ENERGY STAR

Data Center Energy Management

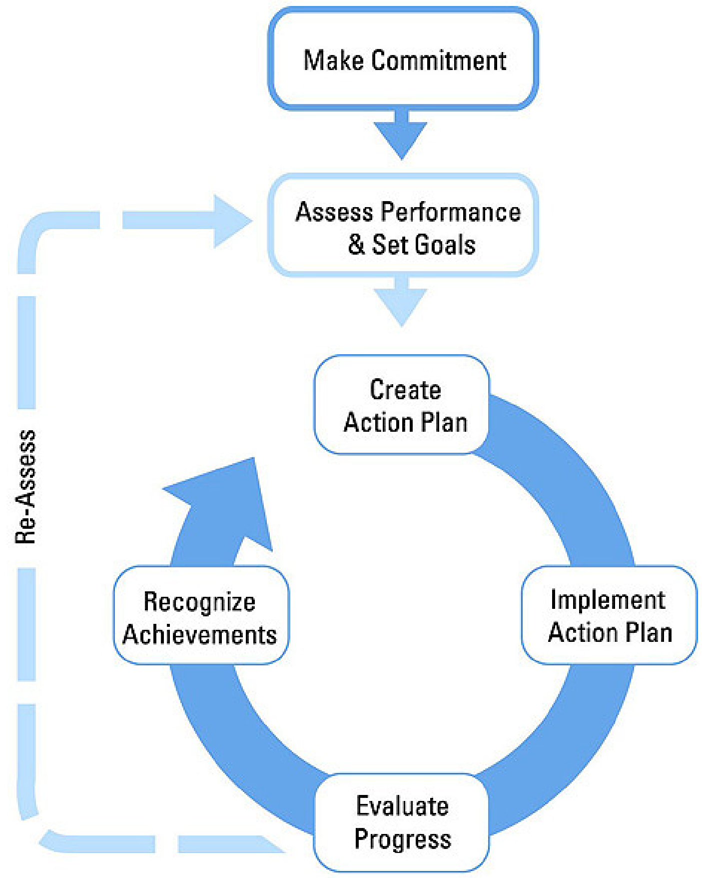
Monthly Partner Web Conference
March 25, 2009

Call-in number: 866 299 3188
Conference Code 202 343 9965#

EPA

About The Web Conferences

- Monthly
- Topics are structured on a strategic approach to energy management
- Help you continually improve energy performance
- Opportunity to share ideas with others
- Slides are a starting point for discussion
- Open & interactive



Web Conference Tips

- Mute – To improve sound quality, all phones will be muted.
- Use # 6 to un-mute and * 6 – to mute
- Presentation slides will be sent by email to all participants following the web conference.

Today’s Web Conference

Data Center Energy Management:

- Background - Mike Zatz, US EPA
- Key Issues – Ted Hight, Target
- Strategies – Joe Parrino, UPS
- Discussion
- Announcements

Measuring Data Center Efficiency – ENERGY STAR Data Center Infrastructure Rating

Mike Zatz
Manager, ENERGY STAR Commercial Buildings

ENERGY STAR Partner Networking Webinar
March 25, 2009

Why Data Centers?

- Data centers currently consume approximately 1.5 percent of total electricity use in the U.S. and cost $4.5 billion per year to operate.
- Data center energy use has doubled in the past 5 years.
- Data center energy use is expected to double again in the coming 5 years.
- Operating costs in data centers now equivalent to (or exceeding) equipment costs.
- Existing ENERGY STAR partners would like to benchmark and track energy use of data centers along with remainder of their portfolio.

Goals for the ENERGY STAR Data Center Rating

- Build on existing ENERGY STAR methods and platforms. Methodology similar to existing ENERGY STAR ratings (1-100 scale).
- Usable for both stand-alone data centers, as well as data centers housed within office or other buildings.
- Assess performance at the building level to explain how a building performs, not why it performs a certain way.
- Provide users with information and links to additional resources to aid in their efforts to determine next steps after receiving an energy performance rating for their building.
- Offer the ENERGY STAR label to data centers with a rating of 75 or higher (performance in the top quartile).

What is the ENERGY STAR Rating for Data Center Infrastructure?

- **Unit of Analysis:** Ratio of Total Energy/IT Energy
- **What:** Measure of infrastructure efficiency
  - Captures impact of cooling and support systems
  - Does not capture IT efficiency
- **Why:** Best available whole building measure at this time
  - Ideal metric would be measure of energy use/useful work.
  - Industry still discussing how to define useful work.
  - While discussions on useful work continue, it is important to start tracking, measuring, improving energy efficiency.
- **How:** Express ratio (Total Energy/IT Energy) as an ENERGY STAR 1-to-100 rating
  - Each point on rating scale equals 1 percentile of performance.
  - Adjust for operating constraints outside of the owner/operators control (e.g. climate or tier level).
  - Factors for adjustment to be determined based on results of data collection and analysis.

Major Barrier to Rating Development – Lack of Data

ENERGY STAR

- Most ENERGY STAR building rating models use CBECS data - collected every 4 years by DOE.
- Few data center facilities have historical data on whole building energy use (or data center portion) and/or IT energy use.
- Data must be measured in the same way.
- **Solution:** Gather data over a 12-month period going forward.

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Selected Participants

- 365 Main Inc.
- ADP Inc.
- AOL
- Boeing
- California Department of Technology Services
- Computershare
- Digital Realty Trust, Inc.
- EMC2
- Enterprise Rent-A-Car
- Equinix
- Fidelity Investments
- Hill Environmental Operations
- Hosting.com
- Intel
- JCPenney
- Jones Lang LaSalle
- King County, Washington
- Lowe's
- Microsoft
- Mobile Satellite Ventures
- New York Life Insurance Co.
- Rackspace
- Raritan, Inc.
- ServerVault Corp.
- Target
- United Parcel Service
- Unum

