

Energy Conservation Methods for Advanced Technology Manufacturing Facilities

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Why Energy/Resource Reduction?

- Gaining in Importance
- Driven By Desire for Cost Reduction
- Competitive Advantage
- Rising Costs Must Be Countered
- Increasing Importance of Sustainable Development
- Availability Of Utility Rebates

Is It Worth The Up-Front Investment?

- It Takes Money To Save Money
- Justify Strategies With Payback Calculations
 - Simple Payback
 - Long-Term Payback
- “Ecology Is Free”

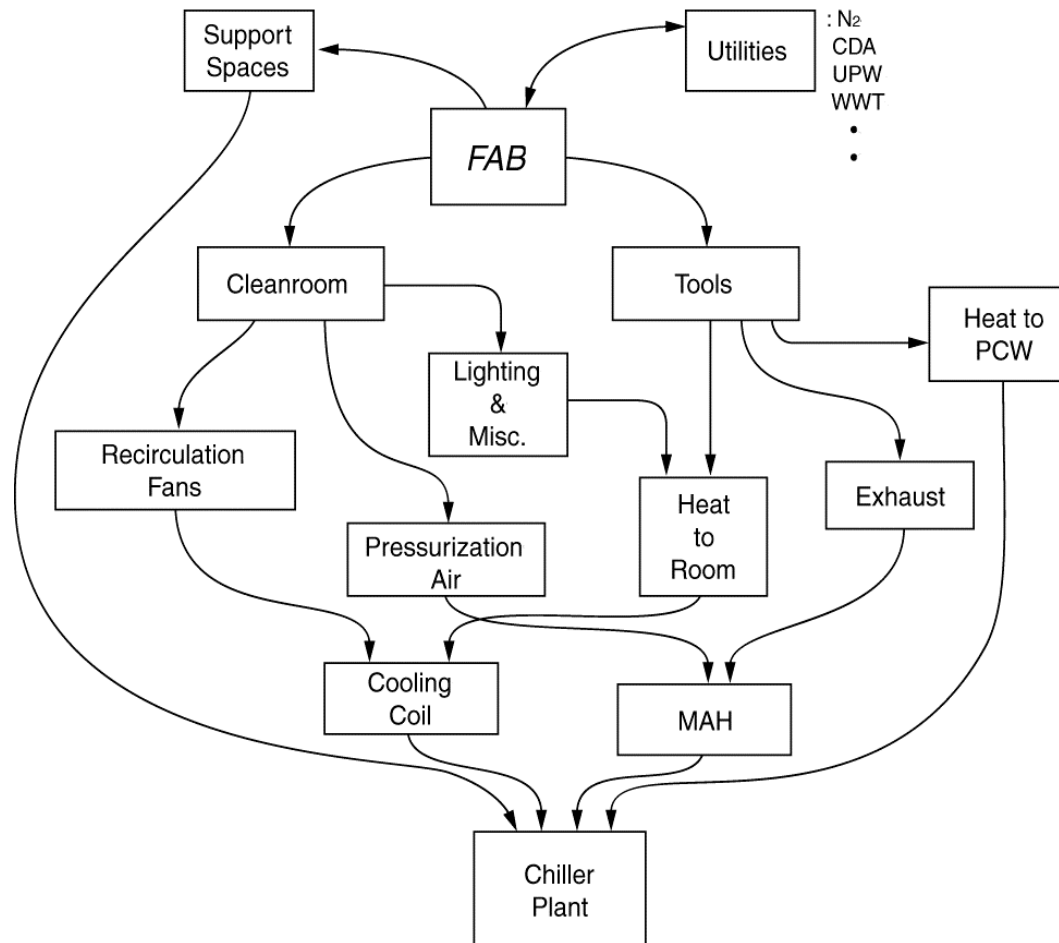
Pairing Theory With Real World Application

- Data
- Analysis
- Performance Evaluation
- Clients Demand Measurable Results
- ROI Rules

Synergy is Key to Energy Savings

- In the Past, Energy Savings Achieved One Component at a Time
 - Complex Network Of Interrelated Systems
 - Can Miss Underlying Root Problems
- Today's Approach Requires Facility-Wide Energy Energy Strategies

