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Savings from Supermarket Re-Commissioning, Testing and Evaluation

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· August 15-18, 2010 · Dallas, Texas ·
· Dallas Convention Center ·

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Dr. Paul Hutchins, PE, CEM, LEED AP

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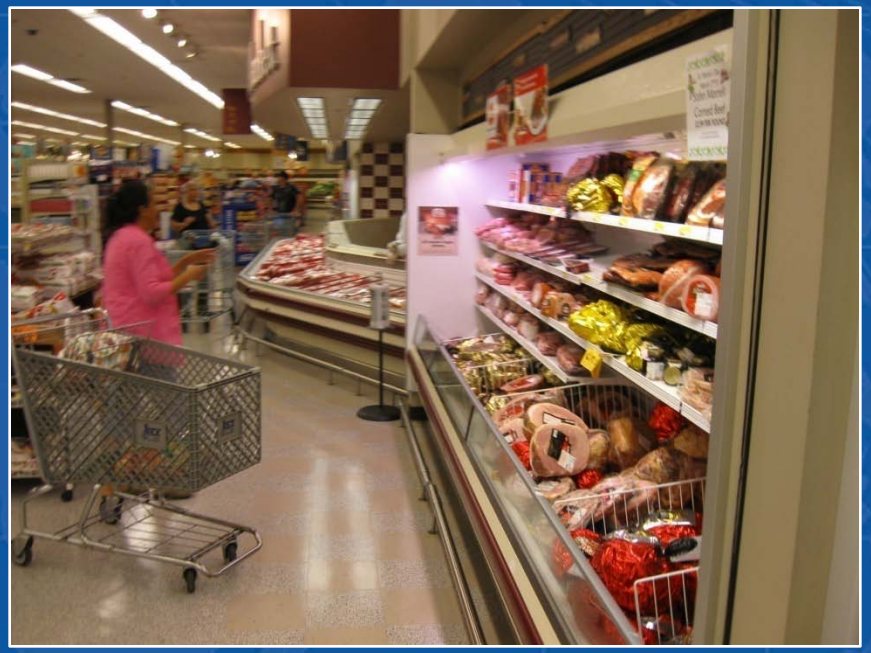
Reynolds, Smith and Hills, Inc.

Outline

- Introduction
- Methodology
- Results
- Analysis
- Conclusions
- Recommendations



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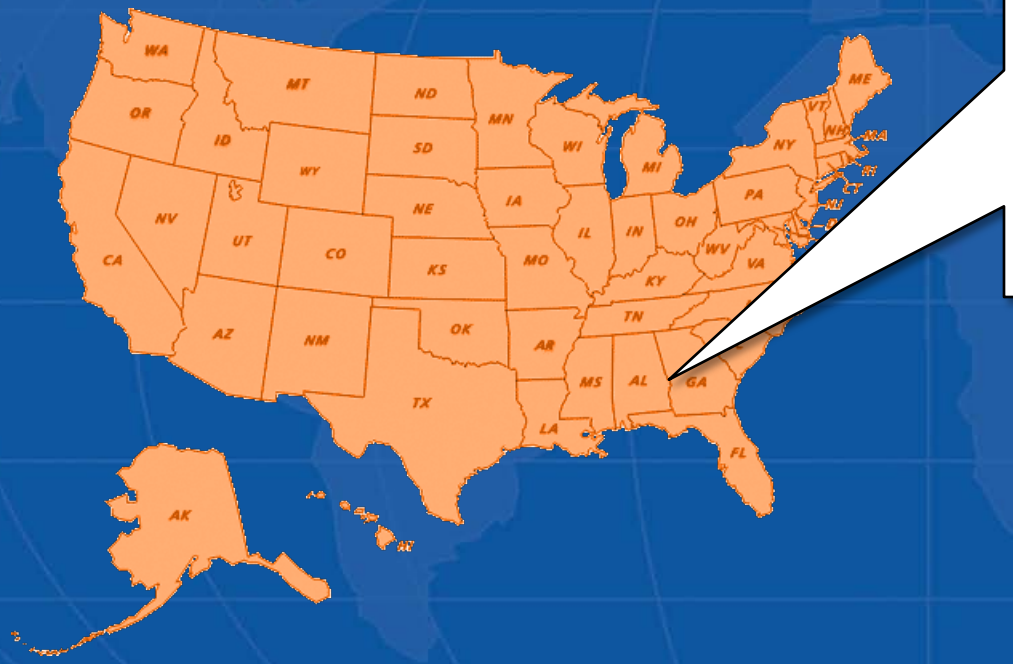
Investigated Five ECMs

1. Refrigeration control system tune-up
2. Sales Area AHU Cycling After Business Hours
3. Floating Head Pressure Control
4. Anti-Sweat Heater Set Point Adjustments
5. Domestic Hot Water Heat Reclaim Coil Positions

The Test Site Supermarket is Located in the SE



- 71,000 square feet
- Open 6 days / week

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Existing Equipment - Refrigeration Racks

Refrigeration

- 5 racks (3 medium, 2 low temperature)
- 4 racks have heat reclaim for DHW and AHU

