This exhibit includes the following three parts:

1. Demonstration of ComEd needle peaks and implications for expected load

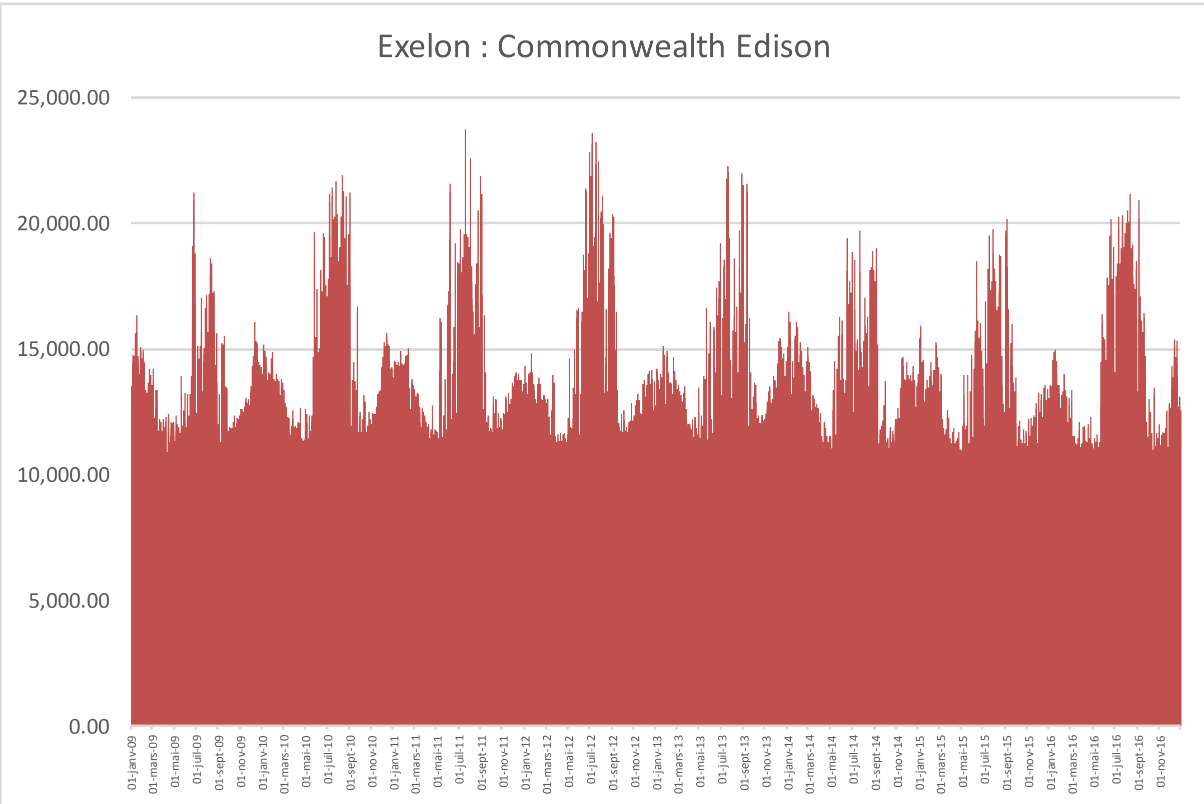
2. Comparison of timing distributions from system-wide load and from distributions

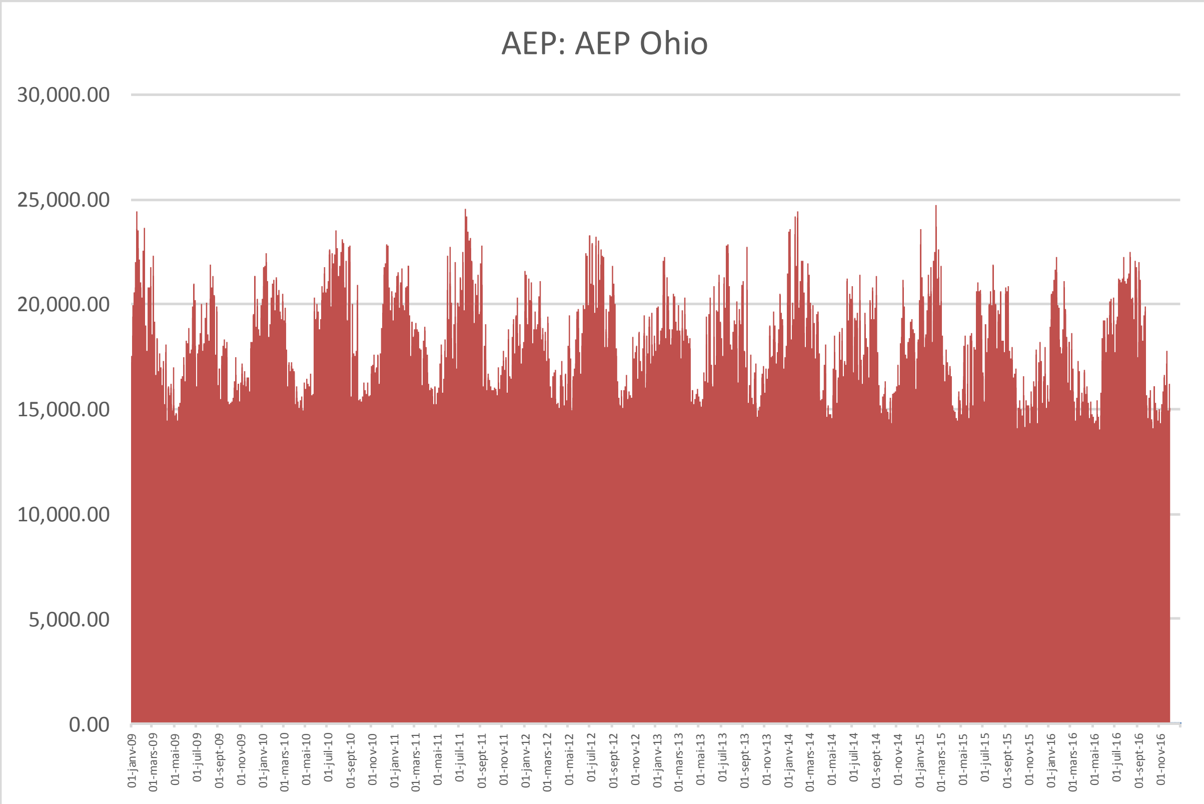
3. Demonstration that if regional peaks do vary, the allocation to street lights is overstated because needle peaks are even more aggravated

1. Demonstration of ComEd Needle Peaks and Implications for Expected Load

In part 1, data from PJM is used to demonstrate that ComEd has a more extreme phenomena of needle peaks than other utilities. To illustrate this, the first set of graphs compare ComEd and a company more like Ameren and MidAmerican. I used AEP as a comparison but you can look at other utilities in the work papers. The graphs present the daily peak load reported by ComEd to PJM.

