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)

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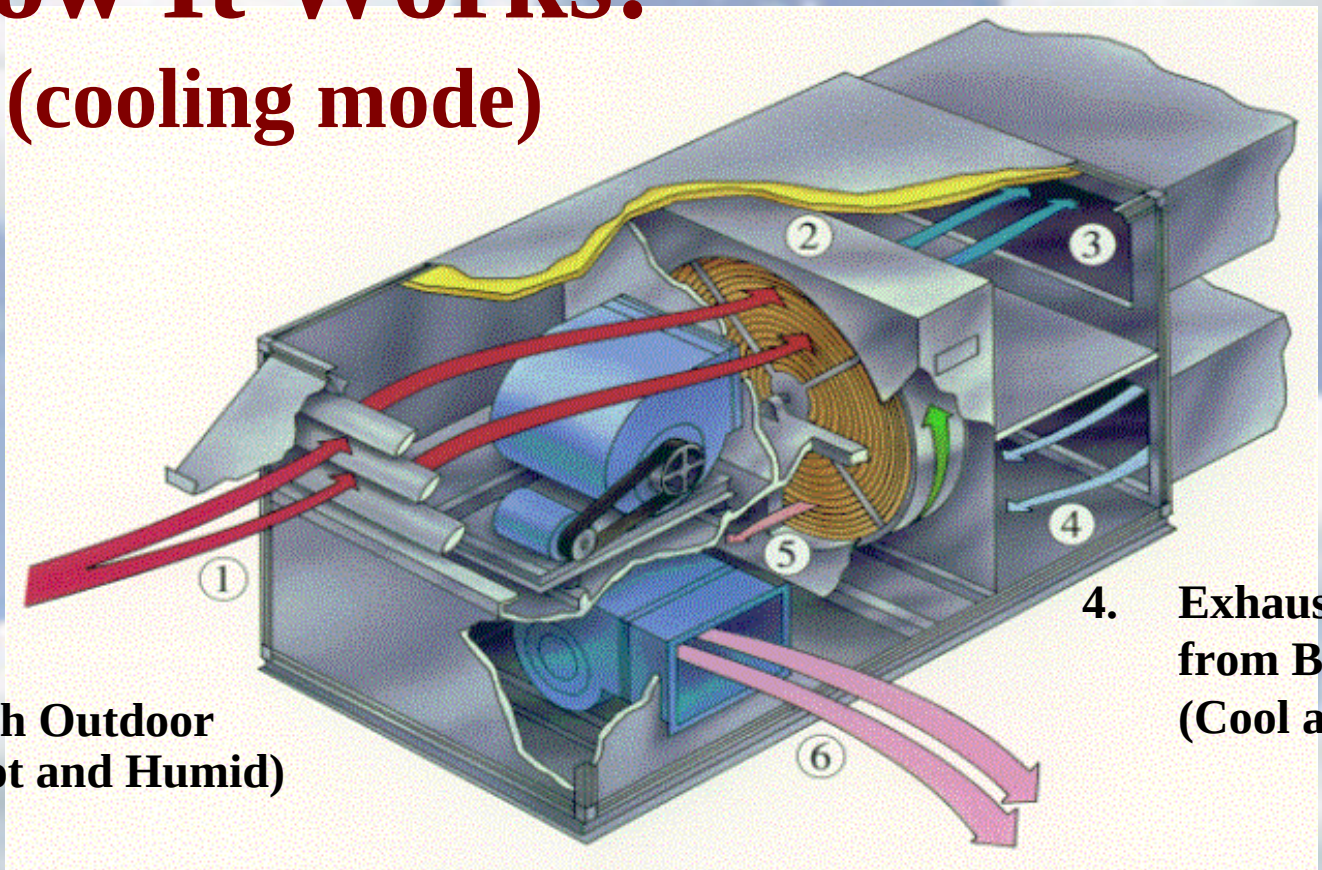
How It Works:
(cooling mode)

3. Outdoor Air to Building (Cooled and Dehumidified)



4. Exhaust Air from Building (Cool and Dry)

1. Fresh Outdoor Air (Hot and Humid)

6. Exhaust Air to Outdoors (Heated and Humidified)

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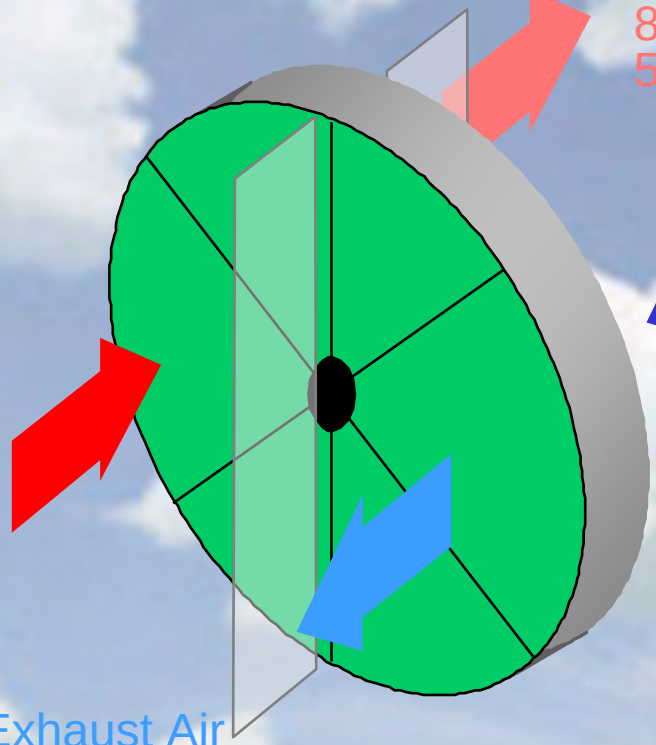
Cooling Mode (Peak Design Day)

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



Supply Air
80°F, 79 gr/lb
51%RH

Return Air
75°F, 68 gr/lb
(50% R.H.)

