

2004 Energy

Benchmarking: Grade Your O & M Program



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Background

Keith McClanahan -

- BS in Engineering from Arizona State
- Registered Professional Engineer
- Real Property Administrator
- Founder of Facility Issues

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Background

- 33 Years of Facility Experience - All Areas
- 18 Years for Salt River Project (SRP)
- Publishes the Newsletter "*Facility Issues*"
- Facility Benchmarking for 13 Years

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Benchmarking Groups Include...

- Boeing
- IFMA's Utility Council
- Facility Managers Roundtable
- Nuclear Generating Stations
- Regional Bell Operating Companies
- Washington Group
- National Laboratories
- Research Facilities Benchmarking Group
- California County Facility Managers
- Chicago Regional Group

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Benchmarking - What Is It?

Bench . mark . ing: The search for industry best practices that lead to superior performance

(The Boeing Company)

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Benchmarking - What Is It?

Bench . mark . ing:
The practice of being humble enough to admit that someone else is better at something and wise enough to try to learn

(IFMA Utility Council)

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Benchmarking - What It Is Not?

- ❑ One site that has all the “*Best Practices*”
- ❑ One site with processes that match up with your organizational issues
- ❑ Implemented or used without understanding the broader corporate context

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What Is Benchmarking

- ❑ A Comparison of Key Metrics
- ❑ A Type of Professional Development
- ❑ An Advanced Learning Process

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Benchmarking Benefits for the Facilities Management Organization...

- Outsourcing Approached Objectively
- Proactive - Not Reactive
- Improved Knowledge About Your Functions
- Improved Employee Satisfaction
- Improved Efficiency

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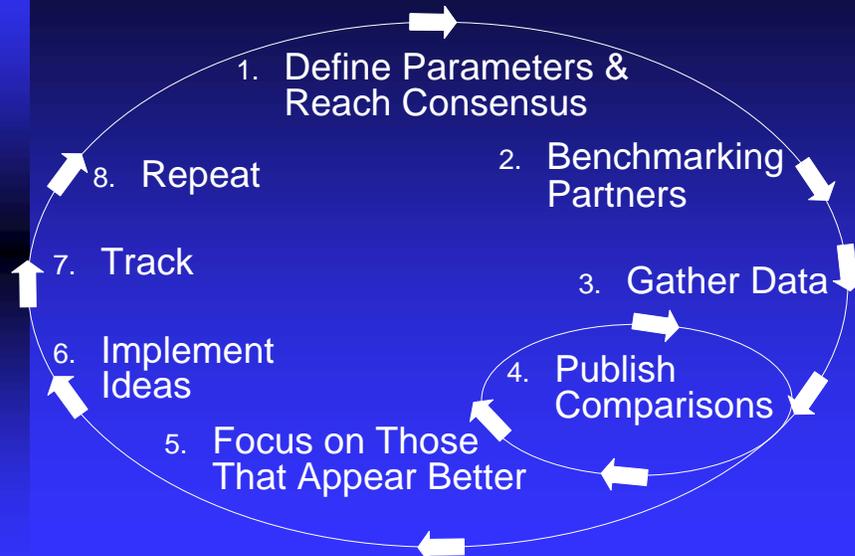
Benchmarking Benefits for Yourself...

- Know What and How to Change
- Better Prepared for Change
- Builds Confidence and Self Esteem
- Overcome Tendency to Defend Your Way or Costs



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Benchmarking Process:



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FM Roundtable Participants...

(Choose Partners)

- Agilent Technologies
- Allstate
- Battelle - Pacific Northwest National Laboratory
- Berkley Laboratories
- Boeing - 28 sites
- BWXT Pantex Corporation, L.L.C.
- CCH, Inc.
- Chevron Texaco
- ConocoPhillips Inc.
- Cox Communications
- Dow / CB Richard Ellis
- Eastman Kodak Company

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FM Roundtable Participants...

