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Associate General Counsel
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December 3, 2018

Hon. Kathleen H. Burgess
Secretary to the Commission
New York State Public Service Commission
Agency Building 3
Albany, NY 12223-1350

Re: Case 14-E-0318 - *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Electric Service*

Dear Secretary Burgess:

Central Hudson Gas & Electric Corporation (Central Hudson) hereby submits for filing in the above-referenced case its 2018 Annual Report for the Targeted Demand Management Program (TDM), a Central Hudson Non-Wires Solution.

Please contact Mark Sclafani at (845)486-5979 or msclafani@cenhud.com with any questions regarding this matter.

Respectfully submitted,

/s/*Paul A. Colbert*

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STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Electric Service	**Case 14-E-0318**

Central Hudson Gas & Electric Corporation's 2018 Annual Report for the Targeted Demand Management (TDM) Program, a Central Hudson Non-Wires Alternative

December 1, 2018

CENTRAL HUDSON GAS & ELECTRIC CORPORATION
284 South Avenue
Poughkeepsie, N.Y. 12601

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1. Background

On July 15, 2016 the Commission issued an Order ("July 15th Order")[1] concerning Central Hudson's Non-Wires Alternative ("NWA") project in which Central Hudson was ordered to "develop an operating procedure for the calculation of the financial incentive, including the milestones, as described in the body of the July 15th Order and file such procedure within 30 days of the issuance of this Order[2]." The Company subsequently requested an extension of the filing deadline to September 15, 2016, which was granted. In the Operation Procedure for NWA Incentives[3] ("Operation Procedure"), the Company detailed key NWA results which would be provided to Staff each year on December 1st. Following consultation with DPS Staff, the Company filed an updated Operation Procedure on October 6th, 2017.

A newly revised Operation Procedure has been included within this filing. The information provided within this report conforms to this new Operation Procedure.

2. Non-Wires Alternative Overview

Central Hudson's portfolio of solutions designed to meet the needs identified within this NWA, are collectively known as the Targeted Demand Management ("TDM") program. The TDM program includes several strategies and technology types. The program has been deployed within three specific load zones in Central Hudson's service territory: Fishkill/Shenandoah, Merritt Park, and the Northwest Corridor. Throughout these areas, a total load relief of 16.0 MW is targeted in order to successfully defer infrastructure investments in each location.

Demand Response "Peak Perks" Program

The demand response portion of the program, referred to as "Peak Perks" is being implemented by Itron. Residential and small commercial customers may participate in Peak Perks using direct load control devices. Such devices are installed by the Company on qualifying equipment at the customer site. Eligible participants receive a free installed WiFi enabled thermostat to control their central air conditioning system. Digital control units ("DCU's") are also used to curtail central air conditioners and

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[1] Case 14-E-0318, Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Electric Service, Order implementing with Modification The Proposal for Cost Recovery and Incentive Mechanism for Non-Wire Alternative Project ("July 15th Order") (issued July 15th 2016).
[2] July 15th Order, p. 14.
[3] Case 14-E-0318, et al., supra, filed on September 15, 2016.

pool pumps, and activate backup generation systems. Participants receive upfront and recurring incentives for each year of participation.[4]

Large commercial and industrial ("C&I") customers may participate in the program by committing to curtail their electricity usage when called upon by Central Hudson. Participants earn a reservation payment of $6.82/kW-month.

Targeting C&I Lighting

In September 2018, the Company launched a targeted C&I efficient lighting initiative within the Fishkill/Shenandoah area and Northwest Corridor. The initiative is designed to impact locational loads by concentrating efficient lighting projects within NWA areas. High adoption rates are achieved using enhanced incentives and marketing. This initiative will supplement load reductions achieved through the Peak Perks program.

3. Operations & Marketing

Demand Response "Peak Perks" Program

To recruit residential and small commercial participants into the Peak Perks program, a comprehensive marketing campaign has been utilized which includes door-to-door sales, outbound calling, direct mail marketing, and an educational website located at www.Cenhubpeakperks.com. A team of technicians has been deployed to install direct load control devices on qualifying equipment. Over 30% participation has been achieved within certain regions.[5]

Customer service operations are supported by Itron's call center, with Central Hudson's contact center providing supplemental support. Itron's solution operation center, and IntelliSOURCE demand response management system are utilized to initiate and monitor curtailment events.

Large C&I participants are recruited through CPower, Itron's subcontractor. CPower is responsible for aggregating and managing the C&I population, and maximizing performance during events.

[4] Incentives are paid per device installed.
[5] Over 30% of eligible participants in the Fishkill/Shenandoah region with central air conditioning are currently participating in the Peak Perks program.

Targeting Efficient Lighting

The targeted lighting initiative is being implemented through Lime Energy, in coordination with the Company's existing small business direct install energy efficiency program. Lime Energy conducts most of the program operations out of their office in Beacon, NY which is within Central Hudson's service territory. Lime performs a free onsite lighting audit and provides the customer with a proposal showing pre-existing and post-installation energy consumption details, payment options, incentives, payback information, and terms and conditions of the program. Customers within the NWA areas receive up to 100% of the project cost covered through incentives. The program is fully "turnkey," with installations completed using a network of qualified lighting installers.

4. Program Results

This year, the Peak Perks program had a total of eight curtailment events for the residential and small commercial populations and one curtailment event for the large commercial and industrial (C&I) population[6]. Performance during qualifying events has been used to calculate the available load reduction within the program. Additionally, 28 targeted lighting projects have been completed. The contribution of each lighting project is determined with respect to its estimated coincidence with locational needs.

As of 9/30/2018, Central Hudson has achieved 9,902 kW of available capacity within the TDM program, as shown in the table below. Detailed measurement and verification results for the Peak Perks portion of the TDM program are provided in "Appendix A: Central Hudson Gas & Electric Peak Perks Program 2018 Load Control Impact Evaluation Report."[7]

[6] Two C&I customers were called for a re-test.
[7] Appendix A presents program impacts as determined by measurements obtained at the customer site, and do not include avoided upstream distribution losses.

Table 1: Overall Program Impacts

Load Zone	Peak Perks: Residential & Small Commercial (kW)	Peak Perks: Large C&I (kW)	Targeted Lighting (kW)	Avoided Line Losses (kW)	Total kW Available[8]
Fishkill/Shenandoah	2,854	219	11	147	3,231
Merritt Park	296	478	-	38	812
Northwest Corridor	1,228	4,505	36	90	5,859
Total	**4,378**	**5,202**	**47**	**275**	**9,902**

Table 2: Targeted Lighting Impacts

Load Zone	Number of Projects	Peak kW	Locational Coincidence Factor	Effective kW	Average kW per Project
Fishkill/Shenandoah	10	18.68	58.4%	10.91	1.87
Merritt Park	0	0.00	69.1%	0.00	N/A
Northwest Corridor	18	61.58	58.6%	36.08	3.42
Total	**28**	**80.26**		**47.0**	**1.68**

5. Avoided Line Losses

Per the revised Operation Procedure, the avoided line losses are incorporated into the calculation of load reductions. The line loss percentages that have been utilized within these formulas are detailed within the following table. Because the retail delivery point varies based on service characteristics, different line loss percentages have been used based on service type.

[8] M&V results have been refined and adjusted slightly compared to those reported in the "Central Hudson Gas & Electric Corporation's Targeted Demand Response Program – Milestone One Incentive Filing" on 10/15/2018 under Case 14-E-0318. These refinements do not impact the achievement of the 8.0MW incentive threshold.

Table 3: Line Loss Factors

Service Type	Line Losses Included	Loss %[9]
Secondary Metered	Primary & Secondary Line Losses	4.70%
Primary Metered	Primary Line Losses	2.54%
Transmission Service	None	0%

All residential and small commercial participants are considered to be secondary metered. Individual line loss contributions are calculated for larger C&I participants based on their service type.

Transmission line losses are not considered for the purposes of this analysis. The deferred projects within Fishkill/Shenandoah and Merritt Park are primary distribution infrastructure, and so avoided line losses on the upstream transmission system do not contribute to that deferral. In the case of the Northwest Area, a transmission project is being deferred. This project, however, represents only a small portion of the bulk transmission system for which transmission line loss percentage has been calculated. The avoided line loss contribution within this small portion is approximated to be zero.

6. Benefit Cost Analysis ("BCA")

Central Hudson has performed a BCA analysis of the TDM Program. The overall results of the program are included below:

Table 4: BCA Results

BCA Test[10]	Results
Societal Cost Test	1.65
Utility Cost Test	1.49
Ratepayer Impact Measure	1.48

[9] Loss percentages are taken from Central Hudson Gas & Electric Benefit-Cost Analysis (BCA) Handbook, Version 2.0., filed 8/31/18, Case 16-M-0412
[10] Performed in accordance with Central Hudson Gas & Electric Benefit-Cost Analysis (BCA) Handbook, Version 2.0. filed 8/31/18, Case 16-M-0412

Appendix A: Central Hudson Gas & Electric Peak Perks Program 2018 Load Control Impact Evaluation Report

Appendix B: Operation Procedure for TDM Non-Wires Alternative ("NWA") and Incentive Calculations: Version 3.0

Central Hudson Gas & Electric Peak Perks Program 2018 Load Control Impact Evaluation Report

Strategic Analytics

November 1, 2018

www.Itron.com

RELEASE 1.0: NOVEMBER, 2018

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Change Notice

Table 1: Change Notice

Version	Date	Description of Changes
1.00	11/01/2018	First Release

1 Executive Summary

This report details the 2018 operation and load reduction results of the Central Hudson Gas & Electric Corporation (CHGE) Targeted Demand Management program, also referred to as the CenHub Peak Perks program.

