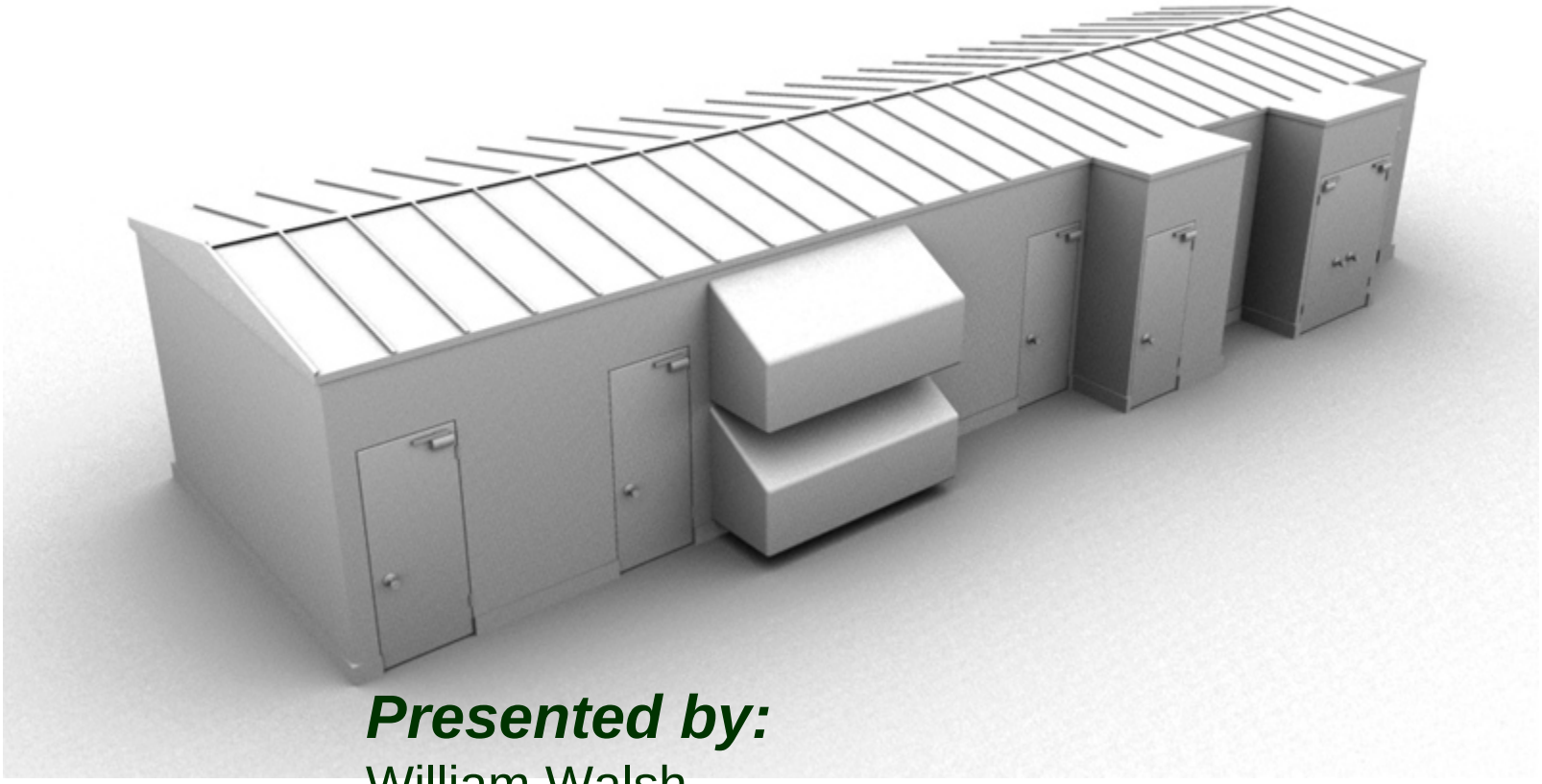
Best Practices in Commercial ENERGY EFFICIENCY



Presented by:
William Walsh
Environmental Hygiene Services Business Manager
Nalco Company

NALCO

Agenda

- Nalco Company Overview
- Purpose, Design & Operation of HVAC Systems
- Chilled Water System Best Practices
- Coil Cleaning Best Practices
- Air Filtration Best Practices
- Key Solutions to Consider

Nalco Overview

- **Nalco is the world leader in water treatment and process improvement applications, providing services, chemicals and equipment to industrial and institutional customers**
- **$4.3 Billion Dollars In Global Sales**
- **Customer base is diversified across multiple industries**

  More than 60,000 customer locations

  Business is divided into three core divisions:

  -Water and Waste Process Services (WPS)

  -Energy Services (Energy)

  -Paper Services (Paper)

- **6,000 strong degreed engineering sales force supports customers in approximately 139 countries**

Nalco's Sustainability Commitment Community, General Public & Investors

Nalco and hundreds of other major corporations are members of the United Nations Global Compact, the world's largest corporate citizenship and social responsibility organization

The CEO Water Mandate

Nalco is one of 58 members of the United Nations Global Compact who's CEOs have made a further commit for their companies to support and advance water sustainability solutions.

WWF

Enhancing World Wildlife Fund's (WWF) ability to deliver on water conservation by supporting WWF's efforts to establish credible water stewardship standards.

