

LEVERAGING MULTI-YEAR SITE-SPECIFIC IMPACT EVALUATION TO DERIVE C&I LIGHTING PARAMETERS

Ryan Powanda
Heather Lisle
Justin Spencer
Jes Rivas

IEPEC 2015, Long Beach
August 11, 2015



TABLE OF CONTENTS

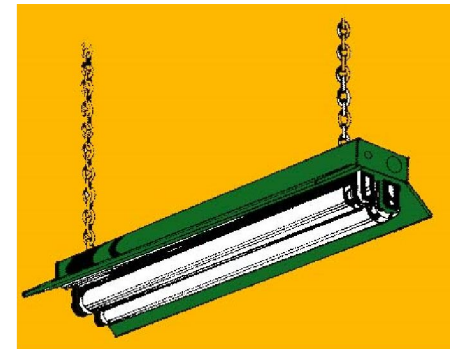


Section 1: Overview of Project - Motivation for Space-Level Parameters

Section 2: EmPOWER Metering Study

Section 3: Space and Building-Level Results

Section 4: Applications to Lighting Evaluation



www.lightfixture.chandelier.com



www.njcleanenergy.com

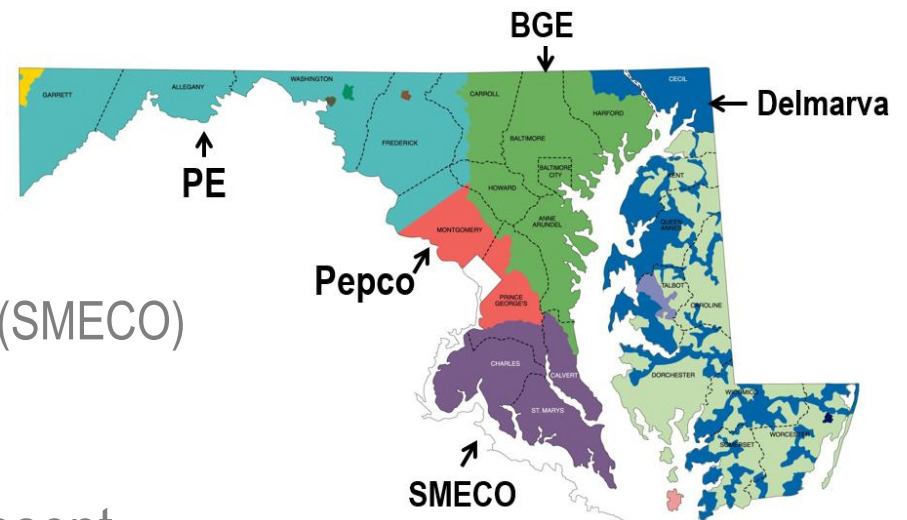
PROJECT OVERVIEW



» **Evaluation:** C&I Prescriptive and Small Business / Direct Install efficiency programs for EmPOWER, MD

» **Utilities Include:**

- › Baltimore Gas and Electric (BGE)
- › Pepco and Delmarva Power
- › Southern Maryland Electric Cooperative (SMECO)
- › Potomac Edison (PE)