Exhaust Air
91°F, 103 gr/lb

Delivering 7.88 Tons @ 3,000 cfm

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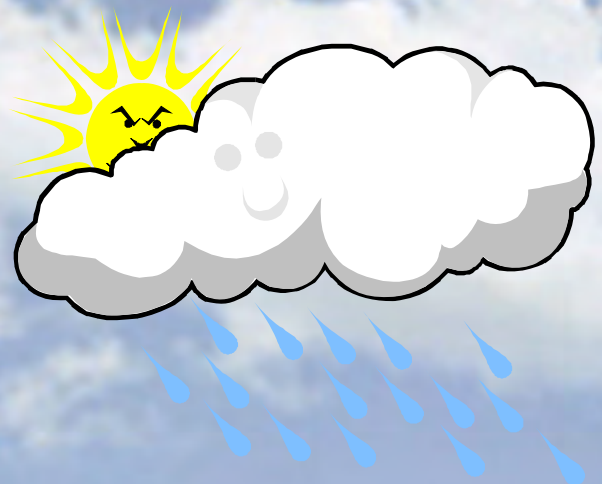
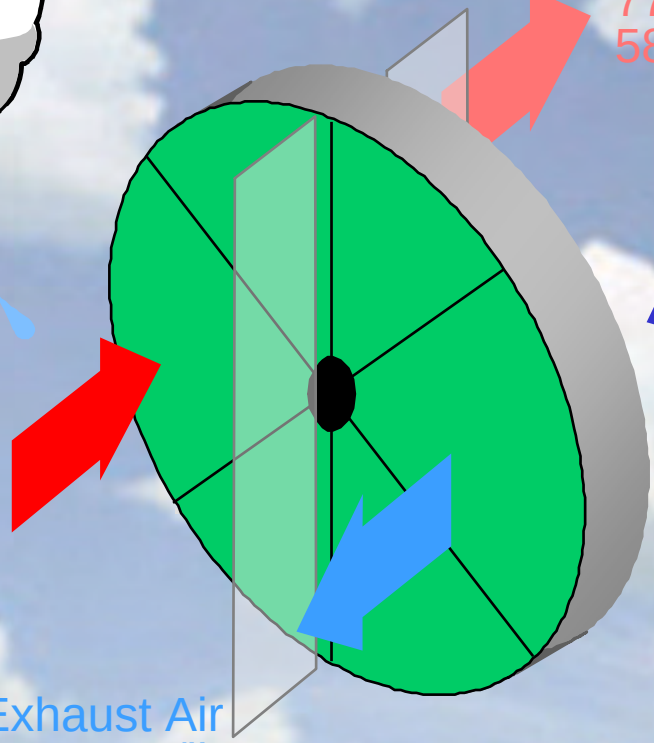
Cooling Mode (Peak Moisture Day)





Supply Air
77°F, 82 gr/lb
58% RH

Return Air
75°F, 68 gr/lb
(50% R.H.)

Outdoor Air
85°F, 140 gr/lb
(78.8°FWB/ 76% RH)

Exhaust Air
83°F, 126 gr/lb

Delivering 9.05 Tons @ 3,000 cfm

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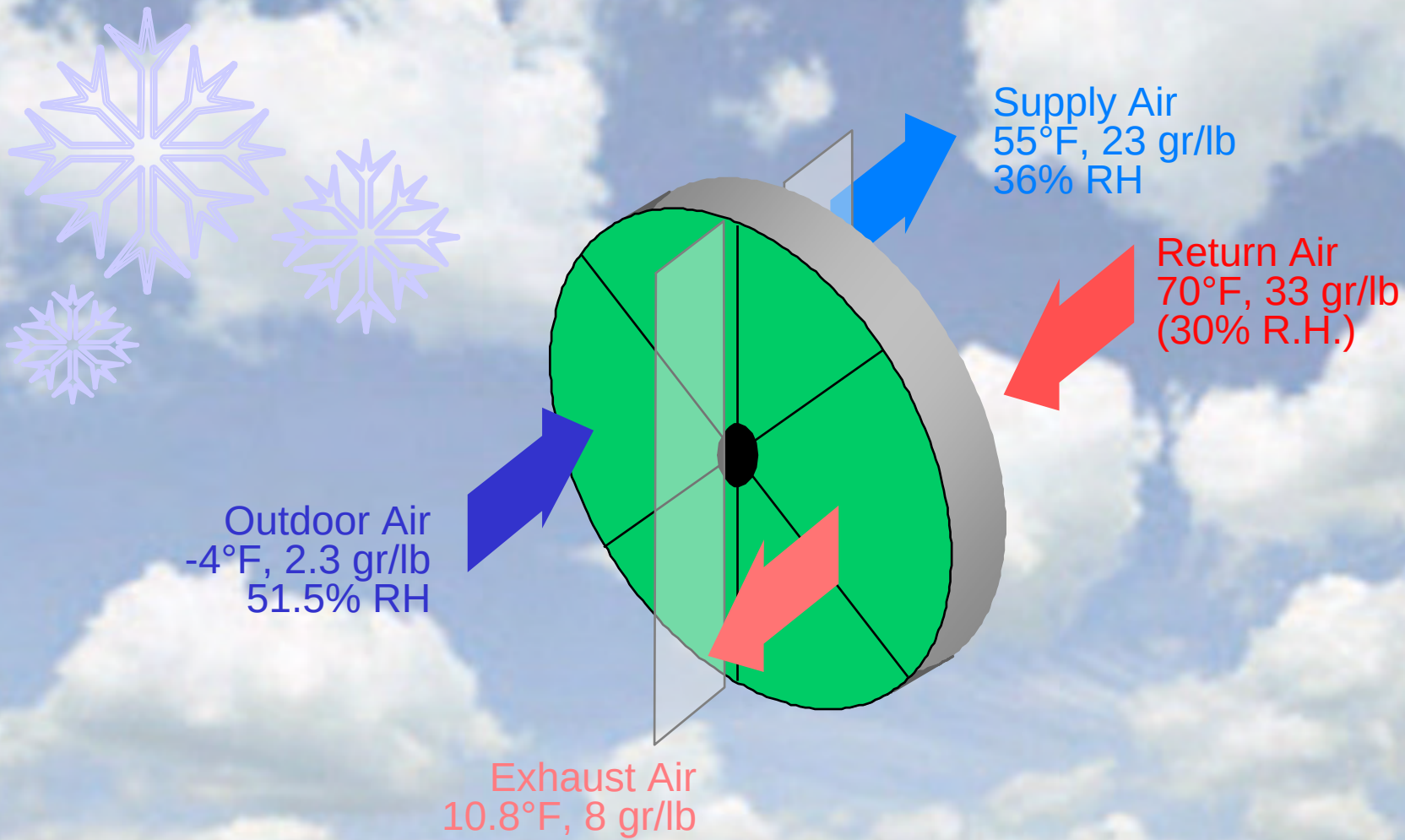
Heating Mode



