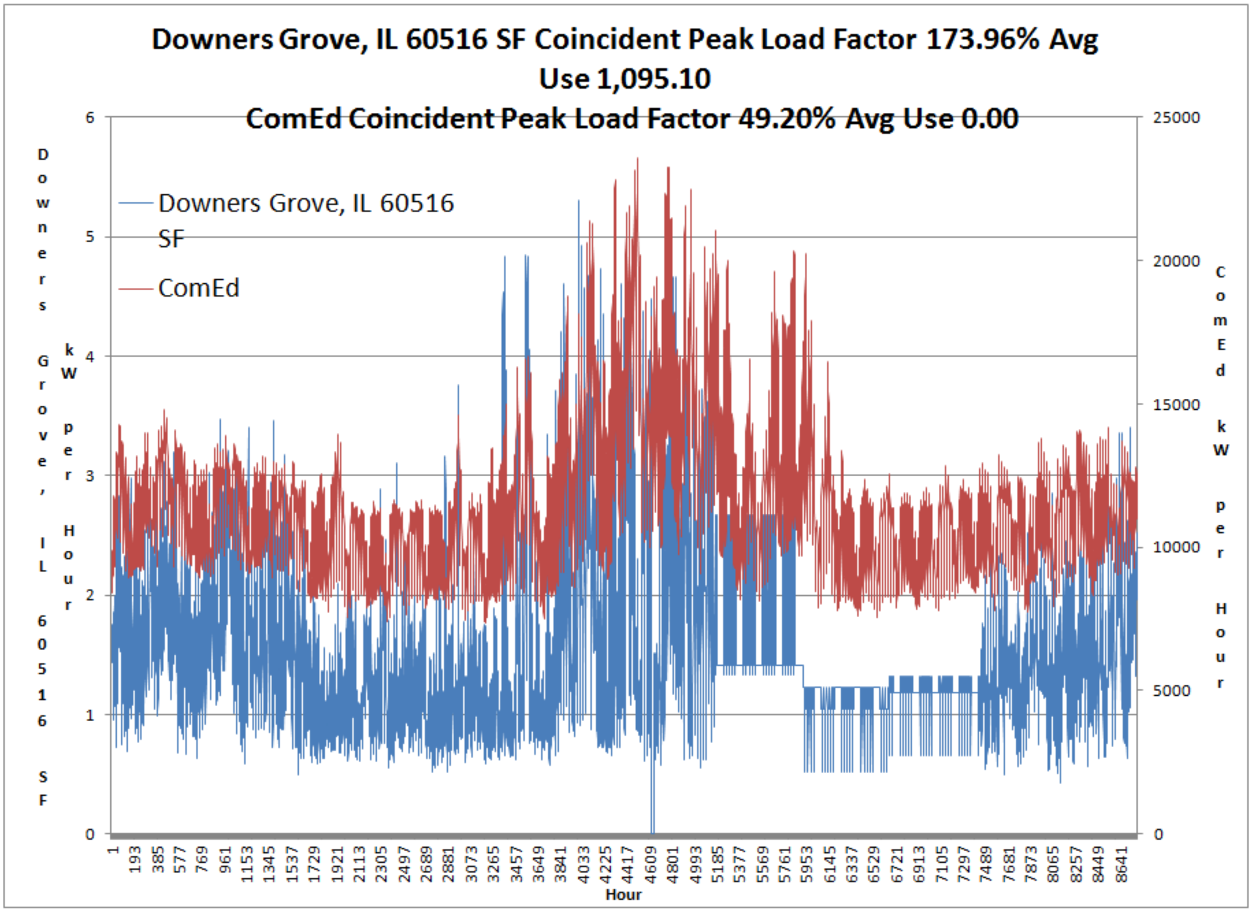


Different Regions do not Exhibit Large Swings in Use as ComEd Suggests

The fact that there are some high users in Chicago as ComEd reports is not surprising. But the relationship between usage and region from year to year is very stable. The tables below show the average, median ad different percentiles of usage inside and outside the City for different years. These tables show that the usage data is stable across time. This refutes ComEd's position that a home in the same hundred block can suddenly switch from low usage to high usage.

In inspecting the data below, one can observe the single family average and median usage inside and outside the City. The median usage in the different regions varies by 150 kWh per month (non-space heat). The City median is consistently 450 kWh per month and the outside city is consistently 600 kWh per month. Similar consistencies exist in the average use and in the low use and the high use categories.

2006

Usage in kWh per Month

	Average Chicago	25% Chicago	Median City	75% City	Average Outside	25% Outside	Median Outside	75% Outside
Single Family	661.64	275.50	450.50	750.50	840.03	375.50	600.50	900.50
Multi-Family	364.40	100.50	250.50	425.50	375.21	150.50	250.50	425.50
Single Family Space Heat	1,637.69	488.00	1,038.00	2,000.50	869.63	275.50	513.00	988.00
Multi Family Space Heat	1,870.31	750.50	1,250.50	2,250.50	878.00	325.50	600.50	1,038.00

0

2010

Usage in kWh per Month

	Average Chicago	25% Chicago	Median City	75% City	Average Outside	25% Outside	Median Outside	75% Outside
Single Family	682.01	225.50	450.50	750.50	862.29	375.50	600.50	900.50
Multi-Family	373.58	100.50	200.50	425.50	388.18	150.50	250.50	425.50
Single Family Space Heat	1,495.29	400.50	850.50	1,750.50	826.43	225.50	450.50	850.50
Multi Family Space Heat	1,759.01	650.50	1,038.00	2,125.50	850.29	300.50	563.00	988.00

2011

Usage in kWh per Month

	Average Chicago	25% Chicago	Median City	75% City	Average Outside	25% Outside	Median Outside	75% Outside
Single Family	666.84	275.50	450.50	750.50	840.89	375.50	600.50	900.50
Multi-Family	366.95	100.50	200.50	425.50	377.66	150.50	250.50	425.50
Single Family Space Heat	1,518.41	425.50	900.50	1,750.50	841.35	225.50	488.00	900.50
Multi Family Space Heat	1,785.53	650.50	1,163.00	2,125.50	866.22	325.50	600.50	1,038.00

