

# SEMCO Indoor Air Quality Systems

John Schilling  
SEMCO, Inc  
Columbia, MO

# Desiccant Wheel Technologies

- Energy Recovery Systems

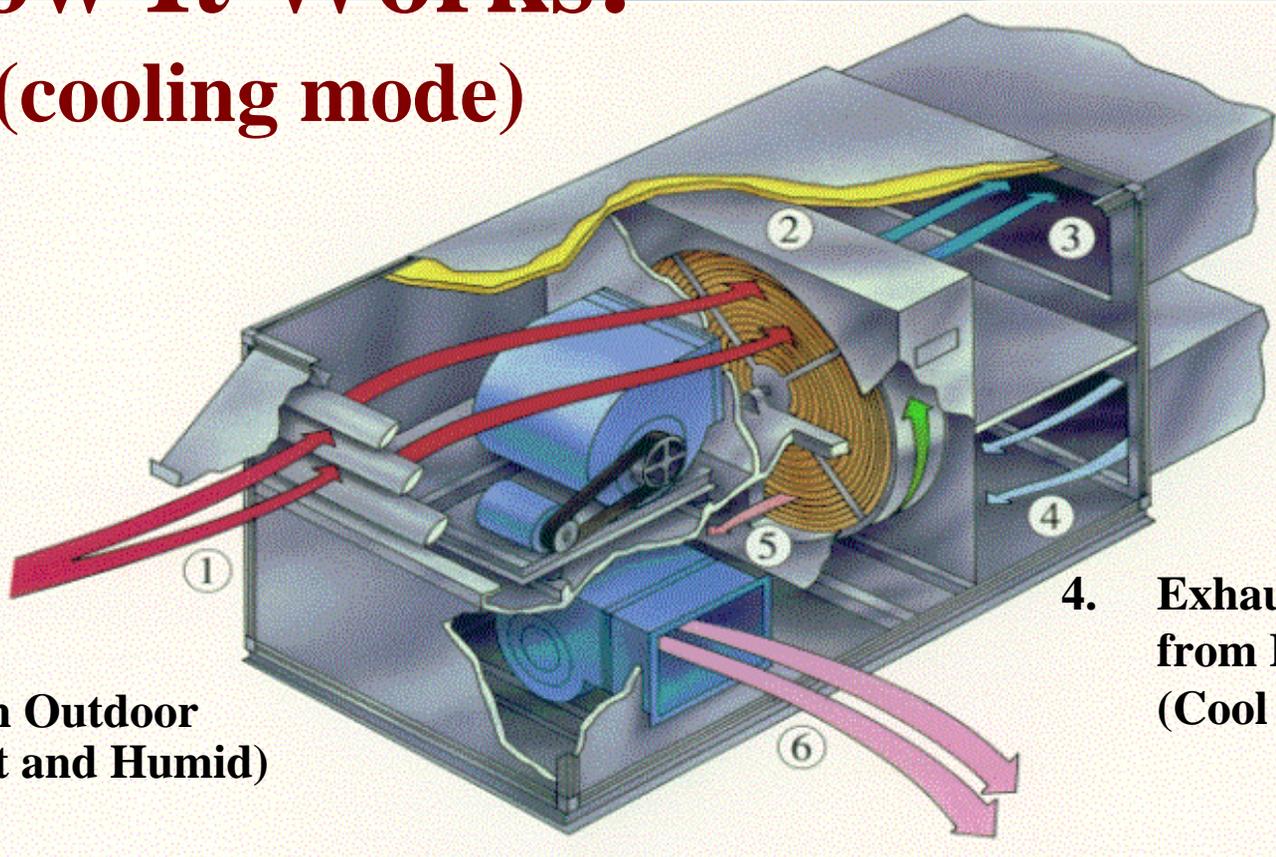
- Uses Exhaust Air to Precondition outdoor air (Passive System)

- Desiccant Dehumidification System

- Uses Artificially Heated Air To Dry Out Building Air (Active System)

# How It Works: (cooling mode)

3. Outdoor Air to Building  
(Cooled and Dehumidified)



1. Fresh Outdoor  
Air (Hot and Humid)

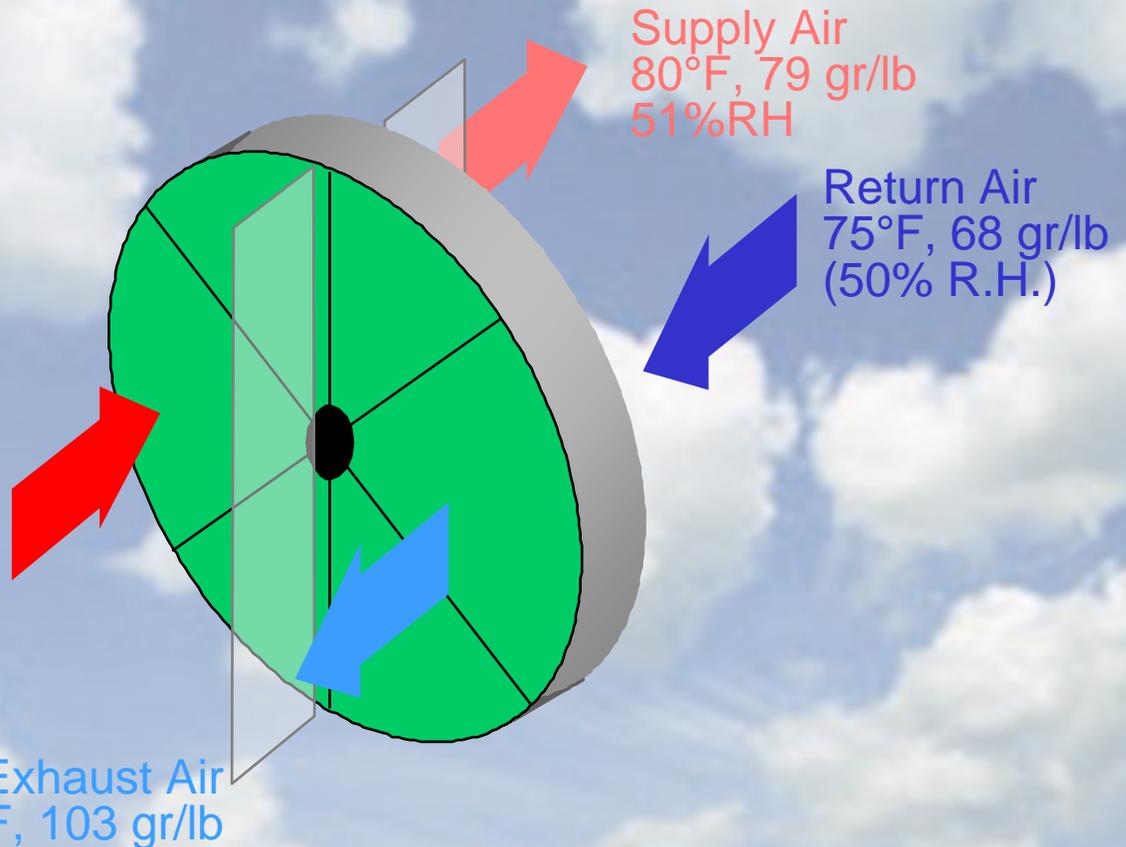
4. Exhaust Air  
from Building  
(Cool and Dry)

