

Northeast Residential Lighting HOU Study

Evaluation Results

Connecticut Energy Efficiency
Board

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Overview

- Last lighting HOU study done in 2009
- Concerns that we might be over-stating operating hours
- Residential lighting remains a large part of the portfolio, and HOU directly drives savings
- Multistate study involving NY, CT and RI along with MA ; May be the most comprehensive study of residential lighting usage patterns ever done in the US.

Results

- Light usage:
 - Upstream: 2.9 HOU
 - Direct install: 2.7 HOU
- Very few significant differences between:
 - States (CT, MA, RI, and UNY)
 - Income levels
 - Home types
- HOU in Downstate New York are significantly higher
- Significant differences between efficient and inefficient bulbs
- Substantial saving opportunities remain
 - No signs yet that EISA is eliminating opportunity

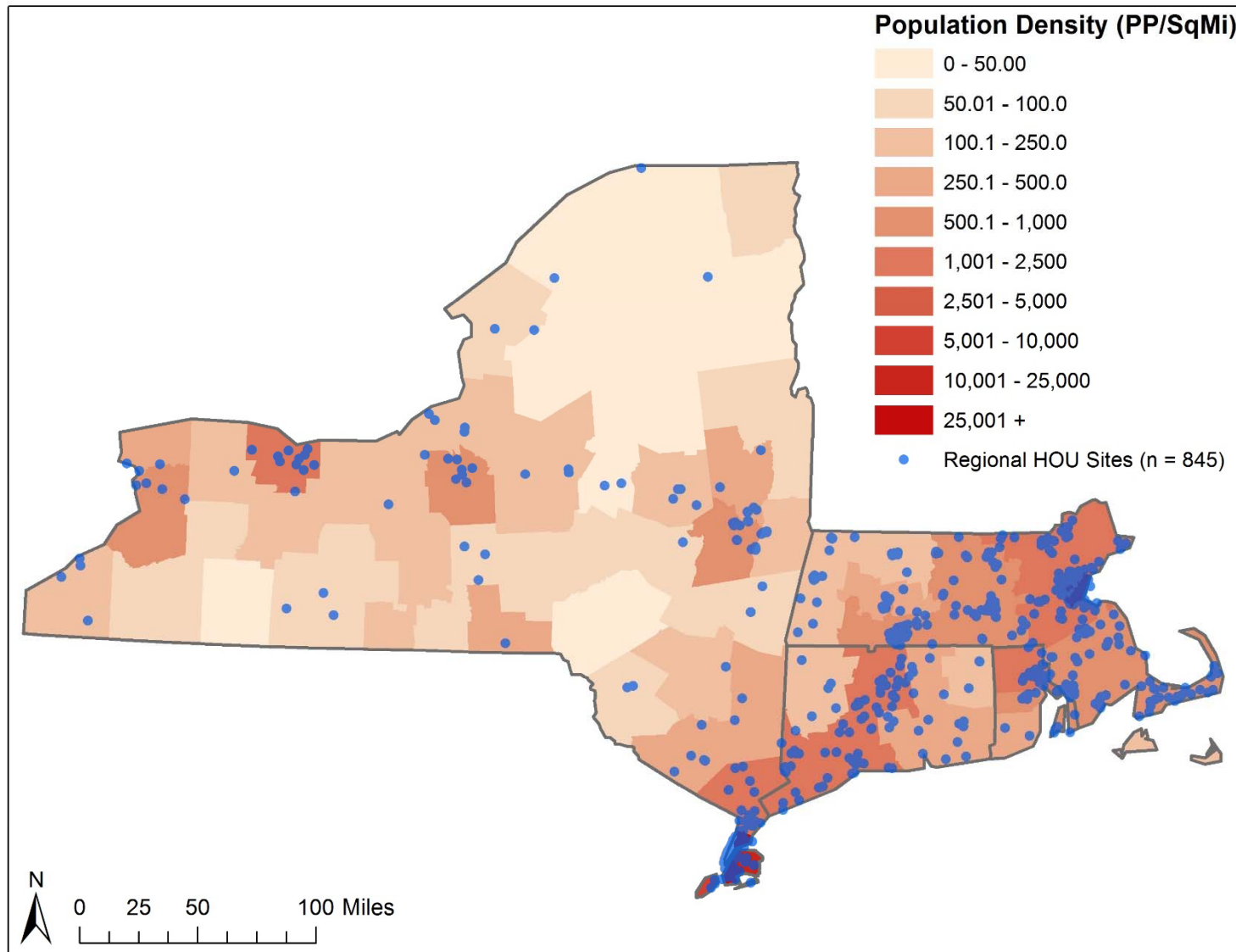
HOU	Previous	Updated
Upstream	2.8 HOU	2.9 HOU
Direct Install	2.8 HOU	2.7 HOU