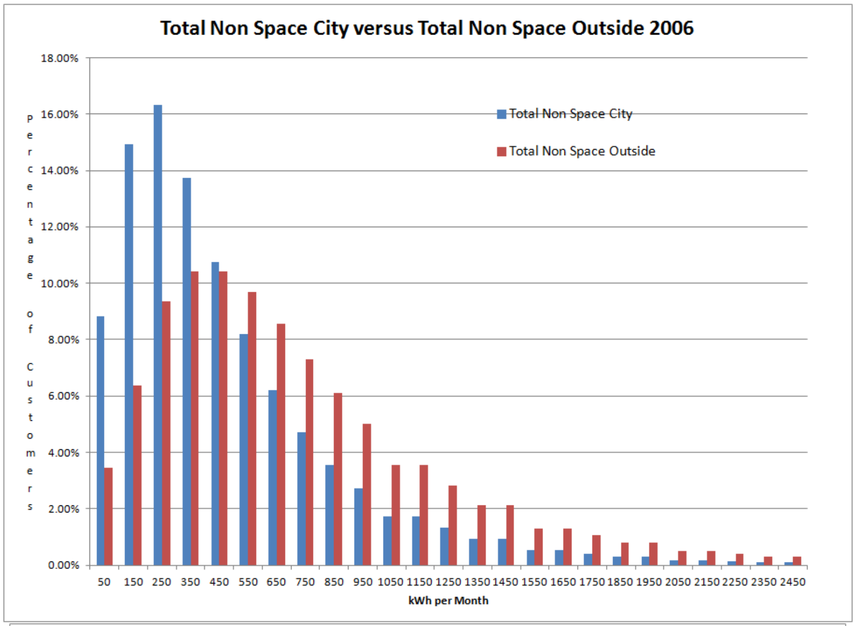
2012

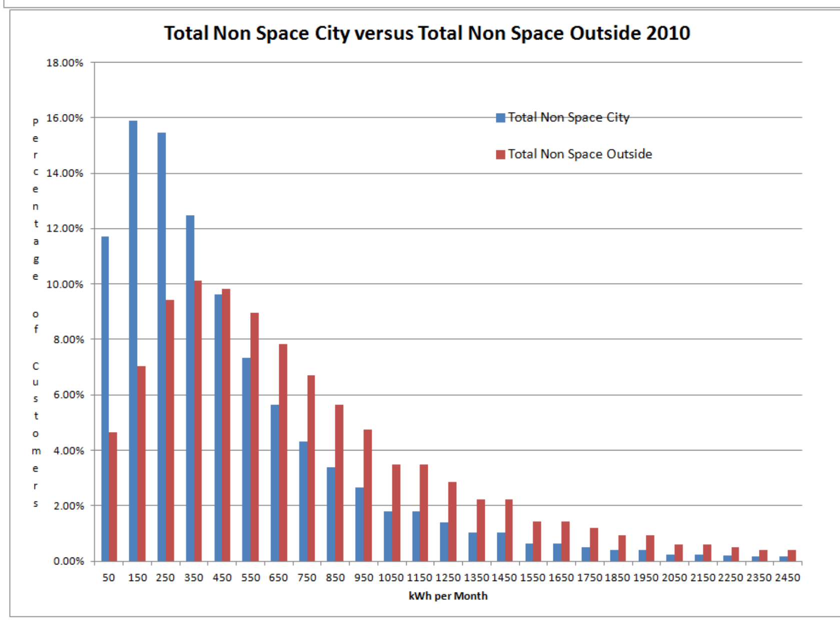
Usage in kWh per Month

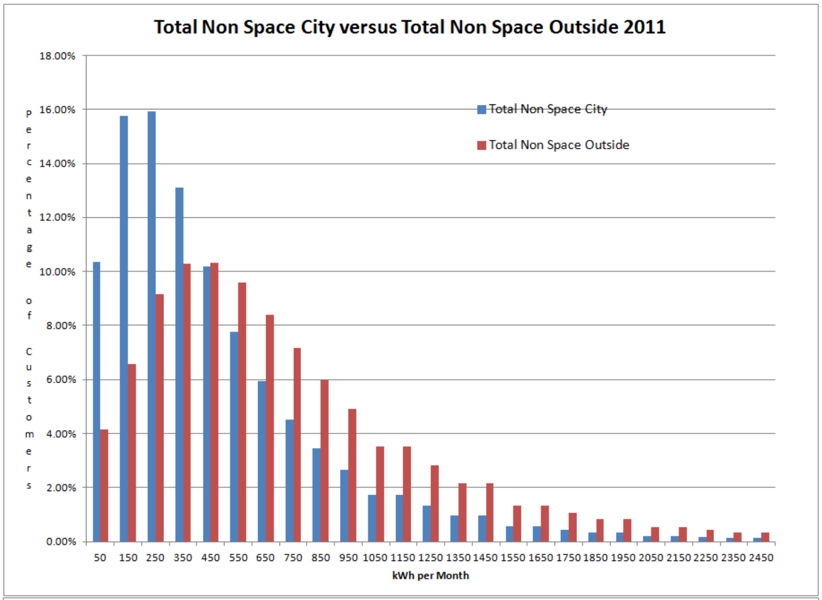
	Average Chicago	25% Chicago	Median City	75% City	Average Outside	25% Outside	Median Outside	75% Outside
Single Family	670.33	275.50	450.50	750.50	839.66	375.50	600.50	900.50
Multi-Family	369.83	100.50	225.50	425.50	381.82	150.50	250.50	425.50
Single Family Space Heat	1,367.96	425.50	850.50	1,625.50	729.11	225.50	425.50	800.50
Multi Family Space Heat	1,589.50	650.50	1,038.00	1,875.50	769.73	325.50	513.00	900.50

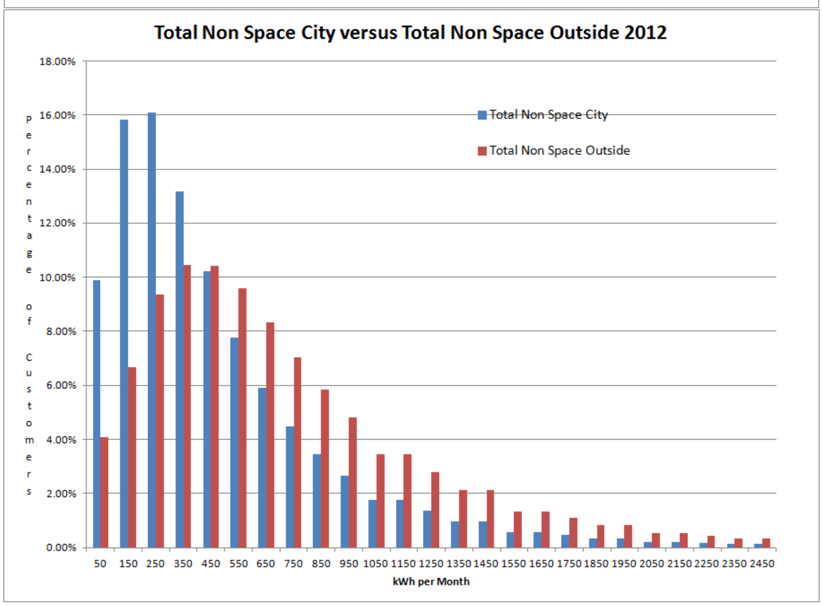
The graphs shown below illustrate the distribution of usage inside and outside the City of Chicago for various groups of non-space consumers for the years 2006, 2010, 2011 and 2012. As with the summary data in the tables above, the distribution graphs demonstrate consistent usage across time. This consistency is counter to the ComEd implication that usage patterns can suddenly change and that high users can suddenly become low users.

The first four graphs show the total non-space use including both single-family and multi-family dwellings. These graphs show that City use has not change relative to City use over the past seven years and is very stable.

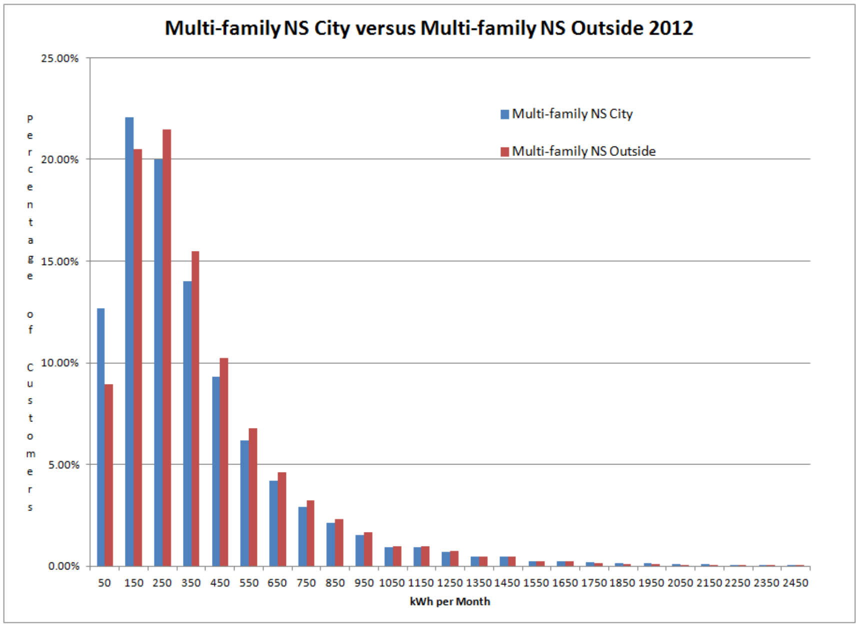

Total Non Space City versus Total Non Space Outside 2006
percentage of Customers
18.00%
16.00%
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
Total Non Space City
Total Non Space Outside
50 150 250 350 450 550 650 750 850 950 1050 1150 1250 1350 1450 1550 1650 1750 1850 1950 2050 2150 2250 2350 2450
kWh per Month