(Choose Partners)

- Fluor Corporation - Facilities & Plant Services
- Grainger
- Honeywell – multiple sites
- Kraft
- Los Alamos National Laboratory
- Lockheed Martin Space Systems - Denver
- Marathon Oil
- Morgan Stanley Dean Witter /Discover Card
- Motorola - Schaumburg, IL
- Navy Federal Credit Union
- Nike, Inc.
- NREL

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FM Roundtable Participants...

(Choose Partners)

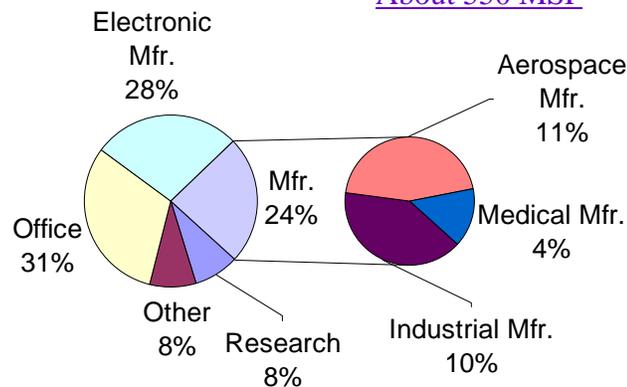
- Oak Ridge National Labs
- PacifiCorp / Facilities West
- Philips Semiconductors
- Phoenix Newspapers, Inc (Arizona Republic)
- Protective Life Insurance Company
- Raytheon Missile Systems Co
- Raytheon Company - MA
- Savannah River
- Sears
- UnumProvident – 4 sites
- US DOE/NETL
- Xerox

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Who Benchmarks with Facility Issues....

Participants By Industry Type

For 2003:
About 550 MSF



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What We Benchmark Annually....

- Space
- Utilities**
- Maintenance**
- Custodial
- Parking and Paving
- Grounds,
- Project Costs / Engineering
- Environmental Health and Safety (EHS)
- Security
- Fixed Costs
- Customer Service Survey

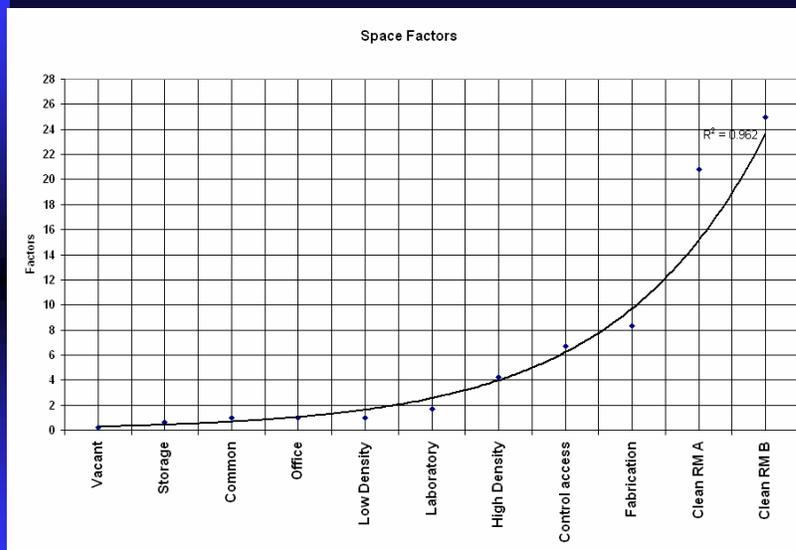
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Benchmark Survey Questions... Space