The Peak Perks program targets central air conditioning systems in both the residential and commercial segments and pool pumps in the residential segment for demand response “conservation events”. More recently, the program also started to target whole home generators. The program is open to customers in the Targeted Demand Management (TDM) load zones, which include: Northwest Corridor, Merritt Park, and Fishkill/Shenandoah.

The program uses IntelliTEMP DirectLink smart thermostats and IntelliPEAK load control devices to automate the curtailing of central air conditioning (A/C) and pool pump loads, and curtailing the whole home for the generator program. It also uses the Itron IntelliSOURCE Demand Response Management System (DRMS) platform to enroll customers in the program, manage day-to-day program activities, optimize event readiness, curtail program devices for load reduction events, measure program performance, and analyze program results.

This year, Central Hudson called a total of eight curtailment events for the residential and small commercial participant populations and one test event and one retest event for the large commercial & industrial (C&I) participant population. For residential and small commercial, only the event hours where the adjusted baseline for thermostats is 2.25 kW or greater are considered as the “Analysis Hours”. Four of the eight curtailment events for the residential and small commercial populations exceeded this threshold and were considered “Analysis Hours”. However, one of the four events (July 5th) had paging and addressing issues, resulting in inadequate data and was subsequently dropped from the “Analysis Hours”.

Table 2, below, presents the total MW reduction for the 2018 control season by segment. The demand response reduction for the residential and small commercial participant populations is 4.378 MW, based on the total installed end points of 3,994 throughout the Central Hudson Peaks Perks program service area as of September 30th, 2018. The demand response reduction for the C&I participant population is 5.201 MW based on the curtailment performance of nine customers. The demand response reduction for the entire Peak Perks program is 9.579 MW.

Table 2: Summary of Reduction

Population	Device	Active end points as of 10/01/18	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	1,075	1.295	1.392
Residential	DCU - A/C	2,593	0.949	2.461
Residential	DCU - Pool Pump	68	0.570	0.039
Residential	DCU - Generator	18	3.896	0.070
Small Commercial	Thermostat - A/C	120	2.215	0.266
Small Commercial	DCU - A/C	120	1.250	0.150
Large C&I	Curtailment	9		5.201
Total		4,003		9.579

Note: Small Commercial DCU devices were not evaluated. The kW factor for this segment is estimated based on the relationship of residential thermostat to DCU savings per ton.

2 Participant Summary

The status of the Peak Perks participants and other program details, such as equipment and device type are recorded in the Itron IntelliSOURCE system. As of the end of September 2018, there were 3,994 active end points for the residential and small commercial populations contained in IntelliSOURCE. *Table 3* shows the number of net installations for the summer months.

Table 3: Net Installations

Month	Residential Thermostats	Residential DCUs	Residential Pool Pumps	Residential Generators	Small Commercial Thermostats	Small Commercial DCUs
Through May 31, 2018	1,021	2,266	68	17	107	103
June	17	174	0	1	0	10
July	13	50	0	-1	1	1
August	12	90	0	0	13	5
September	12	13	0	1	-1	1
As of September 30, 2018	1,075	2,593	68	18	120	120

In addition to the residential and small commercial participant populations, there were nine C&I (large commercial) participants as of September 30, 2018. All C&I participants agreed to take curtailment actions during event hours as specified in a Demand Response Curtailment Plan. Six C&I participants were in the Northwest Corridor, two in Merritt Park, and one in Fishkill.

This section details the Demand Response (DR) program participant population used in determining the performance of the program. The status of each participant and their program information is recorded in IntelliSOURCE. As part of each control device installation on an air conditioner (A/C) unit, the size of the air conditioner is recorded as tonnage. Similarly, for each control device installed on a pool pump, the horsepower is recorded and for the whole home generator, the tonnage is recorded.

Table 4, below, presents a summary of the active participants as of September 30, 2018 that is contained in IntelliSOURCE.

Table 4: Total Active Participant Counts per IntelliSOURCE

Population	Device	Available Tonnage	Missing Tonnage	Total
Residential	Thermostat - A/C	1,022	53	1,075
Residential	DCU - A/C	2,354	239	2,593
Residential	DCU - Pool Pump	63	5	68
Residential	DCU - Generator	16	2	18
Small Commercial	Thermostat - A/C	107	13	120
Small Commercial	DCU - A/C	106	14	120

2.1 Residential A/C Thermostat Participant Population (Two-Way Devices)

Table 5 shows the distribution of A/C tonnage for the residential thermostat participants as of September 30, 2018 by region.

Table 5: Residential A/C Thermostat Participant Tonnage Distribution

Tons Bin	Fishkill Count	Fishkill Pct	Merritt Park Count	Merritt Park Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
<1.0	0	0.00	0	0.00	0	0.00	0	0.00
1.0	0	0.00	0	0.00	0	0.00	0	0.00
1.5	25	2.85	5	7.69	3	2.27	33	3.07
2.0	155	17.65	13	20.00	23	17.42	191	17.77
2.5	140	15.95	18	27.69	38	28.79	196	18.23
3.0	283	32.23	11	16.92	38	28.79	332	30.88
3.5	109	12.41	9	13.85	8	6.06	126	11.72
4.0	99	11.28	6	9.23	6	4.55	111	10.33
4.5	0	0.00	0	0.00	0	0.00	0	0.00
5.0	29	3.30	3	4.62	1	0.76	33	3.07
>5.0	0	0.00	0	0.00	0	0.00	0	0.00
Missing	38	4.33	0	0.00	15	11.36	53	4.93
Total	878	100.00	65	100.00	132	100.00	1,075	100.00

Note: Tonnage bins are presented as top value of a range such that the tonnage is greater than the previous bin and less than or equal to the current bin value. (previous bin < tonnage <= current bin)

Approximately 89% of all residential A/Cs with thermostats installed are between two tons and four tons, while the average is 2.9 tons. *Figure 1* shows the distribution of tonnage for active residential A/C thermostats as of September 30, 2018.

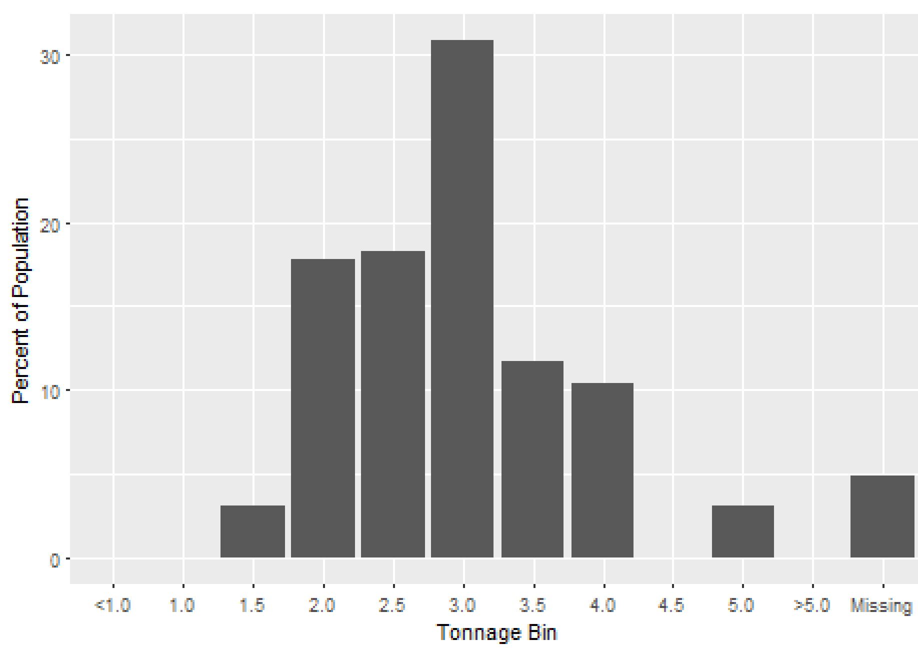

Figure 1: Residential Thermostat A/C Tonnage Distribution

Additional statistics for the tonnage are shown in *Table 6* below.

Table 6: Residential A/C Thermostat Participant Tonnage Statistics

Statistic	Value
Mean	2.90
Median	3.00
Upper 95%	4.00
Lower 5%	2.00
Standard Deviation	0.75

2.2 Small Commercial A/C Thermostat Participant Population (Two-Way Devices)

Table 7 shows the distribution of tonnage for the small commercial A/C thermostat participants as of September 30, 2018 by region.

Table 7: Small Commercial A/C Thermostat Participant Tonnage Distribution

Tons Bin	Fishkill Count	Fishkill Pct	Merritt Park Count	Merritt Park Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
<1.0	0	0.00	0	0	0	0.00	0	0.00
1.0	0	0.00	0	0	0	0.00	0	0.00
1.5	2	2.15	0	0	0	0.00	2	1.67
2.0	4	4.30	0	0	3	13.64	7	5.83
2.5	5	5.38	0	0	1	4.55	6	5.00
3.0	10	10.75	3	60	1	4.55	14	11.67
3.5	3	3.23	2	40	0	0.00	5	4.17
4.0	23	24.73	0	0	2	9.09	25	20.83
4.5	0	0.00	0	0	0	0.00	0	0.00
5.0	40	43.01	0	0	2	9.09	42	35.00
>5.0	5	5.38	0	0	1	4.55	6	5.00
Missing	1	1.08	0	0	12	54.55	13	10.83
Total	93	100.00	5	100	22	100.00	120	100.00

Note: Tonnage bins are presented as top value of a range such that the tonnage is greater than the previous bin and less than or equal to the current bin value. (previous bin < tonnage <= current bin)

Approximately 72% of all small commercial A/C thermostat participants have an A/C that is between three tons and five tons, while the average is 4.79 tons. *Figure 2* shows the distribution of tonnage for active small commercial A/C thermostat participants as of September 30, 2018.