6. Exhaust Air to Outdoors  
(Heated and Humidified)

# Cooling Mode (Peak Design Day)

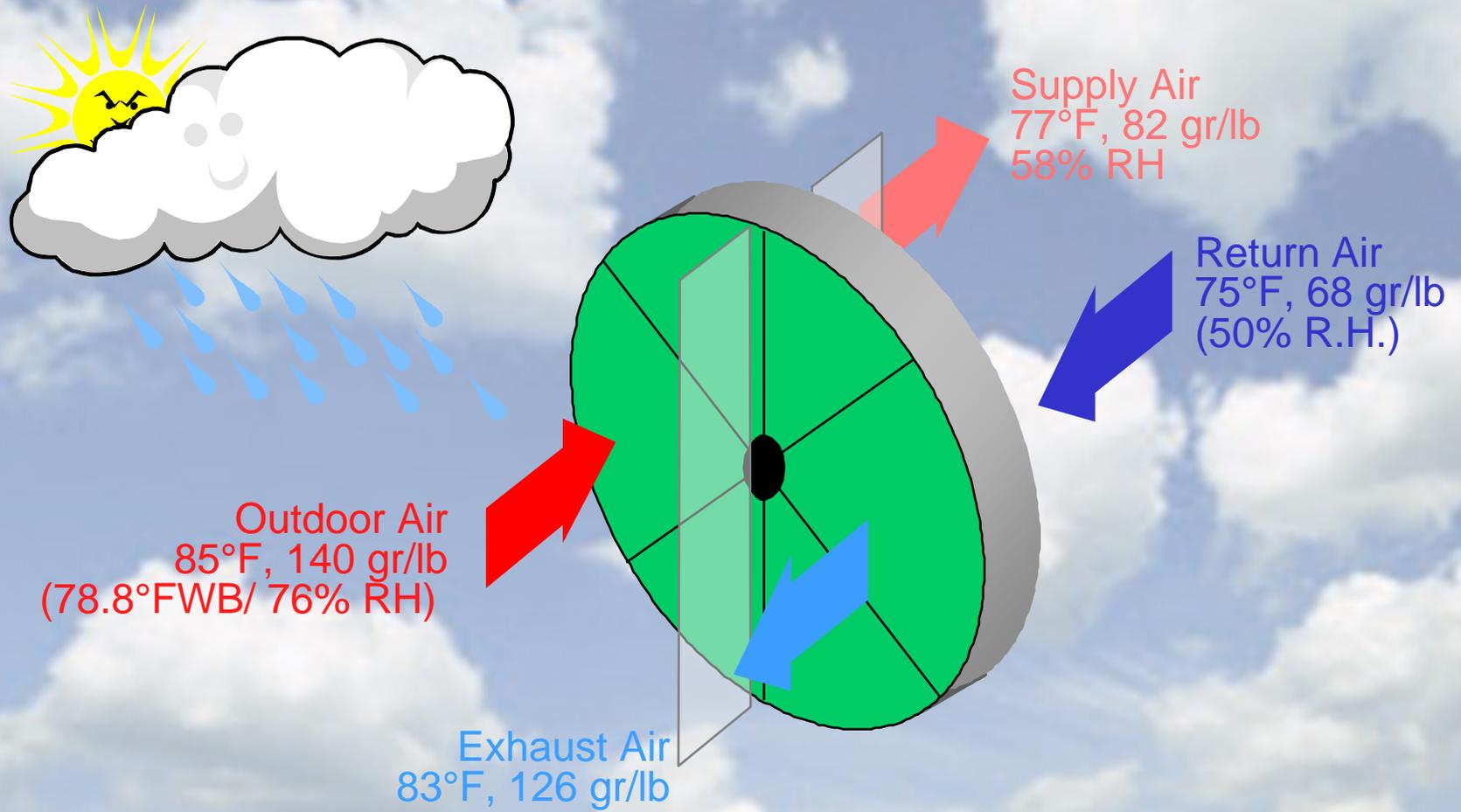


Outdoor Air  
90°F, 113 gr/lb  
(77.2°FWB / 53% RH)