WATER For PEOPLE

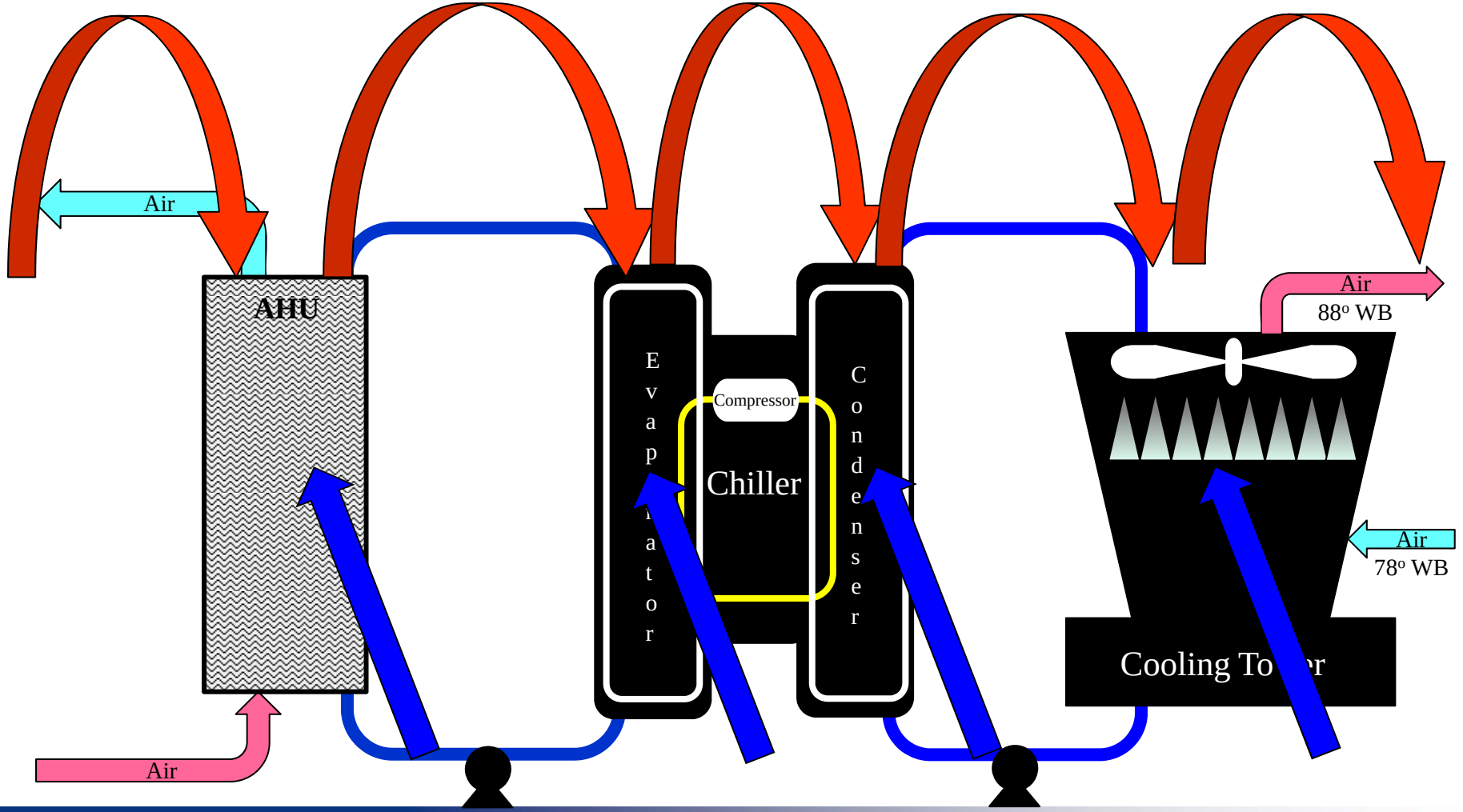
Nalco and the Nalco Foundation support Water For People, a non-profit international development organization supporting locally sustainable drinking water resources, sanitation facilities, and health and hygiene education programs in developing nations.

Nalco is one of 317 companies listed on the Dow Jones Sustainability World Index which tracks the financial performance of the leading sustainability-driven companies worldwide.

Purpose, Design & Operation of HVAC Systems

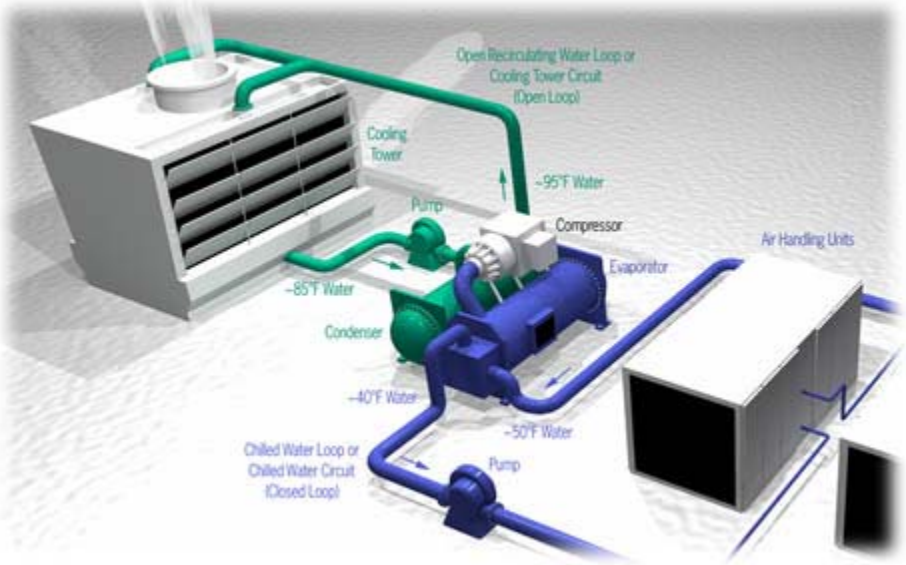
- Remove heat & humidity from air
- Control temperature & humidity in air
- Keep the air environment safe from harmful contaminants (CO2, etc.) - IEQ
- Designed to work efficiency with chilled and cooling water systems

HVAC is Integral to Cooling Systems



Cooling Water Treatment Programs

- Water is an excellent medium for the transfer and exchange of heat and BTUs.
- It is readily available and abundant in most regions
- Water requires treatment for controlling scale, corrosion and microbio activity.