Types of Space	Square Feet Thousands (000)	Operating Hours
A17. Vacant & Storage (TSF = 0.60): Used for storage or storage related activities. Low utility requirements, and very low occupancy. Examples: Stores, shipping, receiving, chemical storage, enclosed docks, storage closets, and materials stores. (000)		
A18. Common (TSF = 1.00): Area used by all building occupants, or for building equipment and structure. The net usable (occupiable) area is gross square feet minus common area. Examples: Rest rooms, stairs, elevators, major aisles, vestibules, lobbies, pay phones, security centers, vending areas, teller machines, passageways, exterior/ interior walls, mechanical /electrical rooms, central plant, and janitor rooms. (000)		
A19. Office (TSF = 1.00): Areas used for offices. Can be open landscape, modular cubicles, or private offices. (000)		
A20. Support spaces (TSF = 1.00): File rooms, conference rooms, classrooms, training rooms, libraries, PC bullpens, kitchens, cafeterias, day care centers, fitness centers, auditoriums, copier rooms, mail rooms, locker rooms, health/nurses station. (000)		
A21. High Bay Work Area (TSF = 1.00): Large open area, high bay, low density, no unusual utility loads, basic shell configuration, air conditioned. Examples: Aircraft Hangar, Auto Repair Shop, and Maintenance Shop. (000)		
A22. Laboratory/Assembly Space (TSF = 1.50): Areas with work stations and/or multiple pieces of equipment for R&D, or repair. Higher power and utility requirements than offices. Typically can operate 24 hours/day. Examples: aircraft assembly lines, chemical labs, wet labs, SEM labs, systems training rooms, electronic labs, software labs, hospital patient rooms, chemical processing, machine equipment, and call centers. (000)		
A23. Assembly and Testing (TSF = 4.00): Areas for product assembly or testing. High density of work stations and related production equipment. Medium utility requirements, additional air conditioning capacity to meet higher heat load requirements, and high lighting requirements. Examples: Test, inspection, and circuit card assembly. (000)		

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Benchmark Survey Questions... Space



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Benchmark Survey Questions... Utilities

Section B. Utilities

Report total utility costs and quantities including production and process consumption.

	Internal Costs (\$000)	Contractual Costs (\$000)
B1. Annual cost of electricity including any penalties imposed by your utility company. (\$000).		
B2. Annual cost of water (\$000). If you can not separate your water and sewer costs include the total cost for these services here.		
B3. Annual sewer costs (\$000).		
B4. Annual cost of fuels such as: natural gas, propane, fuel oil etc. (\$000)		
B5. Other utility costs such as purchased steam or fuel oil. (\$000) If you enter a value here please describe the basis in question B6.		
B6. Other utility costs description...		
Function	Internal Costs (\$000)	Contractual Costs (\$000)
B7. Energy management costs (\$000). Energy management functions include buyers, contract negotiators, energy management systems and support, etc. Use your best estimate where the same system provides support for energy management and operations / maintenance. Do not include building energy management systems in this section.		
B8. Annual consumption of electricity (KWH 000).		
B9. Annual BTUs (000,000) of fuel consumed in question B4 and B5 (do not include electrical BTUs).		
B10. What percentage of your facility is refrigerated air conditioned? (Express as a percent)		
B11. What percentage of gross square feet is heated? (Express as a percent)		

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Benchmark Survey Questions... Maintenance

Section D. Building Maintenance

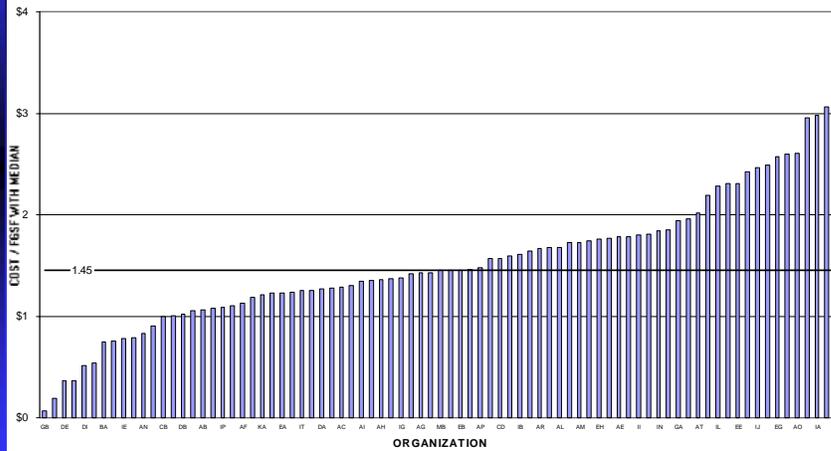
Building Maintenance is the preventive and remedial upkeep of building components i.e., maintenance work done as a normal part of building maintenance operations.

