Pacific Northwest National Laboratory

Managing An Energy Program That Affects The Bottom Line.

Greening in Place: From Policy to Practice
Seattle University, Seattle, WA

September 16, 2008
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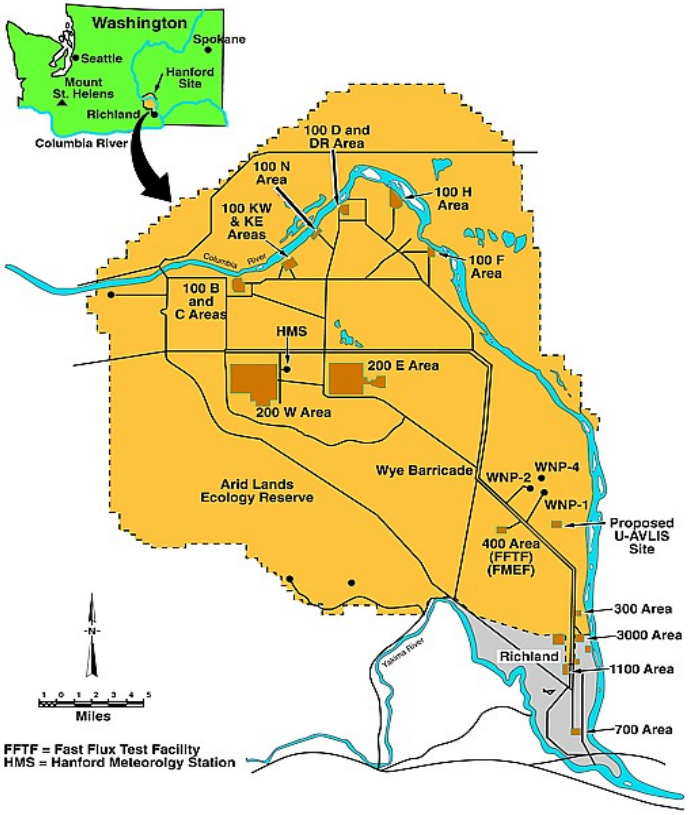
Pacific Northwest National Laboratory (PNNL)

We are located in the South Central area of Washington State.



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- $855 million business volume
- >4,000 staff

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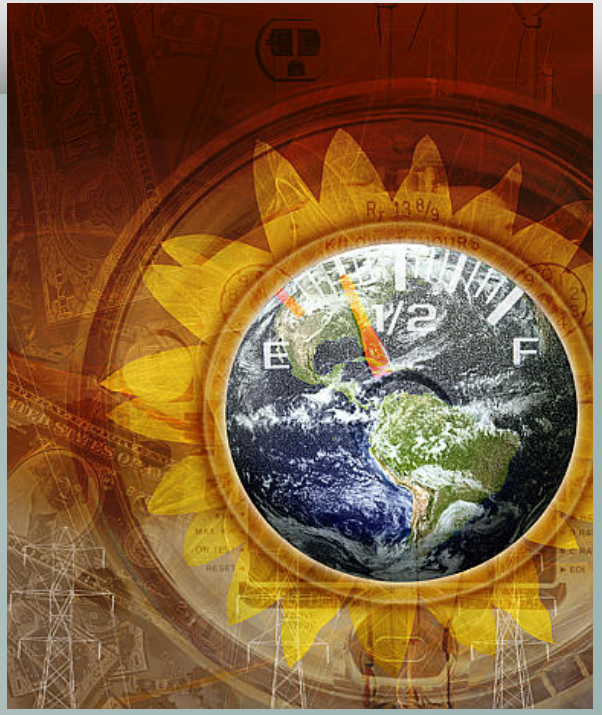
What We Will Talk About…

- Share ideas that have worked for PNNL that you can use for your facility
- PNNL's program good/bad the past few years
- Corporate recognition that utility bills are a large expenditure and always have efficiency opportunity (but need $$ support to receive the returns ☺)
- You need to know your own business (type of building use {lab operations, power house, office building, etc.}, utility rates, providers)
- Develop a plan with a mission/vision/goals
- The ability to measure progress

PNNL's Five Key Program Strategies

Conserving Energy and Water



- Emphasizing conservation
- Modernizing infrastructure
- Diversifying energy supplies, including renewables
- Recommissioning of facility systems continually
- Collaborating/communicating best practices, successes and challenges

Now It Is Time For Action

- We started with open communication to staff including:
  - What the Laboratory goals are and where we stand today
  - Methods to increase awareness to staff on how to conserve at the Lab and at home
  - Presentations at staff meetings
  - Created a web page
  - Had information submitted in weekly newsletters
  - Held monthly meetings with just the Facility Managers to show progress/or not toward goals

How Staff Affect Our Energy Use

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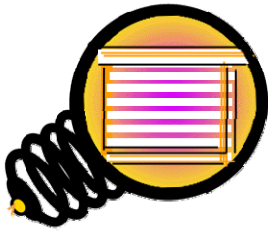
What Can You Do to Conserve at the Office?

- Think conservation
- Turn off lights when leaving any room
- Adjust window shades to utilize sources of natural light
- Turn off monitors and printers when leaving office for more than a few minutes



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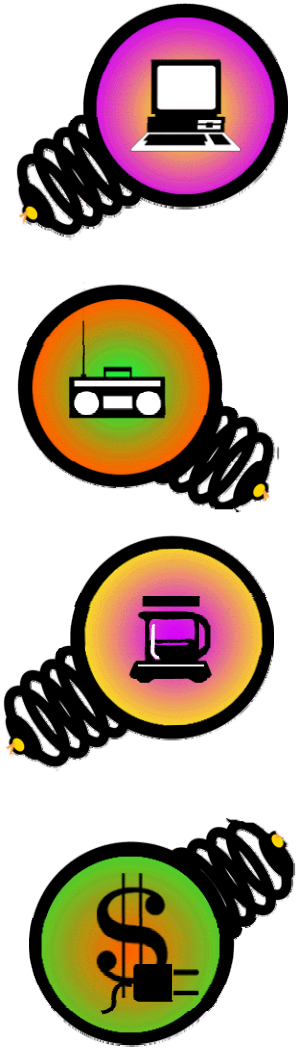
What Can You Do to Conserve at the Office?

