FINAL REPORT

X1931-2 Loadshape and Coincidence Factor Research

Prepared for: Connecticut Energy Efficiency Board (EEB) and Evaluation Administrators Lisa Skumatz, Dakers Gowans, Ralph Prahl, Robert Wirtshafter, and Peter Jacobs

Prepared by: Mike Frischmann, EcoMetric Consulting

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ABSTRACT

The X1931 PSD Review project examined the PSD measures across all sectors. Phase 3 of this study provided detailed measure or parameter research on items that the X1931 team identified in earlier project stages. One of those research efforts, X1931-2, focused on the coincidence factors and loadshapes contained within the measure characterizations and appendices of the PSD. This study had three main objectives; (1) revise the loadshapes in Appendix 2 of the PSD, (2) confirm or update the coincidence factors for residential and commercial measures using the recent ISO-NE seasonal peak hours, (3) compile the updated coincidence factors from all measures into the tables in Appendix 1 of the PSD.

The study team leveraged data from two recent commercial Connecticut evaluations (C1634 and C1635), along with commercial savings loadshape data from additional regional studies. Similarly, the team leveraged extensive metered data from the Massachusetts baseline study to update loadshapes and coincidence factors. The team modified the existing Massachusetts C&I loadshape tool to facilitate the updates to produce loadshapes and coincidence factors. Similarly, the team created a calculator which determines the residential measure loadshapes and coincidence factors. Both calculators are available for updating and future use by Connecticut stakeholders.

The study provided updated loadshapes for four residential and four commercial measures and created four new loadshapes. The study team also recommended updates to 48 measure coincidence factors.

1 INTRODUCTION AND OBJECTIVES

DNV and EcoMetric Consulting (DNV or research team), as part of the ongoing project "X1931 CT Program Savings Document (PSD) Review and Update," examined the information contained in the PSD's seven different appendices. The appendices include tables of key measure savings parameters for a majority of the measures in the PSD.

PSD Appendix 1 provides a compendium of the measure level coincidence factors[1] for the ISO-NE seasonal peak period. ISO-NE utilizes several different period definitions, one of which is related explicitly to capacity resources.

- **Seasonal Peak**: when the actual load exceeds 90% of the 50/50 load forecast for non-holiday weekdays during June, July, August, December, and January

The utility companies base demand savings on the seasonal peak definition, and the PSD should reflect the best estimates of seasonal peak coincident demand. This research involves reviewing PSD appendices to ensure that they contain proper citations, incorporate recent CT evaluation results or relevant regional research, and are consistent with the remainder of the PSD.

1.1 Current PSD Sources

A total of 12 different references support the provided coincidence factors. DNV could not locate five of these for review, and two of the sources calculate peak factors according to the ISO-NE seasonal peak definitions. These two sources accounted for 55% of the factors. A third reference provides a 2-hour extreme peak. All of these references were published in 2007. Appendix 1 includes coincidence factors for 19 of the 72 active measures in the PSD. There are indications that some coincidence factors apply to multiple measures, but this is not explicitly defined. For example, there are no central or geothermal heat pump coincidence factors in the Appendix, only a Central A/C value. Further, there are measures for which the coincidence factor is provided in the PSD measure chapter without reference to Appendix 1, even though a contradicting value is available in Appendix 1.

PSD Appendix 2 contains sixteen different load shapes. These load shapes break down the percentage of savings that occur during four different periods: winter peak, winter off-peak, summer peak, and summer off-peak. The sources referenced in Appendix 2 were published between 2011 and 2016.

1.2 Peaks Over Time

Over the last eight years, the time of day for the ISO-NE seasonal peak has shifted during the summer months. In 2013-2016, seasonal peak hours generally occurred in the early afternoon hours, from 1:00 p.m. to 5:00 p.m. During the last three years, most of the summer seasonal peak hours have occurred in the early evening hours. Figure 2 shows the distribution of summer seasonal peak hours[2] from 2013 to 2020.

[1] Peak coincident demand is amount of capacity (kW) savings that occur during a defined period in time. This is estimated with a parameter called coincidence factor (CF).

[2] Seasonal peak hour data is available from ISO-NE for download back to 2013. https://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/season-peak-hour-data

