Better Buildings Alliance
Plug and Process Loads (PPLs) Team Webinar
Technical Lead: Dr. Kim Trenbath, NREL
May 25, 2021
Plug and Process Loads (PPLs) Technology Research Team

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Agenda

BBA PPL Team Update

Technical Presentation – Dr. Mustapha Beydoun, Dr. Gavin Dillingham, and Dr. Carlos Gamarra, Houston Advanced Research Center
“Getting to Net Zero Energy Through Strategic Building Operations and Plug Load Management”

Q&A

Member Updates
BBA PPL Team Update
PPL Resources for Building Owners

https://betterbuildingssolutioncenter.energy.gov/alliance/technology-solution/plug-process-loads

- Guides for assessing and reducing plug loads
- Fact sheets (i.e. plug load disaggregation)
- *NEW* Utility incentives
- Recorded webinars
- Case studies
Assessing and Reducing Plug and Process Loads in Retail & Office Buildings

Designate a PPL champion
Choose someone who understands PPL systems and can work with all teams to implement system controls.

Institutionalize PPL reduction practices
Formalize and incorporate PPL energy-saving tactics into building policies (see guide for examples).

Establish the business case for PPL reduction
Utilize available resources to demonstrate the potential energy and financial savings from PPL reduction.

Educate employees on the benefits
Educate employees on the benefits of PPL reduction to realize improvements and prevent misuse.

Access the Retail Guide at:
https://www.nrel.gov/docs/fy20osti/76998.pdf

Access the Office Guide at:
https://www.nrel.gov/docs/fy20osti/76994.pdf
Smart Outlet Fact Sheet

• Smart Outlets: Wireless Meter and Control Systems for Plug and Process Loads

• Access at:
  https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/77971.pdf
Plug Load Management System Emerging Technologies


Recently updated! PPL Utility Incentives List

Use the List to Sort by:

- Incentive sponsor
- State
- Type of incentive

Access the PPL Incentive List under the Featured Solutions on our webpage

Better Buildings Beat Blog Post coming soon!
Check Out Our PPL Recorded Webinars!

Access PPL webinars from -

- PPL Website at: https://betterbuildingssolutioncenter.energy.gov/alliance/technology-solution/plug-process-loads

- On-Demand Better Buildings Webinars webpage.
Technical Presentation
Dr. Mustapha Beydoun
Houston Advanced Research Center

Dr. Gavin Dillingham
Houston Advanced Research Center

Dr. Carlos Gamarra
Houston Advanced Research Center
May 25, 2021

Better Buildings Plug and Process Loads (PPL) Technology Research Team

Getting to Net Zero Energy Through Strategic Building Operations and Plug Load Management

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Gavin Dillingham, Ph.D.
Director, Clean Energy Policy

Carlos Gamarra, Ph.D.
Sr. Research Scientist
• About HARC and the HARC Building
• Energy Management at HARC
• Pre-COVID Plug Load Management
• Plug Load Management During Pandemic Times
• Post-COVID Challenges and Goals
• Q&A
About HARC and the HARC Building
ABOUT HARC

Mission
Providing independent analysis on energy, air, and water issues to people seeking scientific answers.

Programs & Competencies
- Air Quality
- Clean Energy
- Water Resources
- Climate Risk
- Geospatial & Analytics

HARC is a nonprofit applied sustainability research organization established in 1982
Objective non-advocacy approach to finding meaningful answers to complex questions
We engage in research that helps people thrive and nature flourish
HARC’s Headquarters

- First office building certified as Net Zero Energy in Texas.
- Certified LEED Platinum since 2017
- Energy Star 2018 (92/100), 2019 (99/100), and 2020 (99/100)
- Pre-COVID Energy Star score of 99 → more efficient than 99 percent of comparable office buildings across the United States, according to EPA.
- EPA’s Energy Star scores in Texas:
  - 20 office buildings ≥ 98
  - 10 office buildings ≥ 99
Building Awards

- October 2017 - Best Projects Award of Merit by Engineering News Record (ENR) Texas and Louisiana

- Houston Business Journal 2018 Landmark Awards finalist

- 2018 Gold Level (highest level) Association of General Contractors (AGC) APEX Award

- 2019 ULI Houston Development of Distinction award winner.

- 2019 US Green Building Council’s TX Chapter Leadership Awards
  - Project of the Year Winner
HARC Building Goals

Energy Star and LEED Platinum certified

First Operational NET ZERO office building in TEXAS

Battery Storage and Microgrid Capabilities

Zero Energy and Water, Resilient Operations

IoT-based EIS, FDD and control systems. Machine Learning

Real-Time Monitoring, Control and Fault Detection Systems (2024)

Grid-Connected Microgrid (2022)

NET ZERO CERTIFICATION (2020)

LIVING LAB
Energy Management at HARC
HARC’s Internal Dashboards
Energy Goals Achieved

- PV plant solar expansion in December 2018
- 12-month PV generation over 105,000 kWh since December 2019
- Energy consumption reduced over 20% in 2019
- Energy Star score of 99 since October 2019
- 1st Net-Zero Certified office building in Texas, 55 in the US.
  - Annual Net Zero status achieved in Nov 2019
  - Verified by the New Buildings Institute (NBI) since December 2019.
  - IFLI’s ZERO ENERGY CERTIFICATION COMPLETED IN MARCH 2020
Energy Costs

• 12-month Energy Bills’ Total

$10,533 in the first 12 months of operations
$9,747 in 2018
$101 in 2019
-$913 in 2020
-$1,033 in the last 12 months
Plug Loads Optimization Process
Energy Consumption

- HARC’s Weather Normalized EUI in the prior twelve months

SITE EUI (kBTUs per sf)
Pre-COVID Plug Loads Optimization Process

Building Energy audit during the second half of 2018.