Preliminary Data Received

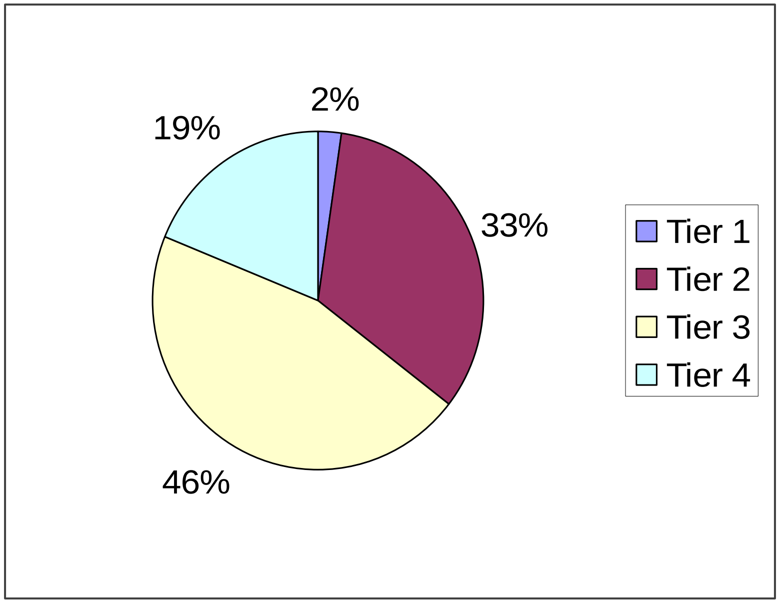
- Final tally of commitments was 126 organizations with 241 data centers representing nearly 18 million sq. ft.
- First data collection in October 2008
- Second data collection by January 2009.
  - Complete data submitted: 109 data centers
  - Partial data submitted by a small number of additional participants.
- No data from about half of those committing.
- Had been hoping for data from at least 125 data centers, but over 100 should be sufficient.

Preliminary Results from 1st Data Collection - Building Type

- Approximately half of the data centers are free standing
  - 48 stand-alone centers
  - 42 data centers within larger buildings
- Some data centers have already earned recognition
  - 2 Located in ENERGY STAR buildings
  - 1 LEED certified building

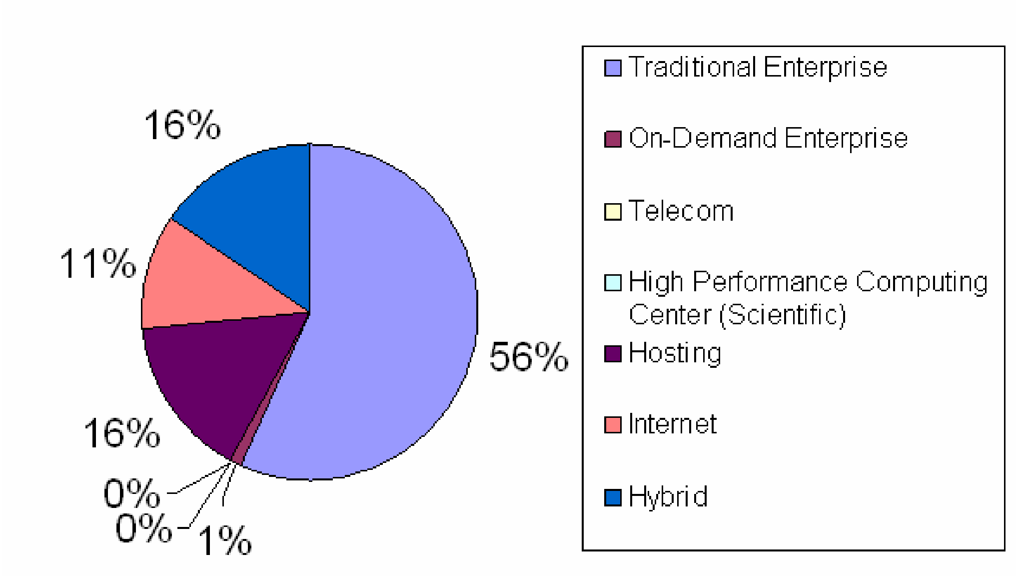
Preliminary Results from 1st Data Collection - Tier Level

- Nearly half are Tier 3
- Good representation of Tier 2, 3, and 4
- Only two Tier 1 data centers
  - Rating may not be able to apply for Tier 1



Preliminary Results from 1st Data Collection - Data Center Type

- Types represented
  - Traditional enterprise data centers (over 50%)
  - Hosting, internet, and hybrid facilities
- Types under-represented
  - No telecom or high-performance computing centers
  - One on-demand enterprise center



Preliminary Results from 1st Data Collection - Data Center Size

	Minimum	Maximum	Average
Data Center (ft^2)	450	300,000	51,293
Building (ft^2)	10,000	2,000,000	258,412
Data Center as percent of total*	19%	100%	59%

for stand alone data centers only, excluding administrative offices, storage, loading docks, and other non-essential space.

Preliminary Results from 1st Data Collection - Data Center Size

	Minimum	Maximum	Average
Number of Racks	8	4974	992
Percent Utilization	0%	99%	56%
Year of Construction	1959	2008	1995

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Next Steps

- ***Data in this presentation is preliminary***
- Still many questions to pursue
  - Missing data
  - Inconsistent data
- EPA will follow-up with organizations on specific questions.
- EPA will analyze data from the second data collection in Spring 2009.
- Final data due from participants in June 2009, after which the rating model will be developed for launch in Portfolio Manager in January 2010.

Increasing energy efficiency within Data Centers

Ted Hight
Target

Increasing energy efficiency within Data Centers

- Why should you care?
- What do you have to know now?
- Computer power
- What is computer virtualization?
- How do you know if your Data Center is efficient?
- What can you do to improve your energy efficiency?
- Is saving energy your most important concern?

Ted Hight - Target

Why should you care?

- Power usage will have a major impact to both your capital and expense budgets.
  - Increased power usage leads to needing new circuits, PDU's, switchgear, cooling units, chillers, UPS systems, Generators, or possibly an entirely new Data Center.
  - Power costs continue to rise
- Reducing power usage is a great win for your company that can be used to show you're a good corporate citizen.
- It's the right thing to do for the planet.

What do you have to know now?

- What is your total usable UPS capacity?
  - UPS systems are rated in KW. A best practice is to not load the UPS system higher than 90%.
- What is your UPS utilization today?
  - How much is actually being used right now? This information should either be available on the UPS System Control Cabinet screen or from your building management system?
- What is your annual UPS growth?
  - It's critical that you understand how much you're growing each year. If your using 80% of your capacity and you've been experiencing 20% annual power growth, you better have an upgrade plan in place now.
- Do you have the cooling capacity available in the Data Center to match the UPS capacity?
  - It doesn't matter how much UPS power is available if you don't have the ability to add cooling units to support it. As a general rule, a 20 ton cooling unit in good working condition can cool 70KW of computer power.
  - Do you have enough redundancy that you can shut down a cooling unit for maintenance or repair without having to shut all the computers down?

