Better Buildings
U.S. DEPARTMENT OF ENERGY

Taming the Energy Hog:

What Every Organization Should Know to Address Data Center Energy Use

November 3, 2015

3:00-4:00 PM ET

U.S. DEPARTMENT OF ENERGY

Overview and Agenda

- Welcome
- Overview – U.S. Department of Energy
- Case Study – The Home Depot
- Case Study – Michigan State University
- Additional Resources
- Question & Answer Session

Today's Presenters

Name		Organization
John Clinger		ICF International
David Oshinski		The Home Depot
Bill Lakos		Michigan State University

John Clinger

ICF International, Supporting U.S. Department of Energy Data Center Program

U.S. DEPARTMENT OF ENERGY

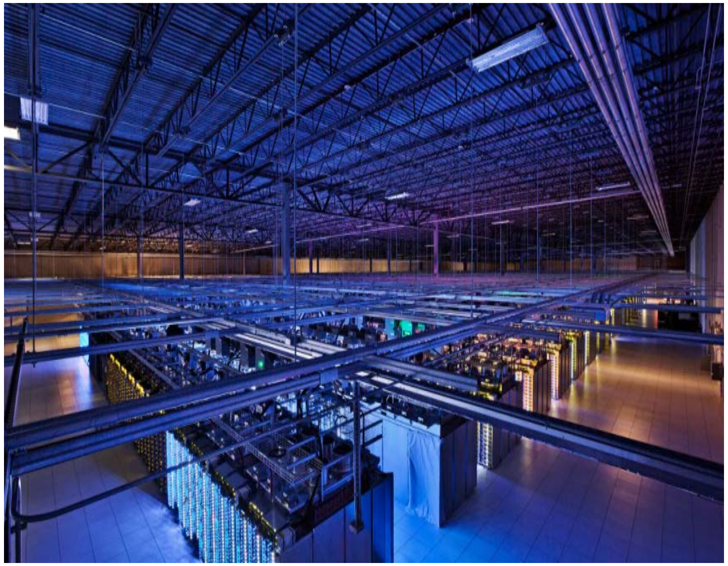
Data Center Better Buildings Initiative:

Making the Case for Energy Efficiency Improvements and Solutions

U.S. DEPARTMENT OF ENERGY

What is a Data Center?

- A room or building that houses computer systems and associated components (e.g. servers, telecom equipment, storage etc.)
- The Better Buildings Program is generally focused on areas with an IT load of 100 kW or greater.



Data Center Energy Context

- Data centers are an important opportunity
  - 10 to 100 times more energy intensive than an office
  - Server racks now designed for more than 25+ kW each
  - Surging demand for data storage
  - Over 2% of US Electricity consumption used by data centers
  - Embedded data centers found in many building types and sectors
  - Power and cooling constraints in existing facilities
  - Cost of electricity and supporting infrastructure now surpassing capital cost of IT equipment in data centers
  - Perverse incentives -- IT and facilities costs often separate, common lack of communication and planning persists

