Better Buildings Alliance
Plug and Process Loads (PPL) Team Webinar
Technical Lead: Kim Trenbath, NREL
April 30, 2020
Agenda

• BBA PPL Team Updates
  • About us
  • Publications
  • Upcoming Events

• Technical Presentations
  • Receptacle Control in Energy Codes
    Harold Jepsen, Legrand
  • Automatic Controlled Receptacles
    Kelly Cunningham, Pacific Gas & Electric and Marisa Lee, Energy Solutions

• Q&A
• Member Updates
Team Players

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Get Involved

- Stay up to date on latest research and resources
- Collaborate with PPL network
- Participate in bi-annual technical calls
- Share updates and best practices

Visit the [PPL webpage](#) to learn more
Or contact us at [ppl@waypoint-energy.com](mailto:ppl@waypoint-energy.com)
Resources

Visit our webpage

How to Assess and Reduce Plug Loads

Utility Incentives List

How To Use Advanced Power Strips in an Office Setting

Each advanced power strip has three outlet types for equipment with various electricity needs. This infographic describes the uses for each outlet type.

Assessing and Reducing Plug and Process Loads in Office Buildings

Using the process and strategies outlined in this brochure, the U.S. Department of Energy’s National Renewable Energy Laboratory (NREL) was able to drastically reduce its PPL energy use in the Research Support Facility (RSF).

Plug Load Efficiency Utility Incentives

Download this list of incentives and rebates for plug and process load controls that are offered by utilities across the country.

Case Study: Plug Load Strategies for Zero Energy Buildings

The U.S. General Services Administration (GSA) successfully renovated the historic Wayne N. Aspinall Federal Building and U.S. Courthouse. GSA’s goals were to preserve the building’s historic features, and achieve Zero Energy Building (ZEB) status.
Emerging Technologies for Improved Plug Load Management Systems: Learning Behavior Algorithms and Automatic and Dynamic Load Detection

• In progress ACEEE paper
• Bennett Doherty, Kim Trenbath, Katie Vrabel, & Carly Burke
Collaborations

Contact Felipe Leon:

integratedlighting@pnnl.gov
Upcoming Events

JUNE 8–11

2020 SUMMIT
A Virtual Leadership Symposium

• Webinars and peer exchanges
• Registration and all sessions free
• More information at https://betterbuildingsinitiative.energy.gov/summit
Upcoming PPL Technology Team Call

- Next Meeting: Summer 2020

- Implementing a Statewide Plug Load Strategy: Highlights from the State of Oregon’s Recent Efforts to Reduce Plug Load Energy Consumption, featuring:
  - **Dave Wortman**, Statewide Sustainability Officer, Oregon Department of Administrative Services,
  - **Stephanie Kruse**, Facilities Engineer, Oregon Department of Energy

- Registration link available soon
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RECEPTACLE CONTROL IN ENERGY CODES

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What Do We Call Them? What Do They Do?

• “Automatic Receptacle Controls”
• “Receptacle Controls”
• “Controlled Receptacles”
• “Plug Load Controls”

• Provide an automatic means to turn off power to receptacle plugs for the purpose of stopping plug load energy use
What Do They Look Like?

Control marked receptacle

Wireless controlled receptacle
What Do They Look Like?

Plug Load Timer Receptacle

Controllable plug strip
What Do They Look Like?

Plug Load Timer Receptacle

Controllable plug strip

Not code compliant
What Do They Look Like?

Occupancy Sensors & Time Switches

Wall Switches
What Do They Look Like?

Distributed “Room” Controls

Centralized “Panel” Controls
What Should be Controlled?

- Displays/monitors
- Task/exam lights
- Space heaters
- Fans
- Radios/speakers
- Printers
- Hot plates
- Kitchen equipment
- Televisions
- Exercise equipment
Why Control?

- 19-32% savings
- August, 2016

- 4.2yr payback – small bldg.
- 2.4yr payback – large bldg.
- October, 2011

- 26% workstation reduction
- 21% average savings
- September, 2012
Why Control?

- 22% average savings
- October, 2016

- 20% average savings
- August, 2016

- 25% target
- Fall, 2018
What Codes Address Receptacle Control?

- ASHRAE/IES 90.1 – 2010:2019
- Title 24 – 2013:2019 (California)
- 2021 IECC (International Energy Conservation Code)
  – To be published


What are the Code Requirements?