The key thing to note is that year after year, ComEd (named CE by PJM and shown on the graph title) has a summer needle peak. Generally, the summer peak is more than 20,000 MW compared to a winter peak of about 15,000 MW. AEP by contrast had has some winter peaks and a much higher load factor. I present a number of years so as not to be accused of focusing on a particular year that may have some extreme characteristics. The data shows that 2014 and 2015 (feeder study years) were not typical.




AEP: AEP Ohio
30,000.00
25,000.00
20,000.00
15,000.00
10,000.00
5,000.00
0.00
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01-mars-09
01-mai-09
01-juil-09
01-sept-09
01-nov-09
01-janv-10
01-mars-10
01-mai-10
01-juil-10
01-sept-10
01-nov-10
01-janv-11
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01-mai-12
01-juil-12
01-sept-12
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01-juil-13
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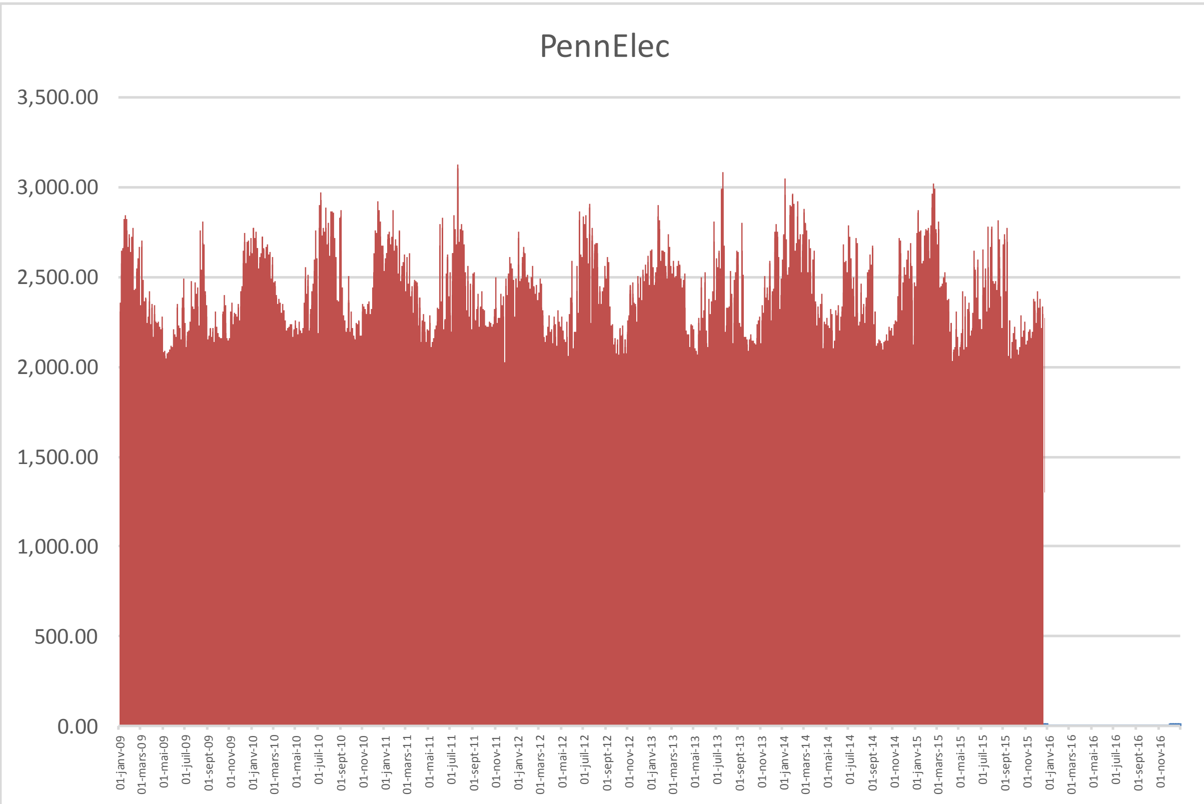
01-nov-16


PennElec
3,500.00
3,000.00
2,500.00
2,000.00
1,500.00
1,000.00
500.00
0.00
01-janv-09
01-mars-09
01-mai-09
01-juil-09
01-sept-09
01-nov-09
01-janv-10
01-mars-10
01-mai-10
01-juil-10
01-sept-10
01-nov-10
01-janv-11
01-mars-11
01-mai-11
01-juil-11
01-sept-11
01-nov-11
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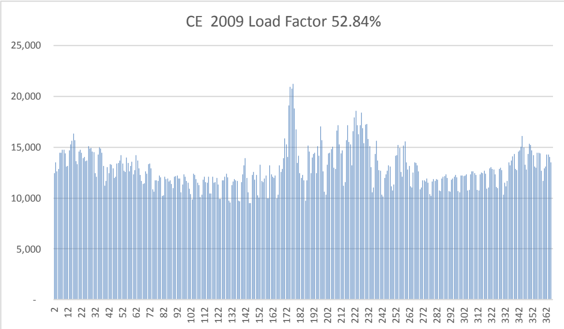
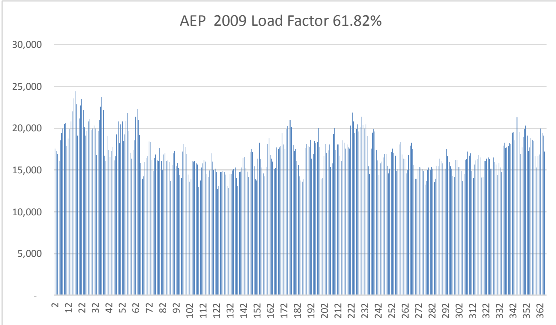
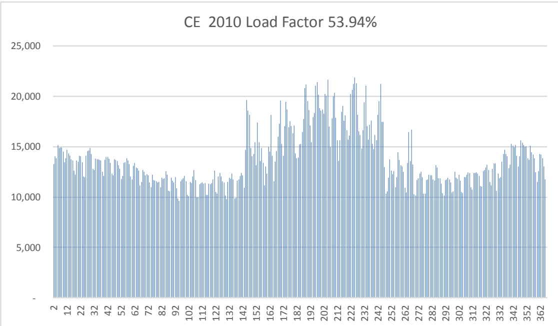
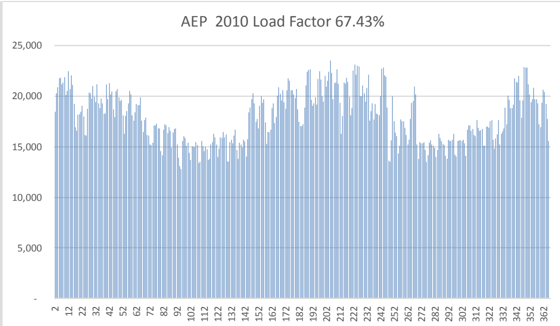
01-nov-16