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

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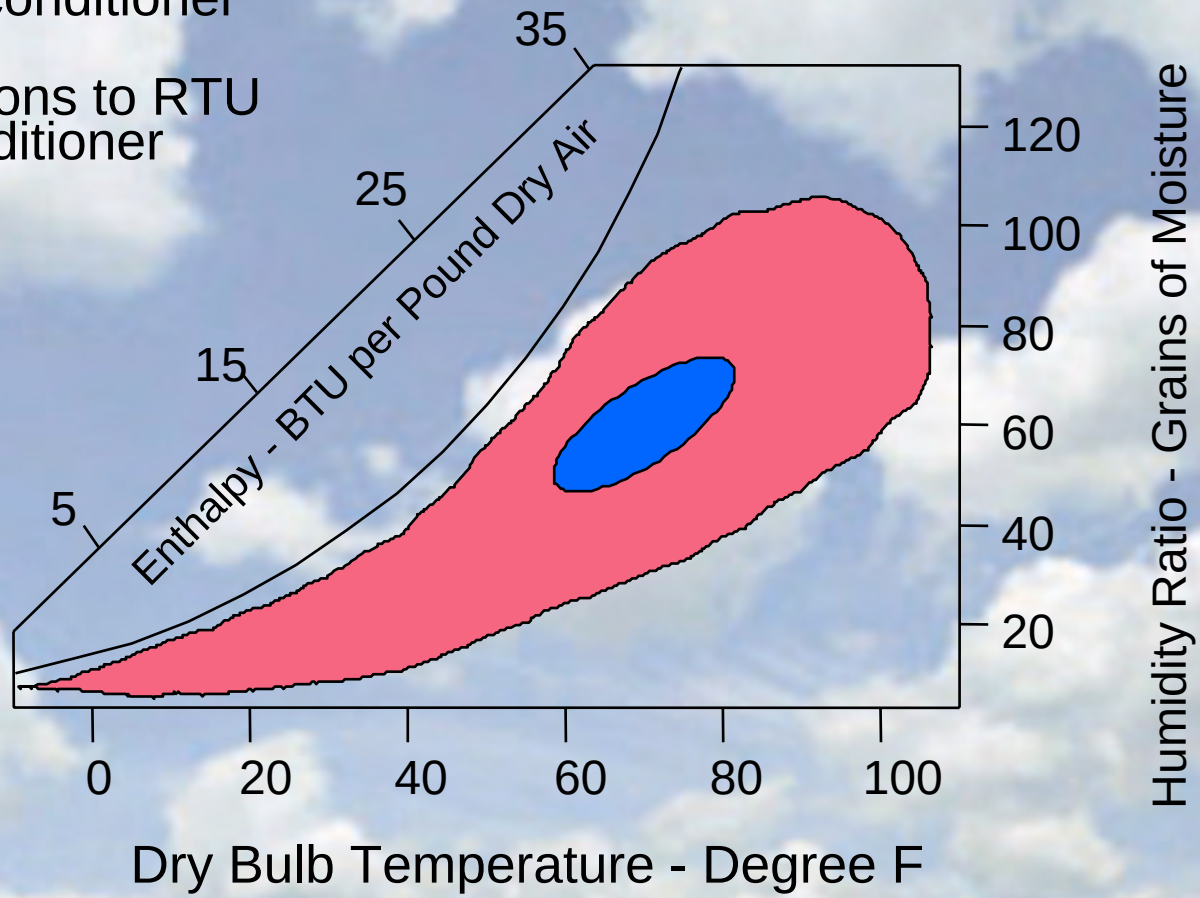
The FV Preconditioner Isolates the RTU from Extreme Summer and Winter Conditions

Outdoor Air Conditions to RTU without the FV Preconditioner

Outdoor Air Conditions to RTU with the FV Preconditioner



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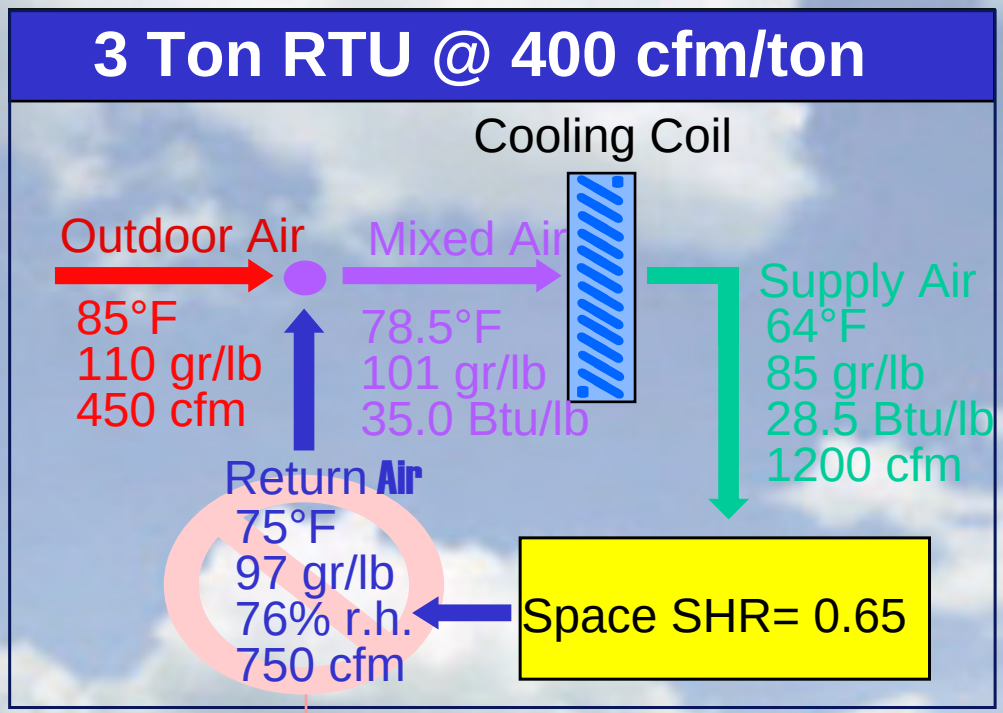
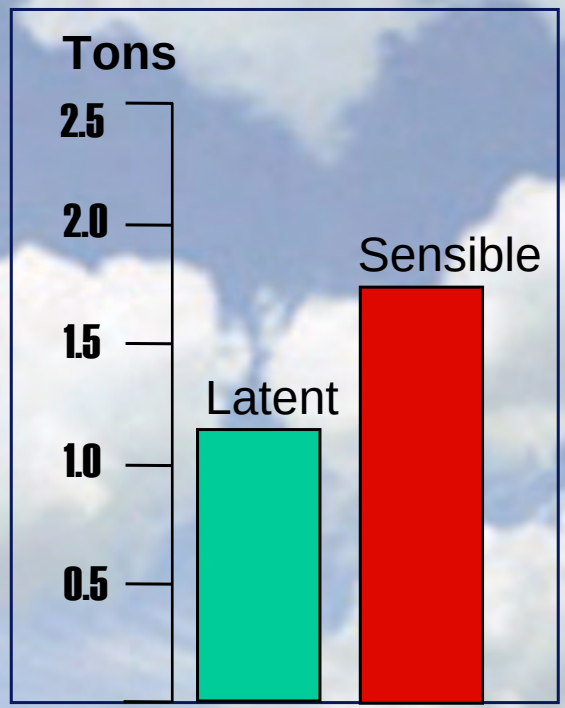
FV - Module

