

**New Hampshire Lost Base Revenue Working Group**

April 11, 2018

**Estimating Customer Peak kW Impacts**  
**due to Energy Efficiency Measures**

# Key Terms for Understanding kW Savings

- **Customer Peak Demand** – The customer's highest 30-minute period of kW demand in a given month.<sup>1</sup> Customer peak demand determines their actual demand charge.
- **Connected Load kW Savings** - The connected load kW savings is the power saved by the equipment while in use. Typically, the savings reflect the maximum power draw of efficient equipment at full load, relative to the maximum power draw of baseline equipment.
- **Coincidence Factor** – Coincidence Factors (CF) represent the fraction of connected load expected to occur concurrent to a particular peak period (e.g., ISO-NE summer and winter peak periods). CF are calculated for peak periods defined by the ISO-NE for FCM purposes.
- **Summer/Winter On-Peak kW Savings** - The average demand reduction during the ISO-NE summer/winter on-peak period. The summer on-peak period is 1pm-5pm on non-holiday weekdays in June, July and August; the winter on-peak period is 5pm-7pm on non-holiday weekdays in December and January.
  - Equivalent to: connected load kW X summer or winter coincidence factors

Source: MA Technical Reference Manual, 2016-2018

<sup>1</sup>Eversource rates GV and LG. Additional factors are applied in some cases, e.g., ratchet charge for rate LG, adjustments for peaks between 8:00 PM – 7:00 AM, etc. See [https://www.eversource.com/content/docs/default-source/rates-tariffs/electric-delivery-service-tariff-nh.pdf?sfvrsn=7fb7f062\\_22](https://www.eversource.com/content/docs/default-source/rates-tariffs/electric-delivery-service-tariff-nh.pdf?sfvrsn=7fb7f062_22)

# Potential Methods for Estimating kW Component of Lost Base Revenue

- Customer-specific analysis of kW savings and impacts on demand charges
  - This method is highly onerous and not cost-effective.
- Connected load kW
  - Generally overstates demand reductions in customer peak hour.
- ISO-NE Summer or Winter on-peak kW
  - Generally understates demand reductions in customer peak hour (see following slides)
- Customer peak kW reduction, based on analysis of EPRI end use load shapes
  - Reasonable estimate of true kW reduction in customer peak hour

# Available Data & Information Sources for Estimating kW Component of Lost Base Revenue

- Connected load kW
  - Source: Project engineers, equipment specs, evaluations. Incorporated in utility screening models.
- ISO-NE Summer/Winter on-peak kW
  - Source: Project engineers, equipment specs, evaluations. Incorporated in utility screening models.
- Customer peak hour for average C&I customers
  - Source: Eversource load shapes, <https://www.eversource.com/content/nh/about/about-us/doing-business-with-us/energy-supplier-information/electric---new-Hampshire>
- End use load shapes (indoor lighting, cooling, etc.)
  - Electric Power Research Institute (EPRI), <http://loadshape.epri.com/enduse>

# Eversource NH Load Shape Data

Electric - Eastern  
Massachusetts

Electric - Western  
Massachusetts

Electric - New Hampshire

Gas - Connecticut

Gas - Massachusetts

Natural Gas Pipeline Capacity  
& Supply Procurement  
(Massachusetts)

Wholesale Supply  
(Connecticut)

Wholesale Supply (Eastern  
Massachusetts)

Wholesale Supply (Western  
Massachusetts)

Renewable Energy Credits  
(Massachusetts)

Wholesale Supply (New  
Hampshire)

Builders & Contractors +

Property Management  
Gateway

Real Estate +

Affiliates +

Municipal & State Officials +

Sourcing +

## ELECTRIC INFORMATION FOR SUPPLIERS & AGGREGATORS

Eversource welcomes the competitive electric market as well as the opportunity to meet and support energy suppliers and aggregators.

Following is information for energy suppliers and aggregators in order to facilitate participation in the competitive energy market.

### LOAD SHAPE PROFILES

The methodology used to estimate supplier loads is described in the Terms and Conditions for Energy Service Providers section of the currently effective [Electric Delivery Service Tariff](#). In compliance with the terms and conditions, Eversource is providing the hourly load shapes for various customer classes which are used to estimate these supplier loads.

To download the average hourly data for a specific customer class, select the MS Excel file format and save the file to your hard drive. Once the file is saved, it can be imported into most spreadsheet programs.

