



Campus Growth Offset by Energy Conservation

The Geisinger Approach

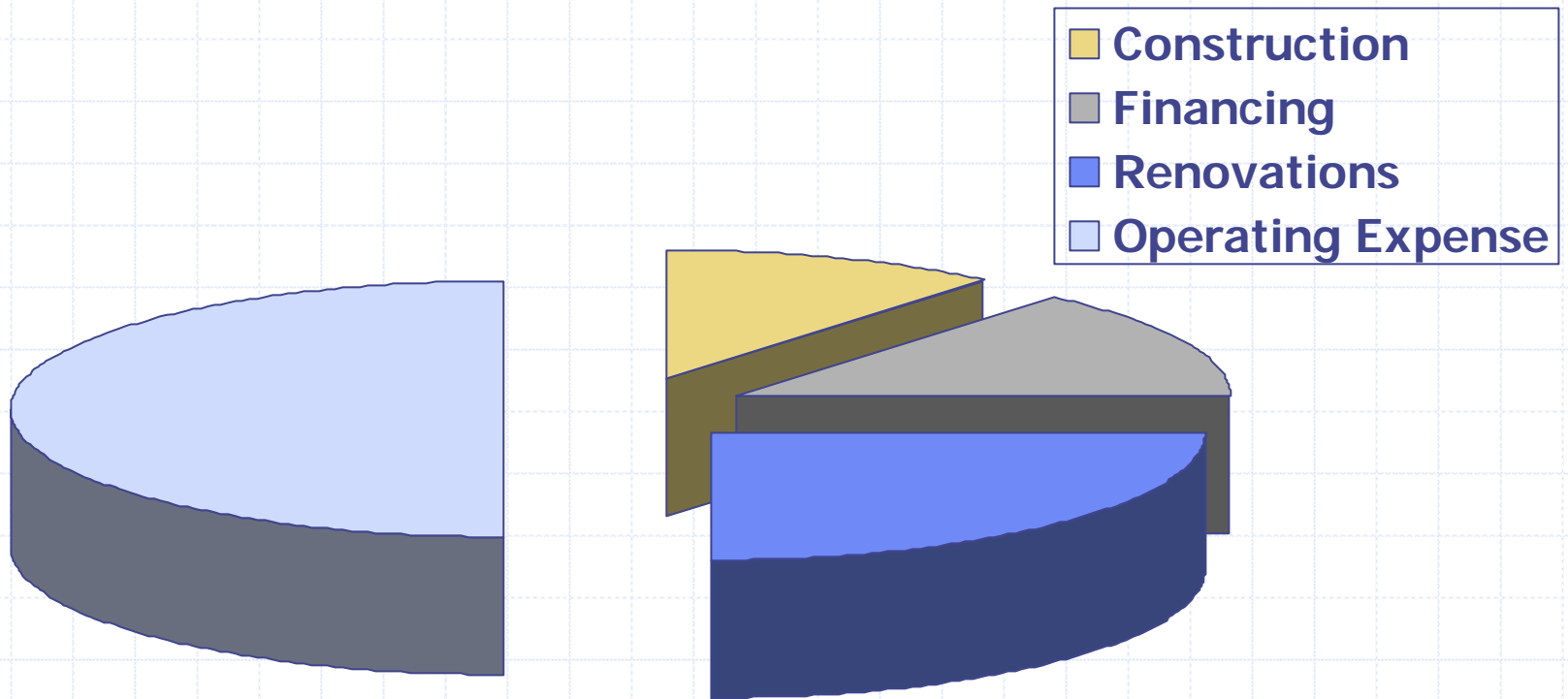
Accomplishments

- ◆ Main site in Danville was 1.2 million square feet in 1988
- ◆ Building was expanded by 75% since that time
- ◆ Absorption chillers replaced by electric
- ◆ 8000 personal computers added
- ◆ Utility expense and electrical demand the same today as 1988
- ◆ Annualized utility savings = \$3 million
- ◆ 2000 Business for the Bay Award (Chesapeake Bay Foundation)
- ◆ 2002 FAME Award of Excellence – Association of Facilities Engineers (AFE)

