



Energy Conservation Methods

For Advanced Technology Manufacturing Facilities

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Architects • Engineers • Constructors

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

The Up-Front Investment

Is It Worth It?

- 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

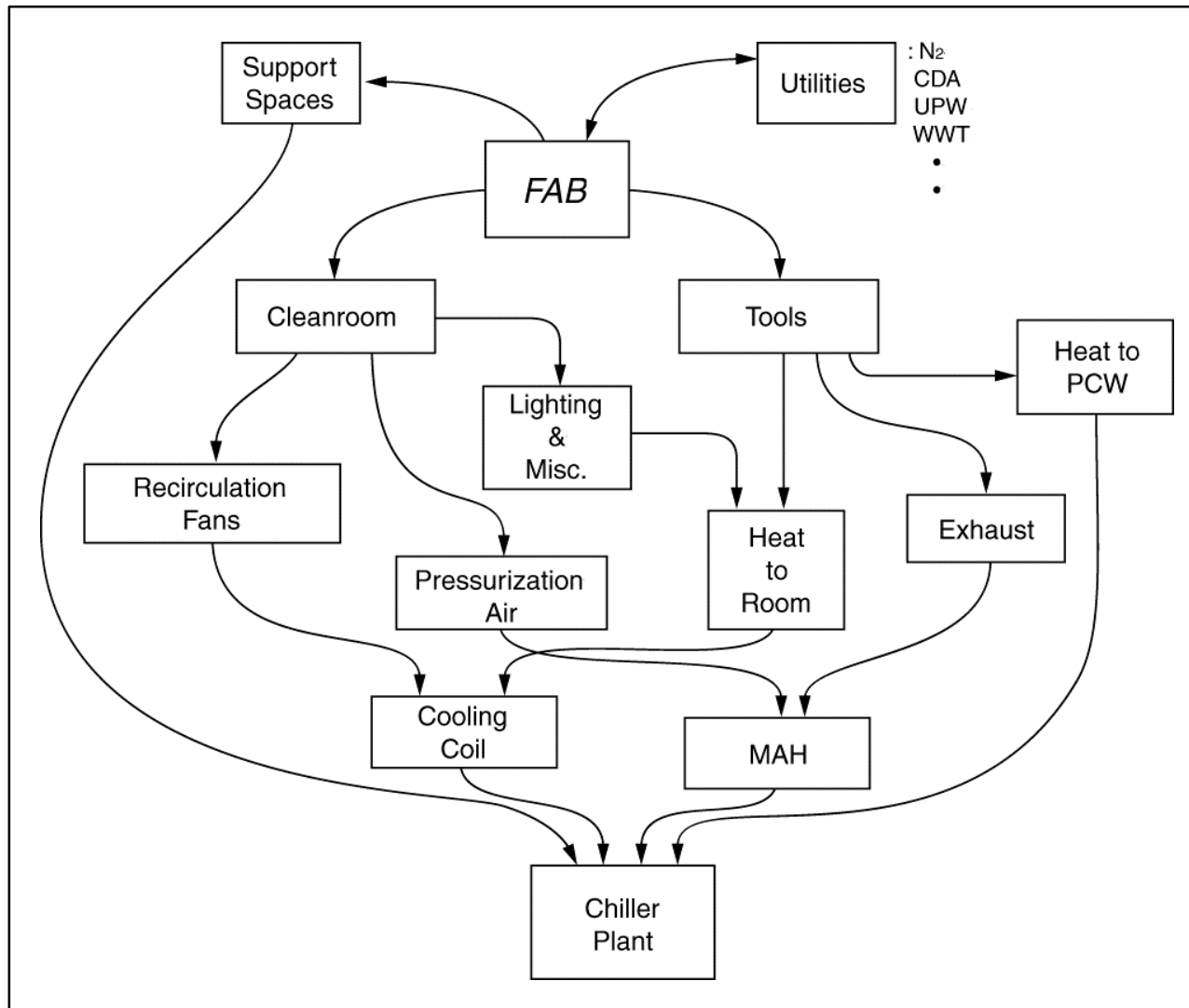
- Data
- Analysis
- Performance Evaluation
- Clients Demand Measurable Results
- ROI Rules

Synergy - 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 Strategies

Facility Energy Use

Interrelationships Example



Facility Energy Use

Driving Root Causes

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

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

Facility Savings

Actually Realized Example

Client	Resource Reduction	Annual Savings to Client	Savings Over Facility Life	Simple Payback
Project #1	6.5 mil. kwh/yr	\$275,000	\$4.1 million	1.9 years
Project #2	11 mil. kwh/yr	\$300,000	\$4.5 million	2.5 years
Project #3	8.1 mil. kwh/yr	\$340,000	\$5.1 million	1.9 years
Project #4	5.3 mil. kwh/yr	\$186,000	\$2.8 million	2 years
Project #5	94.5 mil. kwh/yr	\$200,000	\$3 million	NA
Project #6	8.7 mil. kwh/yr	\$690,000	\$10 million	
	369,000 gal/yr fuel	\$333,000	\$5 million	
		\$1,023,000	\$15 million	1.2 years
Project #7	5.3 mil. kwh/yr	\$450,000	\$6.7 million	1.2 years