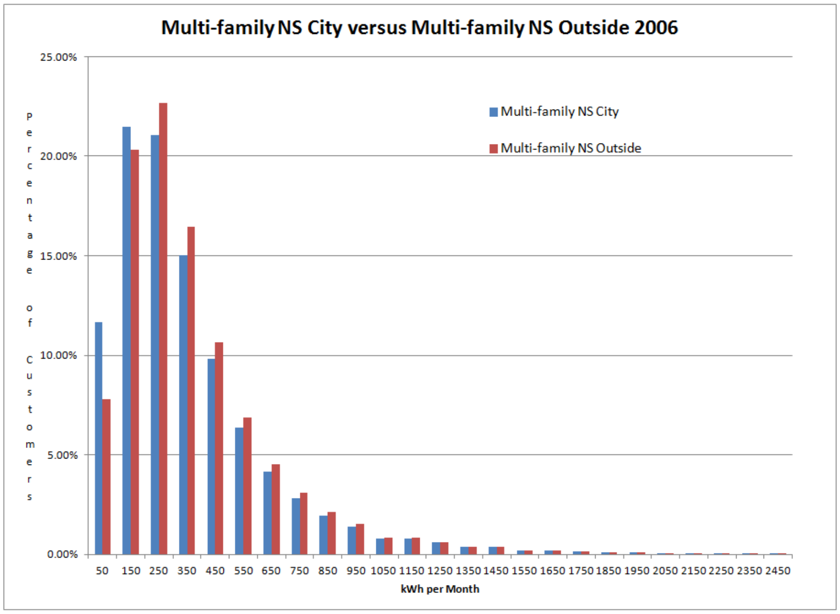

Total Non Space City versus Total Non Space Outside 2010
percentage of Customers
18.00%
16.00%
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
Total Non Space City
Total Non Space Outside
50 150 250 350 450 550 650 750 850 950 1050 1150 1250 1350 1450 1550 1650 1750 1850 1950 2050 2150 2250 2350 2450
kWh per Month



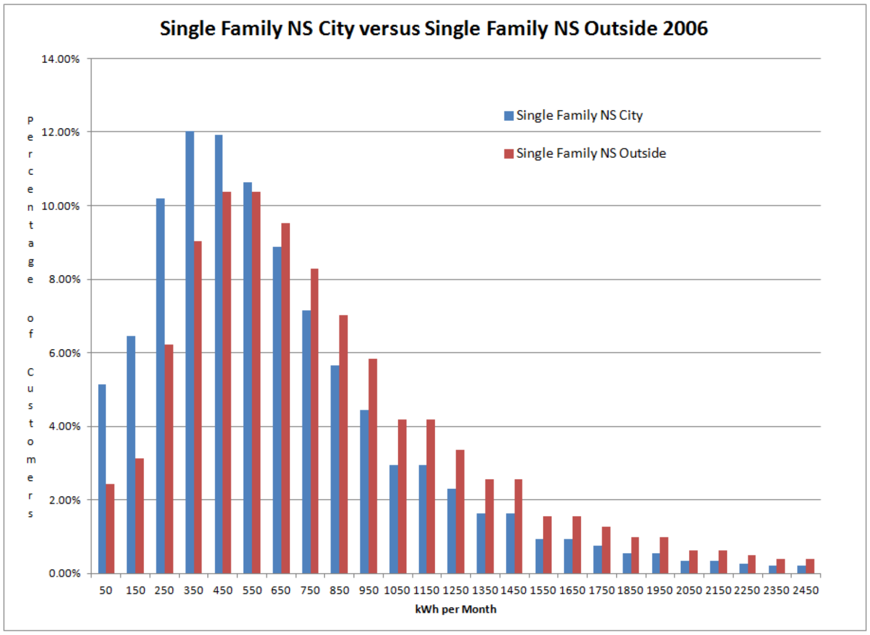


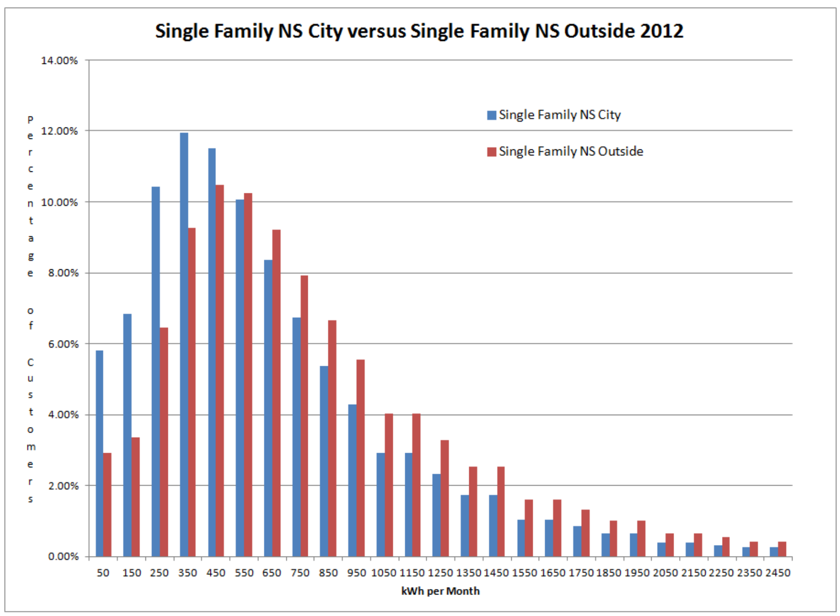
The next two graphs show the same data for multi-family dwellings. These graphs demonstrate that usage inside the City and outside the City is fairly similar for people who live in apartments. As with the aggregate data, the multi-family distribution is stable across time. The graphs show that the variation in usage is lower for multi-family consumers than for single family dwellings with usage concentrated in the 150 kWh per month to 350 kWh per month range.





The final two graphs show the same data for single-family non-space heat dwellings. These graphs demonstrate that usage inside the City is consistently less than outside City usage and that the variation is larger than for the multi-family group.





Load Factor from Load Research Data

This section further elaborates on computation of load factors from the load research data. The first part of the section discusses alternative techniques for computing load factors and explains that computing load factor from the individual peak demands of consumers is irrelevant from the perspective of cost of service analysis. Data in this section demonstrate that the dates of peak load for individual consumers is not consistent with the peak load and that diversity must be included in the load factor computations for a class.

Definition of Coincident Peak

Coincident peak demand is the demand of a consumer at the time the system reaches its peak load for the entire year. In the case of ComEd, this generally occurs on a hot summer weekday in the mid or late afternoon. For ratepayers who have time recoding meters, the coincident peak is easy to measure – one simply plops out the level of energy use at the time of the system peak. For residential and small business ratepayers who do not have meters that record hourly loads, ComEd must measure the coincident peaks using load research.

Coincident peak is less than (or equal to) the sum of the maximum individual peak demands of all consumers on a system because some ratepayers (such as space heating customers, ski lodges, schools, churches and lighting customers) do not reach their maximum peak demand at the time of the system peak. One can compute the coincident factor for a customer-class as the coincident divided by the sum of individual peak demands of the class (this is not the within class diversity discussed below).

Coincidence Factor = Coincident Peak Demand/Sum of Individual Peak Demand

Since the coincident peak must be less than or equal to the sum of individual demands, the coincident peak factor must always be less than or equal to 1.0. The diversity factor which measures how much the difference between the coincident demand and the sum of individual demands can be defined as one divided by the coincidence factor.

Definition of Individual Maximum Demand or Billing Demand

Individual maximum demand or billing demand is simply the sum of the maximum demand for all customers in a rate class regardless of when the demand occurs. For individual maximum demand, there is no diversity. The sum of the maximum billing demand will always be greater than or equal to the coincident demand. This is because if the maximum individual demand for every single consumer occurs during the system peak hour, then maximum individual demand will be the same as coincident peak.

From the perspective of cost causation of primary distribution facilities, measurement of system-wide individual maximum demand does not have any significance. This is because primary costs are driven by maximum actual regional loads experienced on the equipment. One can tabulate higher loads than coincident peak and claim that these loads provide some kind of margin of safety for construction of primary facilities. However the higher loads are irrelevant because they are never faced by the primary distribution equipment.

