



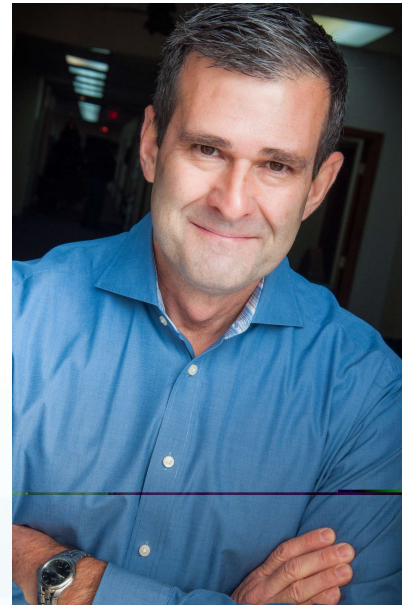
**Helping Leaders Create Better Working Environments for Hard  
Working People**

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# Introductions

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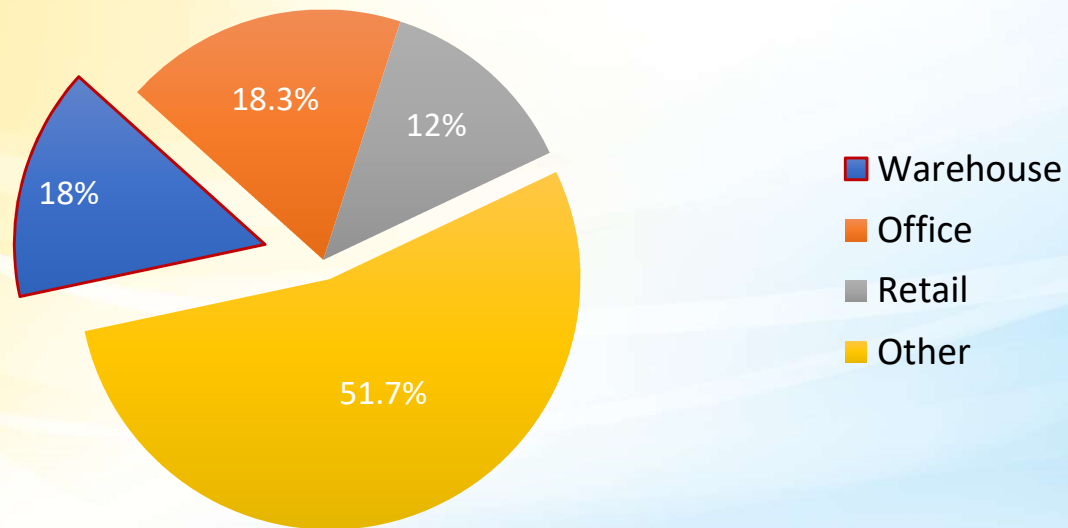


# High Performance Space Heating for High Bay Buildings

# Large Number of Buildings and Floor Space

- Approximately 18% of U.S. commercial floor space belongs to the warehousing and distribution segment\*
- Larger segment than retail and almost as much floor space as all commercial office buildings

U.S. Commercial Floor space by Sector



\*U.S. Energy Information Agency. 2020. Commercial Buildings Energy Consumption Survey (CBECS).