CE 2009 Load Factor 52.84%
25,000
20,000
15,000
10,000
5,000
-


AEP 2009 Load Factor 61.82%
30,000
25,000
20,000
15,000
10,000
5,000
-


CE 2010 Load Factor 53.94%
25,000
20,000
15,000
10,000
5,000
-


AEP 2010 Load Factor 67.43%
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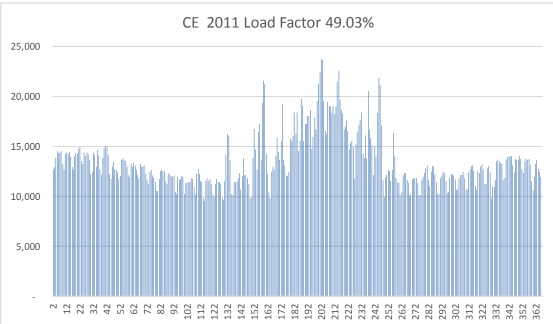
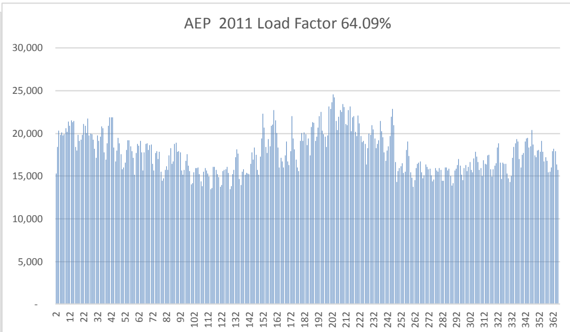
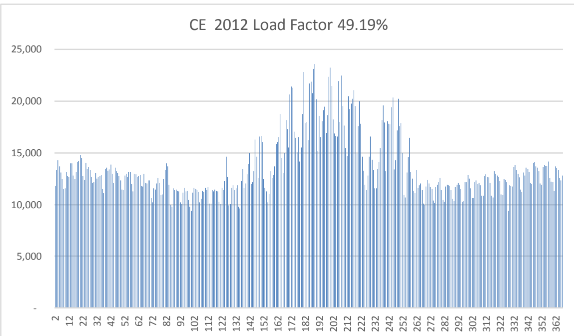
20,000
15,000
10,000
5,000
-


CE 2011 Load Factor 49.03%
25,000
20,000
15,000
10,000
5,000
-


AEP 2011 Load Factor 64.09%
30,000
25,000
20,000
15,000
10,000
5,000
-


CE 2012 Load Factor 49.19%
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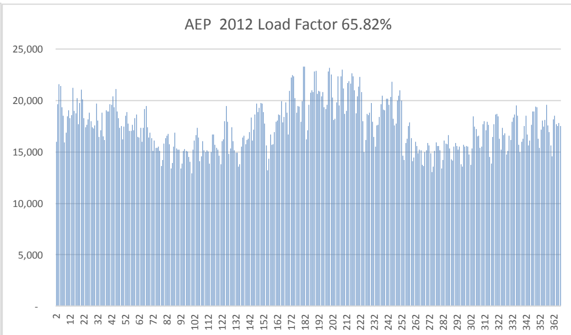
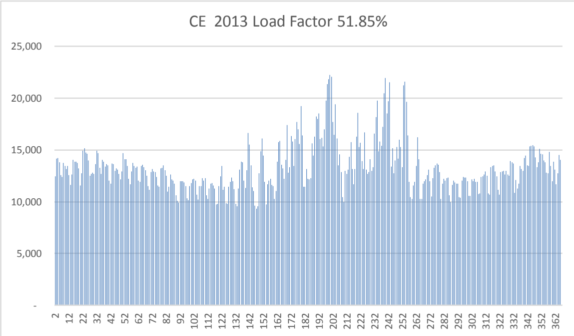
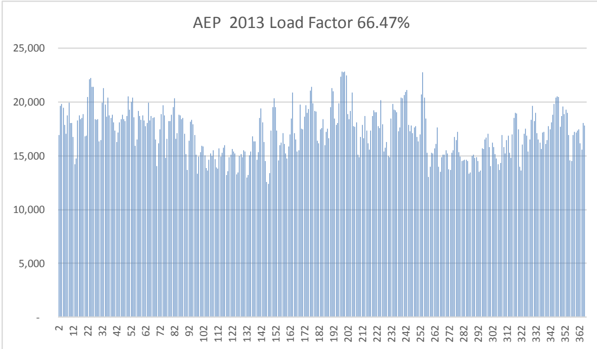
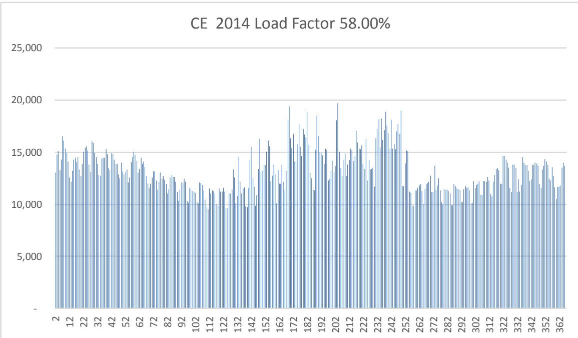
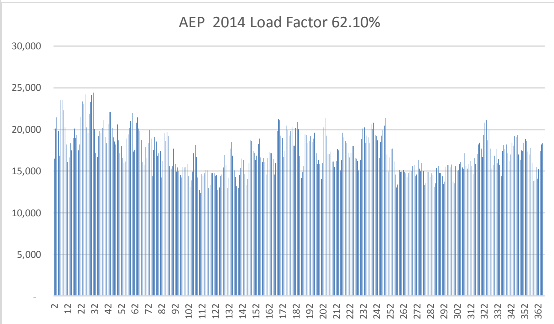
20,000
15,000
10,000
5,000
-