Common Approach: 3 ton unit, 38% outdoor air

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



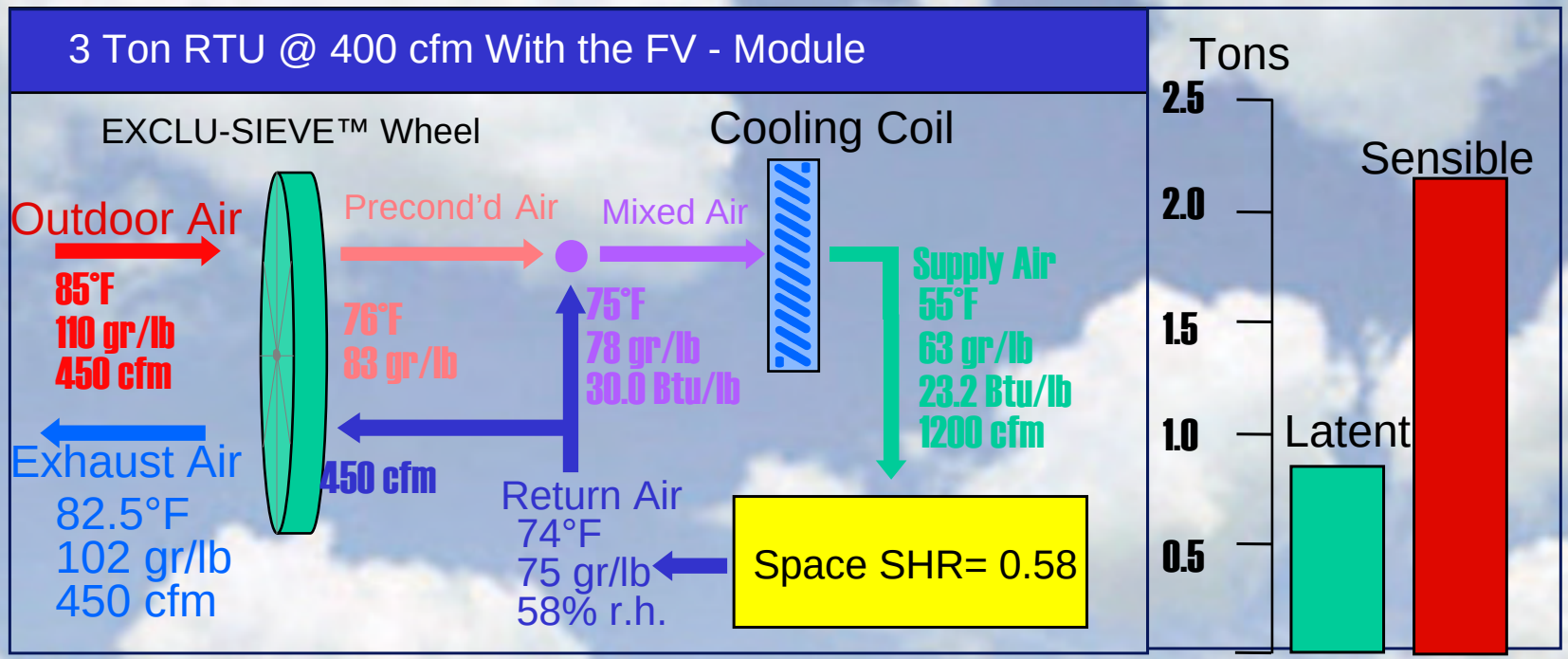
Comfort Conditions Not Acceptable,
Humidity Unacceptable,
Outdoor Air Volume as per ASHRAE
(38%)



SHR on the RTU = 0.58

FV - Module

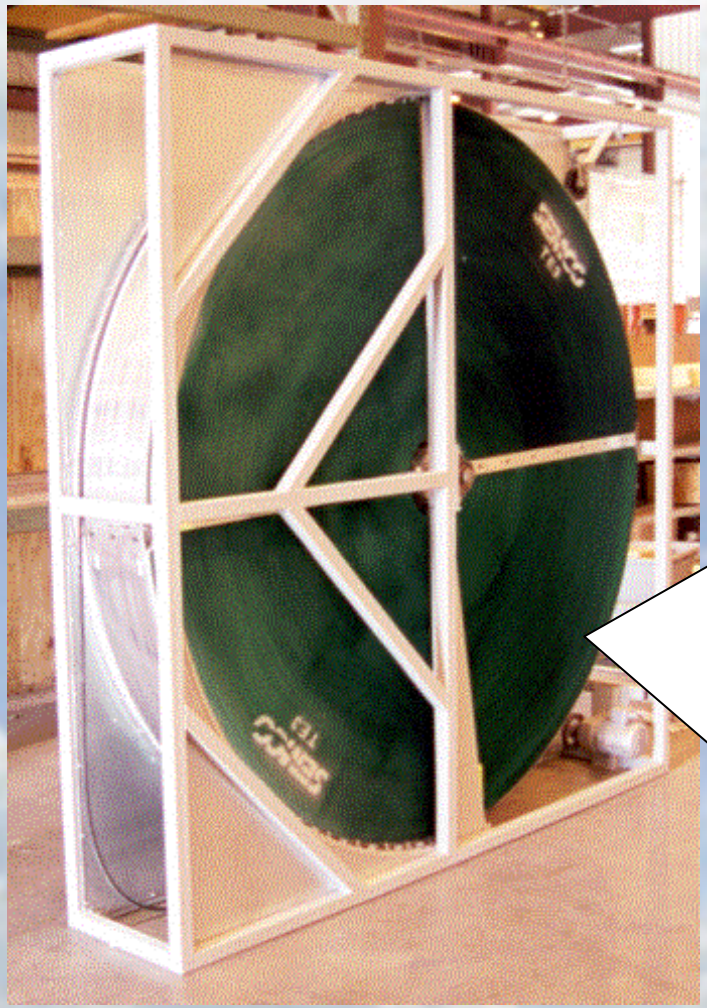
The FV - Module Allows Packaged Equipment to Accommodate ASHRAE 62-1989 in Classroom



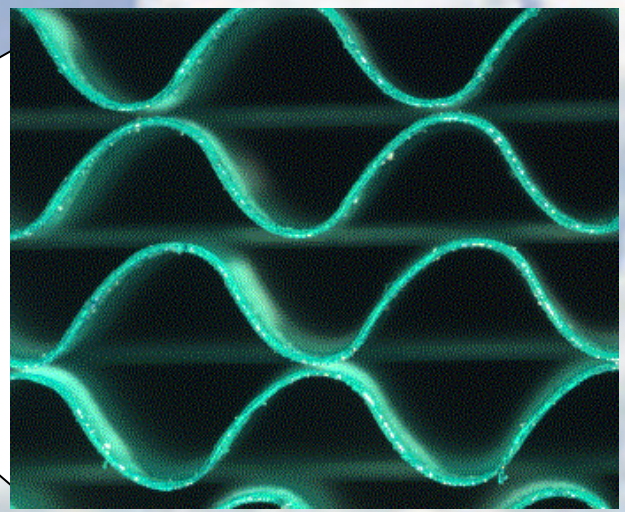
Comfort Conditions Acceptable, Humidity Acceptable, Outdoor Air Volume as per ASHRAE (38%)

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%.