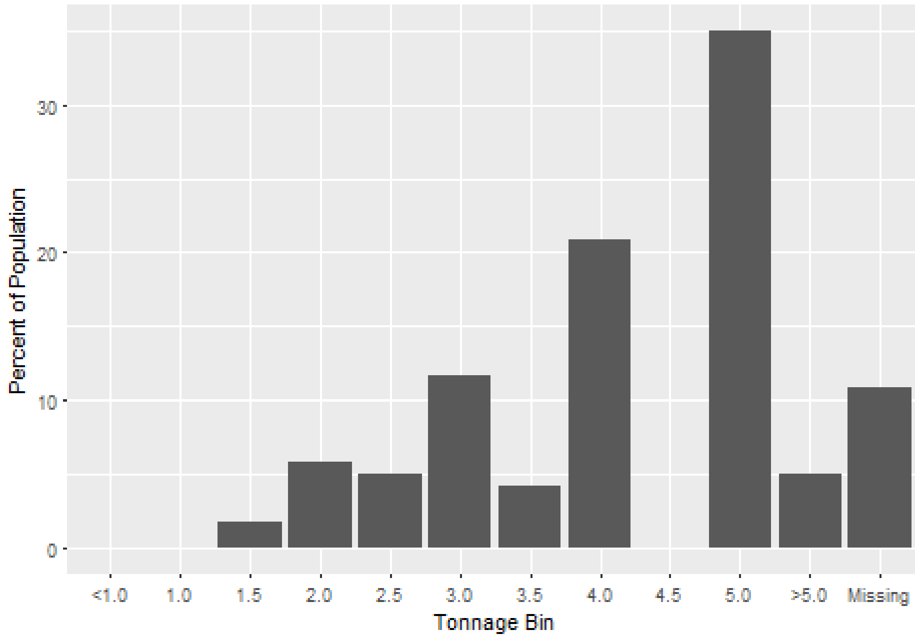

Figure 2: Small Commercial A/C Thermostat Participant Tonnage Distribution

Additional statistics for the A/C tonnage are shown in *Table 8*.

Table 8: Small Commercial A/C Thermostat Participant Tonnage Statistics

Statistic	Value
Mean	4.79
Median	4.00
Upper 95%	6.75
Lower 5%	2.00
Standard Deviation	5.07

2.3 Residential A/C DCU Participant Population (One-Way Devices)

Table 9 shows the distribution of tonnage for the residential A/C DCU participants as of September 30, 2018 by region.

Table 9: Residential A/C DCU Participant Tonnage Distribution

Tons Bin	Fishkill Count	Fishkill Pct	Merritt Park Count	Merritt Park Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
<1.0	0	0.00	0	0.00	0	0.00	0	0.00
1.0	1	0.07	0	0.00	1	0.10	2	0.08
1.5	25	1.77	13	7.10	42	4.22	80	3.09
2.0	139	9.83	25	13.66	158	15.86	322	12.42
2.5	234	16.55	40	21.86	250	25.10	524	20.21
3.0	394	27.86	59	32.24	222	22.29	675	26.03
3.5	196	13.86	11	6.01	76	7.63	283	10.91
4.0	216	15.28	17	9.29	72	7.23	305	11.76
4.5	0	0.00	0	0.00	1	0.10	1	0.04
5.0	118	8.35	8	4.37	36	3.61	162	6.25
>5.0	0	0.00	0	0.00	0	0.00	0	0.00
Missing	91	6.44	10	5.46	138	13.86	239	9.22
Total	1,414	100.00	183	100.00	996	100.00	2,593	100.00

Note: Tonnage bins are presented as top value of a range such that the tonnage is greater than the previous bin and less than or equal to the current bin value. (previous bin < tonnage <= current bin)

Approximately 81% of all residential A/C DCU participants have an A/C between two tons and four tons, while the average is 3.03 tons. *Figure 3* shows the distribution of tonnage for active residential A/C DCU participants as of September 30, 2018.

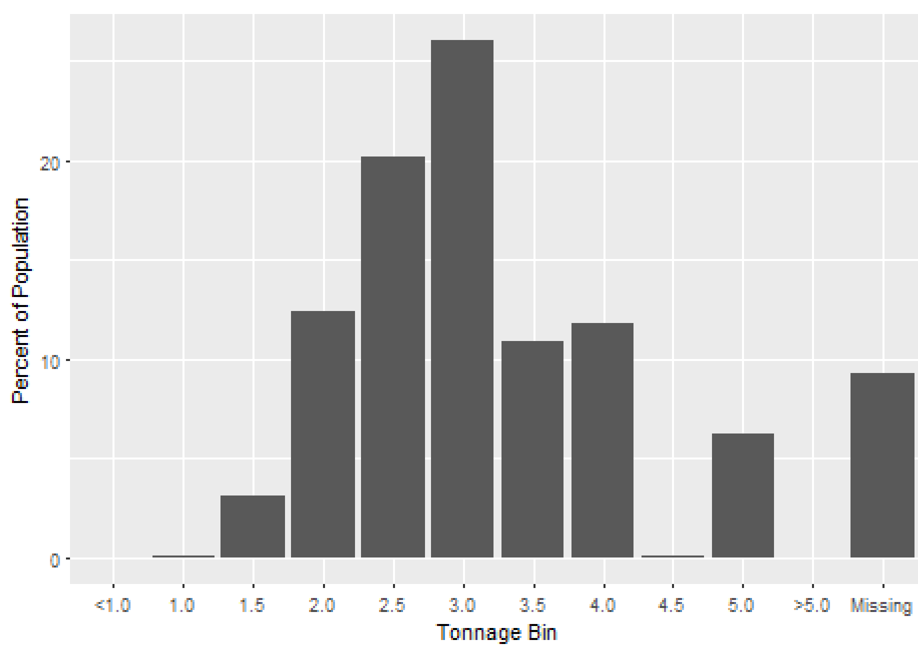

Figure 3: Residential A/C DCU Participant Tonnage Distribution

Additional statistics for the A/C tonnage are shown in *Table 10*.

Table 10: Residential A/C DCU Participant Tonnage Statistics

Statistic	Value
Mean	3.03
Median	3.00
Upper 95%	5.00
Lower 5%	2.00
Standard Deviation	0.84

2.4 Small Commercial A/C DCU Participant Population (One-Way Devices)

Table 11 shows the distribution of tonnage for the small commercial A/C DCU participants as of September 30, 2018 by region.

Table 11: Small Commercial A/C DCU Participant Tonnage Distribution

Tons Bin	Fishkill Count	Fishkill Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
<1.0	0	0.00	0	0.00	0	0.00
1.0	0	0.00	0	0.00	0	0.00
1.5	0	0.00	0	0.00	0	0.00
2.0	4	4.60	3	9.09	7	5.83
2.5	3	3.45	0	0.00	3	2.50
3.0	15	17.24	8	24.24	23	19.17
3.5	19	21.84	0	0.00	19	15.83
4.0	14	16.09	2	6.06	16	13.33
4.5	0	0.00	0	0.00	0	0.00
5.0	28	32.18	8	24.24	36	30.00
>5.0	1	1.15	1	3.03	2	1.67
Missing	3	3.45	11	33.33	14	11.67
Total	87	100.00	33	100.00	120	100.00

Note: Tonnage bins are presented as top value of a range such that the tonnage is greater than the previous bin and less than or equal to the current bin value. (previous bin < tonnage <= current bin)

Approximately 78% of all small commercial A/C DCU participants have an A/C between three tons and five tons, while the average is 3.91 tons. *Figure 4* shows the distribution of tonnage for active small commercial A/C DCU participants as of September 30, 2018.

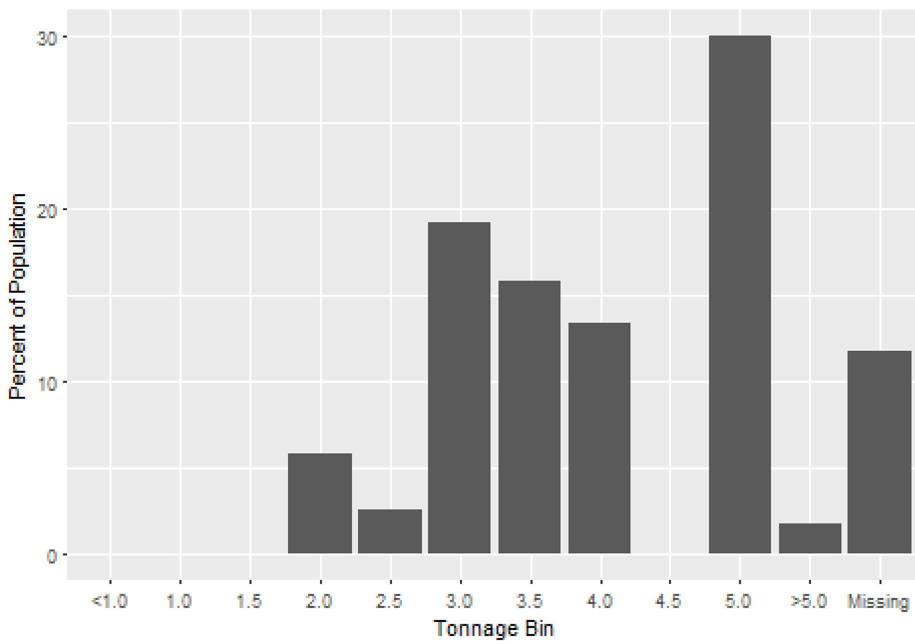

Figure 4: Small Commercial A/C DCU Participant Tonnage Distribution

Additional statistics for the A/C tonnage are shown in *Table 12*.

