

HIGHLIGHTING PLUG LOAD DEVICES IN COMMERCIAL ENERGY EFFICIENCY PROGRAMS EXECUTIVE SUMMARY

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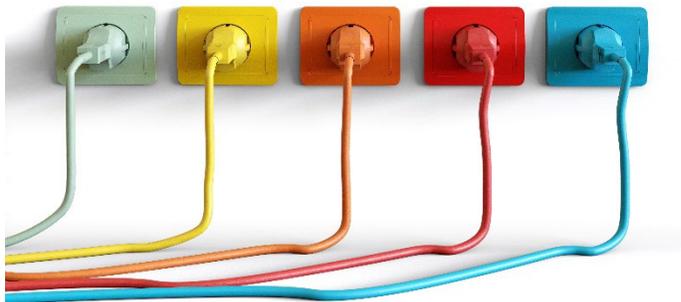


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Prepared For

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ACRONYMS AND ABBREVIATIONS

Term/Acronym	Definition
AC	Air conditioner
ACEEE	American Council for an Energy-Efficient Economy
ADR	Automated demand response
AMI	Advanced metering infrastructure
APS	Advanced power strip
BGE	Baltimore Gas & Electric
CalPlug	The California Plug Load Research Center, at the University of California, Irvine
CFS	Commercial food service
ComEd	Commonwealth Edison
ConEd	Consolidated Edison
DOE	U.S. Department of Energy
DR	Demand response
EE	Energy efficiency
EESP	Energy Efficiency Service Provider
EM&V	Evaluation, measure, and verification
EMS	Energy management system
EV	Electric vehicle
FPL	Florida Power and Light
FSTC	Food Service Technology Center
GEB	Grid-interactive efficient building
GHG	Greenhouse gas
HDD	Hard disk drive
HVAC	Heating, ventilation, and air conditioning
IT	Information technology
MAID	Massive array of idle disks
MELs	Miscellaneous Electric Loads
NREL	National Renewable Energy Laboratory
NYSEG	New York State Electric & Gas
PG&E	Pacific Gas and Electric
PLM	Plug load management
SCE	Southern California Edison
SDG&E	San Diego Gas and Electric
SMUD	Sacramento Municipal Utility District
SoCalGas	Southern California Gas
SSD	Solid state drive (data storage)
UPS	Uninterruptible power supply
VSD	Variable speed drive (motors)
Wh; kWh; GWh; MWh; TWh	Watt hour; kilowatt hour (1,000 Wh); Megawatt hour (1,000 kWh); Gigawatt hour (1,000 MWh); Terawatt hour (1,000 GWh)
ZNE	Zero net energy

1.0 EXECUTIVE SUMMARY

Introduction

Energy efficiency (EE) programs are motivated by growing concerns about the effects of climate change, grid instability, and lack of energy security (Hafer, 2015). The goal of these programs is to promote cost-effective solutions that reduce and manage energy consumption. Like many other utilities, ComEd has been successful in reducing energy consumption of traditional end uses, specifically lighting and HVAC. However, measures targeting consumer electronics, food service equipment, or appliances contributed only marginally to the total net savings in 2019. This reflects the fact that plug load devices are considered an emerging area (Relf, Cooper, Gold, Goyal, & Waters, 2020) and have not yet been a major focus for EE programs (York et al., 2015).

Plug load devices are appliances and equipment that plug into standard electrical sockets. In commercial settings this includes devices such as computers and printers in offices, projectors in conference rooms, cash registers in retail outlets, televisions and food service equipment in restaurants, and refrigerators and water coolers in staff breakrooms. Total energy use attributed to plug load devices has risen as the number of such devices in commercial buildings has increased, and there is consensus that plug load energy consumption will continue to grow (Sofos, 2016; U.S. Energy Information Administration, 2014, 2019). There is evidence that organizations that implement both technological and behavioral strategies observe a significant decrease in plug load energy consumption and waste (Hackel et al., 2016; Lobato, Pless, Sheppy, & Torcellini, 2011; Mercier & Moorefield, 2011; Sheppy, Metzger, Cutler, Holland, & Hanada, 2014; U.S. General Services Administration, 2014). Utilities can support their commercial customers in reducing their energy consumption by offering EE programs that are tailored towards plug loads.

This report reviews and compares EE programs concerned with commercial plug load devices, with the aim of suggesting possible avenues for integrating new approaches or measure categories into ComEd's current programs.