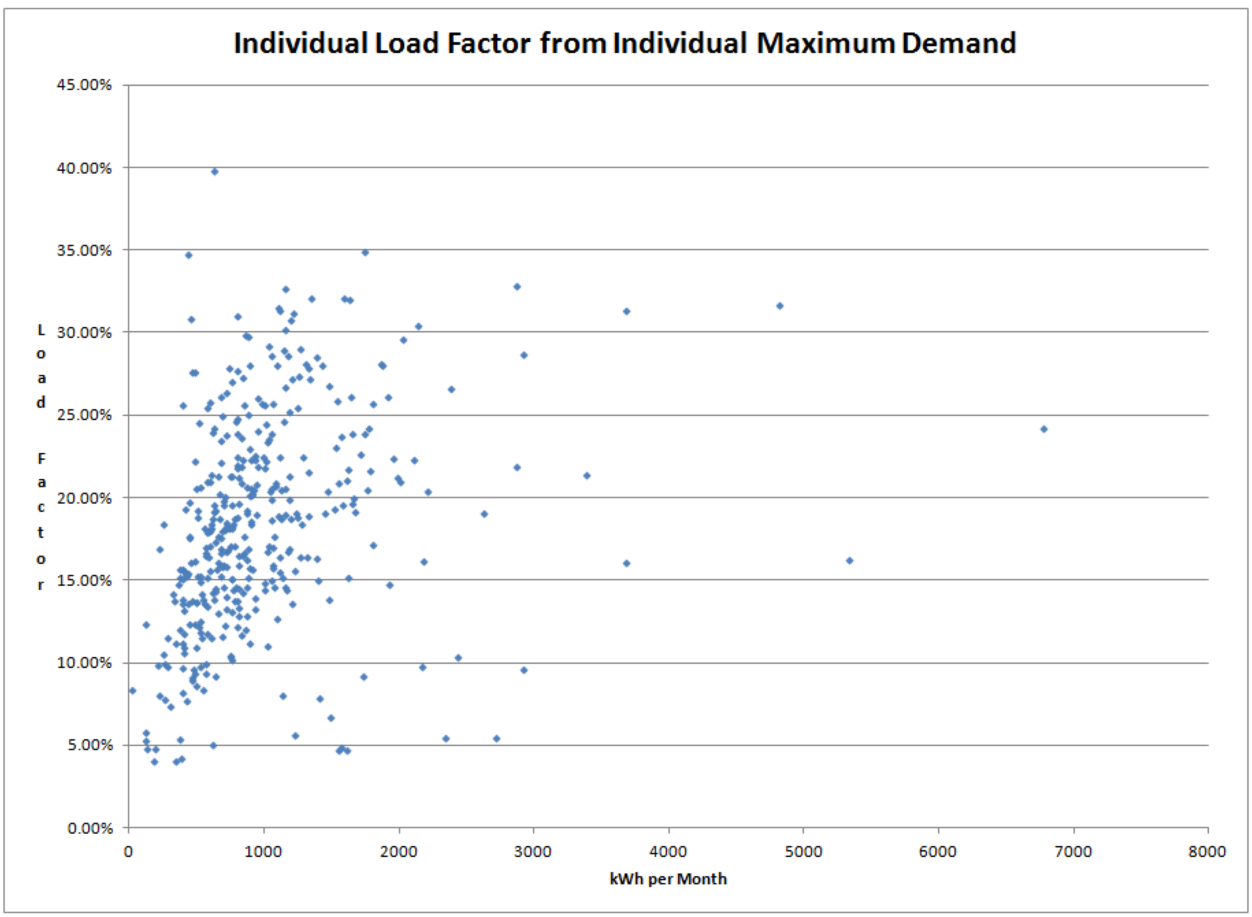
Definition of Non Coincident Peak

Non coincident peak as defined by ComEd computes the maximum system-wide load of a customer class, coincident with the class itself, but ignoring the aggregate loads placed on distribution equipment by other customer classes. Because of diversity among customers in a class, the non-coincident peak load for a class is always less than or equal to maximum individual demand.

There are a host of problems with use of non-coincident peak to allocate distribution costs. First, non-coincident peak has nothing to do with regional peak demands and is measured on a system-wide basis just as is the case for coincident peak. Second and more importantly, the within-class diversity that is so beneficial to certain classes in measuring NCP has nothing whatsoever to do with cost causation.

Maximum Demands in ComEd's Load Research Data

In its rebuttal testimony ComEd presented load factors from individual peak demands. As explained above, this load factor is irrelevant in the context of a cost of service study. For the single family non-space heat class, the graph below demonstrates the relationship between load factor measured on the inappropriate basis of individual peaks and usage.



The screen shots below show the dates of maximum load for individual consumers in the load research sample. The column showing the date and the time of the peak demonstrates that many of the individual peaks occurred at different times than the coincident peak of July 6. The first screen shot is for the consumers listed at the beginning of the data set. The second screen shot is for a page of the data set with many multi-family consumers in Chicago. The third screen shot is the last part of the database.

	Adj LF	CP LF	Cust Peak	Match	Date	Hour
Chicago, IL 60619 MF	103.85%	108.25%	1.95	51.00	3-Jan-12	3.00
Minonk, IL 61760 MF	31.92%	29.80%	2.80	4,645.00	12-Jul-12	13.00
Oak Lawn, IL 60453 MF	80.66%	82.05%	2.29	3,351.00	19-May-12	15.00
Oak Forest, IL 60452 MF	198.50%	86.12%	1.63	8,059.00	1-Dec-12	19.00
Palos Hills, IL 60465 MF	58.42%	342.50%	3.33	5,153.00	2-Aug-12	17.00
Chicago Ridge, IL 60415 MF	29.72%	26.25%	3.68	3,853.00	9-Jun-12	13.00
Chicago Ridge, IL 60415 MF	27.37%	23.98%	6.41	4,505.00	6-Jul-12	17.00
Oak Lawn, IL 60453 MF	25.25%	21.36%	2.61	5,032.00	28-Jul-12	16.00
Palos Heights, IL 60463 MF	17.68%	11.91%	4.91	4,481.00	5-Jul-12	17.00
Kankakee, IL 60901 MF	46.94%	42.69%	6.44	7,628.00	13-Nov-12	20.00
Thornton, IL 60476 MF	27.24%	26.71%	3.24	5,158.00	2-Aug-12	22.00
Dolton, IL 60419 MF	32.39%	27.38%	3.73	7,066.00	21-Oct-12	10.00
Palos Hills, IL 60465 MF	97.79%	336.17%	2.56	3,257.00	15-May-12	17.00
Grayslake, IL 60030 MF	86.13%	231.24%	3.57	426.00	18-Jan-12	18.00
Calumet City, IL 60409 MF	52.74%	376.72%	2.12	3,908.00	11-Jun-12	20.00
Calumet City, IL 60409 MF	11.78%	9.35%	3.48	4,477.00	5-Jul-12	13.00
Calumet City, IL 60409 MF	27.71%	556.11%	3.50	4,312.00	28-Jun-12	16.00
Calumet City, IL 60409 MF	19.96%	40.68%	5.59	4,509.00	6-Jul-12	21.00
Calumet City, IL 60409 MF	25.97%	20.85%	3.86	4,390.00	1-Jul-12	22.00
Calumet City, IL 60409 MF	29.88%	128.64%	1.91	4,488.00	5-Jul-12	24.00
Calumet City, IL 60409 MF	14.99%	14.12%	1.99	4,768.00	17-Jul-12	16.00
Calumet City, IL 60409 MF	23.31%	22.28%	2.14	7,148.00	24-Oct-12	20.00