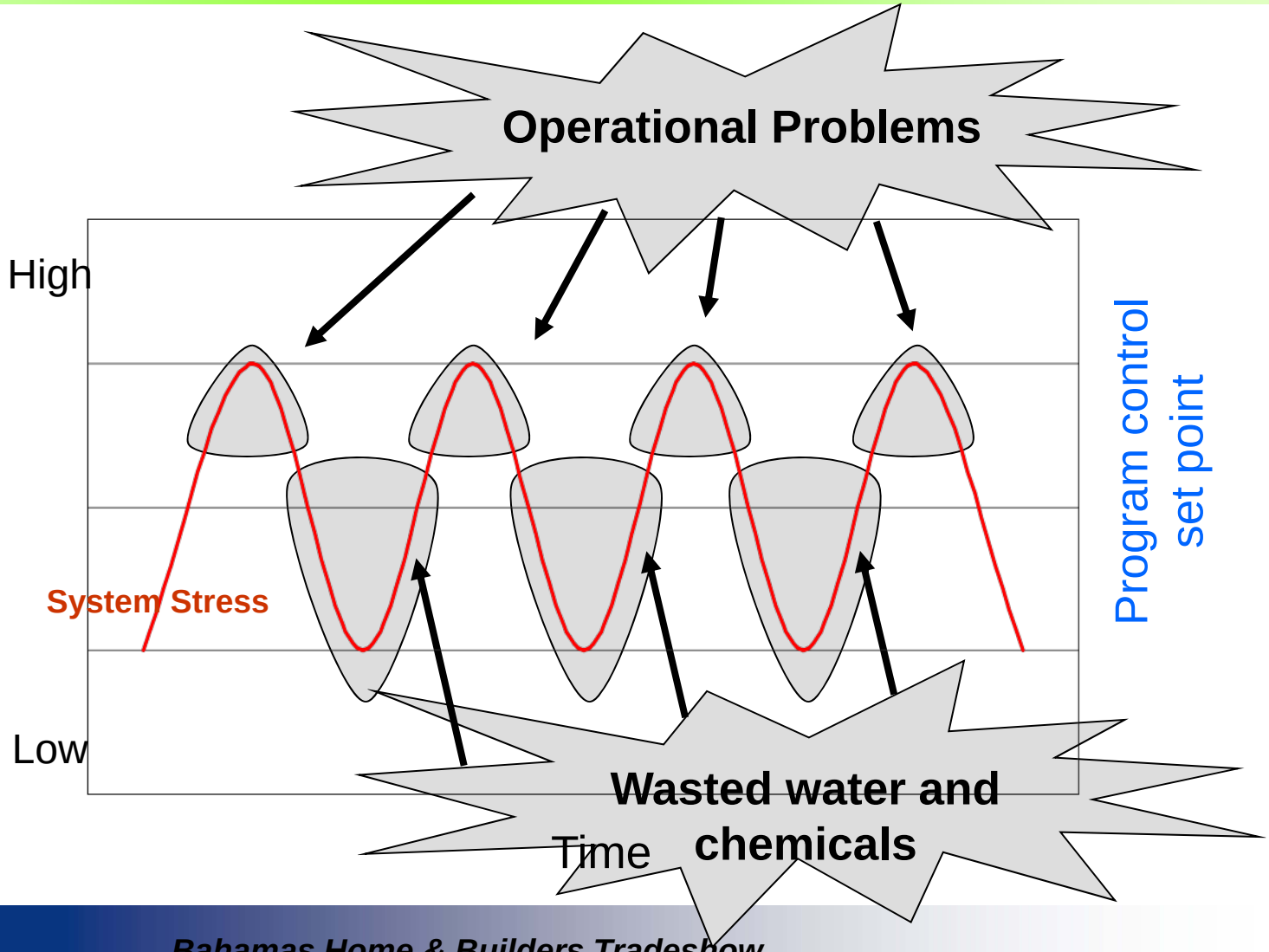


ENERGY STAR PARTNER

Areas for Improvement

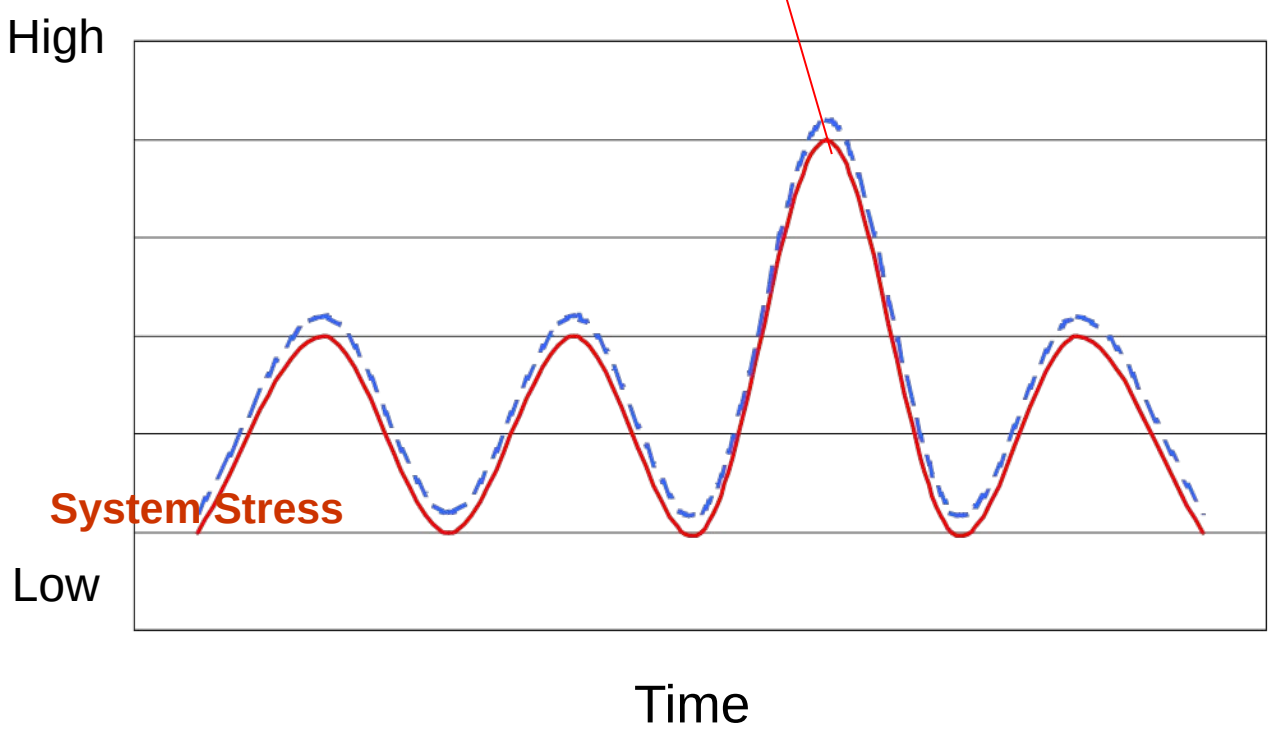
- **WATER** savings through increased cycles
- **ENERGY** savings keep chiller tubes clean

Traditional Approach in Chemical Control



Latest Automation = Improved Control

Unplanned event, Automation anticipates and corrects for the varying conditions!



Optimizes program automatically

Technological Value => Customer Value
*e*ROI Water Savings vs. Cycles

Cooling Water Savings Assessment

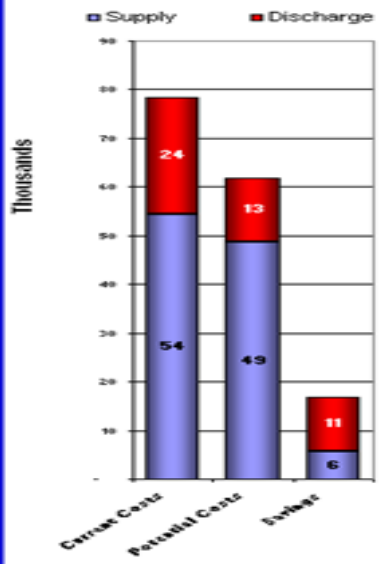
Input Values

Input	Value	Units
Current CT Cycles	4.5	
Potential CT Cycles	7.5	
Delta Temperature	10.0	°F
Recirculation Rate (R)	6,300	gpm
Drift Rate	0.01%	% of R
Evaporation Factor	0.85	
Operating Days	365	d / y
MU Water Cost	1.50	USD/1000 gal
BD Water Cost	3.00	USD/1000 gal
Evaporation Credit in Use?	Y	Y or N
Evap. Credit Available?	Y	Y or N

Calculated Operational Metrics

Result	Value	Units
Evaporation Rate	53.6	gpm
Drift Rate	0.6	gpm
Current Makeup (MU)	68.9	gpm
Potential Makeup (MU)	61.8	gpm
Current Blowdown (BD)	15.3	gpm
Potential Blowdown (BD)	8.2	gpm
Current MU Water Cost	6.20	USD/h
Potential MU Water Cost	5.56	USD/h
Current BD Water Cost	2.75	USD/h
Potential BD Water Cost	1.48	USD/h

Annual Savings Summary



Project X, 3DT265, COC = 7.5

Water Savings = $16,702/yr

Supp			Overall	Units
				gph
			1.91	USD/h
1			45.76	USD/d
5,567	11,135	Yearly Cycles Cost Savings	16,702	USD/y
	84,438	Current Evap Credit Savings	84,438	USD/y
	84,438	Potential Evap Credit Savings	84,438	USD/y

Water Costs and Savings Summary

Supply	Discharge		Overall	Units
54,281	24,125	Current Costs	78,406	USD/y
48,714	12,990	Potential Costs	61,704	USD/y
5,567	**11,135**	**Savings**	**16,702**	USD/y

Annualized Environmental ROI (e^{ROI})

Water Saved Annually (gal/y)	Annual Savings (USD/y)
3,711,545	16,702

Technological Value => Customer Value

ROI Energy Savings

How Does HVAC Inefficiency Impact Your Bottom Line?