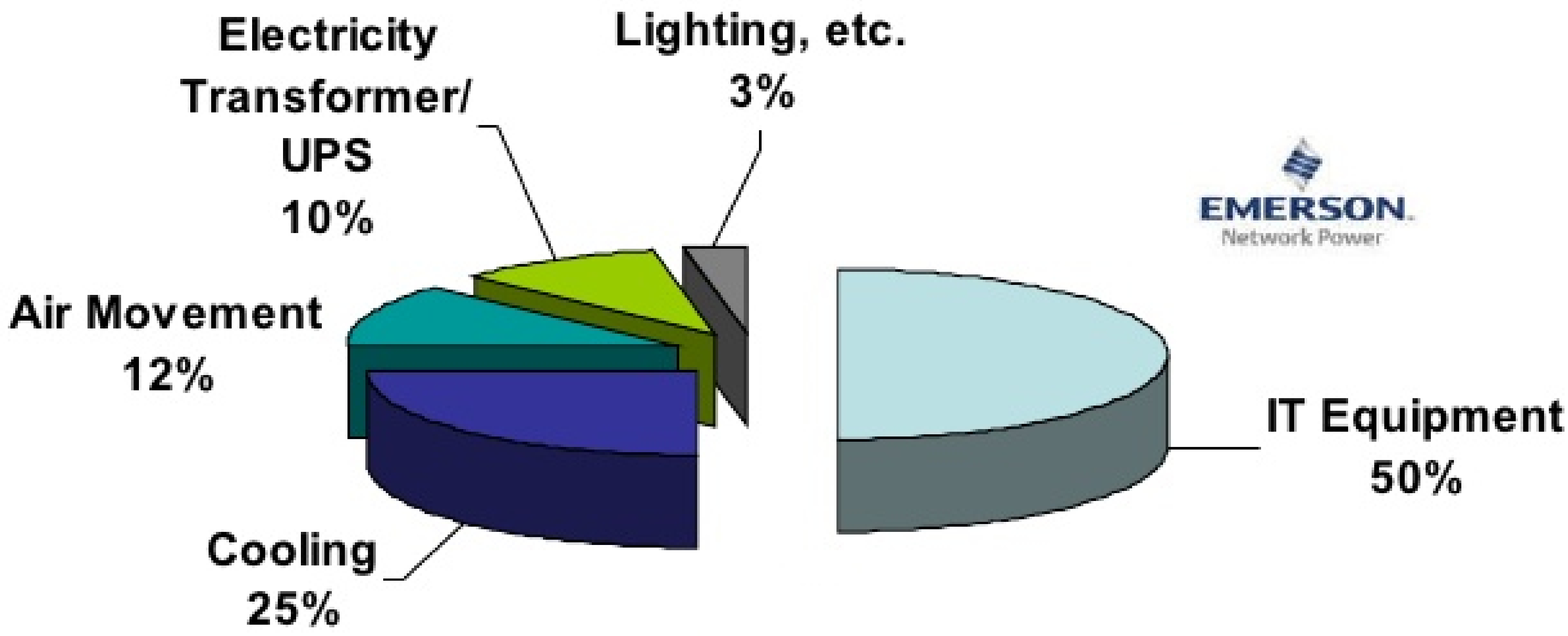
Benefits of Data Center Optimization

- Increased reliability
- Reduced IT equipment requirements
- Reduced facility/infrastructure requirements
- Reduced staffing/maintenance
- Potential 20% to 40% reductions in energy cost with short ROIs

Why Focus On Infrastructure Improvements?

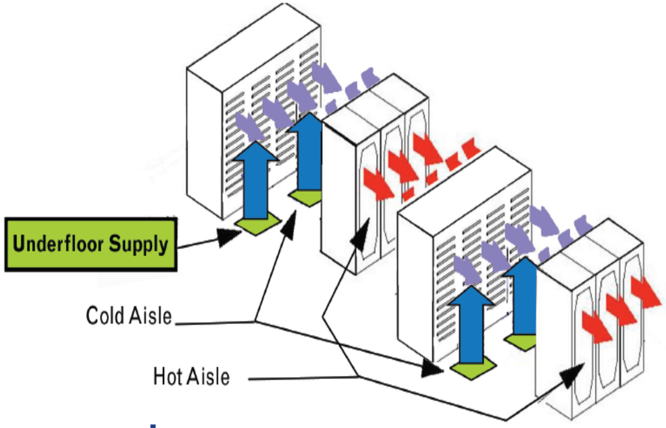
- Infrastructure energy accounts for half or more of most target data centers and is often a more complex process to undertake than improving IT equipment, particularly in multi-use buildings
  - Metering and monitoring issues
  - Sizeable initial capital investment may be required
- IT equipment energy efficiency naturally improves with each new generation and refresh, so it is not the focus, but it is encouraged!