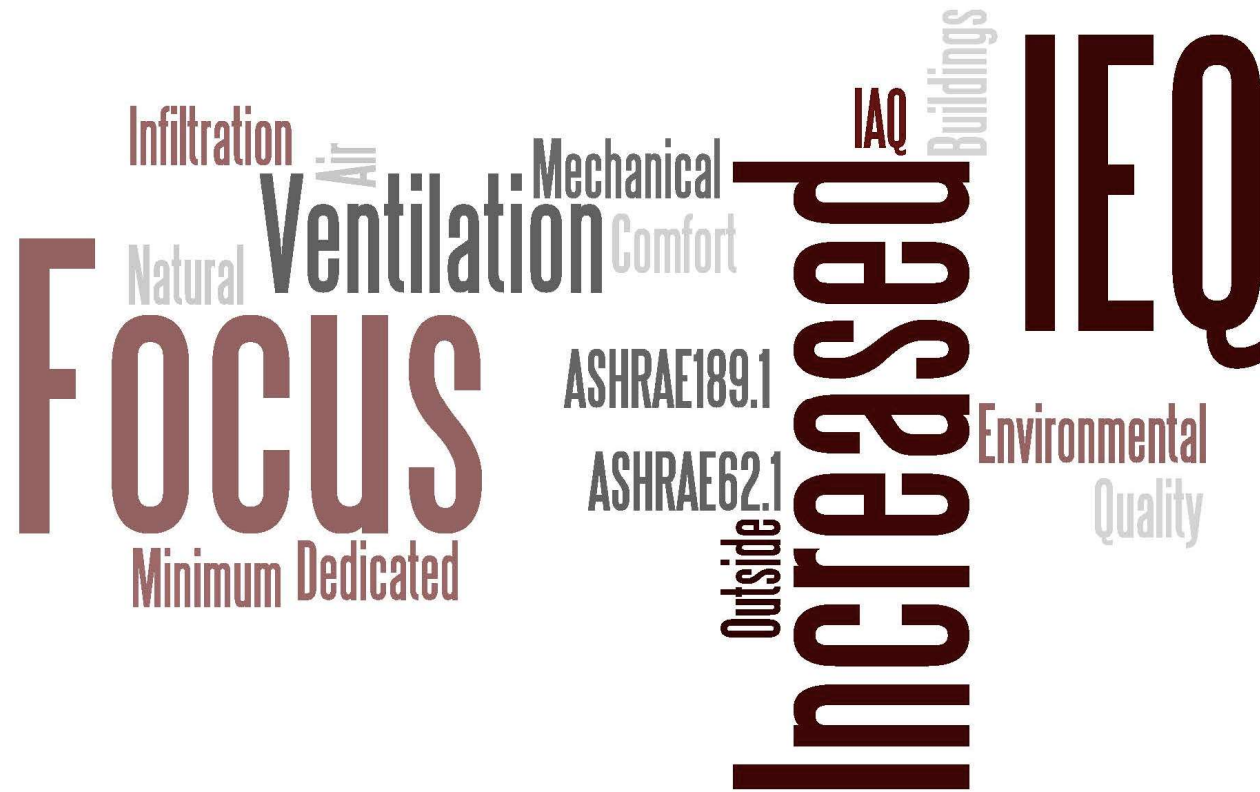
# High Bay Buildings aren't just Distribution & Warehouse Space....

## Other applications are:

- Fire Houses
- Greenhouse facility
- Airplane hangers
- Automotive repair facilities
- Indoor sporting facilities
- Tunnel Carwash Facility