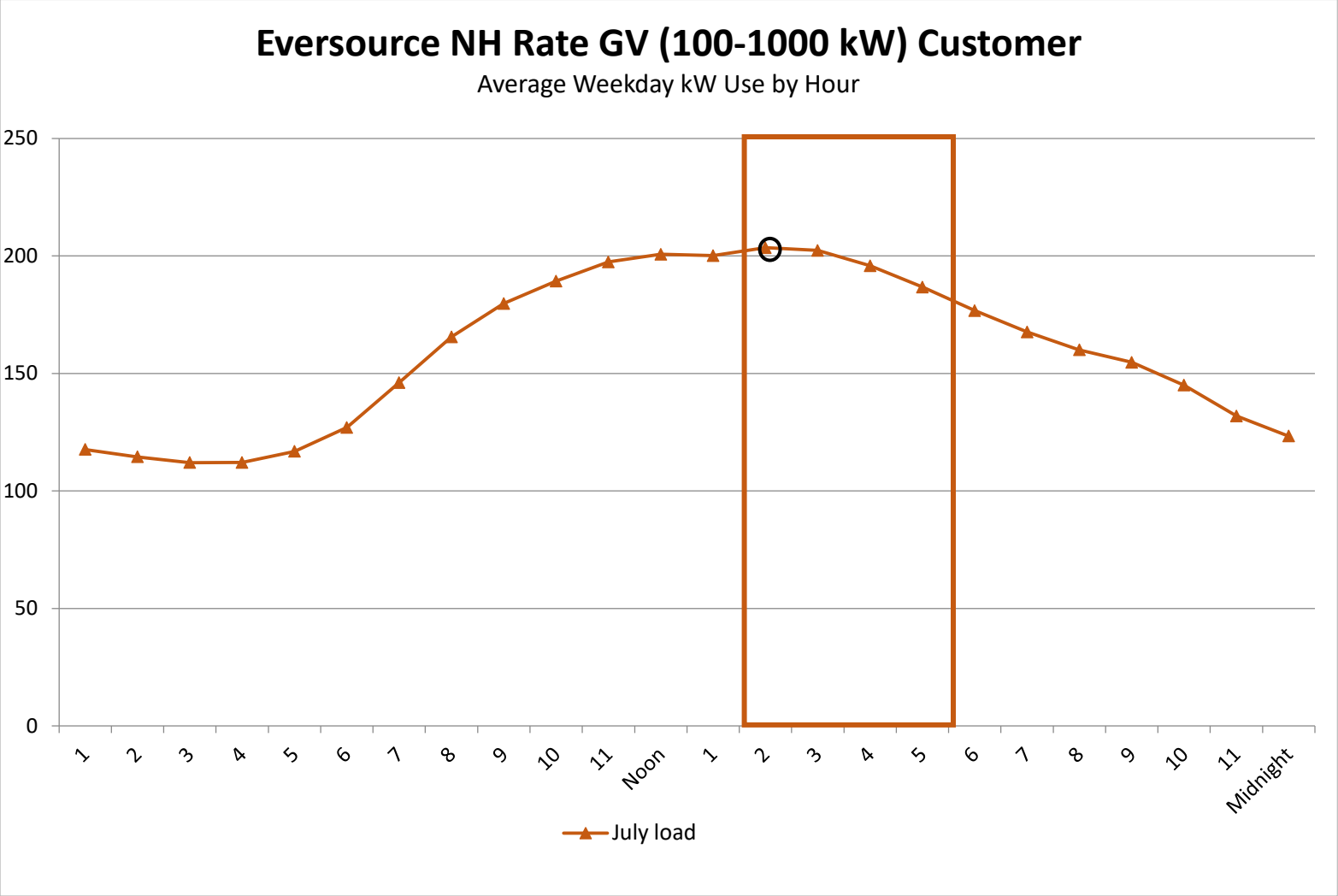
Rate Type	Adobe PDF	Microsoft Excel
Residential Service (Rate R)	<a href="#">PDF</a>	<a href="#">Excel</a>
General Service (Rate G)	<a href="#">PDF</a>	<a href="#">Excel</a>
Primary General Service (Rate GV)	<a href="#">PDF</a>	<a href="#">Excel</a>
Large General Service (Rate LG)	<a href="#">PDF</a>	<a href="#">Excel</a>
Outdoor Lighting Service (Rate OL & EOL)	<a href="#">PDF</a>	<a href="#">Excel</a>