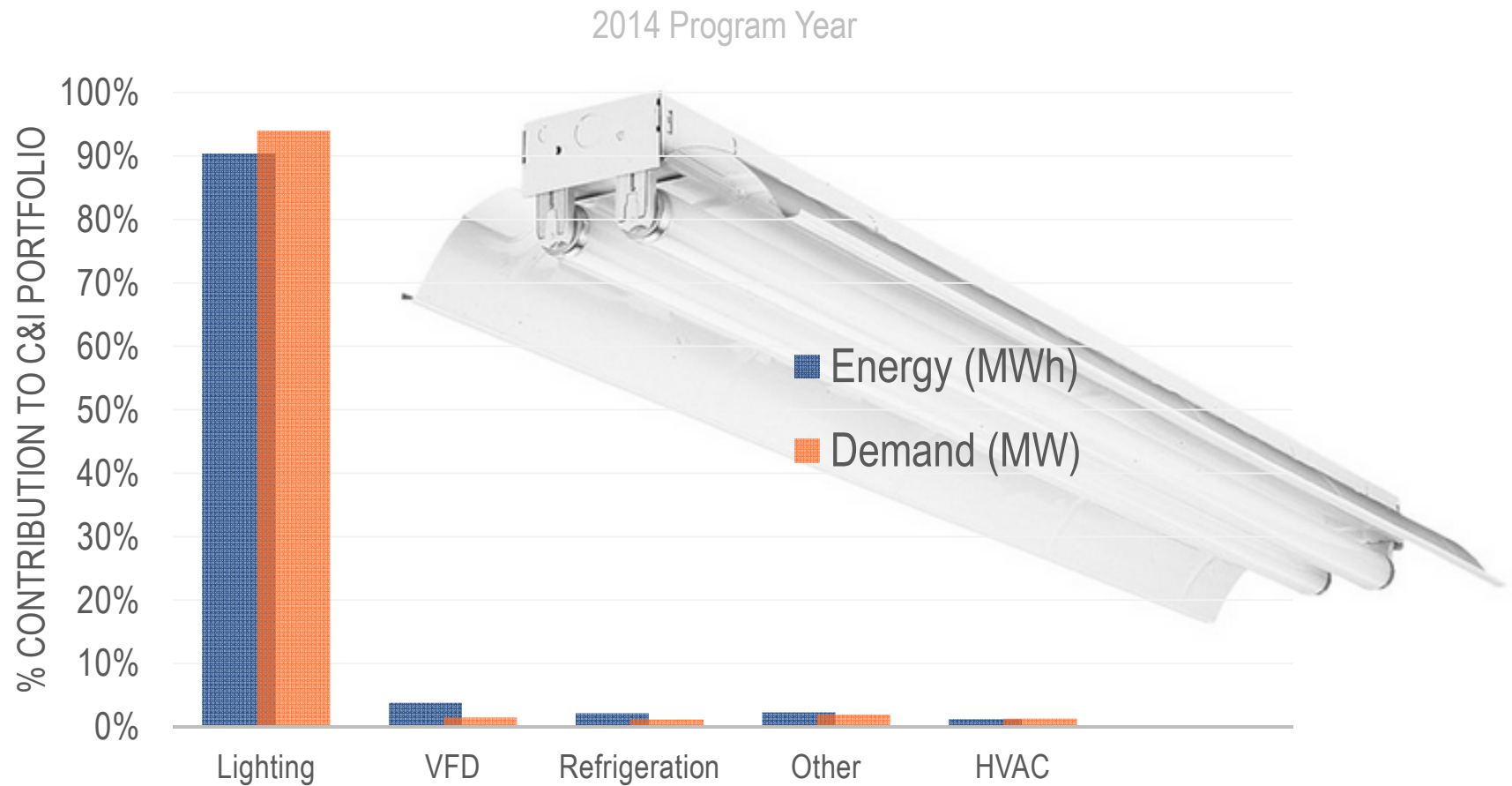


» **Evaluation Period:** 2010 through present

» **Deliverables:** Evaluated energy (MWh) and demand (MW) savings

- › **PJM** coincident peak demand savings

LIGHTING MEASURES DOMINATE C&I



<http://www.noguge.com/tag/commercial-fluorescent-light-fixtures/>

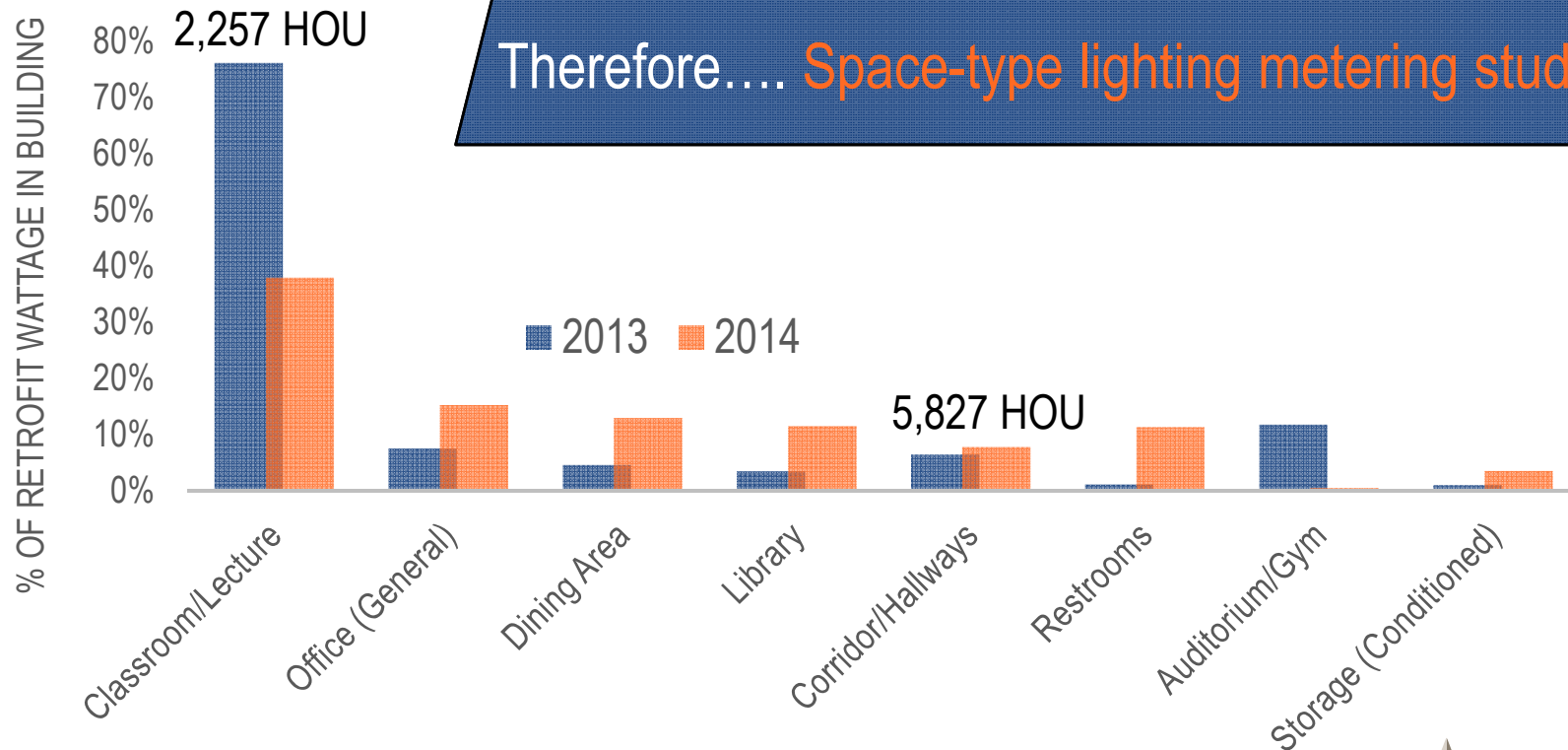
VARIABILITY IN RETROFIT AREAS YEAR-OVER-YEAR



Different HOU and CF

Parameters not applicable to future years

Therefore.... Space-type lighting metering study!! 😊





NAVIGANT LIGHTING METERING STUDY



NAVIGANT PERFORMED SPACE-TYPE LIGHTING METERING STUDY

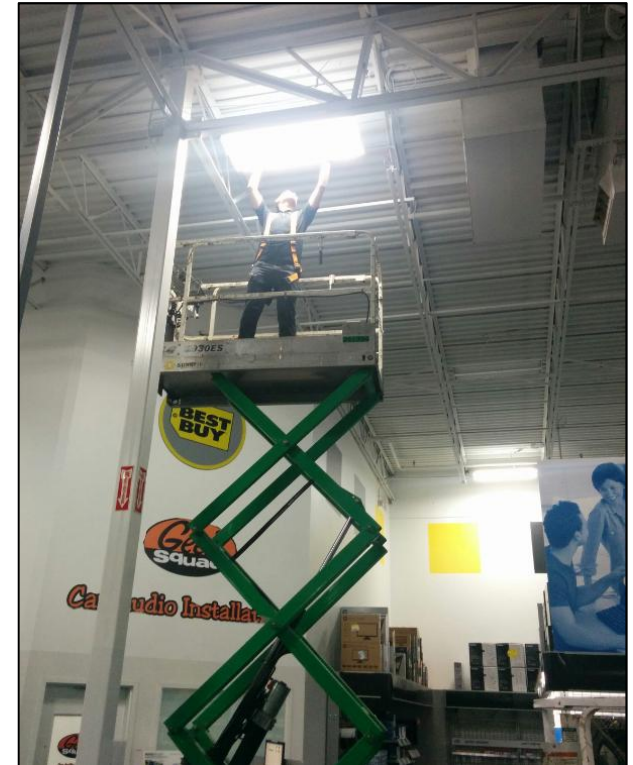


2010-2013

192 sites
928 loggers

61 – Other
38 – Warehouse
25 – Office
21 – Retail
10 – Grocery
10 – School
7 – Health

4-12 weeks per logger
PJM Peak Period



SPACE TYPE INFO COLLECTED



AA Code	Activity Area Type Description	AA Code	Activity Area Type Description	AA Code	Activity Area Type Description
1	Auditorium/Gym	22	Guest Rooms (Hotel/Motel)	42	Religious Worship
2	Auto Repair Workshop	23	Kitchen/Break room & Food Prep.	43	Residential
3	Bank/Financial	24	Laboratory	44	Restrooms
4	Bar Cocktail Lounge	25	Laundry	45	Retail Sales/Showroom
5	Barber/Beauty Shop	26	Library	46	Smoking Lounge
6	Casino/Gaming	27	Loading Dock	47	Storage (Conditioned)
7	Classroom/Lecture	28	Lobby (Hotel)	48	Storage (Unconditioned)