Mission

- ◆ The mission of healthcare is to improve the health of the people we serve.
- ◆ Reducing energy consumption reduces pollution and emissions from power plants
- ◆ Reduced pollution improves health

Cost of Ownership (40 years)



Project Savings at Geisinger

Project	Cost	Savings	ROI
69kv Substation	\$525,000	\$250,000	2.10
Lighting retrofit	\$1,800,000	\$460,000	3.91
Replace absorbers with chillers	\$750,000	\$360,000	2.08
Electrical distribution upgrade	\$550,000	\$50,000	11.00
Air handler upgrade	\$400,000	\$30,000	13.33
Medical air upgrade	\$100,000	\$20,000	5.00
Boiler Upgrade	\$300,000	\$300,000	1.00
Incinerator replacement	\$300,000	\$50,000	6.00
Condensate recovery	\$10,000	\$25,000	0.40
Tower upgrades	\$500,000	\$50,000	10.00
Tower control	\$20,000	\$40,000	0.50
Elevator Upgrades	\$1,000,000	\$45,000	22.22
Steam trap monitoring	\$50,000	\$50,000	1.00
Water side economizers	\$150,000	\$50,000	3.00
Vacuum system enhancements	\$70,000	\$10,000	7.00
Domestic water pumps (vfd)	\$100,000	\$25,000	4.00
Chilled water loop	\$200,000	\$50,000	4.00
Chilled water vfd pumping	\$100,000	\$50,000	2.00
Replace underground steam mains	\$250,000	\$50,000	5.00
Occupancy sensors - lighting	\$30,000	\$15,000	2.00
Well system upgrades	\$50,000	\$20,000	2.50
Waste oil heater	\$3,000	\$2,000	1.50
Building automation upgrades	\$200,000	\$100,000	2.00
Canopies, foyers, etc	\$250,000	\$10,000	25.00
Window replacement	\$200,000	\$10,000	20.00
Instrument air upgrade	\$50,000	\$20,000	2.50
Blowdown control & condensate monitoring	\$5,000	\$30,000	0.17
Heat recovery systems	\$75,000	\$15,000	5.00
Install dealkalizers	\$13,000	\$13,000	1.00
Total	\$8,051,000	\$2,200,000	3.66

Alan R. Neuner, CHFM

LEED

- ◆ Leadership in Energy and Environmental Design
- ◆ Third party designation awarded by United States Green Building Council
- ◆ Geisinger has committed to building all LEED certified buildings
- ◆ Hood Center for Health Research awarded LEED Silver



69,000 volt substation



- ◆ \$560,000 project cost
- ◆ \$250,000 rate savings annually
- ◆ Outages reduced from 12/year to 3 in 10 years

Electrical Distribution Upgrade



- ◆ \$500,000 project cost
- ◆ Replaced all high voltage circuits
- ◆ Found 20 amps to ground at 12,470 volts
- ◆ Electrical savings \$50,000/year