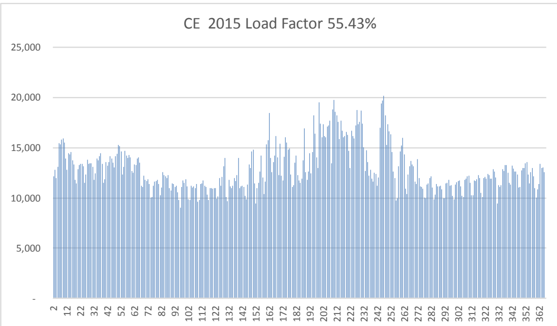

AEP 2012 Load Factor 65.82%
25,000
20,000
15,000
10,000
5,000
-

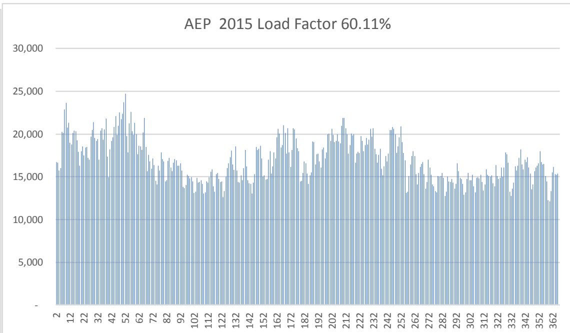


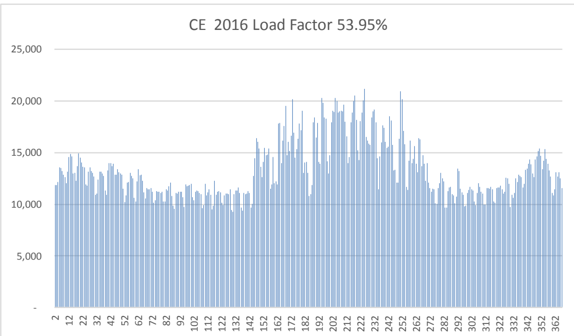


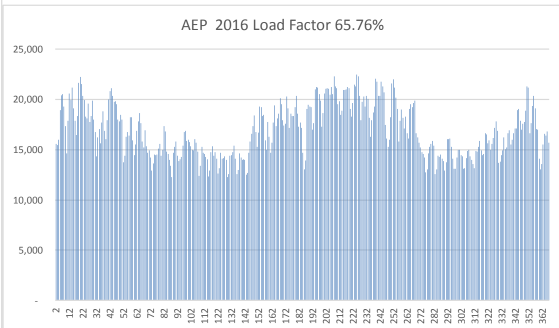




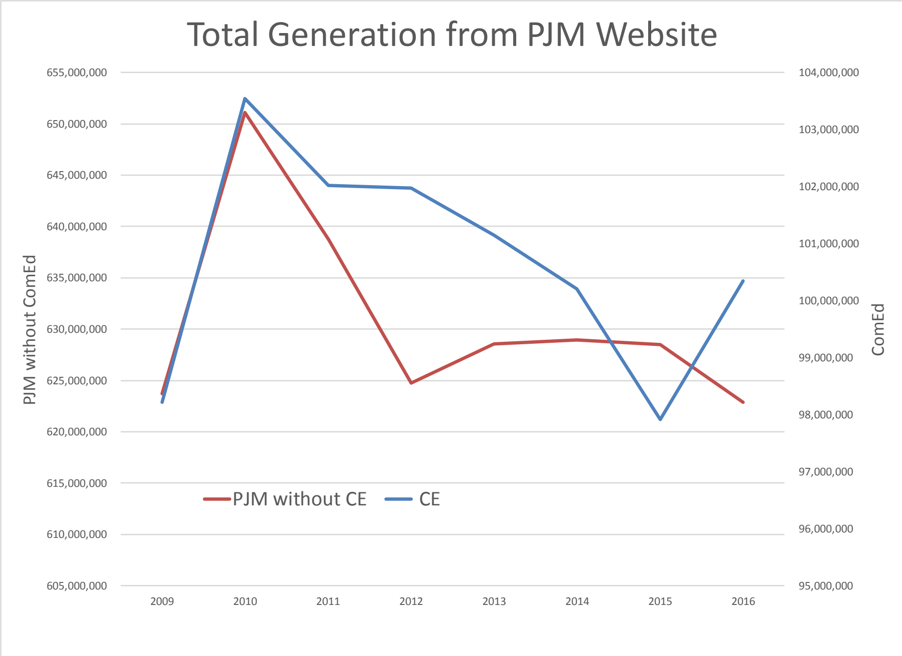


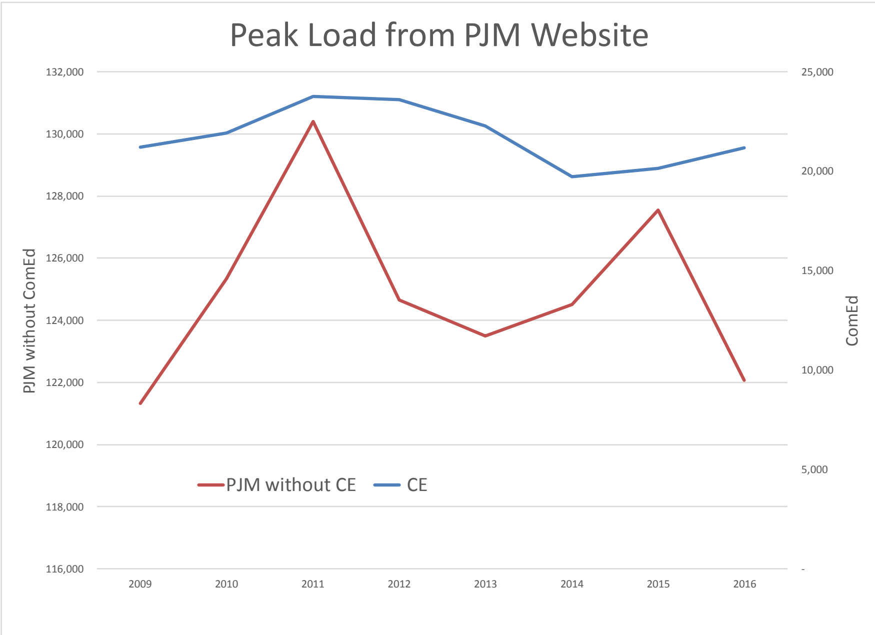


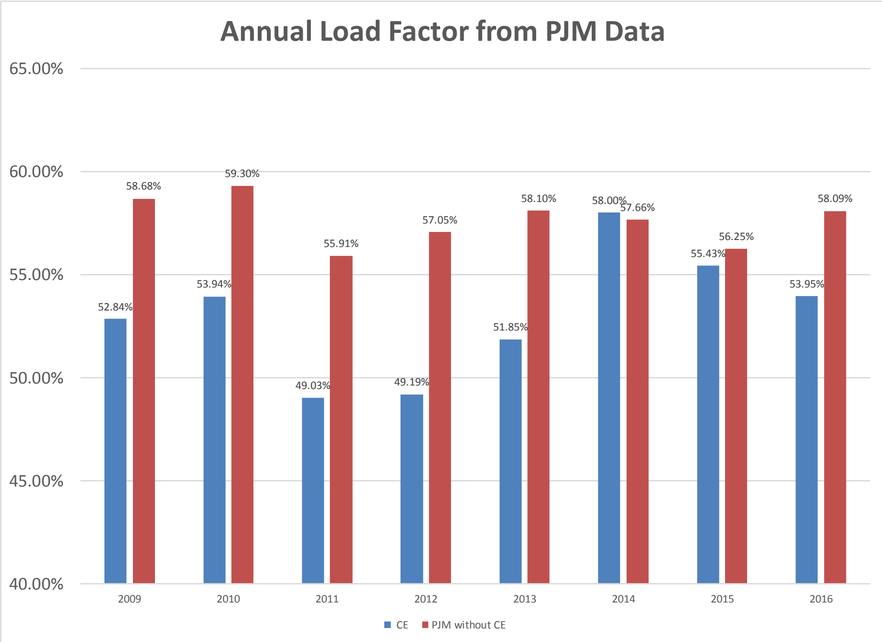




The load factors for ComEd and other utilities are computed as the average load for each hour of the year divided by the peak load. ComEd's relatively low load factor comes from the high summer peak. Loads, generation and the load factors of other companies are shown below.