Computer power

- Dell server power
  - Dell has published that a 2950 server that was plugged in but not performing any work uses 65% of it's total power.
- According to a survey by the Uptime Institute of 45 large Data Centers, almost 30% of installed servers were dead. (No longer in use)
- Technology refreshes
  - When servers get refreshed (installing newer models), the new ones are installed along with the old ones, then the programs are transferred to the new ones. Many times after the transfer gets completed, the old ones don't get turned off. This is a complete waste of energy. Ensure all unused servers get powered off.
- Using More energy efficient servers
  - Many manufacturers offer 'energy efficient' models which can greatly reduce energy usage, but their performance was not quite as high as non-energy efficient servers and the costs were higher so people rarely purchased them. Costs for these are know becoming the same, or less.

What is computer virtualization?

- Typically, a single server gets purchased to run a single application or program.
- Servers get more powerful every year, usually without dramatic price increases, so people tend to buy more powerful servers. Unfortunately this has resulted in average server utilization being only in the 5-30% range. Usually, it's the low end of that range.
- Virtualization is the strategy of running multiple applications on a single server. This can greatly reduce the amount of servers that need to be purchased and powered on.
- Some of the drawbacks to virtualization are that with only a single application running on a device, if the device fails, only a single application gets affected. Trying to manage multiple applications on a single device increases the management complexity. 'Cloud' computing (being able to shift workload between computers) can change how and where power is being consumed without anyone knowing it's changed.
- Mainframes computers were the original 'virtualized servers'. Very large computers designed to run hundreds of applications on them at the same time. They are extremely efficient from a workload vs. power consumed point of view, but if they fail or get brought down for maintenance, you're now affecting hundreds of applications.

How do you know if your Data Center's efficient?

There are 2 main areas of efficiency within computer rooms that should be measured.

1. Electrical and mechanical infrastructure systems efficiency.
   - A metric for determining how efficient these systems are being used is to measure the total amount of power being used to run the Data Center and divide it by the total amount of power being directly used to run the computers.
   - 4000KW total load from utility meters / 2000KW of power on PDU's feeding the computers is an efficiency ratio of 2.0. For every watt of power being used to run the computers you are using a watt for cooling, lighting, transformer losses in the UPS's, and PDU's.
   - An efficiency rating of 2.0 or less is currently considered good.

2. The efficiency of the computers themselves.
   - What is the average processor utilization? (Amount of work actually being performed vs. what the computers are capable of performing.)

What can you do to improve your energy efficiency?

- UPS systems and PDU’s have transformers. Some lightly loaded transformers can be very inefficient losing up to 25% of the energy going in. Measure the input and the output. If losses are high, can you put more load on them?
- Lightly loaded chillers are typically less efficient than highly loaded chillers.
- Redundant units use energy but provide limited value in ‘normal’ operating conditions. Can you reduce the level of redundant units and still maintain stability and reliability?
- Eliminate bypass airflow by sealing all holes and use blanking plates in racks to cover empty slots.
- Use the new ASHRAE guidelines to determine if you can safely increase your Data Center temperature.
- If you are charting your UPS growth, you should be able to predict when you’ll need new capital for infrastructure upgrades or a new Data Center. Ensure your senior executives are kept up to date on this. If reducing power consumption will buy a few more years before having to spend a large amount of capital, they may drive the efforts to reduce power usage.
- If your computers are lightly utilized, consider virtualizing them.
- If you don’t want to virtualize them, ask your computer vendor to provide less powerful computers that will still perform the work but use less power.

Is saving energy your most important concern?

It's always important, just be careful that your desire to save energy doesn't compromise your Data Centers reliability or stability.

Redundancy

- **If you have redundant infrastructure components, they were probably funded for a reason. Don't reduce your redundancy without knowing that reason and getting buy in from all affected parties.**
- **If you turn off redundant components, ensure you have a rotation plan for bringing them back into use occasionally. Large UPS batteries get charged by the UPS modules. If you turn a module off for too long, the batteries may go dead. Turning off a cooling unit for too long may cause bacteria build up within the unit which would then get introduced to your chilled water loop when it's turned back on.**

Other Technologies

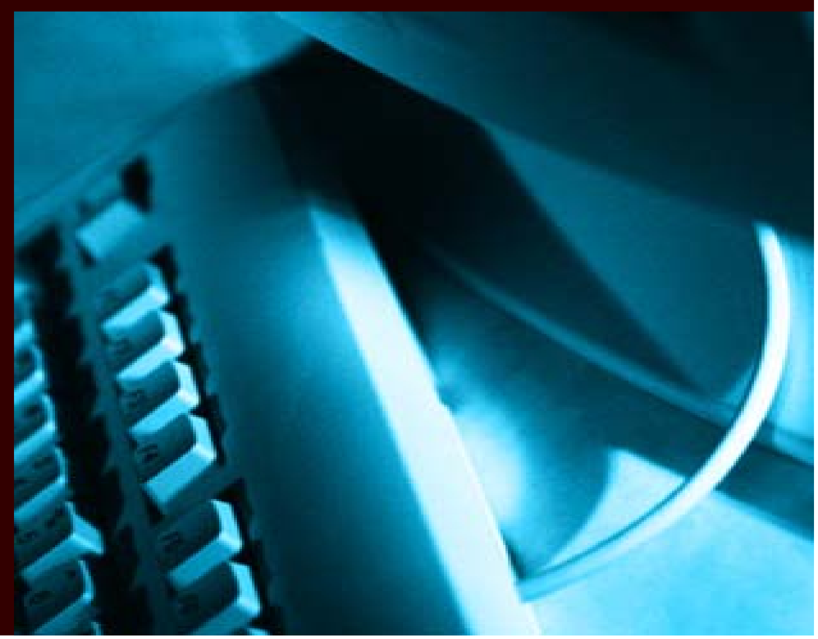
- **Water cooled racks can be very energy efficient but will also take down many devices if they fail.**

Running the computer room hotter

- **Some people are now advocating going far beyond the ASHRAE guidelines and letting input temperatures go up into the 80's. There is limited data on how successful this strategy will be. Theoretically, it could save energy by reducing the amount of cooling needed. On the other hand, this could also cause the computers internal fans to run faster and longer which would use more energy. There may also end up being a correlation between very high, yet tolerable input temperatures and higher than normal component failures.**

Energy Management Techniques

Joseph Parrino
UPS Windward Data Center
March 2009



Information Technology & Increasing Energy Concerns

Taking Measurements

Identifying Energy Reduction Opportunities

Making Improvements

Calculating Savings

Track Progress & Benchmark

Changing Behavior

Carbon Emissions Calculation

Information Technology & Increasing Energy Concerns

A Brief History of Data Centers…

- Data Centers are a relatively new type of facility which houses Information Technology equipment
- Information Technology enables our "digital economy"
  - Financial Transactions, Internet Commerce, Business Processes, etc.