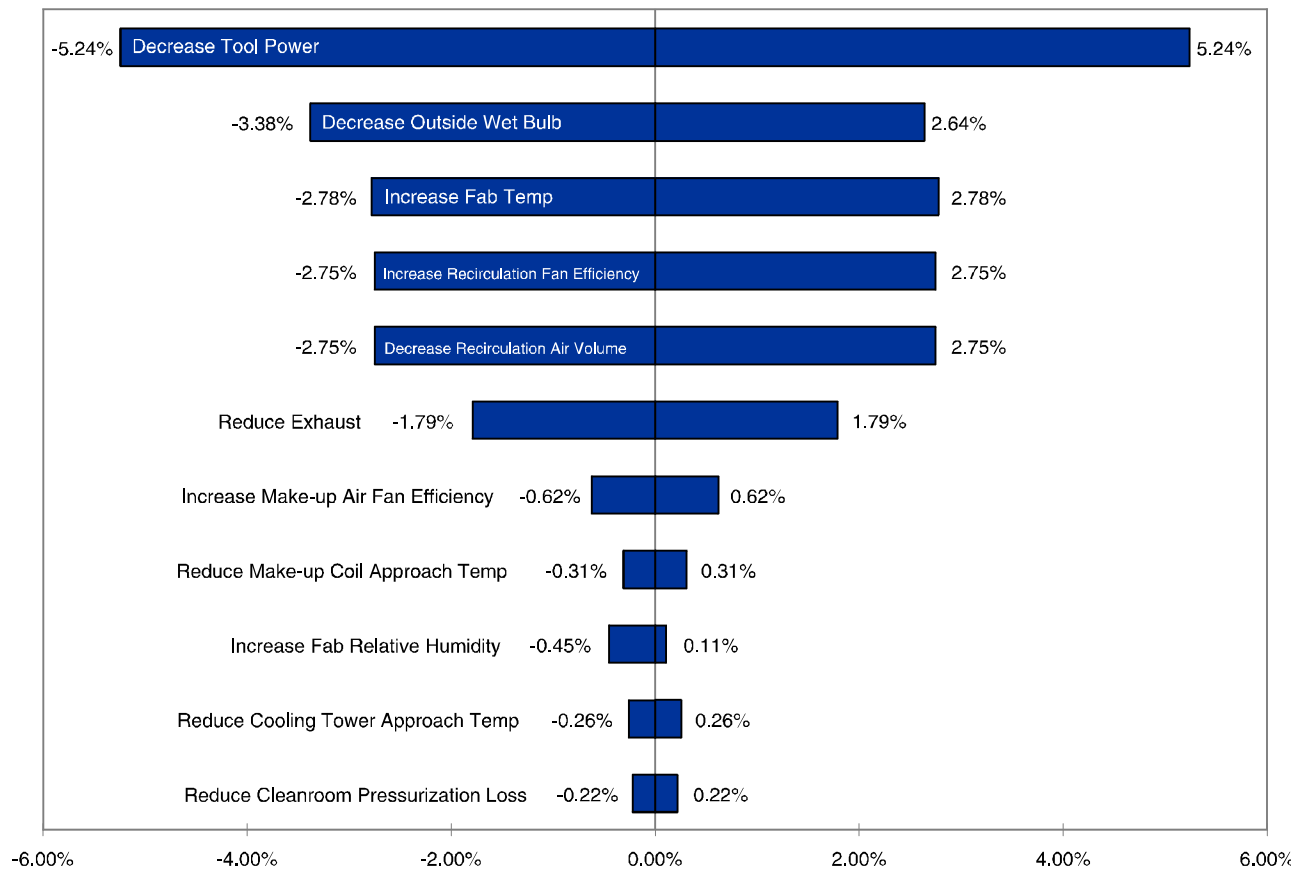
Example: Interrelationships of Facility Energy Use