	Adj LF	CP LF	Cust Peak	Match	Date	Hour
Arlington Heights, IL 60005 MF	82.58%	109.35%	1.43	7,112.00	23-Oct-12	8.00
Chicago, IL 60613 MF	46.27%	157.33%	2.27	6,811.00	10-Oct-12	19.00
Berwyn, IL 60402 MF	65.74%	54.78%	0.72	8,535.00	21-Dec-12	15.00
Chicago, IL 60606 MF	57.43%	88.30%	1.59	6,711.00	6-Oct-12	15.00
Chicago, IL 60607 MF	325.44%	406.80%	0.06	2,244.00	3-Apr-12	12.00
Chicago, IL 60613 MF	273.79%	420.47%	2.66	6,356.00	21-Sep-12	20.00
Chicago, IL 60640 MF	80.01%	139.63%	5.05	8,632.00	25-Dec-12	16.00
Chicago, IL 60622 MF	558.30%	775.41%	0.28	6,313.00	20-Sep-12	1.00
Chicago, IL 60622 MF	339.16%	508.74%	6.74	3,574.00	28-May-12	22.00
Chicago, IL 60622 MF	55.96%	107.19%	3.04	5,678.00	24-Aug-12	14.00
Chicago, IL 60622 MF	29.12%	35.41%	5.17	3,839.00	8-Jun-12	23.00
Riverside, IL 60546 MF	229.38%	949.37%	0.36	1,322.00	25-Feb-12	2.00
Chicago, IL 60640 MF	36.84%	221.63%	2.66	5,271.00	7-Aug-12	15.00
Chicago, IL 60622 MF	159.35%	159.35%	0.29	3,521.00	26-May-12	17.00
Chicago, IL 60622 MF	32.11%	20.95%	7.20	4,430.00	3-Jul-12	14.00
Chicago, IL 60622 MF	36.36%	37.46%	4.35	4,408.00	2-Jul-12	16.00
Chicago, IL 60614 MF	55.16%	28.86%	1.58	4,052.00	17-Jun-12	20.00
Schaumburg, IL 60173 MF	32.08%	22.17%	2.60	4,313.00	28-Jun-12	17.00
Schaumburg, IL 60173 MF	19.66%	21.36%	2.19	4,573.00	9-Jul-12	13.00
Chicago, IL 60608 MF	87.07%	67.12%	1.99	8,619.00	25-Dec-12	3.00
Palatine, IL 60074 MF	36.45%	28.29%	2.71	3,544.00	27-May-12	16.00
Arlington Heights, IL 60005 MF	86.80%	397.29%	5.50	1,334.00	25-Feb-12	14.00

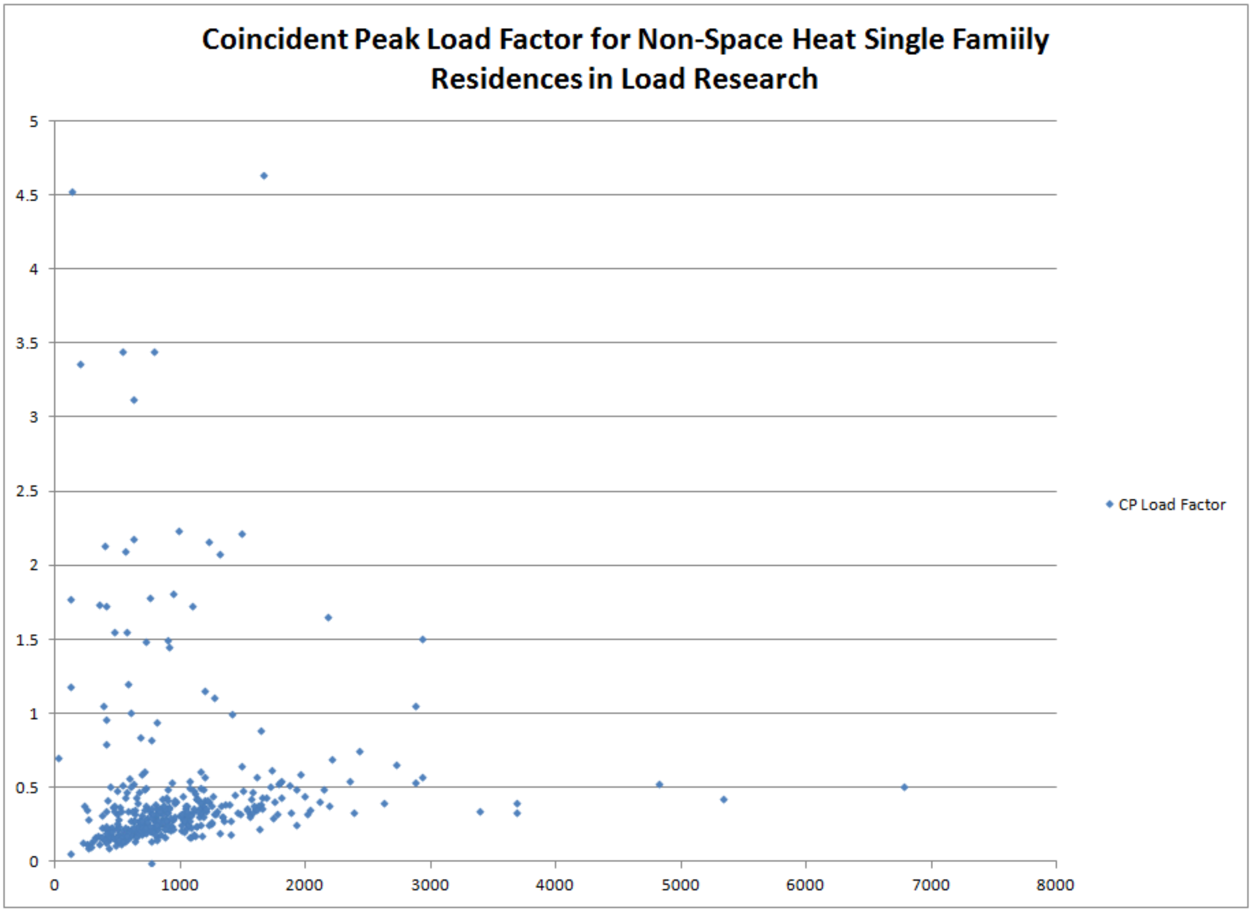
	Adj LF	CP LF	Cust Peak	Match	Date	Hour
Frankfort, IL 60423 SF	15.47%	15.79%	3.85	4,002.00	15-Jun-12	18.00
Chicago, IL 60636 SF	58.19%	53.55%	2.15	4,149.00	21-Jun-12	21.00
Chicago, IL 60617 SF	35.58%	36.16%	5.42	6,011.00	7-Sep-12	11.00
Woodridge, IL 60517 SF	35.70%	34.28%	9.13	5,709.00	25-Aug-12	21.00
Carpentersville, IL 60110 SF	39.76%	38.98%	3.53	4,524.00	7-Jul-12	12.00
Chicago, IL 60608 SF	39.60%	37.89%	2.86	4,889.00	22-Jul-12	17.00
Magnolia, IL 61336 SF	49.66%	57.52%	7.61	4,453.00	4-Jul-12	13.00
Morris, IL 60450 SF	57.96%	58.11%	46.03	6,841.00	12-Oct-12	1.00
Morris, IL 60450 SF	55.26%	42.95%	44.89	6,717.00	6-Oct-12	21.00
Joliet, IL 60435 SF	40.27%	44.78%	6.27	4,724.00	15-Jul-12	20.00
Dwight, IL 60420 SF	45.36%	44.14%	14.32	1,165.00	18-Feb-12	13.00
Mazon, IL 60444 SF	50.16%	48.00%	43.48	7,209.00	27-Oct-12	9.00
Dwight, IL 60420 SF	62.76%	55.62%	58.13	6,284.00	18-Sep-12	20.00
Bridgeview, IL 60455 SF	33.61%	32.81%	3.85	4,509.00	6-Jul-12	21.00
Dwight, IL 60420 SF	67.07%	69.67%	14.73	1,017.00	12-Feb-12	9.00
Joliet, IL 60436 SF	28.84%	33.03%	6.17	2,970.00	3-May-12	18.00
Carpentersville, IL 60110 SF	28.73%	27.20%	4.57	5,947.00	4-Sep-12	19.00
Mazon, IL 60444 SF	37.20%	34.68%	21.62	5,077.00	30-Jul-12	13.00
Lemont, IL 60439 SF	21.28%	21.22%	8.30	4,457.00	4-Jul-12	17.00
Wilmington, IL 60481 SF	62.31%	40.42%	18.75	6,690.00	5-Oct-12	18.00
Mokena, IL 60448 SF	36.24%	38.69%	9.80	5,058.00	29-Jul-12	18.00
Braidwood, IL 60408 SF	35.00%	33.79%	4.04	4,792.00	18-Jul-12	16.00

The table below presents the total maximum demands for alternative months from the non-space residential consumers. The table shows that only 40% of the maximum demand occurred in the coincident peak month of July. The number of consumers that experience a maximum peak on the day of the coincident peak is much less.