Infrastructure vs. IT Energy In Data Center



Common Solutions for Improving Infrastructure

- Improving air management and cooling
  - Hot/cold isles and containment
  - Blanking panels
  - HVAC unit and fan efficiency
  - Alterative cooling strategies
    - Outside air and water-side economizers
    - Liquid cooling
  - Adjusting temperature and humidity set points
  - Optimizing under-floor pressures when applicable



- Electrical efficiency improvements
  - Increase distribution voltage
  - Improve circuitry to UPSs

Data Centers: How to Partner with DOE

Organizations that own and or operate data centers can partner with DOE to lead by example in one of two ways:

Better Buildings Challenge

Partners commit to reduce the energy intensity of their whole building portfolio (including data centers) by at least 20% within 10 years and share their results.

Better Buildings Data Center Accelerator

Partners commit to reducing the energy use of at least one data center (IT load ≥ 100 kW) by at least 25% within 5 years and share their results.

How Is Progress Tracked?

- DOE collects data center PUE data annually through portfolio manager
  - $$PUE = \frac{Total\ Data\ Center\ Facility\ Power\ or\ Energy}{IT\ Equipment\ Power\ or\ Energy}$$
- DOE calculates portfolio PUE-1 (infrastructure energy intensity) from the collected PUE data
  - $$PUE - 1 = \frac{Total\ Data\ Center\ Facility\ Power\ or\ Energy}{IT\ Equipment\ Power\ or\ Energy} - 1$$
- Year by year and current vs. base year is tracked for % change in PUE-1
  - $$\%\ Improvement = \frac{(Baseline\ PUE-1)-(Current\ PUE-1)}{Baseline\ PUE-1}$$
- Baseline year can go back as far as three years from joining

What If Current Metering Is Insufficient?

- Estimated PUE baseline may be established
- Partners install metering as part of their participation, then track PUE using metered data
  - Within 12 months for BBC partners
  - Within 18 months for Accelerator partners
  - Technical assistance available to partners from Lawrence Berkeley National Lab

Participation Benefits

- Recognition for leadership
- Results profiled and promoted
- Best in class technical assistance
- Working with other leaders
- Capture value proposition

Data Center Partner Roster

Defense Information Systems Agency
Department of Veterans Affairs, United States of America
U.S. Justice Department, Drug Enforcement Administration
United States Environmental Protection Agency
Social Security Administration
NASA
United States Army
The Great Seal of the State of Michigan

The Home Depot
ebay
Digital Realty Data Center Solutions
facebook
io
intel
Michigan State University
Sabey Data Centers
Schneider Electric
Staples that was easy®
Indiana University
virtustream Enterprise Class Cloud
Stanford University
NERSC
Berkeley Lab Lawrence Berkeley National Laboratory
Argonne National Laboratory
Lawrence Livermore National Laboratory
Los Alamos National Laboratory EST. 1943
EMSL
NREL National Renewable Energy Laboratory

David Oshinski

The Home Depot

U.S. DEPARTMENT OF ENERGY

Corporate America Data Center Initiatives Starting to See the Benefits

David G. Oshinski
The Home Depot
November 3rd, 2015

Atlanta Location and Size

- 39,000 sq. floor out of a 1.7 million sq. ft. set of buildings

Austin Location and Size

- **120,000 sq. ft. building with offices and call center**
- **Data Center 53,000 sq. ft. of building**

ISSUES

Atlanta Store Support Center

- Cold air flowing 24/7
- Heat Exchanger not working
- Continually adding new equipment increasing energy load

Austin Data Center

- 15 year old air cooled units
- No backup system.
- Economizers not working
- Old R22 refrigerant in units

The Fix Atlanta

- **Install Cold Aisle Containment**

- **Install Cold Aisle Containment**

Experian
A world of insight

REPAIR THE HEAT EXCHANGER

The Fix Austin

- Decommission 19 DX Units

- Install One 800 Ton Water
- Cooled Chiller Tower

REPAIR ECONOMIZERS

The Fix Austin

- **Install Central Plant**

- **Install 3 Back-up**
- **450 ton Air Cooled Chillers**

BACKUP WILL BE N + 2

How We Did It

- Had Consultants do a Study
- Requested Funding From Leadership
- 2 Separate Projects, 2 Separate Requests
- Atlanta Went to Corporate Facilities
- Austin Went to IT