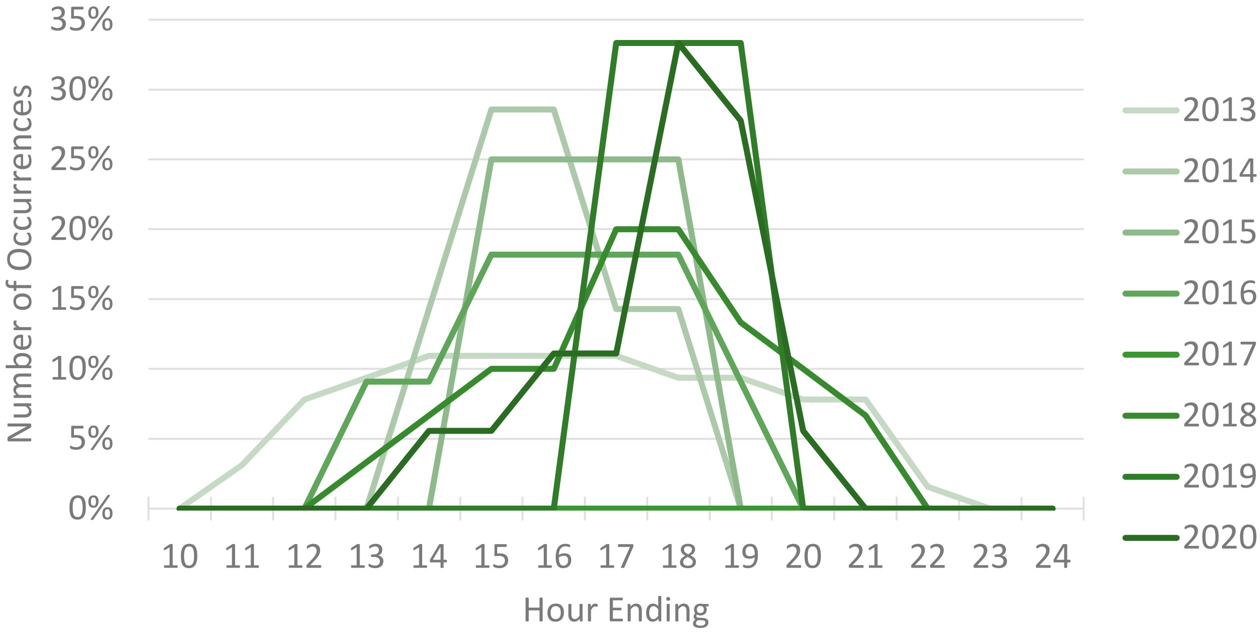

Figure 1. ISO-NE Summer Seasonal Peak Hours by Year

Since a large percentage of the CF values in the PSD are from sources before 2013, it is not clear if those CF values would be directly applicable to the peak period shifting later in the day. DNV recommended research to examine and determine updated CFs based on the shifted peak as part of the X1931 PSD Review Phase[3].

The DNV team also examined the seasonal winter peak hours over time. Figure 3 shows the time of day when ISO-NE winter seasonal peak hours have occurred from 2013 to 2020. Over time, the winter seasonal peak hours have stayed more consistent than the summer hours.

[3] X1931 PSD Review, ERS (now DNV), 2020.

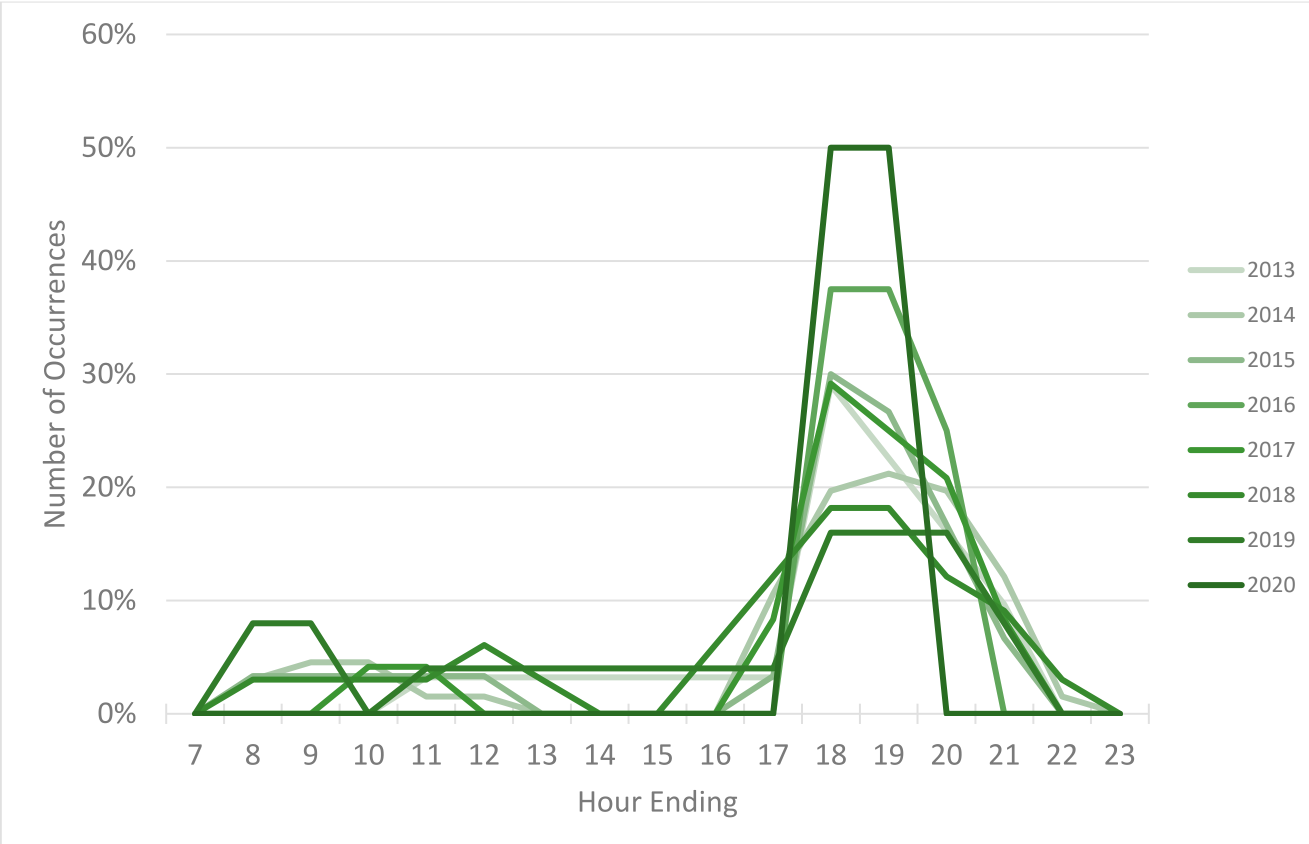

Figure 2. ISO-NE Winter Seasonal Peak Hours by Year

1.3 Shifted Seasonal Peaks

The DNV team used 2019 to define the most recent seasonal peak hours to calculate updated coincidence factors. The 2019 hours avoid grid-level impacts due to COVID, which may not be typical of future years. DNV used a summer seasonal peak definition of 5:00 p.m. – 8:00 p.m., non-holiday weekdays during July and August. While the ISO-NE summer season runs from June through September, ISO-NE did not log June or September seasonal peak hours between 2013 and 2019.