Delivering 7.88 Tons @ 3,000 cfm

# Cooling Mode (Peak Moisture Day)

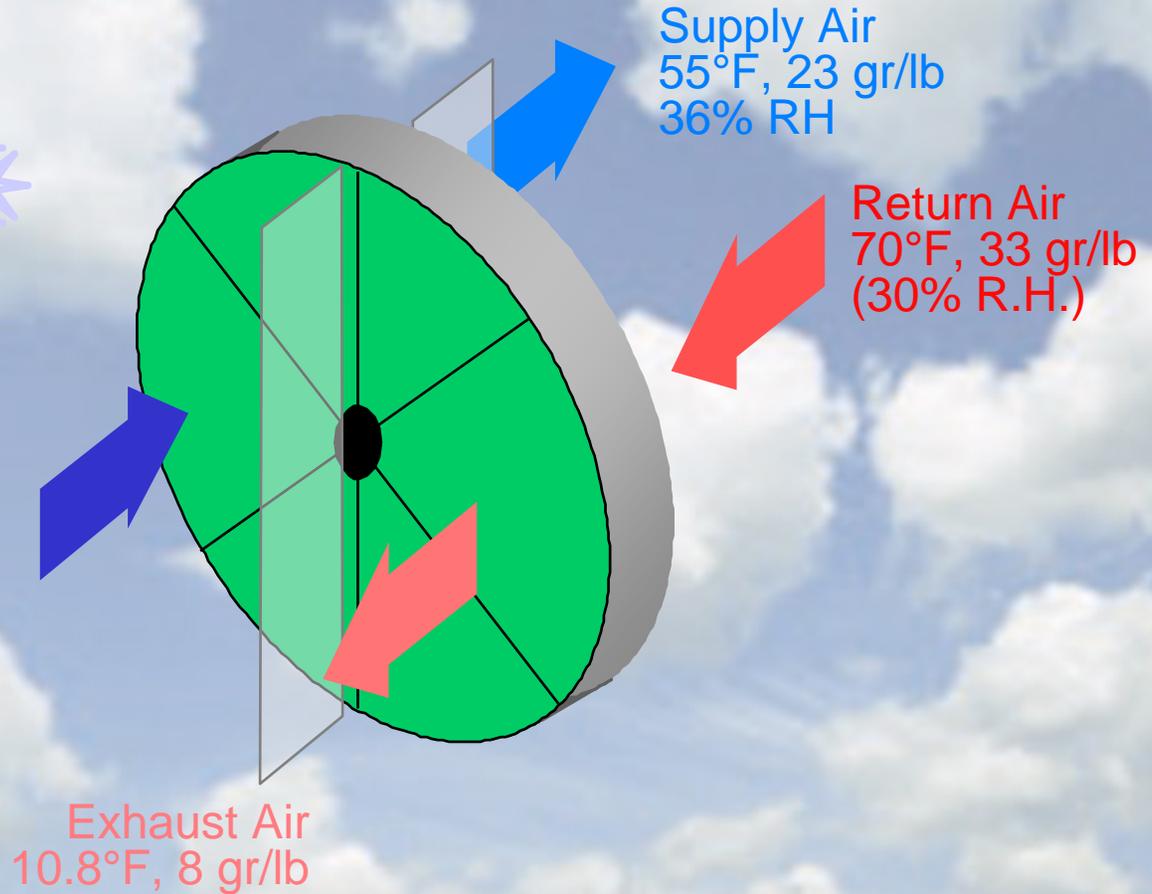


Delivering 9.05 Tons @ 3,000 cfm

# Heating Mode



Outdoor Air  
-4°F, 2.3 gr/lb  
51.5% RH

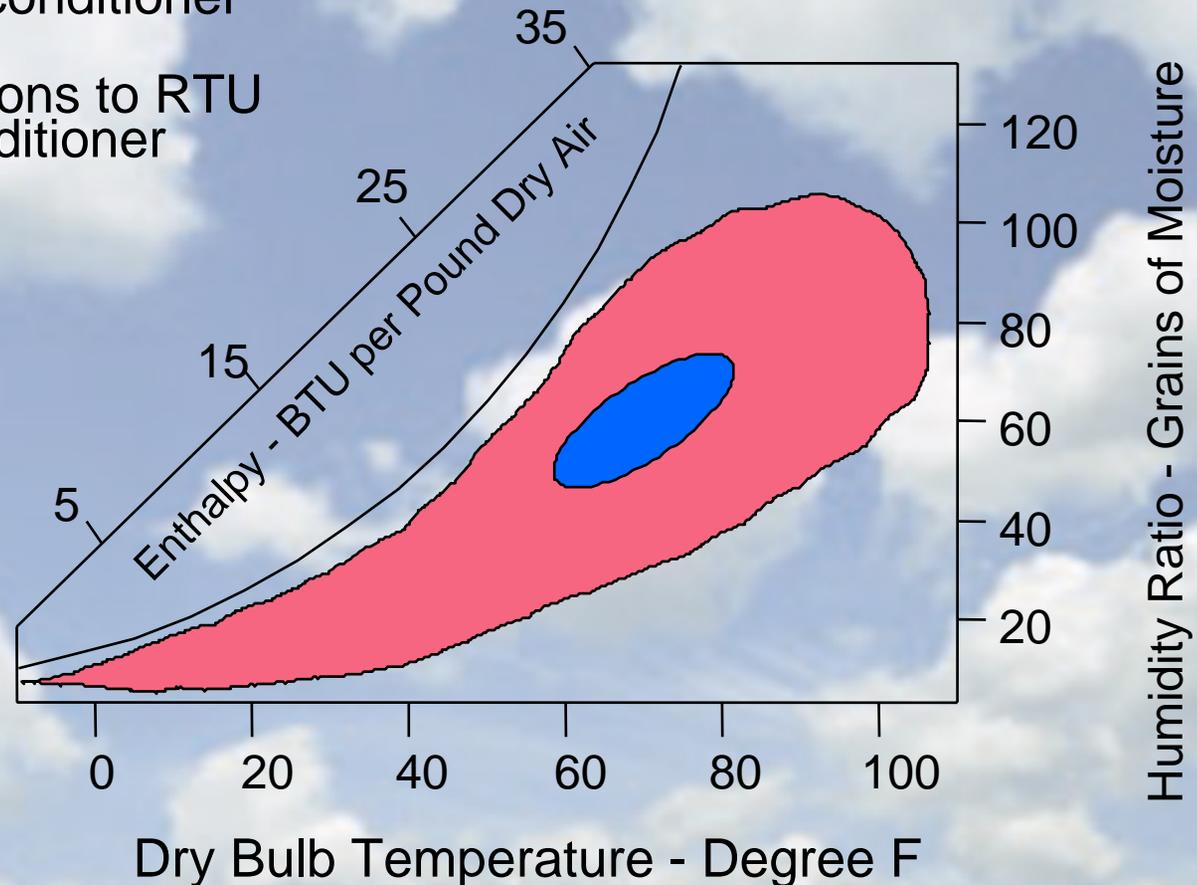


Delivering 173,000 BTU's @ 3,000 cfm

# The FV Preconditioner Isolates the RTU from Extreme Summer and Winter Conditions

 Outdoor Air Conditions to RTU **without** the FV Preconditioner

 Outdoor Air Conditions to RTU **with** the FV Preconditioner

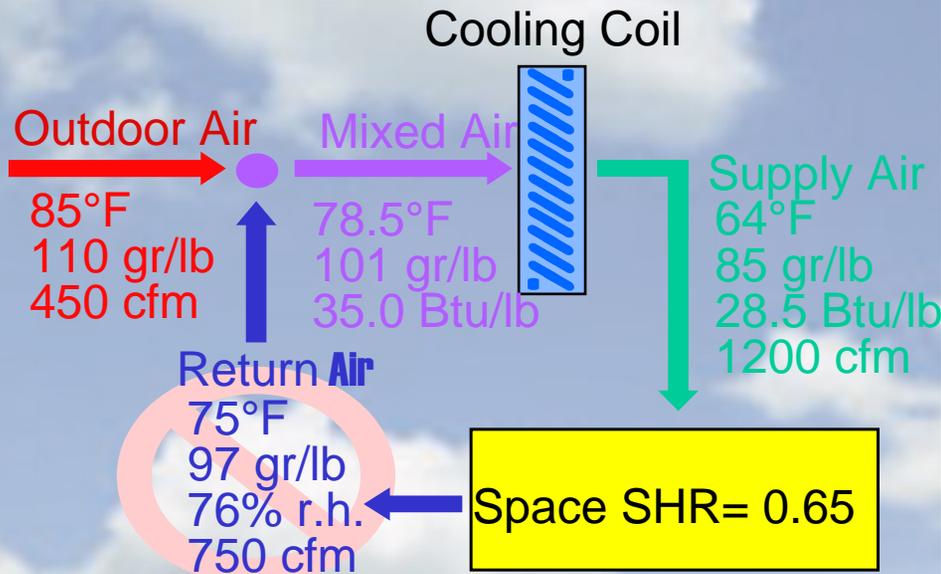


# FV - Module

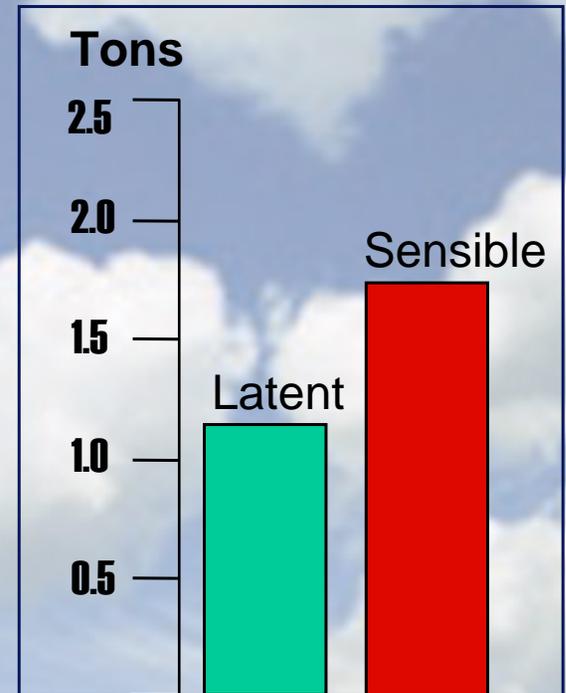
**Common Approach: 3 ton unit, 38% outdoor air**