# Trend #1 - Ventilation



# Trend #2 – Energy Efficiency



**Ventilation**

**Efficiency**

**Conflict**

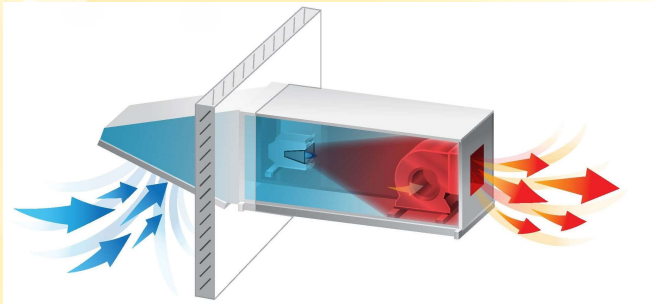


# HTHV.....Direct Fired Technology

**No Heat Exchanger – No Flue Loss – 92% Thermal / 100% Combustions Efficient**

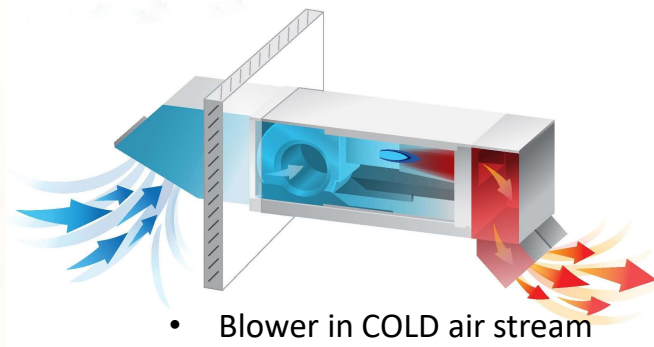
**MAU = 100% Outside Air**

## Standard MAU



- Blower in HOT air stream
- 120°F max discharge

## HTHV



- Blower in COLD air stream
- 160°F max discharge
- > 140°F rise & > 150°F discharge temp
- Fully Modulating Temperature Controls to meet both ventilation & space heating requirements

## Safety Code

*-Non re-circulating direct-fired heaters shall be listed to ANSI Z83.4 (Harmonized US/Canada)*

*- 100% Outside Air Technologies*

*-<5 ppm CO*

*-<3 ppm NO<sup>2</sup>*

*-Industrial & Commercial Occupancies*