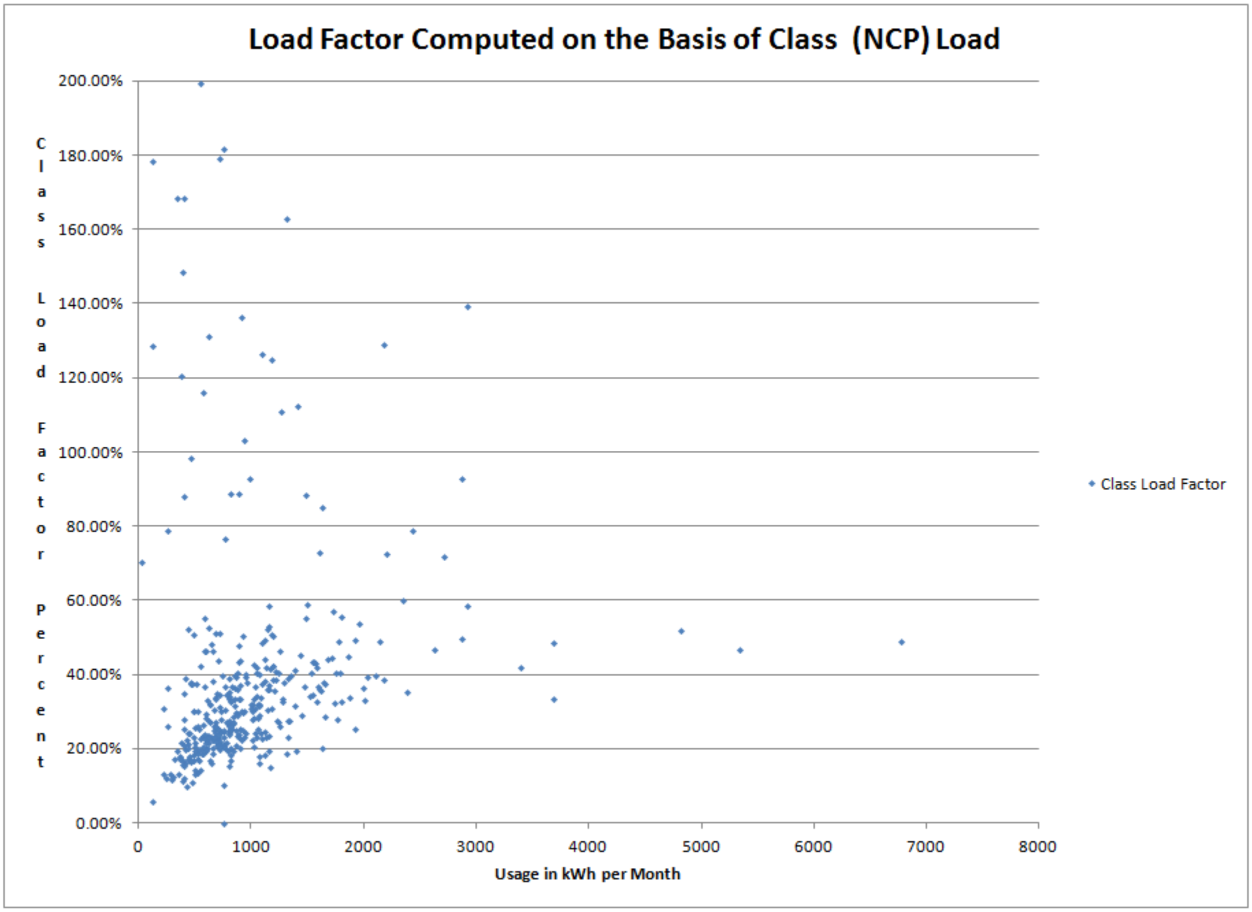
Month		Count	Percent
1	Jan	37	4.96%
2	Feb	22	2.95%
3	Mar	17	2.28%
4	Apr	10	1.34%
5	May	57	7.64%
6	Jun	96	12.87%
7	Jul	305	40.88%
8	Aug	75	10.05%
9	Sep	45	6.03%
10	Oct	27	3.62%
11	Nov	20	2.68%
12	Dec	35	4.69%

Coincident Peak and NCP Load Factors

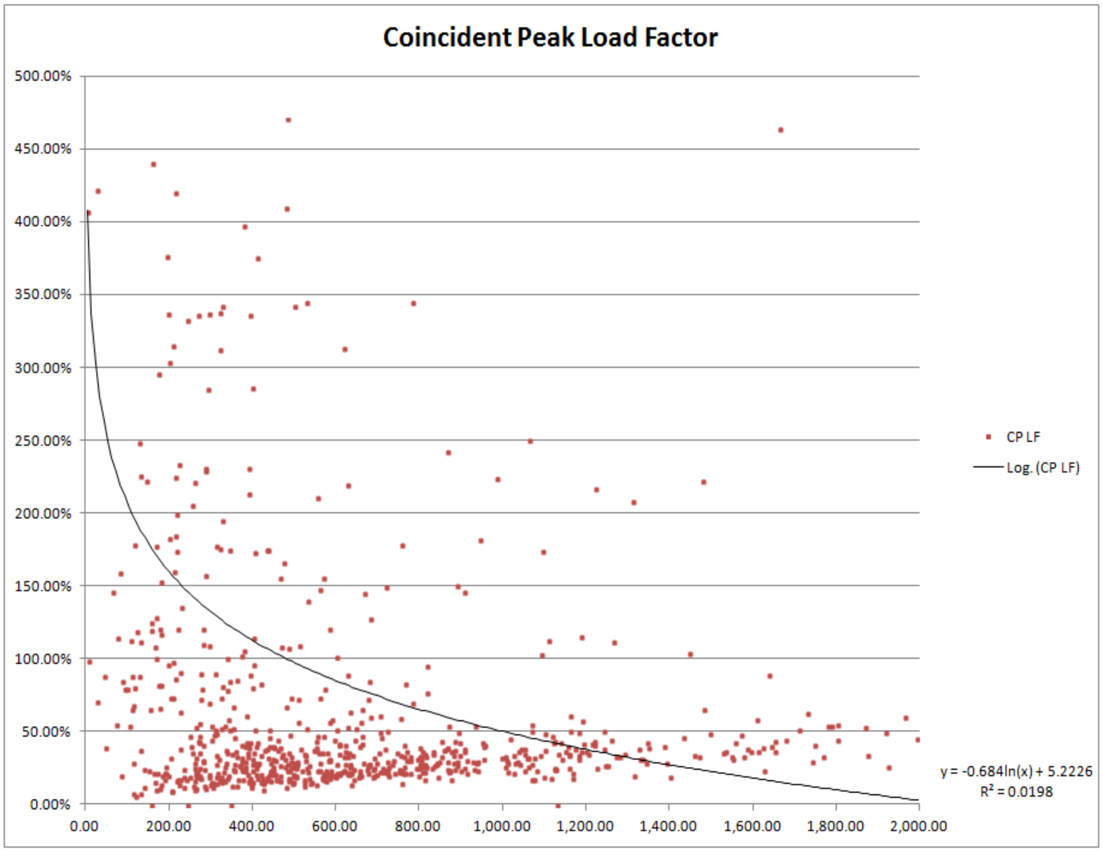
The graph below shows load factor for the same consumers, but measured on the basis of the coincident peak. Comparing the two graphs demonstrates that the load factors computed on the different bases are not comparable. (The load factor computed on the basis of coincident peak can be greater than one use at the peak is below average use for the year.) It also shows that while there may be some increasing relationship between usage and load factor computed on the basis of individual peak demands, no such conclusion can be made when the more appropriate coincident peak factor is used. Note that if there is no relationship between load factor and usage (i.e. one cannot reject the hypothesis that the relationship is a straight line), then this would confirm the proposition that use and demand are correlated as well as the notion that the presence of a ratepayer account does not have any influence on demand. If the load factor were flat, then as usage goes up so does demand.