Craft	Standard Costs		Exceptional Costs	
	Costs (\$000)	Contractual Costs (\$000)	Internal Costs	Contractual Costs
HVAC	\$	\$	\$	\$
Electrical	\$	\$	\$	\$
Plumbing	\$	\$	\$	\$
Energy Management Systems	\$	\$	\$	\$
Mechanical	\$	\$	\$	\$
Waste Water Treatment	\$	\$	\$	\$
Reverse Osmosis De-Ionized (RODI) Water	\$	\$	\$	\$
Elevators	\$	\$	\$	\$
Carpentry	\$	\$	\$	\$
Painting	\$	\$	\$	\$
Roofing	\$	\$	\$	\$
Flooring	\$	\$	\$	\$
General Labor	\$	\$	\$	\$
Miscellaneous	\$	\$	\$	\$
Maintenance Support assistance from Plant Engineering	\$	\$	\$	\$
Supervision & Management	\$	\$	\$	\$
Clerical	\$	\$	\$	\$
Building Operators	\$	\$	\$	\$
Trouble Call Dispatcher and Equipment	\$	\$	\$	\$
Work Order Administration	\$	\$	\$	\$
Vehicles - Operation and Maintenance - to support building maintenance only	\$	\$	\$	\$
Parts Ordering/Buyer	\$	\$	\$	\$
D1. Total maintenance costs (\$000):				

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Benchmarking - Report Highlights

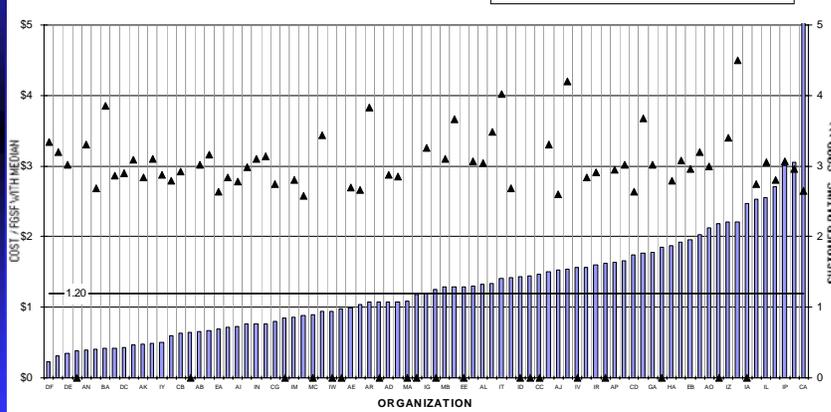
TOTAL UTILITY COST PER FACTORED GSF



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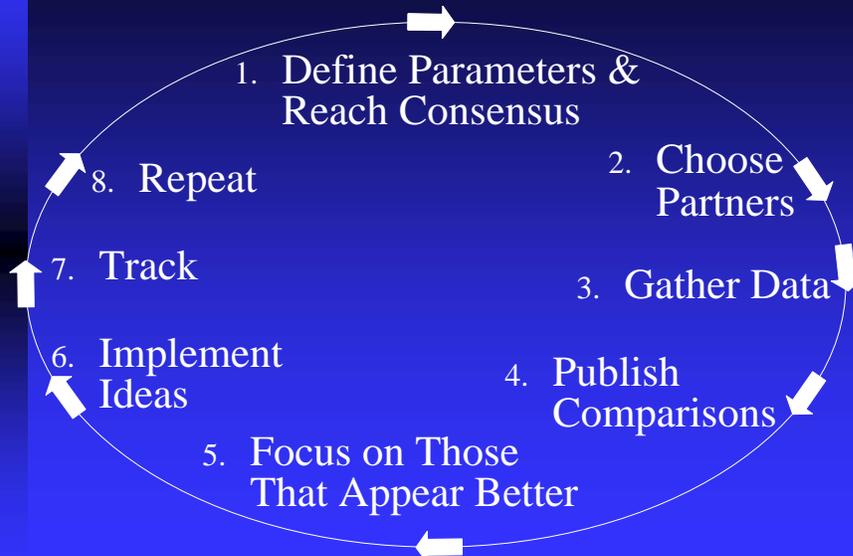
Benchmarking - Report Highlights