DNV used a winter seasonal peak definition of 7:00 a.m. – 10:00 a.m. and 4:00 p.m. – 9:00 p.m., non-holiday weekdays during December and January. All winter seasonal peak hours have occurred during these two months since 2013.

2 METHODOLOGY

The DNV team leveraged existing primary data collected from several recent studies. All of the data was examined, cleaned, and normalized to ensure consistency. All of the processed data was integrated into either the commercial and industrial or residential loadshape calculators. The calculators were then used to determine the updated loadshapes, as well as the summer and winter seasonal peak coincidence factor values.

2.1 Data Sources

The DNV team leveraged four primary sources in this research.

1. C1634 Energy Conscious Blueprint Impact Evaluation, completed by Cadmus in October 2020.[4]
2. C1635 Energy Opportunities Impact Evaluation, completed by DNV in August 2020.[5]
3. Existing savings loadshapes compiled in the loadshape calculation tool leveraged by the Massachusetts program administrators.[6]
4. Residential baseline metered data collected in Massachusetts.[7]

DNV requested project-level metered and savings data from the C1634 and C1635 evaluation contractors. The raw metered data and savings calculations were processed using the steps outlined in section 3.2.

The Massachusetts loadshape tool contains 628 project savings profiles from studies across the region, including Connecticut. The data includes annual hourly ("8760") savings profiles. Results from the tool include loadshapes for ISO-NE summer and winter periods and a custom period. Figure 3 shows the breakdown of the loadshapes by equipment type available in the tool.

[4] Final report available online https://energizect.com/connecticut-energy-efficiency-board/evaluation-reports.

[5] Ibid.

[6] The MA loadshape tool was shared with permission from Eversource, which operates in both Massachusetts and Connecticut.

[7] Massachusetts Residential Baseline Study. Guidehouse, March 2020. https://ma-eeac.org/studies/residential-program-studies/.

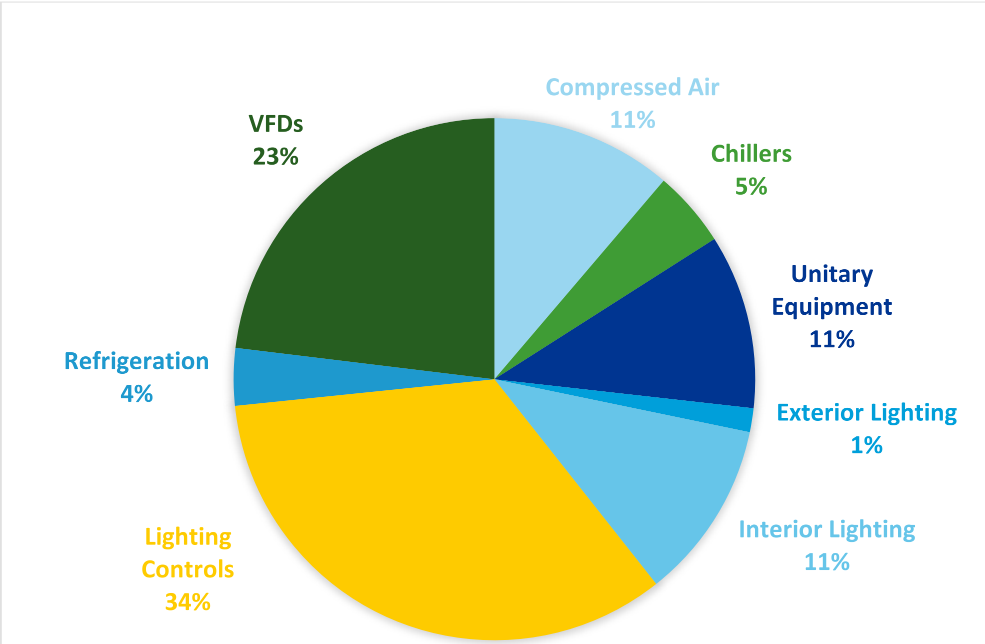

Figure 3. Commercial and Industrial Loadshapes by Equipment Type

The residential baseline study data was collected from 350 homes and included metered data for HVAC, hot water, kitchen, laundry, lighting, and miscellaneous equipment categories. The appendices of the baseline study report contain spreadsheets with summaries of the metered data for various demographic breakdowns. At the time of this study, there were no additional recently completed metering studies from the residential sector the study team could include. Most of the recent residential studies had been delayed due to COVID, for example, R1982. The DNV team leveraged the home-type variable containing single-family attached, single-family detached, and multifamily end-use metered data. Figure 4 shows an example of the data available from the residential baseline study.