- Space humidity control is lost
- High latent to sensible heat ratios on packaged AC unit

## 3 Ton RTU @ 400 cfm/ton



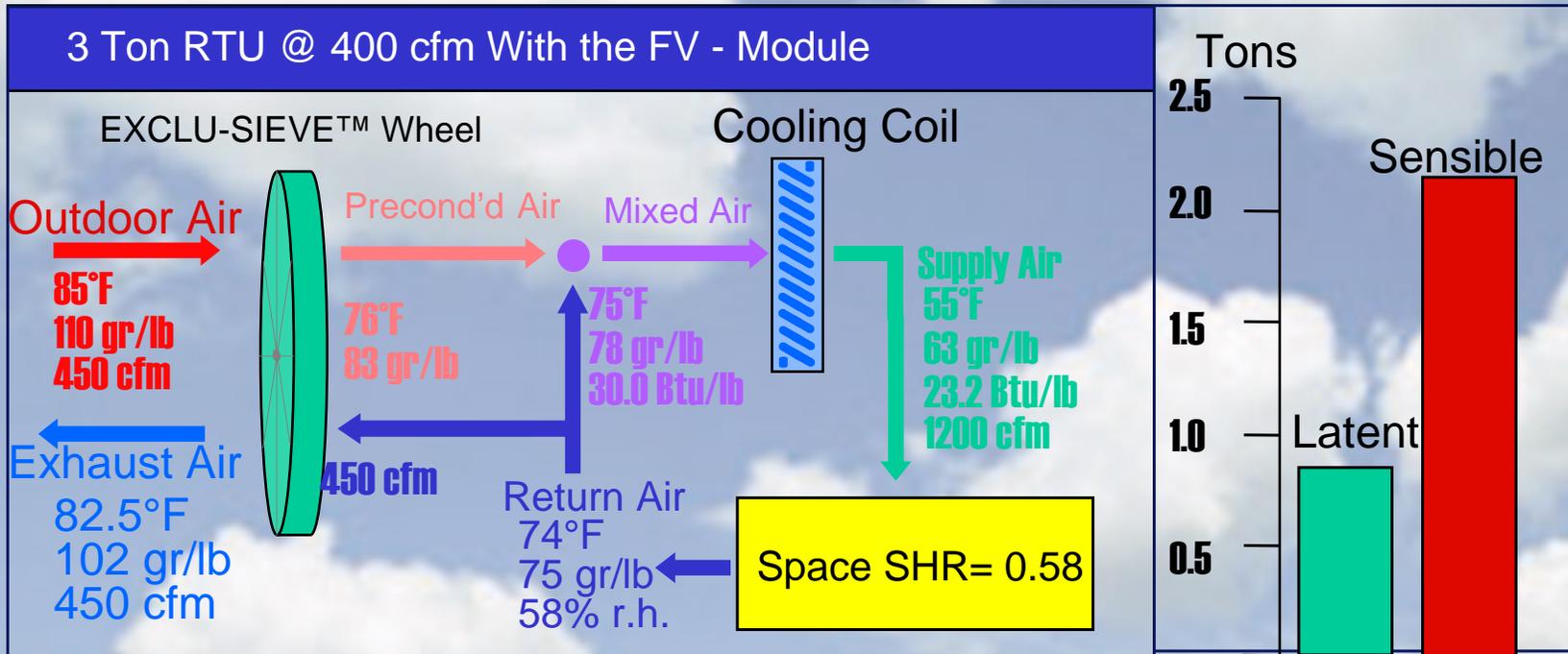
Comfort Conditions Not Acceptable,  
Humidity Unacceptable,  
Outdoor Air Volume as per ASHRAE  
(38%)



SHR on the RTU = 0.58

# FV - Module

The FV - Module Allows Packaged Equipment to Accommodate ASHRAE 62-1989 in Classroom



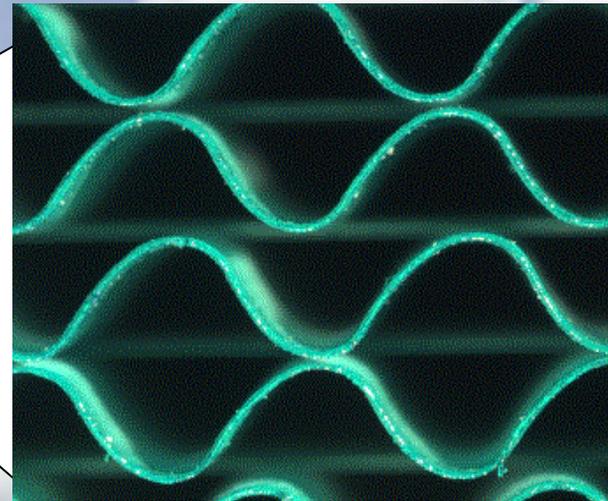
Comfort Conditions  
Acceptable,  
Humidity Acceptable,  
Outdoor Air Volume as per  
ASHRAE (38%)

SHR on the RTU = 0.73

# Total Energy Recovery Wheel



- The SEMCO total energy recovers sensible (temperature) and latent (moisture) energy by up to 85%.