Approach and Methodology

CalPlug took a three-pronged approach to identify potential opportunities for plug load device EE program recommendations. First, CalPlug compiled a list of plug load devices and selected devices that had the most energy savings potential. Second, CalPlug identified and examined all the energy efficiency programs that involve plug load devices in ComEd's current program portfolio and in the portfolios of 18 selected comparison utilities. Third, CalPlug compared ComEd's programs with the comparison utilities' programs and with best practices to identify potential opportunities for more effectively advancing plug load efficiency.

Key Devices

A master list of 92 devices was assessed for potential energy savings through energy efficient alternatives or through being controlled by a plug load control system. Thirty plug load devices were identified as presenting energy efficient options, including computing, imaging, and networking devices, room air conditioners and dehumidifiers, and many kitchen and laundry appliances. Five plug load control devices were identified, including two types of advanced power strips (Tier 1 and Tier 2 APS), plug load occupancy sensors,

smart plugs, and vending machine miser controls. Twenty-three devices (including eight from the first list) were categorized as potentially saving energy if managed by a control device, including many types of office and audio-video equipment. The remaining devices were determined to be out of scope for consideration due to not being a plug load device, having no energy saving potential, or showing a trend toward declining population.

Plug Load Devices in ComEd's Commercial EE Programs

ComEd boasts a mature EE program portfolio that has earned the utility a high ranking in the American Council for an Energy-Efficient Economy (ACEEE) utility scorecard (Relf et al., 2020). Thus, it is not surprising that ComEd already offers measures addressing plug load devices within several programs. For example, ComEd offers rebates for plug load devices and controls in the standard incentives program. ComEd's data center program uses a custom incentives approach based on achieved kWh savings; many plug load measures can be accommodated within this program. ComEd also offers direct installation plug load control measures (such as Tier 1 APS and vending machine controls) within the small business programs and multi-family programs, and also supplies Tier 1 APS devices in free, self-install small business kits. Web-based platforms, like ComEd's Business Energy Analyzer, give customers feedback about their energy use and provide personalized and actionable advice, such as upgrading or shutting off equipment. ComEd also offers facility assessments and helps their customers implement no-cost or low-cost strategies, such as shutting off idle equipment, within the operational savings program.

Any assessment of commercial EE programs and approaches should consider the constitution of the utility's commercial customer base. The vast majority of ComEd's accounts (95 percent) are in ComEd's small load delivery classes (less than 100 kW peak demand) and thus eligible for small business EE programs (ComEd, 2020a). One third of ComEd's commercial customers belong to the office segment (ComEd, 2020a) and most commercial businesses include at least some office space in their facilities, emphasizing the importance of targeting computers, servers, printers, and other office equipment. Only 7 percent of customers are in the food service sector, but commercial kitchen equipment consumes high amounts of energy, making the food service segment one of the most energy-intensive in the commercial sector (Opinion Dynamics, 2018).

Conclusions

Lessons Learned

CalPlug identified many barriers to effectively incorporating plug load devices into EE programs for commercial customers:

- The wide range of plug load devices and the diversity of the commercial sector make it difficult to design programs that are effective for multiple types of devices across different business sectors.
- Many individual plug load devices do not use much energy, but the waste accumulates over a large number of devices. Limited savings per device lead to low incentive amounts, making standard incentives less effective.
- Many plug load devices are difficult to control, either for energy management or demand response purposes, because they cannot have their power cut or reduced without complete loss of functionality.

- Smart connected solutions can potentially link devices, sensors, and energy monitors to save energy, but this future ideal has not been yet realized due to interoperability problems between smart connected devices at the building level. Also, connectivity features in smart connected devices and appliances do not necessarily save energy and have a concurrent overhead energy demand for cloud computing needs.
- In the absence of clear measurement and feedback mechanisms, energy use is invisible in everyday life, and most people are unaware or misunderstand how much energy is consumed by their devices. Even IT managers, who are experts about computers and data centers, may dismiss or overlook the energy use of these devices.
- Effective communication and education are especially important for plug load devices, as user behavior can greatly impact devices' energy consumption. Factors such as effective installation of control devices, enabling on-board power management settings, and selecting efficient water temperature settings affect whether projected energy efficiency gains are actually realized.
- Website interface has an important impact on user experience; problems with navigating across web pages and finding relevant offerings can hinder program participation.
- Money and time constraints are common barriers to major investments such as data center hardware and commercial food service equipment, especially for small businesses. Pressures on short term cash flow can prevent customers from investing in energy efficient upgrades, even if it would save money in the medium to long term.

Recommendations

Standard Incentives

Based on comparisons to other utility offerings and to additional research on these devices, CalPlug recommends that ComEd consider making the following changes to their standard incentive offerings.

