Michigan Statewide Commercial and Industrial Lighting Hours-of-Use Study

Additional Analysis

RESULTS

June 16, 2015

CONTENTS

- **Summary**
- **Background**
- **Methods**
- **Results/Recommendations**
- **Questions/Comments**

EMI CONSULTING

SUMMARY

- This memo presents the results from additional analysis of the data collected as a part of the **Statewide Commercial & Industrial (C&I) Lighting Hours-of-Use (HOU) Study** completed in June of 2014.

- Final values:

Variable	2015 MEMD Value (a)	Revised Value (b)	Ratio (b)/(a)
Hours of Use	2,744	2,669	0.97
Coincidence Factor	0.55	0.49	0.89

- Recommendations:
  - Update HOU and Coincidence Factor (CF) with revised values
  - Examine measure life to reflect reduced usage assumptions

EMI CONSULTING

BACKGROUND

- The original study was designed to collect, analyze, and report data of a representative sample of metered C&I lighting to inform the estimates of electric energy and demand impacts of Energy Opportunities (EO) program lighting measures.

- The primary objective of the 2014 study was to determine statewide lighting hours-of-use (HOU) and coincidence factor (CF) values, which are important "assumed" values in lighting energy and demand savings estimates.

EMI CONSULTING

BACKGROUND

- As a follow-up, the primary objective of the additional analysis presented in this memo was to examine the representativeness of the sample collected in the 2014 study and correct the HOU and CF values as necessary.

- Explored two types of potential corrections:
  - Representativeness of the overall distribution of *facility types*.
    - Is the breakdown of facility types in the 2014 Study sample representative of facility types in the State of Michigan?
  - Representativeness of the *size* of facilities.
    - Are the facilities included in the 2014 Study sample representative of facilities in the State of Michigan in terms of size (i.e., square footage)?

EMI CONSULTING

METHODS: FACILITY DISTRIBUTION

- Initially, we explored many possible sources for generating a suitable reference distribution
  - Candidates included Commercial Buildings Energy Consumption Survey (CBECS), Michigan Economic Dev. Database, DOE Buildings Performance Database, CoStar, Census Data, and others
- Examined methodology, representativeness, timeliness, and geographic specificity.
- Ultimately, we selected the CBECS data for additional analysis.
  - Pros: Timely, high rigor, representative facility categories
  - Cons: Regional only – includes Michigan, Ohio, Indiana, Illinois, and Wisconsin. However, based on examination of other data, these states are similar enough for the purposes of our analysis.

EMI CONSULTING

METHODS: FACILITY DISTRIBUTION
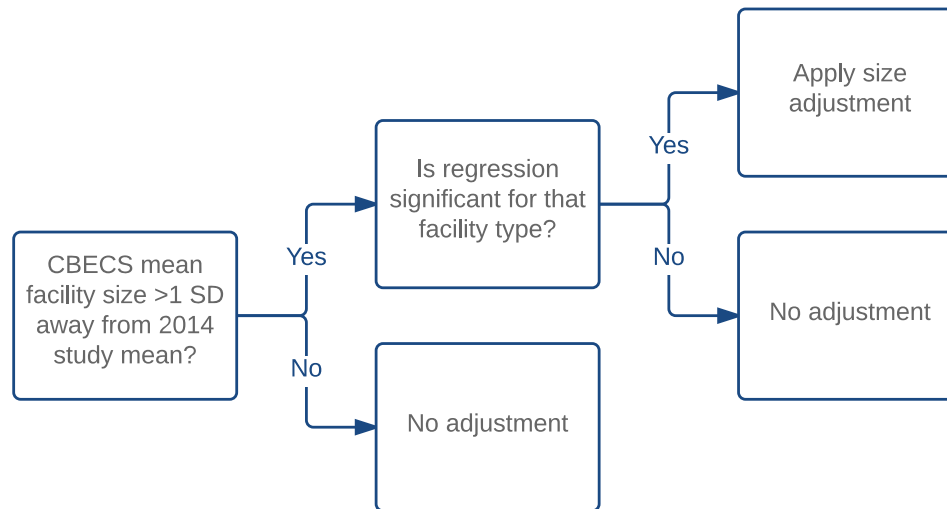
- We mapped facility categories from 2014 data to CBECS data:

Facility Type	2014 Incidence Study Weight	CBECS Facility Dist. Weight
Retail	33%	25%
Office	24%	18%
Assembly (Churches, etc.)	7%	6%
Assembly (Convention, etc.)		8%
Lodging	1%	1%
Medical	5%	3%
Restaurant	5%	5%
School (K-12)	2%	5%
Warehouse	3%	9%
Industry [a]	7%	7%
Apartments [a]	6%	6%
Other	7%	6%

[a] Note that "Industry" and "Apartments" were carried over from 2014 study data. CBECS does not have a category for either of these groups.