# Eversource NH Load Shape Data

PSNH's Load Curve Data for Large General Service Customers																			
Rate GV																			
Average Hourly KW Demand by Month and Daytype																			
For the Period September 2015 through August 2016																			
Key:		WD = Average Weekday (Monday through Friday)																	
		WE = Average Weekend day (Saturday, Sunday & Holidays)																	
Month	Daytype	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	24:00	Peak (Hour Ending)
Jan	WD	118.2	116.7	116.0	117.3	122.6	133.5	152.3	166.7	174.4	177.8	180.0	179.5	176.8	177.3	173.7	166.9	124.1	11
Feb	WD	116.5	114.8	114.1	115.3	120.8	131.9	150.4	163.9	173.0	177.3	179.6	179.1	176.0	176.6	172.8	165.6	121.9	11
Mar	WD	106.9	105.2	104.3	105.3	110.7	121.9	141.4	156.5	166.2	169.9	172.3	171.7	168.6	169.2	165.2	157.3	112.0	11
Apr	WD	103.7	101.7	100.5	101.4	106.6	117.3	135.4	151.6	161.4	166.0	169.2	169.9	167.6	169.1	165.9	158.2	108.8	12
May	WD	108.4	105.7	103.8	104.2	108.9	119.0	138.5	159.4	172.4	180.4	186.6	189.6	189.0	191.7	188.9	180.7	113.5	14
Jun	WD	109.5	106.7	104.9	105.4	110.1	120.1	140.4	160.2	172.9	180.7	187.3	190.2	189.5	192.8	191.5	184.7	117.2	14
Jul	WD	117.6	114.5	112.0	112.1	116.8	127.0	146.1	165.5	179.7	189.3	197.4	200.7	200.1	203.5	202.3	195.8	123.3	14
Aug	WD	102.5	100.0	98.2	98.7	103.1	113.2	129.9	146.6	159.2	167.8	175.2	178.8	179.0	182.1	180.8	174.9	109.3	14
Sep	WD	108.2	105.5	103.6	104.0	109.1	122.0	142.5	160.4	173.4	181.2	188.1	191.0	190.6	193.8	190.8	182.5	115.4	14
Oct	WD	105.7	103.2	101.5	102.1	107.1	120.2	142.1	159.7	169.2	174.3	178.8	180.4	178.6	180.8	177.5	169.1	111.9	14
Nov	WD	107.5	105.6	104.7	106.1	111.4	123.9	142.8	157.5	166.4	169.6	172.4	172.9	170.3	171.6	168.0	160.8	115.3	12
Dec	WD	110.5	108.5	107.5	108.7	113.8	124.6	142.7	156.7	164.6	167.8	169.8	169.3	166.5	167.1	163.7	157.3	116.5	11
Hour Ending		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	24	

- Contains weekday and weekend load shapes for Rate GV (100 kW to 1000 kW) customers for each month, based on average loads from September 2015 to August 2016
- Can be used to determine average peak hour for each month (see red boxes)

# Eversource NH Load Shape Data



# EPRI End Use Load Shape Data

You Are Here: [Load Shape Library 5.0](#) > End Use Load Shapes

## End Use Load Shapes

Add Load Shape(s):

Country: USA  
Region: NPCC/NE

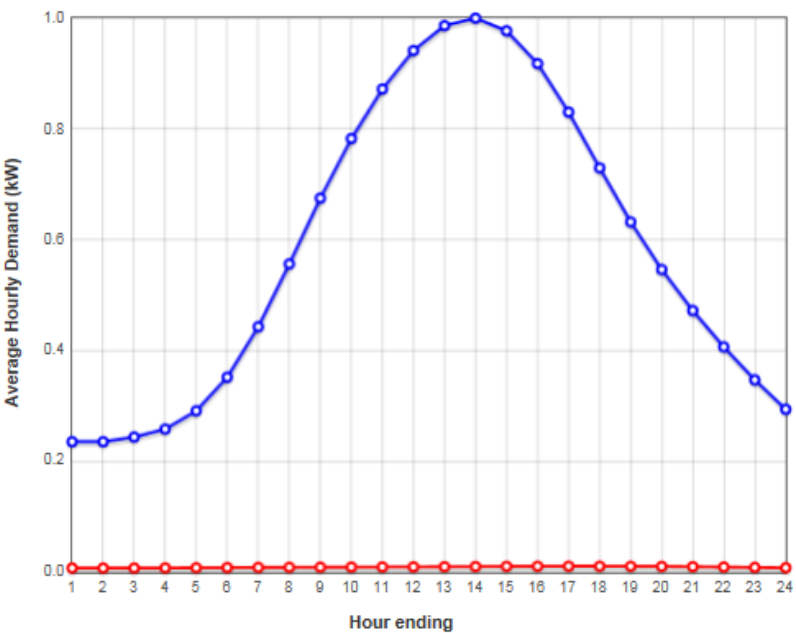
Season and Day Type

☒ Peak Season, Peak Weekday  
☐ Peak Season, Average Weekday  
☐ Peak Season, Average Weekend  
☒ Off Peak Season, Peak Weekday  
☐ Off Peak Season, Average Weekday  
☐ Off Peak Season, Average Weekend

Sector and End Use:

Commercial Residential Industrial

☐ Cooling  
☐ Heating  
☐ Lighting, External ("All Regions" only)  
☐ Lighting, Internal  
☐ Office Equipment  
☐ Refrigeration  
☐ Ventilation  
☐ Water Heating



2 End Use Load Shapes plotted. [Download load shape data \(CSV\)](#)

### Scaling

Region	Sector/End Use	Peak kW	Annual kWh
NPCC/NE	Com. Cooling	1.0	1134.198

### Load Shapes

Region	Sector/End Use	Season	Day Type	
NPCC/NE	Com. Cooling	Peak	Peak Weekday	<input type="checkbox"/>
NPCC/NE	Com. Cooling	Off Peak	Peak Weekday	<input type="checkbox"/>



# EPRI End Use Load Shape Data

You Are Here: [Load Shape Library 5.0](#) > End Use Load Shapes

## End Use Load Shapes

Add Load Shape(s):