8	Clean Room	29	Lobby (Main Entry and Assembly)	49	Storage (Refrigerated/Freezer), Walk-in
9	Computer Room/Data Processing	30	Lobby (Office Reception/Waiting)	50	Storage (Refrigerated/Freezer), Building
10	Comm/Ind Work (General High Bay)	31	Locker and Dressing Room	51	Surgery Rooms
11	Comm/Ind Work (General Low Bay)	32	Mall Arcade and Atrium	52	Theater (Motion Picture)
12	Comm/Ind Work (Precision)	33	Mechanical/Electrical Room	53	Theater (Performance)
13	Conference Room	34	Medical Offices and Exam Rooms	54	Unknown
14	Convention and Meeting Center	35	Office (Executive/Private)	55	Vacant (Conditioned)
15	Copy Room	36	Office (General)	56	Vacant (Unconditioned)
16	Corridor / Hallways	37	Office (Open Plan)	57	Vocational Areas
17	Courtrooms	38	Patient Rooms	98	Non Rebated Area
18	Dining Area	39	Patio Area	99	Other Unlisted Activity Types
19	Dry Cleaning	40	Pool/Spa Area	0	Outside/Outdoor Area
20	Exercise Centers/Gymnasium	41	Police/Fire Station		
21	Exhibit Display Area / Museum				

ONSITE FIELD FORMS COLLECTED SPACE TYPE INFORMATION FOR ALL RETROFIT FIXTURES



5 - Verification & Area Form

Page ____ of ____

Site ID:

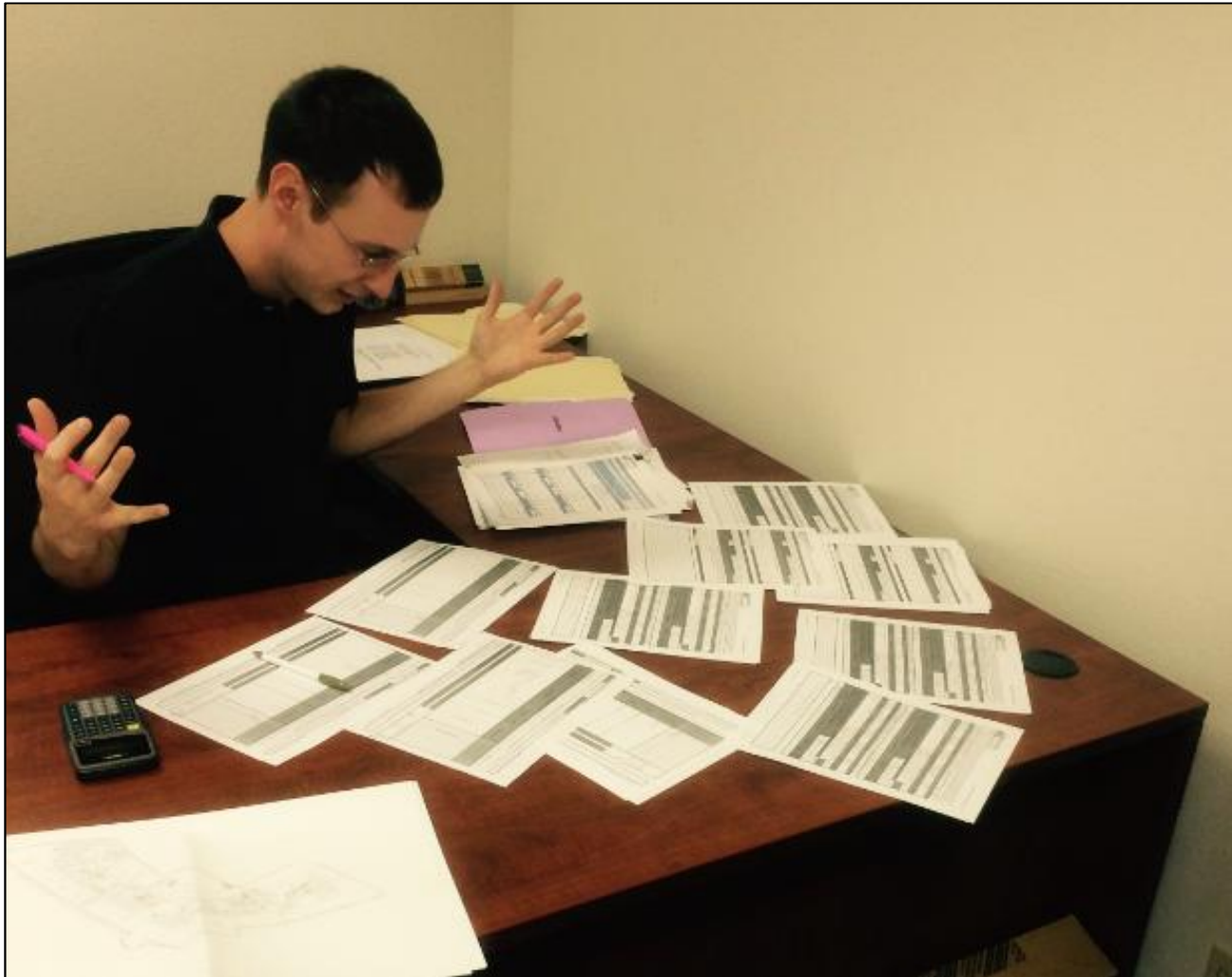
Area Details: Defined by Area Type, Cooling Type, Heating Type. LPC = the number of circuits controlling retrofit fixtures in the area.