METHODS: FACILITY SIZE

- We applied facility size adjustments (based on square footage) to HOU and CF values using individual linear regressions for all facility types for which the mean facility size in the CBECS data was greater than one standard deviation beyond the 2014 study data AND the regression was significant.

```
CBECS mean                    Is regression                    Apply size
facility size >1 SD   --Yes-->  significant for that  --Yes-->  adjustment
away from 2014                 facility type?
study mean?                                           --No-->   No adjustment
            |
           No
            |
            v
        No adjustment
```

EMI CONSULTING

METHODS: FACILITY SIZE

- Five facility types differed by >1 standard deviation (in bold).
- However, only the regression for medical facilities was significant.

	Statewide C&I Lighting HOU Study		CBECS Data Midwest Census Region/East North Central Census Division	
Facility Type	Mean Size (sq. ft.)	S.D.	Mean Size (sq. ft.)	Within One SD?
Retail	**4,610**	**4,118**	**11,405**	**No**
Office	**5,717**	**8,577**	**15,779**	**No**
Assembly (Churches, etc.)	8,180	4,215	10,940	Yes
Assembly (Convention, etc.)	33,975	36,377	18,400	Yes
Other	**4,913**	**2,769**	**16,739**	**No**
Medical	**12,092**	**23,781**	**31,182**	**No**
Restaurant	**3,196**	**1,277**	**4,822**	**No**
Warehouse	34,571	66,848	19,873	Yes
School (K-12)	105,836	73,617	50,114	Yes
Lodging	2,500	NA	74,778	NA

EMI CONSULTING

OVERALL RESULTS

- Overall results by facility type distribution are shown below.
- The only facility size correction was performed for medical facilities (in bold).

Facility Type	2014 Study HOU	Adjusted HOU	EMI Facility Distribution	Adjusted Facility Distribution
Retail	2,830	No change	33%	25%
Office	1,974	No change	24%	18%
Assembly (Churches, etc.)	635	No change	7%	6%
Assembly (Convention, etc.)	2,581	No change		8%
Apartment	5,184	No change	6%	6%
Other	1,414	No change	7%	6%
Lodging	1,515	No change	1%	1%
Medical	**3,222**	**3,893**	5%	3%
Restaurant	4,046	No change	5%	5%
School (K-12)	2,239	No change	2%	5%
Warehouse	3,587	No change	3%	9%
Industry	2,393	No change	7%	7%

EMI CONSULTING

OVERALL RESULTS

- Final adjusted values compared to current values:

Variable	2015 MEMD Value (a)	Revised Value (b)	Ratio (b)/(a)
Hours of Use	2,744	2,669	0.97
Coincidence Factor	0.55	0.49	0.89

RECOMMENDATIONS

- **Recommendation 1:** The research team recommends that the Michigan Public Service Commission (MPSC) update the 2016 MEMD to reflect an annual hours-of-use assumption of **2,669** hours for non-high bay lighting measures and a coincidence factor of **0.49**.

- **Recommendation 2:** The research team recommends that the MPSC revisit assumptions for measure life given this revised HOU value. Given the decrease in estimated usage, a corresponding increase in measure life may be reasonable. However, this study did not formally estimate the measure life associated with lighting equipment.

EMI CONSULTING

THE END

Questions?

EMI CONSULTING

Appendix Slides

EMI CONSULTING

BOXPLOT: 2014 STUDY FACILITY SIZES

- Boxplot showing the distribution of individual buildings' square footage for each facility type:

  (for facilities where the CBECS mean was >1 S.D.)