Total Generation from PJM Website
655,000,000
650,000,000
645,000,000
640,000,000
635,000,000
630,000,000
625,000,000
620,000,000
615,000,000
610,000,000
605,000,000
PJM without ComEd
104,000,000
103,000,000
102,000,000
101,000,000
100,000,000
99,000,000
98,000,000
97,000,000
96,000,000
95,000,000
ComEd
2009
2010
2011
2012
2013
2014
2015
2016
PJM without CE
CE


Peak Load from PJM Website
132,000
130,000
128,000
126,000
124,000
122,000
120,000
118,000
116,000
PJM without ComEd
25,000
20,000
15,000
10,000
5,000
-
ComEd
2009
2010
2011
2012
2013
2014
2015
2016
PJM without CE
CE



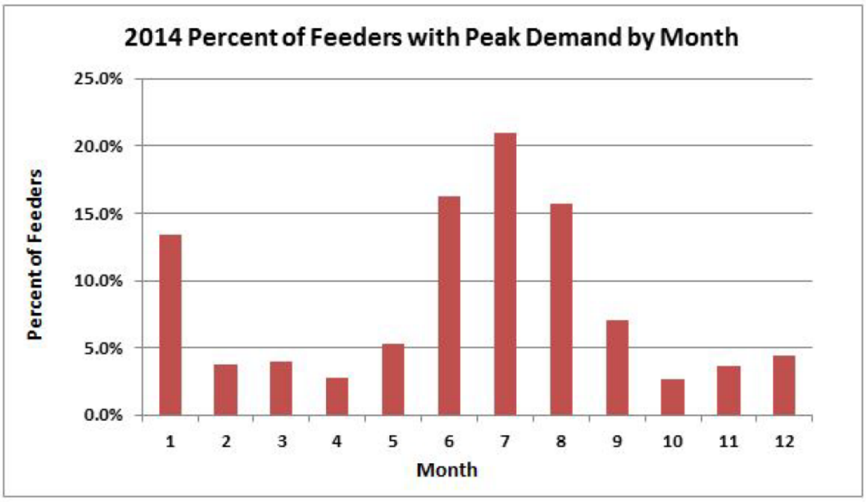
Annual Load Factors for PJM

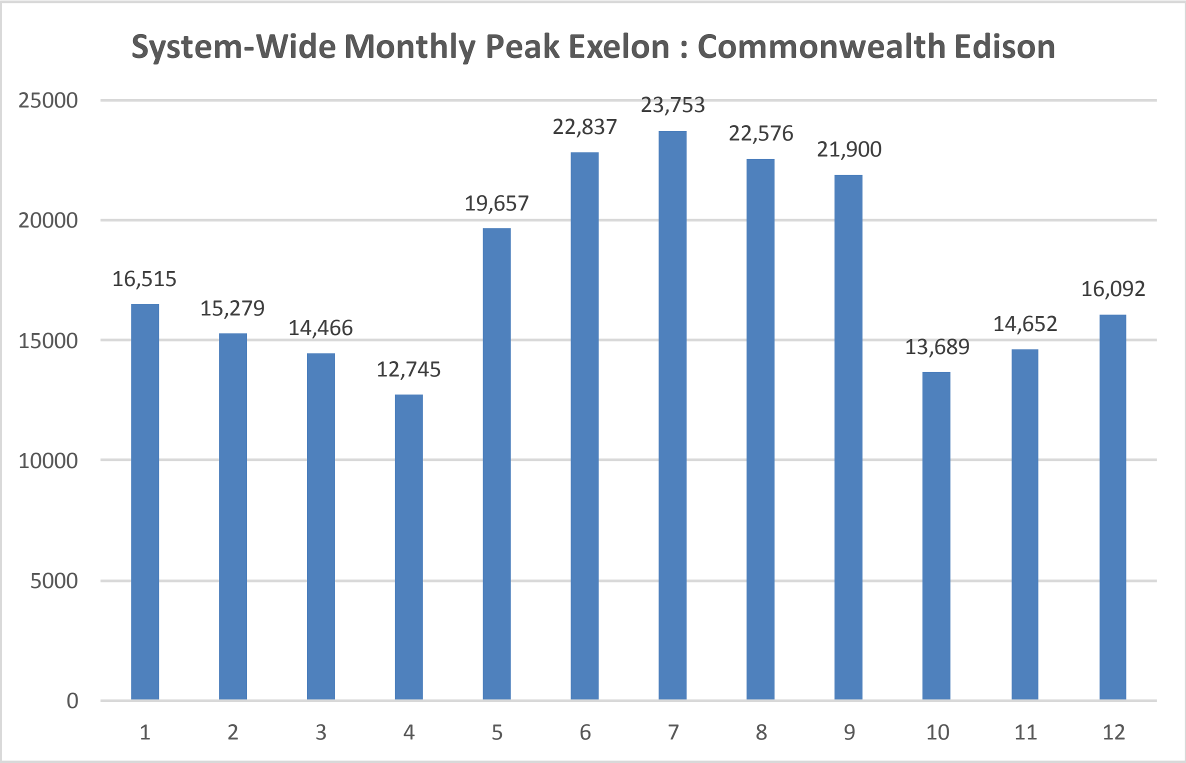
	2009	2010	2011	2012	2013	2014	2015	2016
PS	52.87%	49.43%	47.40%	48.14%	48.56%	52.12%	52.60%	51.37%
PE	58.38%	55.03%	52.99%	53.76%	53.90%	55.69%	57.56%	55.40%
PL	61.73%	64.79%	61.51%	62.60%	63.98%	59.18%	59.00%	61.62%
PLCO	61.79%	64.92%	61.64%	62.70%	64.07%	59.29%	59.03%	61.66%
UGI	58.57%	60.20%	55.67%	59.15%	59.93%	54.64%	57.83%	60.13%
BC	58.08%	57.38%	53.45%	53.53%	54.75%	55.64%	55.51%	55.12%
JC	46.10%	43.30%	40.85%	41.99%	41.84%	46.68%	46.03%	44.16%
ME	61.93%	61.03%	57.19%	57.61%	58.62%	62.67%	63.63%	60.33%
PN	69.51%	69.96%	65.82%	69.08%	65.79%	66.84%	66.62%	68.30%
PEP	57.18%	56.65%	51.98%	52.60%	53.86%	55.46%	56.05%	53.08%
AE	46.59%	45.03%	42.85%	44.00%	44.17%	48.78%	47.58%	43.95%
DPL	54.82%	54.16%	50.86%	51.68%	53.66%	55.37%	52.74%	51.26%
RECO	45.15%	41.48%	39.47%	40.72%	40.24%	44.21%	44.10%	42.34%
AP	62.04%	64.47%	61.36%	63.32%	63.95%	60.49%	58.58%	63.70%
CE	**52.84%**	**53.94%**	**49.03%**	**49.19%**	**51.85%**	**58.00%**	**55.43%**	**53.95%**
AEP	61.82%	67.43%	64.09%	65.82%	66.47%	62.10%	60.11%	65.76%
DAY	59.07%	59.83%	54.57%	56.70%	58.53%	63.04%	60.87%	60.99%
DUQ	58.35%	59.12%	56.57%	56.28%	57.33%	61.75%	58.26%	57.09%
DOM	58.98%	58.92%	54.10%	55.13%	58.11%	55.87%	51.49%	57.01%
Total	57.81%	58.50%	54.85%	55.80%	57.14%	57.71%	56.14%	57.48%