Coincidence	Previous	Updated
Winter Peak	22%	16%
Summer Peak	11%	13%

Project Background

- Project started November 2, 2012
- Sponsored by:
 - Massachusetts PAs, Connecticut PAs, National Grid Rhode Island, & NYSERDA
- Study objectives:
 - Update HOU estimates by room type
 - Develop estimates for categories of homes:
 - Single family (<5 units) vs. multifamily (5+ units)
 - Low-income vs. non low-income
 - High-rise buildings
 - Last HOU study conducted five years ago
- Incorporated data from Low Income HOU Study

Sample Locations



Lighting Loggers

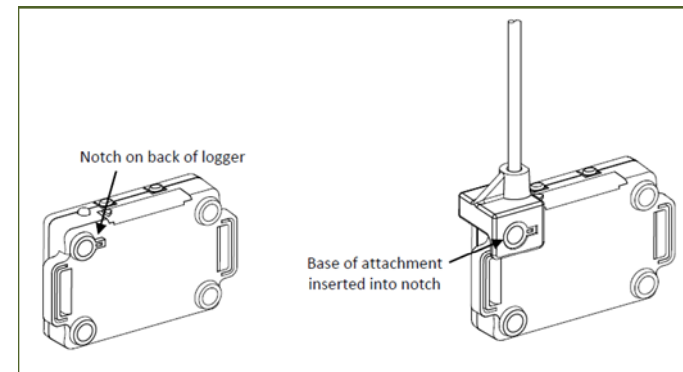
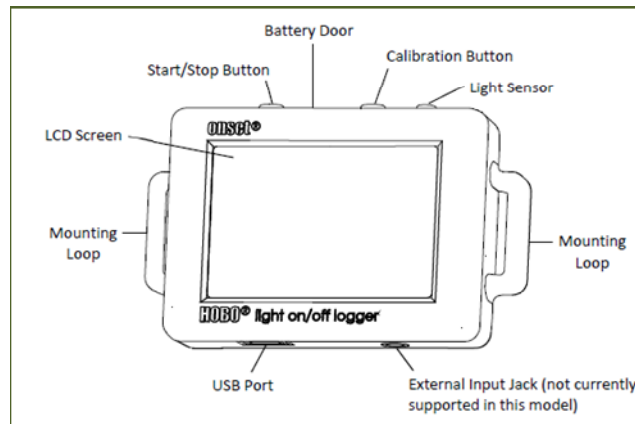
- An average of seven loggers per home
 - Six multifamily
 - Eight single family
- Installed on randomly selected fixtures
- Targets per home:
 - 1 Dining room (single family only)
 - 1 Exterior (single family only)
 - 1 Living space
 - 1 Bedroom
 - 1 Bathroom
 - 1 Kitchen
 - 2 Other (Closets, utility rooms, garages, basements, etc.)

What are Lighting Loggers?

