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# Gumbo 24-7 Power Users

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Siemens Building Technologies



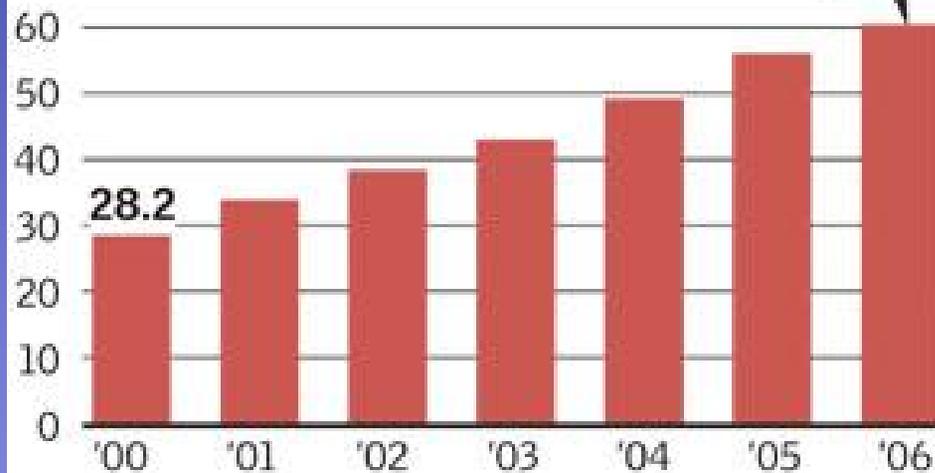
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## Rising energy use

Electricity use for data storage, ranging from small office servers to large data centers, more than doubled from 2000 to 2006, and is expected to double again in the next five years.

Annual electricity use (billion kilowatt-hour)



Source: Environmental Protection Agency

MERCURY NEWS



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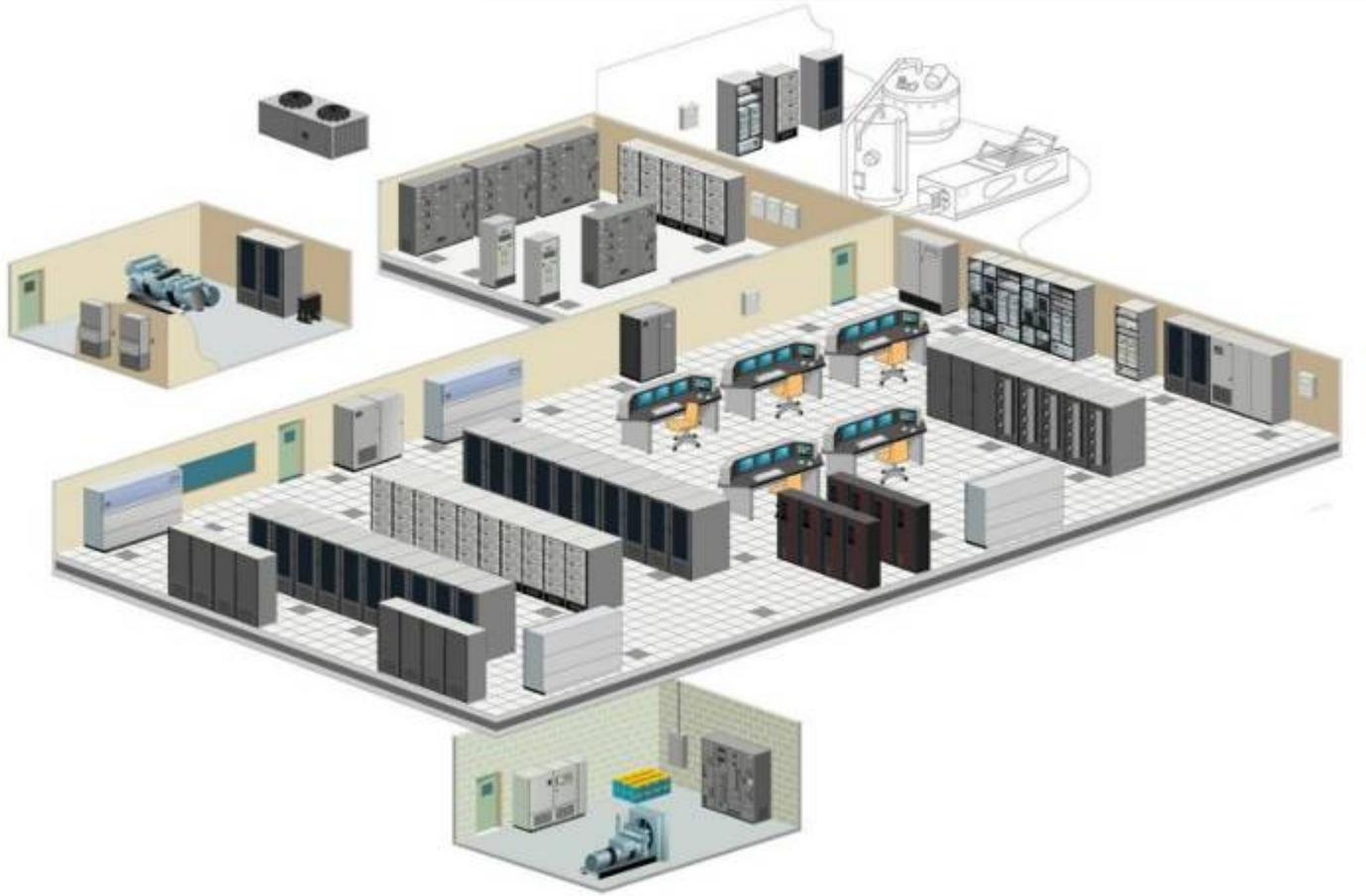
# Major concern is growth rate

