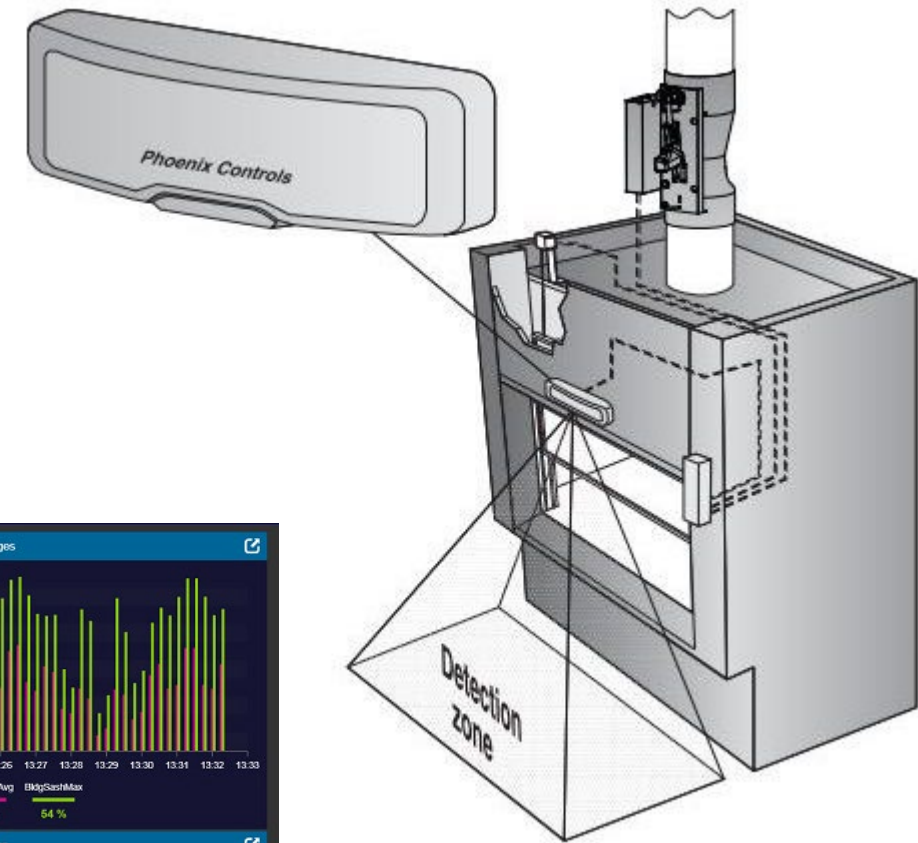
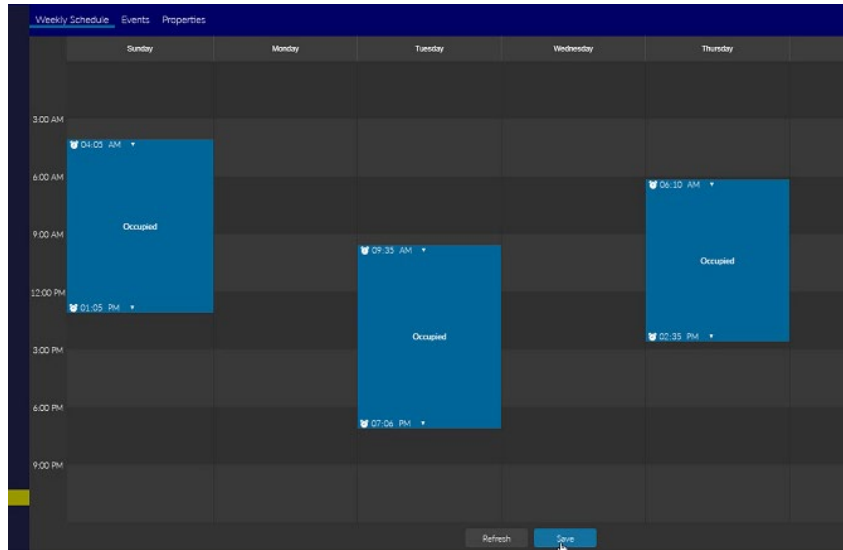
**16.9%**  
**Fan Energy**  
**Savings**