Country  
USA

Region  
NPCC/NE

Season and Day Type

☒ Peak Season, Peak Weekday

☐ Peak Season, Average Weekday

☐ Peak Season, Average Weekend

☒ Off Peak Season, Peak Weekday

☐ Off Peak Season, Average Weekday

☐ Off Peak Season, Average Weekend

Sector and End Use:

Commercial Residential Industrial

☐ Cooling

☐ Heating

☐ Lighting, External ("All Regions" only)

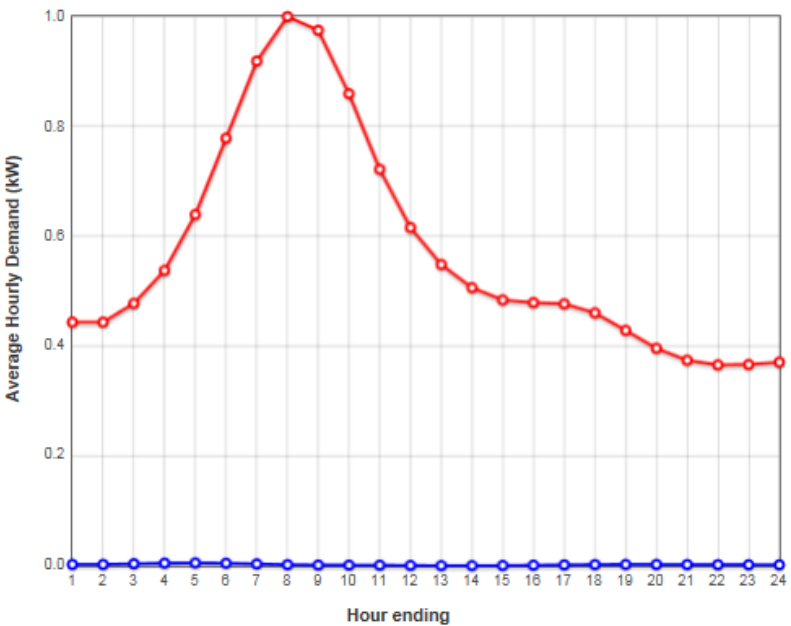
☐ Lighting, Internal

☐ Office Equipment

☐ Refrigeration

☐ Ventilation

☐ Water Heating



2 End Use Load Shapes plotted. [Download load shape data \(CSV\)](#)

### Scaling

Region	Sector/End Use	Peak kW	Annual kWh
NPCC/NE	Com. Heating	1.0	1291.503

### Load Shapes

Region	Sector/End Use	Season	Day Type	
NPCC/NE	Com. Heating	Off Peak	Peak Weekday	<input type="checkbox"/>
NPCC/NE	Com. Heating	Peak	Peak Weekday	<input type="checkbox"/>