- Turn off computer when leaving for the day unless there is an overriding reason not to, such as backups
- Turn off appliances when leaving for the day: coffee pots, radios, space heaters, etc.
- Purchase energy efficient equipment



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Mascots For Monthly Energy and Water Tips

Wally Watt

Wanda Water

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Then Came The Projects…

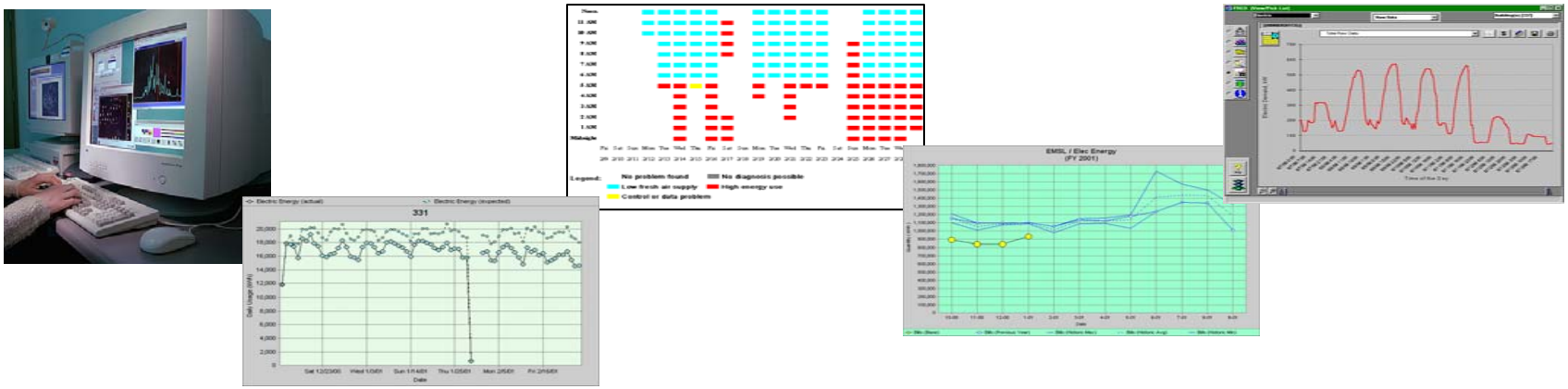
- Water conservation on the grounds
- Re-commissioning (RCx) of facilities
- Electricity reduction contest
- Wattstopper® plug strips/computer monitor settings
- Energy audits of selected facilities
- Using technology
- Purchasing of green power

Water Conservation

- PNNL Grounds Management applies science to its landscaping challenges by reducing the Laboratory's water use with technology on the watering systems, monitor soil moisture, and fertilize with only required chemicals.
- The Laboratory has reduced its river water use by more than 35 percent on the PNNL campus.
- Water used for PNNL facilities was reduced by installing low-flow urinals, automatic infrared sink faucets, and infrared flushometers; replacing single-pass equipment cooling with more efficient technologies.

Re-commissioning (RCx)

- Implemented no-cost, low-cost RCx campaign
  - Earned FEMP and DOE Departmental awards multiple years
  - Use commercial and PNNL developed tools



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Why Do We Need To RCx?

- PNNL buildings were initially commissioned within expected design parameters and energy consumption…
- PNNL O&M and building management personnel felt there were opportunities for improvement and were willing to challenge the status quo.

What is RCx?

- RCx is a systematic process to improve the operation of existing building systems so that they actually meet needs and use only as much energy as is really necessary.
- The PNNL RCx process began with the generation of an energy management opportunities (EMO) listing.
- The foundational checklist for PNNL's internal RCx evolved from the database of the Industrial Assessment Center, sponsored by the U.S. DOE Office of Industrial Technologies' Office of Industrial Productivity and Energy Assessment (OIPEA) program.

EMSL Chosen for our Case Study

- Environmental Molecular Sciences Laboratory
  - ~225,000 ft2, 460,000 Btu/ft2 consumed annually
  - EMSL is 25% of PNNL's total energy consumption
  - Newest facility on campus opening in 1997 for DOE research as a User Facility