Area ID	AA Code	Description	Cooling System ID	% of Area Cooled	Heating System ID	% of Area Heated	Metering Sites Only		Notes
							# of LPCs in Area*	Method for Determining # of LPCs	
A1			H		H			C ER EF OT	
A2			H		H			C ER EF OT	
A3			H		H			C ER EF OT	
A4			H		H			C ER EF OT	
A5			H		H			C ER EF OT	
A6			H		H			C ER EF OT	
Counting Methods: C=Counted all LPCs ER=Estimated from # of Rooms EF=Estimated from Floor Area OT=Other (describe in notes)									

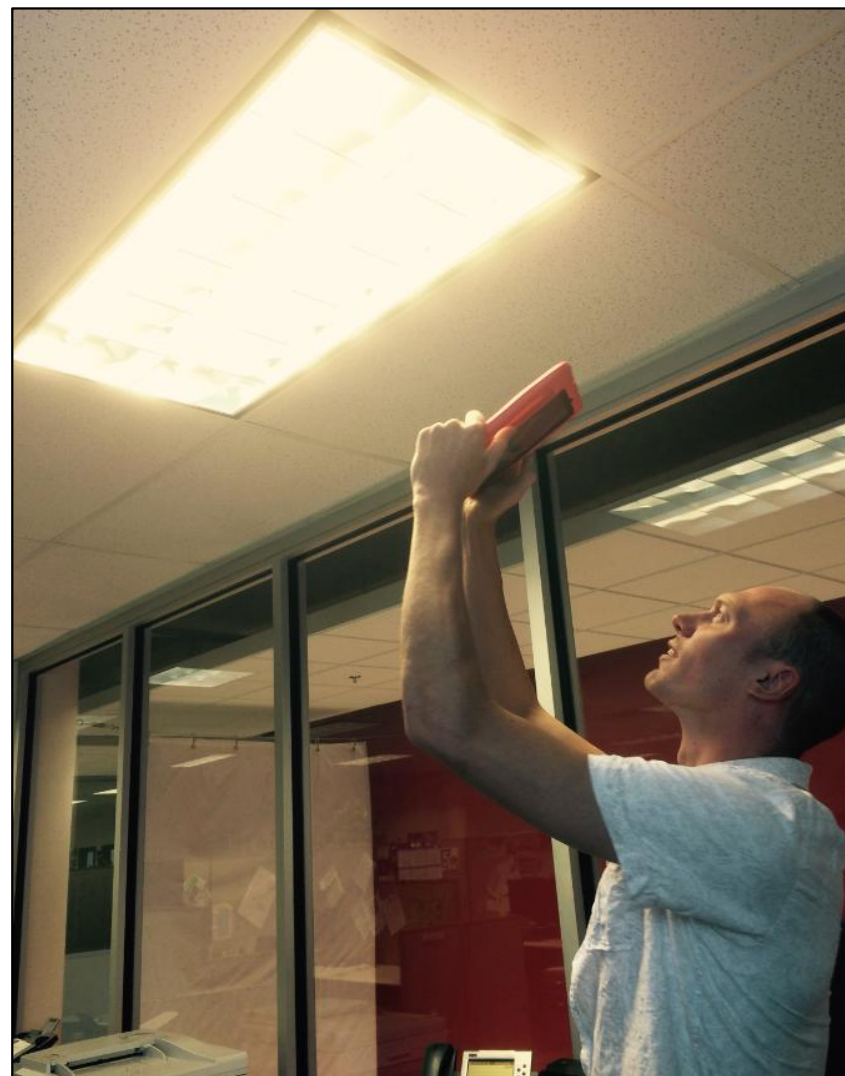
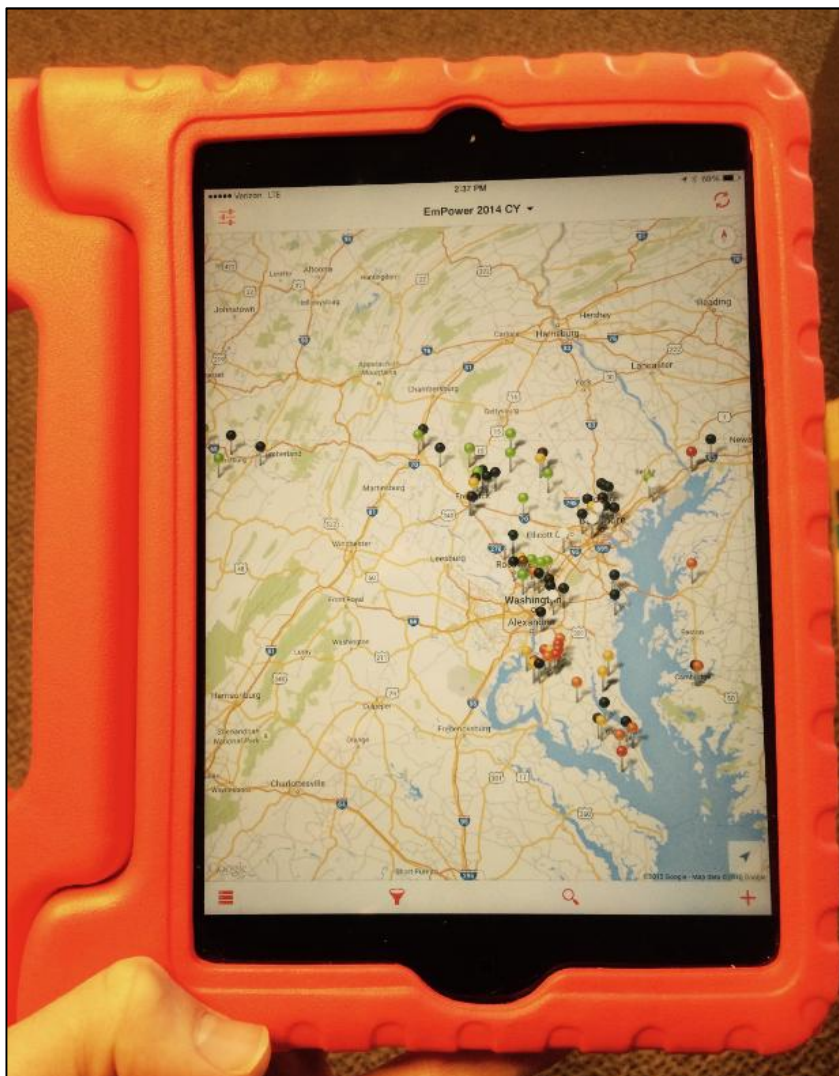
Verification Table: Group fixtures by Area, Schedule, and Fixture ID. Specify Measure Details Line ID for each row. Data must be disaggregated – no more than one Area/Sched/Fixt/Control ID per row. Provide the quantity of equipment pieces for each row. For metering sites, enter the quantity of loggers you installed.