Anti-Sweat Heater Controls

- Min: 60%, 45°F dp
- Max: 100%, 54°F

Air-Cooled Condensers

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Air Handling Unit & Domestic Hot Water Heaters

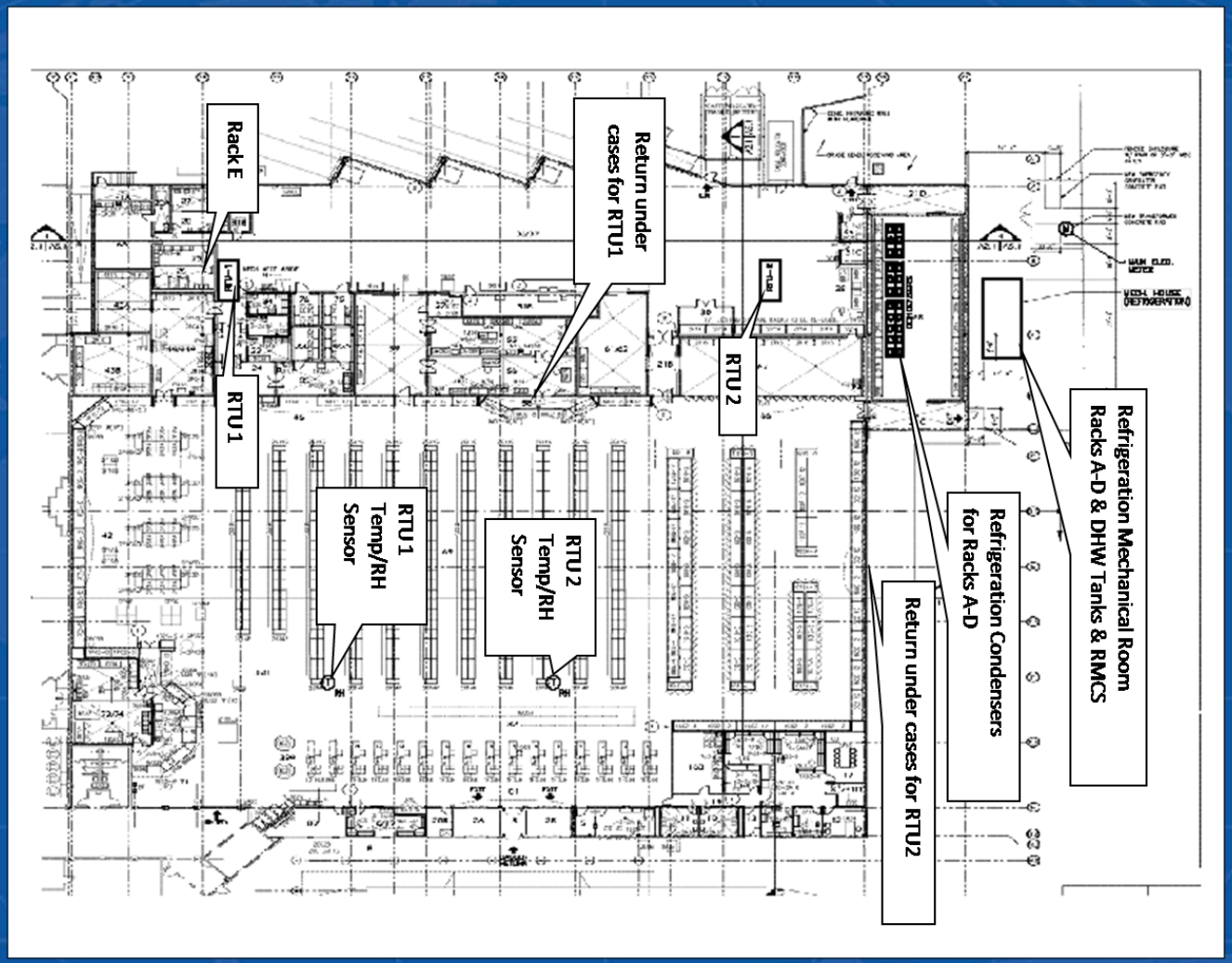
HVAC

- Dual path, DX
- Electric resistance heat

Domestic Hot Water

- 3 tanks
- 2 heat reclaim & one electric resistance water heater

Location of Key Equipment