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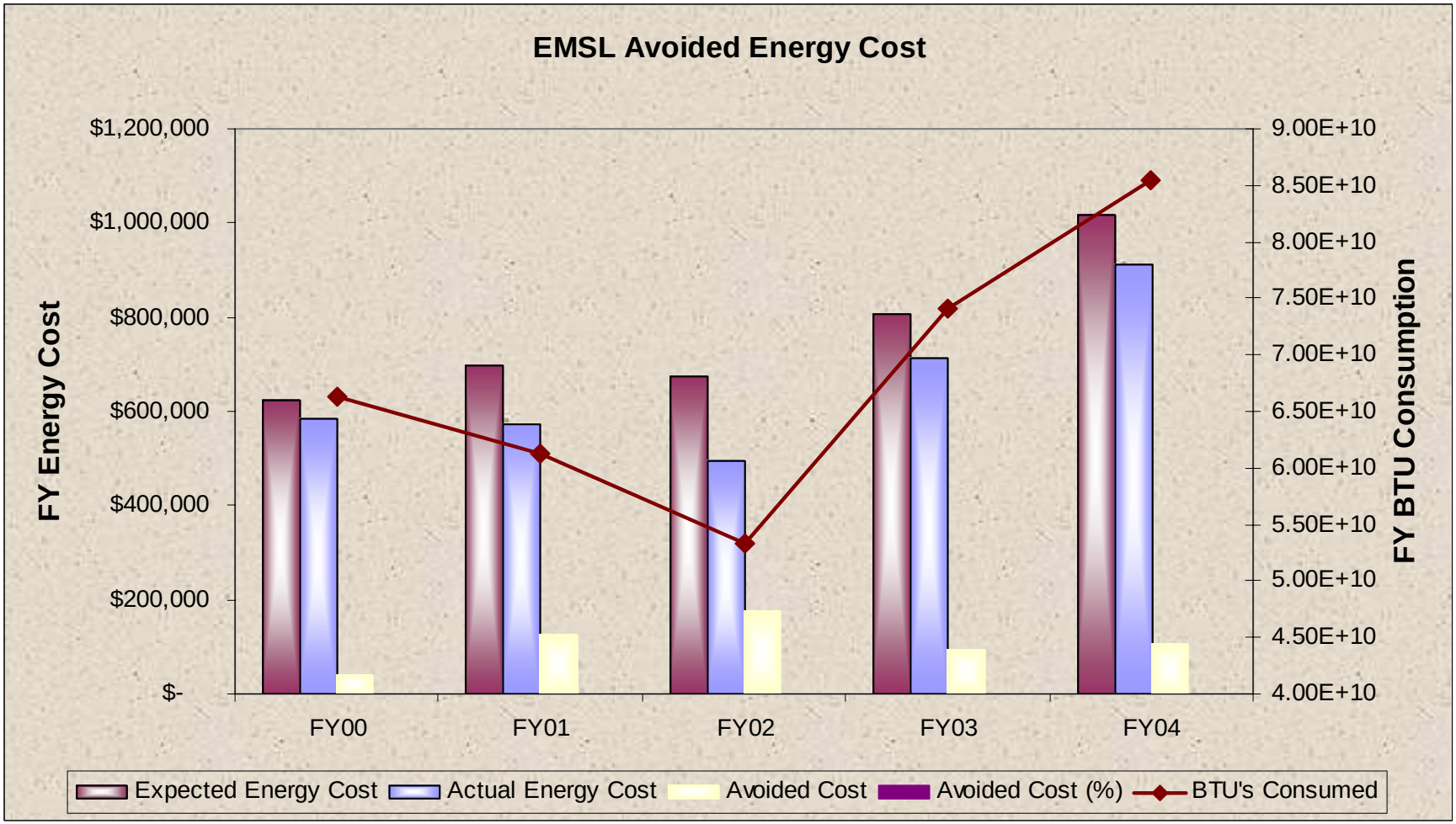
RCx Strategies Implemented at EMSL

- No-Cost/Lost-Cost Energy Savings Strategies
  - Adjusted building/system temperatures
  - Fine-tuned heating, ventilation, and air–conditioning systems
  - Implemented night setbacks
  - Turned off lights not needed during dayshift and after hours
  - Automated control of stand-alone electric heaters
  - Reprogrammed digital controls to shutdown heating/cooling water loops based on outdoor air temperatures
  - Cleaned white roof to increase solar reflectance
  - Appointed staff to seek more operational improvements

What are the Benefits of RCx?

- Building management and the RCx team are involved in all phases of building operation, allowing all aspects of building operation to be reviewed for energy conservation from design through procurement, operations and maintenance.
- Many of the implemented EMOs have resulted in a reduction in equipment operating hours, increasing equipment life-cycles and reductions in required maintenance.