Control IDs: ROS=Remote-mounted Occ Sensor; WOS=Wall-mounted Occ Sensor; FOS=Fixture-mounted Occ Sensor; DC= Daylighting Controls; OT=Other:_____																	
Verf ID #	Line ID (from MD Form)	Area ID	Sched ID	Fixt ID	Control ID (for Retrofit Controls Only)	Verified Fixture Qty	Verified Controls Qty (if applicable)	Counting Method Counted or Estimated	Explanation for Fixt/Ctrl Quantity Discrepancy NA: Verified Qty = Rebated Qty N: New units have been purchased since L: Units are installed in other affiliated sites R: Units were removed and Not Replaced F: Units failed and were replaced in-kind S: Units placed in storage DK:-- Don't Know							Qty of Loggers Installed (Meter Sites Only)	
V0	1	A1	S1	A	WOS	24	5	C E	NA	N	L	R	F	S	OT	DK	2
V1								C E	NA	N	L	R	F	S	OT	DK	
V2								C E	NA	N	L	R	F	S	OT	DK	
V3								C E	NA	N	L	R	F	S	OT	DK	
V4								C E	NA	N	L	R	F	S	OT	DK	
V5								C E	NA	N	L	R	F	S	OT	DK	

FIELD FORMS ARE A DRAG!



TABLET DATA COLLECTION – MUCH BETTER!