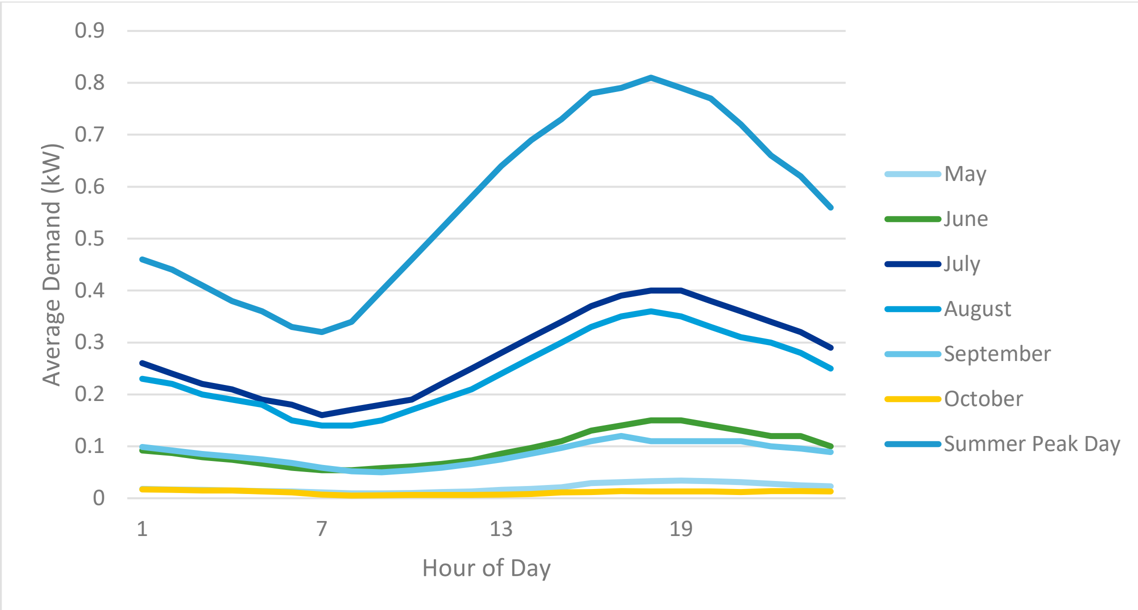

Figure 4. Monthly Loadshapes for SF Detached Room AC

2.2 Data Analysis

The DNV team carefully reviewed and synthesized all of the received data. Data from the four sources were cleaned and verified to be complete, such as checking for missing or invalid values. After ensuring the data was clean, the DNV team created annual hourly loadshapes.

All data was verified to be weather normalized. For C&I project data, which was not weather normalized (i.e., metered data), the DNV team used statistical models to extrapolate metered data to a full year using typical meteorological year (TMY) data from the nearest weather station. The DNV team transformed the hourly loadshapes by day type (weekday, weekend) for each month and mapped them to create an 8760 hourly loadshape.

The team transformed the weather normalized commercial and residential profiles into an hourly percentage by dividing the hourly number by the annual total. The DNV team took the resulting percentage savings loadshape and added it to the loadshape tool datasets.

2.3 Loadshape Calculation Tools

The DNV team created two different loadshape calculation tools, one for commercial and industrial and another for residential.

2.3.1 Commercial Loadshape Tool

The DNV team adapted the Massachusetts C&I loadshape calculator to include the savings loadshapes derived from C1634 and C1635. The tool already could filter results by different equipment types and calculate loadshapes for the typical ISO-NE summer on-peak, summer off-peak, winter on-peak, and winter off-peak periods. The tool also contained the ability to select any months, days of the week, hours of the day, and holidays to create a custom loadshape.

The existing tool did not calculate a coincidence factor and did not account for the seasonal peak periods used in the PSD. The DNV team modified the calculation algorithms so that when custom months, days, and hours are selected, the tool returns a coincidence factor relative to average demand[8]. DNV used average demand within the tools because the project level details necessary to calculate coincidence factors relative to maximum connected load were not available.

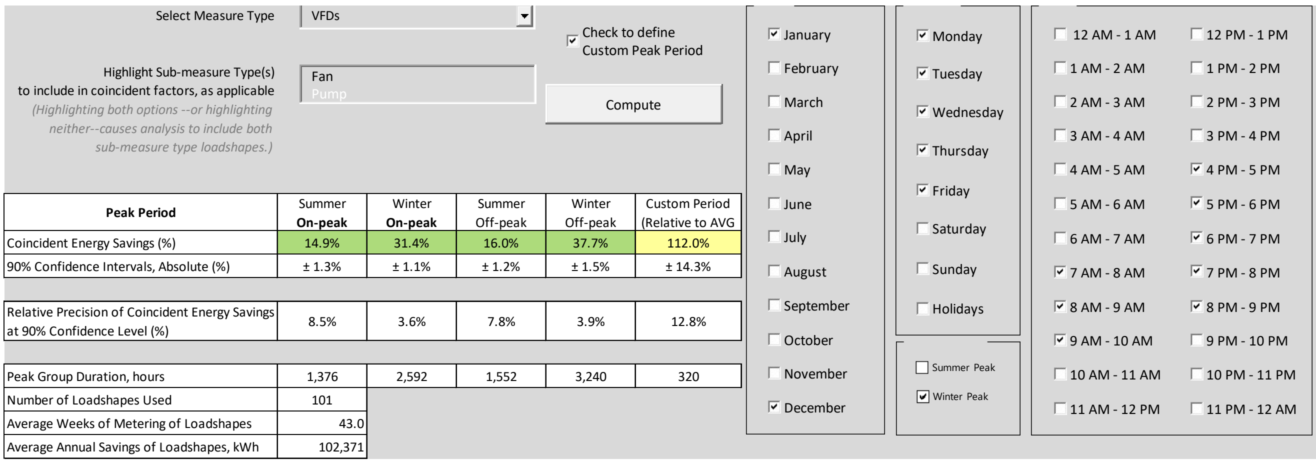

Figure 5. C&I Loadshape Tool Inputs and Outputs Example

The DNV team also added the ability to account for the typically seen extremes during the seasonal peak. As part of a prior effort, DNV wrote a memo[9] that examined historical ISO-NE seasonal peak hour data and determined which TMY3 hours met the requirements to be considered seasonal peak hours. The DNV team included using a summer or winter peak hour factor in the C&I loadshape tool. The peak hour factor is the average savings ratio during the seasonal peak hours to the other on-peak hours. Users can toggle the peak hour factor on and off as desired. The coincidence factors determined by this study include the peak hour factor to best estimate the usage during the more extreme seasonal peak periods.