EMSL Measured Performance



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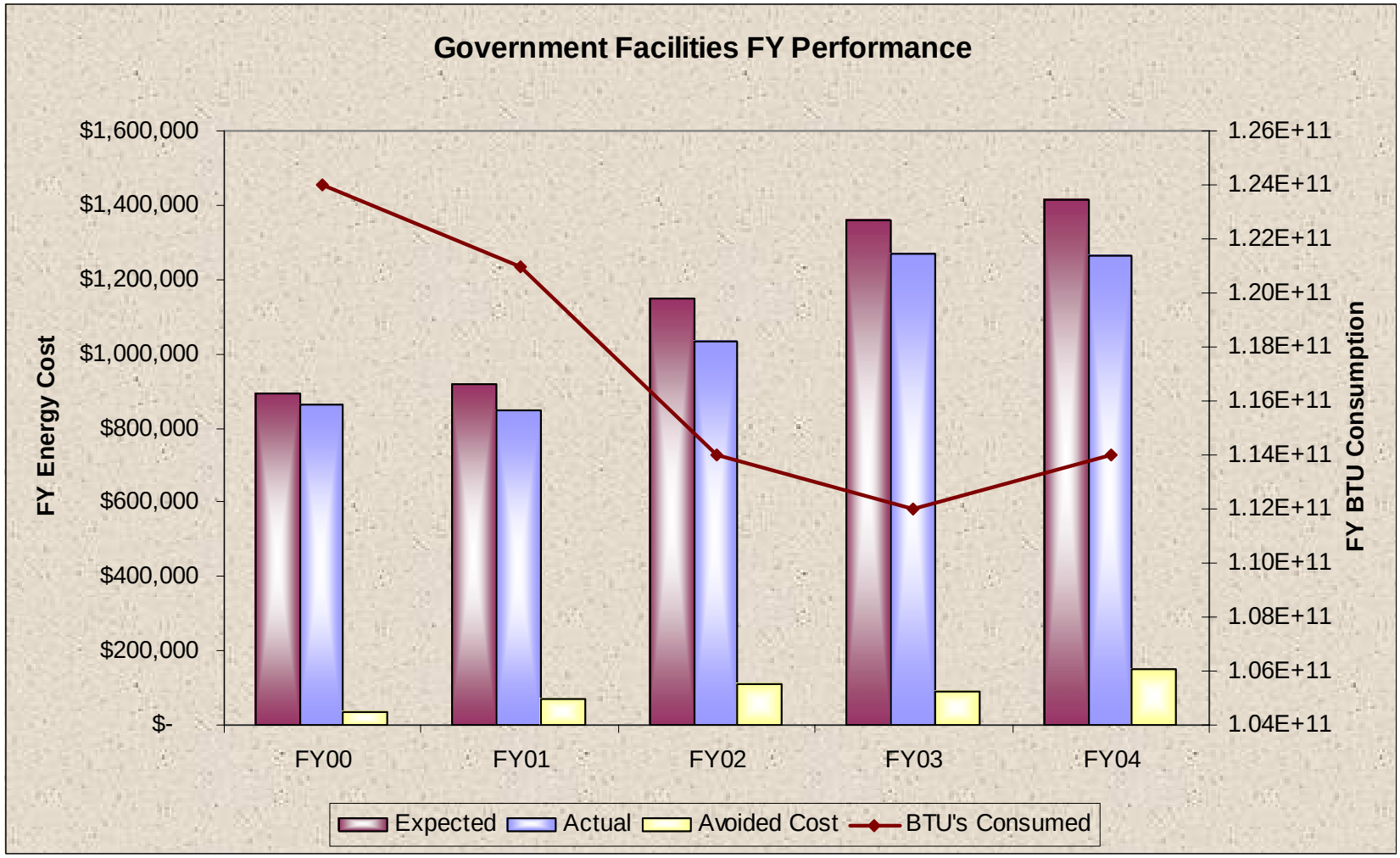
Other Building Performance



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Intelligent Building Controls - Microsoft Internet Explorer

Back Search Favorites History

File Edit View Favorites Tools Help

Address http://bp/welcome.html Go

Show my favorites only

Facilities

- PNNL
  - Battelle-Richland Campus
  - Battelle-Sequim Campus
  - 200 East Area
  - 300 Area
    - 303C
    - 303J
    - 305B
    - 306W
    - 314
    - 318
    - 320
    - 323
    - 325
    - 326
    - 329
    - 331
      - 331BA
    - 331C
    - 331D
    - 331E
    - 331G
    - 331H
    - 332
    - 336
    - 337
    - 338
    - 350
    - 3020 (EMSL)
    - 3614A
    - 3708
    - 3718A
    - 3718B
    - 3718E

331 Building

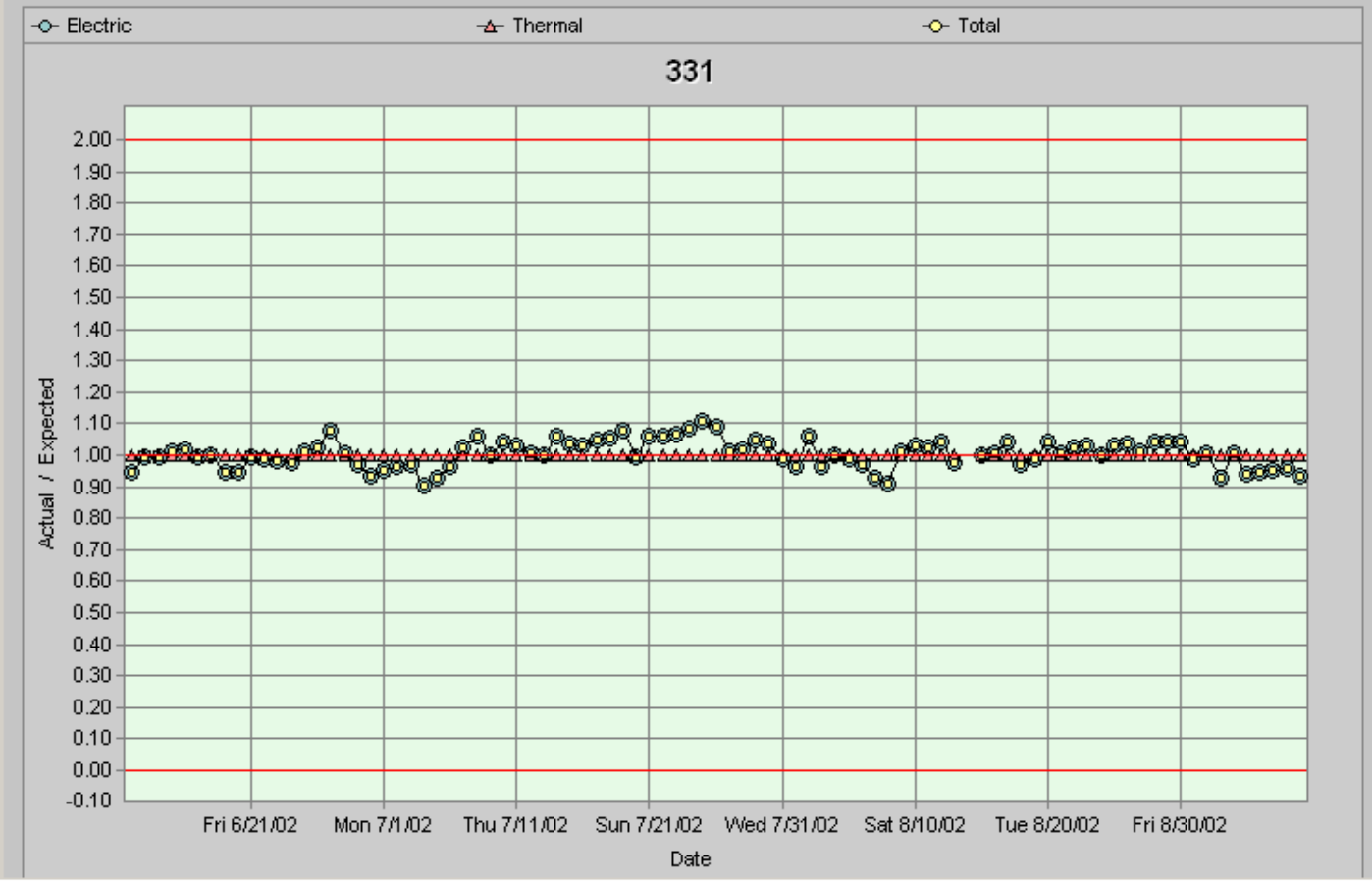
PNNL Billings | Service Intensity | Building Info | Electric Data | Diagnosis | Sub-Metering