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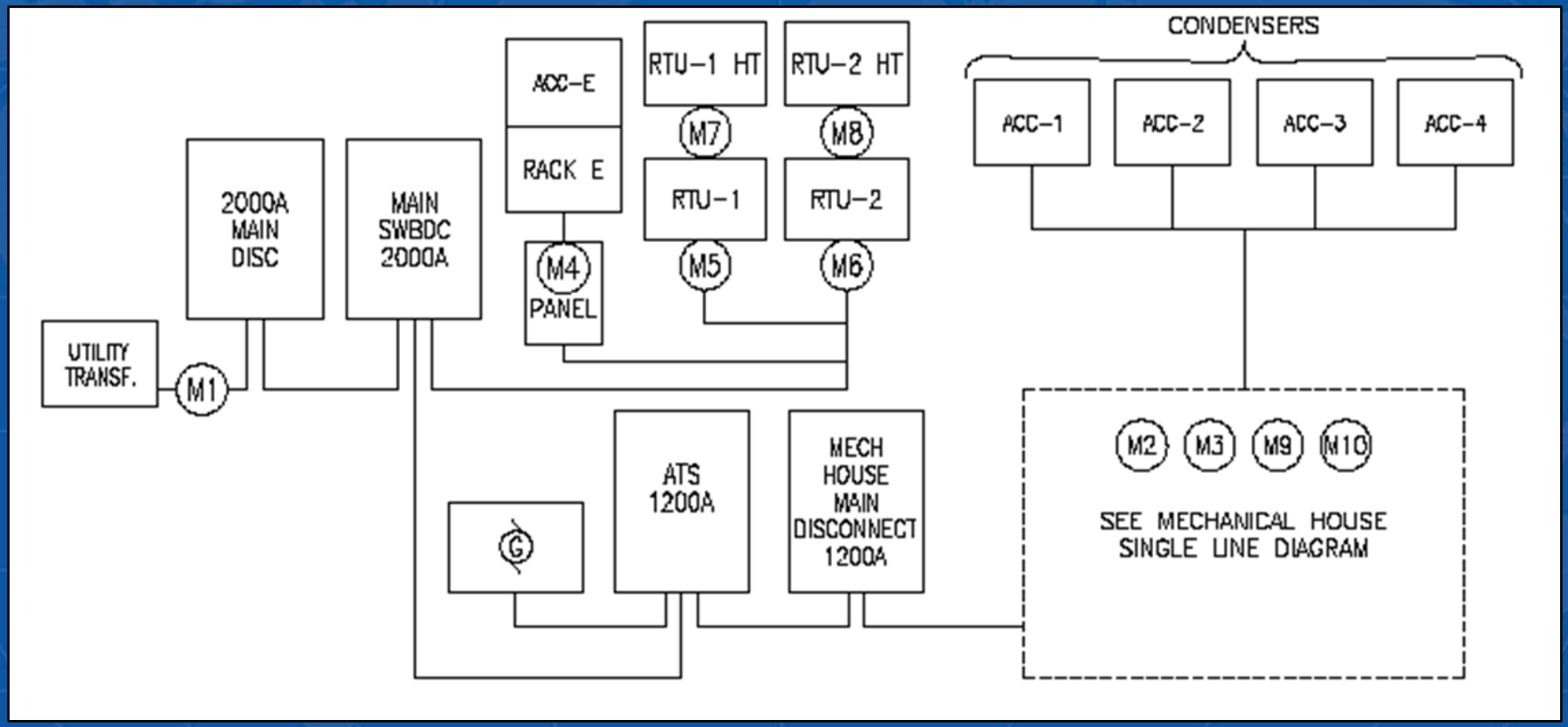
Methodology

- Sub-meter major energy and water users
- Phase in ECMs
- Collect energy use data for two weeks following each change
- Perform regression analysis of energy as a function of outside air temperature
- Calculate savings using regression equations and recent weather data

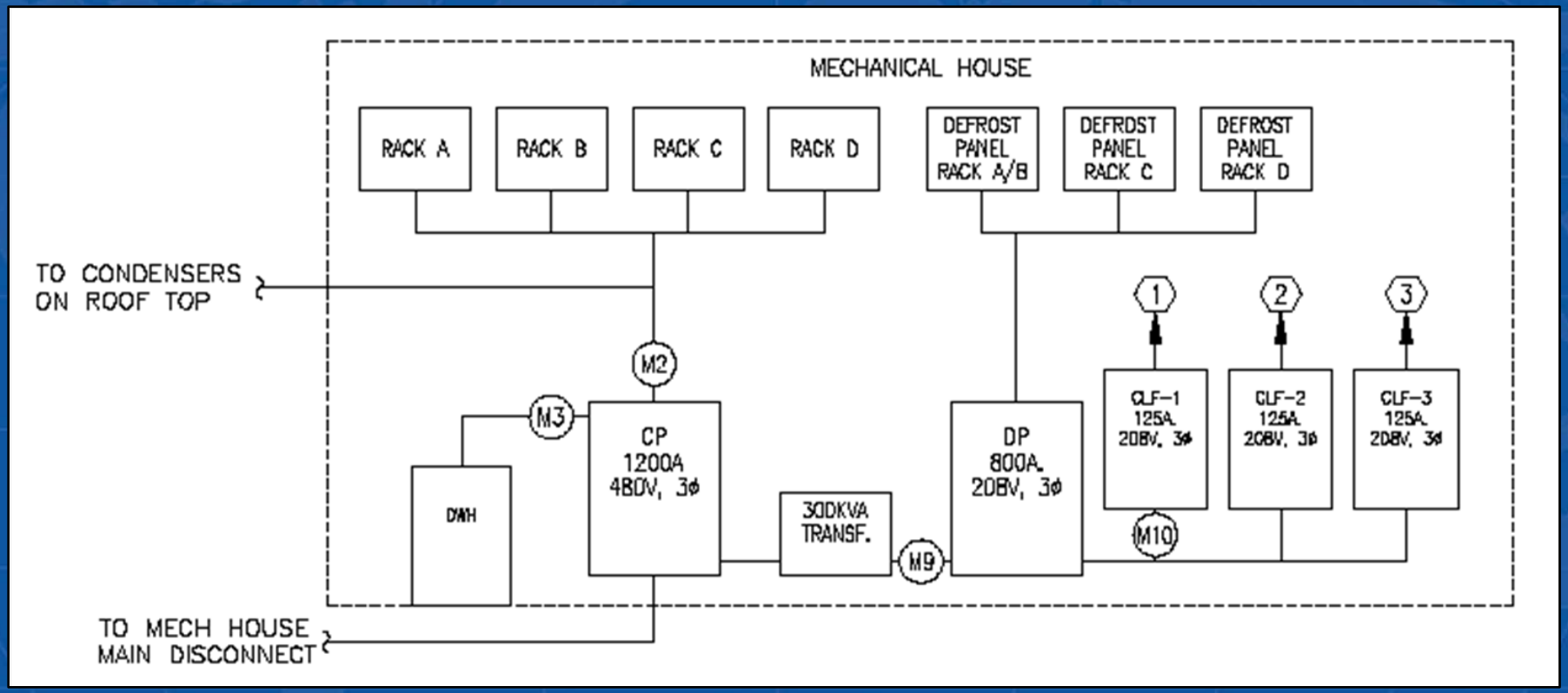
Installed 10 Electric Meters on Key Equipment