Expected Completion

- **Atlanta is complete, Except***
  ***We are always adding new equipment.**

- **Austin on line 10/1/15, starting to collect data.**

- **Working through separate metering.**

We have seen significant savings in energy at Atlanta

Bill Lakos

Michigan State University

U.S. DEPARTMENT OF ENERGY

Taming the Energy Hog:

What Every Organization Should Know to Address Data Center Energy Use

Bill Lakos

Energy Analyst

MSU IPF Planning Design and Construction

Background Information

Michigan State University – East Lansing, MI

Mission:

Michigan State University Spartans work every day to advance the common good in uncommon ways. Together we tackle some of the world's toughest problems to find solutions that make life better.

Background Information

Michigan State University – East Lansing, MI

Statistics:

- 49,350 Students
- 11,110 Faculty & Staff
- 5,200 acre campus with 2,100 acres in existing or planned development
- 538 buildings, including 95 academic buildings
- Own and operate 100MW co-generating power plant (steam and electricity)

Background Information

Michigan State University – East Lansing, MI

Better Buildings Challenge Data Center Commitment:

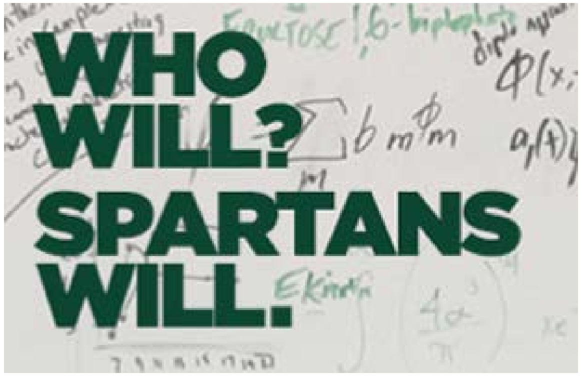
- Two major facilities
- 5,900 Sq. Ft.-700kW Total Load
- Campus Administration
- High Performance Computing Center
- Back Up Facility

Data Centers are Critical Infrastructure

Infrastructure needed to support the:

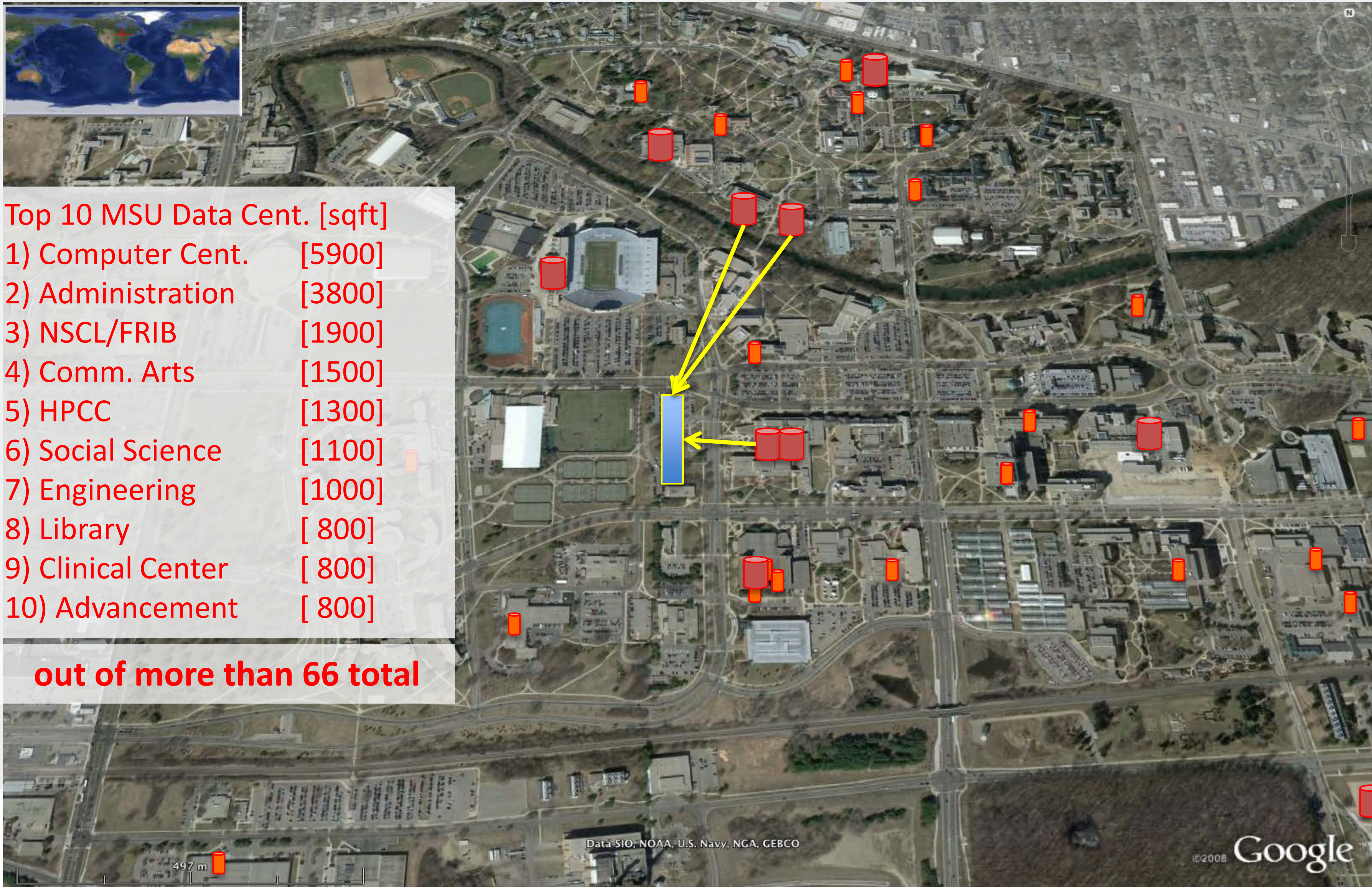
- Academic mission of the University
- Operational needs of the University
- Research needs of the University

Spartans will find a solution.



Existing Landscape:

MICHIGAN STATE UNIVERSITY



MSU Campus (consumes 28-61 MW electricity, total annual energy input: ~ 6 BCF gas)

MSU Data Center Census

Over 1000 square feet:

- 7 facilities

Under 1000 square feet:

- 45+ facilities

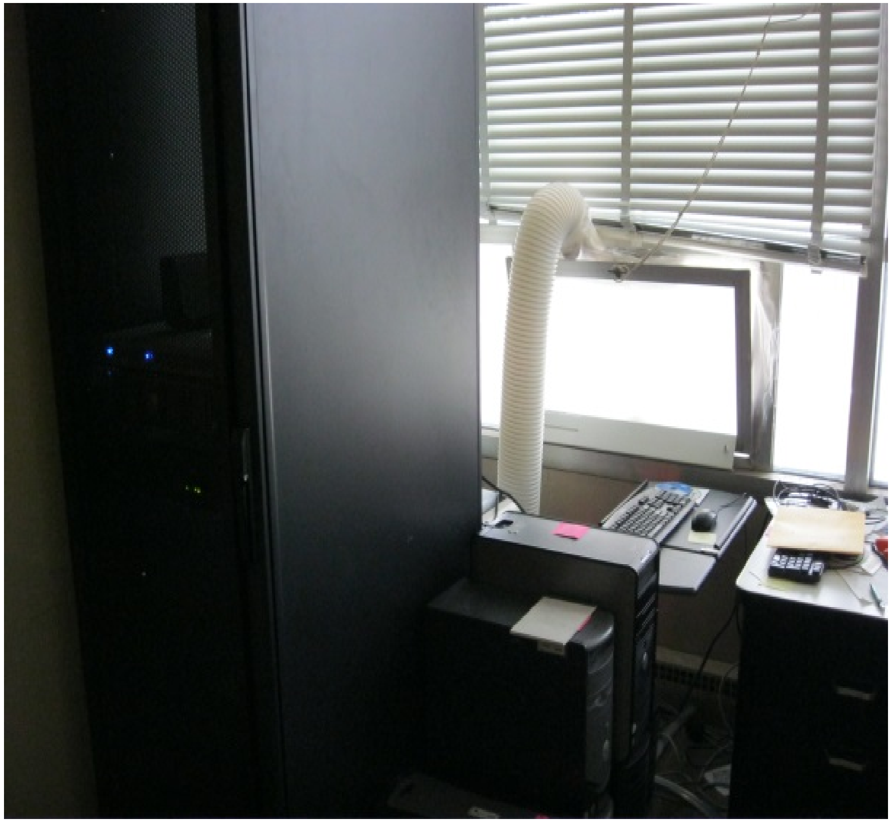
Under 100 square feet (server closets):