- About the size of a business card



- Small sensor detects light



Methodology - Outliers

- Installation QA/QC steps
 - Test logger activation based on light on/off (install)
 - Test logger activation based on light on/off (removal)
 - Ask customer to estimate usage (removal)
 - Revisits at 5% of sampled sites to verify installation (install)
- During data cleaning some anomalies or outliers were identified – anomalies included:
 - Loggers that were on for weeks at a time
 - Loggers turning on/off rapidly (flickering)
 - Exterior loggers that were on during daylight hours
- More information on QA/QC and data cleaning included in the full report

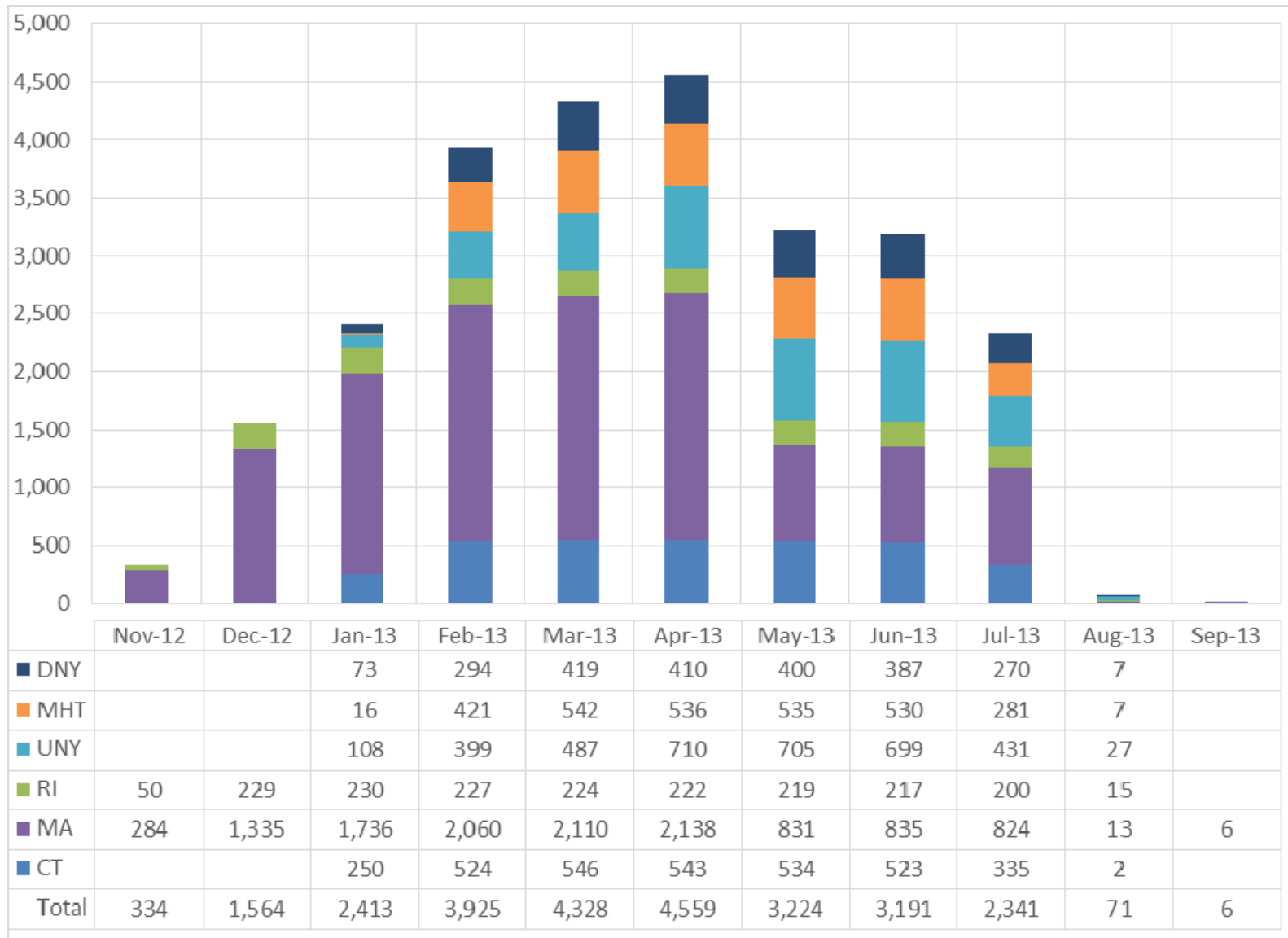
Confirmation of Light Usage

Self-Reported Estimate	# of Loggers	Avg HOU Recorded
<i>Total # of Loggers</i>	3,506	3.6
Less than 1 hour per day	191	1.5
1-2 hours per day	392	2.7
3-4 hours per day	274	4.5
5-6 hours per day	333	4.7
7-9 hours per day	59	8.6
10-14 hours per day	63	11.1
15-20 hours per day	29	11.4
24 hours per day/always	45	14.1
Never/Almost never	90	1.8
Infrequent Use	1,294	2.3
Frequent Use	504	4.5
Don't know	232	3.6