# EPRI End Use Load Shape Data


Region	Season	Day Type	Sector	End Use	Scale N	HR1	HR2	HR3	HR4	HR5	HR6	HR7	HR8	HR9	HR10	HR11	HR12	HR13	HR14	HR15
NPCC_NE	OffPeak	PeakWeekday	Commercial	Cooling	1	0.007739914	0.007739914	0.007781433	0.007996357	0.008299	0.008605	0.008862	0.009072	0.009277	0.009494	0.009698	0.009892	0.010136	0.010456	0.010
NPCC_NE	Peak	PeakWeekday	Commercial	Cooling	1	0.235738461	0.235738461	0.244108292	0.258505985	0.291381	0.352066	0.4431	0.55648	0.675108	0.782648	0.87201	0.94142	0.986456	1	0.977
NPCC_NE	OffPeak	PeakWeekday	Commercial	Heating	1	0.443509088	0.443509088	0.477693917	0.537633927	0.639462	0.778437	0.918895	1	0.974949	0.859498	0.721731	0.615762	0.548493	0.506285	0.483
NPCC_NE	Peak	PeakWeekday	Commercial	Heating	1	0.00230685	0.00230685	0.003585923	0.004791382	0.00523	0.004627	0.003269	0.001912	0.001208	0.00108	0.000936	0.000529	0.000162	0.000138	0.00
NPCC_NE	OffPeak	PeakWeekday	Commercial	LightingInternal	1	0.270855854	0.270855854	0.271501772	0.273262683	0.298593	0.36606	0.483008	0.6359	0.789231	0.905217	0.969968	0.995704	1	1	0.989
NPCC_NE	Peak	PeakWeekday	Commercial	LightingInternal	1	0.266551099	0.266551099	0.269859775	0.295957156	0.363088	0.477729	0.627789	0.780793	0.898169	0.962425	0.986692	0.993376	0.99279	0.982039	0.952
NPCC_NE	OffPeak	PeakWeekday	Commercial	OfficeEquipment	1	0.56356725	0.56356725	0.564625893	0.565353654	0.574915	0.60321	0.657345	0.735595	0.823687	0.901446	0.95621	0.987374	1	1	0.988
NPCC_NE	Peak	PeakWeekday	Commercial	OfficeEquipment	1	0.561146716	0.561146716	0.562275101	0.572541108	0.601211	0.654321	0.730591	0.817857	0.89629	0.951	0.981329	0.994735	0.995859	0.983669	0.953
NPCC_NE	OffPeak	PeakWeekday	Commercial	Refrigeration	1	0.634652184	0.634652184	0.632864392	0.63522245	0.643334	0.657874	0.678172	0.7019	0.725433	0.745215	0.759191	0.767212	0.770645	0.771422	0.770
NPCC_NE	Peak	PeakWeekday	Commercial	Refrigeration	1	0.820471907	0.820471907	0.823803462	0.834713901	0.853667	0.879793	0.910434	0.941151	0.967028	0.985062	0.995358	0.999967	1	1	0.996
NPCC_NE	OffPeak	PeakWeekday	Commercial	Ventilation	1	0.961823446	0.961823446	0.957260036	0.958524454	0.961847	0.964924	0.967526	0.971241	0.977422	0.984636	0.989298	0.989347	0.986008	0.982053	0.979
NPCC_NE	Peak	PeakWeekday	Commercial	Ventilation	1	0.86664481	0.86664481	0.865496182	0.864225156	0.864755	0.869393	0.879655	0.894412	0.909201	0.919138	0.923211	0.924195	0.924761	0.925402	0.925
NPCC_NE	OffPeak	PeakWeekday	Commercial	WaterHeating	1	0.309732313	0.309732313	0.307478928	0.323474704	0.372688	0.463225	0.590242	0.731614	0.854924	0.938009	0.981952	1	1	0.988906	0.963
NPCC_NE	Peak	PeakWeekday	Commercial	WaterHeating	1	0.183133055	0.183133055	0.190237812	0.220484712	0.274475	0.348051	0.430393	0.505042	0.557324	0.584181	0.593824	0.59467	0.588781	0.574827	0.55
All	OffPeak	PeakWeekday	Commercial	LightingExternal	1	1	1	1	1	0.930502038	0.762438	0.53685	0.305053	0.131334	0.054226	0.049971	0.058386	0.049971	0.041745	0.049971
All	Peak	PeakWeekday	Commercial	LightingExternal	1	0.993456316	0.993456316	0.943529668	0.764847734	0.530413	0.305887	0.14171	0.059481	0.042414	0.049971	0.052998	0.049971	0.04945	0.049971	0.046
NPCC_NE	OffPeak	PeakWeekday	Industrial	HVAC	1	0.688573035	0.688573035	0.68339605	0.657346342	0.652922	0.696455	0.786871	0.891451	0.965749	0.992742	0.994331	0.996841	1	1	0.980
NPCC_NE	Peak	PeakWeekday	Industrial	HVAC	1	0.688573035	0.688573035	0.68339605	0.657346342	0.652922	0.696455	0.786871	0.891451	0.965749	0.992742	0.994331	0.996841	1	1	0.980
NPCC_NE	OffPeak	PeakWeekday	Industrial	Lighting	1	0.714073193	0.714073193	0.706569828	0.682617393	0.678535	0.71754	0.799451	0.895748	0.965863	0.992397	0.99397	0.995609	1	1	0.983
NPCC_NE	Peak	PeakWeekday	Industrial	Lighting	1	0.714073193	0.714073193	0.706569828	0.682617393	0.678535	0.71754	0.799451	0.895748	0.965863	0.992397	0.99397	0.995609	1	1	0.983
NPCC_NE	OffPeak	PeakWeekday	Industrial	MachineDrives	1	0.798182481	0.798182481	0.789055974	0.771934517	0.768487	0.793747	0.848994	0.916797	0.969315	0.991579	0.99386	0.994511	0.998919	1	0.99
NPCC_NE	Peak	PeakWeekday	Industrial	MachineDrives	1	0.798182481	0.798182481	0.789055974	0.771934517	0.768487	0.793747	0.848994	0.916797	0.969315	0.991579	0.99386	0.994511	0.998919	1	0.99
NPCC_NE	OffPeak	PeakWeekday	Industrial	ProcessHeating	1	0.776743636	0.776743636	0.766346075	0.752757439	0.754385	0.78482	0.845085	0.917339	0.972351	0.994261	0.994967	0.995282	1	1	0.986
NPCC_NE	Peak	PeakWeekday	Industrial	ProcessHeating	1	0.776743636	0.776743636	0.766346075	0.752757439	0.754385	0.78482	0.845085	0.917339	0.972351	0.994261	0.994967	0.995282	1	1	0.986


- Values represent the percent of maximum load expected to occur for each end use at a specific time, for the peak season (summer in our region) and offpeak season (non-summer in our region). Equivalent to **coincidence factors**.
  - Example: For the hour ending at noon, during the “off peak” season less than 1% of maximum commercial cooling load is on, and during the “peak” season, over 94% of maximum commercial cooling load is on (see red boxes)
- Can be used to determine efficiency savings for each end use, assuming a certain efficiency level (slides 12 and 13)

