

Measuring Plug Loads in Office Spaces

Dan Harris, MSME, P.E.

NBI

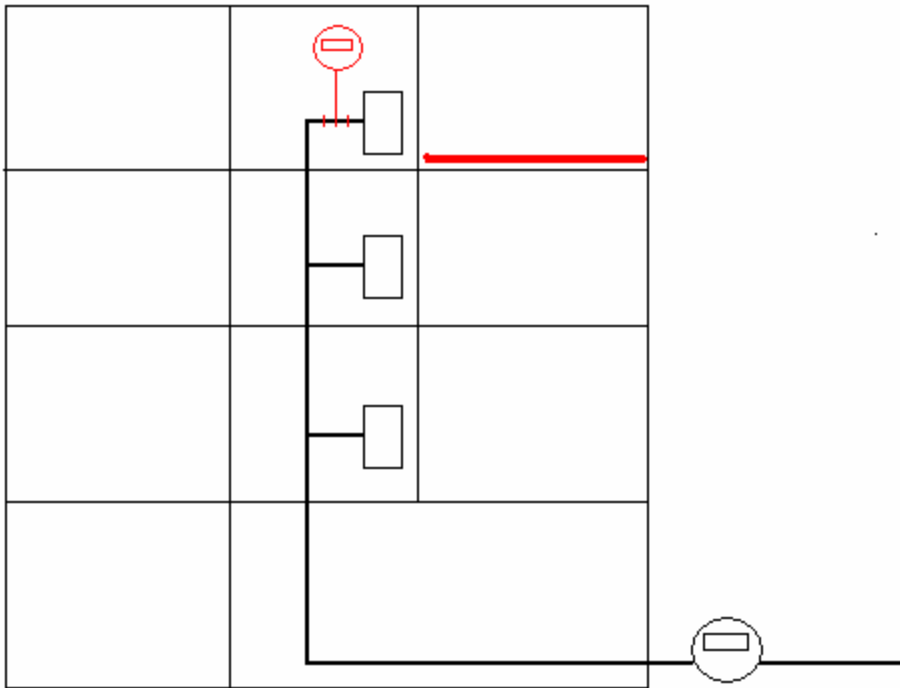
Today

- NBI Plug Load Data
 - Framework of metrics
 - Results from the field
 - Thoughts on market access

Data Sources

- PIER Project – Evidence Based Design
- Office of the Future
- Vendor Partners
- Collaborative Partners