Months 3 7-day ticks ECI

Prev Next Today

start end Special

Traces	Baseline
Electric	1/1/98
Thermal	to
Total	11/26/01



Done Local intranet

Intelligent Building Controls - Microsoft Internet Explorer

Back Search Favorites History

File Edit View Favorites Tools Help

Address http://bp/welcome.html Go

- 303J
- 305B
- 306W
- 314
- 318
- 320
- 323
- 325
- 326
- 329
- 331
- 331C
- 331D
- 331E
- 331G
- 331H
- 332
- 336
- 337
- 338
- 350
- 3020 (EMSL)
  - Air handlers
    - Ahu-6
    - Ahu-7
    - Ahu-8
    - Ahu-9
    - Ahu-10
    - Ahu-11
    - Ahu-12
    - Ahu-14
- 3614A
- 3708
- 3718A
- 3718B
- 3718E
- 3718G
- 3718P

326 Building

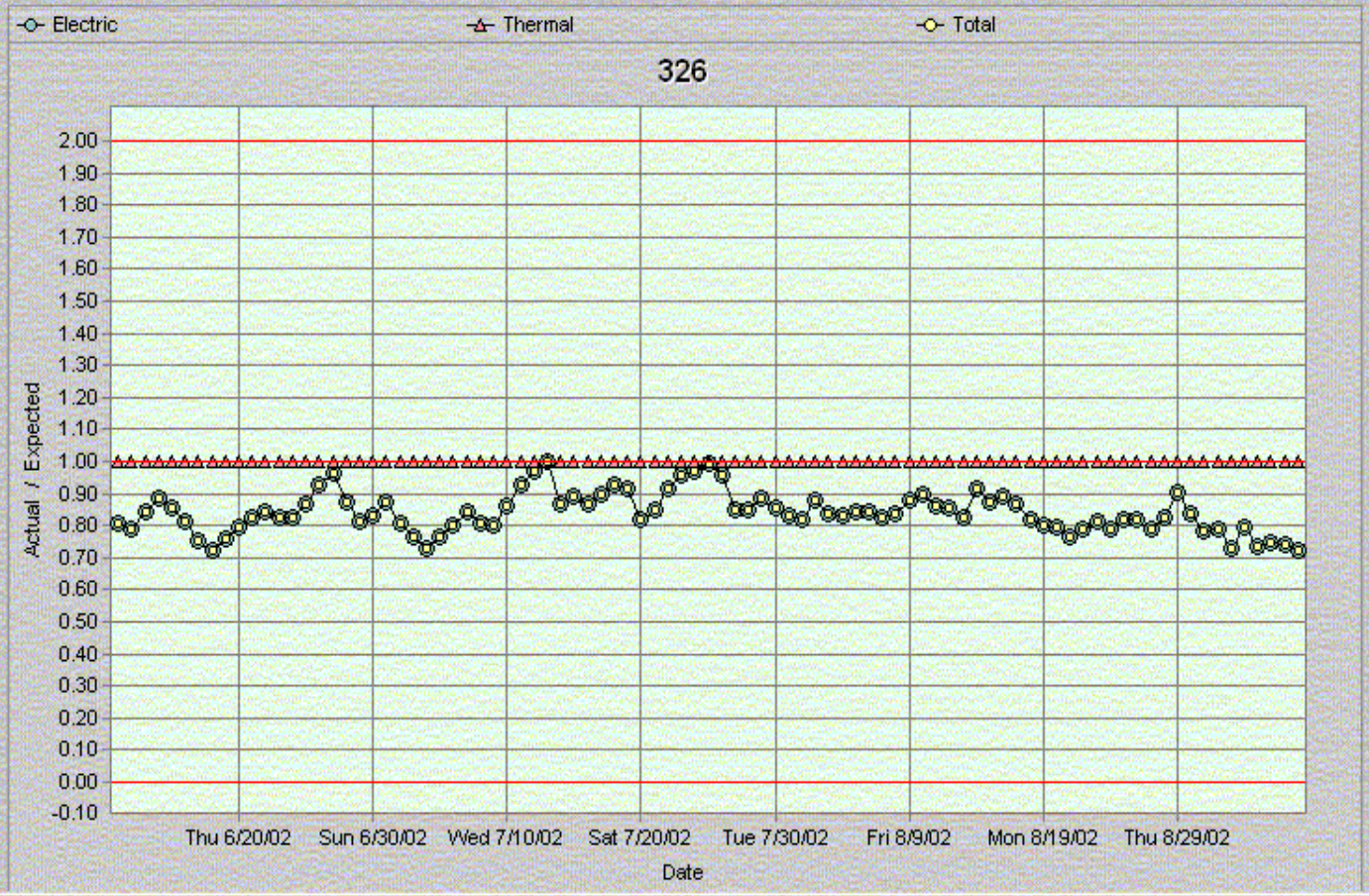
PNNL Billings | Service Intensity | Building Info | Electric Data | Diagnosis | Sub-Metering