- Computer server facilities will double their consumption of energy in the next five years
- U.S. government is the biggest single data energy user, accounting for about 10 percent of the nation's computer energy demand
- 133-page EPA report sent to Congress on Friday – calls for incentives and best practice sharing



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# Even small data centers are major energy consumers





# Kilowatts or Megawatts?

## Energy Conservation Opportunity Summary

| ECM #                                  | MEASURE DESCRIPTION                              | PEAK DEMAND REDUCTION (kW/Month) | ELECTRIC ENERGY SAVINGS (kWh/Yr) | ELECTRIC COST SAVINGS (\$/Yr) | GAS ENERGY SAVINGS (Therm/Yr) | GAS COST SAVINGS (\$/Yr) | ANNUAL ENERGY SAVINGS (\$/Yr) | PROJECT COST (\$) | ESTIMATED UTILITY INCENTIVE (\$) |
|--|--|----------------------------------|----------------------------------|-------------------------------|-------------------------------|--------------------------|-------------------------------|-------------------|----------------------------------|
| 1                                      | AHU-1, 2 and 3 Modification                      | 17.7                             | 306,060                          | \$ 34,976                     | 27,855                        | \$ 18,175                | \$ 62,832                     | \$ 129,339        | \$ 59,562                        |
| 2                                      | Install Economizers on AHU-1, 2 and 3            | 14.6                             | 351,812                          | \$ 40,205                     | -13                           | \$ (8)                   | \$ 40,192                     | \$ 69,489         | \$ 49,246                        |
| 3                                      | AHU-4, 5 and 6 Modification                      | 8.8                              | 263,162                          | \$ 30,074                     | 20,648                        | \$ 13,472                | \$ 50,722                     | \$ 135,122        | \$ 49,231                        |
| 4                                      | AHU-7 and 8 Modification                         | 19.2                             | 552,993                          | \$ 63,196                     | 7,037                         | \$ 4,592                 | \$ 70,233                     | \$ 124,488        | \$ 81,641                        |
| 5                                      | Install VFDs on Chilled Water Pumps P-4, 5 and 6 | 2.7                              | 63,594                           | \$ 7,268                      | 0                             | \$ -                     | \$ 7,268                      | \$ 47,754         | \$ 8,900                         |
| <b>TOTALS FOR RECOMMENDED MEASURES</b> |  | <b>63.0</b>                      | <b>1,537,622</b>                 | <b>\$ 175,718</b>             | <b>55,528</b>                 | <b>\$ 36,230</b>         | <b>\$ 231,245</b>             | <b>\$ 506,192</b> | <b>\$ 248,584</b>                |