EMI CONSULTING
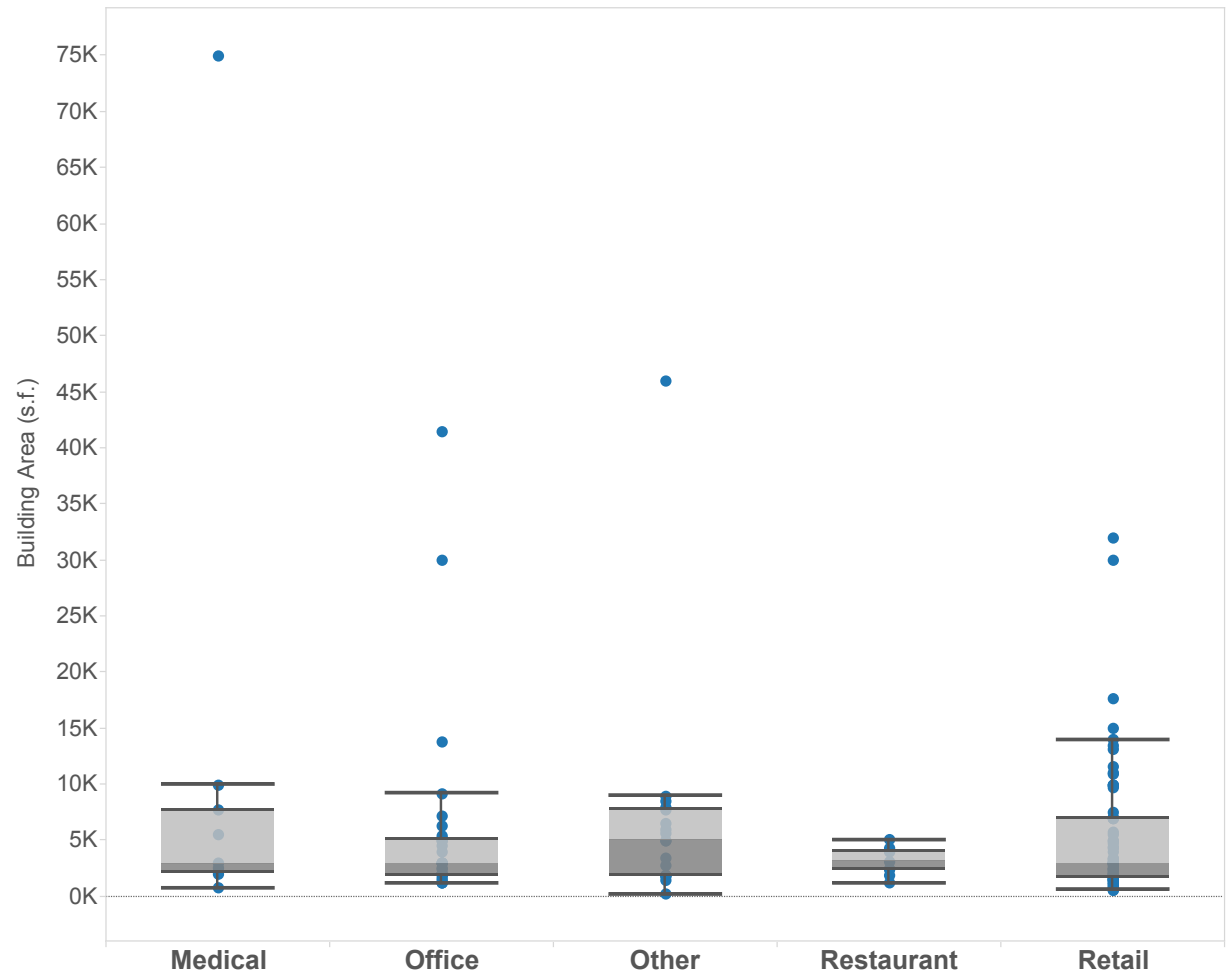
REGRESSION PLOTS (1/2)
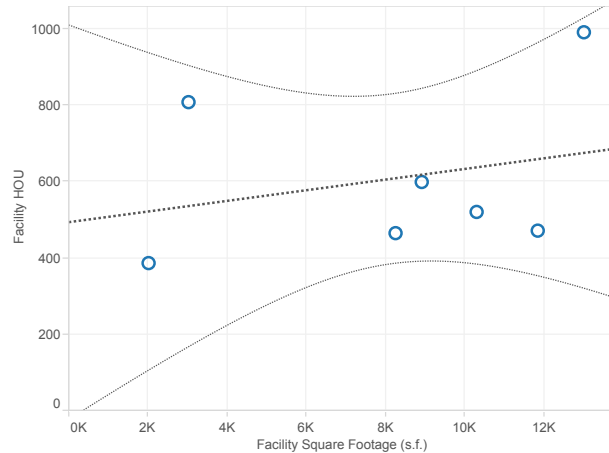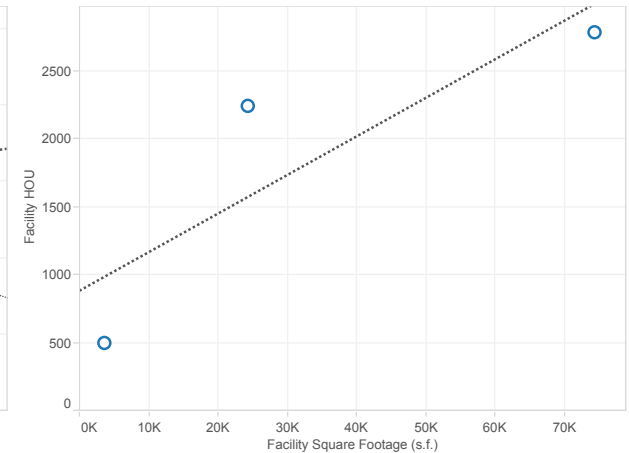
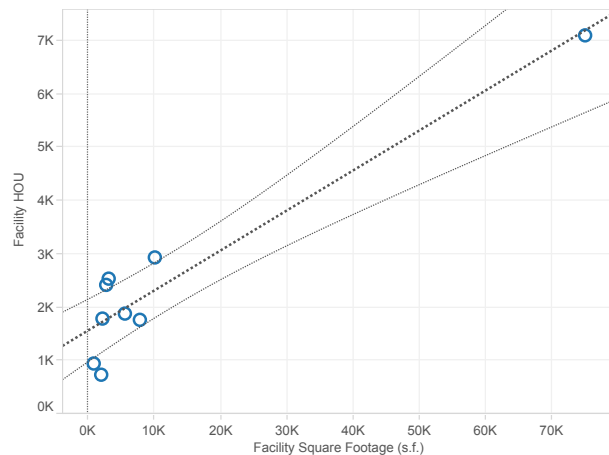