- Study of individual plug loads consumption with portable meters and the plug loads submeter.

- First energy conservation measures:
  - Improve the schedule of coffee makers and water dispensers
  - One coffee maker removed
  - Encourage staff member to turn off their computers at night
  - IT department finally agreed on pushing updates on specific dates

- Plug loads continued increasing during the first months of 2019 and we don’t know why ➔ New equipment was being installed without the energy management team knowing.
Pre-COVID Plug Loads Optimization Process

Challenges related with plug loads identified during the 2019 building energy audit

- Resources spent on periodic energy audits vs. cost of energy
- Lack of visibility on what is plugged into the building
- Limited visibility on energy consumption of individual plug loads
- Limited automation capabilities to manage them
- Redundant equipment: monitors, computers, coffee makers...
- Server operating 24/7 was consuming 20% of the total energy of the building
- Devices that “cannot be turned off” due to potential operational disruption
- Purchase of additional equipment (for example, UPSs for desktop computers)
Pre-COVID Plug Loads Optimization Process

- Increasing consumption and relevance of plug loads before the pandemic.
Pre-COVID Plug Loads Optimization Process

- Plug Loads are our main challenge from an energy management standpoint
April 2019: Meeting with staff members to present and discuss the goals of the building

HARC’s Road to Net-Zero Energy

April 10, 2019
Pre-COVID Plug Loads Optimization Process

June 2019: Selection and installations of a plug load monitoring platform

- Self-deployment of smart plugs and removal of old plug power strips
- Self-reporting on which device is connected to each individual socket
- Plug load monitoring platform configuration for data collection and analysis
Pre-COVID Plug Loads Optimization Process

September 2019: Follow-up Plug load audit with the Sapient platform and portable meters.

- 35% of the annual building consumption was in plug loads at that time
  - 19% server and workstations in the server room
  - 6% in laptops, desktops and office equipment
  - 10% in kitchen appliances, audio and video equipment

December 2019: Partial re-configuration of the plug load management platform

- Identification of stable loads that do not need intensive monitoring.
- Relocation of some of the power strips and smart plugs to cover 100% of the variable loads.
Plug Load Management During Pandemic Times
On March 15th 2020, staff members are encouraged to work from home and building is closed.

New challenges and opportunities related with plug loads optimization arise

+ Plug loads turned off in empty offices of laptop users.
+ Fridge, hot water dispenser, and other appliances turned off.
+ Plug load savings from all staff members working remotely.
+ Server’s UPS upgrade after winter storm URI.
- More computers to remain on 24/7 for staff members remoting.
- Some non-essential devices are confirmed to remain on.
Plug Loads Management During COVID

Plug load demand reduced during COVID but it becomes more relevant
Post-COVID Challenges and Goals
Post-COVID Challenges and Goals

✓ The HARC building to reopen soon after Memorial Day 2021.

✓ GOALS starting June 2021
  
  • Identify the new plug-load demand profile→ plug loads consumption expected to increase
  
  • Define realistic goals for plug loads that fit into the 2020-2022 HARC Strategic Plan
    – Control the plug load consumption without disrupting the operations and growth of the company

✓ New challenges and opportunities related with plug loads management
  
  - New staff members have joined the team→ Additional plug loads
  
  - All kitchen equipment to be turned back on with a moderate to low usage ratio
  
  - More staff members alternating remote and onsite work → some will continue computers operating 24/7
  
  + More staff members alternating remote and onsite work → some of the savings will remain
CONCLUSIONS:
Challenges in Plug Load Management
Conclusions: Challenges in Plug Load Management

- Additional plug loads are usually required during the lifespan of the building.
- **OUR GOAL:** to control the increase in plug load consumption without disrupting the operations and growth of the company.
- Lack of visibility and management capabilities without the proper platform.
- Internal communications on plug load management strategies are key to:
  - Purchase efficient equipment
  - Limit the installation of devices not designed to be turned on and off at least once a day.
  - Limit the number of users that feel uncomfortable with any level of automation.
  - Do not overspend time on conversations about which equipment is important, essential, or critical.
  - Avoid having redundant devices: for example, many users with multiple computers and screens.
Conclusions: Challenges in Plug Load Management

- Plug Load management platforms are great tools to improve energy efficiency in the short term and maintain it.
- Keeping a plug load platform in the long term is usually a trade-off decision between the value of the data, the cost of the platform, and the inefficiencies incurred by not having it.
- Plug Load management platforms are incorporating additional data and data analysis capabilities for the clients to promote customer loyalty once they reach their initial optimization goals.
Thank You!

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Question & Answer
Member Updates
We would love to hear from you!

• Are you thinking about PPL strategies?
  • What are your successes?
  • What are your challenges?
• What resources or support would help you?

Please email us:

PPL@NREL.gov

Visit our BBA website:

https://betterbuildingsinitiative.energy.gov/alliance/technology-solution/plug-process-loads
Thank You!

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