National Renewable Energy Laboratory

Innovation for Our Energy Future

Research Support Facility (RSF):

Information Technology in the Big Green Building

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Background

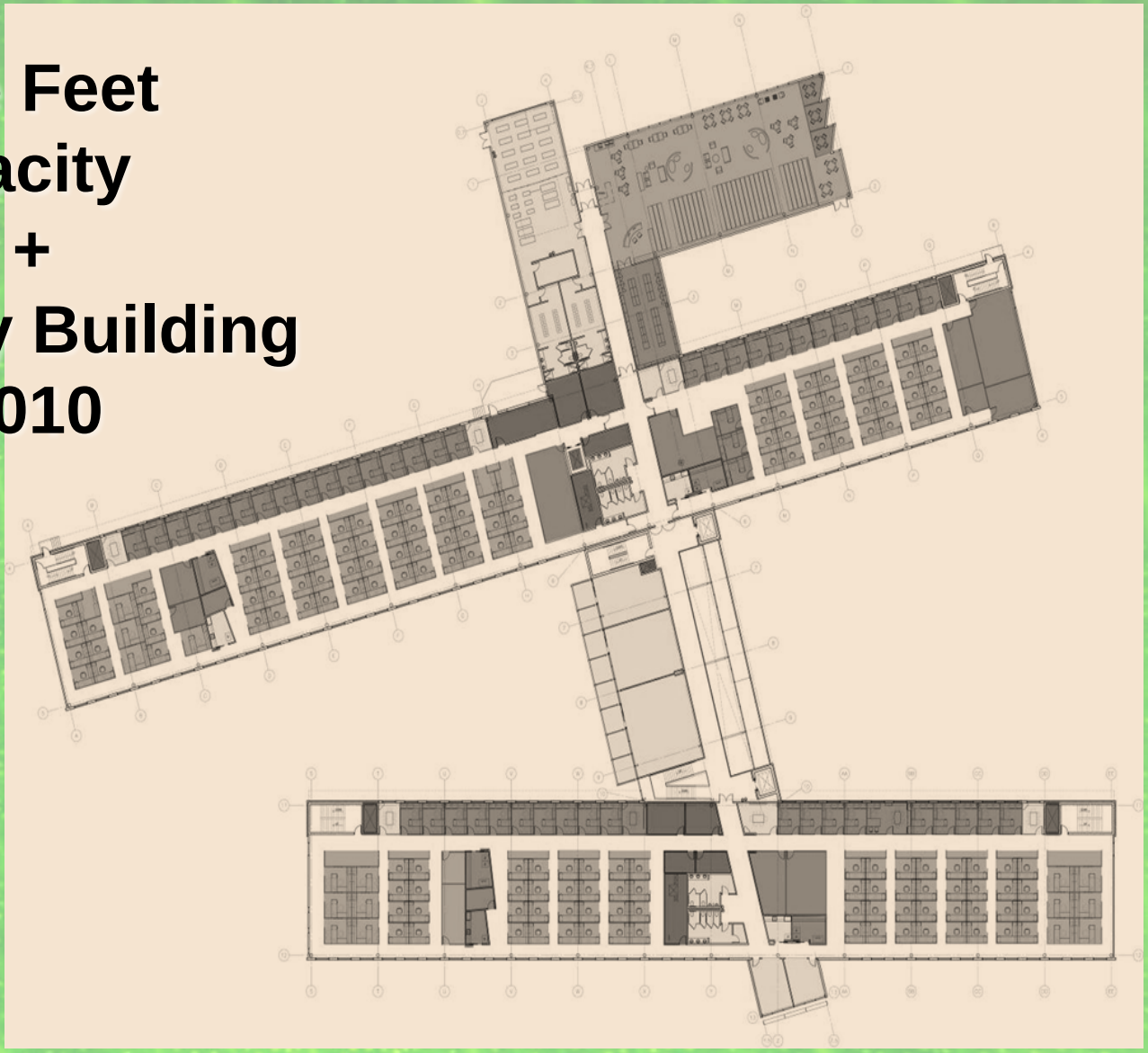
- According to the U.S. Energy Information Administration, nineteen percent of the United States primary energy is consumed by commercial buildings.
- The goal with the RSF project is to reduce the nation’s energy consumption by changing the way commercial office buildings are designed and built.