Months 3 7-day ticks ECI

Prev Next Today

start end Special

Traces	Baseline
☑ Electric	3/1/99
☑ Thermal	to
☑ Total	2/28/00



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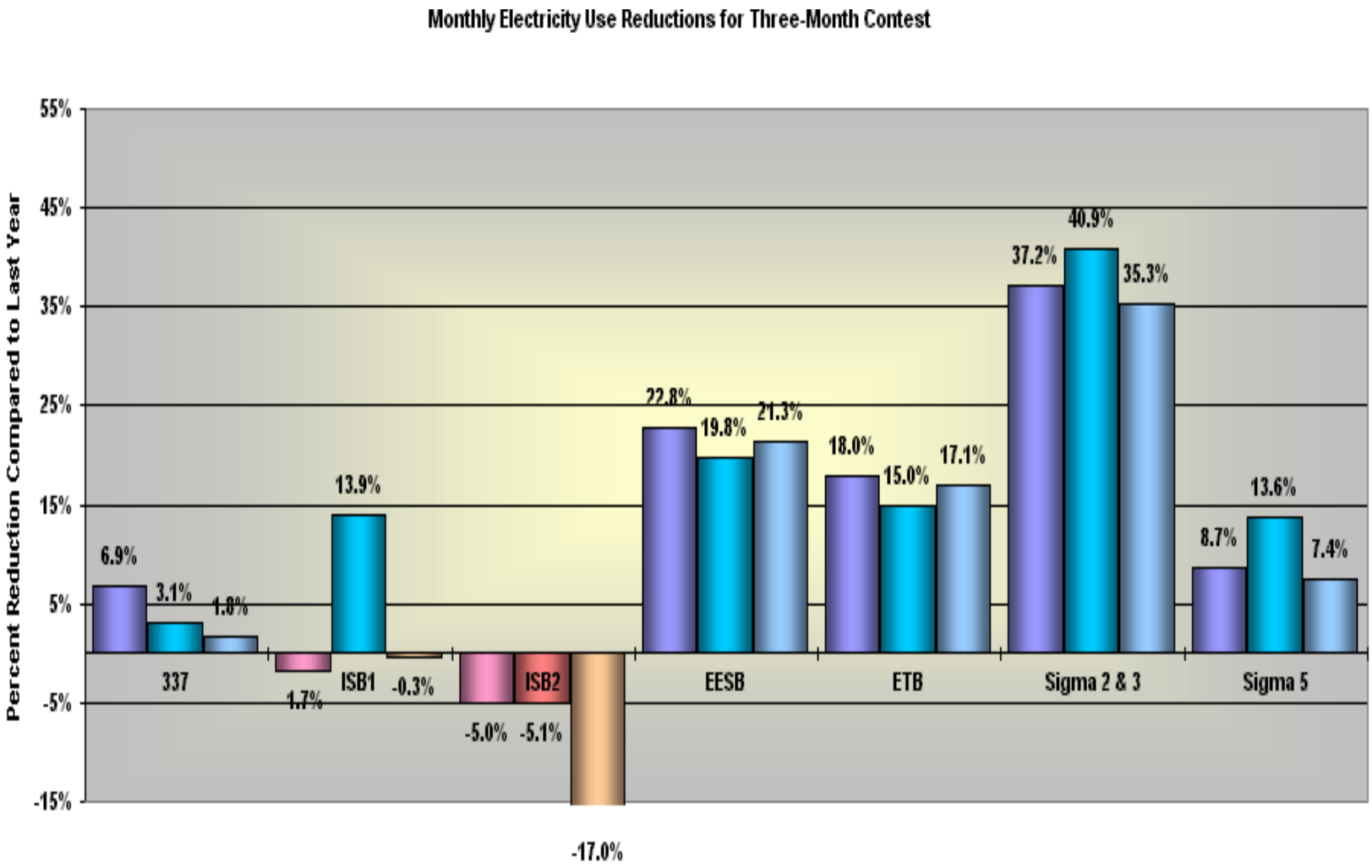
Then We Decided To Have A Contest

- We chose 8 office buildings and used the previous year actual consumption as the baseline
- We reminded staff to practice the strategies mentioned earlier (lights, computers, etc.)
- We held the competition for three consecutive months during the winter (electric heated buildings)
- The winning building occupants received donuts each month and the over all three month winner received a catered lunch!
- We had a 400% ROI and the energy use is still down in most of the buildings

400% ROI



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Energy Audits/Wattstoppers®

- We had a third party come in to perform audits (costs between $0.05-$0.25/sf)
- Audits showed electricity use from plug loads was between 35%-50% of total building consumption
  - Primary cause of this was because PNNL staff average 2.6 computers each
- We partnered with BPA and distributed over 2700 plug strips and encouraged staff to activate standby settings on their monitors (used IT staff and the network to setback)
- Project success = 2.9M kWh reduction, $120K avoided cost the first year, 2.7% reduction/ft**