A Brief History of Data Centers…

- Data Centers house processing equipment which cannot tolerate downtime
- Downtime can result in
  - Loss of financial transactions
  - Stoppage of business processes
  - Database corruption
  - Equipment damage
  - Even safety issues
- Therefore, redundant power and cooling infrastructure is necessary
- Redundant equipment provides more availability at the expense of efficiency

Data Centers are therefore…

…energy-intensive buildings

…consume 10-15x more energy per sq. ft. than office buildings

…consume the energy of 40-60 typical U.S. homes

…have become one of the top energy users in the U.S.

Figure 2-1. Electricity use of U.S. servers and data centers compared to U.S. industries

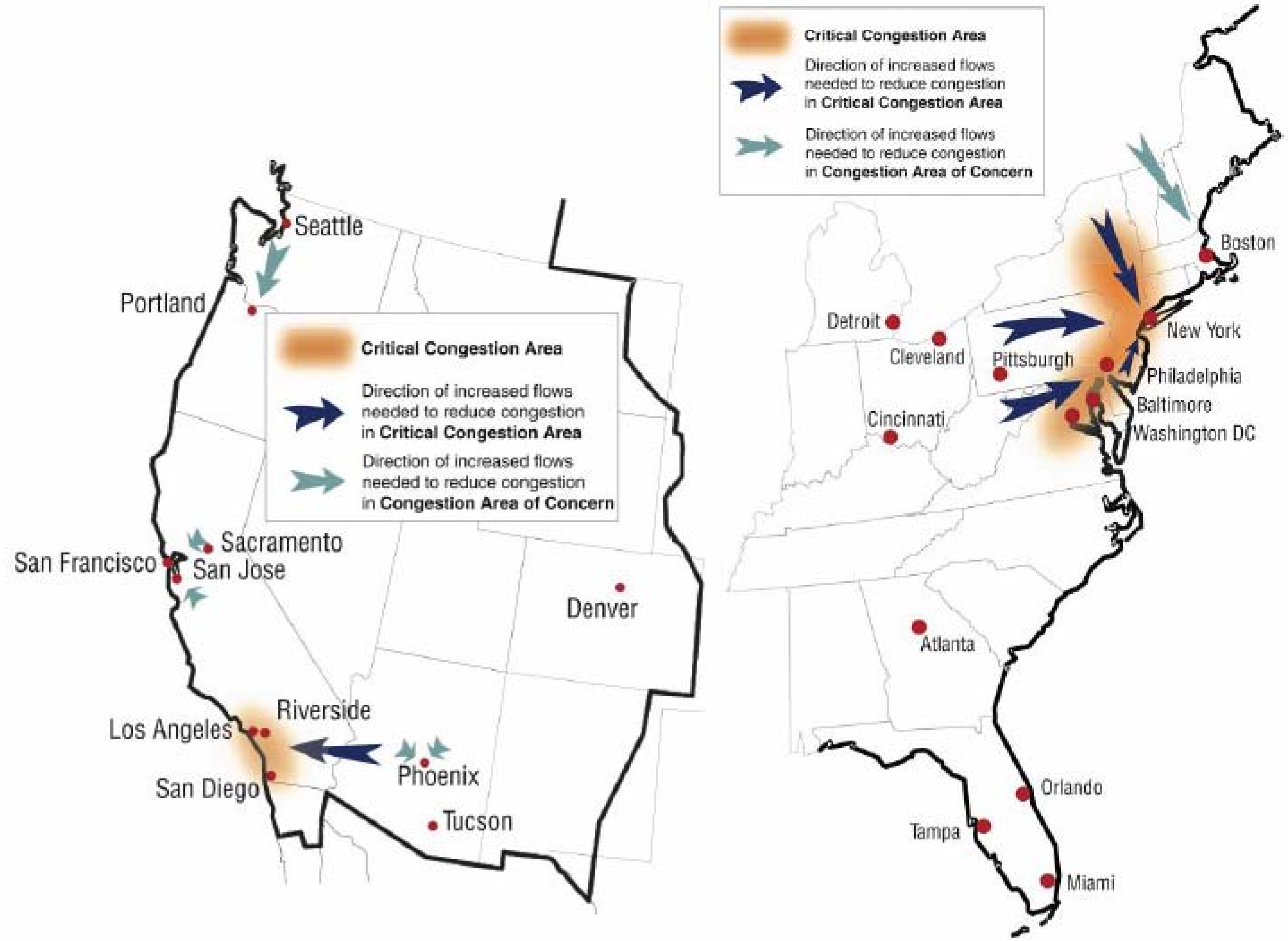
Electricity use rank among U.S. industries	Industry (North American Industry Classification System Code)	Electricity use (billion kWh/year)
1	Chemical manufacturing (325)	151
2	Primary metal manufacturing (331)	137
3	Food manufacturing (311)	79
4	Paper manufacturing (322)	75
5	Plastics and rubber products manufacturing (326)	66
6	Transportation equipment manufacturing (336)	58
7	Fabricated metal product manufacturing (332)	53
8	Petroleum and coal products manufacturing (324)	49
9	Nonmetallic metal products manufacturing (327)	46
10	Computer and electronic product manufacturing (334)	35

← **U.S. servers and data centers** 59 billion kWh/year

Source: U.S. Census Bureau (2006)

Strains on the U.S. Power Grid

Figure 4-5: Critical Areas and Areas of Concern for Transmission Congestion



Source: (US DOE 2006)

Taking Measurements

Identification of Energy Reduction Opportunities

Determination of Baseline Loads…

- **Follow EPA and DOE guidelines to determine baseline usage for each building segment**
  - **Lighting – HVAC – Office Equipment**
- **Who is your Energy Czar??**