*-Permitted as Ventilation and/or Heating Devices for these Buildings*

*-No residential applications or any area containing sleeping quarters.*

## Utility Rebates

-HTHV technologies qualify for both prescriptive and custom rebates from natural gas and electric utility providers.

-HTHV qualifies for federal rebate program EPC Act 179D

-HTHV qualifies for other Rural Energy for America Program (REAP).

# Three Technologies in One Unit

## Fresh Air (Ventilation)

Provides Ventilation Air (100% Outside Air)

Can meet or exceed ASHRAE 62.1 requirements

Constant speed fan can provide fresh air year around and heat as needed

## Warm Air (Heating)

160°F max discharge heats space very efficiently

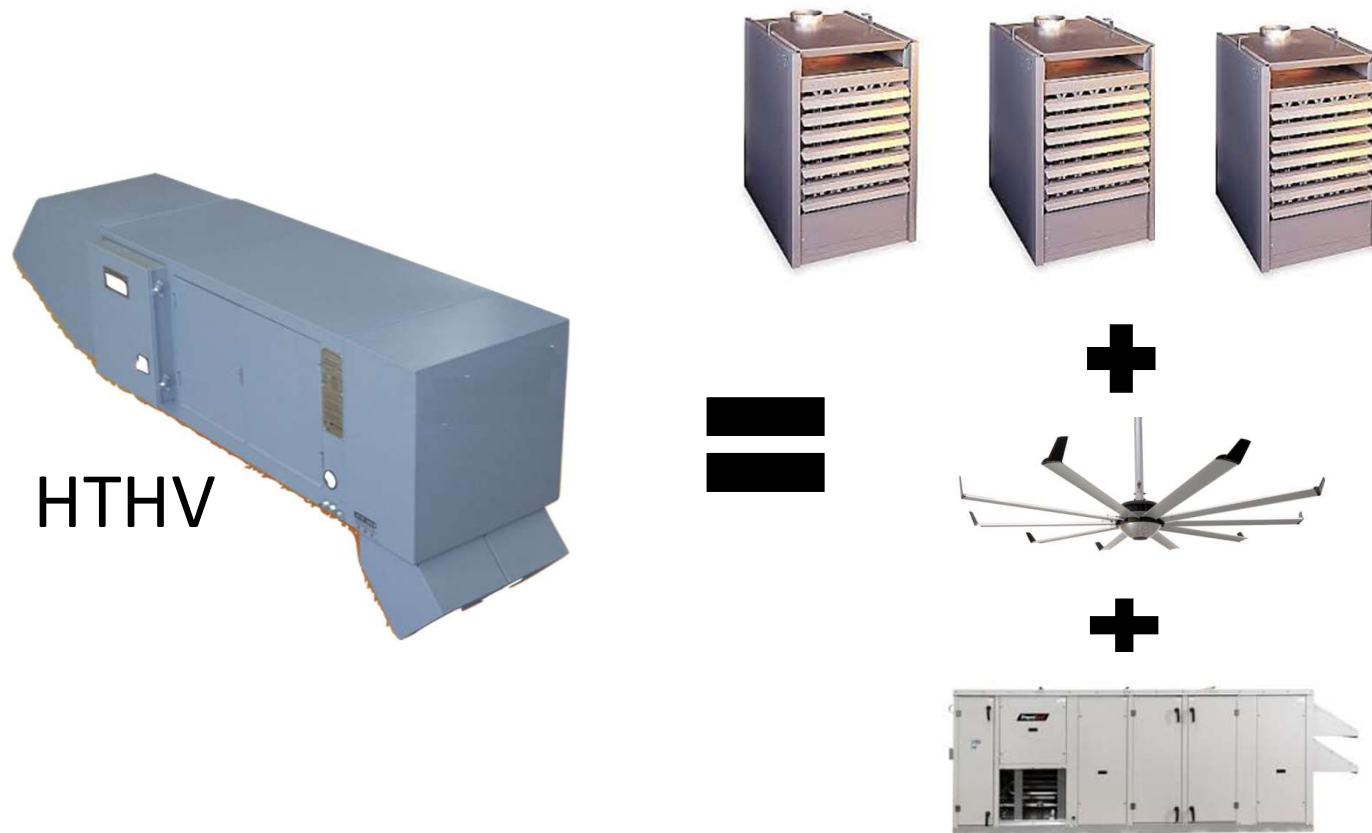
HTHV offers the highest discharge and temp rise in the industry