Meter ID	Description	Meter ID	Description
M-1	Main Feed	M-6	RTU-2 (includes fan, heat (M-8) and HVAC compressor)
M-2	Refrigeration Racks A-D (including condenser fans)	M-7	RTU-1 Electric Resistance Heat
M-3	DHW Electric Resistance Heat	M-8	RTU-2 Electric Resistance Heat
M-4	Refrigeration Rack E (including condenser fans)	M-9	DP Panel (display case fans, lights, anti-sweat heat (M-10) and defrost)
M-5	RTU-1 (includes fan, heat (M-7) and HVAC compressor)	M-10	Anti-sweat Heaters

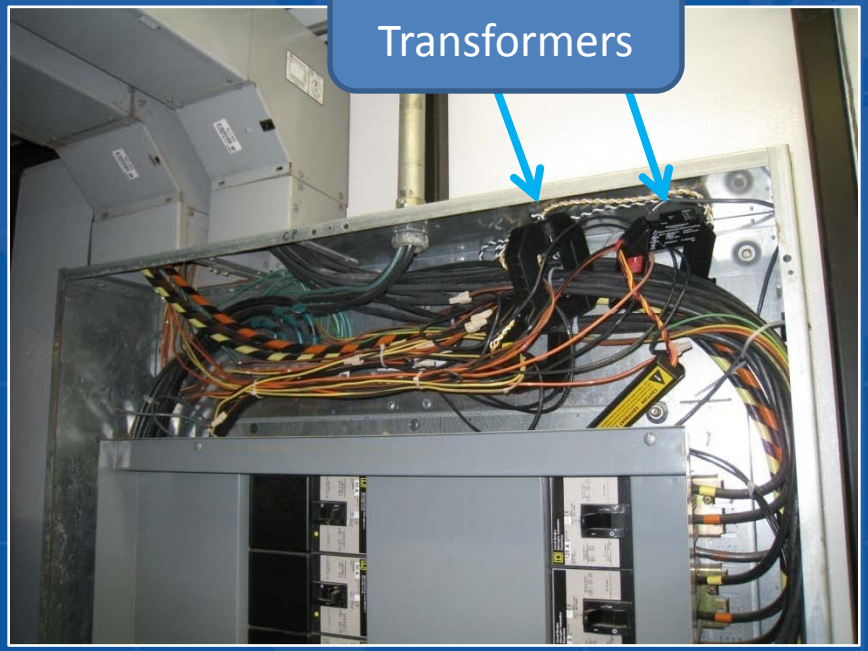
Electric Meter Locations



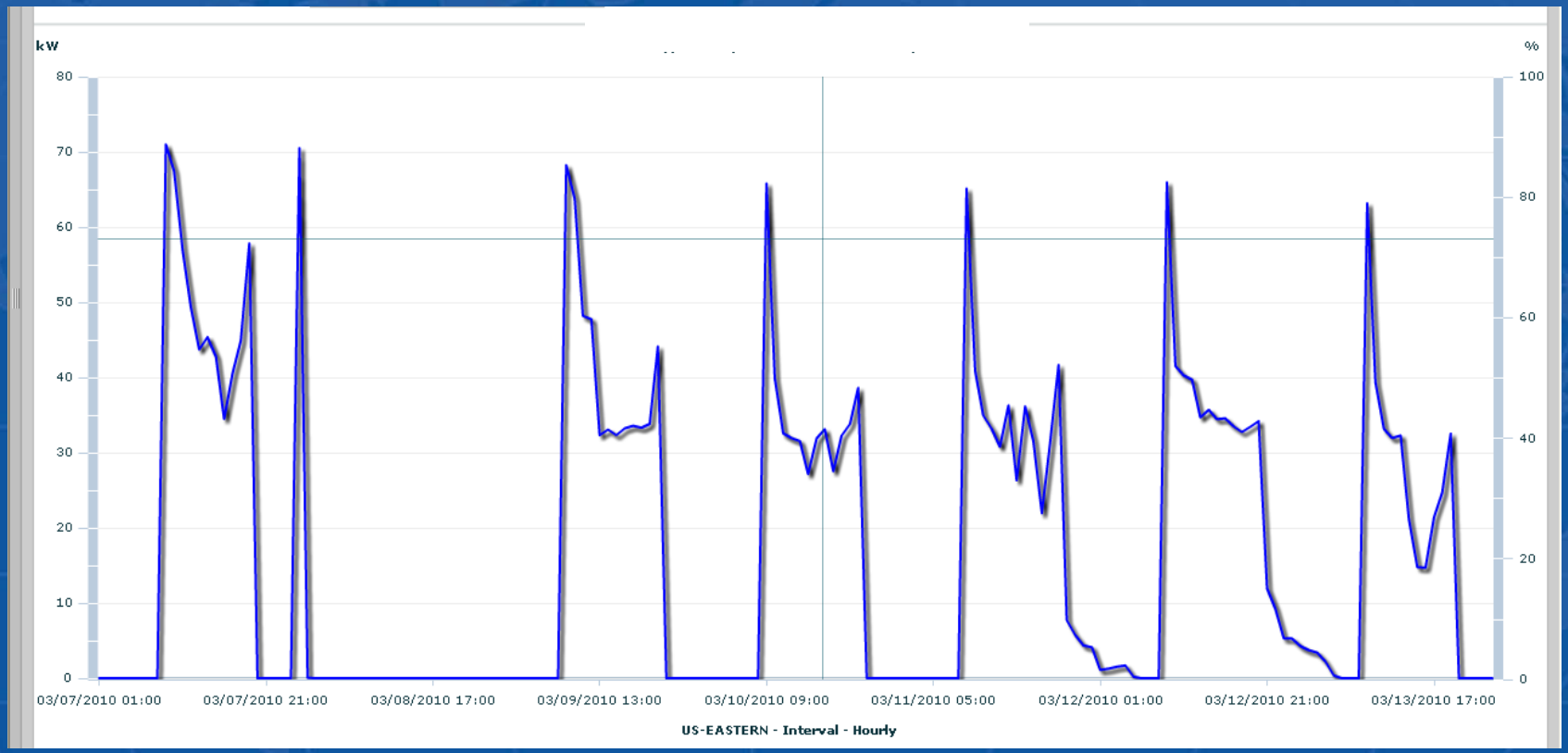
Mechanical Room Meters - DHW, all Refrigeration Racks & Condensers, and A/S Heaters