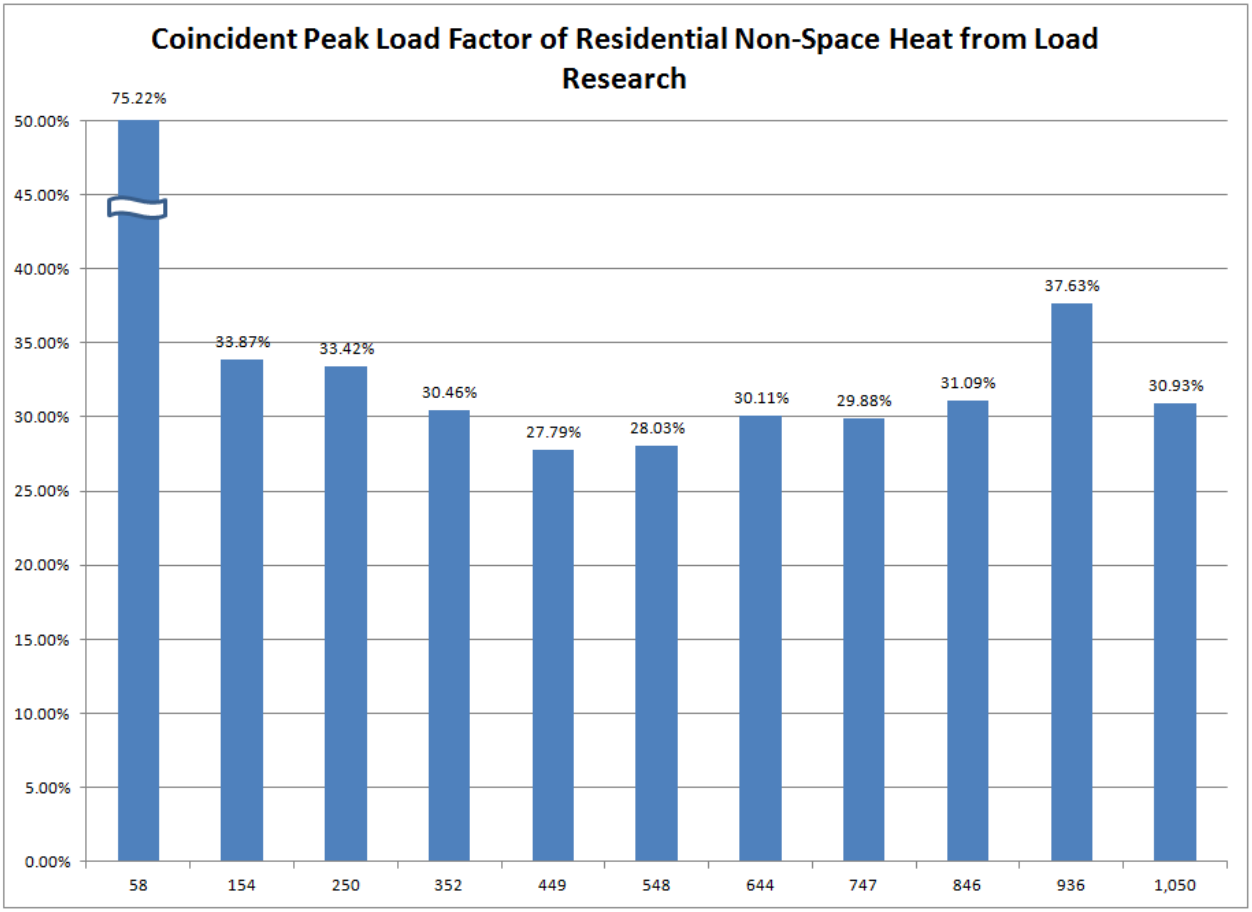
The next graph below is a scatter plot of class peak factors relative to usage for the single family non-space class. This is the load factor relevant for assessing the NPC as defined above. In the ECOSS, the NCP is used for allocating secondary wires. For the non-space single family consumers, the class peak occurred one hour after the coincident peak for the system using the load research sample (at 6PM on July 6th rather than the system peak of 5:00 PM). Because the coincident peak and the class peak are so close, the graph below demonstrates that the relationship is about the same.



The graph below is a scatter plot of coincident peak load factors relative to usage for the entire non-space class (i.e. including multi-family non-space heat consumers). While the relationship is weak, when one fits a line to the graph, the relationship is negative suggesting higher load factors for low use consumers.

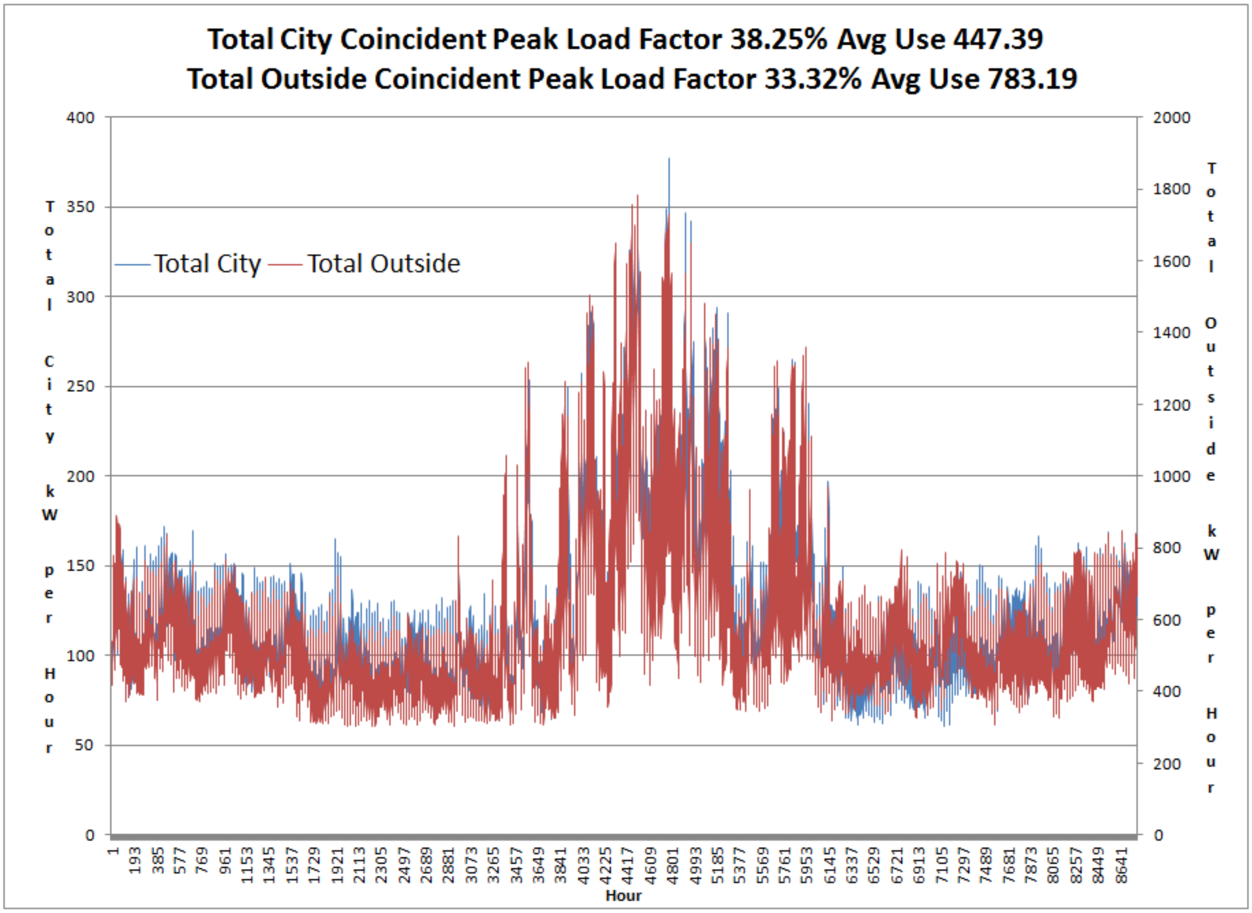


The chart below shows the coincident peak load factor for consumer groups in the load research data. The consumers are grouped into increments of 100 kWh of average use per year. After the data is grouped, the load factor of the lowest usage increment is much higher than the load factor for the higher use increments. After the very high load factor for the lowest increment, the load factor decreases until usage of 450 kWh per month occurs. For usage increments above 650 kWh the load factor increases by minor amounts. Data in the graph is influenced by the relatively small sample.



City and Outside City Load Factors

The final set of graphs show the details of the City and outside City load factors in the load research data. Recall that City consumers are under-represented in the load research sample for single family non-space heat consumers. For multi-family consumers the better load factor is not simply explained by usage as the usage level is similar inside and outside of the City. If the single family load research was more representative, the load factor for the entire residential class may be reduced.