MAU, air rotation, recirculating, unit heaters limited temp rise

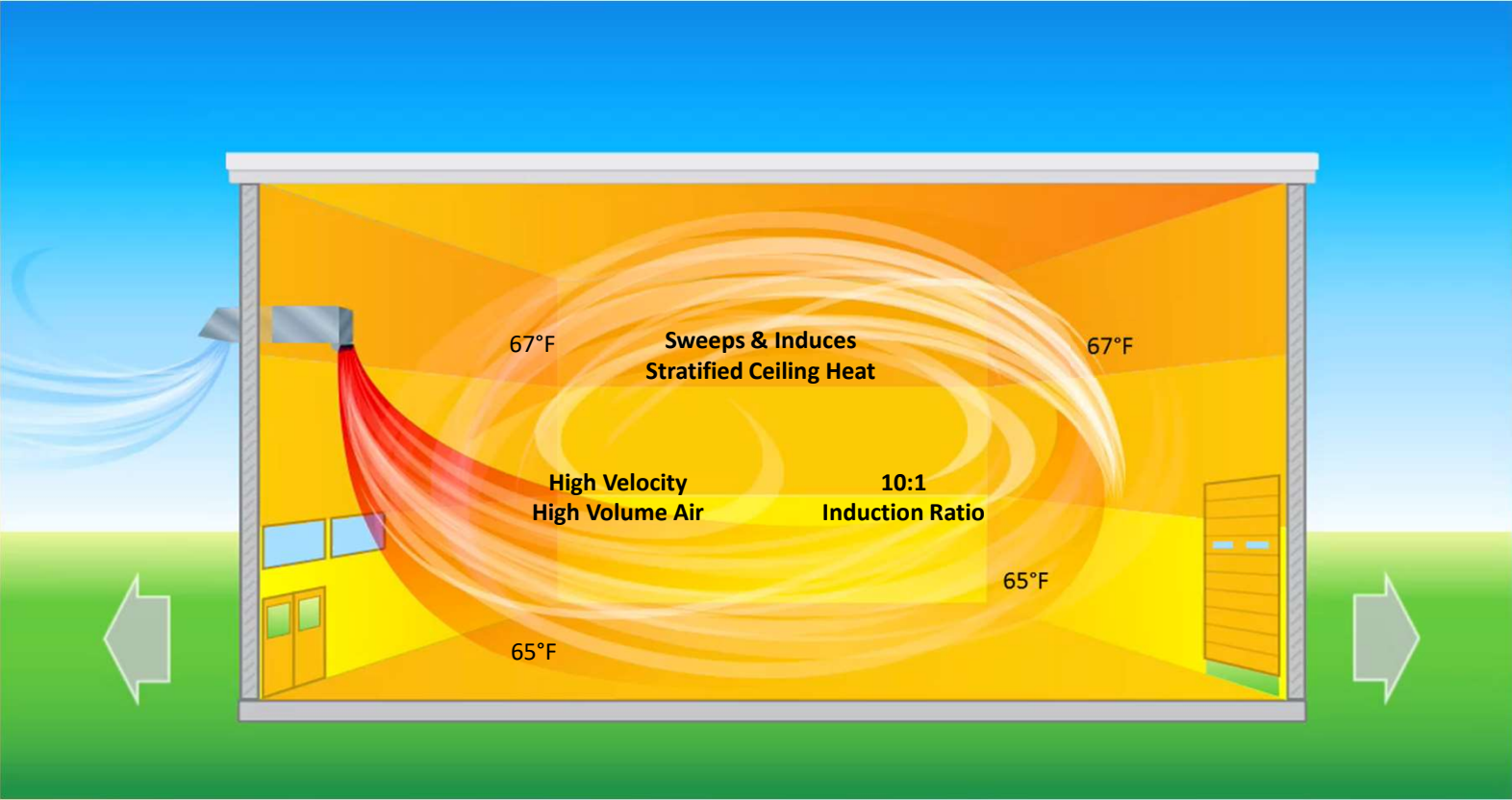
## De-stratified Air

High speed blower provides minimal temperature variations from floor to ceiling

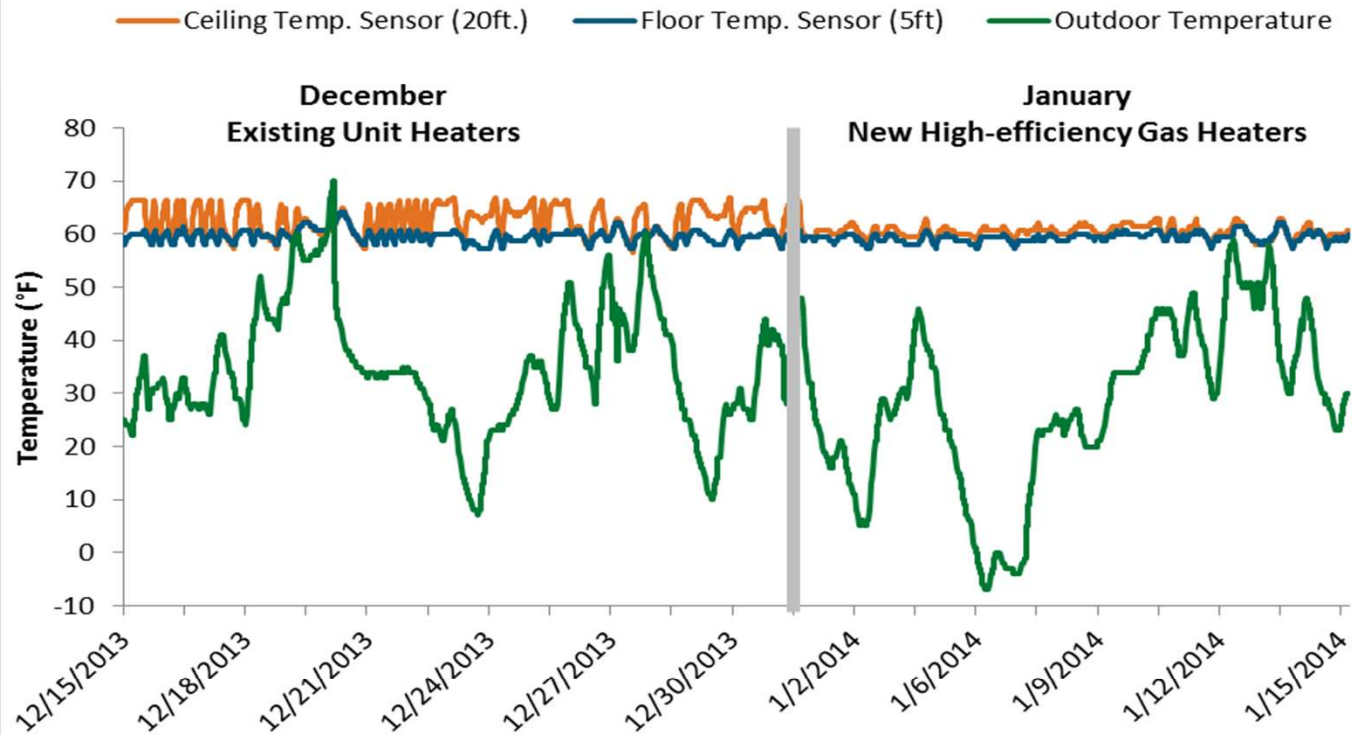
# Considerable Value for the Money



# De-Stratification



## Example of Thermal Stratification Central Temperature Sensors - High and Low



# CJ Automotive



- 126,000 ft<sup>2</sup> manufacturing facility
- One S-2200, One S-800 & One S-400
- \$20,400 rebate potential

| Month         | Therms used | Month         | Therms used | Savings |
|---------------|-------------|---------------|-------------|---------|
| January 2019  | 11,673      | January 2021  | 5,314       | 54%     |
| February 2019 | 9,880       | February 2021 | 7,369       | 23%     |
| March 2019    | 5,556       | March 2021    | 2,781       | 50%     |



# Real Salt Lake Indoor Soccer Facility



- 208,000 s/f facility
- Four S-1850 vertical through wall
- Rebate potential \$44,400
- Energy modeling savings of 37%



# Ultimate Soccer



- Ultimate Soccer Indoor Soccer facility
- Goal was warm and even indoor temperatures in the winter
- 28% reduction in natural gas usages
- Two S-1200s with a potential rebate of \$14,000