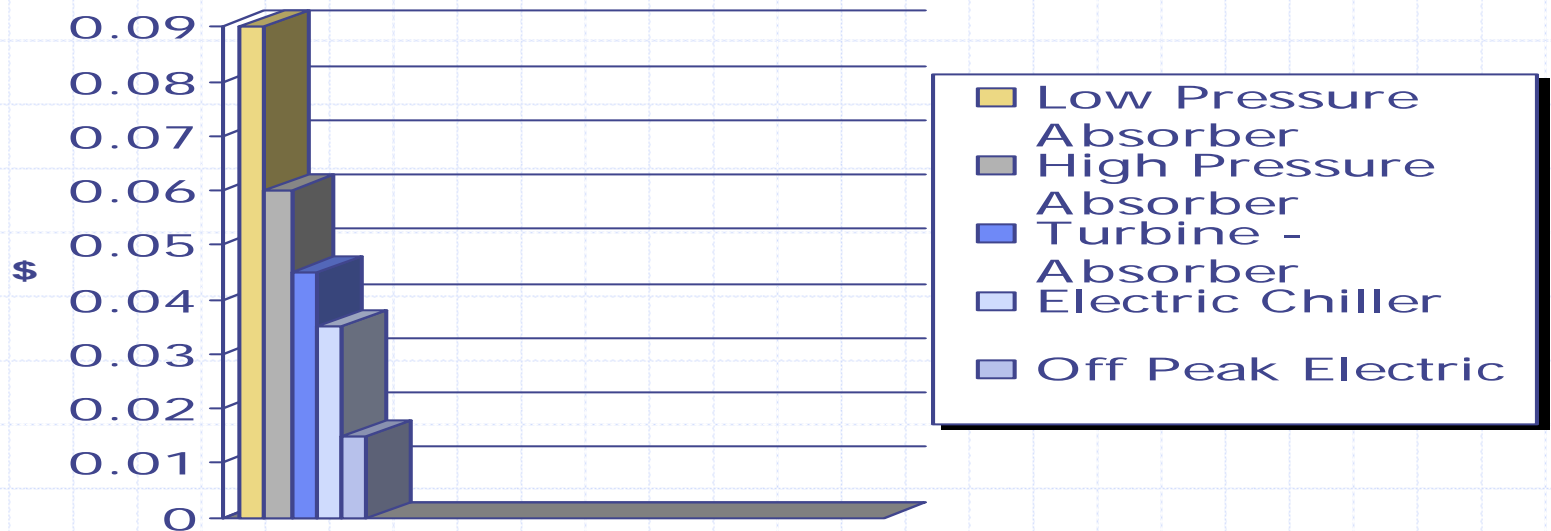
Lighting



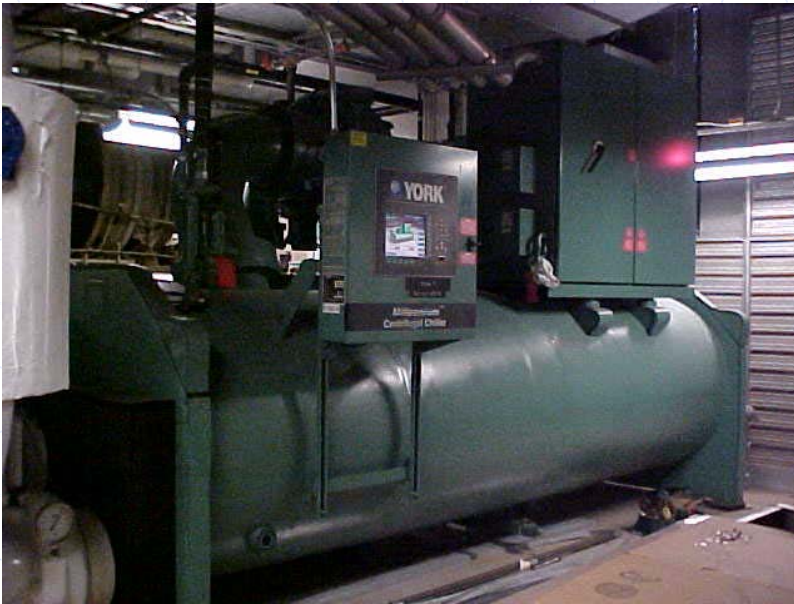
- ◆ Upgraded 24,000 fixtures
- ◆ Added over 1000 occupancy sensors
- ◆ Cost \$1.8 million
- ◆ Annual savings \$460,000
- ◆ Demand reduced one megawatt
- ◆ Operating lease (7 years, \$300,000/yr)