- Increase the incentive amounts:
 - Solid-door reach-in refrigerators
 - Glass-door reach-in refrigerators
 - Convection ovens
 - Combination ovens
 - Griddles
 - Commercial clothes washer
- Offer a range of incentives by size:
 - Solid-door reach-in refrigerators
 - Glass-door reach-in refrigerators
 - Solid-door reach-in freezers
 - Glass-door reach-in freezers
 - Hot food holding cabinets
 - Fryers
- Extend residential standard incentives to commercial customers:

- Dehumidifiers
- Residential refrigerators
- Residential clothes washers (multifamily building owners only)

- Add new device to standard incentive program:
 - Room air conditioning units
 - Commercial dishwashers
 - Wrap machine
 - Heat pump dryers
 - Tier 1 APS and Tier 2 APS

In addition, CalPlug recommends numerous alternate strategies for encouraging energy savings for specific devices instead of, or in addition to, offering standard incentives. Many steps could be taken during field assessments and other customer interactions. For instance, service providers should encourage the purchase of energy efficient devices, especially those that are not otherwise incentivized (e.g., desktop computers); install plug load controls to control a range of devices (e.g., computers and other office equipment, televisions, cash registers, and water coolers); and advise customers to remove wasteful personal devices such as mini-refrigerators. CalPlug also recommends clarifying information about plug load occupancy sensors and other plug load control strategies, as well as providing installation guides.

Online Marketplace

To increase customer engagement, CalPlug recommends that ComEd create an online marketplace targeted to business customers, as an extension of the existing residential online store. This store should include direct sales of plug load devices including plug load occupancy sensors, the full range of Tier 1 and Tier 2 APS devices, and EV chargers, as well as lighting. CalPlug also recommends participating in an online brokering platform to provide a common exchange site where customers can obtain verified product reviews, compare prices between models across retailers and distributors, see Enervee energy savings scores for products, and connect customers with third-party trade allies.

Midstream Programs: Commercial Food Service Equipment Pilot Program

CalPlug's recommendations are intended for consideration when ComEd evaluates results for the ongoing pilot program. These recommendations summarize best practices exhibited by comparison utilities with more established midstream CFS programs. Many of these practices are details that were not included in CalPlug's sources for ComEd's CFS pilot and may already be utilized. CalPlug recommends that ComEd:

- Add commercial dishwashers and wrap machines to the offered devices
- Consider requiring distributors to pass on a percentage of their incentives directly to end use customers, and whether to include “spiffs” for individual sales representatives
- Consider instituting higher incentives for ENERGY STAR® Most Efficient products
- Develop and test an online tool to facilitate instant rebate distributions to retail partners and customers
- Use consistent branding for the midstream program across utility and distributor partner websites

- Offer online webinars to engage end-use customers and potential retail partners
- Offer in-person courses and CFS product demonstrations at utility sites for distributor partners for deeper training on marketing strategies and new technology
- Compare the metrics and methodologies for evaluation, measure, and verification procedures used for the midstream program to those used by other utilities with more established programs

Data Center (Custom Incentives)

ComEd currently addresses data center measures, such as closet-to-colocation, within the custom incentives program. The existing program for data centers is robust and effective for larger retrofit projects but may be more complicated than required for businesses seeking more modest investments or upgrades. ComEd could reach a wider audience by linking the existing standard incentives catalog webpage (e.g., HVAC and lighting) to the data center program webpage and adding standard incentives for ENERGY STAR certified servers, UPS devices, and data storage equipment. This program should target customers with older IT equipment and low levels of UPS utilization. CalPlug also recommends requiring ENERGY STAR certified devices as part of the custom incentive process. Furthermore, CalPlug recommends encouraging other energy reduction strategies for high-consuming plug loads on their webpage and factsheets: specifically, unplugging comatose servers, replacing HDDs with SDDs and using MAID technology. ComEd could also benefit from expanding the education offered online (e.g., webinars, factsheets, online training) to include data center-specific energy efficiency strategies, and from partnering with government agencies that offer online and in-person trainings to train utility personnel to identify energy efficiency opportunities in data centers.

Small Business Programs

CalPlug recommends that ComEd expand their small business direct install measures to include plug load occupancy sensors and the full range of Tier 1 and Tier 2 APS devices. This will give Energy Efficiency Service Providers (EESPs) greater flexibility to select the plug load control strategies that are most effective for individual customers' specific combinations of devices and usage needs. CalPlug also recommends exploring alternate business kit combinations that vary in the type of plug load control device(s) included to tailor to specific customer needs. In order to increase visibility and generate interest, ComEd should consider adding factsheets on no- and low-cost plug load management strategies.