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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)

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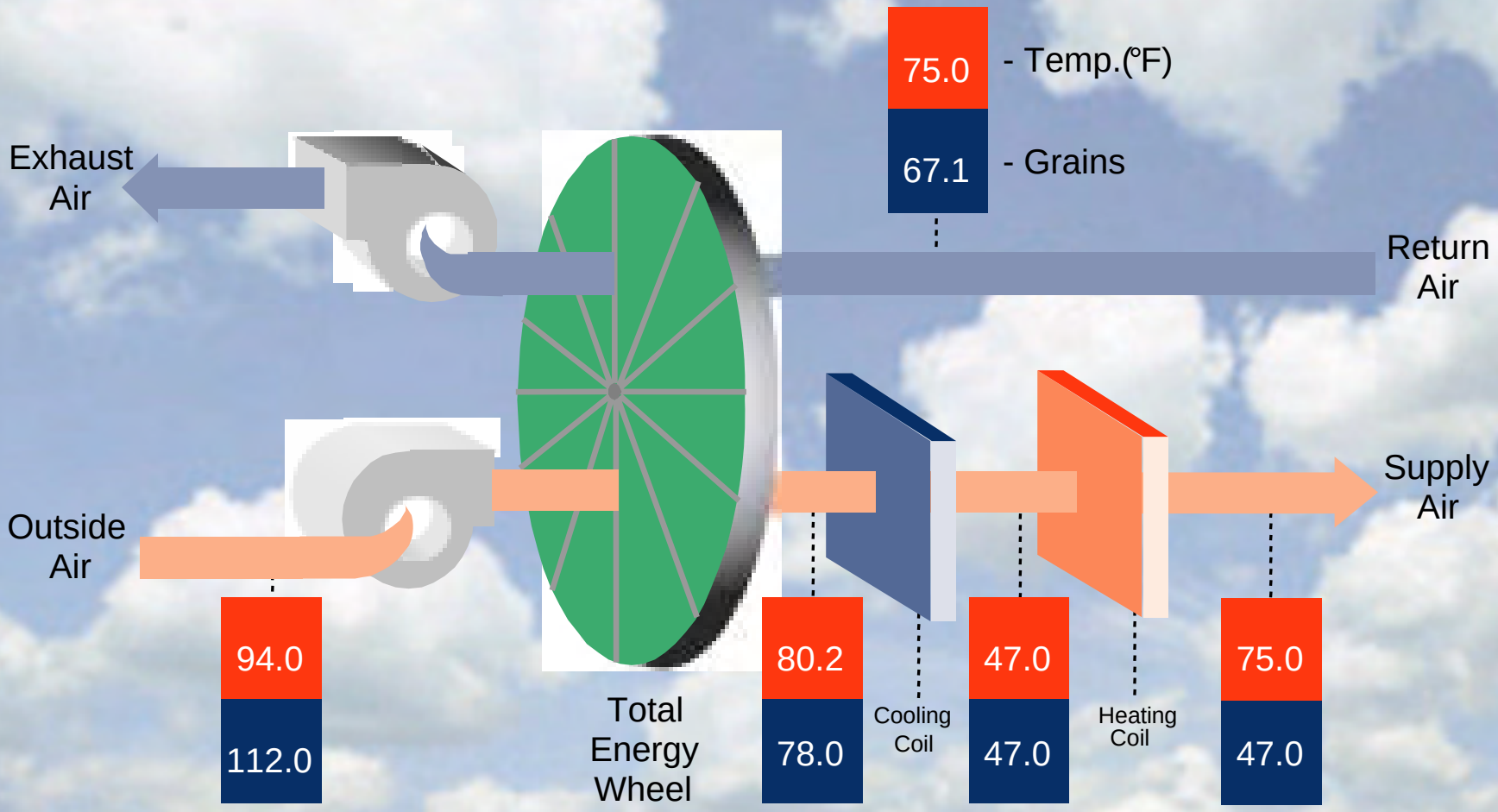
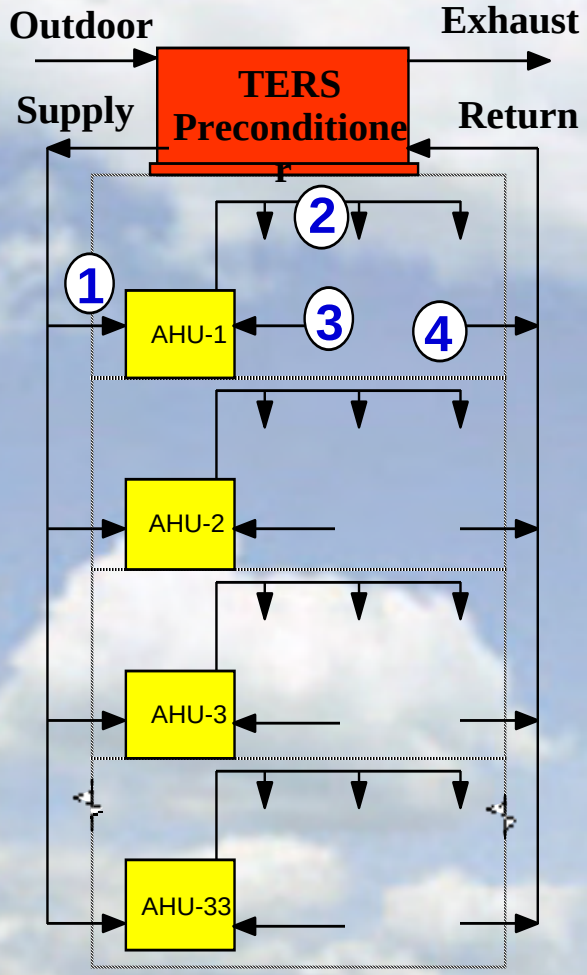
EPCH Solution



