



AUGUST 21-23, 2018 • CLEVELAND, OHIO

Plug Load Management System Field Study

Wireless Meter & Controls

NREL/PR-7A40-72084



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Presentation Overview

- Why we tested this technology (Plug Load Management (PLM))
- Introduction to PLM
- Field Study
- Results
- Lessons learned

Why We Tested This Technology

- Plug and process loads (PPLs)—loads plugged into electrical outlets in a building such as computers, coffee makers, etc.—and hard-wired loads, such as fire detectors, escalators, etc.
- PPLs consume about one third of primary energy in U.S. commercial buildings.
- As buildings become more efficient, PPL efficiency becomes more relevant to achieving aggressive energy targets.

SAVINGS POTENTIAL*	Individual Equipment	Whole Building
Residential	17-33%	5-10%
Commercial	10-48%	6-10%

*Based on numerous studies

Introduction to Plug Load Management (PLM)

- Ibis IntelliNetwork™ PLM system:
 - Intelligent socket devices, which plug into existing electrical outlets and collect energy usage information
 - A gateway, which manages communication between the intelligent sockets and the PLM cloud service
 - A PLM network, which is a cloud-based measurement and control network for the entire system.
- Estimated potential plug load savings of 20%-50%

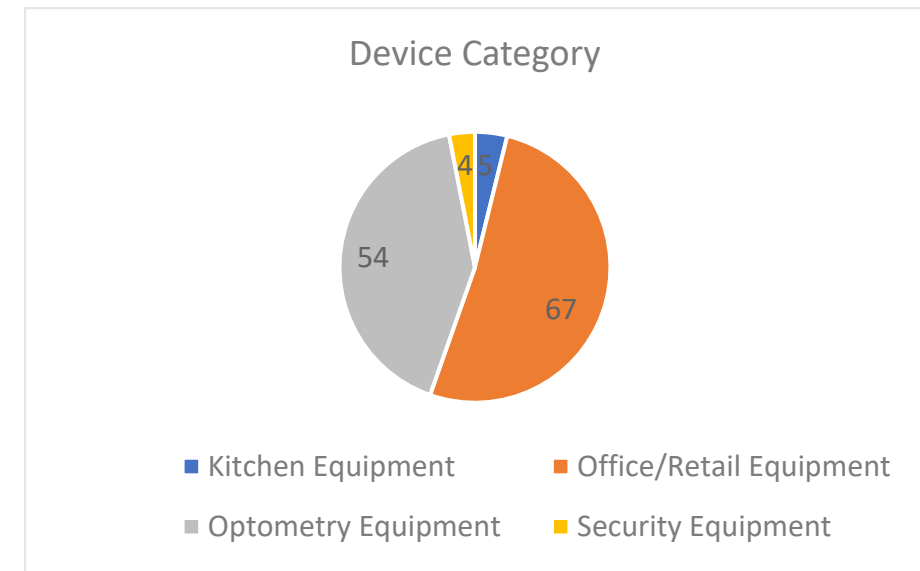
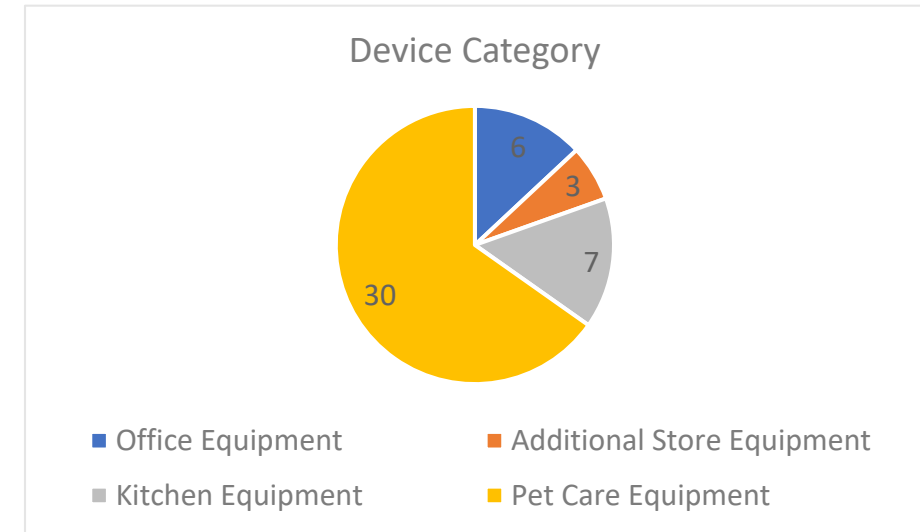