Background

Upon completion, the RSF is expected to be the nation's ***largest*** net zero energy building

Building Basics

- 218,000 Square Feet
- 820+ Staff Capacity
- LEED Platinum +
- NetZero Energy Building
- Occupy June 2010



Every Watt Counts

- Whole building energy use = 283 Watts continuous per occupant

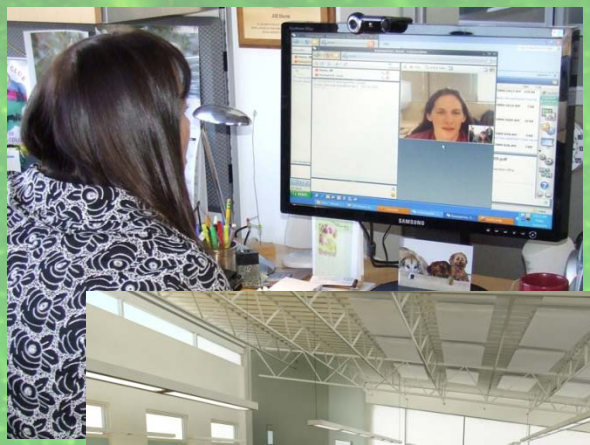
- $8500 of PV per occupant
- 1 watt = $33 of PV
- Every watt counts!

Artist Rendering

Zero Energy Strategies

Making IT Green

- On the desk
- Around the office
- In the data center
- And everywhere else



On the Desk

Desktop Computers

- 300-450W power supply
- 80-170W idling
- <5% average utilization
- Space heater effect
- Stays at the office

On the Desk

Laptop Computers

- 45-135W power supply
- <30W idling
- Growing capabilities
- Desk and floor space
- Telecommuting

On the Desk

Desktop Computers

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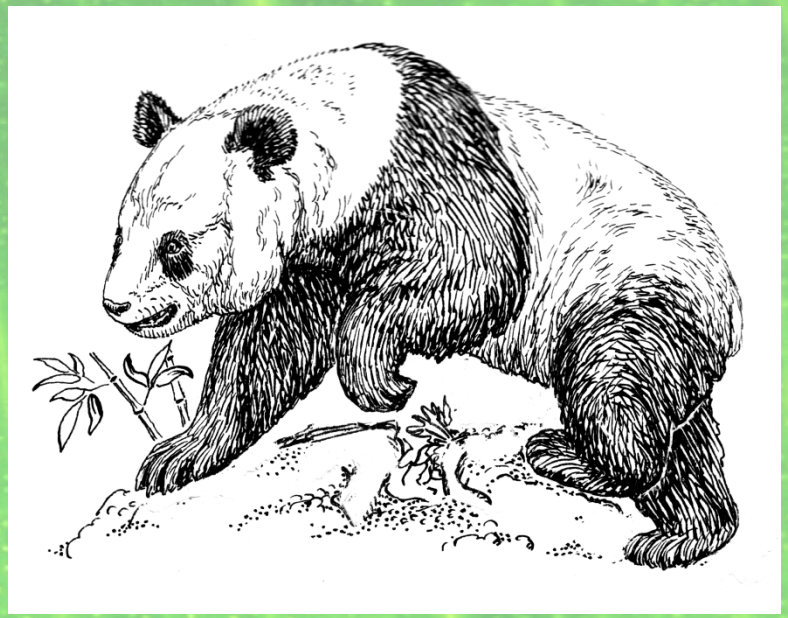
Endangered Species



Using Built-in Capabilities

- Operating System Energy Settings
  - Dimming or turning off displays
  - Spinning down harddrive
  - Sleeping the system
  - Scheduled power off
- Smarter Hardware
  - Switching video processor
  - Variable speed processor technology
  - Auto-adjusting displays

On the Desk - Monitors

CRT

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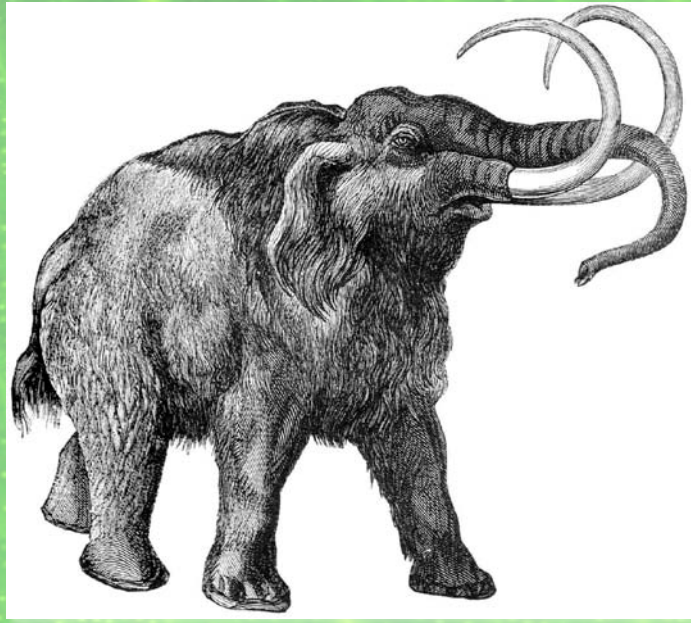
Extinct!