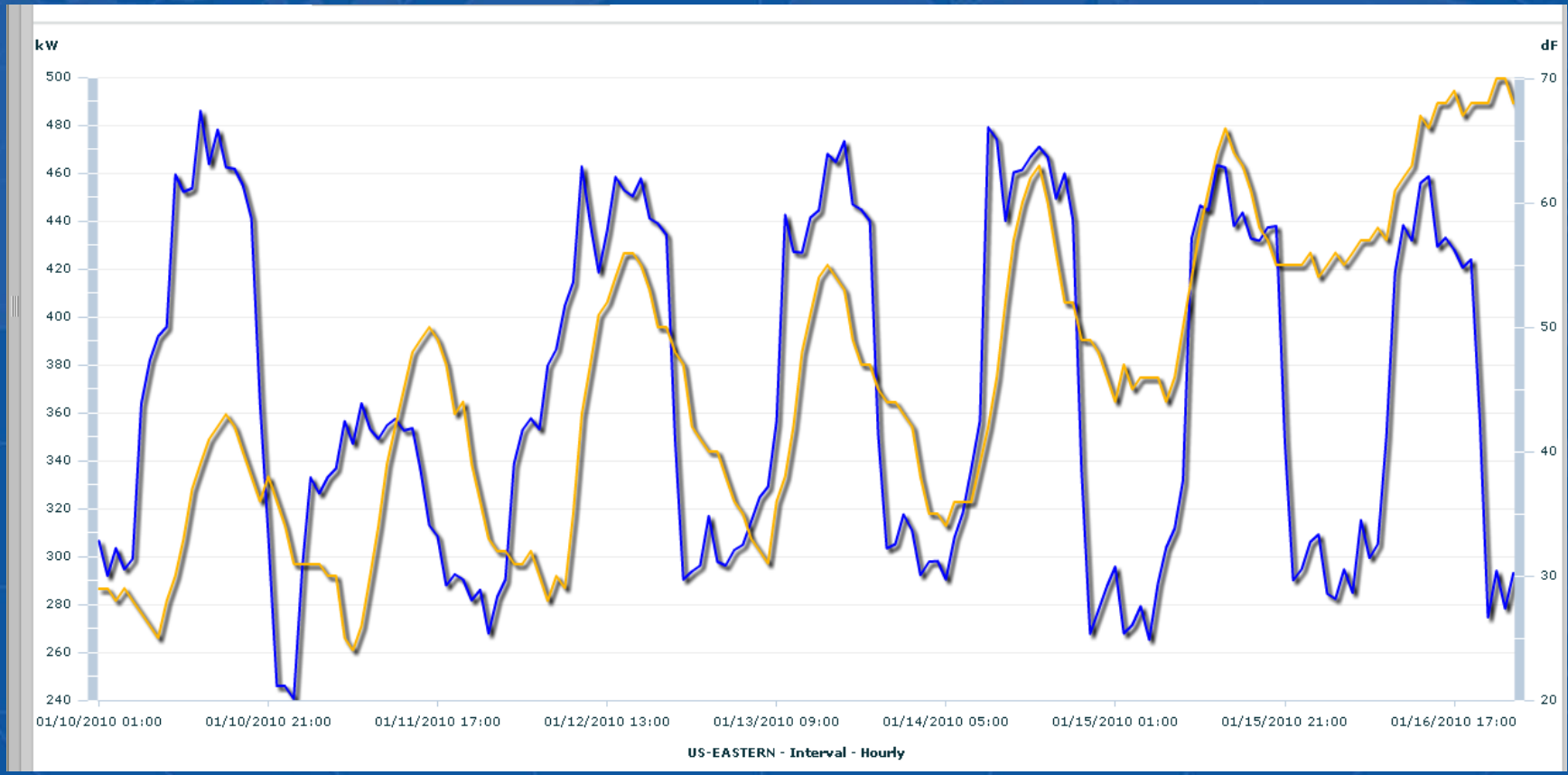
Sub-Metering to Internet



Online Metering Data – AHU Cycling Off after Business Hours



Total Power with OSA Temperature