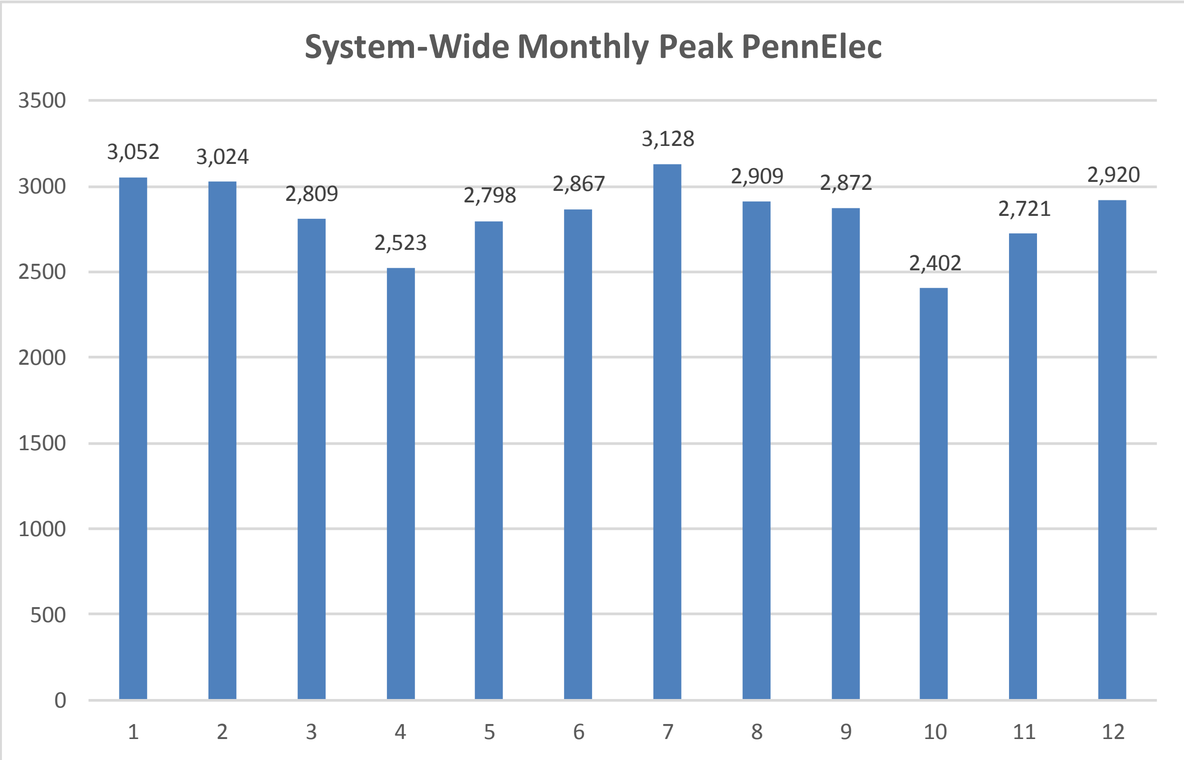
	2009	2010	2011	2012	2013	2014	2015	2016
CE	52.84%	53.94%	49.03%	49.19%	51.85%	58.00%	55.43%	53.95%
PJM without CE	58.68%	59.30%	55.91%	57.05%	58.10%	57.66%	56.25%	58.09%

2. Comparison of timing distributions from system-wide load and from distributions

ComEd presents the graph below (ComEd Ex. 2.0), which seems to demonstrate that many peaks occur during times other than hot days in the summer. According to ComEd (in this graph), only 53% of regions had peaks from June to August. Including the month of September, the accumulated number is still only 60%. Surprisingly 3% of the regions had a peak load in April. Similarly, 3% of the regions (feeders) had a peak in October. This information is dramatically different from the needle peaking data that is present from system-wide data, as I demonstrate below by presenting month by month peak loads. For ComEd's regional data to be consistent with the annual system-wide data, the regions that do experience summer peaks would have to exhibit extremely pronounced needle peaking.






System-Wide Monthly Peak PennElec
3500
3000
2500
2000
1500
1000
500
0
3,052
3,024
2,809
2,523
2,798
2,867
3,128
2,909
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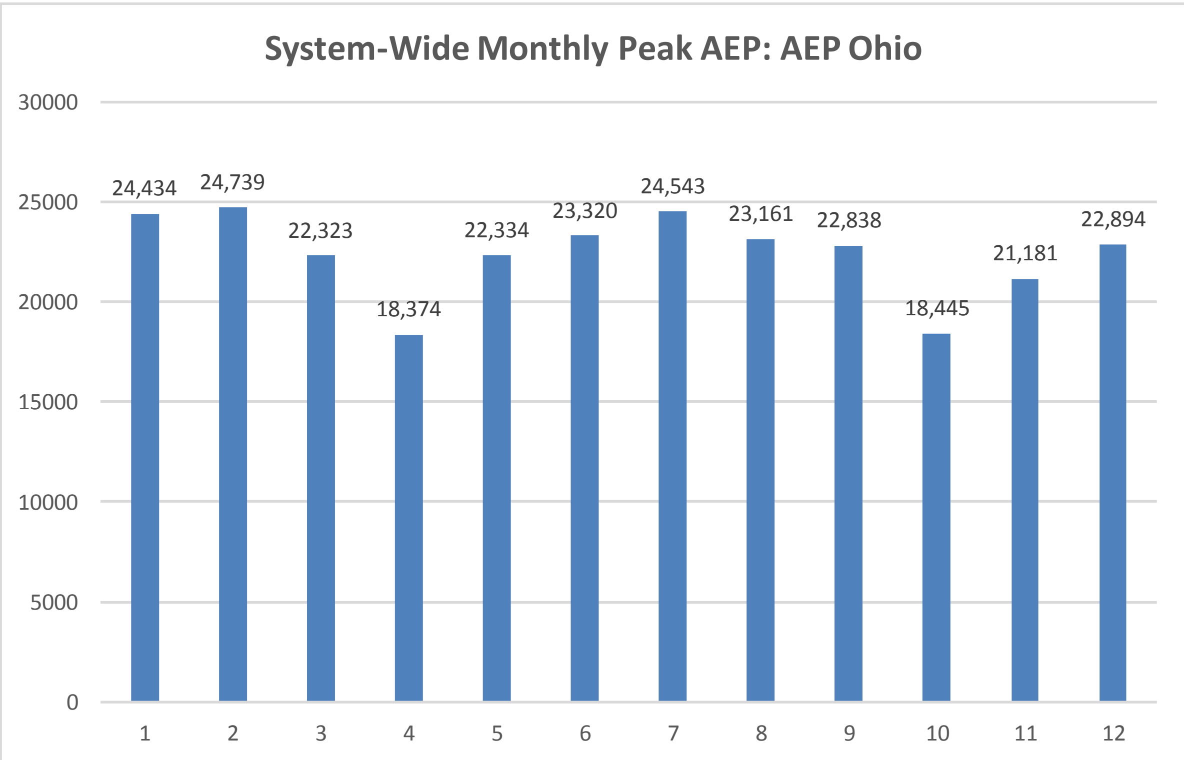
8
9
10
11
12