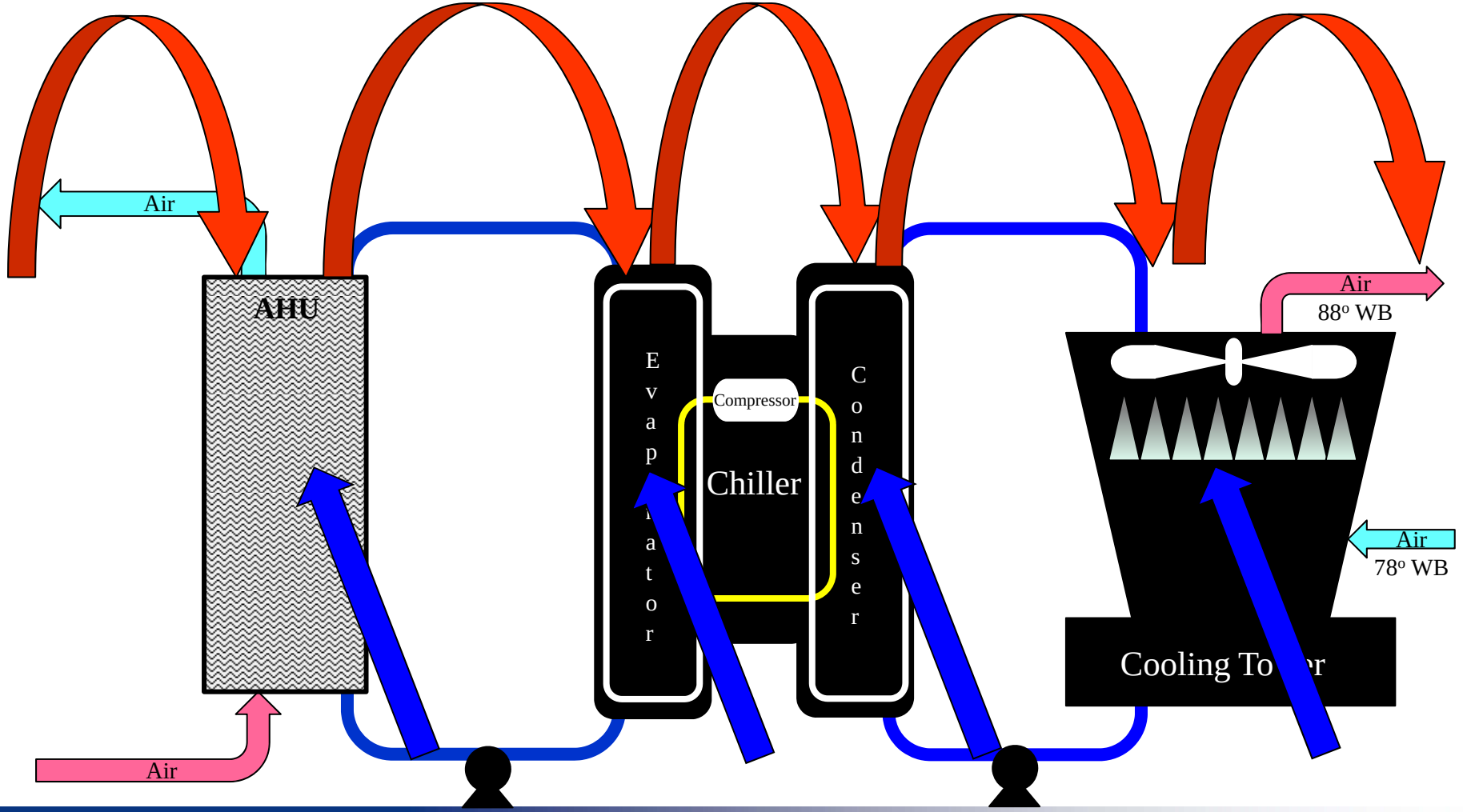
Cooling Water Norms				
Energy Increase from Condenser/Evaporator Scale				
$/kWh	0.01 inch causes +10%	0.02 inch causes +20%	0.03 inch causes +30%	0.04 inch causes +40%
$0.12	$10,800	$21,600	$32,400	$43,200
$0.16	$14,400	$28,800	$43,200	$57,600
$0.20	$18,000	$36,000	$54,000	$72,000
$0.24	$21,600	$43,200	$64,800	$86,400
Calculations based on design 0.75 kW/ton, 500 tons, 12 hr/d, and 200 d/yr operations.				

Cooling Programs – Best Practices Recap

- **Water Treatment Control Equipment – Latest Capabilities**
  - Automated cycle control
  - Automated chemical use
  - Bio-Reporter, automated biocide usage
    - Feed based on bio-activity

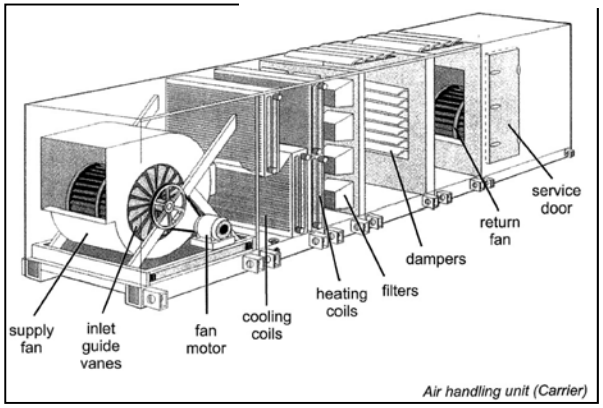
- **Chemistry – Always evolving**
  - Chemistry to control corrosion & scale
  - Patented chemistry to control microbio
  - Non-heavy metal closed loop treatment : advanced chemistry options with excellent corrosion control results (PSO)

HVAC is Integral to Cooling Systems



Types of Air Handling Units (AHU)

- PTAC (Packaged Terminal Air Conditioner)
- Packaged Unit
- Built-up Unit



Maintenance

- **Preventative Maintenance** *(preventive or convenience?)*
- **Scheduled in Advance** *(are schedules kept?)*
- **HVAC Systems**
  - Lube/belts/motor balance/duct leaks/inspections/etc. *(does all the work get completed? Inspected? Repaired?)*
  - Filters *(scheduled – changing clean or dirty filters?)*
  - Coil cleaning? *(does it get completed? Deep cleaning?)*

Coil condition effects on system performance

Sources of DIRT in coils

- ✓ Dirt
- ✓ Process contamination
- ✓ Bacteria
- ✓ Water
- ✓ Packed dirt from improper cleanings