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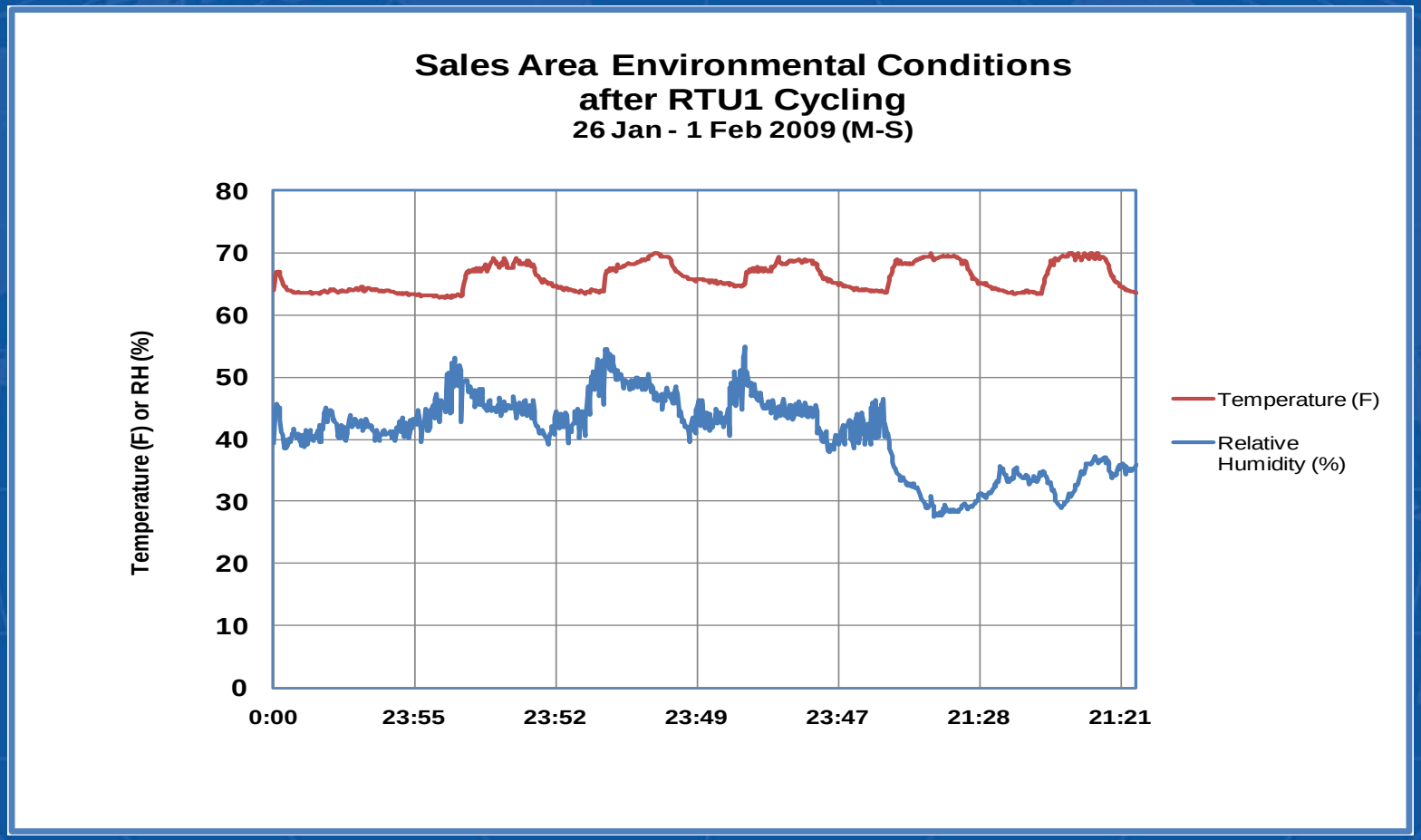
AHU Cycling Affects on Sales Area Temperature & RH