Whole Building Versus Floor/Office

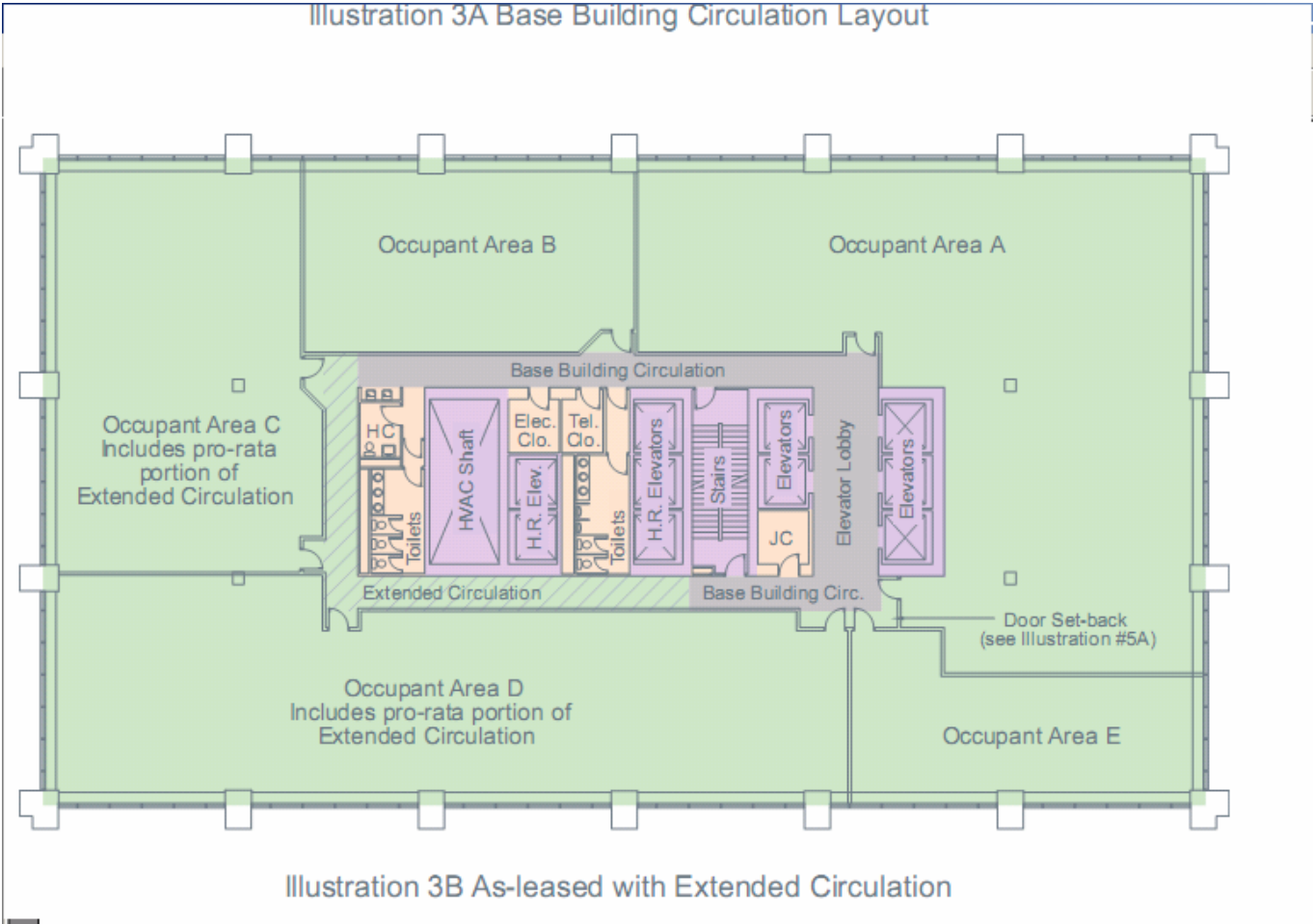


Core Areas
Removed

Office "Panel"
level

Office Plug Load
Aggregation

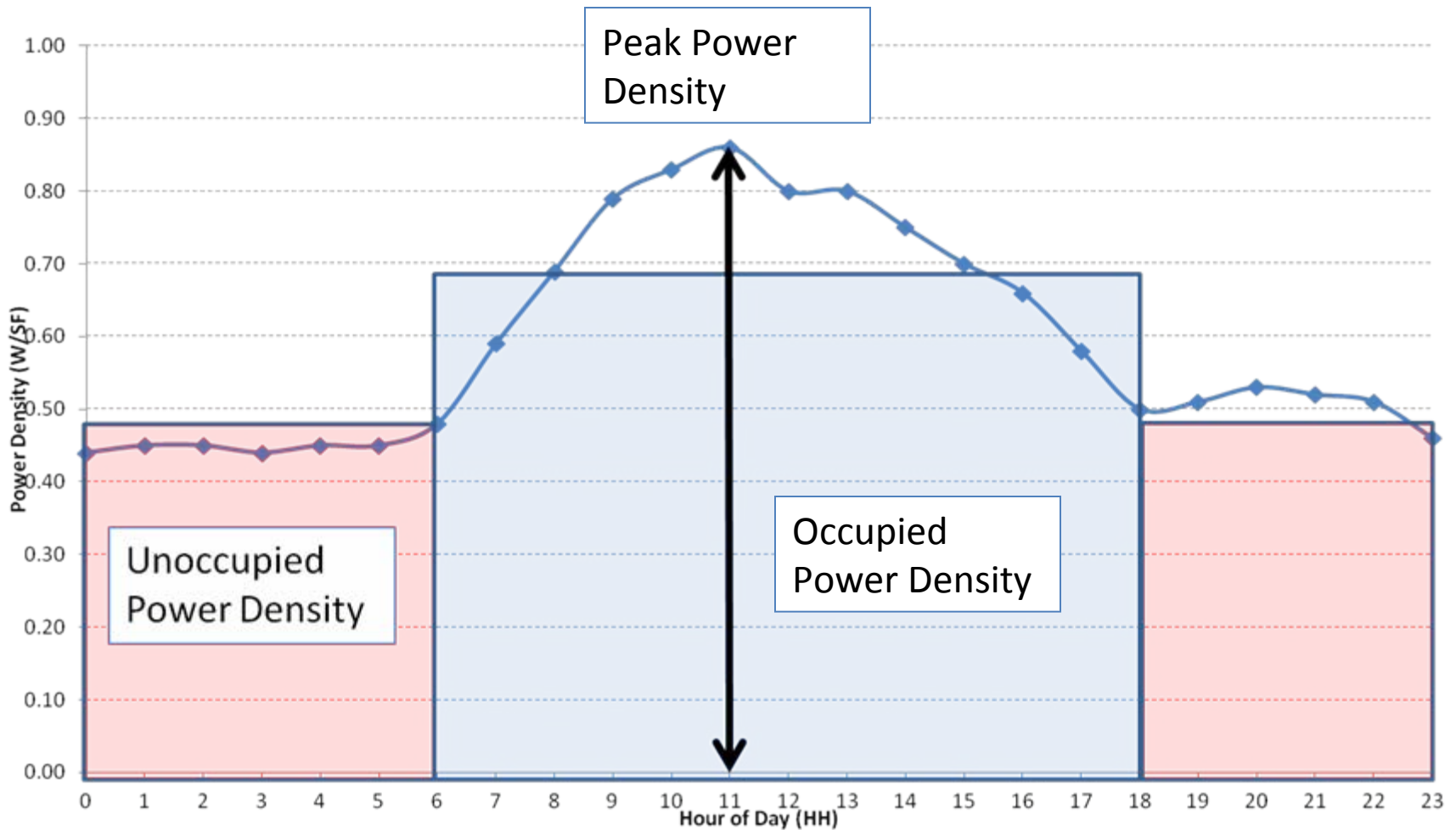
ANSI/BOMA Office Areas



NBI Metrics

Name	Unit	Definition
Occupied Power Density	W/SF	Average power per SF for non-holiday weekdays between 6AM – 6PM
Weekday Power Density	W/SF	Average power per SF for non-holiday weekdays in 24-hour day
Sat/Sun/Hol Power Density	W/SF	Average power per SF for weekends and holidays in 24-hour day
Off Hours Ratio	Dim.	Ratio of average power density for non-holiday weekdays between 6PM – 6AM and the Occupied Power Density
SSH Ratio	Dim.	Ratio of SSH Power Density and Weekday Power Density
Peak Demand Density	W/SF	Absolute maximum demand density (at smallest interval available) seen in period.
Annualized Energy	kWh/SF	Average power per SF for non-holiday weekdays between 6AM – 6PM in the period