System-Wide Monthly Peak AEP: AEP Ohio
30000
25000
20000
15000
10000
5000
0
24,434
24,739
22,323
18,374
22,334
23,320
24,543
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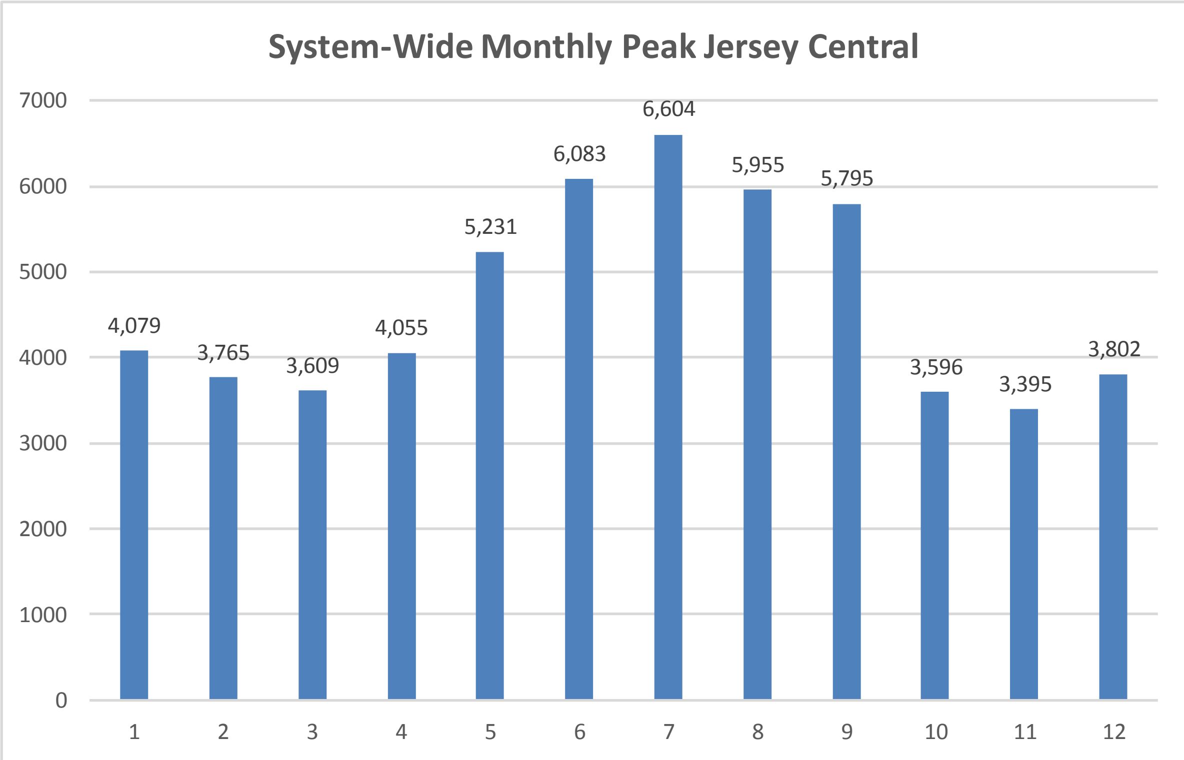
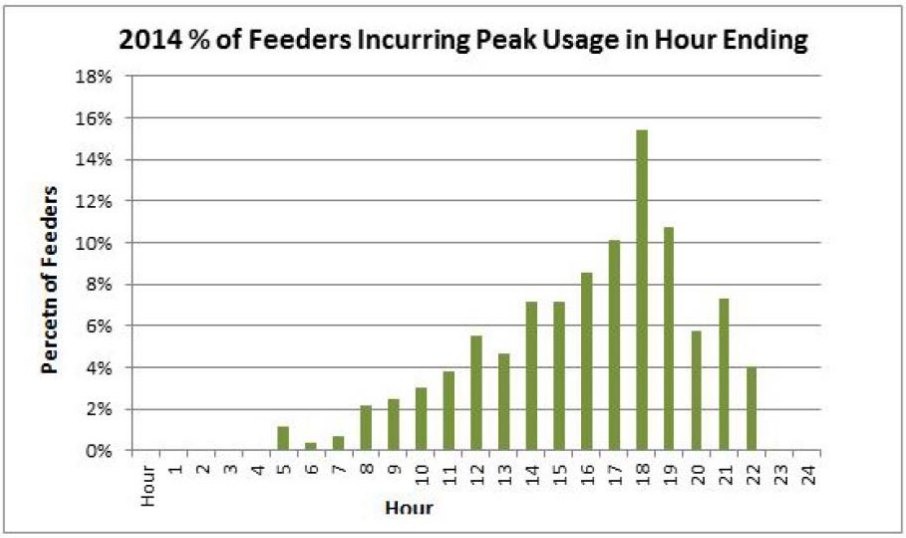
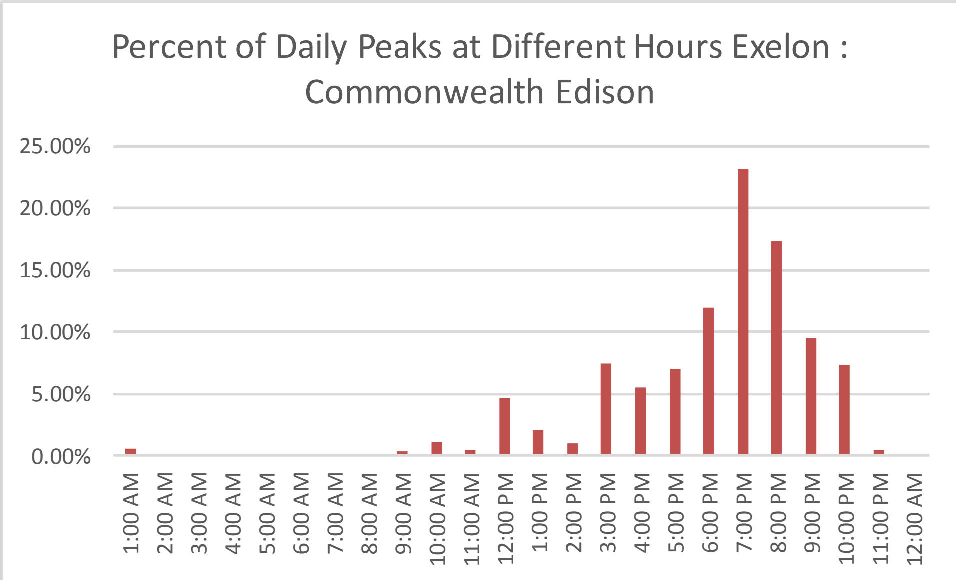
8
9
10
11
12