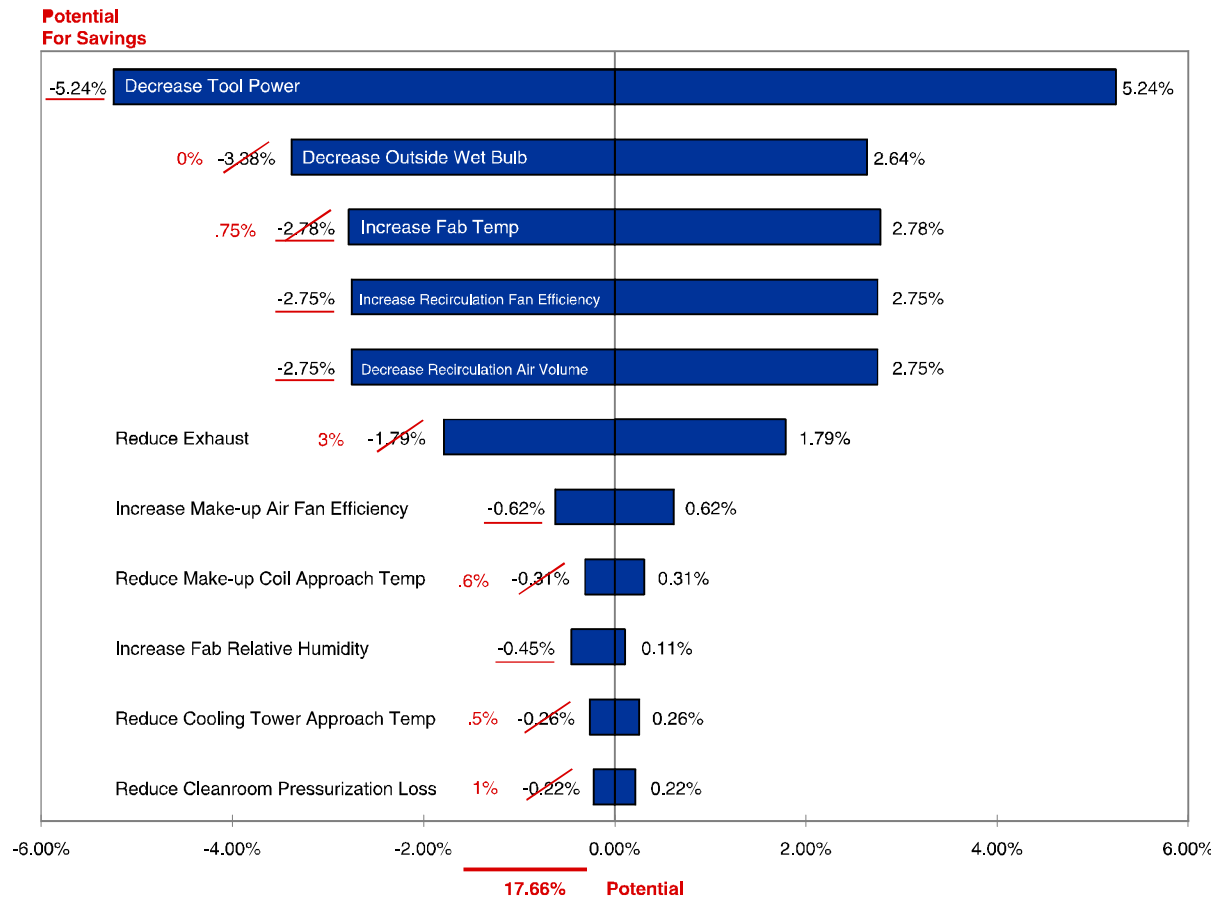
Root Causes Driving Facility Energy Usage

- Tool Exhaust
 - Determines Makeup Air Volume
- Cleanroom Class
 - Determines Recirculation Volumes, Fan Power, Pressurization Requirements
- Tool Electrical Usage