Table 12: Small Commercial A/C DCU Participant Tonnage Statistics

Statistic	Value
Mean	3.91
Median	4.00
Upper 95%	5.00
Lower 5%	2.00
Standard Deviation	1.04

2.5 Residential DCU Pool Pump Population

Table 13 shows the distribution of horsepower for the residential pool pump DCU participants as of September 30, 2018 by region.

Table 13: Residential Pool Pump DCU Participant Horsepower Distribution

Horsepower Bin	Fishkill Count	Fishkill Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
<1.0	1	2.78	0	0.00	1	1.47
1.0	9	25.00	18	56.25	27	39.71
1.5	22	61.11	11	34.38	33	48.53
2.0	1	2.78	1	3.12	2	2.94
Missing	3	8.33	2	6.25	5	7.35
Total	36	100.00	32	100.00	68	100.00

Note: Horsepower bins are presented as top value of a range such that the horsepower is greater than the previous bin and less than or equal to the current bin value. (previous bin < horsepower <= current bin)

Figure 5 shows the distribution of horsepower for active residential pool pump DCU participants as of September 30, 2018.

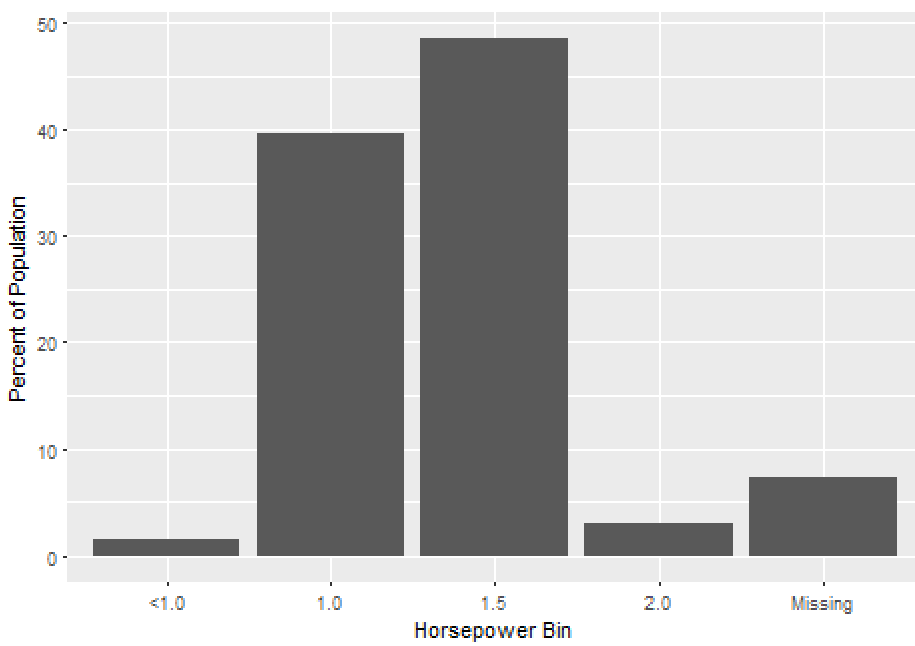

Figure 5: Residential Pool Pump Horsepower Distribution

The overall pool pump horsepower distribution is shown in *Table 14*.

Table 14: Residential Pool Pump Horsepower Statistics

Statistic	Value
Mean	1.29
Median	1.50
Upper 95%	1.50
Lower 5%	1.00
Standard Deviation	0.28

2.6 Whole Home Generator Participant Population

Table 15 shows the distribution of tonnage for the residential whole home generator participants as of September 30, 2018 by region.

Table 15: Residential Generator Participant Tonnage Distribution

Horsepower Bin	Fishkill Count	Fishkill Pct	Merritt Park Count	Merritt Park Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
14	0	0.00	0	0	1	100	1	6.25
16	1	11.11	0	0	0	0	1	6.25
17	2	22.22	0	0	0	0	2	12.50
20	5	55.56	3	50	0	0	8	50.00
22	1	11.11	3	50	0	0	4	25.00
Total	9	100.00	6	100	1	100	16	100.00

Note: Tonnage bins are presented as top value of a range such that the tonnage is greater than the previous bin and less than or equal to the current bin value. (previous bin < tonnage <= current bin)

Figure 6 shows the distribution of tonnage for active residential whole home generator participants as of September 30, 2018.

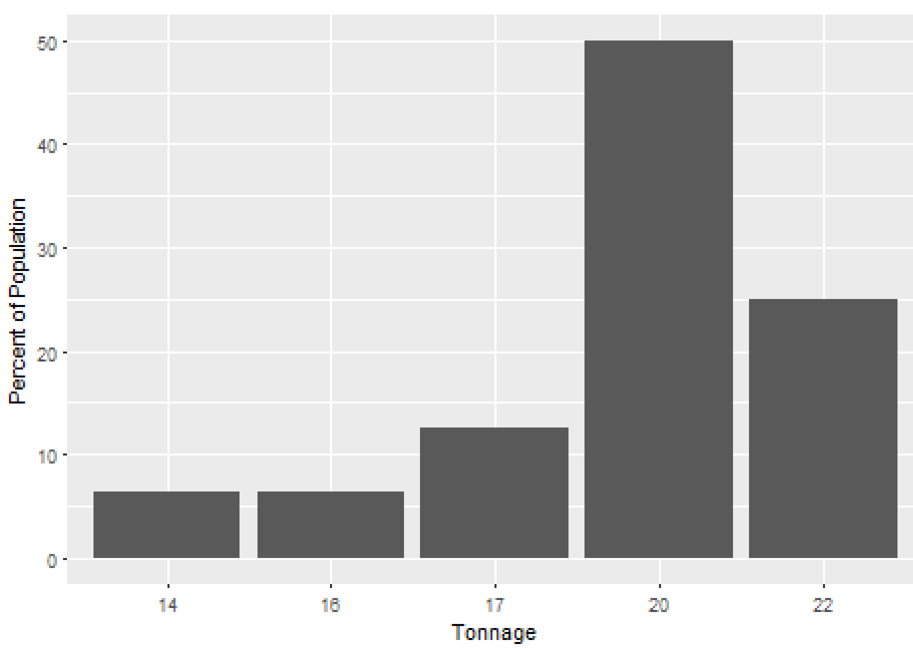

Figure 6: Residential Generator Tonnage Distribution

The overall whole home generator tonnage distribution is shown in *Table 16*.

Table 16: Residential Generator Tonnage Statistics

Statistic	Value
Mean	19.50
Median	20.00
Upper 95%	22.00
Lower 5%	15.50
Standard Deviation	2.34

2.7 C&I (Large Commercial) Participant Population

As of September 30, 2018, there are six C&I participants in the Northwest Corridor, two in Merritt Park and one in Fishkill.

3 Curtailment Algorithms

The Itron IntelliSOURCE energy management platform is configured for the different rate contracts required to support this program. A rate contract is used to specify a group of devices that are curtailed in a similar manner. *Table 17* presents the rate contracts for this program that have active participants as of September 30, 2018.

Table 17: Peak Perks Program Rate Contracts

Rate Contract	Description	Device Type
Residential-AC-Switch-50	Residential - A/C DCUs - 50% Curtailment	One-Way
Residential-AC-Switch-75	Residential - A/C DCUs - 75% Curtailment	One-Way
Residential-AC-Switch-100	Residential - A/C DCUs - 100% Curtailment	One-Way
Residential-Thermostat-50	Residential - A/C Thermostats - 50% Curtailment	Two-Way
Residential-Thermostat-75	Residential - A/C Thermostats - 75% Curtailment	Two-Way
Residential-Thermostat-100	Residential - A/C Thermostats - 100% Curtailment	Two-Way
Residential-PP	Residential - Pool Pumps - 100% Curtailment	Two-Way
Residential-WHG	Residential - Whole Home Generators - 100% Curtailment	Two-Way
Commercial-AC-Switch-30	Small Commercial - A/C DCUs - 30% Curtailment	One-Way
Commercial-AC-Switch-50	Small Commercial - A/C DCUs - 50% Curtailment	One-Way
Commercial-Thermostat-30	Small Commercial - A/C Thermostats - 30% Curtailment	Two-Way
Commercial-Thermostat-50	Small Commercial - A/C Thermostats - 50% Curtailment	Two-Way
Large-Commercial C&I	Large Commercial C&I Customers	N/A
DLM	Dynamic Load Management	N/A

The IntelliSOURCE system is configured with curtailment templates before the start of the season. These templates are used by Central Hudson to schedule events based on load need. The difference between each of the curtailment templates is the type of curtailment initiated.