BUILDING MAINTENANCE COST / FACTORED GSF WITH CUSTOMER RATINGS



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Benchmarking Process:



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Site Visits - Understanding the Numbers

Meet to review benchmarked information and understand the organization



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Starts With a Facilities Audit



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Good Site Orientation



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Energy Efficient Landscaping



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Energy Efficient Landscaping



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LED Exit Signage ...



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Uplighting - Energy efficient / minimize glare



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Uplighting

No task lighting



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Central Plant

Modular Central Plant / Smart Spending



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Thermal Storage

Reduced Utility Costs Using Offpeak Rates...



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Energy Utilization – Best Practices

- Generators at all facilities
- Interruptible rate
- Energy management system at all facilities (BACnet)
 - Systems maintained by United Properties
- Indirect lighting (low light levels)
- Night setback program
- No UPS except for phones and servers

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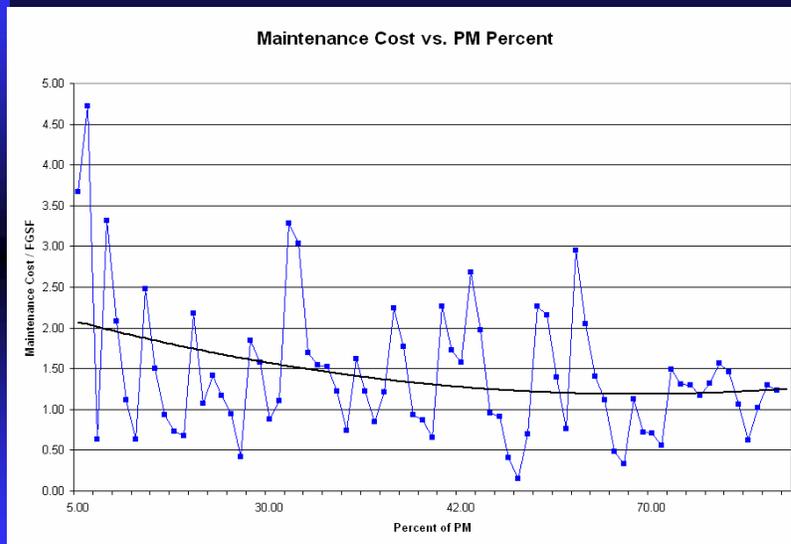
PM Program ...

60 % PM



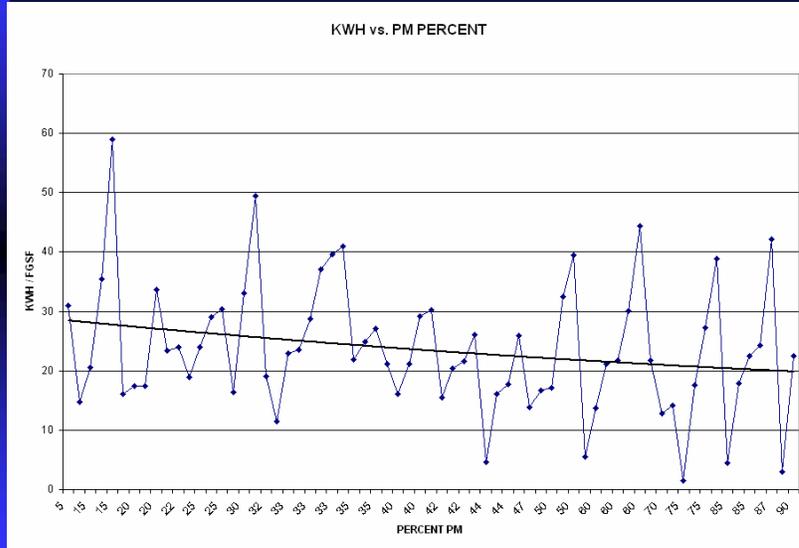
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PM Program Impacts Costs