2.3.2 Residential Loadshape Tool

The DNV team also created a residential loadshape tool. Modeled after the C&I loadshape tool, the residential tool summarizes and filters data by home type, end-use, and equipment type. The residential loadshape tool will output the savings loadshape for summer on-peak, summer off-peak, winter on-peak, and winter off-peak periods. The residential loadshape tool will also calculate a custom loadshape based on the month, daytype (weekday or weekend), and the day's hours selected.

[8] Average demand equals the total annual energy savings divided by 8760 hours.

[9] DNV Seasonal Peak Hours Summary Memo. May 2020.

Table 1. Residential Loadshape Tool Input Example

Building-Type	End Use Category	End Use	Time Period	Day Type	Hour Ending	
Single Family Detached	Misc	Primary TV and Peripherals	☐ January	☑ Weekday	☐ 1	☐ 13
			☐ February	☐ Weekend	☐ 2	☐ 14
			☐ March		☐ 3	☐ 15
			☐ April		☐ 4	☐ 16
			☐ May		☐ 5	☐ 17
			☐ June		☐ 6	☑ 18
			☑ July		☐ 7	☑ 19
			☑ August		☐ 8	☑ 20
			☐ September		☐ 9	☐ 21
			☐ October		☐ 10	☐ 22
			☐ November		☐ 11	☐ 23
			☑ December		☐ 12	☐ 24
			☑ Summer Peak			
			☑ Winter Peak			

The outputs of the residential tool also include the calculation of a coincidence factor. However, unlike the C&I tool, the residential tool calculates the coincidence factor for each ISO-NE period and the summer and winter seasonal peak periods. The coincidence factors output from the residential tool are relative to average demand, given that equipment consumption data is the basis.

Energy Load Shape				
Summer **On-peak**	Winter **On-peak**	Summer Off-peak	Winter Off-peak	Custom Period
16%	36%	15%	33%	3%

Demand Coicidence Factor*				
Summer **On-peak**	Winter **On-peak**	Summer **Seasonal** Peak	Winter **Seasonal** Peak	Custom Calculation
1.017	1.143	1.254	2.061	1.437

*Relative to Average Demand

2.4 Coincidence Factor Calculations

To transform the tool's output, the DNV team leveraged the PSD algorithms to calculate the annual energy savings in kWh. DNV used the output of the C&I or residential tool to determine the seasonal peak demand savings. This seasonal peak value was then substituted back into the PSD measure algorithm for seasonal peak demand to determine the required coincidence factor.

3 RESULTS AND RECOMMENDATIONS

The DNV team recommends updates to four C&I loadshapes and four residential loadshapes, four new residential loadshapes, and updates of coincidence factors for 48 different types of equipment. The recommended values are shown in Sections 3.1 and 3.2.

Overall, the recalculated commercial coincidence factors were slightly lower, while the residential factors were marginally higher than the values in the 2021 PSD. DNV believes the commercial differences are caused by the shift of seasonal peak hours later when many commercial buildings begin to ramp down energy usage. Figure 5 shows a load profile for a prototypical office building in July. Note that at 5:00 p.m. (hour 17), the energy consumption in the office building declines quickly, leading to a slight decrease in the seasonal peak coincidence factor.

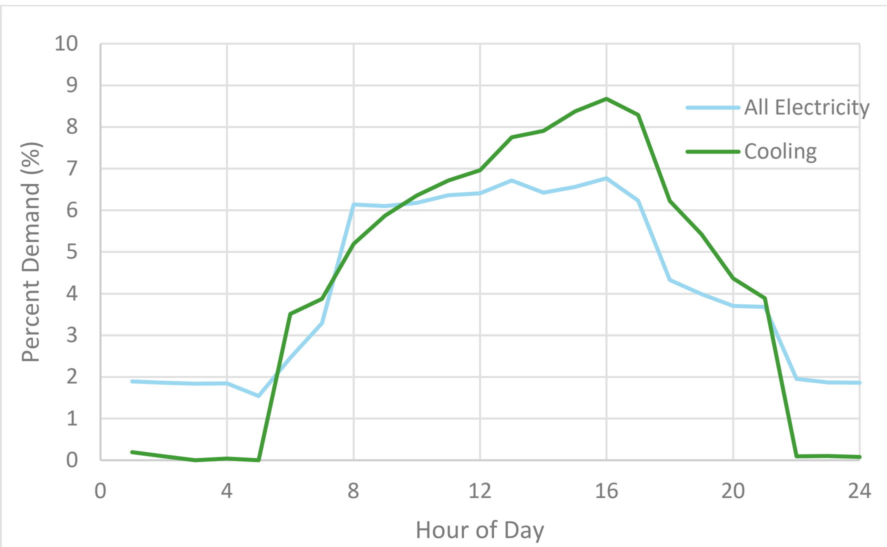

Figure 6. Commercial End Use Profiles - July

Conversely, the early evening is when a significant number of loads in residential homes are beginning to increase. Figure 6 shows the end-use profile for a residential home in July. The cooling usage during the 5:00 p.m. hour is very near the peak in residential dwellings. Other end uses such as laundry and hot water also increase usage as residents return home from work or school. The higher coincidence factors for many residential measures reflect higher usage during the evening hours.