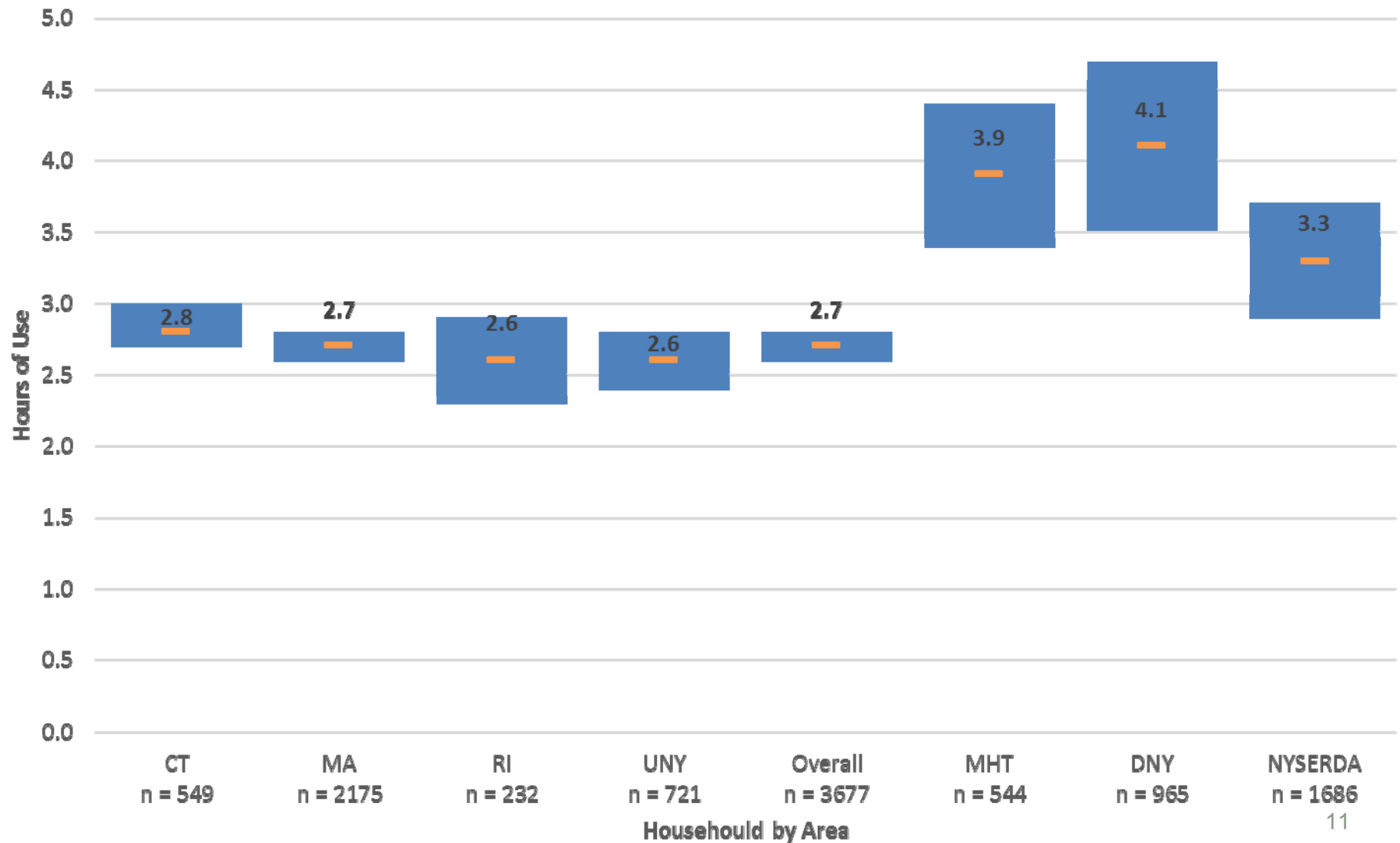
*Data presented are unweighted.