Financing

Offering financing with zero or low interest has been successfully promoted by other leading utilities to help small businesses pay for energy-efficient upgrades. CalPlug recommends that ComEd consider adding financing options to the small business program, data center program, commercial food service program, and other programs involving high upfront investment costs for equipment upgrades.

Plug Load Education and Training

CalPlug makes several recommendations aimed at advancing plug load device awareness and solutions through enhanced training of EESPs and education of customers. Both approaches help promote no- and low-cost strategies for reducing plug load energy consumption, such as effective use of plug load control systems, ensuring that energy-

saving settings are engaged, and unplugging or removing extraneous devices. CalPlug recommends training EESPs to identify and solve specific plug load devices inefficiencies in facility assessments and EE project recommendations, including determining which type of plug load control strategy is appropriate for the situation. EESPs should demonstrate for customers (and the rest of the staff) how exactly to set up an APS or occupancy sensor with a range of devices, and how to check whether multiple types of devices have their standby modes activated. Training and outreach should extend to all stakeholders, including building occupants as well as building managers, IT managers at data centers, and distributors involved in midstream programs. Courses and demonstrations could be held at the utility's sites or remotely.

CalPlug recommends expanding educational materials offered on ComEd's website for a greater focus on plug load devices. Several comparison utilities examined for this report provide excellent examples to follow, such as providing tips pages to promote no- and low-cost plug load reduction strategies, factsheets on plug load savings aimed at offices, instructions for how to install plug load control devices, and worksheets that organize plug load-related incentives into one place. Where relevant, these pages should link to ComEd's programs and incentives.

To facilitate engaging and educating customers, CalPlug recommends a usability assessment of the ComEd website, aimed toward making the energy efficiency pages easier to navigate.

Future Trends

CalPlug identified two future trends for which ComEd does not currently have EE programs in place: the growing importance of zero net energy grid-interactive efficient buildings (GEBs) and the growing need for electric vehicle (EV) chargers.

To prepare for implementing GEB-related programs, CalPlug recommends that ComEd conduct research on GEB technology as it pertains to its commercial customer base. Research would ideally focus on how to measure and incentivize savings of plug load control devices and smart controlled devices and how to leverage existing AMI and ADR systems to integrate with plug load controls in smart buildings. ComEd should also plan to conduct feasibility studies, including the possibility of integrating plug load controls with temperature and lighting controls in future program designs.

Given trends toward electric transportation, CalPlug recommends that ComEd consider implementing an incentive program for EV chargers. This would require research on EV trends in Illinois and the Midwest more generally, followed by research and cost effectiveness analyses on possible program designs. CalPlug identified several features based on comparison utilities' established programs, including offering rebates on charging stations, selling discounted charging stations through an online marketplace, and providing free consultations to customers on where best to install the chargers, as well as free infrastructure installation for grid connection.

Summary

ComEd boasts a full and robust energy efficiency portfolio for its commercial customers, and already effectively incentivizes many key plug load devices. The assessment and recommendations given here are intended to identify opportunities for highlighting plug load devices more effectively in ComEd's portfolio, both to boost the uptake of the existing programs and to add more energy-saving elements.

CalPlug had no access to internal documents on ComEd's program design or administration, and the scope of this project did not allow for interviewing program managers; as such, suggestions about training, educational materials, and other inward-facing program elements are necessarily generalized, and may refer to practices already being used.

This project focused on breadth rather than depth, prioritizing the identification of the widest and most comprehensive range of plug load problems and solutions rather than detailed analysis of any specific program recommendation. This prevented CalPlug from spending time on deep-dive assessments of programmatic elements that ComEd has already explored and is not interested in. The next step is for ComEd to decide which of the recommended changes to prioritize, given their greater knowledge of past and current offerings, and then to pursue more in-depth assessments.

Summarizing key projects based on the recommendations given above, next steps could include:

- Pilot studies, device testing, and assessment analyses
 - Cost effectiveness analyses of adding devices to standard incentive list or modifying incentive amount/range
 - Expand online marketplace and/or investigate product brokerage page possibilities
 - Assess proposed changes to data center program
 - Consider recommendations in commercial kitchen pilot evaluation
 - Explore offering financing
 - Conduct research into GEB/smart building technology, incentivizing smart controls
 - Research regional EV trends; EV charger program design options
- Reviewing and revising education and training resources
 - Assess usability of website and available online materials
 - Group office-related plug load information into one fact sheet
 - Group plug load incentives into one worksheet
 - Revise EESP training materials and facility assessment procedures to clearly address plug load control options
 - Revise educational materials and demonstrations aimed at building operators and occupants on plug load management
 - Incorporate plug loads into demonstrations at utility sites