Domestic Hot Water Heat Reclaim Tests

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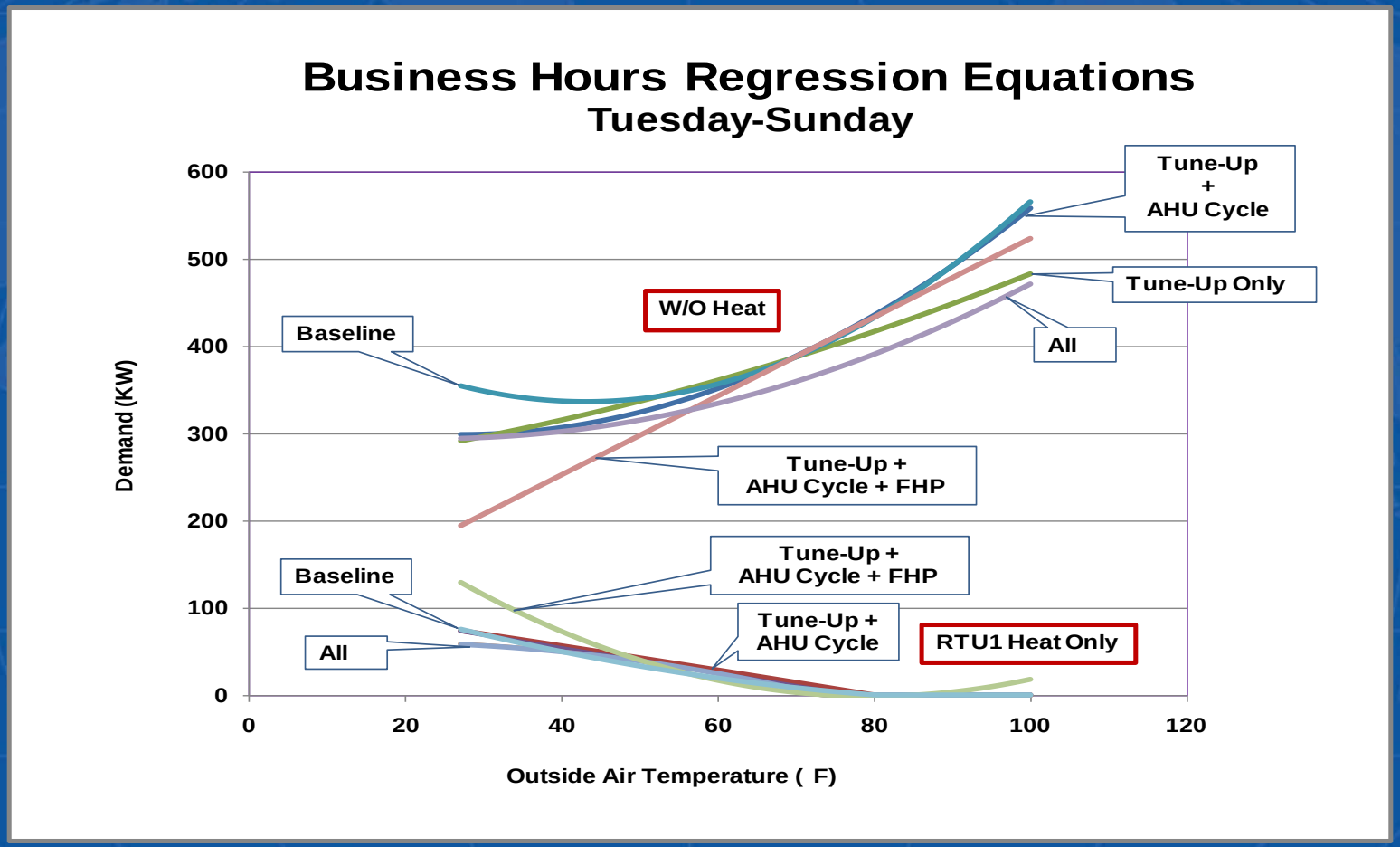
Sample Regression Analysis Results During Business Hours