At the beginning of the 2016 program year, the curtailment strategies were 50% Adaptive Distributed Intelligence (ADI) for residential and 30% or 50% ADI for small commercial. After the 2016 control season, 75% and 100% ADI were added to the residential curtailment strategies. Examples of the curtailment strategies are provided below in *Figure 7* through *10*. The curtailment strategy for pool pumps and whole home generators is 100% shed.

Figure 7 shows the Adaptive 30% curtailment strategy as it pertains to the participant population. In this graph, it takes approximately 9 minutes for the population to reach a steady state where one-third of the devices are in curtailment. This plateau remains until the end of the event. All devices are restored by 30 minutes after the event end time.

Figure 7: 30% ADI Curtailment Strategy

Figure 8 shows the ADI 50% curtailment strategy as it pertains to the participant population. In this graph, it takes approximately 15 minutes for the population to reach a steady state where 50% of the devices are in curtailment. This plateau remains until the end of the event. All devices are restored 30 minutes after the event end time.

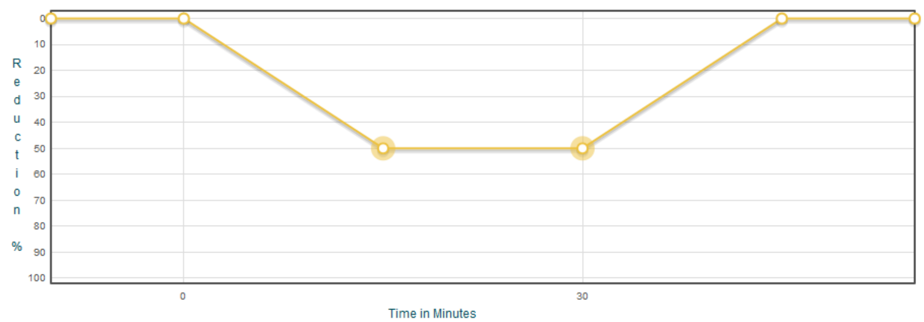

Figure 8: 50% ADI Curtailment Strategy

Figure 9 shows the ADI 75% curtailment strategy as it pertains to the participant population. In this graph, it takes approximately 22.5 minutes for the population to reach a steady state where 75% of the devices are in curtailment. This plateau remains until the end of the event. All devices are restored 30 minutes after the event end time.

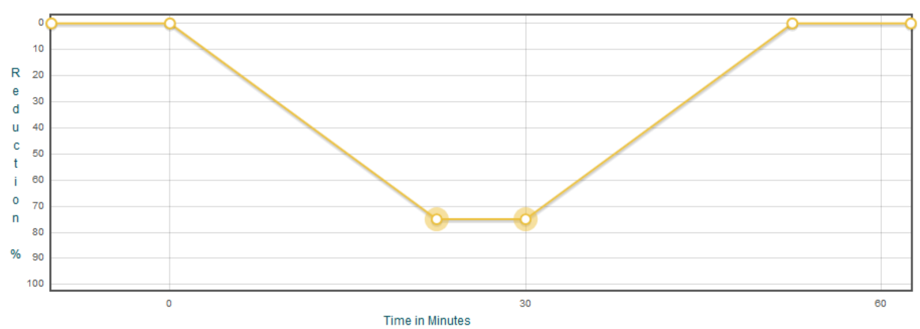

Figure 9: 75% ADI Curtailment Strategy

Figure 10 shows the Immediate 100% Shed curtailment strategy as it pertains to the participant population. In this graph, all devices begin curtailment immediately and remain in curtailment until the end of the event. A +/- 1.5-minute randomized ramp out is employed at the end of curtailment.

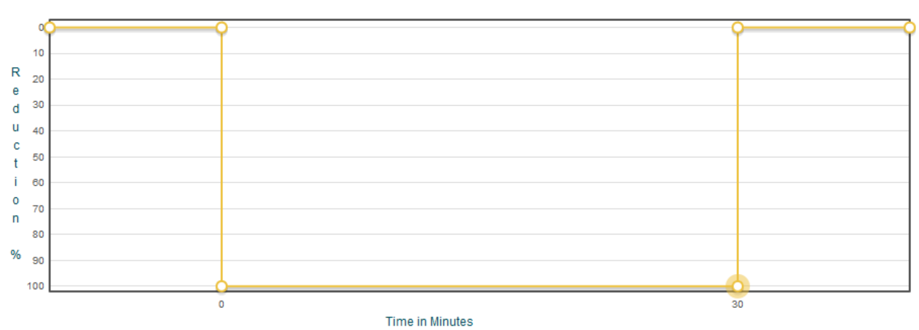

Figure 10: Immediate 100% Shed Curtailment Strategy

4 Evaluation Algorithms

4.1 Residential and Small Commercial

This section describes the method used to evaluate the impact of the 2018 load curtailment events for the residential and small commercial participant populations. The event hours where the adjusted baseline for thermostats (as computed from the run time reported by the two-way communicating thermostats and the connected load as reported by the field install teams) is 2.25 kW or greater are referred to throughout the remainder of the of this section as the "Analysis Hours". Itron may also call up to two M&V events per Control Season provided that the duration of the M&V events is equal to or less than two hours each for each device type. The Itron-called M&V events are not subject to the 2.25 kW baseline criteria.

The kW factor is calculated separately for each sub-population: residential A/C thermostat, small commercial A/C thermostat, residential A/C DCU, small commercial A/C DCU, residential pool pump DCU, and generators.

The kW factors for each population is based on an average of all Analysis Hours for the 2018 season. The first 15-minute interval for each event is excluded as this time interval is when the population is ramping into curtailment.

Where applicable, the final load impact estimates are calculated based on a baseline methodology defined in NYISO Emergency Demand Response Program Manual. One such methodology is entitled "The Average Day CBL[1] for Weekdays".[2]

The following subsection describes this method in detail.

4.1.1 Customer Baseline Load

This methodology develops a baseline energy use by, first, examining the 30 days prior to the event. NYISO holidays in the previous 30 days are excluded; SCR, EDRP or TRDP3 events where the resource was eligible to participate and prior day are excluded; any days where the resources DADRP bid was accepted and prior day are excluded; CHGE dispatch days are excluded; and the day prior to the event is excluded.

The next step is to identify the peak load hour within the event period for the previous 30 days. This peak load hour value is multiplied by 25% for an initial value. Low usage days are where the average daily event period usage is less than this initial value. Low usage days are eliminated from consideration in the CBL calculation. Then going backward, the five days with the highest average usage during the event period out of the last ten eligible days are used in the CBL calculation. The simple average of these five days then defines the CBL.

The CBL adjustment factor is calculated using the ratio of the event day load and the average CBL day load between the 2 to 4 hours prior to an event. The Demand Response (DR) performance is calculated by subtracting the event day load from the adjusted CBL load.

4.2 C&I (Large Commercial)

This section describes the method used to evaluate the 2018 impact of the load curtailment events for the C&I participant population. The C&I participants agree to provide 4 hours of curtailment for typical demand response events and up to 8 hours of curtailment for special emergency situations that could result from extreme circumstances, including but not limited to, temperature exceeding 95 degrees Fahrenheit, temporary loss of distribution infrastructure, or temporary loss of transmission infrastructure.

[1] Customer Baseline Load

[2] New York Independent System Operator, "Emergency Demand Response Program Manual", Manual 7, October 2013, p. 5-4.

4.2.1 C&I Customer Baseline Load

The Customer Baseline Load (CBL) is calculated in the same manner as detailed in *Section 4.1.1*. If the C&I participant has selected a weather-adjusted CBL, then a weather adjustment factor is applied to the average CBL.

For each C&I participant, the Demand Response (DR) performance is calculated by subtracting the event day load from the adjusted CBL load. The entire portfolio performance is the sum of the individual C&I participant performance values for each hour.

The seasonal performance is determined as follows:

- If an event is 4 hours or less, all hours from the event will be included in the seasonal performance.
- If an event exceeds 4 hours, the 4 consecutive rolling hours (240 contiguous minutes) with the highest total Itron portfolio performance value will be included in the seasonal performance.

The seasonal performance for an individual participant will be the average of the hourly performance values over all event hours as described above. In the case where no events have occurred during the event season, the last test hour will apply.

5 Overall M&V Process

5.1 Standard M&V Process

This section describes the processes performed or supported by Itron's Strategic Analytics department in the operations of residential and commercial Demand Response (DR) programs. The processes are divided into three top-level processes as illustrated by *Figure 11* and described in more detail in this section. This is a continuous process as the Strategic Analytics team rolls immediately from reporting of the previous seasons results to the preparations for the next season.

Figure 11: Strategic Analytics Continuous Annual Process

5.1.1 Pre-Season Preparations

In the pre-season, Strategic Analytics prepares for Demand Response (DR) operations and measurement and verification of the performance of the curtailment devices. Strategic Analytics oversees the pre-season tests that are performed by the field teams and the Solution Operations Center (SOC). Strategic Analytics reviews the data collected by the SOC team to ensure that it is accurately captured in IntelliSOURCE. Strategic Analytics verifies that the curtailment strategy assignment reaches each device and that the equipment size is accurately recorded in IntelliSOURCE. These data need to be correct in both IntelliSOURCE and at the device as accurate data is essential to evaluating DR performance.