From www.energystar.gov

STEP 1: Make Commitment

STEP 2: Assess Performance

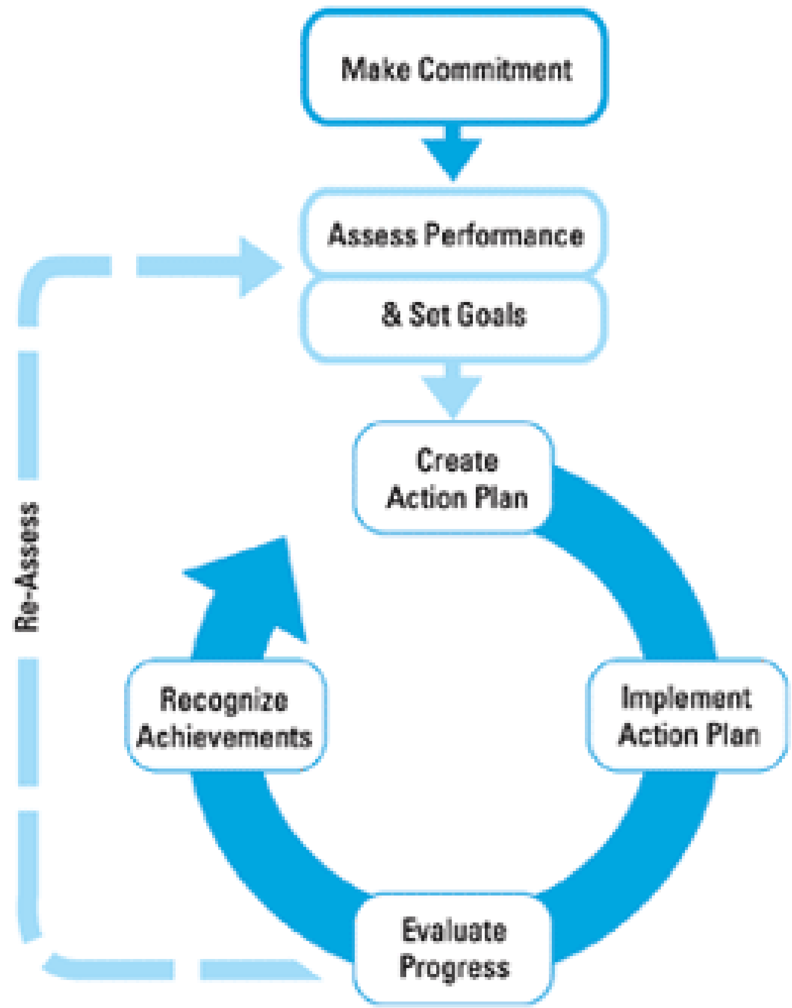
STEP 3: Set Goals

STEP 4: Create Action Plan

STEP 5: Implement Action Plan

STEP 6: Evaluate Progress

STEP 7: Recognize Achievements



Windward's Power Consumption

Microsoft Excel - Energy Usage w chart - Windward rev 4-18-08

Windward Data Center Power Consumption & Efficiency

Power IN - kW (Centrifugal Chiller)	**2995**	**Power Cost:**	**$0.0622**
Power IN - kW (Free Cooling)	**2586**	**Cooling Efficiency (kW/Ton):**	**0.48**
Power OUT - kW (UPS Output of PDUs)	**1384**	(CRAH's, Secondary Pumps and Emergency Lighting not included)	

Date: April 18, 2008
Time: 4:20 p.m.
Weather: DB = 77.9 WB = 58.06 deg. F RH = 27.8
Mechanical Config: Centrifugal Chiller while supporting Building Load and recharging Thermal Storage Tank

PUE - Centrifugal Chiller	**2.16**	**Annual Avg PUE (5 months Free Cooling)**	**2.04**
PUE - Free Cooling	**1.87**		

		Primary (kW)	Secondary (kW)	Difference (kW)	Annual Electrical Cost $0.0622	Efficiency - η	Cooling Tonnage	Cooling kWh @ 0.48kW/ton	Annu $
Losses - Substations	M1A	0	0	0	$ -	0.0%	0.00	0.00	$
	M1B	635	628	7	$ 3,814	98.9%	1.99	0.96	$
	M2A	0	0	0	$ -	0.0%	0.00	0.00	$
	M2B	185	176	9	$ 4,904	95.1%	2.56	1.23	$
	UPS-1A	412	400	12	$ 6,538	97.1%	3.41	1.64	$
	UPS-1B	378	370	8.3	$ 4,522	97.8%	2.36	1.13	$
	UPS-2A	753	728	25	$ 13,622	96.7%	7.11	3.41	$
	UPS-2B	632	620	12	$ 6,538	98.1%	3.41	1.64	$
			Total	**73.30**	**$ 39,939**	**97.3%**	**20.85**	**10.01**	**$**

		Input (kW)	Output (kW)	Difference (kW)	Annual Electrical Cost $ 0.0622	Efficiency - η	Cooling Tonnage	Cooling kWh @ 0.48kW/ton	Annu $
Losses - UPS	UPS-1A	400	340	60	$ 32,692	85.0%	17.06	8.19	$
	UPS-1B	370	310	60	$ 32,692	83.8%	17.06	8.19	$
	UPS-2A	728	644	84	$ 45,769	88.5%	23.89	11.47	$
	UPS-2B	620	540	80	$ 43,590	87.1%	22.75	10.92	$
		Total	**1,834**	**284**	**$ 154,744**	**86.1%**	**80.77**	**38.77**	**$**