Total City Coincident Peak Load Factor 38.25% Avg Use 447.39
Total Outside Coincident Peak Load Factor 33.32% Avg Use 783.19
Total City kW per Hour
Total Outside kW per Hour
Total City
Total Outside
Hour
0
50
100
150
200
250
300
350
400
0
200
400
600
800
1000
1200
1400
1600
1800
2000
1
193
385
577
769
961
1153
1345
1537
1729
1921
2113
2305
2497
2689
2881
3073
3265
3457
3649
3841
4033
4225
4417
4609
4801
4993
5185
5377
5569
5761
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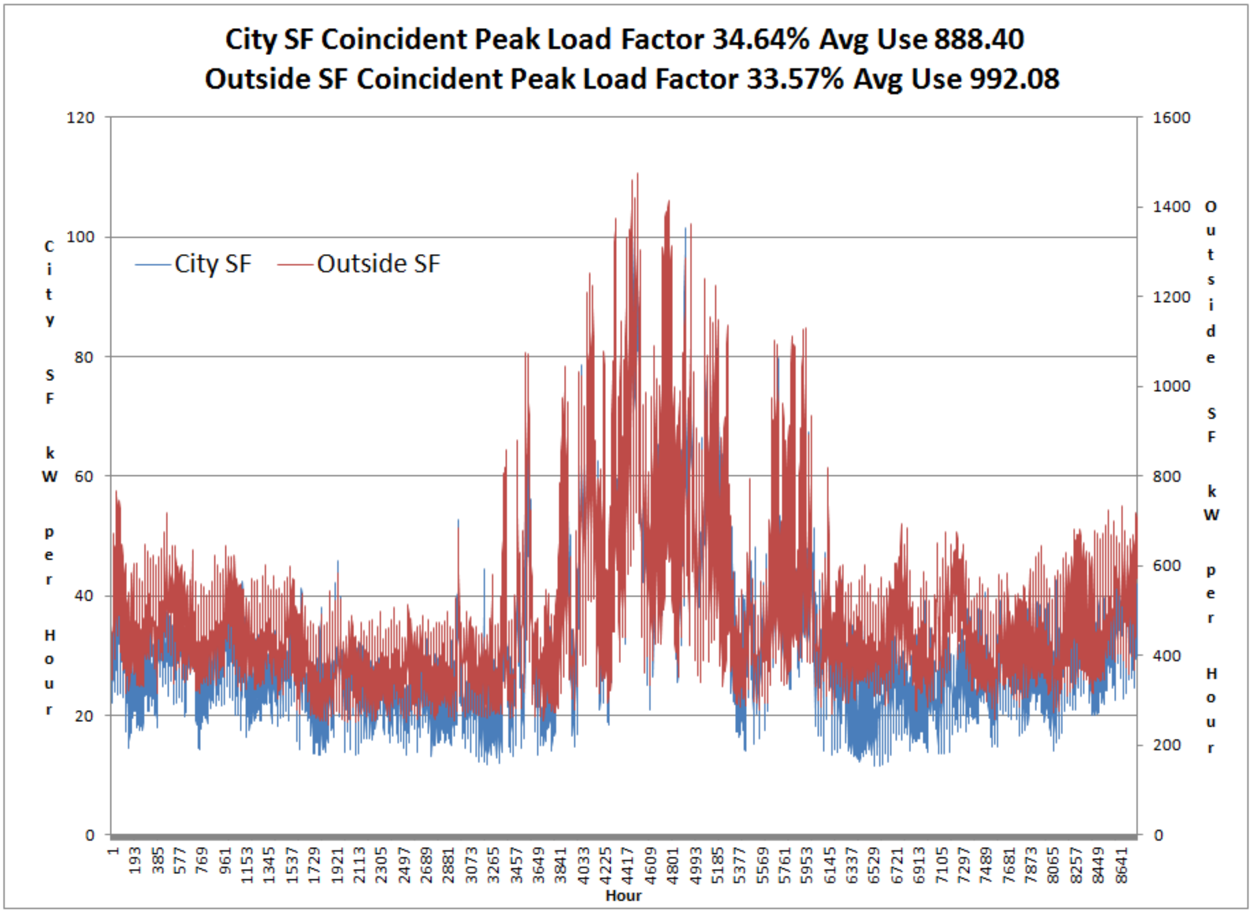
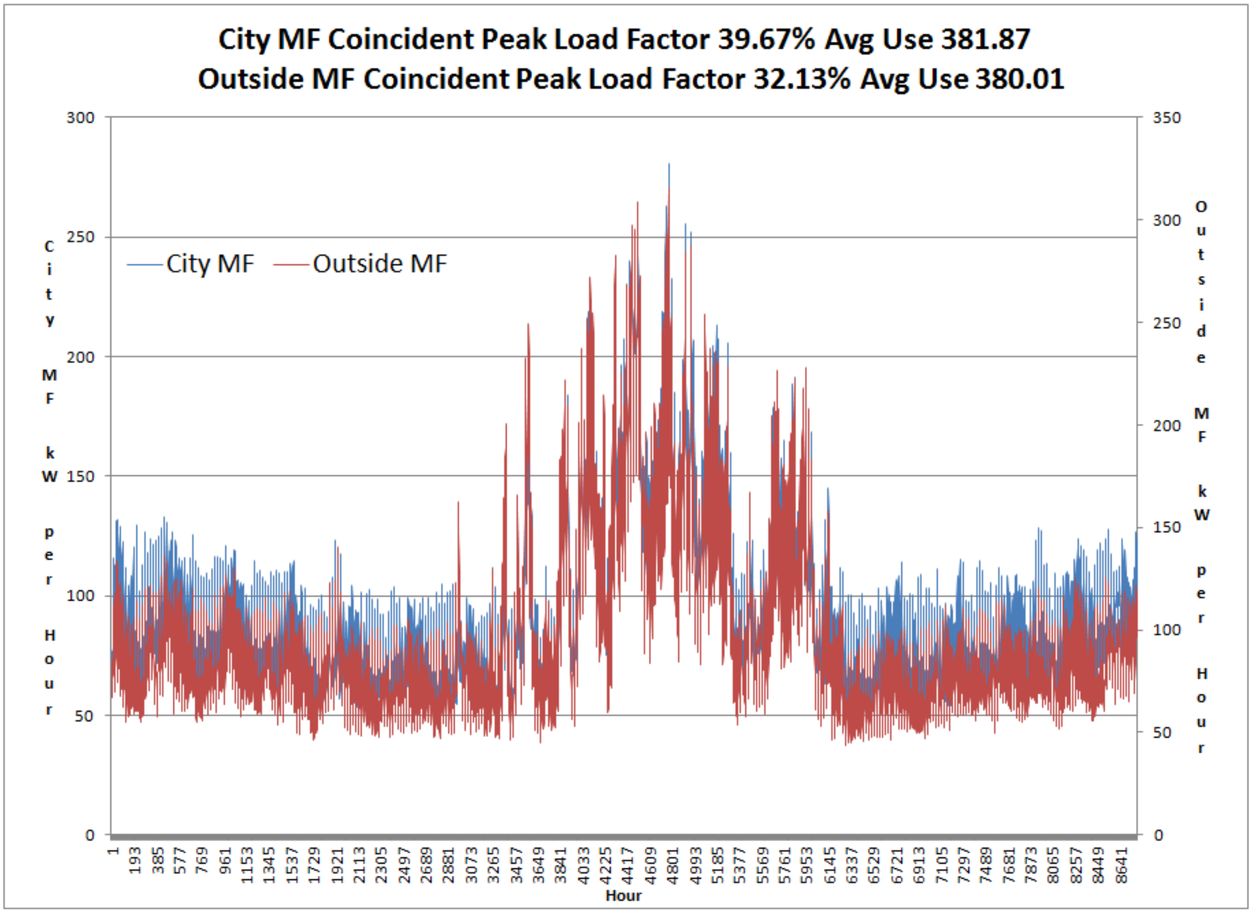
8641



City SF Coincident Peak Load Factor 34.64% Avg Use 888.40
Outside SF Coincident Peak Load Factor 33.57% Avg Use 992.08
City SF
Outside SF
City SF kW per Hour
Outside SF kW per Hour
Hour


City MF Coincident Peak Load Factor 39.67% Avg Use 381.87
Outside MF Coincident Peak Load Factor 32.13% Avg Use 380.01
City MF
Outside MF
City MF kW per Hour
Outside MF kW per Hour
Hour