Relative Cooling Costs

Cooling Costs per Ton

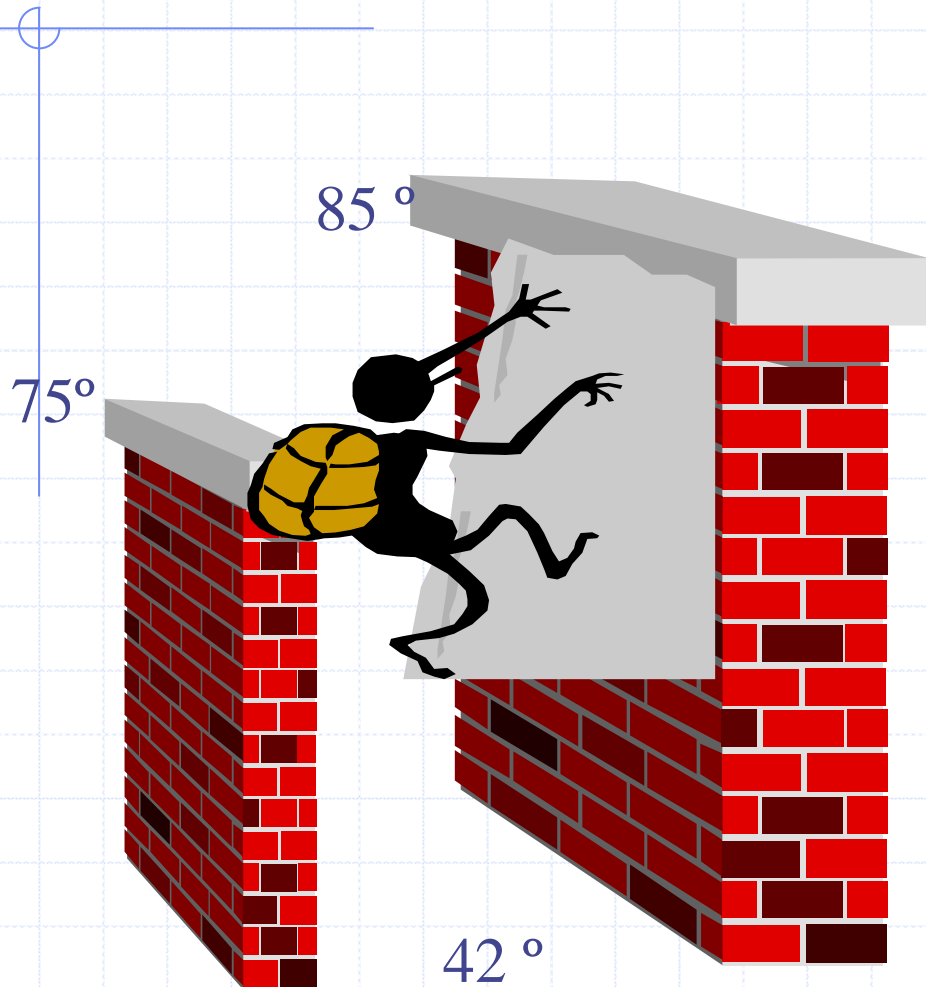


Replace Absorbers With Chillers



- ◆ Low pressure absorber cost \$.09/ton
- ◆ Chiller cost \$.03/ton
- ◆ Savings \$360,000
- ◆ Investment \$750,000

Thermal Lift



- ✓ The amount of energy to create cooling is proportional to the differential temperature.
- ✓ Example: creating 42° chilled water with 85° condensing water uses more energy than using 75° condensing water.