DIRT effects on COIL System Performance

DIRT

- *…creates back-pressure, increasing **energy requirement***
- *…reduces **surface area** of coils in contact with air*
- *…reduces the amount of **air flowing** through the system*
- *…reduces **heat transfer efficiency** of coils*
- *…does not make it possible to **meet cooling requirements***
- *…provides the environment for **bacteria, mold and fungus to grow***
- *…can cause the need for **expansion** of HVAC system to meet demand, increased demand on chillers*

Coil Cleaning Process

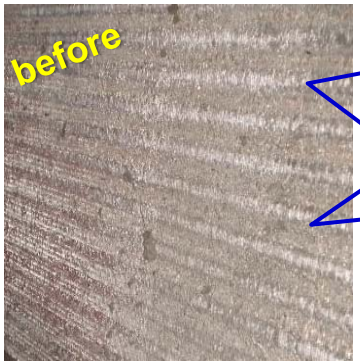
- **Traditional coil cleaning**
  - Chemical sprayer
  - Foaming spray
  - Pressure washer
  - Harmful chemicals

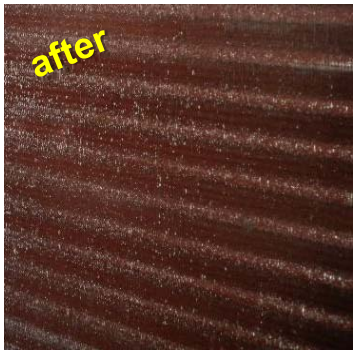
Coil Maintenance – Best Practices

- *SAFETY* first !
- Lube/belts/motor balance/duct leaks/ inspections…
- *Proper equipment & method* to prevent fin damage
- Use of *neutral pH chemicals* (non corrosive)
- Cleaning chemicals applied with optimum *pressure* for full coil *penetration*
- Biocide to control odor-causing *bacterial and algae growth*
- Monitor Performance to *maintain efficiency*
- Protect coils with an *adequate filtration* solution

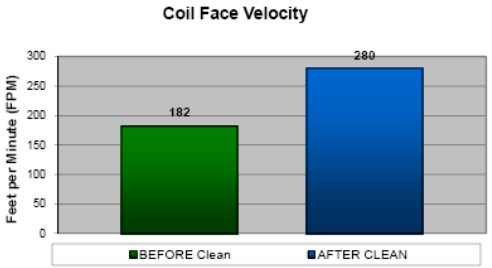
Coil Cleaning Process – Case Study

- Increased air flow rate by **53.8%**
- Reduced pressure drop by **2.06”w.g.**
- Increased temp drop by **0.8 ºF**
- 60 sq ft Unit

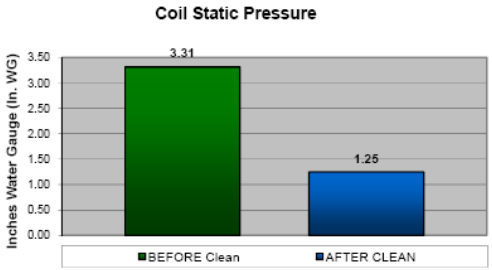




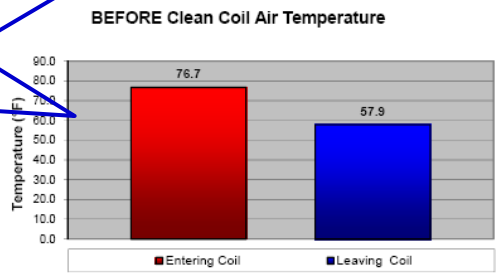
Estimated Cost Savings
3,426.63
Greenhouse Gas (Tons)
23.8



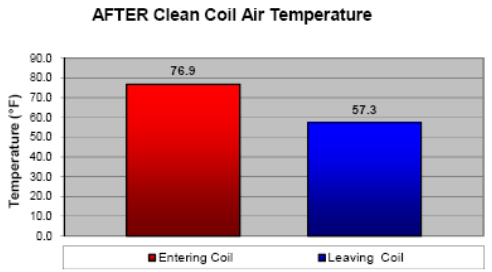
Difference 98 FPM (53.8%)



Difference 2.06 at 280 FPM (62.3%)

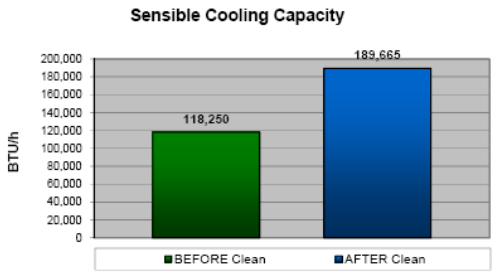


Difference 18.8°F

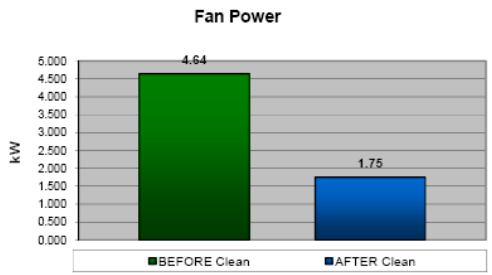


Difference 19.6°F

Difference 0.8°F (4.3%)