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PM Program Impacts Energy Usage



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PM Program – Filter Changes



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PM Program – Boiler Maintenance



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PM Program – Chiller Maintenance



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Locate Occupants Away From Windows



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Locate Occupants Away From Windows



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Communicate With Your Occupants: Metrics



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Communicate With Your Occupants: Box Lunch Program



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Easy Access to Mechanical



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Easy Access to Mechanical



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GSF/Occupant

- Space planning objectives:
 - 200 nsf/person
 - 8x8 workstations
 - Minimal offices
 - 5% flex space

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Improve Cafeteria Utilization



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Improve Cafeteria Utilization



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Extensive Use of Motion Sensors



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Lighting Control Strategy

- ❑ Floor lighting control sheds lights off at 18:30
 - ❑ Lights have local switches on each floor to turn lights on after 18:30
 - ❑ Controller sweeps lights off every hour
- ❑ Lighting controller can be programmed for events or after hour meetings
- ❑ Perimeter lights have dimming controls that measure and adjust for outside lights

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Daylighting / Dimmable Ballasts



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Energy Efficient Lighting



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VFD's For All Major Equipment



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Soft Start Controls



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HVAC Control Strategy

- ❑ Air handling units set up on enthalpy control
- ❑ AHU's minimum outside air percentage is based on CO₂ set point of 1100 ppm
- ❑ AHU's discharge air temperature is reset off outside temperature
- ❑ AHU's discharge static pressure is set back after hours
- ❑ VAV's are set back at 18:00 to range 4.5 degrees from temperature set point. Normal hours range is 1 degree
- ❑ VAV's are set to the occupied mode in 15 minute increments (3 floors maximum at a time)

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BC Gas



Main entrance

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BC Gas

Operations Center Background...

- 180,000 GSF
- 625 Employees
- 288 GSF / Employee
- Occupied in December 2000
- No full height offices... President is in 88 SF modular

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BC Gas



Building sun glasses

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BC Gas



Low maintenance / environmentally friendly landscape

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Good hoteling accommodations

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BC Gas



Light diffusers

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BC Gas



Indirect lighting / exposed concrete ceiling

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BC Gas



Typical offices / Occupants can open windows

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BC Gas



Centralized copiers / printers – no desktop units

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Raised floor throughout
Each workstation is pre-wired

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BC Gas



HVAC distributed thru raised floor

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BC Gas



HVAC distributed thru raised floor

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BC Gas

Best Practices ...

- Used benchmarking to incorporate the “best” of the Utility Council aspects
- Construction cost of \$100 / SF (Canadian) about \$67 / SF US
- Energy efficient – projected to use about 60% of energy as a standard office building
- Two year payback on energy saving options

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Chevron / Texaco



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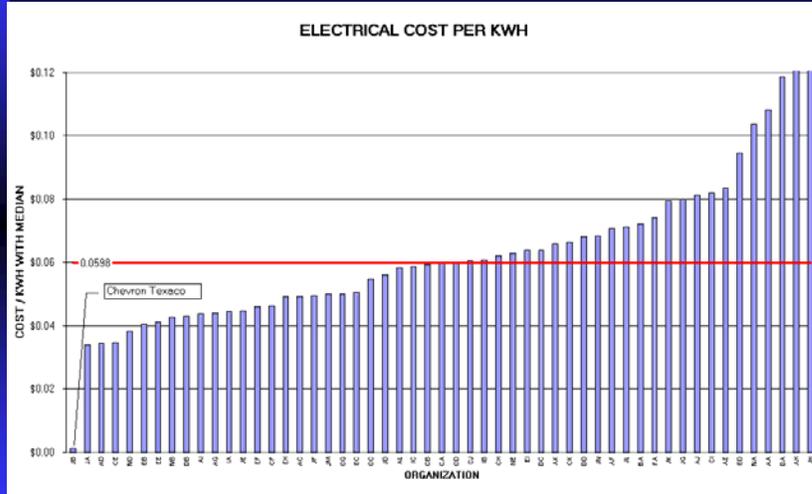
Chevron / Texaco

Operations Center Background...