Analysis of Energy Consumption Ranges of Variation



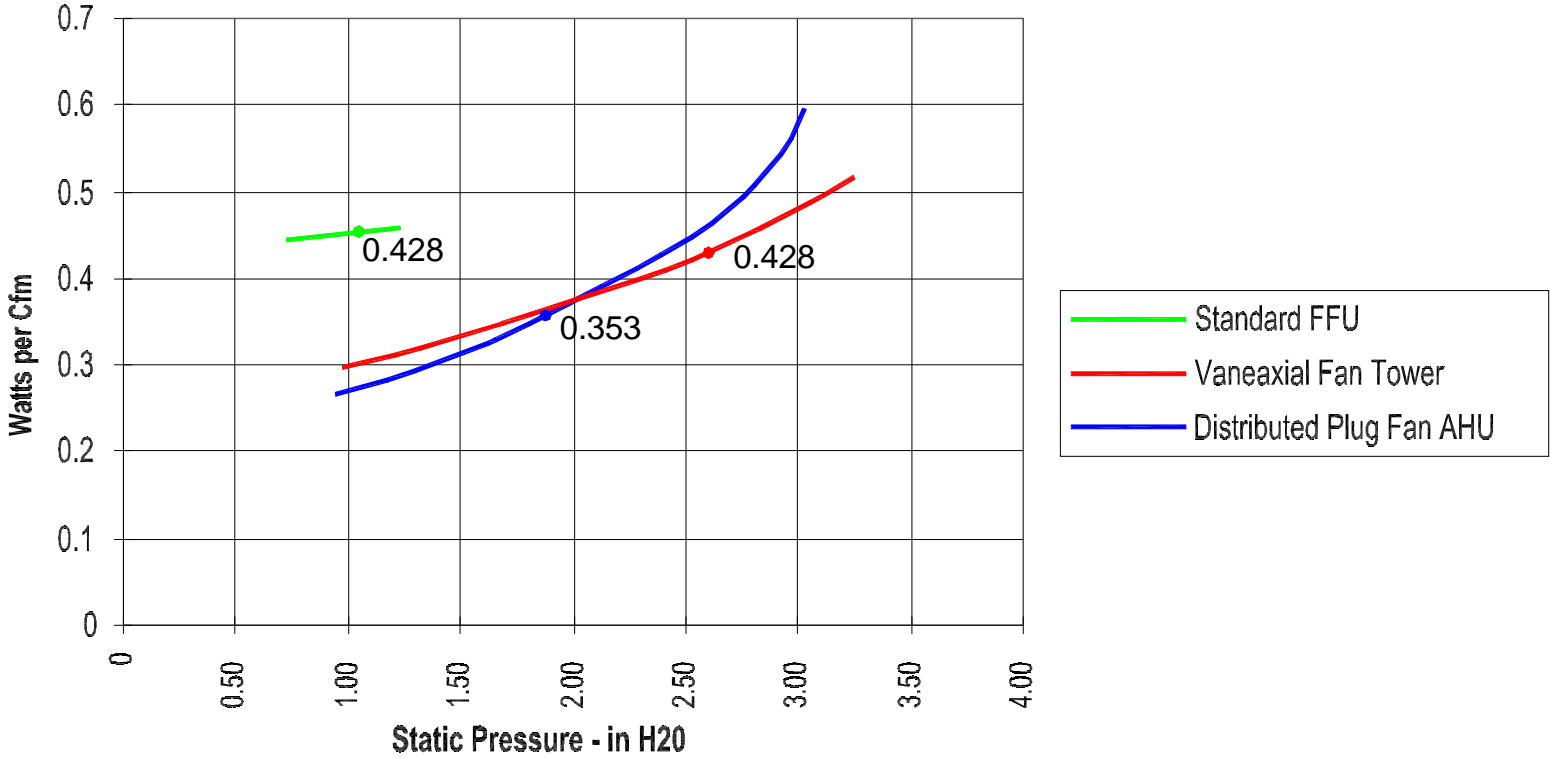
Assessment of Potential for Energy Consumption Reductions