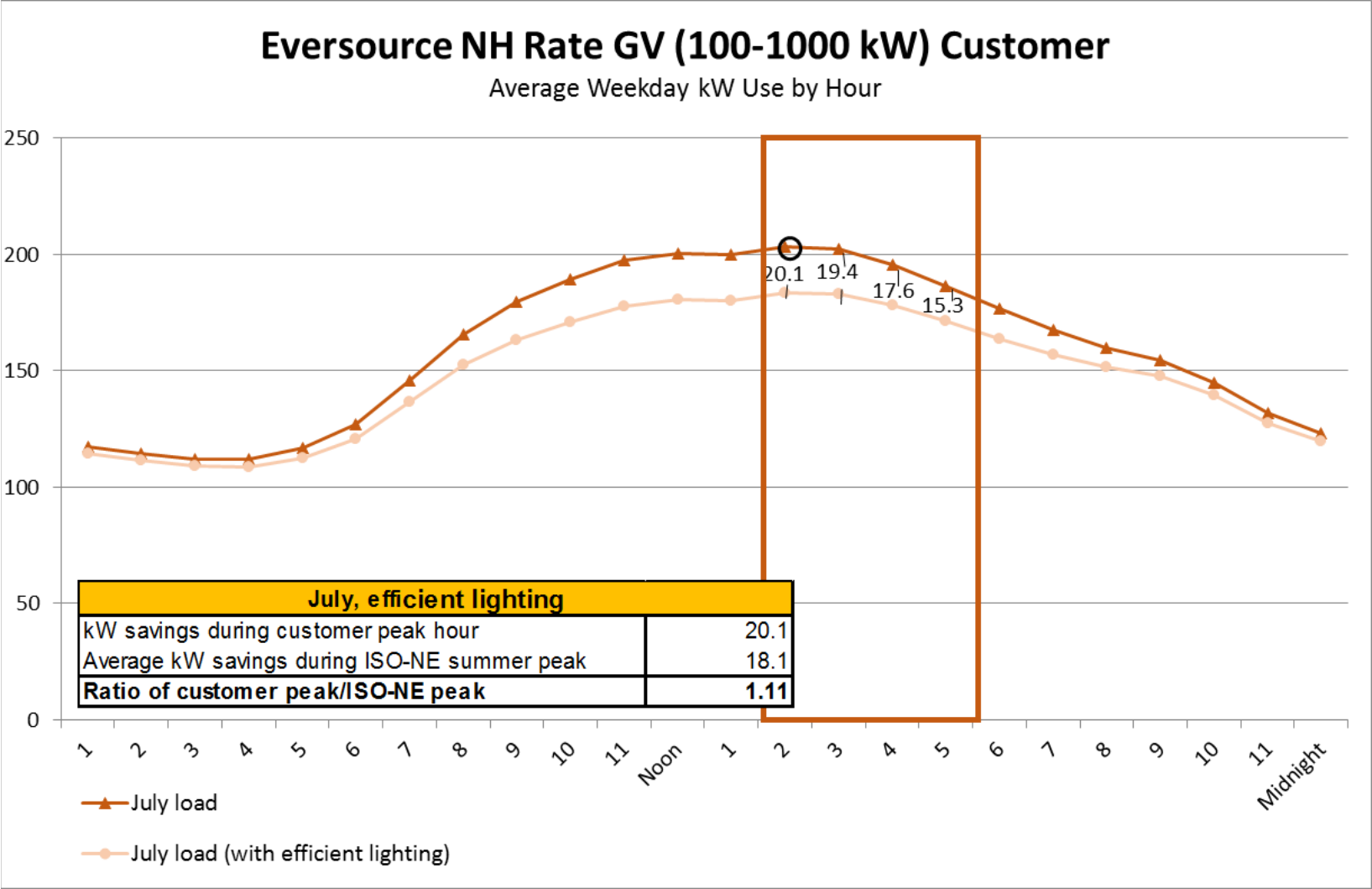
ISO-NE Winter and Summer On-Peak kW Savings  
vs.  
Customer Peak kW Savings

# ISO Summer Peak vs. Customer Peak: Indoor Lighting

- Summer indoor lighting: kW reduction at customer peak is on average **11% greater** than kW reduction during ISO-NE summer on-peak period
- **Two-thirds** of Eversource's 2018 Summer kW are from indoor lighting.