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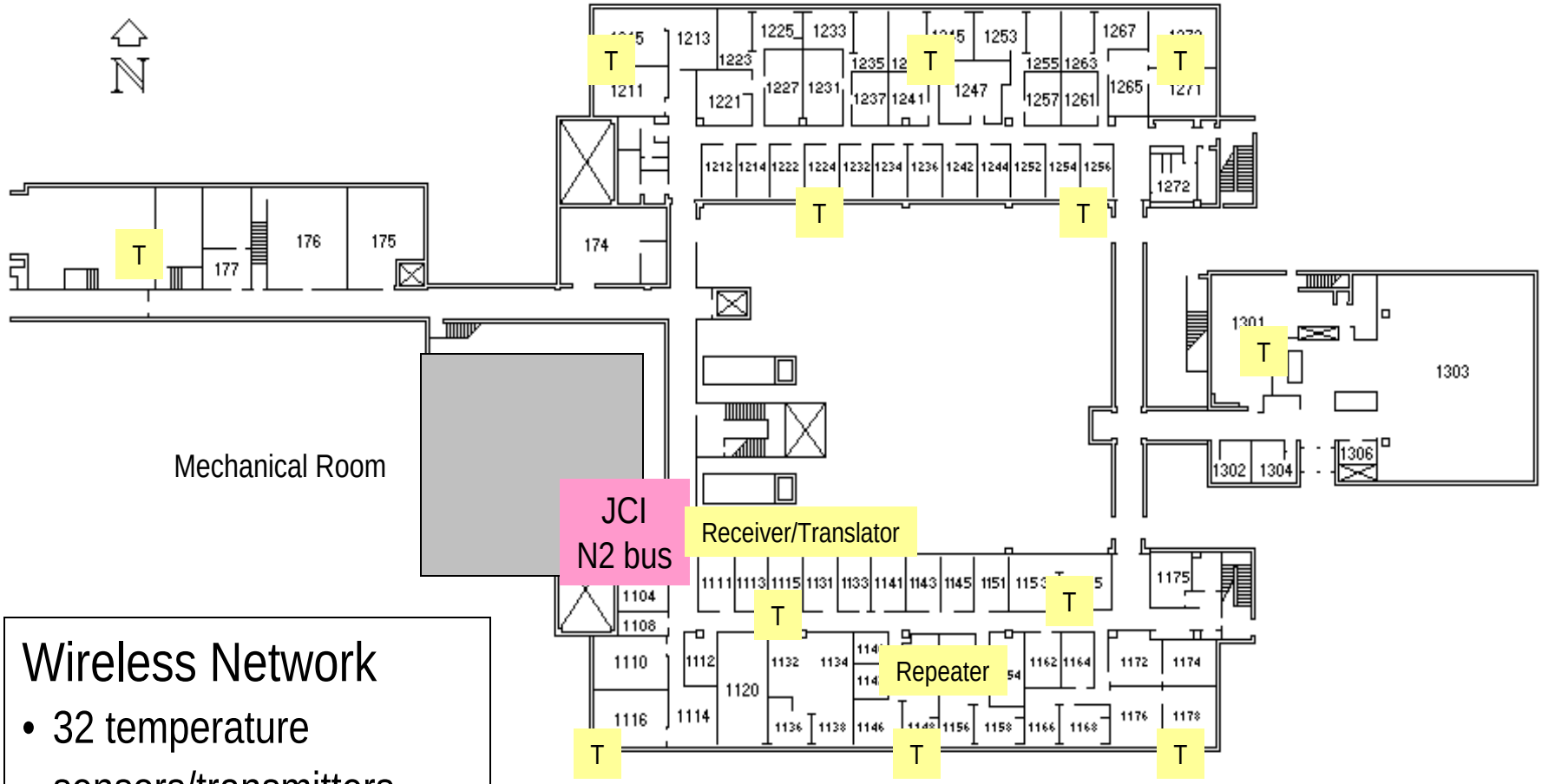
Wireless Network Topology



Wireless Network

- 32 temperature sensors/transmitters
- 3 repeaters

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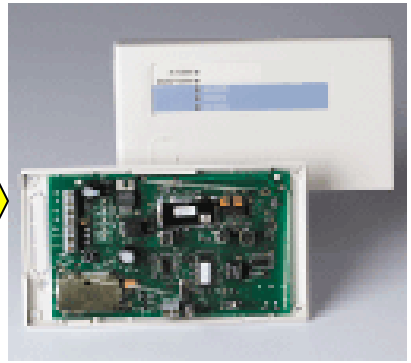
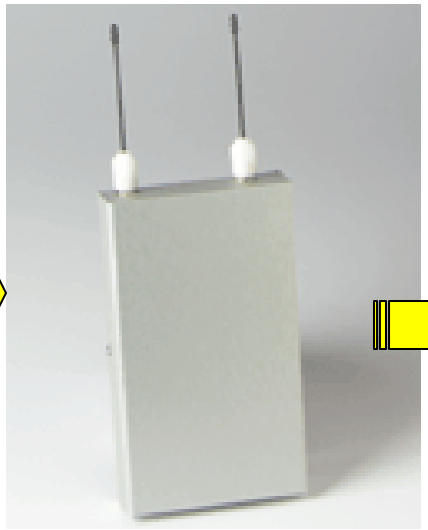
Inovonics Wireless Network at PNNL