NBI Metrics – Graphical



NBI Metrics, n=16

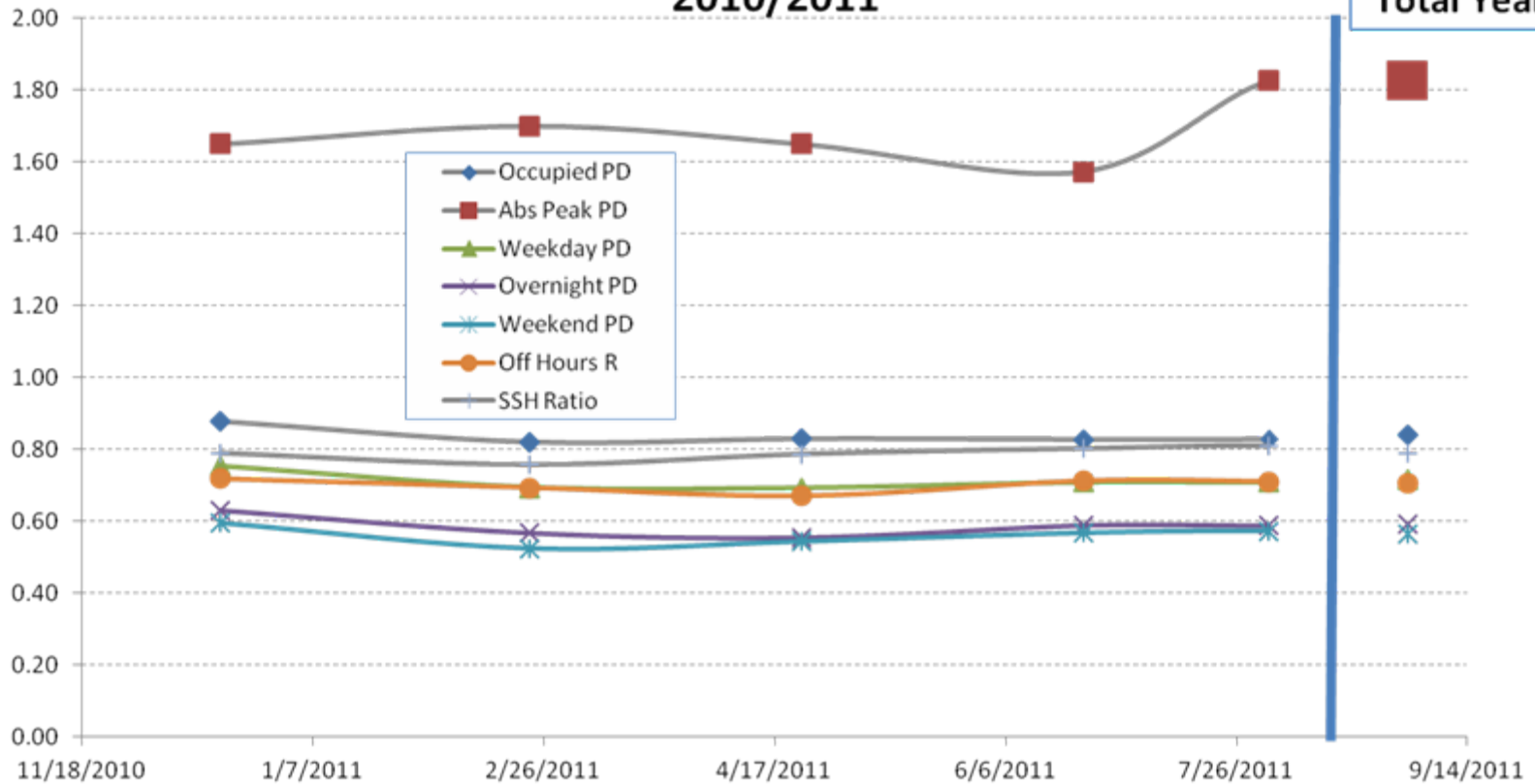
Name	Unit	Min	Median	Max	Average
Occupied Power Density	W/SF	0.12	0.60	1.69	0.65
Weekday Power Density	W/SF	0.10	0.43	1.64	0.55
Sat/Sun/Hol Power Density	W/SF	0.07	0.29	1.57	0.46
Off Hours Ratio	Dim.	39%	53%	95%	57%
SSH Ratio	Dim.	50%	70%	105%	71%
Peak Demand Density	W/SF	0.39	0.86	2.0	1.07
Annualized Energy	kWh/SF	0.85	3.33	14.21	4.74

Results - Over Time

DCH 9-1-2011

One Year of Lighting Metrics at two month trailing periods for 2010/2011

Total Year



Results – Compared to Lighting

	Ratio of Annualized Lighting to Annualized Plug Loads
Min	0.9
Median	2.4
Max	14
Average	3.7

- Plug load annualized energy exceeds lighting annual energy in 15 of 16 cases

Discussion – Takeaways

- Plug loads in offices are 2 – 3 times larger than lighting loads
- Even in the “best” offices, energy use in the Unoccupied periods is at least 50% of the Occupied periods
- Peak load density, which best reflects installed capacity, maxes out at 2.0 W/SF
- Plug load metrics seem to remain unchanged over time given stable occupancy

Accessing the Resource

- Meterability as part of codes
- Common metrics
- Meter products explosion
- Periodic checks versus permanent meters
- Behavior and feedback – best practices

Thanks

Dan Harris

nbi

dan@newbuildings.org

360-567-0950 x101

nbi new buildings
institute