# HVAC Energy



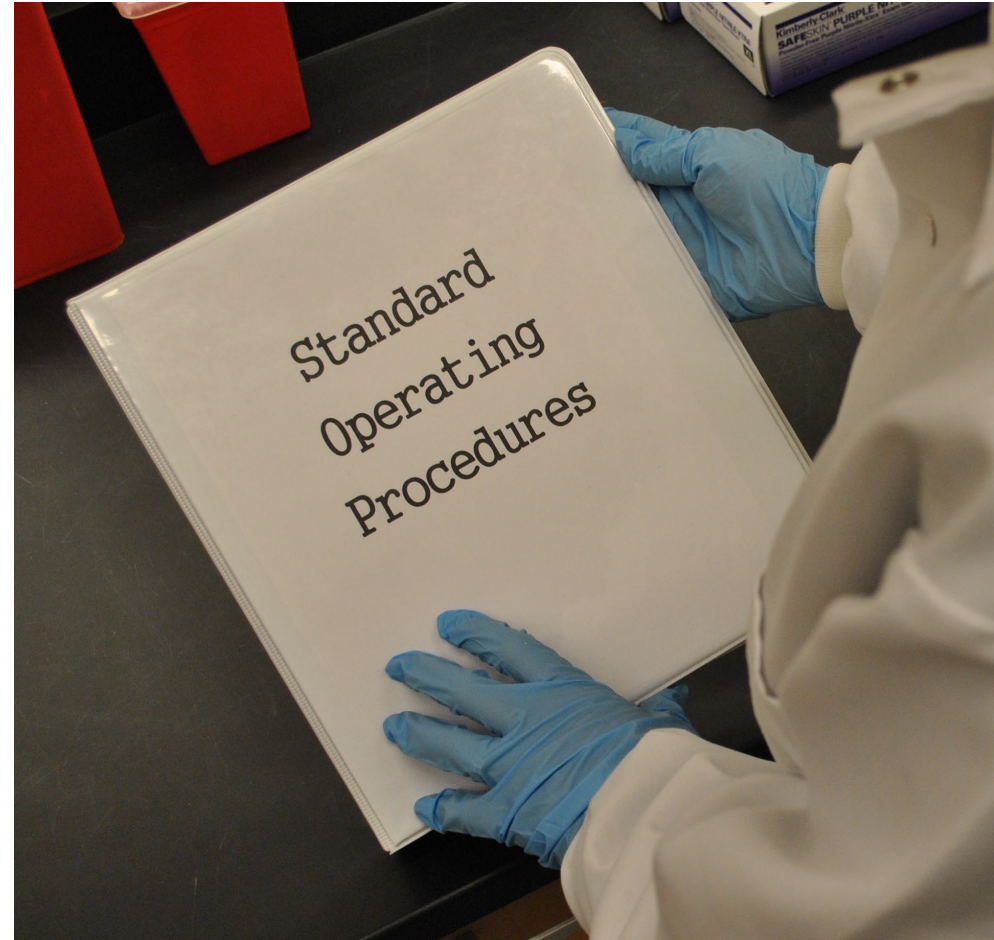
# Setback





# Maintenance Costs

- System Maintenance
  - Cleaning
  - Calibration
  - Filter Changeouts



# System Visualization

**VISION2.0**  
Brought to you by Phoenix Controls, Inc.

Phoenix Controls 13

Campus

Lab Building

Lab Building Reports

Lab Building Analytics

1st Floor

Lab101

IAQ101

Lab102

Lab103

Lab104

Lab105

Lab106

Lab107

Lab108

Lab109

Lab110

2nd Floor

3rd Floor

4th Floor

5th Floor

AHU

Exhaust Fans

Niagara Schedules

Reports

Niagara Alarms

### Lab Temperature Chart

Lab Temperature

- AVG\_SPACE\_TEMP\_TOT 75.9 °F
- EFF\_TEMP\_SETPT\_TOT 76.0 °F
- CoolingDemand\_AVGTOT 60.2 %
- HeatingDemand\_AVGTOT 26.9 %

### Lab Offset / Pressure Chart

Lab Offset / Pressure

- OFFSET -110 cfm
- EFF\_OFFSET\_SETPT -100 cfm
- TOTAL\_ZONE\_EXHAUST 706 cfm
- TOTAL\_ZONE\_SUPPLY 780 cfm
- HOOD\_FLOW\_FDBK 949 cfm

### Lab Air Change Rate Chart

Lab Air Change Rate

- ACH 5.2
- ACH Min 8.0
- ACH Max 11.0
- Temp\_Override DISABLE
- Hood\_Override ENABLE
- IAQ\_Override DISABLE
- OCC\_MIN\_SETPT 1080 cfm
- UNOCC\_MIN\_SETPT 710 cfm

### Lab Diversity Chart

Lab Diversity

- Diversity 50.4 %
- Diversity\_SP 60.0 %
- DIVERSITY\_ALARM normal

Lab Modes

- EFF\_OCC\_MODE OCCUPIED
- OCCUPANCY\_CMD OCCUPIED
- EFF\_EMERG\_MODE EM\_NORMAL
- EMER\_MODE\_CMD EM\_NORMAL

### MAV101-1 MAV101-2 Lab101

Makeup/Supply Valve Points

- VLV\_FLOW\_FDBK 1403 cfm
- EFF\_VLV\_FLOW\_CMD 100 cfm
- FLOW\_ALARM alarm
- JAM\_ALARM alarm
- deviceStatus online

Lab Temperature Points

- AVG\_SPACE\_TEMP 84.5 °F
- EFF\_TEMP\_SETPT 70.0 °F
- COOLING\_DEMAND 60 %
- HEATING\_DEMAND 27 %
- OCC\_COOL\_SETPT 74.0 °F
- OCC\_HEAT\_SETPT 72.0 °F
- UNOCC\_COOL\_SETPT 80.0 °F
- UNOCC\_HEAT\_SETPT 66.0 °F

ACH Status Diner

### GEV101-1

General Exhaust Valve Points

- VLV\_FLOW\_FDBK 893 cfm
- EFF\_VLV\_FLOW\_CMD 150 cfm
- FLOW\_ALARM normal
- JAM\_ALARM normal
- deviceStatus online

### HEV101-1

Hood Exhaust Valve Points

- VLV\_FLOW\_FDBK 493 cfm
- EFF\_VLV\_FLOW\_CMD 200 cfm
- FLOW\_ALARM normal
- JAM\_ALARM normal
- deviceStatus online

Fume Hood Points

- FACE\_VELOCITY 100 f/min
- FACE\_VELOCITY\_SETPT 100 f/min
- SASH\_OPEN\_PERCENT 82 %
- USER\_STATUS inactive
- SASH\_HEIGHT\_ALARM normal
- HOOD\_OVERRIDE normal
- HOOD\_ENERGY\_WASTAG... normal
- BROKEN\_SASH\_CABLE normal
- HOOD\_MODE NORMAL
- deviceStatus1 online

Hibernation\_Mode

Normal

# System Visualization





# Success Story – GradLabs



# Success Story - CRADL