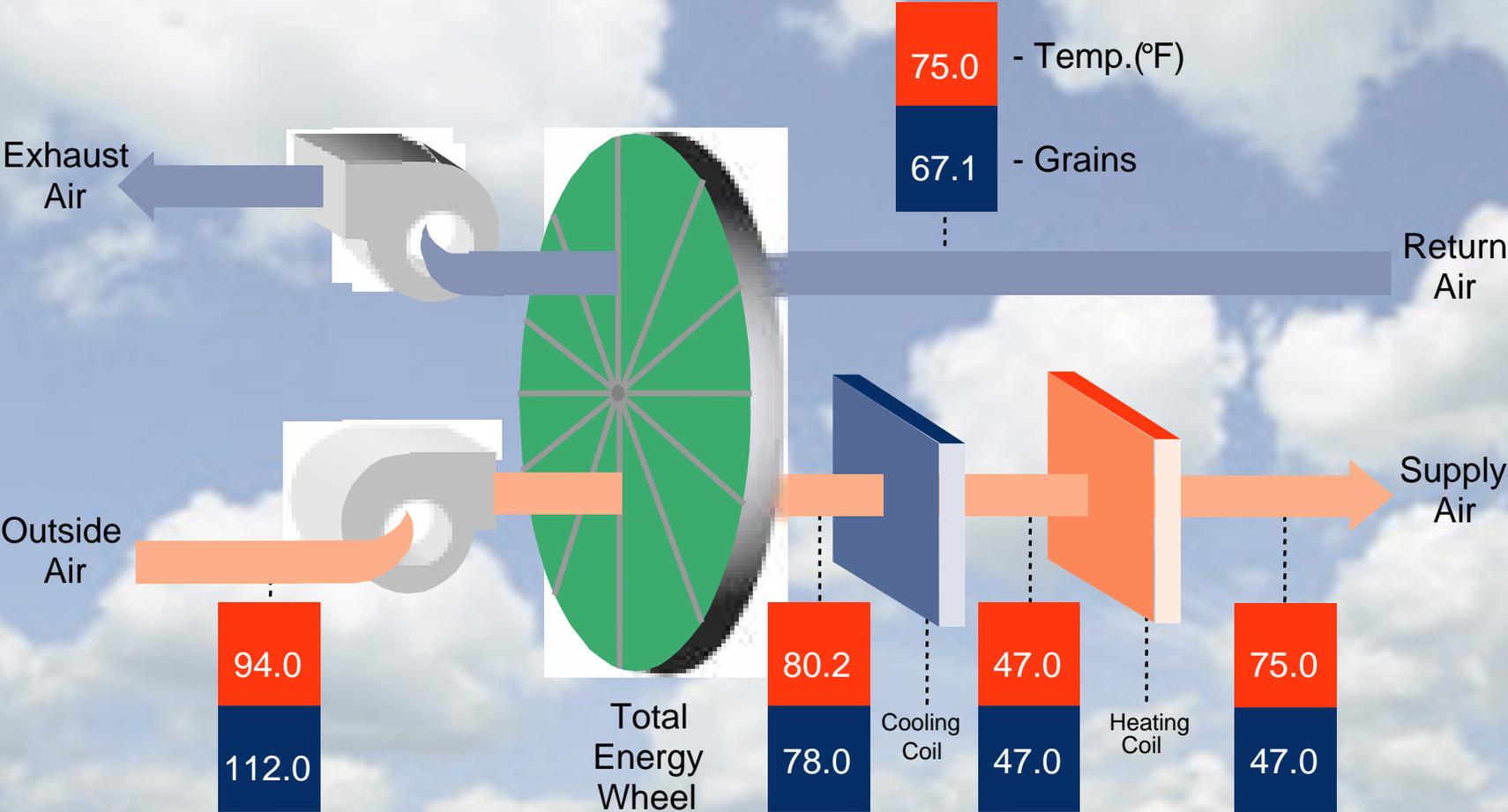


# SEMCO Technology Has Been Utilized by Numerous Research Facilities

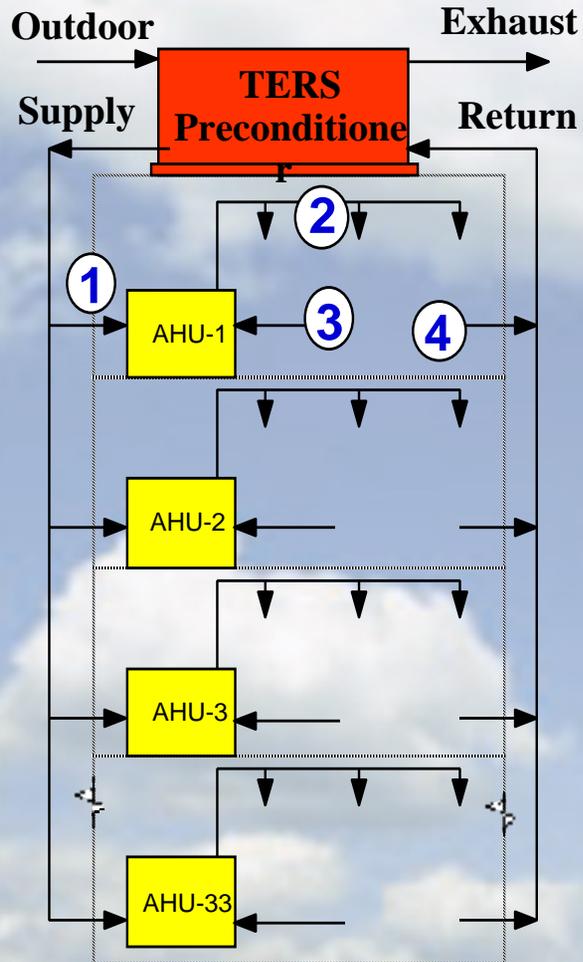


Example: The National Institute of Health's Louis Stokes Laboratories  
(For more information see the NIH Website at [http—des.od.nih.gov-building\\_50](http—des.od.nih.gov-building_50))