Energy Reduction Approaches

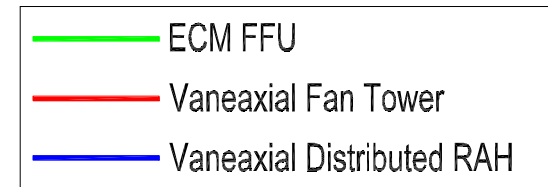
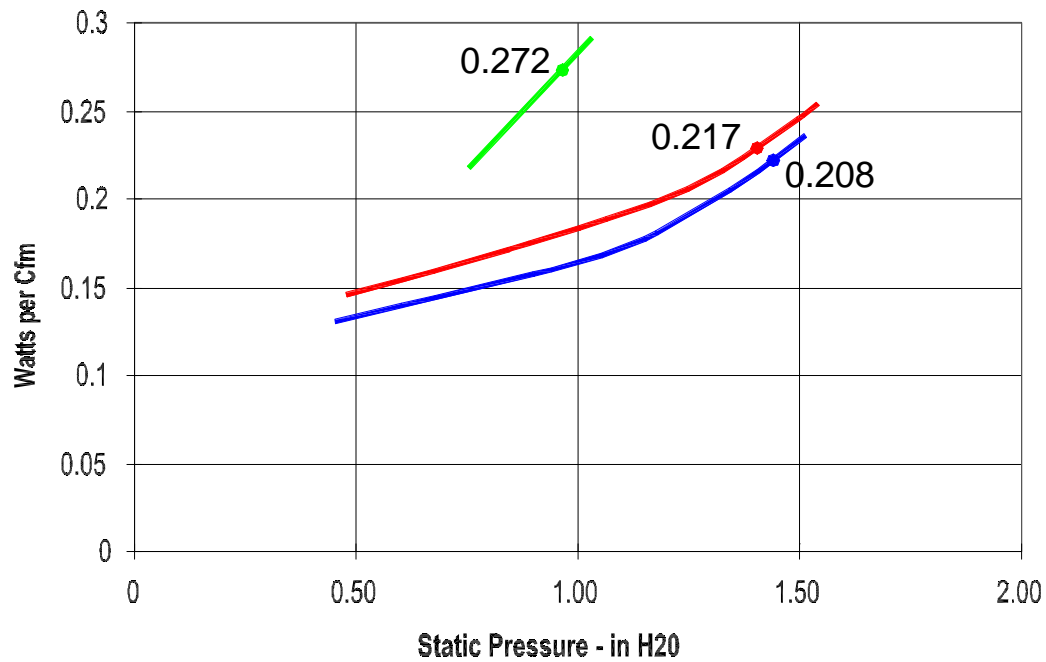
- Tool Exhaust & Tool Electrical Usage
 - Mini-Environments
 - Active Exhaust Reduction at Tool
 - Minimizing Makeup Air Most Effective Way To Reduce Energy Costs
- Cleanroom Class
 - Driven By Process & Technology

Relative Energy Effectiveness, Standard Fans, 100% Coverage



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Energy Effectiveness, Advanced Fans, 100% Coverage



FILE: graph2.dwg

Cost Factors, 100% Filter Coverage

Facility Component	Fan-Filters	Distributed RAHs	Fan Towers
Air-moving equipment	high	low	low
Access floor height	same for all		
Return chase width	high	low	high
Interstitial space height	high	highest	lowest
Structural fan deck	none	required	none
Cooling coil surface	high	low	low
Piping	low	high	low
Ceiling grid	gasketed	gel	gel
Electrical service	median	highest	lowest
Automation	highest	high	lowest

Sample of Actually Realized Facility Savings

Client	Resource Reduction	Annual Savings to Client	Savings Over Facility Life
Project #1	6.5 mil. kwh/yr	\$275,000	\$4.1 million
Project #2	11 mil. kwh/yr	\$300,000	\$4.5 million
Project #3	8.1 mil. kwh/yr	\$340,000	\$5.1 million
Project #4	5.3 mil. kwh/yr	\$186,000	\$2.8 million
Project #5	94.5 mil. kwh/yr	\$200,000	\$3 million
Project #6	8.7 mil. kwh/yr 369,000 gal/yr fuel	\$690,000 \$333,000	\$10 million \$5 million
		<hr/> \$1,023,000	<hr/> \$15 million
Project #7	5.3 mil. kwh/yr	\$450,000	\$6.7 million

Sampling of Specific Facility System Savings

	Energy (kWh)	Savings (\$)
Lighting	3,009,600	135,000
Premium Efficiency Motors	1,111,600	47,000
High Efficiency Chillers	533,200	27,000
HVAC Systems	1,483,800	63,000
Mechanical Systems	2,537,500	101,000
Process Systems	2,411,500	104,000

Total Projected Facility Life Cycle Savings - \$4.5 million

Equipment-Related Strategies

- Progressive Design Firms Must Take Initiative For Product Innovation
- Examples
 - OptiMAH
 - AcoustiFLO

Where Does Your Company Go From Here?

- Establish Your Corporate Energy Policy
- Benchmark Your Facility's Performance Against the Best of Industry
- Execute Your Strategy

Conclusion

- Energy/Resource Reduction Not Best Achieved One System At A Time
- Understand Complex Relationships Among A Facility's Complex Systems
- Both New And Existing Facilities Can Benefit