- 608,000 GSF
- 1951 Employees
- 311 GSF / Employee
- Occupied in 1975
- Annual electric costs = \$0.03 / GSF

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Selection Process



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Standard offices – 8' x 8'

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Standard full height offices

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Employee break areas – by atriums

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Numerous atriums to break up large floor plates

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Safety is the top priority...

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VFD's and Soft Start on most motors

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Chevron / Texaco

Reliability issues...

- ❑ Numerous utility outages of less than one-half second in length disrupted data center operations.
- ❑ Clean power and reliability was the focus when Chevron began to pursue solutions.
- ❑ No service interruptions since installation of the system... 1998. There have been 60 utility power failures documented since 1995

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Chevron / Texaco

Cogeneration facility...

- ❑ Two natural gas-fired 2650 HP reciprocating engines
- ❑ Each drives a 1.55 MW nameplate electric generator.
- ❑ Generated electricity, less auxiliary load, is used to serve the electric load requirement of the complex.
- ❑ The engines and generators usually are operated at a load to satisfy the thermal needs of the facility
- ❑ Excess power is sold back to the utility company to offset other utility costs

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Power plant details...

- ❑ Serves the four buildings that make up this site
- ❑ Fully self-contained operating system
- ❑ Continuous operation 24 hours a day, 365 days a year

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Chevron / Texaco

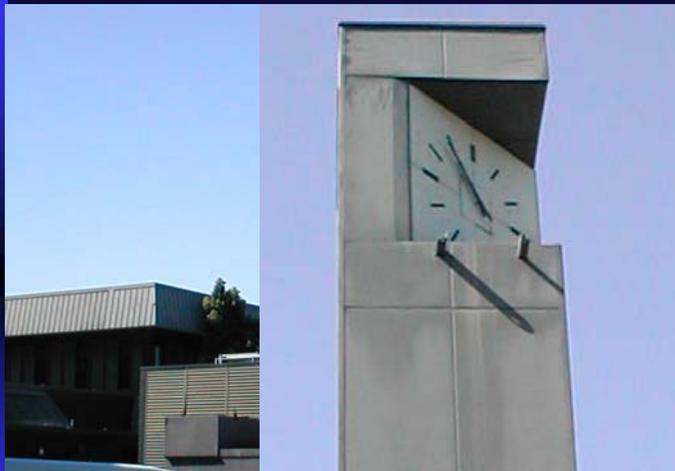
Efficiency issues...

The cogeneration facility is a topping-cycle system...

- ❑ Cold water for air conditioning is produced from the engine exhaust and water jacket waste heat by absorption chilling
- ❑ A portion of the heat is diverted to a plate heat exchanger that produces a flow of heated water for space heating

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Stack exhaust through the clock...

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Extensive power monitoring...

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Power plant control room...

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Chevron / Texaco



Power plant control room...

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Waste heat used in absorption chiller – improved efficiency

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Chevron / Texaco



Heat exchanger for hot water

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Engine 1 – view from the top ... Two engines run during day / maintenance performed at night on one.

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Value Your Employee's



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Benchmarking Failures....

- File It
- Impress Their Boss
- Keep "Score" / Focus on the "Numbers"
- No Reason To Change
- Unwillingness to Change

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Successful Benchmarking....

- Identifies Under / Over Performance
- Basis for Goal Setting
- Creates an Acceptance for Change
- Identifies Improved Work Processes
- Improved Understanding of Organization
- Better Prepared for Outsourcers
- Auditors Focus on Other Departments

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More Information....

- *Facility Issues* (newsletter)
- Website: <http://www.FacilityIssues.com>

Thank You

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