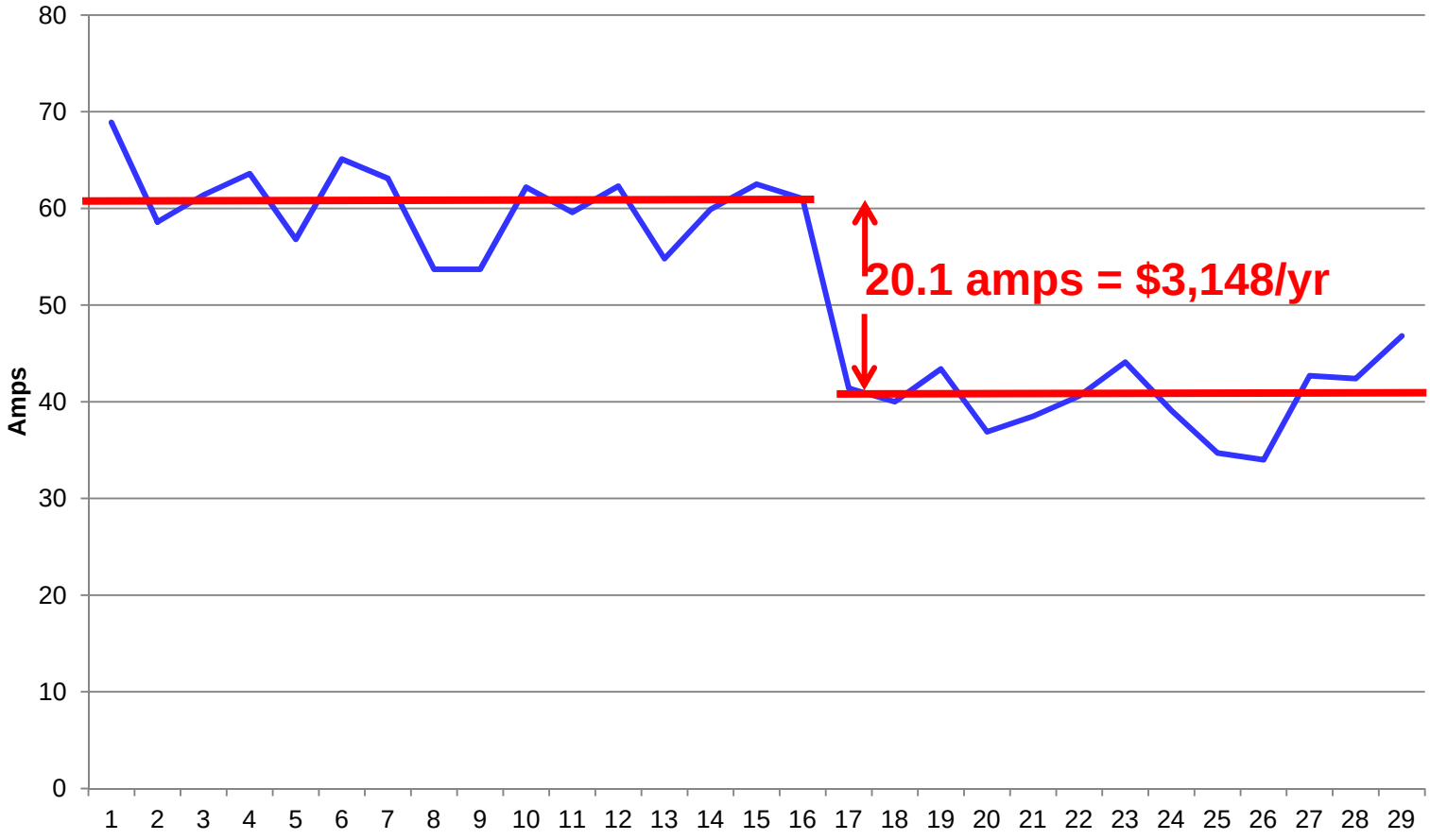
Difference 71415 BTU/h (60.4%)



Difference 2.89 kW (62.3%)

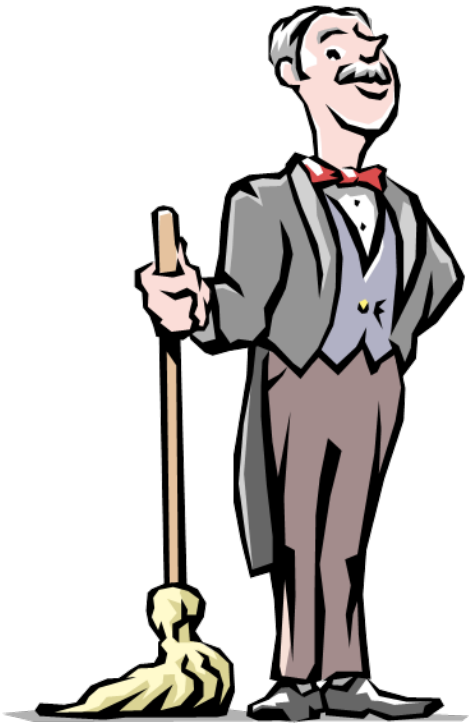
Coil Cleaning Example – Energy Savings

Direct Measurement – Fan Energy Only:



Factors affecting Coil Cleaning FREQUENCY

- **Filtration**
  - MERV rating (=filter efficiency)
  - Air by-pass (it accelerates dirt to coil)
- **Type of contamination**
  - Typical outside air
    (or process contamination)
- **Hours of operation**



<u>Typical Cleaning Frequency</u>: *Once a Year*

Today's Best Practice

- Centered around energy conservation
- Minimizing waste of all kinds
- Utilizing high efficient equipment
- Operating systems efficiently

BENEFITS of Best Practices

- **Energy conservation**
  - Fan energy reduction

    (Realized from reduction in pressure in system)

  - Thermal energy savings

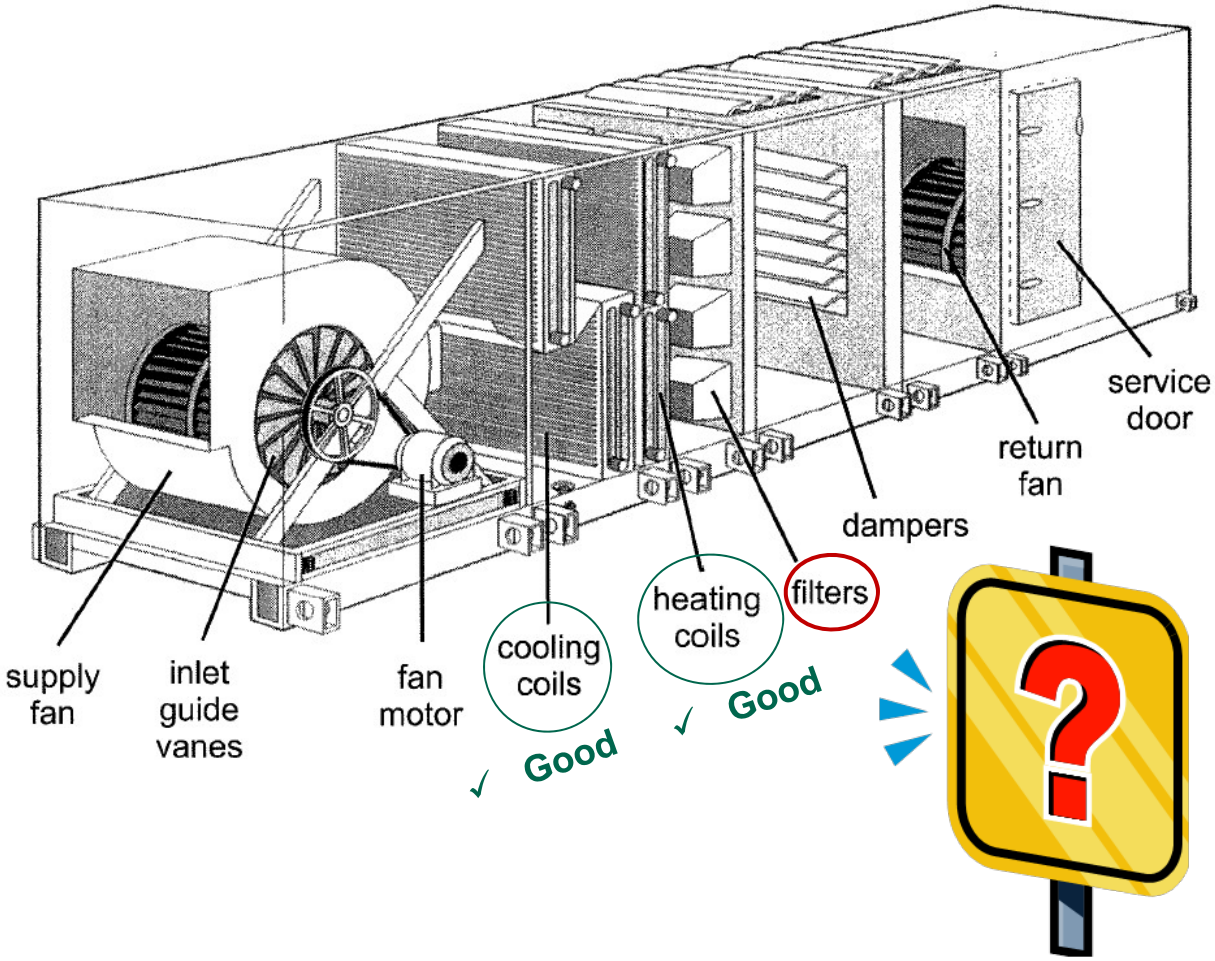
    (Realized from sensible heat load improvement)