 ISO-NE summer peak hours


 Customer peak hour

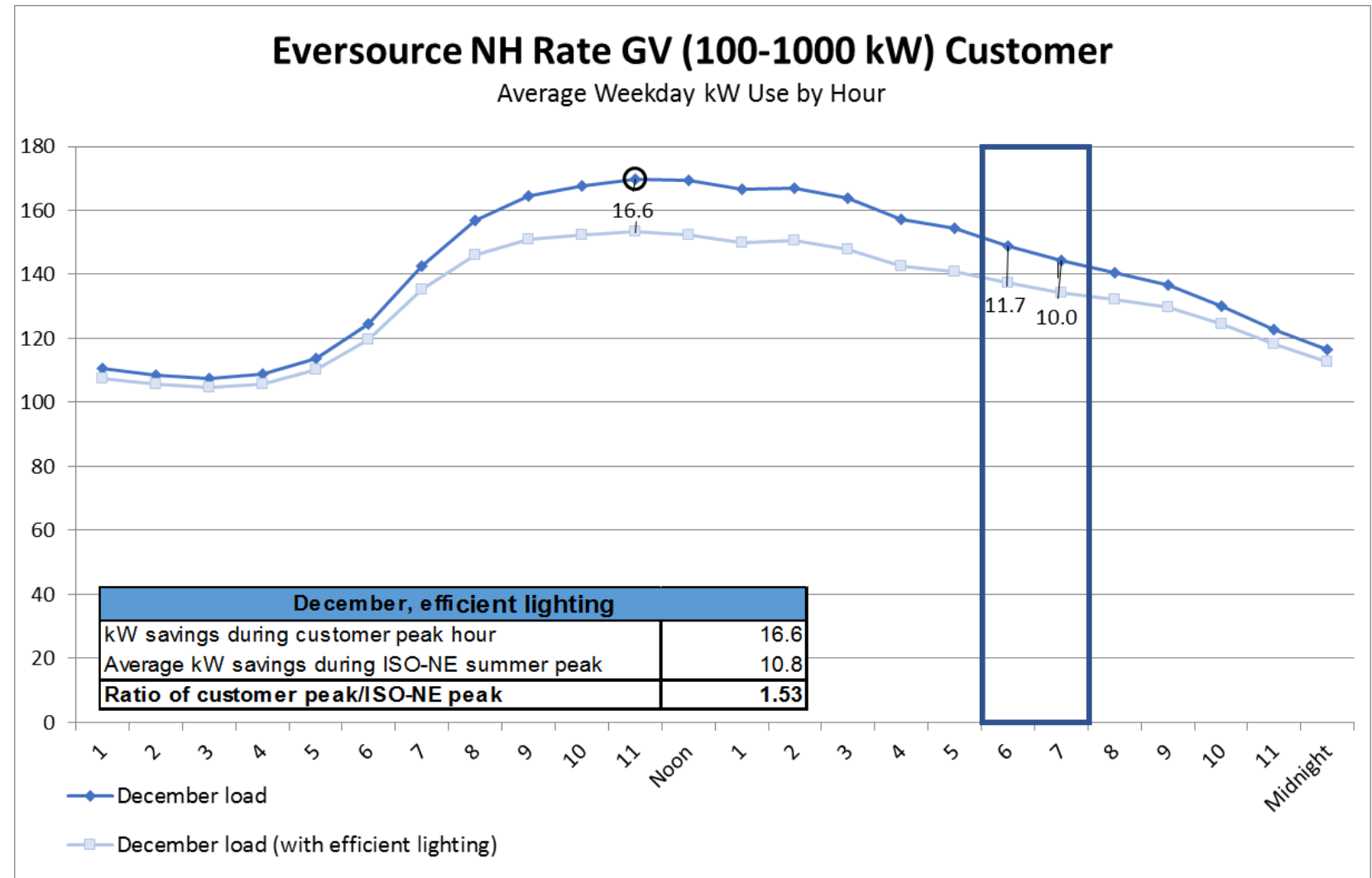


# ISO Winter Peak vs. Customer Peak : Indoor Lighting

- Winter indoor lighting: kW reduction at customer peak is on average **53% greater** than kW reduction during ISO-NE winter on-peak period
- One-half** of Eversource's 2018 Winter kW are from indoor lighting.

 ISO-NE winter peak hours

 Customer peak hour



# Customer Peak kW Analysis, based on EPRI End Use Load Shapes

# EPRI End Use Coincidence Factors (CF) at Customer Peak

PSNH's Load Curve Data for Large General Service Customers											
Rate GV											
Average Hourly KW Demand by Month and Daytype											
For the Period September 2015 through August 2016											
Key: WD = Average Weekday (Monday through Friday)											
WE = Average Weekend day (Saturday, Sunday & Holidays)											
PEAK HOUR COINCIDENCE FACTORS, BASED ON EPRI LOAD SHAPES, PEAK WEEKDAY											
Month	Daytype	Peak (Hour En Season	Cooling	Heating	LightingInternal	OfficeEquipment	Refrigeration	Ventilation	WaterHeating	LightingExternal	
Jan	WD	11.0 OffPeak	0.0097	0.721731	0.969967865	0.956210283	0.759191154	0.98929827	0.981951537	0.058386146	
Feb	WD	11.0 OffPeak	0.0097	0.721731	0.969967865	0.956210283	0.759191154	0.98929827	0.981951537	0.058386146	
Mar	WD	11.0 OffPeak	0.0097	0.721731	0.969967865	0.956210283	0.759191154	0.98929827	0.981951537	0.058386146	
Apr	WD	12.0 OffPeak	0.00989	0.615762	0.995703607	0.987374141	0.767212338	0.98934682	1	0.049971219	
May	WD	14.0 OffPeak	0.01046	0.506285	1	1	0.771421855	0.98205297	0.988906261	0.049971219	
Jun	WD	14.0 Peak	1	0.000138	0.982038841	0.983669286	1	0.92540191	0.574826763	0.049971219	
Jul	WD	14.0 Peak	1	0.000138	0.982038841	0.983669286	1	0.92540191	0.574826763	0.049971219	
Aug	WD	14.0 Peak	1	0.000138	0.982038841	0.983669286	1	0.92540191	0.574826763	0.049971219	
Sep	WD	14.0 OffPeak	0.01046	0.506285	1	1	0.771421855	0.98205297	0.988906261	0.049971219	
Oct	WD	14.0 OffPeak	0.01046	0.506285	1	1	0.771421855	0.98205297	0.988906261	0.049971219	
Nov	WD	12.0 OffPeak	0.00989	0.615762	0.995703607	0.987374141	0.767212338	0.98934682	1	0.049971219	
Dec	WD	11.0 OffPeak	0.0097	0.721731	0.969967865	0.956210283	0.759191154	0.98929827	0.981951537	0.058386146	
Hour Ending			Average	0.2575	0.46981	0.984782933	0.979216439	0.823787905	0.97152094	0.884917102	0.052776195