- Applicable spaces
  - Private offices
  - Conference rooms
  - Copy/print rooms
  - Break rooms
  - Classrooms
  - Individual workstations
  - Modular partitions
  - Office workstation systems
What are the Code Requirements?

- **Application requirements**
  - Control at least 50% of all receptacles
  - Control at least 25% of feeders installed for future (not shown) modular furniture
  - Locate from uncontrolled receptacle
    - 12” – 2021 IECC
    - 72” - In modular furniture

Source: 2019-ICC- PUBLIC-COMMENT-AGENDA-compressed
What are the Code Requirements?

• Application requirements
  – Visually different from standard receptacle

(E) Controlled Receptacle Marking. All nonlocking-type, 125-volt, 15- and 20-ampere receptacles that are controlled by an automatic control device, or that incorporate control features that remove power from the receptacle for the purpose of energy management or building automation, shall be permanently marked with the symbol shown in Figure 406.3(E) and the word “controlled.”

Source: 2014-2020 NEC, NFPA 70 406.3 (E)
What are the Code Requirements?

• Shut off control function
  – Scheduled basis, time-of-day
    • 5000ft$^2$ maximum area, one floor
    • Override device, 2 hour maximum
  – Occupancy sensor within 20 minutes
  – Automated signal within 20 minutes

• Not allowed
  – Plug in devices
  – Not permanently installed
What are the Code Requirements?

- Exceptions
  - Equipment requiring 24hr operation
  - Safety or security equipment or which might endanger occupants

Source: https://abc7ny.com/faa-jobs-job-openings-careers/1461520/

Source: gentec-csw.com
How are Receptacle Controls Implemented?

Wireless Control

Wired Control
TYPICAL-ALL RECEPTACLES IN THE ROOM ARE TO BE #WRC-20-1 FOR HALF CONTROLLED BY THE RF TRANSMITTER. NO ADDITIONAL WIRING TO THE RECEPTACLES IS NECESSARY.
TYPICAL-ALL RECEPTACLES IN THE ROOM ARE TO BE WRC-20-1 FOR HALF CONTROLLED BY THE RF TRANSMITTER. NO ADDITIONAL WIRING TO THE RECEPTACLES IS NECESSARY.

wireless receptacle control outlets

RC wireless transmitter
TYPICAL—ALL RECEPTACLES IN THE ROOM ARE TO BE #WRC-20-1 FOR HALF CONTROLLED BY THE RF TRANSMITTER. NO ADDITIONAL WIRING TO THE RECEPTACLES IS NECESSARY.

SMALL PRIVATE OFFICE

room controller

Occupancy sensor wall switch

WRC TXLM

LMRC 102

LIGHTING BRANCH CIRCUIT (UNSWITCHED HOT LEG)
TYPICAL-ALL RECEPTACLES IN THE ROOM ARE TO BE CONNECTED TO AN UN-SWITCHED HOT AND SWITCHED HOT FOR RECEPTACLE. SPLIT-CIRCUIT WIRING. PROVIDE A PERMANENT AND DURABLE MARKING FOR THE CONTROLLED RECEPTACLE AS REQUIRED BY ASHRAE 90.1 SECTION 8.4.2.
wired receptacle control outlets

receptacle/plug load controller
occupancy sensors
Code & Control Summary

- Receptacle Control, many names
- Reports/studies on the energy savings
- Growing adoption and use
- 50% receptacles controlled in specific space types (offices, copy/print, etc.,)
- Available methods and products
- How are we adapting?

Image Source: https://www.focalpointlights.com/gallery/open-office
Thank You!