The communications infrastructure is another component that is evaluated in the pre-season. Strategic Analytics has developed simulation tools and field test procedures to assess the performance of the RF systems upon which the paging curtailment devices depend on to transmit load data and receive curtailment messages. The field staff implements study plans to measure paging signal strength throughout the program areas.

In the pre-season, Strategic Analytics also examines changes in the population since the previous season. As the installed population changes, the system performance can be impacted for better or worse by changes to the mix of customers. Parameters such as customer lifestyle attributes, equipment size, equipment type, dwelling type, and geography can affect the available curtailment load and potential DR performance.

Another pre-season activity is the design and deployment of the M&V sample for one-way devices. For residential A/C DCUs (which have one-way communication), a sample is selected from the participant population. The sample is selected in a way that will represent the region, A/C size, and curtailment strategy distribution of the participant population. The selected sample will have an Insights+ AMI meter installed to collect whole home energy usage on event and non-event days.

Performing as much testing as possible in the pre-season is an important element of a successful in-season operation. Strategic Analytics works with the SOC to define the tests and provide assistance to correct any issues.

Table 18 outlines the pre-season preparations.

Table 18: Strategic Analytics Pre-Season Preparations

Title	Subtitle
Determine M&V Participants	
	Investigate Alternative Sample Approaches
	Document Removal and Install Requirements
	Create Participant Solicitation/Removal Lists
	Create M&V Plan
	Review with Client and Obtain Agreement
Support M&V Equipment Installation	
	Provide Stratified Participant Lists for Insights+ Installations
	Update IntelliSOURCE
System Configuration	
	Define/Update Curtailment Strategies
	Define/Update IntelliSOURCE Customer Data Configuration
	Verify Data Imports
	Reprogram Population
Initial Data Collection & Verification	
	End Point Communications Verification
	Operational Availability
	Energy Data Collection Verification
	RF Field Study
System Readiness Test	
Estimate Load Reduction Potential	
Client Training	

5.1.2 In-Season Operations

The in-season operations focus on anticipating, identifying and resolving potential issues as well as reporting on event day performance. The Strategic Analytics team works closely with the SOC and the field teams to ensure that DR events operate as expected, required telemetry and AMI data is collected accurately and on schedule, and results are compared and validated with other available information.

An ongoing task throughout the year is verifying the M&V configuration in IntelliSOURCE and assuring that all the information has been entered correctly. For instance, for a participant segment where DR is measured by comparing a group that is curtailed with one that is not curtailed, an accurate result depends on having each of these groups correctly configured in IntelliSOURCE.

During the curtailment season, it is critical to verify and validate the data collected. Throughout the season, the Strategic Analytics team monitors the data collected to check for accuracy and availability. If the data collected from a two-way device is interrupted, field staff may be requested to investigate. Sources of data that are monitored for thermostats and pool pumps include the run-time data, switch or thermostat response, opt out reports, and inspection data. Sources of data that are monitored for the A/C DCUs and whole home generators include the AMI meter data, switch response, opt out reports, and inspection data.

Monitoring DR events throughout the season is important. The Strategic Analytics team serves as the “tier two” support for the SOC. In this role, they respond to issues relative to communications system operations and software operations. During the season, Strategic Analytics typically interacts with the SOC several times per day.

Event reporting and analysis are key activities during the curtailment season. For each event, an analysis is performed to determine the load reduction observed. The estimate of the load reduction value is calculated based on each event. At the end of the season a comprehensive review is completed which looks at all the data for each event.

From both the telemetry data and the AMI data, the number of switches or thermostats that curtail as expected and those that do not is recorded. Root cause analysis is performed, and operational changes are implemented as warranted.

Event reports are provided to the program managers and the clients as needed to support outside processes. These reports typically contain the kW reduction per device for each segment, summaries of the curtailment strategy, weather, and the analysis approach.

Finally, the in-season operations are completed based on the program requirements. Immediately thereafter, the focus transitions to the post-season analysis.

Table 19 outlines the in-season operations.

Table 19: Strategic Analytics In-Season Operations

Title	Subtitle
Verify Implementation of Sample Plan	
	Verify All Stratum Are Correctly Represented
	Check That Groups Are Balanced
	Monitor/Replace Deactivations
Verify Data	
	Evaluate Operational Availability
	End Point Communications Verification
	Energy Data Collection Verification
Timely Estimation of Load Reduction	
	Compute Baseline
	Project Curtailment Profile
Determine Events	
	Monitor Weather Data
	When to Curtail
	How Much to Curtail
Analyze Event Results	
	Check Individual End Point Curtailment Profiles
	Check Individual Energy Profiles
Publish Event Results	

5.1.3 Post-Season Analysis

In the post-season, the individual curtailment reports that were prepared throughout the season are integrated. Data are checked for accuracy and field visits are performed to collect any missing data.

A final report and a summary presentation are prepared for the program. This is typically delivered in person to the client. After review and resolution of any questions or concerns, client approval is obtained which permits invoicing for the season and publication of the results.

Table 20 outlines the post-season analysis.

Table 20: Strategic Analytics Post-Season Analysis

Title	Subtitle
Analyze Data & Events	
	End of Season Estimation of Load Reduction
	Field Verification
Verify Data	
	Operational Availability
	End Point Communications Verification
	Energy Data Collection Verification
Evaluation Report	
	Compute kW Factors
	Compute MW Availability for Program
	Ancillary Analysis
	Report to Itron Finance
	Report to Client
Client Signoff	

5.2 Process Tailoring

Table 21 indicates the applicability of each process to the Peak Perks program.

Table 21: Process Tailored to CenHub Peak Perks Program

Process	Title	Applicability to Program
Pre-Season Preparations		
	System Configuration	Solutions Operations Center
	Initial Data Collection & Verification	Solutions Operations Center
	System Readiness Test	Solutions Operations Center
	Estimate Load Reduction Potential	Strategic Analytics
	Client Training	Solutions Operations Center
In-Season Operations		
	Verify Data	Solutions Operations Center
	Timely Estimation of Load Reduction	Strategic Analytics
	Determine Events	Strategic Analytics
	Analyze Event Results	Strategic Analytics
	Publish Event Results	Strategic Analytics
Post-Season Analysis		
	Analyze Data & Events	Strategic Analytics
	Verify Data	Solutions Operations Center
	Evaluation Report	Strategic Analytics
	Client Signoff	Strategic Analytics

6 Sample Plan

In the first quarter of 2018, Itron provided the sample plan that is presented in this section, which describes the plan for obtaining a sample of enrolled premises for the residential A/C DCU population for the 2018 curtailment season. To represent the population as closely as possible, participants were stratified by region, number of A/Cs, and tonnage per premise as explained in *Section 2*.

6.1 Residential A/C DCU (One-Way Devices)

Starting in 2017, Itron began to collect whole home energy usage from Insights+ electric meters on a sample of residential participants that have an A/C with a DCU. The distribution of the participant population as of December 31, 2017 and the sample distribution are shown in *Tables 22 through 24*. Note that tonnage is averaged for premises with more than one A/C.

Table 22: Residential A/C DCU Participant Population and Proposed Sample Distribution - 50% Curtailment Strategy

Region	Num ACs	Tonnage Bin	Pop Count	Pop Percent	Sample Count	Sample Percent
Fishkill	1	<3.0	119	13.0	19	13.0
Fishkill	1	=3.0	137	14.9	22	15.1
Fishkill	1	>3.0	225	24.5	36	24.7
Fishkill	2+	<3.0	67	7.3	11	7.5
Fishkill	2+	=3.0	65	7.1	10	6.8
Fishkill	2+	>3.0	94	10.2	15	10.3
Merritt Park	1	<3.0	18	2.0	3	2.1
Merritt Park	1	=3.0	22	2.4	4	2.7
Merritt Park	1	>3.0	15	1.6	2	1.4
Merritt Park	2+	<3.0	13	1.4	2	1.4
Merritt Park	2+	=3.0	8	0.9	1	0.7
Merritt Park	2+	>3.0	6	0.7	1	0.7
NW Corridor	1	<3.0	47	5.1	8	5.5
NW Corridor	1	=3.0	33	3.6	5	3.4
NW Corridor	1	>3.0	26	2.8	4	2.7
NW Corridor	2+	<3.0	15	1.6	2	1.4
NW Corridor	2+	=3.0	6	0.7	1	0.7
NW Corridor	2+	>3.0	2	0.2	0	0.0
Total			918	100.0	146	100.0

Table 23: Residential A/C DCU Participant Population and Proposed Sample Distribution - 75% Curtailment Strategy

Region	Num ACs	Tonnage Bin	Pop Count	Pop Percent	Sample Count	Sample Percent
Fishkill	1	<3.0	8	3.7	1	2.9
Fishkill	1	=3.0	8	3.7	1	2.9
Fishkill	1	>3.0	15	6.9	2	5.7
Fishkill	2+	<3.0	10	4.6	2	5.7
Fishkill	2+	=3.0	10	4.6	2	5.7
Fishkill	2+	>3.0	5	2.3	1	2.9
Merritt Park	1	<3.0	2	0.9	0	0.0
Merritt Park	1	=3.0	5	2.3	1	2.9
Merritt Park	1	>3.0	3	1.4	1	2.9
Merritt Park	2+	<3.0	5	2.3	1	2.9
Merritt Park	2+	=3.0	2	0.9	0	0.0
Merritt Park	2+	>3.0	0	0.0	0	0.0
NW Corridor	1	<3.0	62	28.4	10	28.6
NW Corridor	1	=3.0	31	14.2	5	14.3
NW Corridor	1	>3.0	33	15.1	5	14.3
NW Corridor	2+	<3.0	12	5.5	2	5.7
NW Corridor	2+	=3.0	2	0.9	0	0.0
NW Corridor	2+	>3.0	5	2.3	1	2.9
Total			218	100.0	35	100.0