- **Waste Minimization**

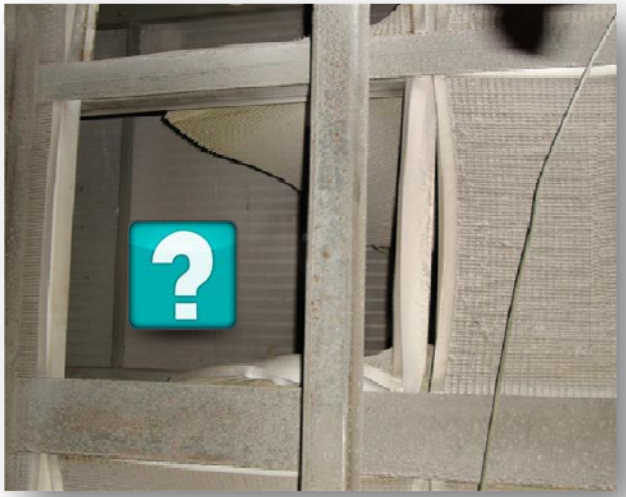
- **Efficient System Operation**

  (sustained energy conservation)

Performance Improvement Opportunities

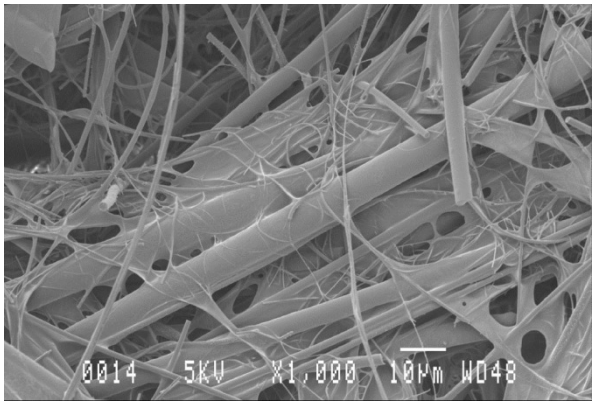


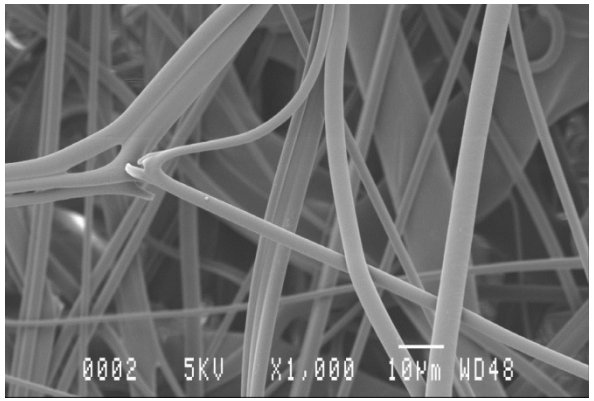
Performance Improvement Opportunities

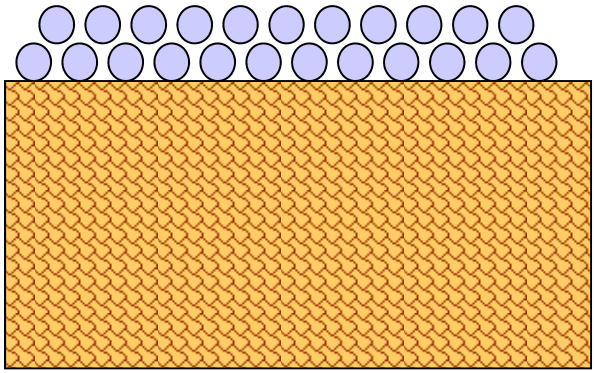


How DIRTY are your filters?