- 12+ facilities

Multi-use space (office and server room)

Clever (?) "free cooling" option

Multi-use space (office and server room)



Clever (?) solution for heat rejection

University Goal

Centralized Solution (first step):

- Combine two major data centers into a single purpose-built facility
- Direct In-door / In-rack Cooling
- Determine the optimal mix of local, remote, and cloud based IT solutions

Project Status

- RFP issued for project development to firms or teams with experience designing, engineering, and managing the construction of data centers

Challenges/Barriers

- Balance future operation cost savings with need for initial investment
- Create trust relationships between Administration, Facilities, Academia, and IT

Anticipated Outcome

- Target PUE < 1.3 from current > 2.2
- Reduction of energy use by 40%
- Avoided consumption of 10,000 MWh per year
- Utility savings of approximately $1 million
- Avoid outages due to failures
- Future integration opportunities with additional data centers on and off campus (other universities, State of Michigan, etc.)

Additional Resources

U.S. DEPARTMENT OF
ENERGY

For More Information

U.S. Department of Energy

- DOE Center of Expertise for Energy Efficiency in Data Centers

The Home Depot

- Better Buildings Partner profile

Michigan State University

- Implementation Model: Integrated Model for Long Term Campus Energy Planning
- Better Buildings Showcase Project: Anthony Hall
- Better Buildings Showcase Project: Erickson Hall

Q & A

U.S. DEPARTMENT OF ENERGY

Join us for the next Better Buildings Webinar

Registration is now open!

Plug into Energy Savings: Strategies and Resources for Reducing Plugload Energy Use in Your Buildings

December 1, 3:00 – 4:00 PM ET

Presenters:
Rois Langer – National Renewable Energy Lab (NREL)
Jason Sielcken - The General Services Administration (GSA)
Moira Hafer – Stanford University

Register here.

Better Buildings®
U.S. DEPARTMENT OF ENERGY

2016
SAVE THE DATE
BETTER BUILDINGS SUMMIT

WASHINGTON, DC ▪ MAY 9–11



U.S. DEPARTMENT OF
ENERGY

Additional Questions? Please Contact Us

betterbuildingswebinars@ee.doe.gov

Today's Presenters	John Clinger ICF International john.clinger@icfi.com David Oshinski The Home Depot david_g_oshinski@homedepot.com	Bill Lakos Michigan State University wjlakos@ipf.msu.edu
DOE Program Leads	Holly Carr DOE, Better Buildings Challenge holly.carr@EE.Doe.Gov	DOE, Data Center Program datacenterpartners@ee.doe.gov
Program Support	Kendall Sanderson JDM Associates ksanderson@jdmgmt.com	Holt Mountcastle JDM Associates hmountcastle@jdmgmt.com

Follow us on Twitter @BetterBldgsDOE