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designed to be better.
Automatic Controlled Receptacles
National Data Collection

Codes and Standards Enhancement (CASE) Initiative

Kelly Cunningham (Pacific Gas & Electric)
Marisa Lee (Energy Solutions)

April 30, 2020
Statewide Utility Codes and Standards Team

Actively supporting:

• The California Energy Commission in developing proposed changes to the California Energy Code (Title 24, Part 6)

• ASHRAE/IES 90.1 and 189.1 in developing national model building codes

This program is funded by California utility customers and administered by Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E®), and Southern California Edison Company (SCE), under the auspices of the California Public Utilities Commission.
Project Background

• ASHRAE/IES 90.1-2016\textsuperscript{i} and Title 24, Part 6\textsuperscript{ii} include requirements for automatic controlled receptacles

• The California Energy Alliance (CEA) is considering a Title 24, Part 6 code change proposal to expand existing requirements for controlled receptacles

• Some stakeholders expressed concern about complying with existing requirements

\textsuperscript{i} Section 8.4.3  
\textsuperscript{ii} Section 130.5(d)
Survey Goals

- Support the ASHRAE/IES 90.1 lighting subcommittee in understanding stakeholders’ concerns
- Gather information to help determine if the requirements need modification for easier compliance, potentially by providing an alternative compliance pathway
Approach

Outreach and interviews with industry stakeholders about:

• Product availability
• Market trends
• Current design practices
• Occupant acceptance
• Technical feasibility of meeting and exceeding code minimum requirements
• Market barriers to meeting and exceeding code minimum requirements
• Applying controlled receptacles beyond minimum code requirements
• Energy savings
Outreach

• Respondents work globally and in multiple states
  • Washington, Illinois, Michigan, Texas, Louisiana, Missouri, Florida, Colorado, New Mexico, Utah, California, New York, New Jersey, Maryland

• Focused on nonresidential buildings

• Varying familiarity with controlled receptacles

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<th>Stakeholder Group</th>
<th>Contacted</th>
<th>Responded</th>
<th>Interviewed</th>
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<td>Designers</td>
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<td><strong>Total:</strong></td>
<td><strong>147</strong></td>
<td><strong>22</strong></td>
<td><strong>14</strong></td>
</tr>
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Not contacted: Technology End Users, Contractors/Builders
Key Findings

• Cost is a driver, but not a barrier
• Compliant products are available
• Technical feasibility is not a barrier
• Existing code language is not confusing or unclear
• Using different code interpretations to circumvent requirements is common
• Education opportunities exist
• Savings uncertainty leads to lower perceived value
• Lack of information on the end user experience
Existing Code Language

• Respondents did not feel that code requirement language was unclear or difficult to apply
• When asked, most respondents offered some code change recommendation
Different Code Interpretations

• Jurisdictions where both ASHRAE/IES and IECC apply do not install controlled receptacles
  • Michigan and New York City adopted ASHRAE, but do not enforce the controlled receptacles language

• Ambiguity about when the requirement applies allows contractors and local jurisdictions to opt-out
  • San Francisco code officials define a remodel as any building space with an existing electrical panel, which describes most projects and does not require controlled receptacles

Being addressed in 2021 IECC
Education Opportunities

• None of the respondents said that building occupants are widely aware of controlled receptacles
• Opportunity to develop educational strategies and materials
  • Building compliance officials
  • Building occupants/technology end users
  • Key building management groups (i.e., anyone that receives calls when users struggle with the technology)
Savings Uncertainty

• The majority of respondents did not believe or were not sure that controlled receptacles were cost effective for the energy efficiency gain received.

• Most respondents felt that existing studies were biased, missing important information, or based on outdated information.
Savings Uncertainty

- Lack of perceived value is the primary barrier to and source of pushback against controlled receptacle requirements.

- Supporters and detractors both agree:
  - Difficult to demonstrate cost and energy savings.
  - End users don’t know about / aren’t using the technology.

“Most devices have sleep mode already, so how much savings are the receptacles saving?”
End User Experience

- Respondents could not confidently answer “What devices do people typically favor or avoid plugging into controlled receptacles?”
- Highly speculative
  - Typically favor: Computer monitors, task lighting, AV equipment in conference rooms, coffee makers, power strips
  - Typically avoid: Desktop computers, routers, phones, printers, chargers, “everything”
What is the End User Experience?

- Confusing user interface design
- No education
- Very little information available
Next Steps

Take steps to help technology stakeholders feel more confident in savings estimates:

• Support or commission updated plug load assumptions that distinguish controllable and non-controllable load

• Broadcast the use of cost-effectiveness calculations based on “unbiased” third party studies and measurements taken from real-world scenarios

Collect additional data:

• Are contractors really removing controlled receptacles from final building plans? What is the motivation? What is the extent to which this is occurring?
Questions?

Memo can be found at title24stakeholders.com/measures/looking-forward

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Thank You!