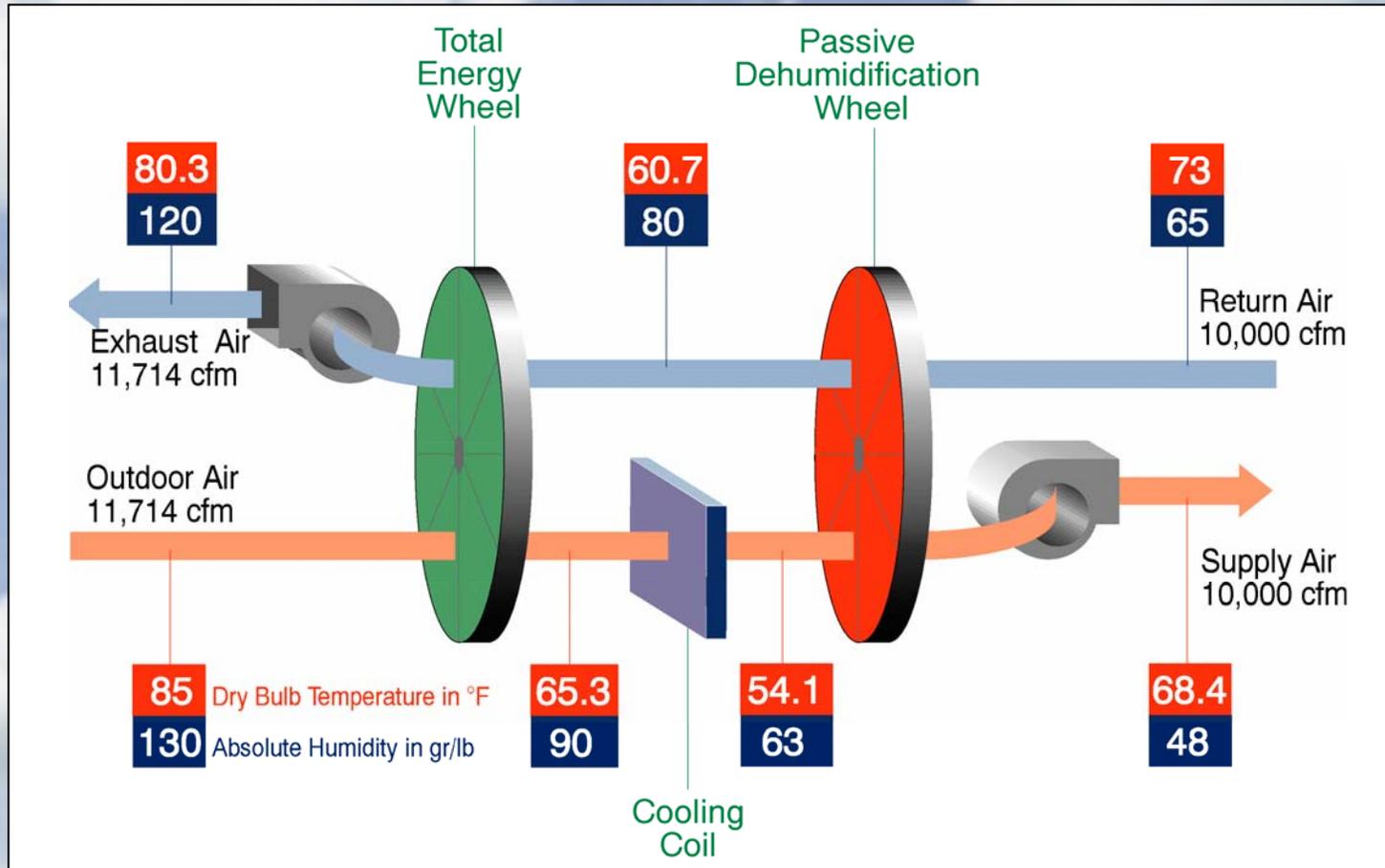
# EPCH Solution



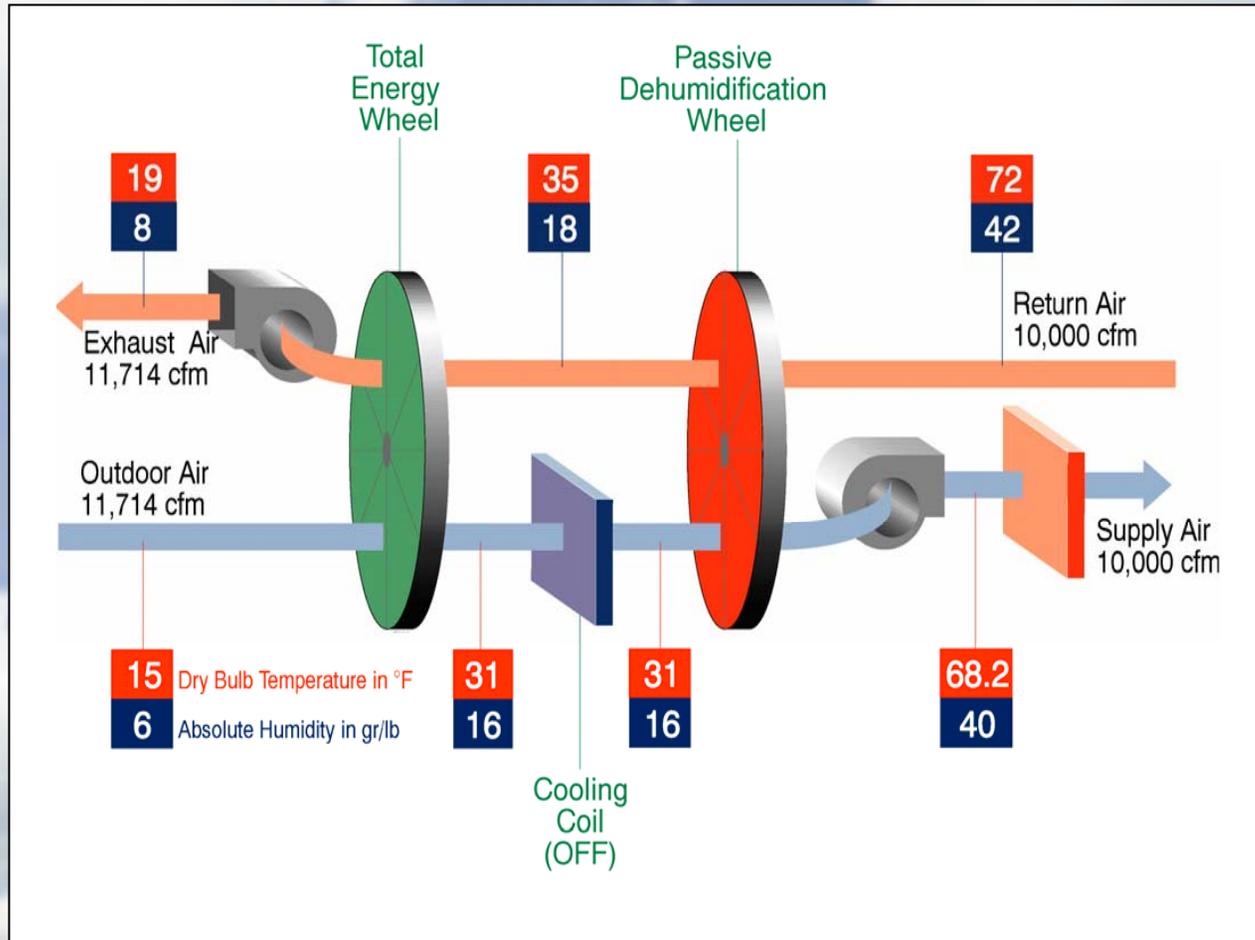
# 1100 Peachtree, BellSouth Facility Atlanta, GA