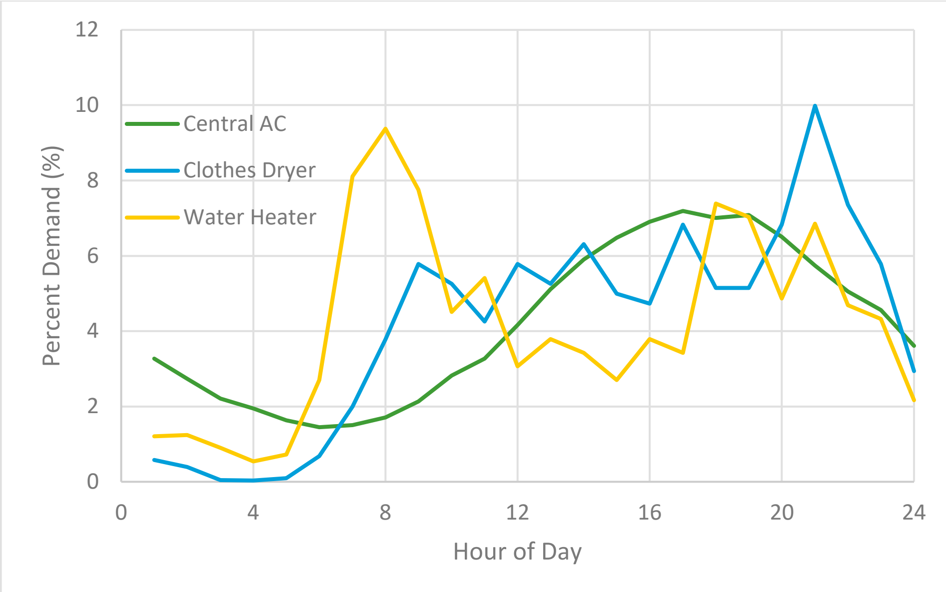

Figure 7. Residential End-Use Profiles - July

3.1 Loadshapes

The DNV team used the C&I and residential loadshape calculators to determine updated energy savings loadshapes for four commercial and four residential end-uses in Appendix 2 of the PSD. Additionally, information was available to create four additional loadshapes for different types of equipment. The recommended update to PSD Table A2-1 in the PSD is shown in Table 3.

Table 3. Recommended Update to PSD Table A2-1 Loadshapes by End-use and Sector.

Load Shape	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
End Use	**Residential**			
Cooling - Central AC	4.83%	4.33%	54.40%	36.45%
Cooling - Room AC	1.75%	2.10%	51.81%	44.34%
Cooling - Ductless HP	8.56%	10.20%	47.51%	33.73%
Heating	47.23%	52.77%	0.00%	0.00%
Lighting	42.10%	32.50%	13.90%	11.50%
Refrigeration - Fridge	30.34%	30.85%	19.57%	19.24%
Refrigeration - Freezer	28.73%	31.76%	19.11%	20.40%
Water Heating - Electric	43.26%	29.72%	16.19%	10.82%
Water Heating - HP	41.88%	31.05%	15.56%	11.50%
Residential General	30.30%	36.30%	15.50%	17.90%
End Use	**C&I**			

Cooling - Chillers	18.45%	17.26%	32.23%	32.06%
Cooling - RTUs	18.19%	10.22%	43.16%	28.43%
Heating (b, f, Note [3])	55.00%	27.00%	12.00%	6.00%
Lighting (large C&I) (b, h)	44.50%	19.40%	25.70%	10.50%
Lighting (small C&I) (b, h)	38.30%	25.10%	22.50%	14.10%
Refrigeration	29.95%	36.58%	15.95%	17.51%
Other (b, g, Note [5])	37.00%	29.00%	19.00%	15.00%
Motors	31.74%	36.49%	15.77%	15.99%
Process (b, e, Note [7])	32.00%	36.00%	16.00%	16.00%

3.2 Coincidence Factors

The DNV team also recommends updating the tables in Appendix 1 of the PSD. The updated tables provide a comprehensive list of the coincidence factors for each measure in the PSD and are shown in Table 4, Table 5, and Table 6.

Table 4. Recommended Update to PSD Table A1-2 – Other C&I Measures.

Section	Measure Number	Measure Name	2021 PSD Summer CF	X1931-2 Summer CF		2021 PSD Winter CF	X1931-2 Winter CF	
				Comparable PSD Value†	Value from Calculator		Comparable PSD Value†	Value from Calculator
Section 2: C&I Lost Opportunity	2.2.1	Chillers	Custom	70%	236.5%*	0%	3%	11%*
Section 2: C&I Lost Opportunity	2.2.2	Unitary A/C and Heat Pumps	44%	42%	463.7%*	0%	0.01%	1.8%*
Section 2: C&I Lost Opportunity	2.2.3	Water and Ground Source Heat Pumps (Com)	82%	82%		82%	82%	
Section 2: C&I Lost Opportunity	2.2.3	Water and Ground Source Heat Pumps (MF)	59%	80%	991.8%*	100%	100%	
Section 2: C&I Lost Opportunity	2.2.4	Dual Enthalpy Controls	NA	NA		NA	NA	
Section 2: C&I Lost Opportunity	2.2.5	Demand Control Ventilation	Custom	Custom		Custom	Custom	
Section 2: C&I Lost Opportunity	2.2.6	Natural Gas Fired Boilers and Furnaces	0%	0%		0%	0%	
Section 2: C&I Lost Opportunity	2.2.7	Natural Gas Radiant Heaters	0%	0%		0%	0%	
Section 2: C&I Lost Opportunity	2.2.8	Natural Gas-Fired Domestic Hot Water Heaters	0%	0%		0%	0%	
Section 2: C&I Lost Opportunity	2.2.9	Variable Refrigerant Flow (VRF) HVAC System	Custom	Custom		Custom	Custom	
Section 2: C&I Lost Opportunity	2.3.1	Low Voltage Dry Type Distribution Transformers	0%	0%		0%	0%	
Section 2: C&I Lost Opportunity	2.4.1	HVAC Variable Frequency Drives - Fans	0.18	0.15	123%*	0.33	0.11	92.4%*
Section 2: C&I Lost Opportunity	2.4.1	HVAC Variable Frequency Drives - CHWP	0.30	0.13	155.9%*	0.00	0.05	56.1%*