For example, in **January**, the average peak hour for Eversource Rate GV customers is the hour ending at 11:00, during which commercial facilities in the Northeast region are typically operating at:

- <1% of maximum cooling load
- 72% of maximum heating load
- 97% of maximum indoor lighting load
- 6% of maximum outdoor lighting load

# Customer Peak kW, based on NH 2018 – 2020 Plan

Subprogram	Measure	EPRI load shape	Customer Peak CF (from EPRI)	2018 Max Net kW (from screening model)	2018 Customer Peak kW (Max Net kW * Customer Peak CF)	2019 Max Net kW (from screening model)	2019 Customer Peak kW (Max Net kW * Customer Peak CF)	2020 Max Net kW (from screening model)	2020 Customer Peak kW (Max Net kW * Customer Peak CF)
LCI (Retrofit)	Cooling	Cooling	0.2574955	62.005	15.96599754	77.887	20.05560175	100.667	25.92125054
LCI (Retrofit)	Heating	Heating	0.4698098	76.043	35.72590462	95.521	44.8769025	123.459	58.00202096
LCI (Retrofit)	Lighting	LightingInternal	0.9847829	174.414	171.7602463	219.090	215.7557075	283.167	278.8576389
LCI (Retrofit)	Lighting-LED	LightingInternal	0.9847829	2,072.075	2040.544587	2,602.826	2563.219083	3,364.073	3312.8821
LCI (Retrofit)	LightingOS Only	LightingInternal	0.9847829	76.478	75.31457817	96.068	94.60600138	124.165	122.275357
LCI (Retrofit)	Park Lot Lights	LightingExternal	0.0527762	1,037.559	54.75839587	1,303.324	68.7844638	1,684.506	88.90181115
LCI (Retrofit)	Process	ProcessHeating	0.9975360	978.983	976.5704759	1,229.744	1226.713739	1,589.406	1585.489908
LCI (New Equipment and Construction)	Cooling	Cooling	0.2574954979032	256.546	66.05953401	321.388	82.75604734	414.951	106.8480468
LCI (New Equipment and Construction)	Heating	Heating	0.4698098163474	167.474	78.68100011	209.803	98.56758254	270.881	127.2626474
LCI (New Equipment and Construction)	Lighting	LightingInternal	0.9847829330312	4.217	4.153027099	5.283	5.202702568	6.821	6.717317046
LCI (New Equipment and Construction)	Lighting-LED	LightingInternal	0.9847829330312	753.692	742.2226426	944.187	929.8190348	1,219.059	1200.508615
LCI (New Equipment and Construction)	LightingOS Only	LightingInternal	0.9847829330312	0.000	0	0.000	0	0.000	0
LCI (New Equipment and Construction)	Park Lot Lights	LightingExternal	0.0527761950271	338.307	17.8545491	423.814	22.36727723	547.195	28.87885491
LCI (New Equipment and Construction)	Process	ProcessHeating	0.9975360449535	570.814	569.4077769	715.087	713.3253005	923.264	920.9890701

Annual average customer peak hour CF (bottom row in table on prior slide), for each measure type  
**X** Maximum Connected Load kW Savings, for each measure type  
**= Customer Peak kW Savings**



# Comparison of Eversource kW for 2018 – 2020 Plan

## **Total Customer Peak kW for C&I Programs**

- 2018: 8,345.5 kW
- 2019: 10,643.4 kW
- 2020: 13,779.5 kW

## **Maximum Net Connected Load kW for C&I Programs**

- 2018: 11,116.5 kW
- 2019: 13,974.6 kW
- 2020: 17,903.5 kW

## **Summer On-Peak kW for C&I Programs**

- 2018: 6,213.0 kW (Bates 217)
- 2019: 7,922.3 kW (Bates 222)
- 2020: 10,259.7 kW (Bates 227)

## **Winter On-Peak kW for C&I Programs**

- 2018: 7,330.6 kW (Bates 217)
- 2019: 9,088.9 kW (Bates 222)
- 2020: 11,536.7 kW (Bates 227)