Facility System Savings

Specific Sampling

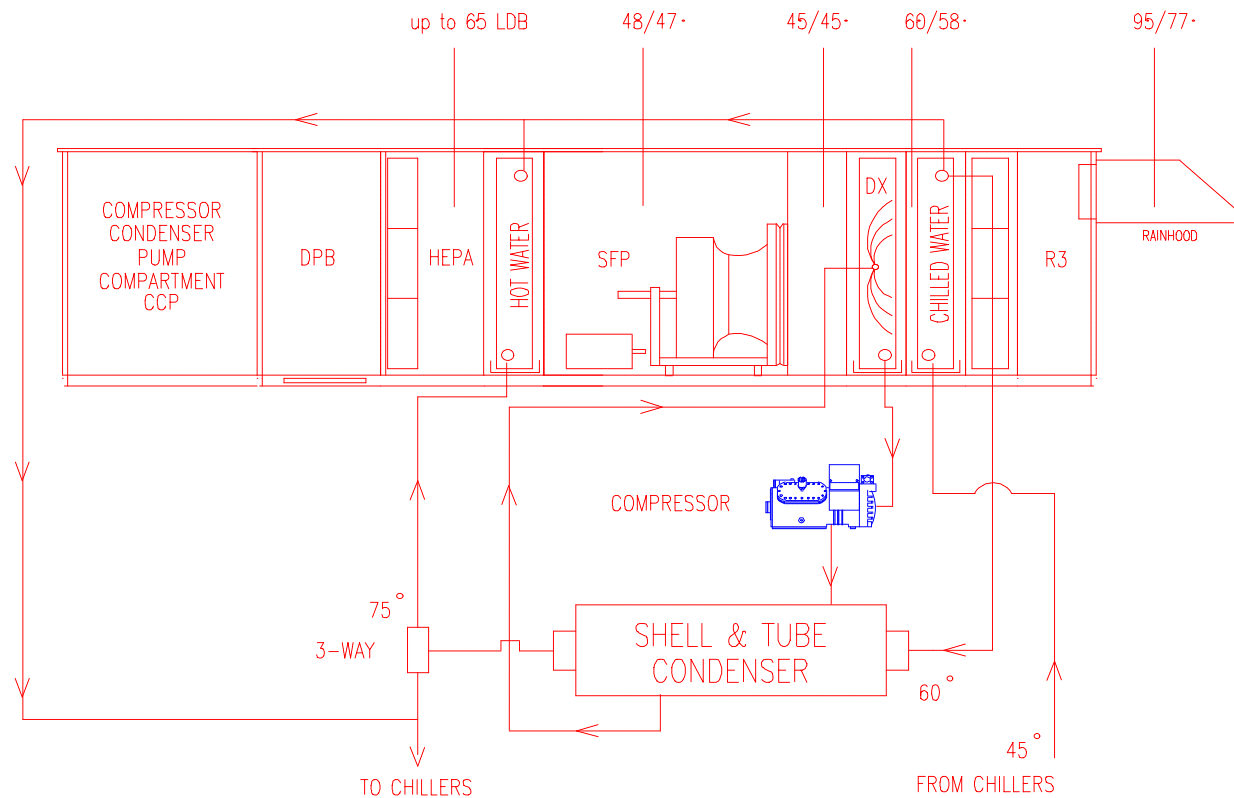
	Energy (kWh)	Savings (\$)
Lighting	3,009,600	135,000
High Efficiency Motors	1,111,600	47,000
High Efficiency Chillers	533,200	27,000
HVAC Systems	1,483,800	63,000
Mechanical Systems	2,537,500	101,000
Process Systems	2,411,500	104,000

Total Projected Facility Life Cycle Savings = \$4.5 Million

Equipment-Related Strategies

- Progressive Design Firms Must Take Initiative for Product Innovation
- Examples
 - OptiMAH

OptiMAH



**Hot Water is Modulated to the Reheat Coil to
Maintain Desired Leaving Air Temperatures
From 60-70°F**

OptiMAH BENEFITS

Free Refrigerant Reheat

- May Eliminate the Need for a Boiler in Tropical Locations
- Tremendous Reheat Energy Savings
 - Up to 270 MBH or 79 kw per 10,000 cfm
 - $(79 \text{ kw})(5000 \text{ hours})(.08 \text{ \$/kw hr}) = \$31,600$
 - Up to \$31,000 Annual Savings per 10,000 cfm Compared to an Electric Reheat Alternative

OptiMAH BENEFITS

Faster Construction Cycle

- OptiMAH can Provide Construction Air Conditioning and Dehumidification Prior to Commissioning the Chilled Water System
 - Temporary Condenser Water Heat Rejection Must be Arranged
 - The OptiMAH DX Refrigeration is Usually Sized for 25-35% of the Total Makeup Air Load
- Mild Construction Heat can be Generated

OptiMAH BENEFITS

- \$42,000 Annual Chiller Energy Savings per 1000 Tons of Chilled Water
- Up to \$31,600 Annual Reheat Energy Savings per 10,000 cfm
- Faster Construction Cycles
- Cleanroom Construction for Makeup Air Handlers
- Precise Control of Leaving Temperature and Humidity [= /-.5 Degrees and 3%]
- OptiMAH Refrigeration Reduces Chilled Water Plant Capacity and Possibly the Need for Glycol

OptiMAH Summary

- 1. OptiMAH provides primary cooling with a chilled water coil, secondary cooling from a factory packaged DX system, and free reheat.**
- 2. OptiMAH provides excellent control of leaving air temperature and humidity down to 45° dew point.**
- 3. The primary benefit is the chiller energy savings and free reheat.**
- 4. OptiMAH also can reduce construction costs and time tables.**

Next Step

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