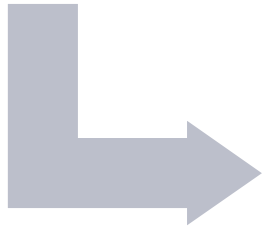


LOGGERS WEIGHTED TO SPACE-LEVEL AND BUILDING PARAMETERS



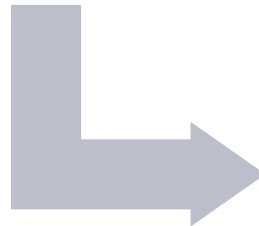
Individual
Loggers

- Weight individual loggers to building-space values for individual site



Building-
Space
Combos

- Weight site-specific building-space values to overall building-space values



Building-
Level

- Weight to building-level



SPACE- AND BUILDING-LEVEL PARAMETER RESULTS



RESULTS – SPACE-LEVEL PARAMETERS



Building Type	Space-Type Group	Qty of Sites	Qty of Loggers	Annual Operating Hours	CF-Utility	CF-PJM	Customer Self-Report Ratio
All/Other	Other	55	151	5,199	0.66	0.67	0.95
	Auto Repair Workshop	15	24	4,498	0.88	0.88	1.05
	Classroom/Lecture	11	30	1,707	0.34	0.33	0.69
	Commercial/Industrial Work	22	66	3,667	0.66	0.69	0.92
	Corridor/Hallways	42	105	5,604	0.79	0.80	1.24
	Kitchen/Break room & Food Prep	19	23	3,694	0.55	0.57	0.92
	Library	9	13	3,287	0.70	0.66	1.38
	Lobby (Main Entry and Assembly)	11	12	5,518	0.87	0.85	1.24
	Lobby (Office Reception/Waiting)	5	8	4,401	0.93	0.94	1.04
	Mechanical/Electrical Room	15	31	4,163	0.55	0.55	0.83
	Medical Offices/Exam & Patient Rm	5	11	2,678	0.75	0.75	0.63
	Office (Executive/Private)	23	41	1,960	0.49	0.51	0.66
	Office (General)	38	99	3,092	0.69	0.68	0.85
	Office(Open Plan)	13	25	2,494	0.59	0.61	0.88
	Restrooms	21	35	3,494	0.47	0.48	1.00
	Retail Sales/Showroom	42	129	5,247	0.92	0.92	1.05
	Storage	47	125	3,584	0.61	0.62	0.88
Grocery	Retail Sales/Showroom	10	39	7,149	0.96	0.96	1.14
Health	Corridor/Hallways/Lobbies	5	11	4,834	0.95	0.93	1.10
	Offices and Exam Rooms	5	12	2,852	0.78	0.78	0.67
Office	Corridor/Hallways/Lobbies	12	27	3,068	0.68	0.66	0.81
	Offices - General/Open	18	60	2,585	0.73	0.72	0.75
Retail	Corridor/Hallways/Lobbies	4	5	6,986	1.00	1.00	1.48
	Retail Sales/Showroom	20	70	4,951	0.97	0.95	1.05
	Storage (Conditioned)	5	11	5,232	0.84	0.84	1.20
School	Other	10	34	2,110	-	-	0.96
	Classroom/Lecture/Conference Rooms	5	18	2,257	-	-	0.97
	Corridor/Hallways	6	12	5,827	-	-	2.08
Warehouse/Industrial	Workspace	23	68	4,486	0.80	0.82	1.20
	Offices - General/Open	11	25	2,414	0.61	0.62	0.68
	Storage	20	68	3,726	0.62	0.65	0.94

Parameters:

- HOU
- CF – Utility
- CF – PJM
- CSRR

Customer Self-Report Ratio =

Logged Hours

Customer
Reported
Hours

RESULTS – BUILDING-LEVEL PARAMETERS



Building Type	Sector	Annual Operating Hours	CF-Utility	CF-PJM	Customer Self-Report Ratio
Grocery	Prescriptive & Small Business	7,134	0.96	0.96	1.14
Health	Prescriptive & Small Business	3,909	0.80	0.79	0.88
Office	Prescriptive	2,969	0.70	0.69	0.79
	Small Business	2,950	0.67	0.67	0.80
Other	Prescriptive & Small Business	4,573	0.66	0.67	0.96
Retail	Prescriptive	4,920	0.96	0.94	1.05
	Small Business	4,926	0.86	0.85	1.03
School	Prescriptive & Small Business	2,575	-	-	1.04
Warehouse/Industrial	Prescriptive	4,116	0.70	0.72	1.04
	Small Business	3,799	0.68	0.70	0.99