## Energy Conservation Opportunity Life Cycle Economic Summary

| ECM #         | MEASURE DESCRIPTION                              | TOTAL ANNUAL SAVINGS (\$/Yr) | NET PROJECT COST (\$) | SIMPLE PAYBACK PERIOD (yrs) | SAVINGS TO INVESTMENT RATIO | ADJUSTED INTERNAL ROR (%) | LIFE CYCLE CO <sub>2</sub> REDUCTION (kg) | LIFE CYCLE SO <sub>2</sub> REDUCTION (kg) | LIFE CYCLE NO <sub>x</sub> REDUCTION (kg) |
|---------------|--|------------------------------|-----------------------|-----------------------------|-----------------------------|---------------------------|---|---|---|
| 1             | AHU-1, 2 and 3 Modification                      | \$ 62,832                    | \$ 69,777             | 1.1                         | 10.58                       | 15.90%                    | 6,558,424                                 | 24,282                                    | 11,767                                    |
| 2             | Install Economizers on AHU-1, 2 and 3            | \$ 40,192                    | \$ 20,243             | 0.5                         | 15.10                       | 17.98%                    | 4,155,203                                 | 605                                       | 10,688                                    |
| 3             | AHU-4, 5 and 6 Modification                      | \$ 50,722                    | \$ 85,891             | 1.7                         | 21.28                       | 20.02%                    | 10,887,772                                | 63,236                                    | 14,522                                    |
| 4             | AHU-7 and 8 Modification                         | \$ 70,233                    | \$ 42,847             | 0.6                         | 20.29                       | 19.73%                    | 7,276,820                                 | 6,967                                     | 17,425                                    |
| 5             | Install VFDs on Chilled Water Pumps P-4, 5 and 6 | \$ 7,268                     | \$ 38,851             | 5.3                         | n/a                         | n/a                       | 751,348                                   | 111                                       | 1,932                                     |
| <b>TOTALS</b> |  | <b>\$ 231,245</b>            | <b>\$ 257,608</b>     | <b>1.1</b>                  |                             |                           | <b>29,629,567</b>                         | <b>95,201</b>                             | <b>56,334</b>                             |



# Data Center facts of life

- Servers are power hogs
- Each new generation is smaller but uses more power and generates more heat
- Watts per sq ft going through the roof



- How do you operate 24x7 facilities like command centers, data centers, and operations centers and still manage to conserve energy?





# Older centers like refrigerators

Inefficient equipment cooling requires the entire space to be kept at very low temperatures

Alternatives?

- Directed air flow for more efficient extraction of heat from servers and other critical electronics
- Spot cooling systems for racks