Section 2: C&I Lost Opportunity	2.4.1	HVAC Variable Frequency Drives - HWP	0	0.12	45.7%*	0.21	0.38	146%*
Section 3: C&I Retrofit	2.6.1	Lean Manufacturing	0%	0%		0%	0%	
Section 3: C&I Retrofit	2.6.2	Commercial Kitchen Equipment	100%	100%		100%	100%	
Section 3: C&I Retrofit	2.6.3	Lost Opportunity Custom	Custom	Custom		Custom	Custom	
Section 3: C&I Retrofit	2.6.4	Commercial Clothes Washers	0%	0%		0%	0%	
Section 3: C&I Retrofit	3.1.2	Refrigerator LED	100%	100%		100%	100%	
Section 3: C&I Retrofit	3.2.1	Water-Saving Measures	0%	0%		0%	0%	
Section 3: C&I Retrofit	3.2.2	Pipe Insulation	0%	0%		0%	0%	
Section 3: C&I Retrofit	3.2.3	Duct Sealing	100%	100%		100%	100%	
Section 3: C&I Retrofit	3.2.4	Duct Insulation	0%	0%		0%	0%	
Section 3: C&I Retrofit	3.2.5	Setback Thermostats	0%	0%		0%	0%	
Section 3: C&I Retrofit	3.2.6	Steam Trap Replacement	0%	0%		0%	0%	
Section 3: C&I Retrofit	3.2.7	Blower Door Test (Small C&I)	100%	100%		100%	100%	
Section 3: C&I Retrofit	3.2.8	Add Speed Control to Rooftop Unit Fan	100%	100%		100%	100%	
Section 3: C&I Retrofit	3.2.9	Commercial Kitchen Hood Controls	Custom	Custom		Custom	Custom	
Section 3: C&I Retrofit	3.3.1	Custom Measures	Custom	Custom		Custom	Custom	
Section 3: C&I Retrofit	3.4.1	Cooler Night Covers	0%	0%		0%	0%	
Section 3: C&I Retrofit	3.4.2	Evaporator Fan Controls	100%*	97.4%*	97.4%*	100%*	98.2%*	98.2%*
Section 3: C&I Retrofit	3.4.3	Evaporator Fans Motor Replacement	100%*	97.4%*	97.4%*	100%*	98.2%*	98.2%*
Section 3: C&I Retrofit	3.4.4	Door Heater Controls	100%*	97.4%*	97.4%*	100%*	98.2%*	98.2%*
Section 3: C&I Retrofit	3.4.5	Vending Machine Controls	0%	0%		0%	0%	
Section 3: C&I Retrofit	3.4.6	Add Doors to Open Refrigerated Display Cases	100%*	97.4%*	97.4%*	100%*	98.2%*	98.2%*

*Values denoted with an asterisk are relative to average demand savings. Average demand savings is defined as total energy (kWh) savings divided by 8760. Data available during X1931-2 did not include sufficient detail to calculate maximum connected loads for each profile, which necessitated the use of seasonal peak coincidence factors relative to average demand. Values which do not have an asterisk are relative to connected load or seasonal peak demand as outlined by the measure characterization in the PSD.

† Comparable PSD values were calculated ease comparing results from the study to those currently in the PSD. These numbers were back calculated by comparing the demand savings using the PSD CFs and average demand CFs from the X1931-2 study tools, and solving for what the PSD CF would need to be to make the two values equal. The comparable PSD values are recommended to be update the CF values in Appendix 1 of the PSD. These recommended values were calculated using the residential and C&I loadshape tools created for project X1931-2.

Table 5. Recommended Update to Table A1-3 – Residential Measures.

Section	Measure Number	Measure Name	2021 PSD Summer CF	X1931-2 Summer CF		2021 PSD Winter CF	X1931-2 Winter CF	
				Comparable PSD Value†	Value from Calculator		Comparable PSD Value	Value from Calculator
Section 4: Residential	4.1.1	Lighting	13%	13%		20%	20%	
Section 4: Residential	4.2.1	Energy-Efficient Central Air Conditioning	0.45	0.57	1373.9%*	0%	0%	
Section 4: Residential	4.2.2	Heat Pump	0.45	0.57	1373.9%*	0%	0%	
Section 4: Residential	4.2.3	Geothermal Heat Pump	69%	74%	1373.9%*	50%	50%	
Section 4: Residential	4.2.4	Electronically Commutated Motor HVAC Fan	7%	7%		12%	12%	
Section 4: Residential	4.2.5	Duct Sealing	100%	100%		100%	100%	
Section 4: Residential	4.2.6	Heat Pump – Ductless	23%	23%		16%	16%	
Section 4: Residential	4.2.7	Package Terminal Heat Pump	59%	59%		0%	0%	
Section 4: Residential	4.2.8	Quality Installation Verification	11%	11%		59%	59%	
Section 4: Residential	4.2.9	Duct Insulation	0.02	1.53	1373.9%*	0.57	0.46	398.8%*
Section 4: Residential	4.2.10	Boilers	0%	0%		0%	0%	
Section 4: Residential	4.2.11	Furnaces	0%	0%		0%	0%	
Section 4: Residential	4.2.12	Boiler Reset Controls	0%	0%		0%	0%	