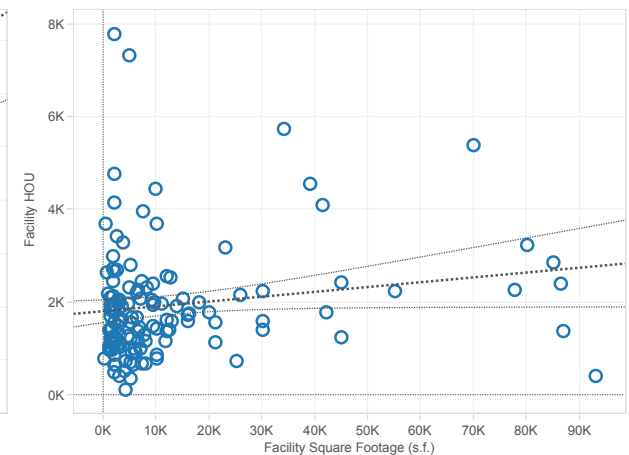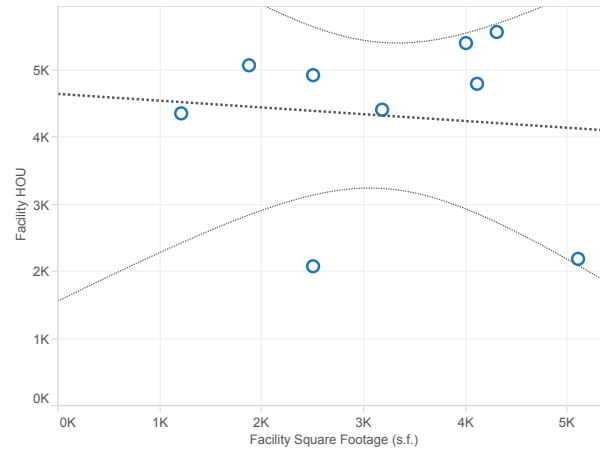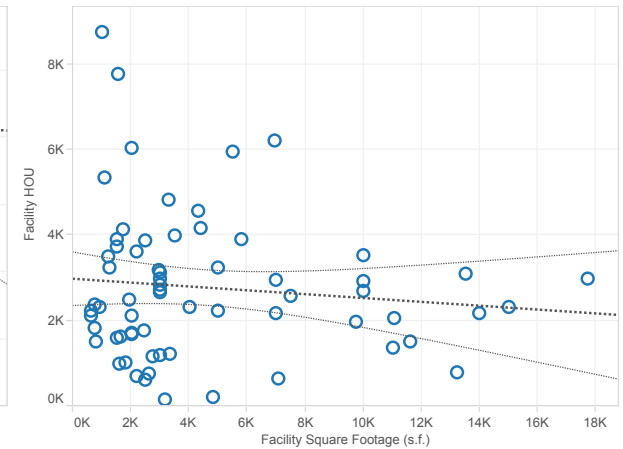- Regression plots show the plotted relationship between square footage and HOU for each facility type:

REGRESSION PLOTS (2/2)

- Regression plots show the plotted relationship between square footage and HOU for each facility type:

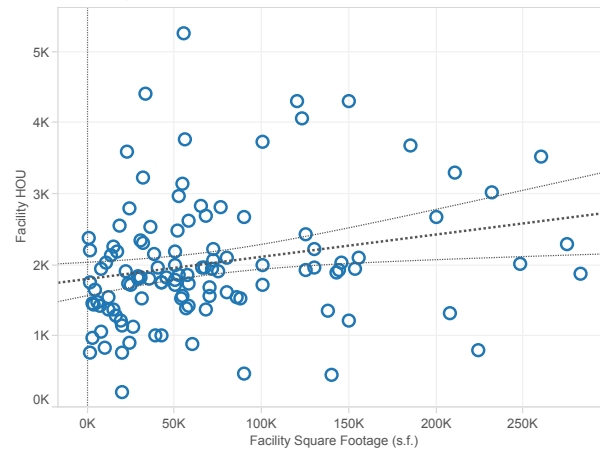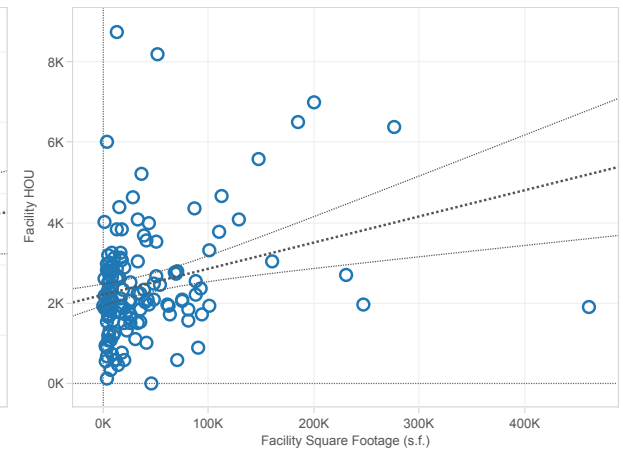# CBECS: INDUSTRY COMPARISON BETWEEN STATES

- Differences in the number of establishments by industry classification between the five states in the East North Central region were minimal:

NAICS Industry Type (2013 data)	Percentage of Total Establishments by State					
	MI	IL	IN	OH	WI	Average
Accommodation and Food Services	9%	9%	9%	9%	10%	9%
Administrative and Support and Waste Management and Remediation Services	5%	5%	5%	5%	5%	5%
Arts, Entertainment, and Recreation	2%	1%	1%	2%	2%	2%
Construction	8%	9%	9%	8%	10%	9%
Educational Services	1%	1%	1%	1%	1%	1%
Finance and Insurance	6%	7%	7%	7%	7%	7%
Health Care and Social Assistance	12%	11%	11%	11%	11%	11%
Information	2%	2%	1%	1%	2%	2%
Management of Companies and Enterprises	1%	1%	1%	1%	1%	1%
Manufacturing	6%	4%	6%	6%	6%	5%
Other Services (except Public Administration)	10%	10%	11%	11%	11%	11%
Professional, Scientific, and Technical Services	10%	12%	9%	10%	8%	10%
Real Estate and Rental and Leasing	3%	4%	4%	4%	3%	4%
Retail Trade	16%	13%	15%	15%	14%	14%
Transportation and Warehousing	3%	4%	4%	3%	4%	3%
Wholesale Trade	5%	6%	5%	6%	5%	6%

EMI CONSULTING