Cooling Towers



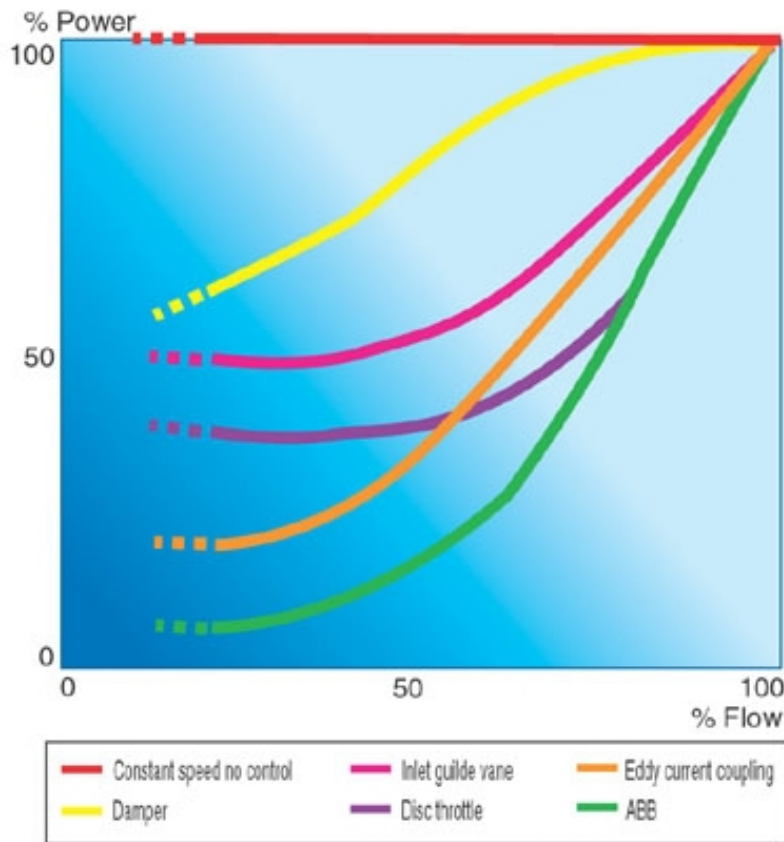
- ◆ Switch to 5° approach temperatures
- ◆ Savings \$50,000
- ◆ Approach to wet bulb control
- ◆ Savings \$40,000

Centralized Cooling

- ❖ Strategic centralized plants were established for existing buildings to exploit diversity and minimize capital investment
- ❖ Distribution systems were extended and older equipment retired



VFD Savings



- ◆ Assume a 100kW motor
 - 100% flow = 100kW
 - 80% flow = 50 kW
 - 50% flow = 12.5kW
- ◆ Power savings are the cube of flow reduction

VFD Applications

- ◆ Variable chilled water flow
- ◆ Boiler feed pumps
- ◆ Air handling systems (Variable Air Volume)
- ◆ Medical air compressors
- ◆ Cooling tower fans
- ◆ Chiller compressors
- ◆ Exhaust fans

Waterside Economizers



- ◆ Saves 1400 chiller hours per year per installation
- ◆ Investment \$150,000
- ◆ Savings \$50,000

Air Handler Replacement



- ◆ \$400,000 to date expended
- ◆ Average savings \$5,000 per air handler
- ◆ Improved features (blenders, UV, DDC controls)

Condensate Recovery



- ◆ Capture condensate from air handlers and pump to cooling towers
- ◆ Cost - \$500 per air handler
- ◆ Savings - \$25,000

Medical Air Upgrade



Medical air compressor with heat of compression dryer

- ◆ \$100,000 investment
- ◆ Savings \$20,000 annually
- ◆ Replaced 25 compressors with two
- ◆ Waste heat dryers
- ◆ VFD
- ◆ No water increases reliability

Vacuum Pumps



- ◆ Waterless system improves reliability
- ◆ Higher efficiency
- ◆ Water savings
\$5,000
- ◆ Electric savings
\$5,000
- ◆ Investment \$70,000

Boiler Upgrade



- ◆ Replace burners & controls
- ◆ Investment \$300,000
- ◆ First year savings \$300,000
- ◆ Boilers 34 years old, but in great shape.
- ◆ DDC control with oxygen trim