Bar Graph Usage | Energy Calcs | Sheet2 | Sheet3

Ready

Power Usage – Windward Data Center

Microsoft Excel - Energy Usage w chart - Windward rev 4-18-08

D78

Row	A	B	C	E	F	G	K	L	M
47	**Mechanical Plant - 365 Days / Yr Use**		**Amps**	**Usage (kW)**	**$ 0.0622**	**Efficiency - η**	**Power & Cooling**		
48	Centrifugal Chiller - used 195 days annually		550.00	406.29	$ 118,268	N/A	$ 118,268		
49	Cooling Tower Fans - Low Speed - 33% annually		5.00	3.74	$ 672	N/A	$ 672		
50	Cooling Tower Fans - High Speed - 67% annually		10.20	7.62	$ 1,370	N/A	$ 1,370		
51	Condenser Water Pump		105.65	78.92	$ 22,973	N/A	$ 22,973		
52	Primary Chilled Water Pump		27.81	20.77	$ 6,047	N/A	$ 6,047		
53	Secondary Chilled Water Pumps	(use VFD reading)		14.39	$ 4,189	N/A	$ 4,189		
54	Blending Loop Pump		2.68	2.00	$ 583	N/A	$ 583		
55	AHU's - all		80.37	60.04	$ 32,712		$ 37,178		
56			**Total Mechani**	**593.76**	**$ 186,814**		**$ 191,280**		
57									
58									
59					**Annual Electrical Cost**		**Total Annual Cost**		
60	**Usage - Humidifiers**			**Usage (kW)**	**$ 0.0622**	**Efficiency - η**	**Power & Cooling**		
61	Steam - 100 days at 50% Utilization			94	$ 7,016	N/A	$ 7,974	Measured w/ Fluke 435 April 13, 2008	
62	Ultrasonic - 164 days at 100% Utilization			4.8	$ 1,175	N/A	$ 1,336	Measured w/ Fluke 435 April 13, 2008	
63			**Total Humidifi**	**98.8**	**$ 8,191**		**$ 9,310**		
64									
65									
66					**Annual Electrical Cost**		**Total Annual Cost**		
67	**Lighting**		**Amps**	**Usage (kW)**	**$ 0.0622**	**Efficiency - η**	**Power & Cooling**		
68	M2B - BKR-554 Lighting Panel		126.67	33.33	$ 18,162	N/A	$ 20,642		
69	STS-EM		54.33	42.84	$ 23,343	N/A	$ 26,530		
70			**Total Lighting**	76.18	**$ 41,506**		**$ 47,172**		
71									
72		**Power Consumption - All Systems**							
73									
74					**Annual Electrical Cost**		**Total Annual Cost**	**Division**	
75				**kW**	**$ 0.0622**	**Efficiency - η**	**Power & Cooling**	**of Load**	
76	**Losses**	**Substation Transformers**		73.30	$ 39,939	97.3%	$ 45,392	2.5%	**Substation Transfo**
77		**UPS**		284.00	$ 154,744	86.1%	$ 175,869	9.8%	**UPS**
78		**STS - PDU (Estimated)**		106.65	$ 58,110	92.8%	$ 66,043	3.7%	**STS-PDU**
79	**Usage**	**CRAHs**		286.12	$ 155,899	N/A	$ 177,182	9.9%	**CRAHs**
80		**Humidifiers**		98.80	$ 8,191	N/A	$ 9,310	3.4%	**Humidifiers**
81		**Mechanical Plant**		593.76	$ 323,524	N/A	$ 323,524	20.5%	**Mechanical Plant**
82		**Critical Load**		1384.00	$ 754,103	N/A	$ 754,103	47.7%	**Critical Load**
83		**Lighting**		76.18	$ 41,506	N/A	$ 47,172	2.6%	**Lighting**
84				**2902.81**	**$ 1,536,015**	**92.1%**	**$ 1,598,594**		
85									

Bar Graph Usage / Energy Calcs / Sheet2 / Sheet3

Ready

Making Improvements

"Go after the low-hanging fruit"

It starts with an Energy Policy…

- **Lighting…**
  - **Upgrade the fixtures**
  - **"OFF" when not in use**
- **HVAC…**
  - **Know your Building Management System**
  - **Program in the setbacks and USE THEM**
  - **"Hot-Cold" complaints should be:**
    - **More "Hot" than "Cold" in summer**
    - **More "Cold" than "Hot" in winter**
    - ***"Perfection is impossible – dress accordingly"***
- **Workstations**
  - **PC's, Monitors, Task Lighting "OFF" when not in use…i.e. nights, weekends, etc.**

Measure to Identify Reduction Opportunities…

- ***Fix what you can fix…***
  - **Lighting**
    - **Usage**
    - **Upgrades**
  - **HVAC**
    - **Set Point Changed during unoccupied periods**
    - **System Maintenance: filter changes, pulley alignments, etc.**
  - **Behavioral Changes**
    - **Did you get employee commitment to your goals?**