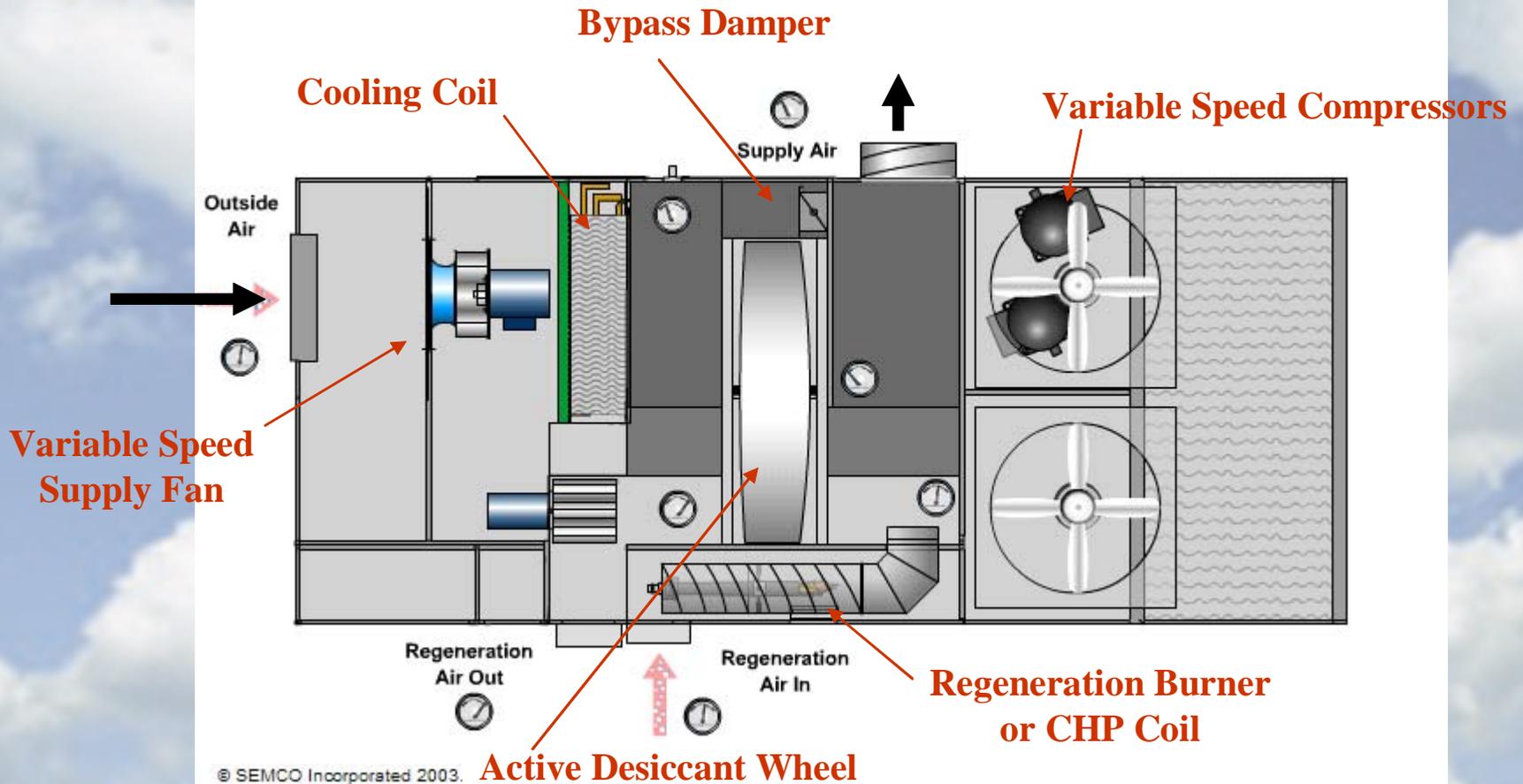
# Pinnacle Control: High Latent Load



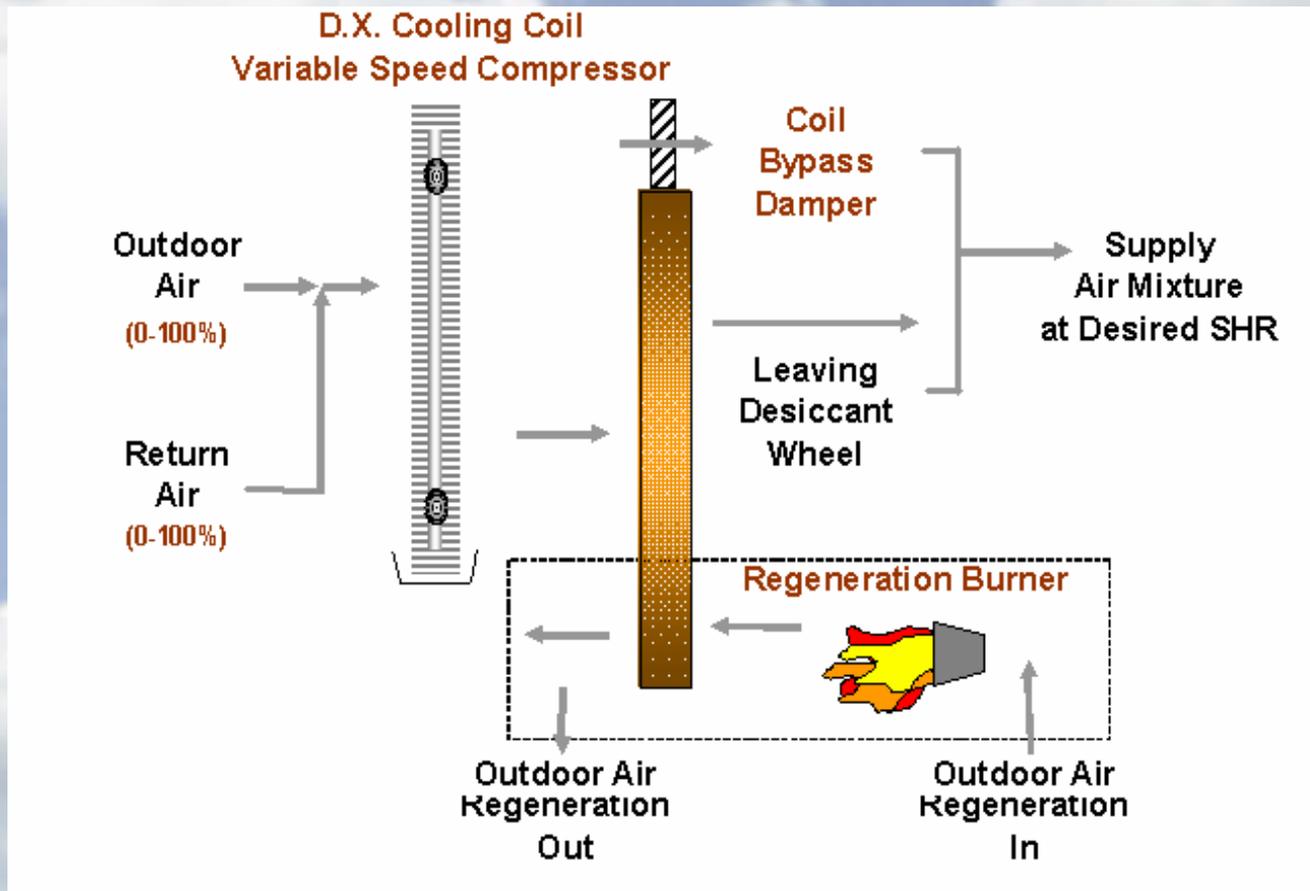
# Pinnacle: Heating Mode



# Revolution Hybrid

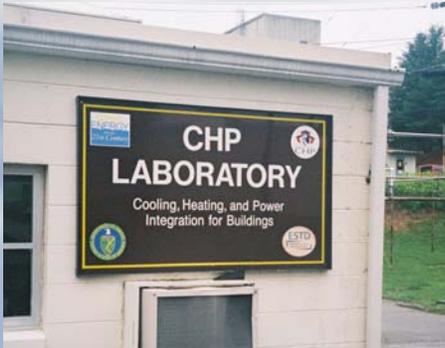


# A Simplified Flow Schematic



# Oak Ridge National Laboratory Test Site

Joint Research Project for CHP and Heat Pump Integration



SEMCO antimicrobial duct



REV 2250 installed at the Oak Ridge CHP Lab

# IADR Testing at ORNL: High Refrigeration and Heat Pump Cycle Efficiency

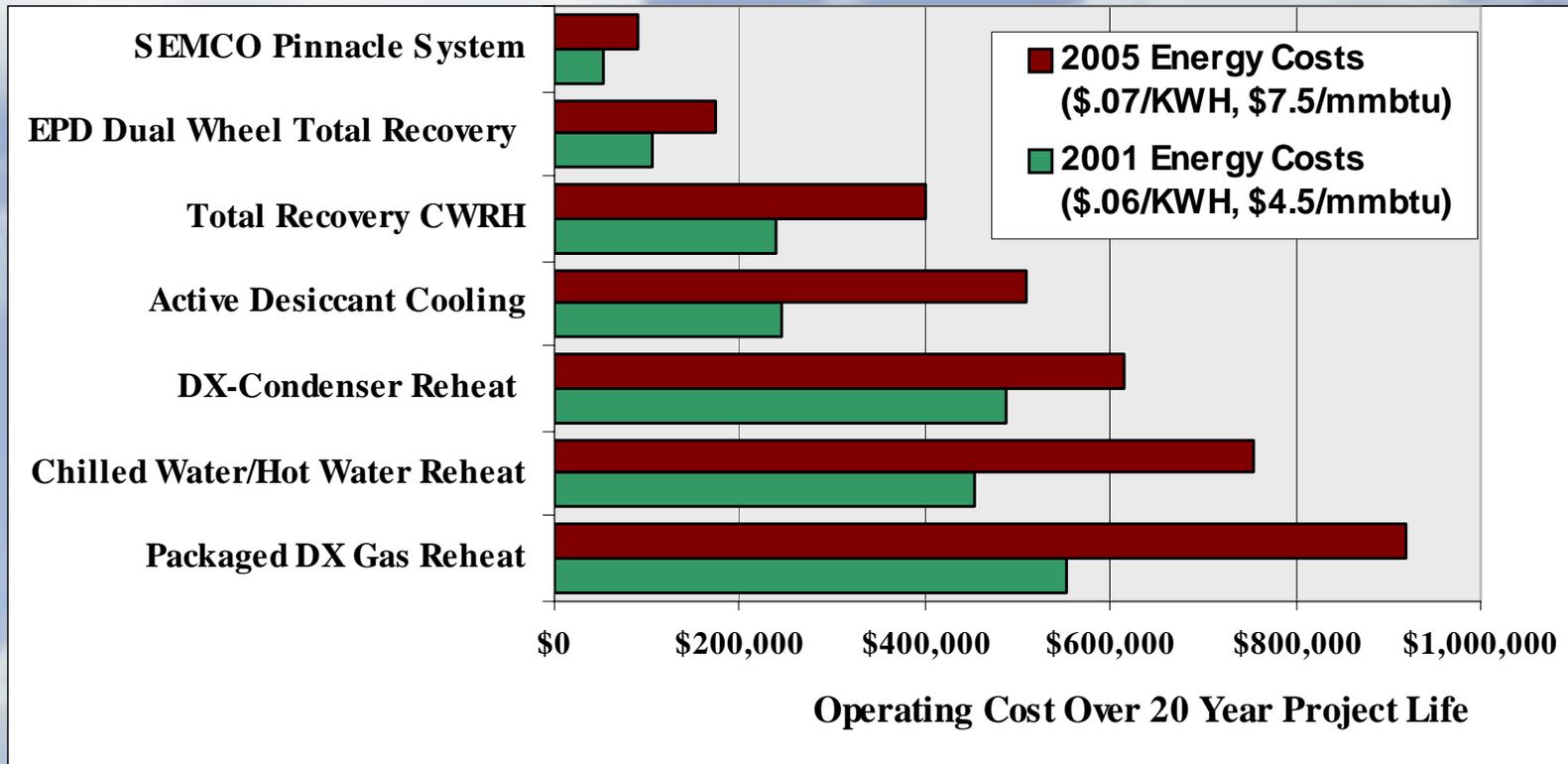
Field Measured for IADR Hybrid				Conventional RTU Literature*	EER Increase
hz	tons	kw	EER	EER	Percent
60	26.0	23.1	<b>13.5</b>	11.3	<b>20%</b>
50	24.6	18.7	<b>15.8</b>	11.0	<b>44%</b>
40	21.6	14.4	<b>18.0</b>	10.0	<b>80%</b>
30	18.0	11.1	<b>19.5</b>	9.0	<b>117%</b>
20	12.4	7.6	<b>19.6</b>	8.0	<b>146%</b>

Cooling performance of REV-6000 unit tested as part of the DOE/ORNL sponsored school demonstration site. EER values shown are compared with that published by a major rooftop manufacturer operating at like conditions.

Similar data observed with REV-2250 unit installed at the ORNL CHP test lab.