Air Filtration Technology

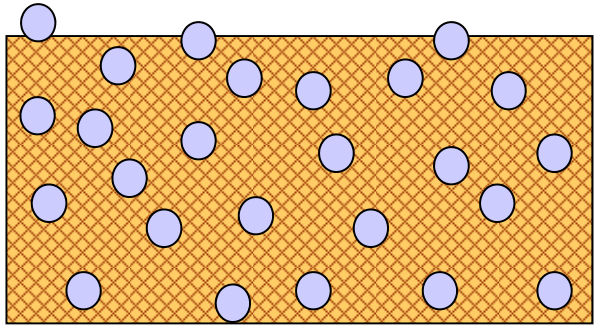






Face Loading

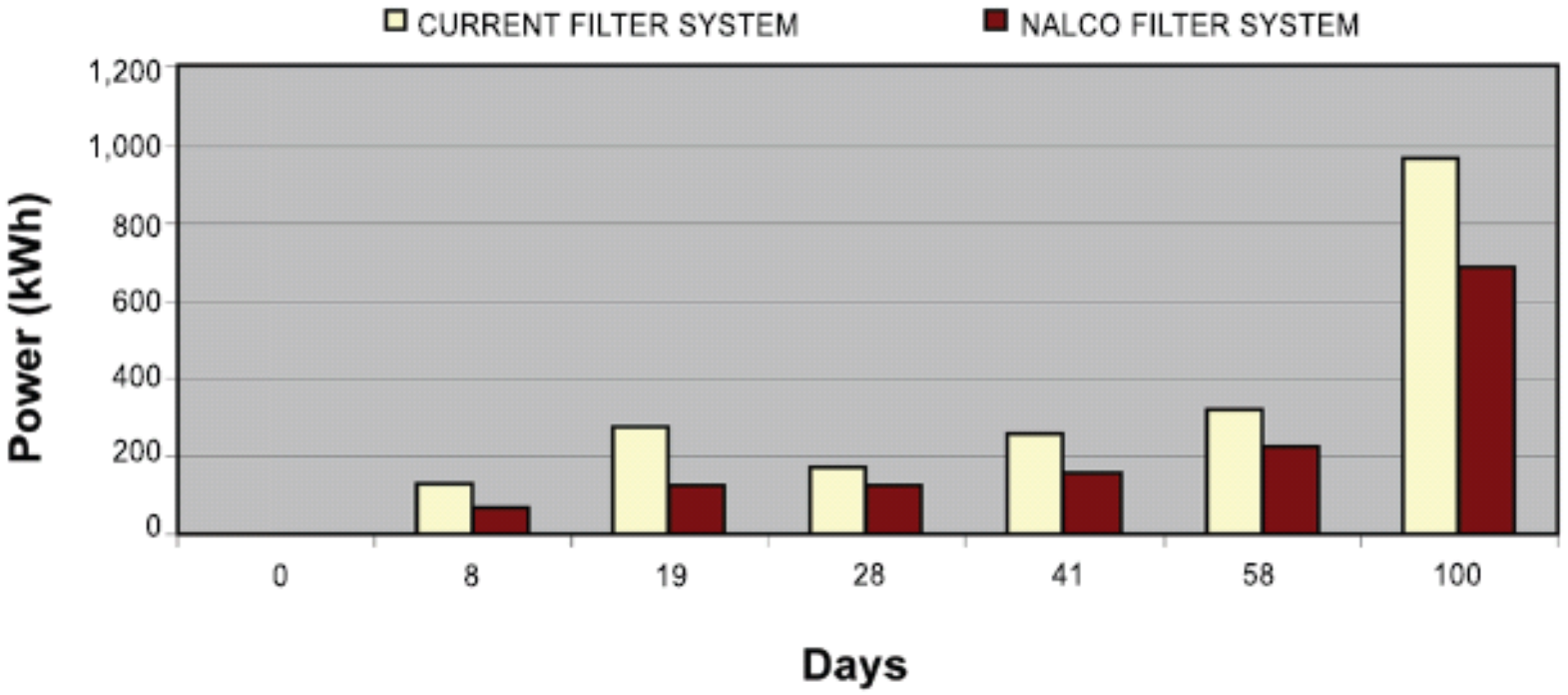
More Media Area Needed



Depth Loading

Less Media Area Needed

Filtration Upgrade Example



- Reduced fan energy (annual estimated >$17K
- Less filter change outs saves >$4K annually
- Significantly less waste going to landfill

Air Filtration Best Practices

- Understand your filtration needs
- Use efficient filters

Predictive Maintenance

- Use end-of-life determined by manufacturer (Design maximum pressure drop at design air flow rate)
- Use performance monitoring to predict filters end-of-life

Don't change clean filters !

Don't leave dirty filters in place!

ASW Engineering, Air Handling Systems Feb. 2003

BENEFITS of Best Practices

Cleaner and more AIR …. with less ENERGY

- Lower fan energy consumption by providing low pressure drop and high performance filtration
- Reduced maintenance by keeping HVAC coils cleaner
- Reduced life cycle costs by providing longer life
- Waste volume reduction
- Reduced labor on filter change outs
- Lower allergen particle concentrations
- Improved Indoor Air quality
- Results based program

The Role of the Government in Energy Efficiency

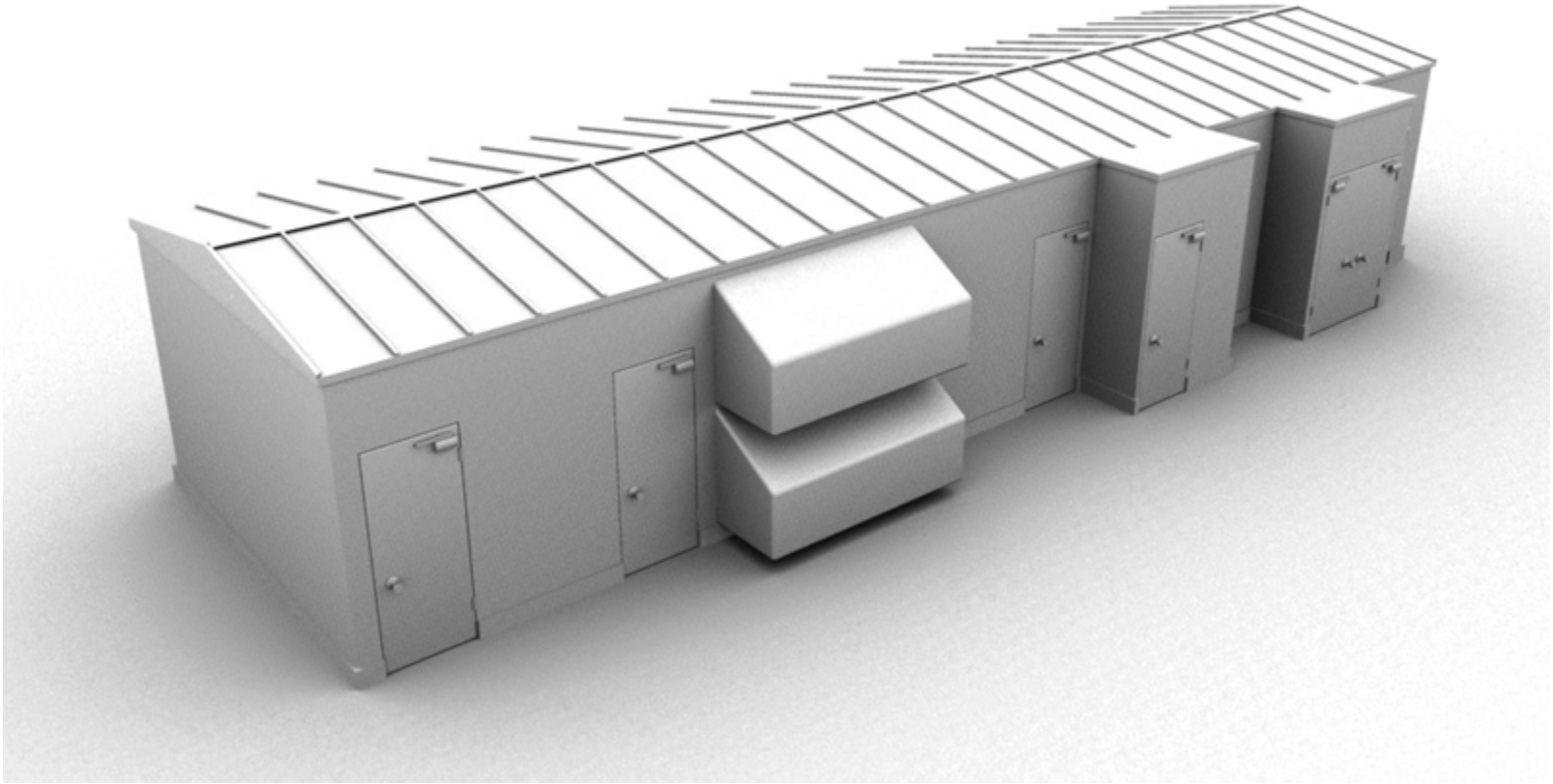
- **British Columbia, Canada: Energy demand currently outpacing energy production. Solution = rebate program to pay for 45% to 50% of the cost of energy reduction programs**

- **Southern California, USA: Energy and Water Shortages. Solution = state funding for chemical automation control linked to increased cycles of concentration or use of recycled “purple” water.**

How Do You Know Your System is Operating Properly/Efficiently?

- **Know the design specifications**
- **Measure & document where you're operating vs. design**
- **Determine efficiency improvements based on design and determine plan for improvement**
- **Measure & document improvements**
- **Document your improvement gains & value/ROI**

Any Questions?



Thank you for your attention!