Full results available in the report

A FEW INTERESTING FINDINGS - OFFICE



Hours of Use , PJM CF

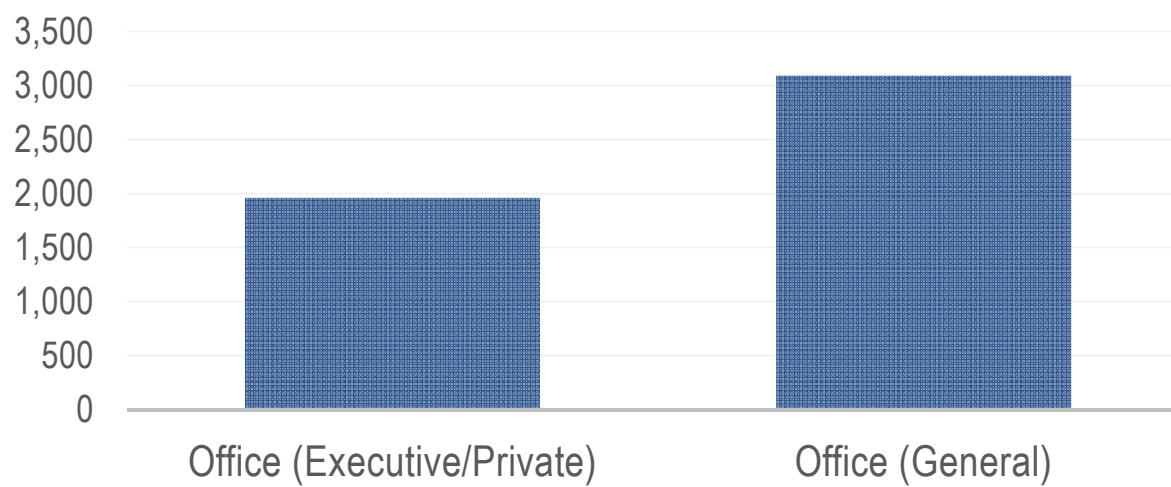
Private – 1,960 , 0.51

General/Open – 3,092 , 0.68

Customer Self-Report
Ratio

Office building type:
Approx. 80%

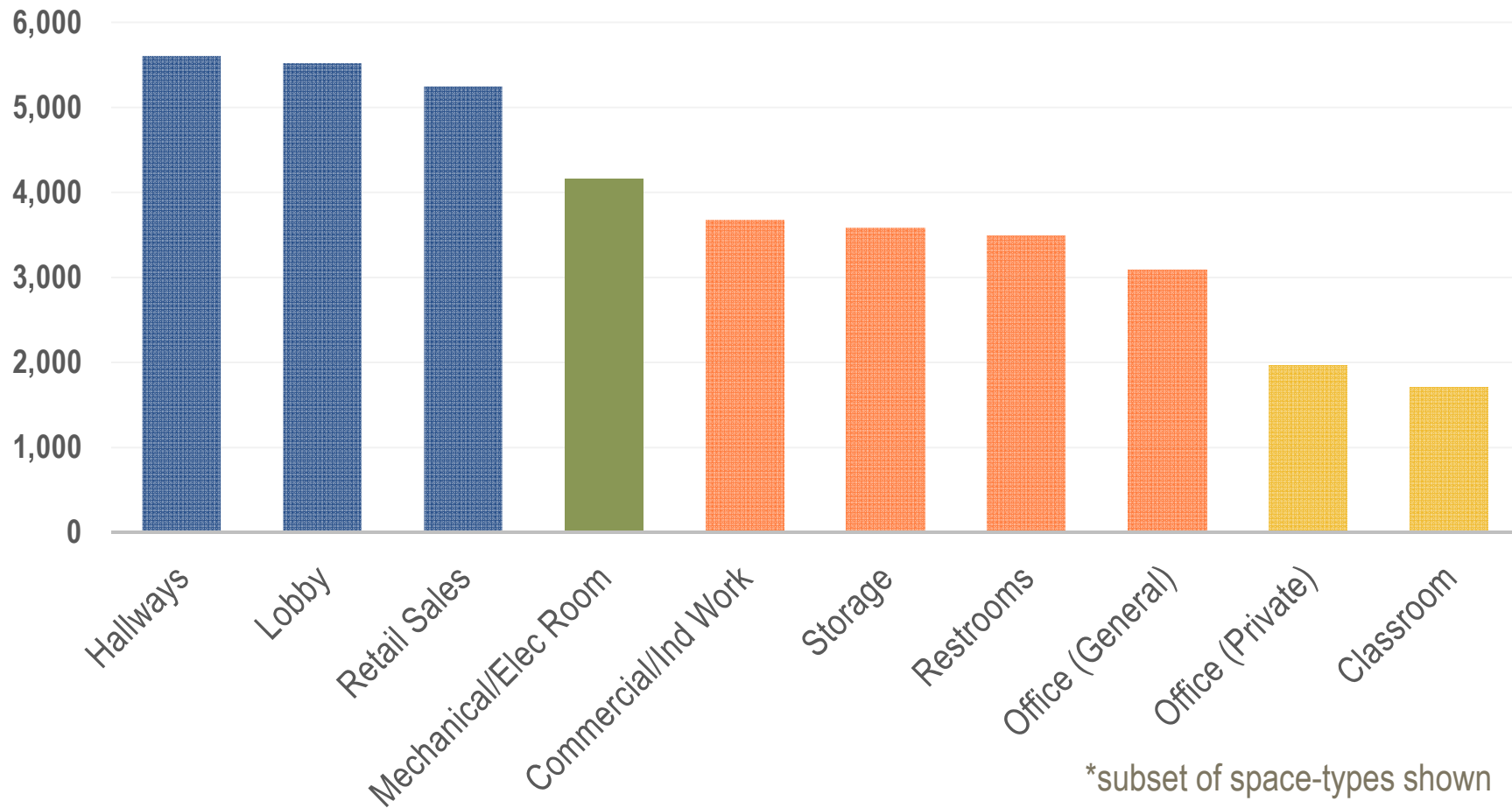
Annual HOU



ALL/OTHER SPACE TYPES



Annual HOU – All Building Types



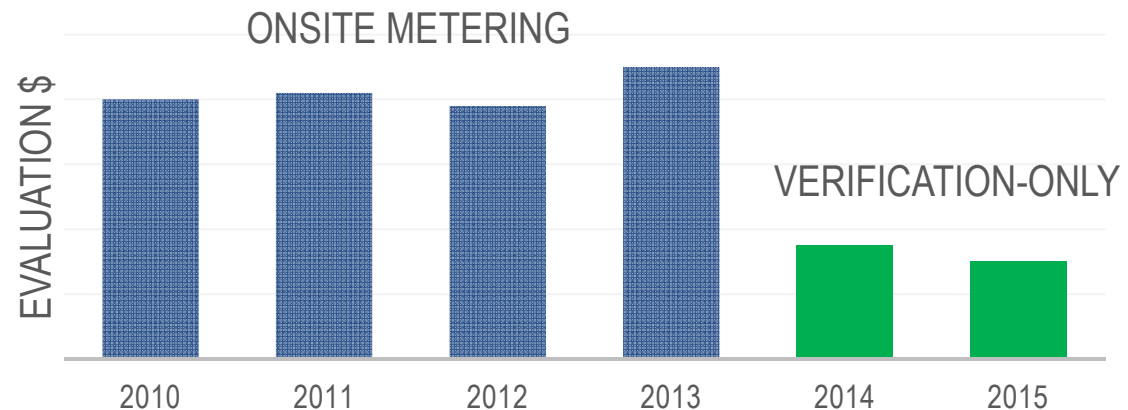
KEY TAKEAWAYS



1. HOU and CF vary by space type

2. Space-type variability in lighting retrofits year-over-year

3. Space-type parameters support evaluation by reducing yearly EM&V costs



Navigant applied space-type metering parameters to **verification-only** onsite data in 2014 and 2015 evaluation years