Battery-powered Temperature sensors and transmitters

Repeaters



Receiver decodes signals from hundreds of transmitters



JOHNSON CONTROLS EMCS

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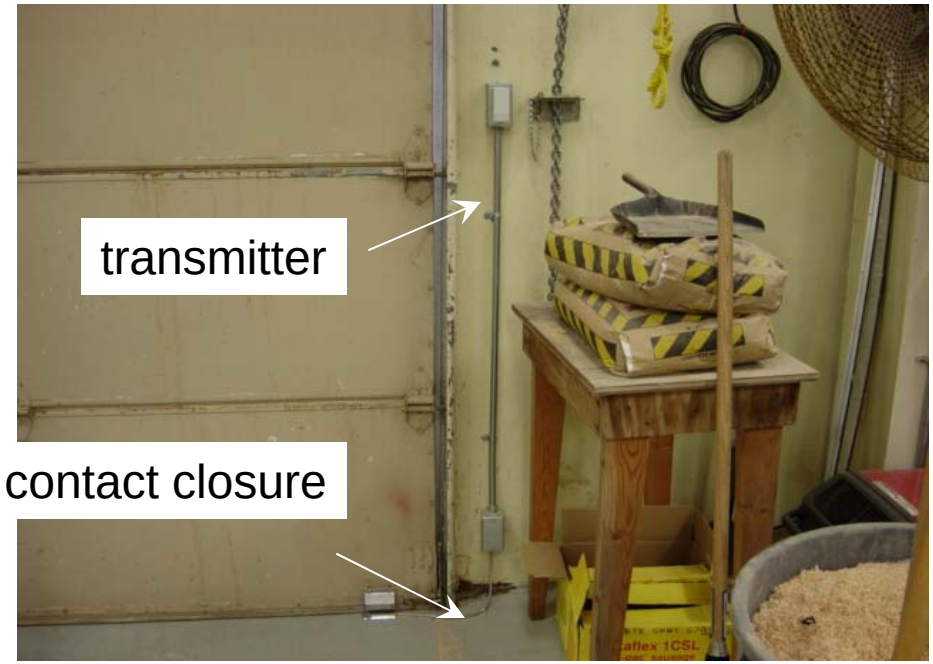
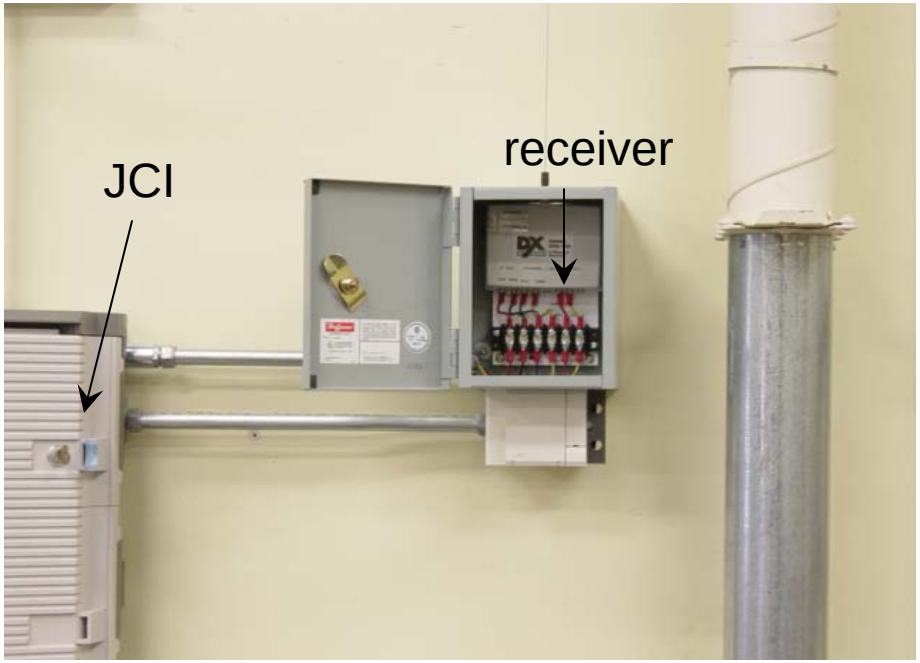
Additional Wireless Technology Being Deployed

- Roll-up door switch tied into room HVAC
- When the door is open the HVAC shuts off, saving energy and run time





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Fueling Alternatives

- PNNL is committed to using environmentally friendly energy sources.
- In 2006, the Laboratory helped bring the first public and government use Ethanol-85 and Biodiesel-5 station to eastern Washington.
- In 2006, PNNL became the first laboratory to use biofuel on such a large scale.
- Biodiesel became the alternative fuel source to power the large-scale boilers and back-up generator at the Environmental Molecular Sciences Laboratory.
- ~10% of PNNL electricity is NW wind/small hydro/landfill gas

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Green Purchasing Through PNNL's Business-to-Business (B2B) Program

B2B is a 100% paperless, electronic process for purchasing routine, commercial-off-the shelf items such as office products, computer hardware and lab equipment. Users "punch-out" to supplier-hosted web catalogs containing PNNL approved items.

- B2B suppliers only offer items in accordance with the Federal Executive Order for purchasing items containing recycled content (i.e. copy paper, paper products and toner cartridges)
- All computers and monitors are Energy Star and EPEAT certified
  - All computers are imaged with the PNNL image which has the "Energy Savings" setting enabled
- H2Orange2 Green Custodial chemicals
- Misc
  - Annual supplier meetings to encourage green initiatives
  - Portion of internal B2B website dedicated to Green issues
  - Quarterly newsletters highlighting Green issues (sent electronically to users!!!)
  - Obtain samples of new-to-the market Green items and distribute to users

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Conclusion

- Facility Managers have learned that making conservation and energy efficiency key elements of its Energy Plan is not difficult but it takes coordination, perseverance, and education of staff
- PNNL demonstrated that hardware upgrades and human leadership are both effective ways to save energy; however, the synergy created by combining both strategies has had the greatest impact on the bottom line

Questions?

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