*Self-reported usage was not provided by all participants

Loggers Installed by Month



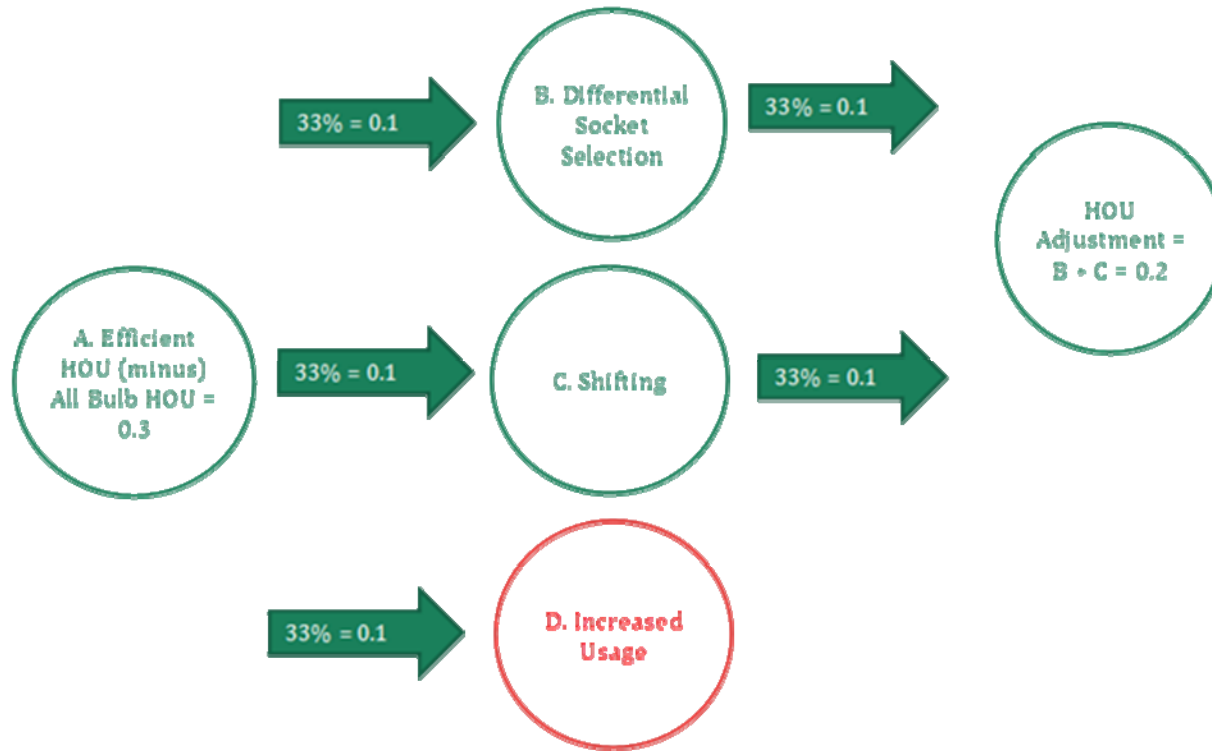
Household HOU by Area



Efficient vs. All Bulbs

- Household Efficient Bulb HOU
 - 3.0 / day or 1,095 / year
- Household All Bulb HOU
 - 2.7 / day or 986 / year
- Difference
 - 0.3 / day or 110 / year

Adjusting for Differences



- HOU**
 3.0 Efficient HOU
 2.7 All bulb HOU
- A.** 0.3 Difference
- B.** 0.1 Differential Socket Selection = one-third of difference
C. 0.1 Shifting = one-third of difference
D. 0.1 Increased Usage = one-third of difference

2.90 Adjusted Efficient HOU = all bulb HOU - differential socket selection - shifting (2.7 - 0.1 - 0.1)
 OR
 = efficient bulb HOU - increased usage (3.0 - 0.1)