Table 24: Residential A/C DCU Participant Population and Proposed Sample Distribution - 100% Curtailment Strategy

Region	Num ACs	Tonnage Bin	Pop Count	Pop Percent	Sample Count	Sample Percent
Fishkill	1	<3.0	5	8.6	1	11.1
Fishkill	1	=3.0	9	15.5	1	11.1
Fishkill	1	>3.0	12	20.7	2	22.2
Fishkill	2+	<3.0	10	17.2	2	22.2
Fishkill	2+	=3.0	2	3.4	0	0.0
Fishkill	2+	>3.0	2	3.4	0	0.0
Merritt Park	1	<3.0	0	0.0	0	0.0
Merritt Park	1	=3.0	0	0.0	0	0.0
Merritt Park	1	>3.0	0	0.0	0	0.0
Merritt Park	2+	<3.0	1	1.7	0	0.0
Merritt Park	2+	=3.0	2	3.4	0	0.0
Merritt Park	2+	>3.0	0	0.0	0	0.0
NW Corridor	1	<3.0	4	6.9	1	11.1
NW Corridor	1	=3.0	4	6.9	1	11.1
NW Corridor	1	>3.0	4	6.9	1	11.1
NW Corridor	2+	<3.0	1	1.7	0	0.0
NW Corridor	2+	=3.0	1	1.7	0	0.0
NW Corridor	2+	>3.0	1	1.7	0	0.0
Total			58	100.0	9	100.0

7 Deployed Sample

For one-way devices, the M&V requirements for the Peak Perks program call for a statistically valid sample of M&V sites to be used to calculate the load impact estimate for the entire enrolled population. The agreed to 2018 sample plan included 190 residential A/C DCU sites as presented in *Section 6*. As of the beginning of July 1, 2018, the residential A/C DCU participant list is shown in *Table 25*.

Table 25: 2018 Residential A/C DCU Sample Sites

Premises ID	Premises ID	Premises ID	Premises ID	Premises ID	Premises ID
0000053327	0000187599	0000193208	0000206225	0000308210	0000323296
0000054128	0000188021	0000193266	0000206682	0000309050	0000324027
0000056705	0000188052	0000193616	0000217741	0000310005	0000324124
0000065963	0000188191	0000202869	0000217785	0000312096	0000325381
0000066020	0000188195	0000202880	0000217890	0000312184	0000329966
0000066207	0000188541	0000203222	0000217976	0000312576	0000330441
0000066210	0000188821	0000203295	0000218333	0000312604	0000334353
0000068169	0000189166	0000203732	0000218720	0000313263	0000335021
0000068459	0000189324	0000203878	0000297395	0000314547	0000344754
0000070312	0000189525	0000203955	0000299209	0000316160	0000344762
0000070596	0000189818	0000204195	0000299639	0000317960	0000344764
0000072451	0000189912	0000204408	0000299642	0000318118	0000348367
0000075431	0000190446	0000204410	0000299644	0000318742	0000348369
0000075453	0000190584	0000204440	0000299656	0000319307	0000349221
0000075550	0000190765	0000204486	0000299659	0000319612	0000349261
0000088794	0000190876	0000204510	0000299667	0000322319	0000351426
0000088946	0000190908	0000204528	0000300420	0000322337	0000356872
0000090669	0000190937	0000204728	0000300426	0000322339	0000356873
0000091232	0000191089	0000204942	0000301300	0000322347	0000356877
0000091374	0000191326	0000204950	0000303040	0000322356	0000356882
0000094950	0000191782	0000205063	0000303829	0000322380	0000356894
0000098317	0000191800	0000205570	0000305051	0000322388	0000356896
0000176743	0000191866	0000205577	0000306226	0000322412	0000356905
0000177037	0000192324	0000205659	0000306656	0000322510	0000356906
0000177561	0000192505	0000205765	0000306989	0000322522	0000357763
0000177564	0000192585	0000205840	0000307002	0000322524	0000360109
0000177686	0000192868	0000205859	0000308206	0000322558	0000360273
0000178368					

For two-way devices, no sample is needed as data used to calculate the load impact is collected from all participants through their control device.

Figure 12 shows a map of the Peak Perks program area and the M&V site locations for residential A/C DCU participants. Yellow colored circles show the 2018 Peak Perks participant installations, while the red circles represent the M&V sites.

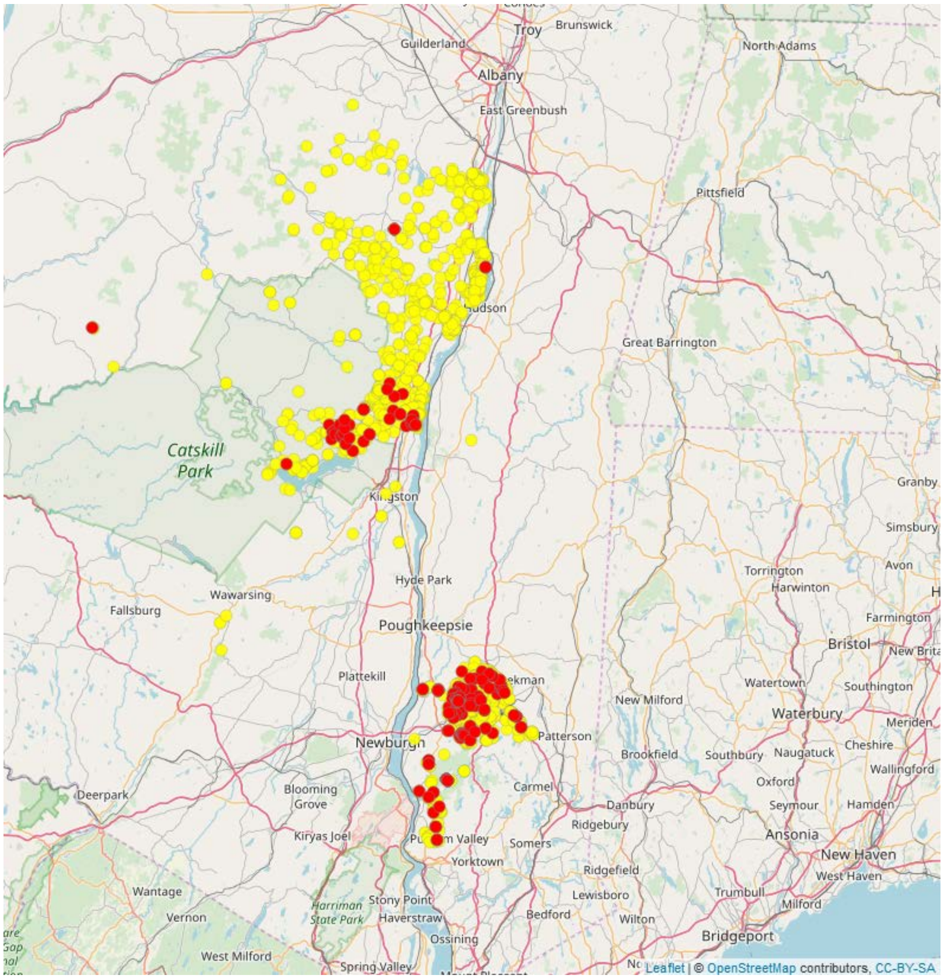

Figure 12: Peak Perks Program Residential A/C DCU M&V Sample

8 Adjustments to Sample

8.1 Types of Adjustments

During the curtailment season, the number of M&V participants will fluctuate. Listed below are the possible reasons for the changes in the M&V sample:

- Install - A new customer is recruited as an M&V customer and M&V equipment is installed on the premises
- Reactivate – A premises already is equipped with M&V equipment; however, it needs to be activated because a new customer moves in.
- Disconnect – A customer moves out of an M&V premises and the equipment is left on site. This is common for Multi-Dwelling Units (MDUs) or apartments. The M&V site can be reactivated if a new customer moves in and signs up for the program.
- Deactivate/Removal – A customer exits the program (program optout) or moves out of a residence. The M&V equipment is typically removed from the premises after a deactivation.

8.2 Curtailment Season Adjustments

Table 26 documents the changes to the M&V population during the 2018 curtailment season.