High Purity Boiler Feed Water

- ◆ Nearly eliminates blow down
- ◆ Reduces chemical feeds
- ◆ Reduces scaling potential
- ◆ Reduces water usage
- ◆ Reduces heat loss



Incinerator Replacement



- ◆ Cost to replace with sterilizer less than cost of scrubber
- ◆ \$300,000 investment
- ◆ Energy savings \$50,000
- ◆ Waste cost \$.08/lb

Steam Trap Monitoring



- ◆ Detects blow-by or flooded traps
- ◆ Investment \$50,000
- ◆ Savings \$50,000

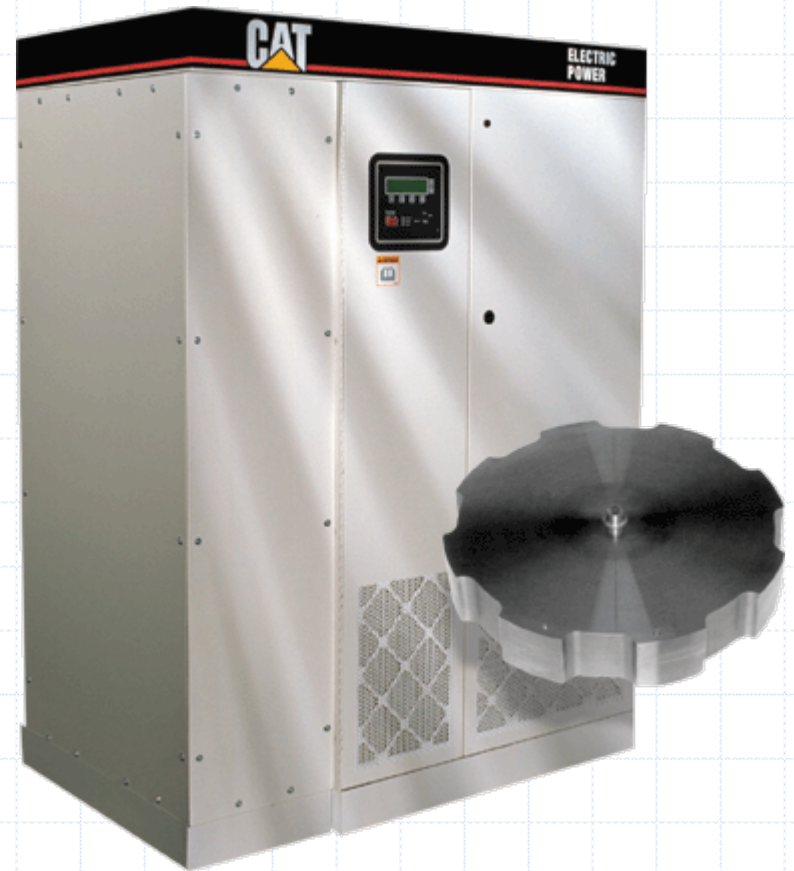
Chilled Water Storage

- ◆ Reduces electrical demand
- ◆ Mitigates investment in chiller capacity
- ◆ Chilled water \$/ton decreases due to lower approach temperatures at night



High Efficiency UPS Systems

- ◆ Lower operating costs due to higher efficiency
- ◆ Reduced heat load
- ◆ No batteries (kinetic energy storage)



Cash or Credit?

- ◆ If capital is not available, consider leasing as an option
- ◆ Utilize operating leases where possible (vs. capital leases)
- ◆ Structure financing to provide significant positive cash flow
- ◆ Utilize performance contract only when outcome is questionable

Conclusions

- ◆ A planned approach to infrastructure renewal can provide significant energy savings
- ◆ Development or expansion of centralized systems increases capacity without increasing demand due to diversity
- ◆ Exploit the Laws of Thermodynamics
- ◆ Always install the most efficient systems possible

??? Questions ???

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