1100 Peachtree, BellSouth Facility

Atlanta, GA



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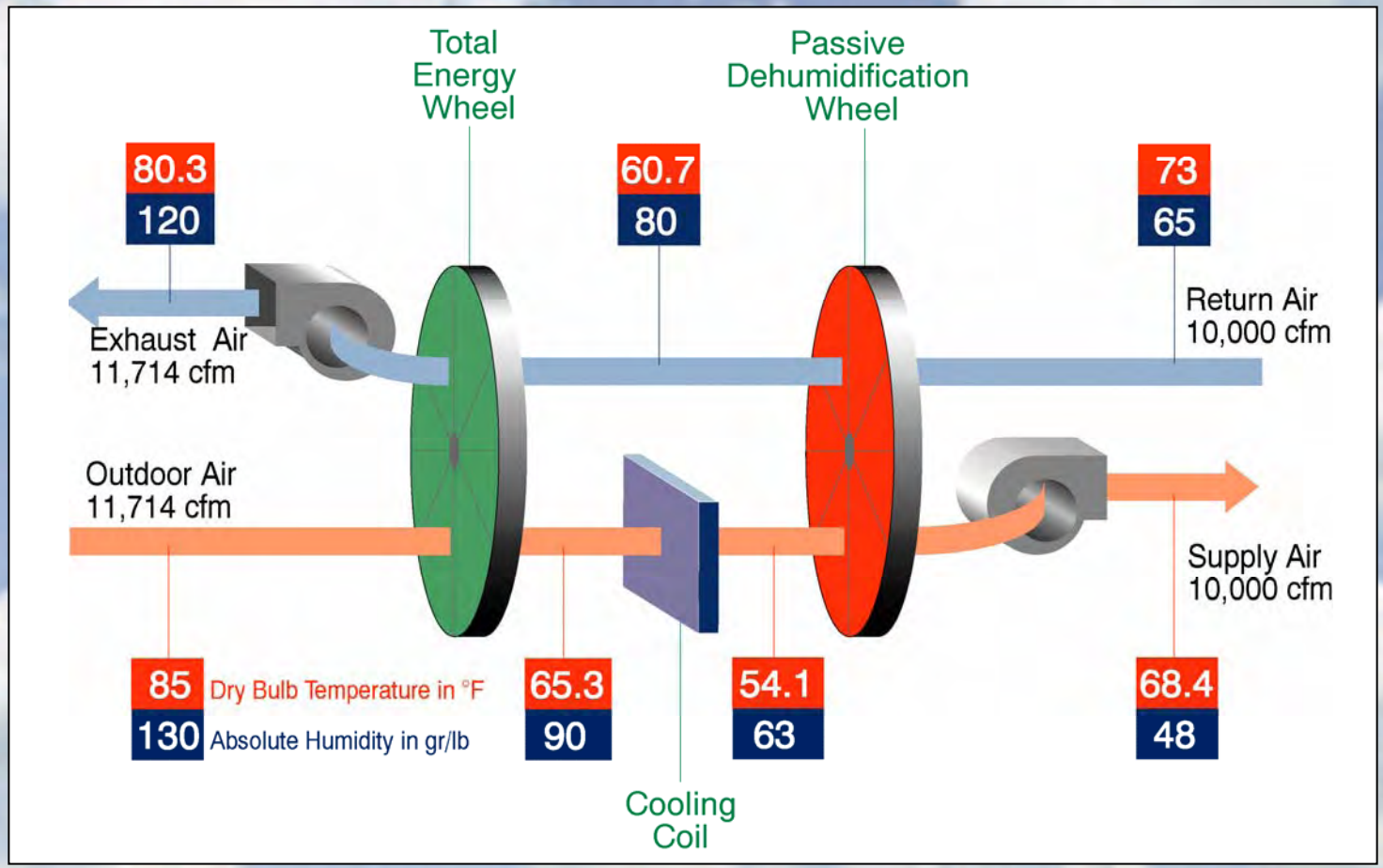
Pinnacle Control: High Latent Load