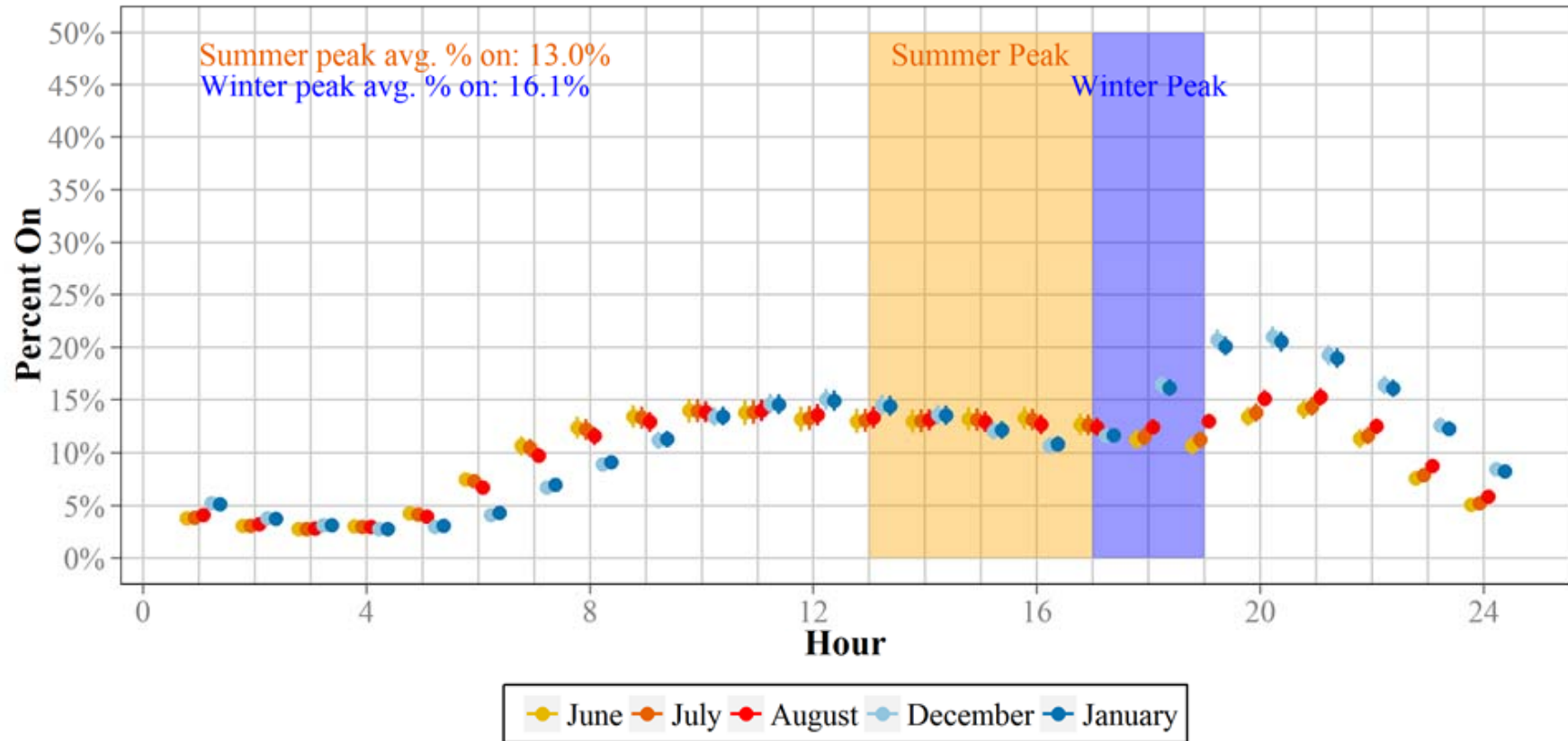
HOU Estimates by Program Type

- Programs require different estimates
- Upstream
 - Snapback adjusted efficient HOU (2.9)
 - Room-by-room updated by saturation
- Direct Install - Full replacement
 - All bulb HOU (2.7)
- Direct Install - Partial replacement
 - Room-by-room estimates (when applicable)