# SWIRE Coke



- **Doubled building size from 300,000 s/f to 600,000 s/f**
- **Nine S-950 rooftop mount units**
- **\$51,300 rebate potential**

# Fuller's Carwash



- Ability to keep doors open in winter months
- reduced energy consumption by 32%
- Two S-950 units roof top mount
- \$11,500 in potential rebates

# Big River Steel



## Big River Steel

- Goal - keep temperatures above dew point in the winter
- Ten S-2200 vertical through wall
- \$132,000 in potential rebates

# DOE Study

- Over the course of the heating season, the new units reduced natural gas consumption by 20%.
  - Greater than the ~11% savings predicted by thermal efficiency alone.

|                         |                  | Gas Heater |          | % Savings | Notes  |
|-------------------------|------------------|------------|----------|-----------|--|
|                         |                  | New        | Existing |           |  |
| Natural Gas Consumption | Therms/HDD       | 1.67       | 2.10     | 20%       | Natural gas site-to-source ratio of 1.05*, 100,000 Btu/therm |
|                         | Btu/HDD (Source) | 175,515    | 220,584  |           |  |

## Retrofit Case Study

HTHV vs. Make Up Air

Distribution Center

Building Specifications

- 700,000 ft<sup>2</sup>
- 17 year old building
- Located in Shenandoah Valley, VA