Figure 1: Intelligent Sockets
Image: Ibis Networks

Field Study Sites

- Two test sites

	Test Location A	Test Location B
Location	Chandler, AZ	Honolulu, HI
Type of Facility	Pet-oriented retail store	Eyewear manufacturer and retail store
Devices Identified for Pilot Inclusion (monitoring, control, or other efficiency strategies)	46	130
Average Electric Rate	\$0.12/kWh	\$0.30/kWh



Testing Protocol

- Equipment inventory and PLM installation period
- Baseline period
- Controls period

Test Site	Baseline Period	Controls Period
Test Location A	4 weeks 1 day	4 weeks 1 day
Test Location B	3 weeks 6 days	3 weeks 6 days

Quantitative Objectives

Objective	Metrics & Data	Success Criterion
Electricity Savings	Electricity savings	Electricity savings compared to a baseline period: <ul style="list-style-type: none">• At least 10% electricity reduction in measured plug loads
Cost-Effectiveness	Simple payback and SIR	<ul style="list-style-type: none">• Simple payback < 10 years• SIR > 1
Deployability	PLM solution has broad applications across the retailer's portfolio of buildings (for a large quantity of devices within each store)	Favorable payback and SIR are achieved in most building and equipment types

Quantitative Findings

Metrics & Data		Test Location A	Test Location B	Success Criterion Met
Electricity Savings	Metered electric consumption	1,040 kWh/year \$124.80/year ¹ 11% savings ²	2,730 kWh/year \$819/year ³ 18% savings ⁴	✓
Cost-Effectiveness	Simple payback	59 years	24 years	✗
	Savings to investment ratio (SIR)	0.17	0.41	✗
Deployability	PLM solution has broad applications across the retailer's portfolio of buildings (for a large quantity of devices within each store)	Unfavorable payback and SIR; however, complications during pilot negatively affected outcomes and savings potential	Unfavorable payback and SIR; however, complications during pilot negatively affected outcomes and savings potential	✗

¹ Assuming an electric rate of \$0.12/kWh

² Percent savings in measured plug loads





³ Assuming an electric rate of \$0.30/kWh

⁴ Percent savings in measured plug loads

Qualitative Objectives

Objective	Metrics & Data	Success Criterion
Ease of Installation	<p>Interview with vendor and retailer representative(s):</p> <ul style="list-style-type: none"> • Time required to install and configure • Labor associated with install • Impact of install on operations 	<ul style="list-style-type: none"> • < 1 day to install • < 1 week to provide online data access
Operability	<p>Interview with retailer representative(s):</p> <ul style="list-style-type: none"> • Usability of intelligent sockets • Usability of PLM network • Time commitment required for continual management of plug loads 	<ul style="list-style-type: none"> • No impact to operation and maintenance effort • < 4 hours to understand online data interface
Nonenergy Benefits		At least one non-energy benefit is realized

Qualitative Findings

Metrics & Data		Test Location A	Test Location B	Success Criterion Met
Ease of Installation	Time required to install system at test site	Less than a day to install	More than a day to install	 (Location A)
	Time required by vendor to configure and provide online data interface access	2–3 days	2–3 days	 (Location B)
	Impact of install on operations	None	None	 

Qualitative Findings (continued)

Metrics & Data		Test Location A	Test Location B	Success Criterion Met
Operability	Usability of intelligent sockets	Easy and intuitive	Easy and intuitive, but problems encountered with devices not functioning as intended after controls deployed and with staff unplugging sockets	✓ (Location A) ✗ (Location B)
	Usability of online data interface	Did not use enough to provide feedback	Did not utilize online data interface	✗
	Time commitment required for monitoring and management of plug loads	Staff did not have the 1–2 hours needed per week	Staff did not have the 1–2 hours needed per week	✗
Nonenergy Benefits	PLM solution results in increased equipment life, early detection of device failure, awareness of energy use trends resulting in savings not attributed to controls, staff become educated about and	None	This pilot was a good way to engage staff about plug load energy use.	✗ (Location A) ✓

Key Takeaways

- Real world testing = real world complications
 - Mother nature
 - Sockets gone missing
 - Staff engagement

- Successful deployment conditions:
 - High electricity rates
 - Many 'controllable' devices
 - A staff member who can spend 1-2 hours per week monitoring the PLM

Report Forthcoming

- Plug Load Management System Field Study:
 - <https://www.nrel.gov/research/publications.html>



Prepared for the General Services Administration and the Department of Energy
by the National Renewable Energy Laboratory

AUGUST 2018

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Thank You!

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This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by U.S. Department of Energy Building Technologies Office. The views expressed in the presentation do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the presentation for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.