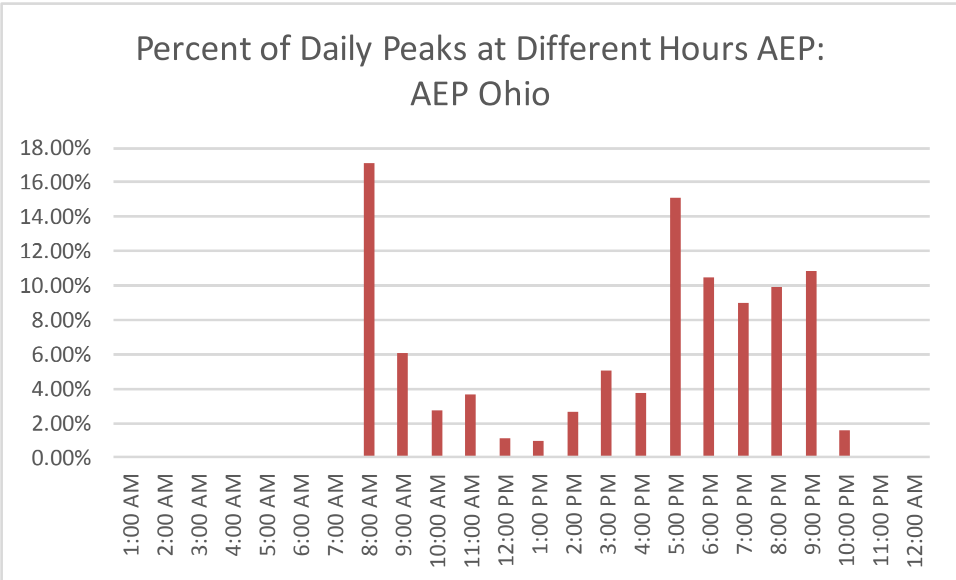


ComEd's presentation of the hour of the regional peak may not seem odd. But even if only one out of 100 regions (implying about 55 regions) has a peak at 5:00 AM, the result should be shocking. The story is similar for the 4% of regions with a peak at 10:00 PM. The graphs below show how rare it is to have a single daily peak at 5:00 AM or 10:00 PM, much less an annual peak. The system-wide results suggest there is something special about the regions or that there is simply a problem with the data.



The graphs below use system-wide data presented to PJM. The graphs show day by day peak load data across the year for the calendar years 2009-2016. The fact that not one of the hours in the entire period is 5:00 AM and that there were regions where the entire annual peak was supposed to occur at 5:00 AM should raise questions about the data.





Part 3: Overstatement of Street Light Regional Peak Allocator from Reconciliation of Total with Regions

Lets' say that for some odd reason some regions peak at 5:00 AM in April. The ComEd system has a strong needle peak that occurs in July or August. If individual regions are tabulated, then the remaining regions that do have a peak in August or July have and even more extreme needle peak. This comes about because the sum of the regions must equal the whole of the system.

I have illustrated this in a few tables below. To make things simple, assume only two time periods, for example in April and August. Assume the peak can only occur in either April or August. Also, assume that for the entire system, the peak in August of 400 is two times the peak in April of 200 (this is not inconsistent with ComEd data). Finally, assume street light load of 1 in each period.

In the first table, I set-up a case where there are 10 regions and they all peak at the same time. The sum of the regional peaks is equal to the entire system peak. The system is assumed to have a 200 peak in April and a 400 peak load in August.

Case 1: Same Regional Peaks

Region	Street Light Load	Region April Peak	Region August Peak
1	1	20	40
2	1	20	40
3	1	20	40
4	1	20	40
5	1	20	40
6	1	20	40
7	1	20	40
8	1	20	40
9	1	20	40
10	1	20	40
Total	10	200	400

In the second table, I assume that three of the ten regions have peaks have a peak in April rather than in August. To assure that the total system peaks are consistent with the entire system load, the other regions peak have a more aggravated summer peak and a lower April peak. If ComEd's regional peak study is not biased, this even more aggravated needle peak for some regions is an implication of the study. The annual peak is now not only the August peak. Instead, annual peak consists of the April peak for three of the regions and the August Peak for the remaining seven regions. For the total August and April peaks to be consistent with the entire system, the regional peaks must be adjusted.

Case 2: Varying Regional Peaks

Region	Street Light Load	April Peak	August Peak	Annual Peak
1	1	40	5	40
2	1	40	5	40
3	1	40	5	40
4	1	7	55	55
5	1	7	55	55
6	1	7	55	55
7	1	7	55	55
8	1	7	55	55
9	1	7	55	55
10	1	7	55	55
Total		170	400	505

The third table demonstrates mathematical consequences of the fact that the sum of the regions must equal the overall system load. I assume that street lighting load has a value of 1 (MW, kW, GW etc.) This is assumed to be coincident with the overall peak for the first three regions. Correct allocation using the CP load would add the street lighting load from the first three regions (which has a value of three) and divide the sum of the street light load by the aggregate peak load for all of the regions. This results in an allocation factor for the street lights.

This correct allocation of costs is contrasted with the general approach used by ComEd, which ignores the implications of higher regional needle peaks that come along with regions that do not peak at the needle peak times. Simplistic allocation methods such as using the number of regions that do not peak at the overall needle peaking time (e.g., adjusting the NCP by the number of regions that have a measured peak at night) overstate allocation to the street light class. The final table below shows that when the increased load from the reconciliation of the total with the different regions is accounted for, the hypothetical allocation to street lights is reduced by 26.25%

The correct allocator divides the assumed street light loads that are coincident with the expected regional peak together with the aggregate regional coincident peak. In the example, this results in an allocator of .59%. If a simple approach of dividing the regions with potential coincidence of street light load with expected load are used, the allocator is higher such as the .75% shown in the example.

Street Light Allocation

	Street Light Coincident with Region Peak	Total Regional Peak
	1	40
	1	40
	1	40
		55
		55
		55
		55
		55
		55
		55

	Regional CP	Total CP
Street Light	3	505
Correct Allocator		0.59%
ComEd Allocation	3	400
ComEd Allocator		0.75%
Percent Overstatement		**26.25%**