You can't fix…

Transformer losses **Extreme hot-cold weather** **Variation of Energy rates**

Calculating Savings

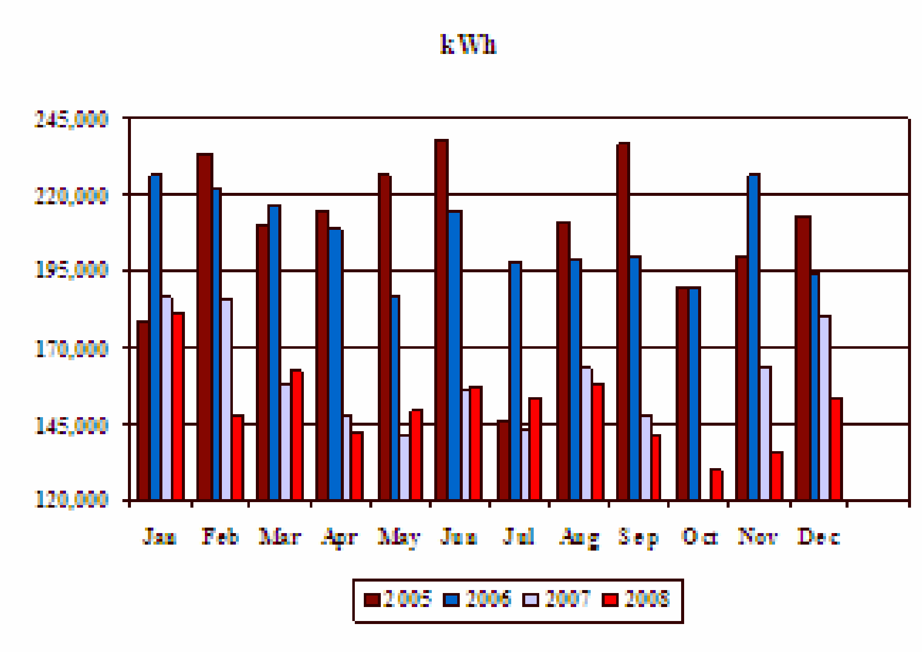
Track Progress

Benchmark

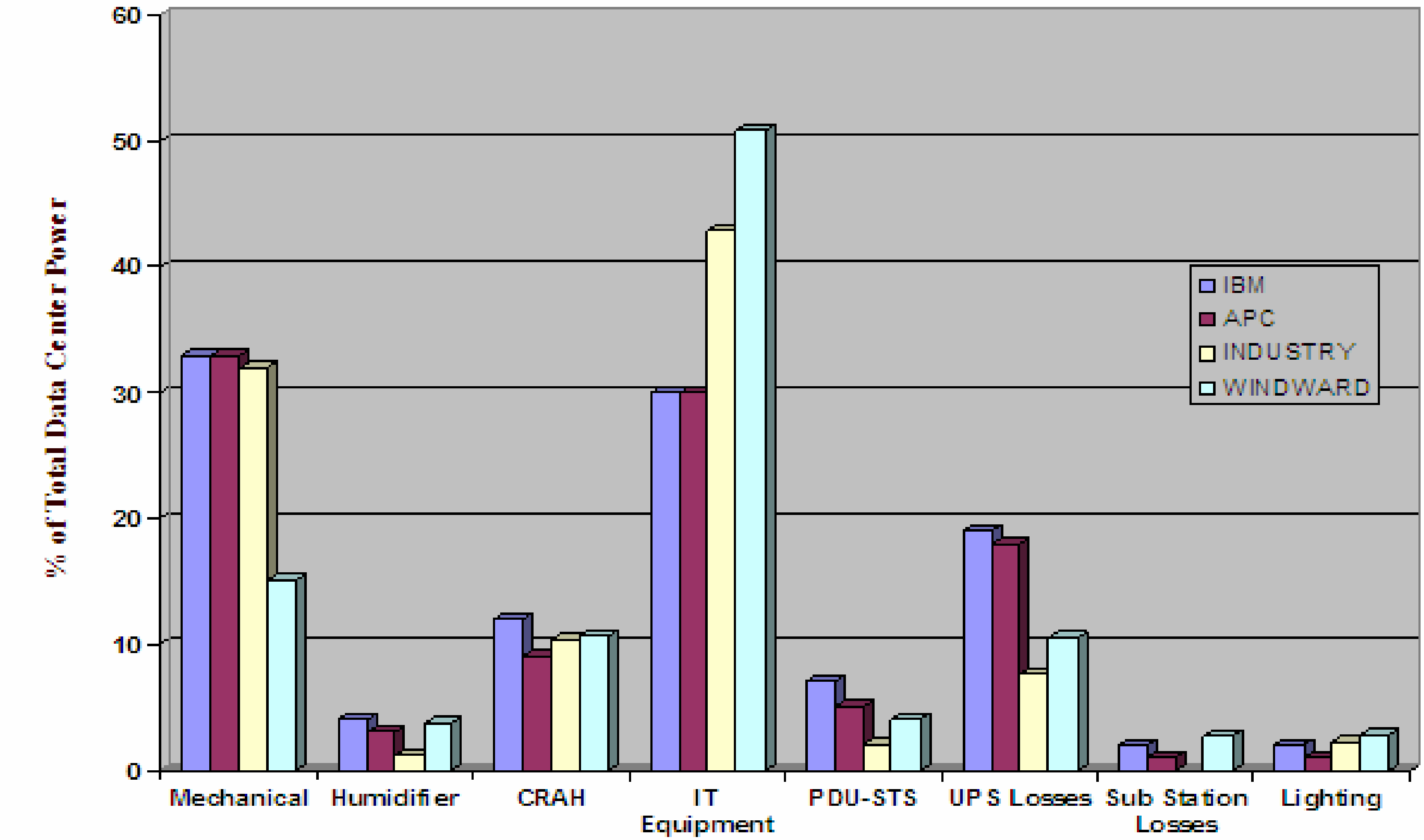
Track Progress…

Take an "annual usage" viewpoint…

- **Compare TY vs. LY <u>usage</u>**
  - **Look at energy *<u>usage</u>* (kWh, ccf, etc.) more so than costs**
  - ***(Utility costs will change, usage reductions will be more quantifiable)***
  - **Cost reduction will be a *<u>secondary benefit</u>* of usage reductions**
- **Has your Energy Czar got everyone abiding by your Energy Policies?**
- **Benchmark with other buildings**
  - **Buildings of similar type and use will have similar energy "footprint"**
  - **Which sub-system is higher-lower?**
  - **How can the reduction goals be cost-effectively attained?**