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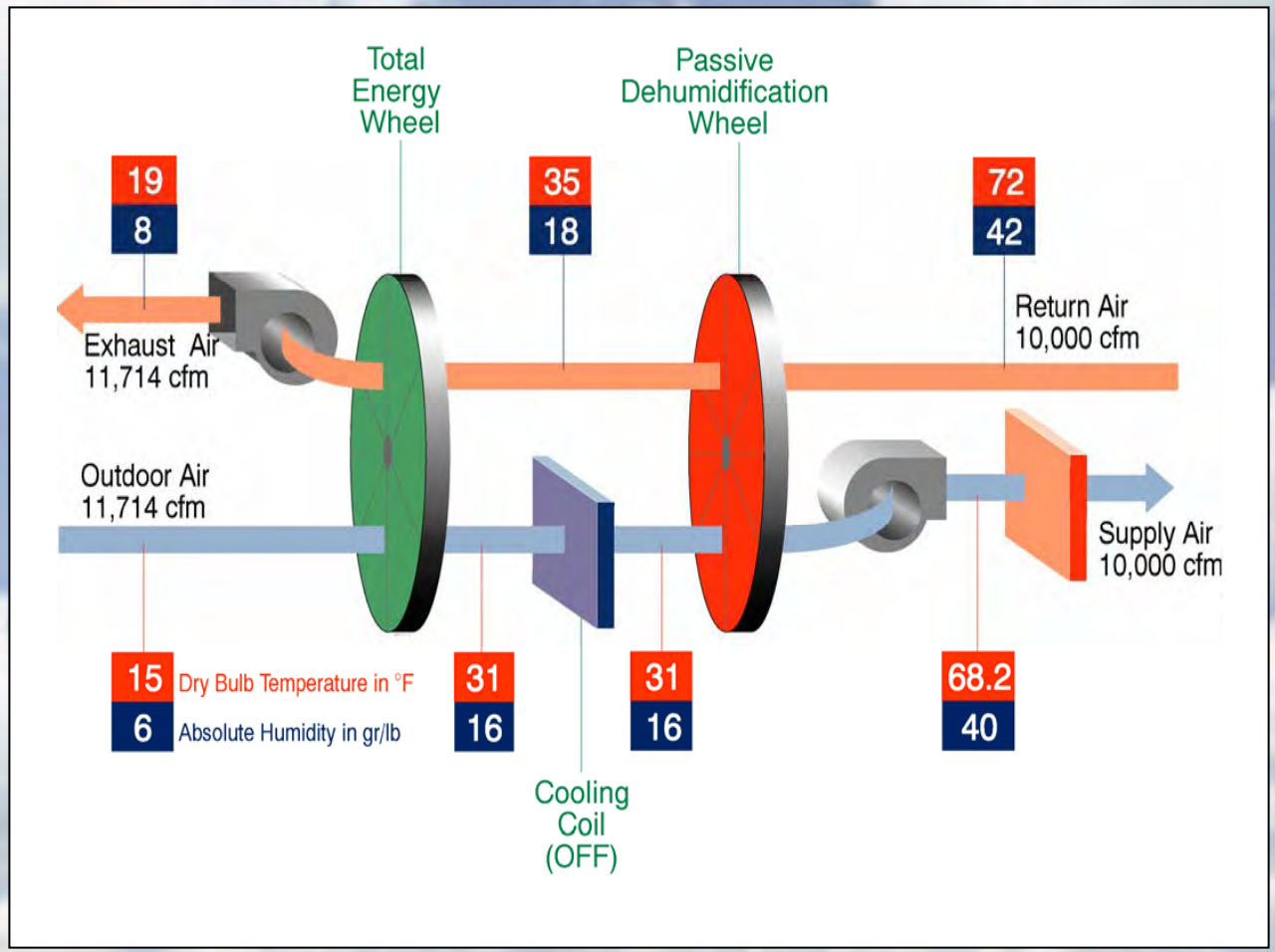
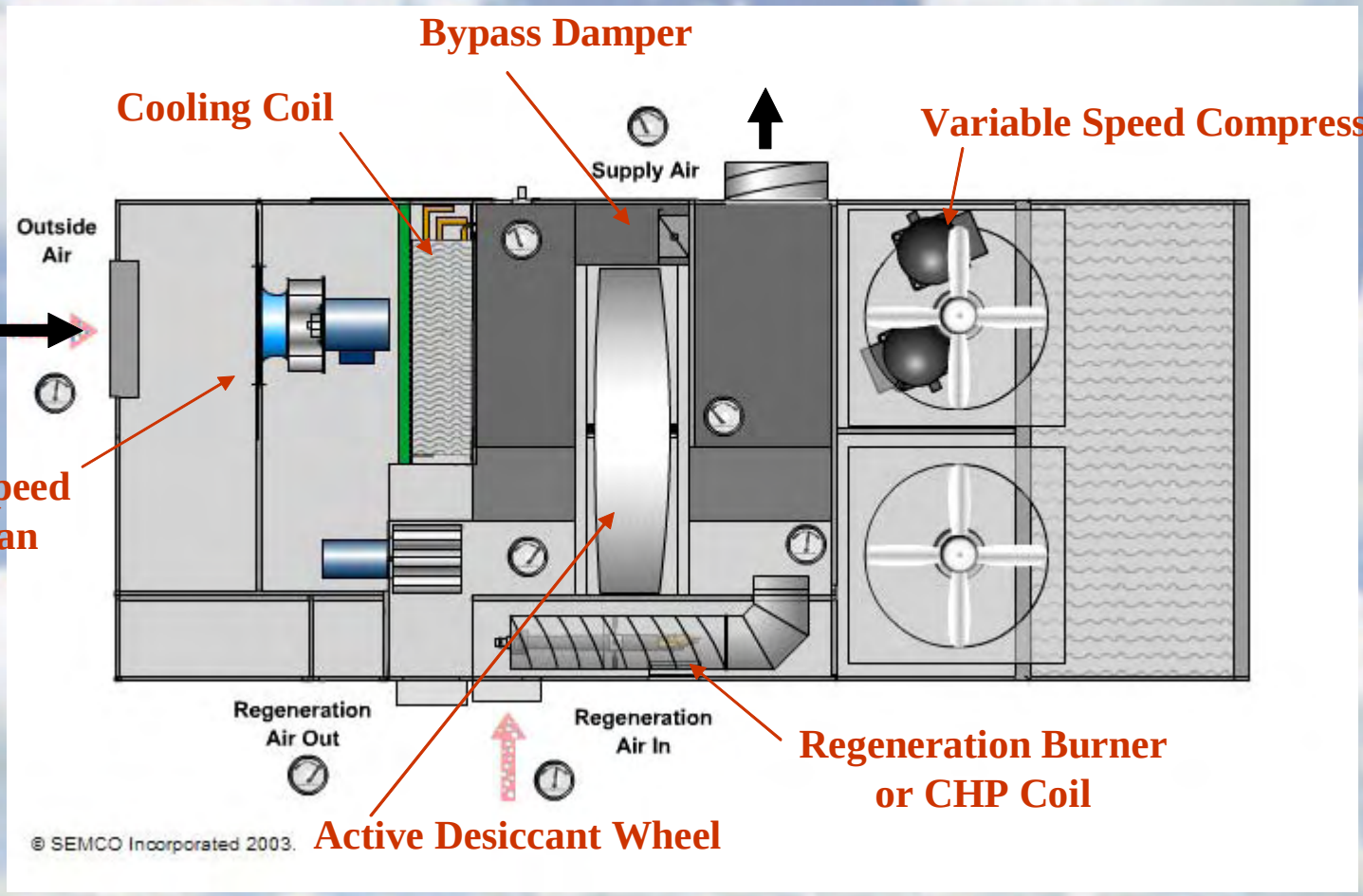
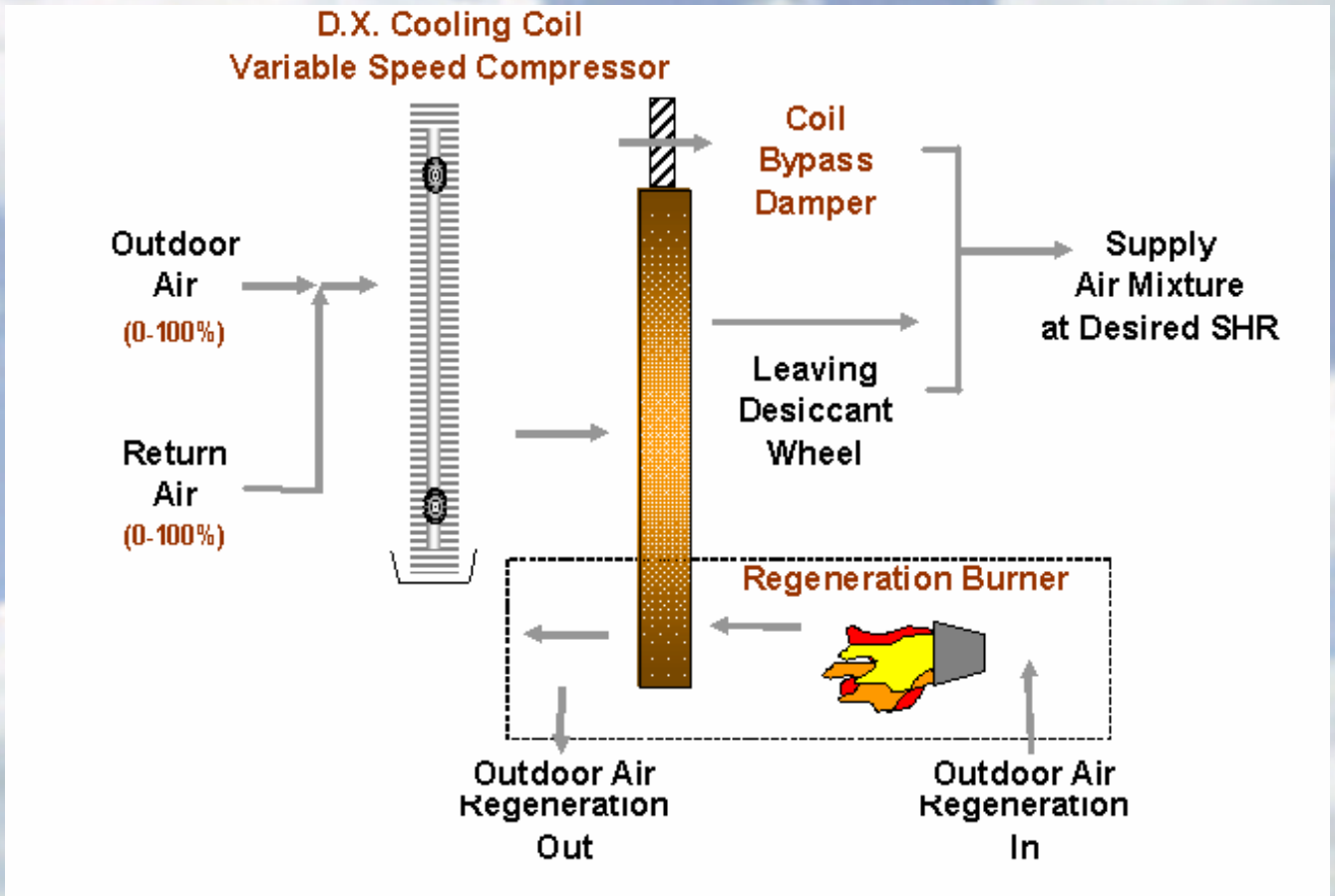
Pinnacle: Heating Mode