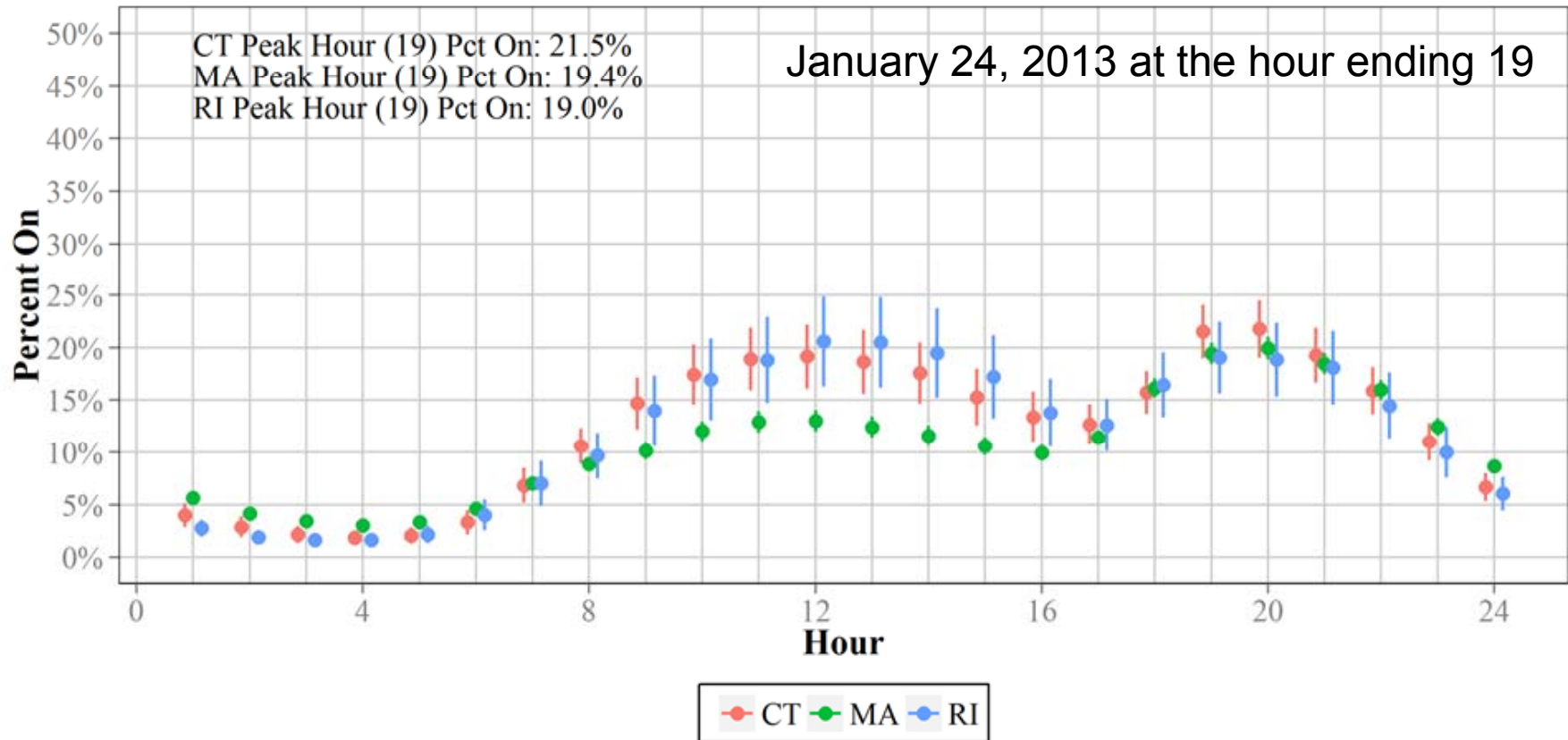
Load Shapes

- Used in calculation of coincidence factors
- Developed for each month
 - Actual hourly data: February – July
 - Modeled hourly data: August – January
- Model provides a very good fit
 - Model vs. Actual indicate predictions are on average within +/- 0.01 of actual

Overall Load Curve



ISO-NE Seasonal Peak Hours – (Winter)



ISO-NE Seasonal Peak Hours – (Summer)