Displays

- Fluorescent-backlit LCD Displays
- LED-backlit LCD Displays
- OLED Displays
- E-Ink
- At the Desk
- In the Conference and Huddle Room

On the Desk - Peripherals

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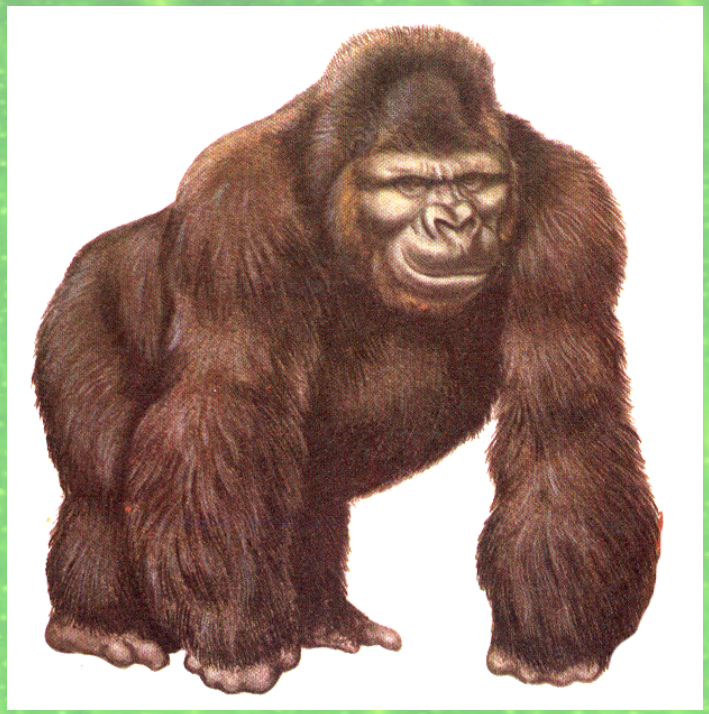


Around the Office

- Multifunction Devices – Savin C5050
  - Copy (50ppm)
  - Print (up to 12x18)
  - Fax/E-mail
  - Scan (up to 11x17)
  - Secure Print
  - 1200dpi

Around the Office

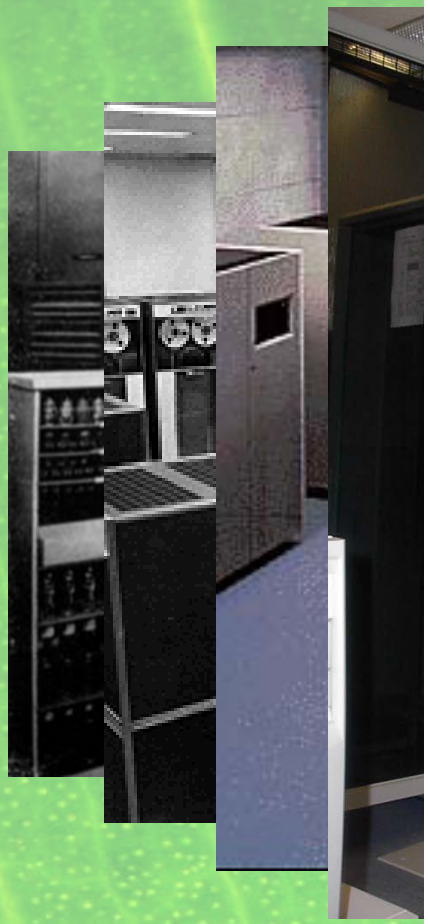
- Voice-over-IP Phones
  - VoIP Advantages
  - Headsets
  - Soft Phones

Around the Office

- Smart Power Strips
  - Motion Detectors
  - Timers
  - Auto-Switched
- External Harddrives
  - USB/Firewire
  - Bus-Powered

In the Data Center

- Genealogy of the Server



Individual Servers

- 1U Server (HP DL360 G5)
  - Dual 700W power supplies
  - 9 cooling fans
  - Typically less the 5% utilized
- 4U Server (HP DL580 G5)
  - Up to four 800-1200W power supplies
  - 6 cooling fans
  - Also <5% utilized

Blade Servers

- 10U Blade Server Chassis (HP C-Class)
  - Up to six 700W power supplies
  - Up to ten cooling fans
  - Up to **16 servers** in a chassis
  - Many (we average 20) virtualized servers per individual blade server

Data Centers Past

- Old School Power and Cooling
  - Chillers
  - Air Handlers
  - Raised Floor
  - Inefficient UPS’s and PDU’s
  - Poor Rack Systems
  - Lack of Cable Management

In the RSF Data Center

- New School Power and Cooling
  - Air Handlers and the labyrinth
  - Air side economizer
  - Evaporative cooling
  - Above and below cold isle distribution
  - Fully contained hot isle exhaust
  - Waste heat recovery
  - Wide racks with complete cable management
  - Ultra-efficient power systems

And Everywhere Else

- On the Road
- At Your House
- Around the Campus

Questions?