Section 4: Residential	4.2.13	ECM Circulating Pump	0%	0%		100%	100%	
Section 4: Residential	4.2.14	WI-FI Thermostat	0%	0%		0%	0%	
Section 4: Residential	4.2.15	Clean, Tune and Test	0%	0%		0%	0%	
Section 4: Residential	4.3.1	Residential Appliances	Table A1-4	Table A1-4		Table A1-4	Table A1-4	
Section 4: Residential	4.3.2	Electronics	Table A1-4	Table A1-4		Table A1-4	Table A1-4	
Section 4: Residential	4.4.1	REM Savings	100%	100%		100%	100%	
Section 4: Residential	4.4.2	Infiltration Reduction Testing (Blower Door Test)	100%	100%		100%	100%	
Section 4: Residential	4.4.3	Window or Sliding Glass Door Replacement	69%	74%	1373.9%*	0.57	0.46	398.8%*
Section 4: Residential	4.4.4	Thermal Enclosure	100%	100%		100%	100%	
Section 4: Residential	4.4.5	Install Storm Window	0%	0%		0.57	0.46	398.8%*
Section 4: Residential	4.4.6	Insulate Attic Openings	0%	0%		0.57	0.46	398.8%*
Section 4: Residential	4.4.7	Infiltration Reduction (Prescriptive)	0%	0%		0.57	0.46	398.8%*
Section 4: Residential	4.4.8	Wall Insulation	69%	74%	1373.9%*	0.57	0.46	398.8%*

*Values denoted with an asterisk are relative to average demand savings. Average demand savings is defined as total energy (kWh) savings divided by 8760. Data available during X1931-2 did not include sufficient detail to calculate maximum connected loads for each profile, which necessitated the use of seasonal peak coincidence factors relative to average demand. Values which do not have an asterisk are relative to connected load or seasonal peak demand as outlined by the measure characterization in the PSD.
† Comparable PSD values were calculated ease comparing results from the study to those currently in the PSD. These numbers were back calculated by comparing the demand savings using the PSD CFs and average demand CFs from the X1931-2 study tools, and solving for what the PSD CF would need to be to make the two values equal. The comparable PSD values are recommended to be update the CF values in Appendix 1 of the PSD. These recommended values were calculated using the residential and C&I loadshape tools created for project X1931-2.

Table 6. Recommended Update to Table A1-4 – Residential Appliance and Electronics.

Measure	Measure Name	2021 PSD Summer CF	X1931-2 Summer CF	2021 PSD Winter CF	X1931-2 Winter CF
4.3.1	Air cleaner/purifier	98%	100%	98%	100%
4.3.1	Clothes washer, Tier I	89%	117%	119%	140%
4.3.1	Clothes washer, Tier II	87%	117%	117%	140%
4.3.1	Clothes dryer (ENERGY STAR)	117%	113%	117%	191%
4.3.1	Clothes dryer (hybrid)	106%	113%	106%	191%
4.3.1	Clothes dryer (heat pump)	107%	113%	107%	191%
4.3.1	Dehumidifier	27%	202%	27%	15%
4.3.1	Dishwasher	0%	110%	0%	144%
4.3.1	Refrigerator Tier I (10% greater than ENERGY STAR)	96%	151%	82%	100%
4.3.1	Refrigerator Tier II (15% greater than ENERGY STAR)	96%	151%	73%	100%
4.3.1	Room A/C	737%	1298%	0%	0%
4.3.1	Freezer, upright	100%	123%	80%	79%
4.3.1	Freezer, chest	110%	123%	73%	79%
4.3.1	Refrigerator recycling	99%	159%	99%	68%
4.3.1	Freezer recycling	99%	123%	99%	79%
4.3.1	Multifamily clothes washer (in unit)	97%	196%	0%	13%
4.3.1	Multifamily clothes dryer	117%	232%	0%	54%
4.3.1	Multifamily dishwasher	82%	66%	0%	192%
4.3.1	Multifamily refrigerator	120%	129%	0%	93%
4.3.1	Multifamily room A/C	741%	1065%	0%	0%
4.3.2	Blu-Ray player	0%	127%	0%	157%
4.3.2	Computer monitor (displays)	0%	121%	0%	121%
4.3.2	Cordless phones	0%	100%	0%	100%
4.3.2	Desktop computers	0%	121%	0%	121%
4.3.2	DVD player	0%	127%	0%	157%
4.3.2	Laptop computers	0%	121%	0%	121%
4.3.2	Televisions	0%	127%	0%	157%
4.3.2	Set-top boxes	0%	127%	0%	157%
4.3.2	Sound bars	0%	127%	0%	157%
4.3.2	Advanced power strips Tier I	0%	0%	0%	0%
4.3.2	Advanced power strips Tier II (IR)	0%	0%	0%	0%
4.3.2	Advanced power strips Tier II (IR-OS)	0%	0%	0%	0%

†All values are relative to average demand savings. Average demand savings is defined as total energy (kWh) savings divided by 8760. Data available during X1931-2 did not include sufficient detail to calculate maximum connected loads for each profile, which necessitated the use of seasonal peak coincidence factors relative to average demand.

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