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

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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	**13.5**	**11.3**	**20%**
50	24.6	18.7	**15.8**	**11.0**	**44%**
40	21.6	14.4	**18.0**	**10.0**	**80%**
30	18.0	11.1	**19.5**	**9.0**	**117%**
20	12.4	7.6	**19.6**	**8.0**	**146%**

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.

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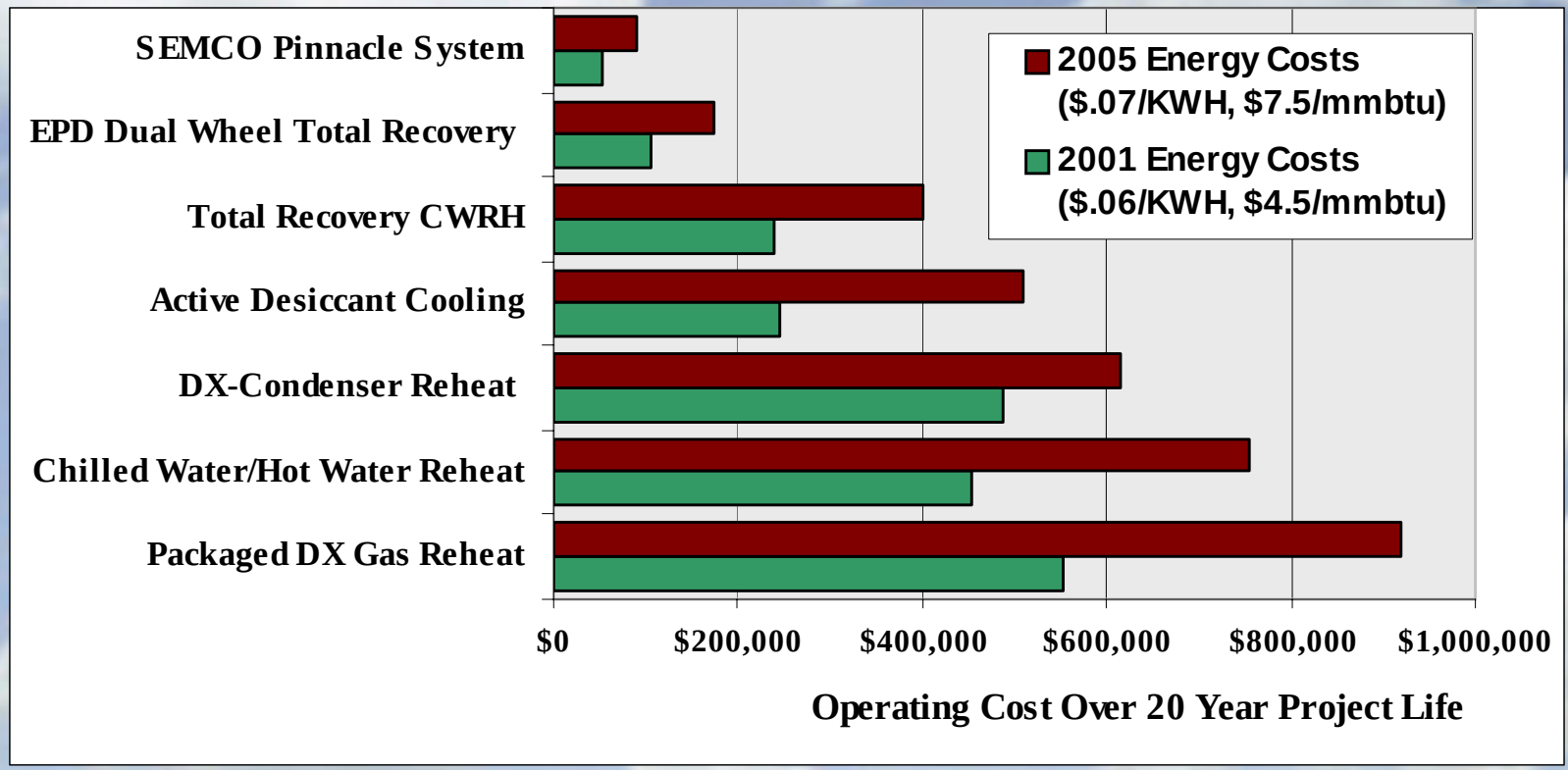
Sound Economics

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

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

Equipment Options	Latent Capacity Delivered	Equipment Cost (1)	Annual Cost of Operation (2)	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

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