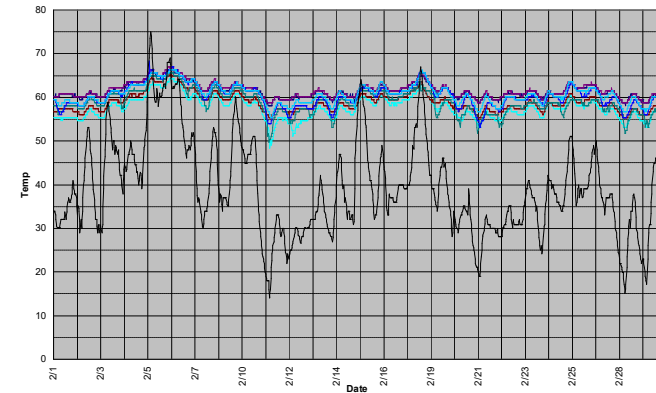


### **Before – Make Up Air Performance**

- Uneven temperatures
- High operating costs

### **Operating Costs**

Based on 59° avg. temp

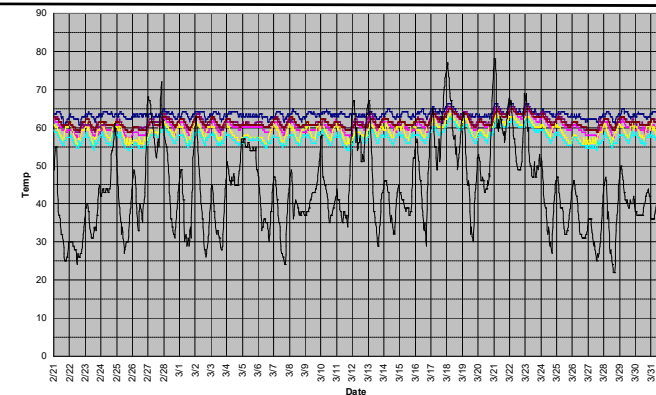


### **After – HTHV Performance**

- More even temperatures
- Lower operating Cost

### **Operating Costs**

Based on 61° avg. temp



- HTHV used **47% less** gas and reduced annual CO2 by >1,000 metric tons
- Saved approximately **\$52,000/year** in natural gas cost
- Five S-3200 rooftop mount units
- \$96,000 rebate potential

# Efficiency of Heating Technologies

**Computer Modeling Results**

**Stratification Comparison**  
 4°F Stratification for HTHV, Air Turnover\*, Infrared  
 10°F Stratification for all other systems  
 ASHRAE 62.1 Ventilation (0.06 cfm/ft<sup>2</sup>)

*Energy Plus*

| <b>Energy Consumption</b> | <b>Gas (therms)</b> | <b>Fan Electric (kWh)</b> |
|---------------------------|---------------------|---------------------------|
| ASHRAE 90.1 Baseline      | 32,563              | 78,594                    |
| HTHV/Blow-Thru            | 20,220              | 5,758                     |
| Draw-Thru                 | 27,506              | 7,589                     |
| Recirculation             | 27,805              | 52,644                    |
| Unit Heater               | 32,833              | 16,875                    |
| Air Turnover              | 26,822              | 17,153                    |
| Infrared                  | 32,156              | 11,164                    |

|                |       |       |
|----------------|-------|-------|
| HTHV/Blow-Thru | 37.9% | 92.7% |
| Draw-Thru      | 15.5% | 90.3% |
| Recirculation  | 14.6% | 33.0% |
| Unit Heater    | -0.8% | 78.5% |
| Air Turnover   | 17.6% | 78.2% |
| Infrared       | 1.2%  | 85.8% |

| <b>% Increase vs. HTHV Blow-Thru</b> |       |        |
|--------------------------------------|-------|--------|
| Draw-Thru                            | 36.0% | 31.8%  |
| Recirculation                        | 37.5% | 814.2% |
| Unit Heater                          | 62.4% | 193.1% |
| Air Turnover                         | 32.6% | 197.9% |
| Infrared                             | 59.0% | 93.9%  |

\* Low velocity constant air turnover units require 2-3 building air turnovers per hour to minimize stratification.



# Thank You

Randy Niederer



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