# Sound Economics

## Life Cycle Analysis: Dedicated Outdoor Air Systems



Based on a 20,000 cfm system in Minneapolis, serving a 1000 student school, energy costs as shown.  
Supply air to classrooms at 68°F/55 grains cooling, 70°F and 38 grains heating

# Comparing First Cost, Operating Cost and Life Cycle Cost at Like Dewpoints

Equipment Options	Latent Capacity Delivered	Equipment Cost <sup>(1)</sup>	Annual Cost of Operation <sup>(2)</sup>	Life Cycle Cost	Simple Payback
Packaged Rooftop Gas Reheat	42.5 Tons	\$56,500	\$24,045	\$610,020	-
Chilled Water/Hot Water Reheat	42.5 Tons	\$63,000	\$20,130	\$514,960	1.1 yrs.
Customized Package DX with Condensor Reheat	42.5 Tons	\$66,000	\$21,920	\$556,370	2.6 yrs
Active Desiccant Based Cooling	36.8 Tons	\$87,000	\$12,240	\$332,250	2.4 yrs
Total Energy Recovery, Chilled Water with Hot Water Reheat	42.5 Tons	\$60,500	\$11,290	\$300,490	.30 yrs
Dual Wheel Total Energy Recovery	42.5 Tons	\$61,500	\$4,465	\$146,330	.20 yrs
SEMCO "Passive" Dehumidification Pinnacle System	42.5 Tons	\$65,300	\$3,420	\$119,050	.40 yrs

- (1) 1999 equipment cost (2) 10,000 cfm system in Atlanta, continuous operation, electricity at \$.06/KWH,  
 (2) \$4.5/million BTU, supply air at 68oF/55 grains cooling, 70°F and 38 grains heating