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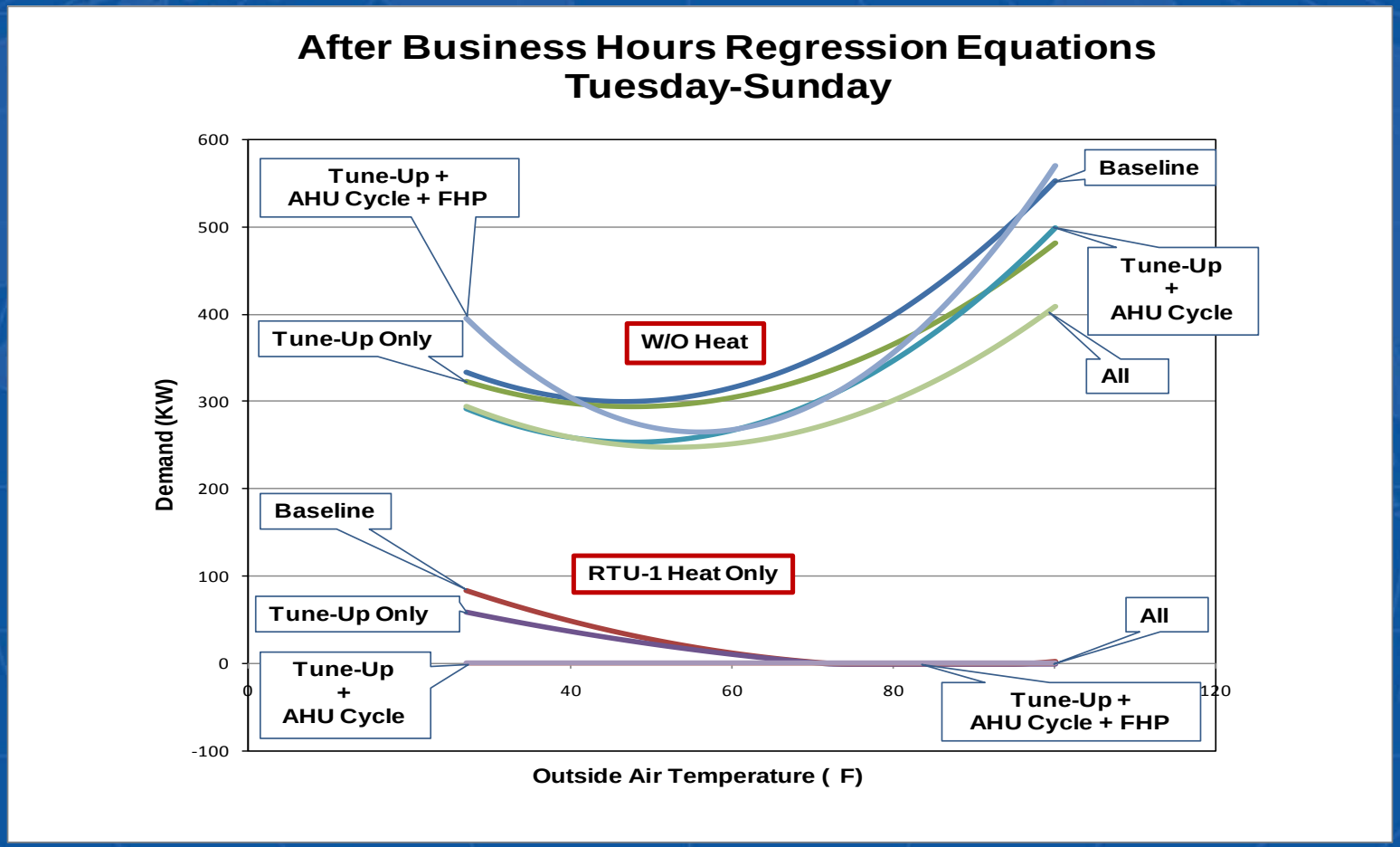
Sample Regression Analysis Results After Business Hours



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Results: DHW Heat Reclaim Coil Location

ECM	Calculated Total Store Annual Energy Use (KWH)	Savings with Respect to Baseline	
		KWH	%
Baseline (No Heat Reclaim)	76,136		
Make-Up Water Only	47,851	28,285	37.2%
Recirculated Water Only	33,907	42,229	55.5%
Both Make-Up & Recircirculated Water	23,889	52,247	68.6%

- **Best heat reclaim method**:

heat reclaim for both make-up & recirculation water

Results - Advanced Control Strategies Achieved 15.3% Energy Use Reduction

ECM	Calculated Total Store Annual Energy Use (KWH)	Savings with Respect to Baseline	
		KWH	%
Baseline[1] (Pre-ReCommissioning)	3,436,746		
Tune-Up	3,430,071	6,675	0.2%
AHUs Cycle with Night Setback	3,339,299	90,772	2.6%
Floating Head Pressure with Ambient Temperature Relief	3,151,715	187,584	5.5%
Antisweat Heater	2,909,331	242,384	7.1%
Totals		**527,415**	**15.3%**

- Anti-sweat Heater Adjustment and Floating Head Pressure account for 82% of savings

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Recommendations

- Advanced Controls strategies can reduce EUI w/o sacrificing comfort or product integrity
- The ROI is very high; payback w/in 1 year
- Important tool for meeting energy, water and greenhouse gas reduction targets