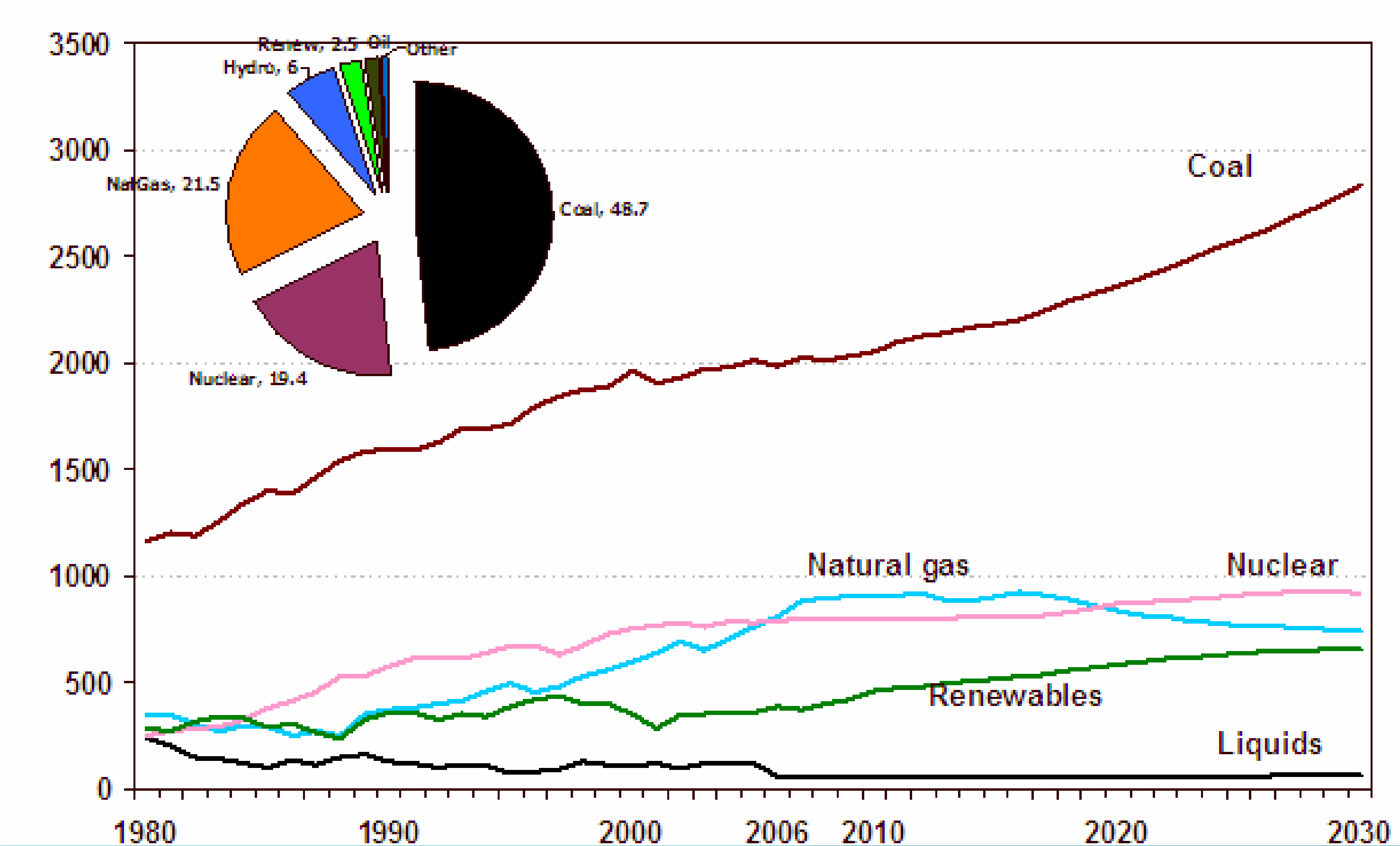
Then – Benchmark with Similar Buildings



Changing Behavior

Carbon Emissions Calculation

In the U.S., Coal Provides Cheap Power (billion kWh)



Energy Production in Georgia…

2007 Electricity Mix in Georgia

63.85% Coal

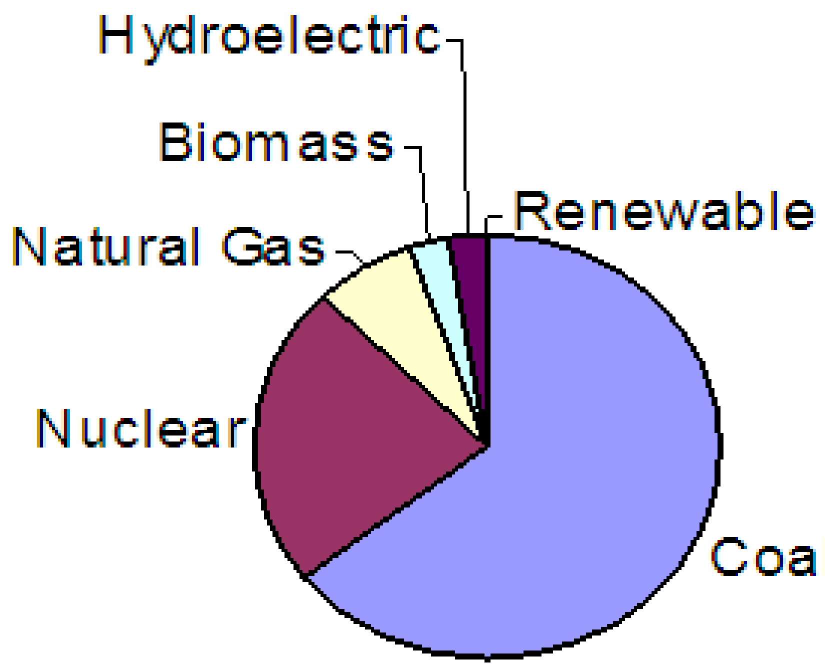
23.08% Nuclear

7.15% Natural Gas

2.35% Biomass

2.79% Hydroelectric

0% Renewable (Wind-Solar)



2007 Emissions Profile for Georgia

- **Carbon Dioxide (lbs/MWh) 1,436**
- **Sulfur Dioxide (lbs/MWh) 10.94**
- **Nitrogen Oxide (lbs/MWh) 2.130**

Environmental Impact of Single Workstation…

Computer – Monitor – Task Light: left "ON"…

- **Power usage: 167 Watts = 0.167kW**
- **If left "ON" during non-working hours = 6740 hrs per year**
- **6740 hrs/yr x 0.167kW = 1,126 kWh = 1.126 MWh/yr**

Emissions:

CO_2 = 1.126 x 1,436 = 1,617 lbs

(Carbon Dioxide is a greenhouse gas thought to cause global warming)

SO_2 = 1.126 x 10.94 = 12.3 lbs

(Sulfur Dioxide causes acid rain)

NOx = 1.126 x 2.130 = 2.4 lbs

(Nitrogen Oxides cause ground-level Ozone)

http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html#download

Results at Windward Data Center

2008 Consumption: 24,370,224 kWh

Estimated Energy Reductions: ≈ 4,000,000 kWh (≈ 16%)

Reductions came from:

1,440,000 kWh Free Cooling

1,550,000 kWh Computer Room Air Handlers "OFF"

1,000,000 kWh other Mechanical Plant Efficiencies

Emissions Avoided:

CO_2 = 4,000MWh's x 1,436 lbs/MWh = 5,744,000 lbs = 2,872 tons

SO_2 = 4,000MWh's x 10.94 lbs/MWh = 43,760 lbs = 21.88 tons

NOx = 4,000MWh's x 2.13 lbs/MWh = 8,520 lbs = 4.26 tons

Thank You!

Announcements

- April 13 @ 2 PM - Laboratory Benchmarking Initiative (energystar.webex.com)

- Earth Day – Bring Your Green to Work resources for employee engagement

2009 Web Conferences

Month	Topic
January	ENERGY STAR Update
February	Designing Energy Efficient Buildings
March	Datacenter Energy Management
April	Disclosing and Communicating Energy Performance
May	Leading Energy Management Programs – The ENERGY STAR Partners Or the Year
June	Solar Strategies
July	Engaging Sites With Performance Data
August	Lighting Technology & Strategies
September	TBA
October	Energy and GHG Management
November	TBA
December	No web conference

- Thank you