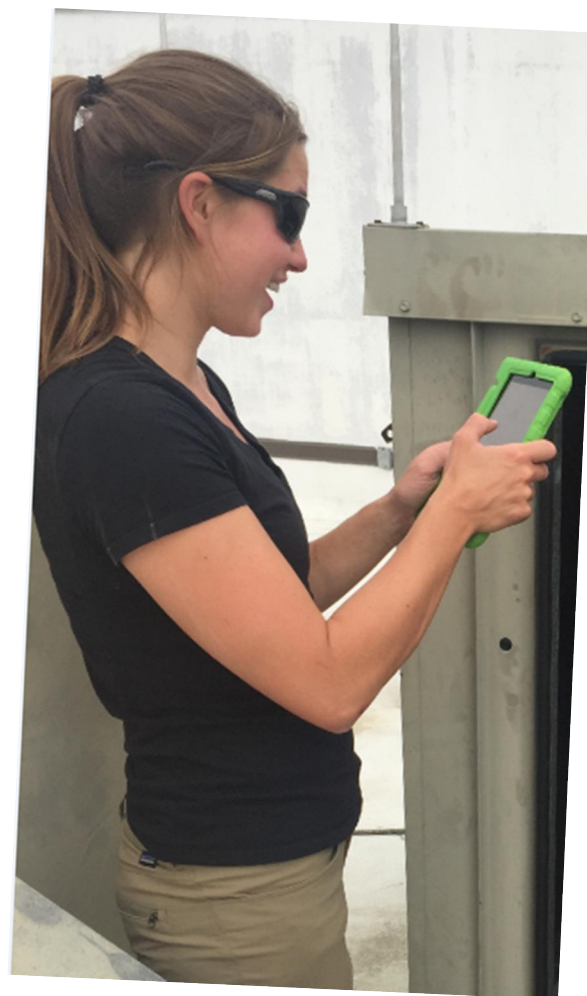
- collected detailed space-type information

Supplement with targeted metering in future years, including **winter metering**

SPECIAL THANKS!



- » **EmPOWER Maryland utilities:**
- › **Baltimore Gas and Electric**
 - › **Potomac Electric Power Company**
 - › **Delmarva Power & Light Company**
 - › **Potomac Edison**
 - › **Southern Maryland Electric Cooperative**



DISCUSSION

Ryan Powanda

Managing Consultant, Navigant

ryan.powanda@navigant.com

303-728-2480

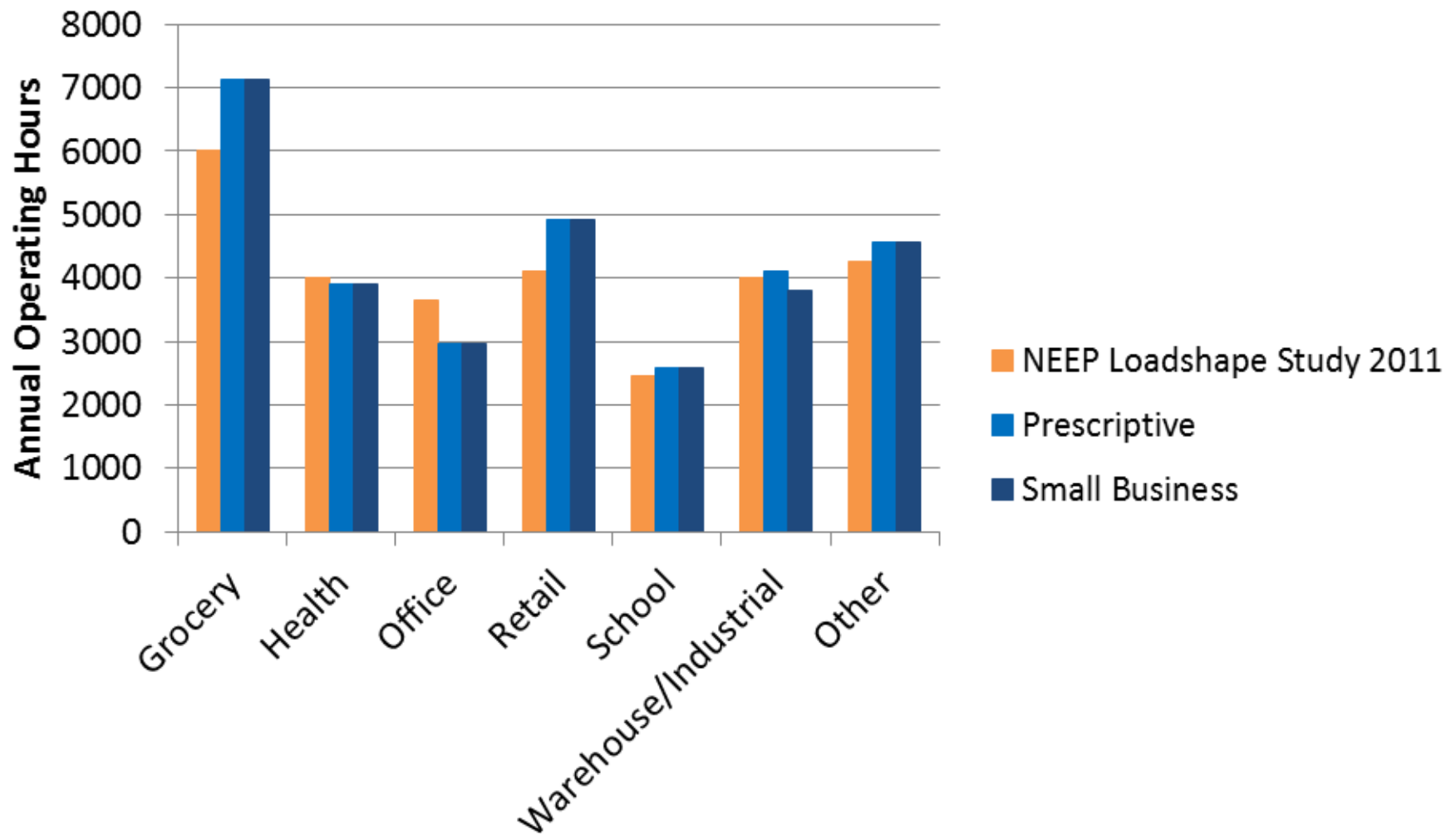
Full report available at:

<http://www.navigant.com/insights/events/2015/08/11/iepec-2015/>



©2015 Navigant Consulting, Inc. All rights reserved.

BENCHMARKING – NEEP/TRM HOU



BENCHMARKING – NEEP/TRM COINCIDENCE FACTORS