# HVAC techniques

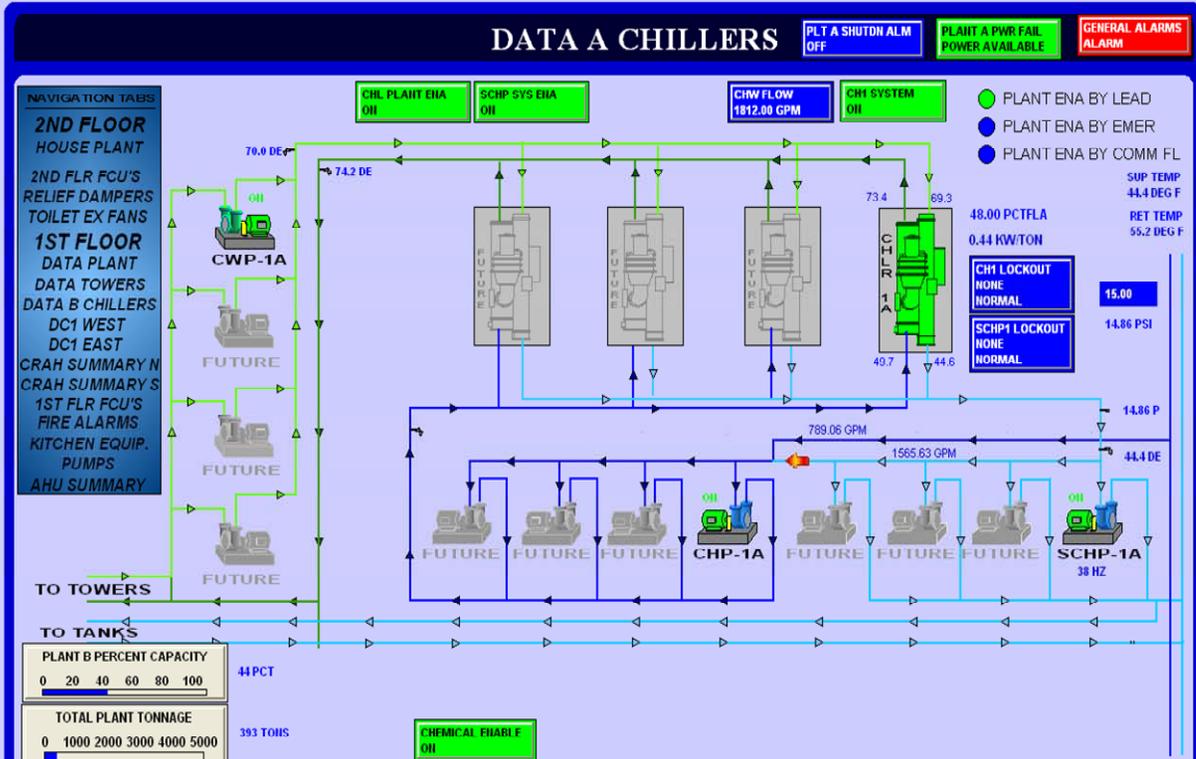
- Maximize return air temperature by supplying air directly to the loads
- Avoid supply/return mixing –hot aisle/cold aisle  
Minimize air leaks in raised floor systems
- Select racks with good internal airflow
- Airside economizer (temp and humidity)
- High efficiency motors and VFDS on AHUS
- Operate wet side efficiently

# Efficient equipment and controls



Countrywide Home Loans  
Coit Road Data Center

OA-TEMP 76.4 DEG F OA-HUMIDITY 51%RH





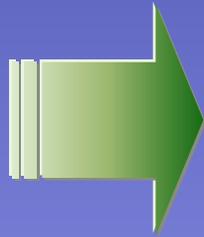
# Ideas?

- Get rid of remaining monitors (go flat)
- Reduce all non-critical loads like lighting
- Substitute LED task lighting for general lighting. Drop GL from T12 to T5
- Move personnel into control rooms outside of the processing areas
- Actively manage both power and HVAC

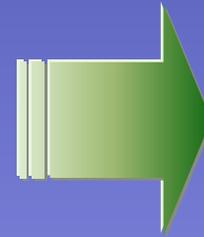
# 33% less energy



1.5" dia.



1.0" dia.



.625" dia.



# Technology specifiers can help

- Select equipment that consumes less energy and can operate at higher temperatures
- Provide for facility improvement along with datacenter technology funding





# C4 centers: beyond the servers

- Take a hard look at individual workstations
- Hundreds of over specified workstations with powerful CPUs and high power graphics cards may have more impact in aggregate than the servers in the data center
- Drop clock speeds to lower heat output and power usage. Turn systems off when not in use





# Success Stories

- Fleet Numerical Meteorology & Oceanography Center – Bldg 700 Monterey
- Affordable Internet Services Online, Inc. (AISO) provides Internet solutions that are 100 percent solar-powered.





# So I asked my two new friends

AI and AI

AG&AG



# When will Industry respond with solutions?



When gas is \$5 and electricity is 30 cents a KWH the markets will respond with amazing technology



If we wait that long to take action your beach Condo will only be good as a wreck diving destination



# Industry response to the problem

- HP introduces a technology solution, Dynamic Smart Cooling that the company claims will offer 20- to 45-percent energy cost savings
- IBM begins offering turnkey data center construction
- Specialty contractors handling majority of new construction in private sector



# References & organizations

- [www.energystar.gov](http://www.energystar.gov)
- <http://hightech.lbl.gov/DCTraining/best-practices.html>
- <http://www.7x24exchange.org/aboutus.html>
- [www.TheGreenGrid.org](http://www.TheGreenGrid.org)
- <http://hightech.lbl.gov/DCTraining/case-studies/naval-dc.html>