Table 26: Adjustments to the Residential A/C DCU M&V Sample During the Curtailment Season

Premises ID	Notes	Start Date	Stop Date
0000088212	New AMI meter installation	07/05/18	09/30/18
0000091588	New AMI meter installation	07/05/18	09/30/18
0000098400	New AMI meter installation	07/05/18	09/30/18
0000177353	New AMI meter installation	07/05/18	09/30/18
0000302907	New AMI meter installation	07/05/18	09/30/18
0000309813	New AMI meter installation	07/05/18	09/30/18
0000315423	New AMI meter installation	07/05/18	09/30/18
0000203876	New AMI meter installation	07/06/18	09/30/18
0000204858	New AMI meter installation	07/06/18	09/30/18
0000094433	New AMI meter installation	07/12/18	09/30/18
0000176642	New AMI meter installation	07/12/18	09/30/18
0000312588	New AMI meter installation	07/12/18	09/30/18
0000192608	New AMI meter installation	07/13/18	09/30/18
0000206194	New AMI meter installation	07/13/18	09/30/18
0000098405	New AMI meter installation	07/16/18	09/30/18
0000089113	New AMI meter installation	07/17/18	09/30/18
0000318205	New AMI meter installation	07/17/18	09/30/18
0000357431	New AMI meter installation	07/17/18	09/30/18
0000187649	New AMI meter installation	07/19/18	09/30/18
0000322567	New AMI meter installation	07/20/18	09/30/18
0000190969	New AMI meter installation	07/25/18	09/30/18
0000317247	New AMI meter installation	08/02/18	09/30/18
0000191196	New AMI meter installation	08/10/18	09/30/18
0000323307	New AMI meter installation	08/17/18	09/30/18
0000322412	No meter data after 07/26/18	06/01/18	07/26/18
0000206225	No meter data after 08/17/18	06/01/18	08/17/18
0000204408	No meter data after 09/10/18	06/01/18	09/10/18
0000203396	opted out 08/10/18	06/01/18	08/10/18
0000189324	Also pool pump site, not included in analysis		
0000204486	Also thermostat site, not included in analysis		
0000205659	Also pool pump site, not included in analysis		
0000303040	Also thermostat site, not included in analysis		

9 Measurement Activities

9.1 Data Sources and Uses

The M&V evaluation utilizes several data sources to monitor, analyze, and forecast load. The IntelliSOURCE server is used to collect data on the appliance runtime and the appliance connected load for the two-way devices. During the 2018 Curtailment Season, information from the two-way devices will be sent to the database every day and contain data in 5-minute increments. R will be used to download and store data that is posted from the Insights+ electric meters. R will also be used for all data analysis.

In addition to these databases, Strategic Analytics uses external data sources to monitor weather and system load. Since temperature at the time of a curtailment event is an important factor for DR performance reporting, Strategic Analytics utilizes the US Government NOAA forecast weather data for official temperature information. R is used to view and process the weather data.

9.1.1 Residential and Small Commercial Two-Way Device Participants (A/Cs with a Smart Thermostat and Pool Pumps with a DCU)

For all of the A/C smart thermostat two-way device participants and all of the pool pump participants, data is collected on the runtime of the appliance and the connected load of the appliance.

The two-way control devices record and report the time during which the appliance is running, which is referred to as “runtime”. The accumulated runtime is recorded in integer minutes. This information is transmitted to the IntelliSOURCE system and stored in a database. For A/Cs, the indoor temperature and the working set point are also transmitted to IntelliSOURCE. IntelliSOURCE calculates the five-minute interval runtime by differencing the accumulated runtime between successive five-minute data intervals. This information is multiplied by the connected load to calculate the kW energy usage for each five-minute interval.

The connected load values are estimated based on the equipment name plate information collected by the field technician. The field technician records, when available, the manufacturer, make, model, and manufacture year. Additionally, for each A/C, the A/C size (typically in BTU/hr or A/C tons), the A/C load amps, and the fan load amps are captured; for pool pumps, the horsepower is recorded; and for whole home generators, the generator size (typically in BTU/hr or tons) is recorded.

9.1.2 Residential and Small Commercial One-Way Device Participants (A/Cs with a DCU)

In the Peak Perks program, digital control units (DCU) with one-way paging capability are currently deployed for the DR curtailment of air conditioning units at locations where Wi-Fi thermostats cannot be installed and operated, or when the participant prefers a DCU. These units are not capable of communicating load data. To estimate DR reductions, Insights+ electric meters were deployed on a representative sample of 190 residential premises with one-way paging digital control units (“sample group”). These meters provide 15-minute interval whole home kW usage data which is downloaded from a third-party system and analyzed to estimate the mean kW reductions for the residential digital control unit participant population.

For the residential A/C DCU population, the M&V sample was grouped in an A/B design and was proportionally allocated based on the participant population distribution by region and A/C tonnage. These groups remained constant throughout the season except for changes needed to reduce bias between the groups or changes needed when sites were deactivated. The curtailment event scheduling alternated the group curtailed between successive events, i.e., for the first event group A was curtailed, for the second event group B was curtailed, etc. With whole-home AMI data, it is not possible to disaggregate the load contribution from each A/C. Therefore, it is difficult to separate the population into two groups of near-equal A/C load. When there are differences in consumption between the groups, it is not known if they are associated with the A/C. It was therefore determined that higher precision could be achieved by curtailing the entire M&V

population simultaneously for the remainder of the season and utilizing a CBL methodology to estimate the load impacts.

9.1.3 Whole Home Generator (WHG) Participants

Central Hudson Gas and Electric provides 15-minute interval data to Itron daily for 10 of the enrolled whole home generator program participants.

9.1.4 C&I (Large Commercial) Participants

Central Hudson Gas and Electric provides 15-minute interval data to Itron for all participants enrolled in the program under the C&I segment. Itron provides the interval data to CPower, and CPower calculates load reduction results for the C&I segment.

9.2 Hourly Weather Data

Since temperature at the time of a curtailment event is an important factor for DR performance reporting, Strategic Analytics utilizes the US Government NOAA forecast weather data for official temperature information. These data help to forecast load and determine the possibility of a load curtailment event taking place. Research is done on the relationship between temperature and load in order to make the decision to call a curtailment event. Recorded temperature will be used from the following weather stations: KPOU station (Poughkeepsie, Dutchess County Airport) for Fishkill/Shenandoah, KSWF station (Newburgh / Stewart) for Merritt Park, and KALB station (Albany International Airport) for Northwest Corridor.

Figure 13 shows the daily temperature extremes recorded at the area NOAA weather station KPOU from June 1, 2018 to September 30, 2018. The red triangles mark days selected to be curtailment event days.

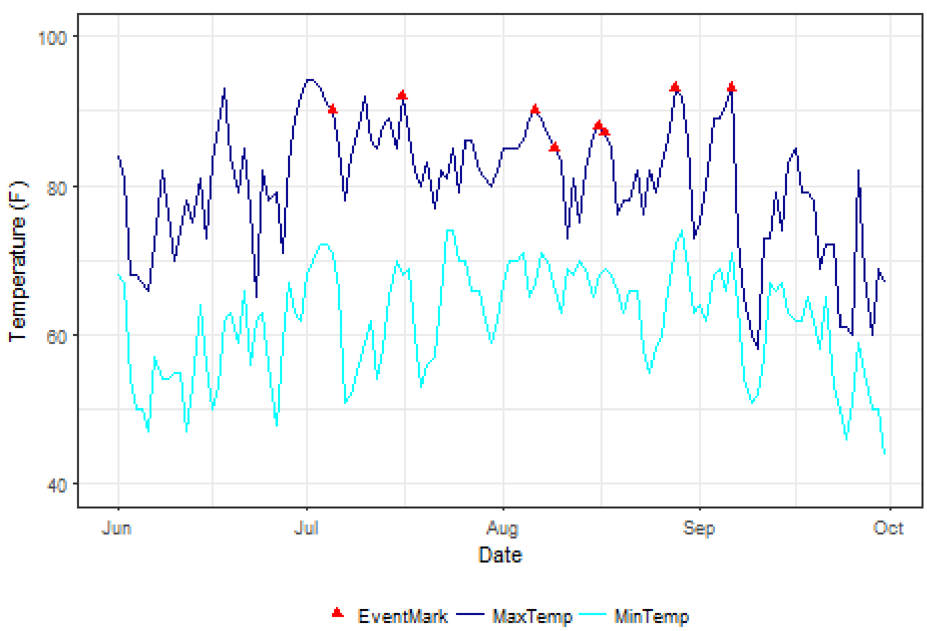

Figure 13: Maximum Recorded Temperatures at KPOU Weather Station

10 Exception Handling

This section describes the circumstances when either an adjustment of load data used for reduction calculations is needed or when a technician visit is needed to verify data. As summarized in *Section 9*, the Solutions Operations Center will monitor, validate, and maintain the quality of data. This process may require a field visit by an Itron technician. When a field visit is conducted, technicians verify that the equipment information are correctly listed in the Itron database. Any differences are updated when found.

This section has a brief description of how the Solutions Operations Center will remedy each situation in a manner that best estimates the equipment performance of the participant population.

10.1 Data Validation

For two-way devices, each 5-minute interval runtime will be validated and assigned a value, designating if there is an error in reading the data for that interval.

Any data missing over multiple intervals might be the result of:

- Wi-Fi issue at customer location that prevents the smart thermostat from reporting,
- an issue in IntelliSOURCE that prevents data from being stored,
- a customer leaving the program and their device has been deactivated,
- a problem with the wiring between the thermostat/switch and the equipment, or
- a thermostat device failure.

If the customer has left the program, any data collected after the deactivation dates are not counted toward DR reduction analysis. If there is a problem with the wiring between the thermostat/switch and the equipment, a technician will go on-site to fix the connection.

For Insights+ electric meter data, a status value is created with each interval reading. Readings with invalid status values are not counted toward DR reduction analysis.

For C&I participants, the meter data provided by CHGE will already have been validated and any missing intervals will have been estimated.

10.2 Data Verification

Occasionally, the Solutions Operations Center finds that certain sites never report zero loads in any interval. In this case, the Solutions Operations Center calculates the minimum load reading reported for those sites over the course of the curtailment season. In most cases, the load will be between 0.01 and 0.30 kW. If substantial load is always found at the site, the Solutions Operations Center dispatches a technician to verify that the equipment is wired and functioning properly and that the equipment is running during the entire time they are there. It is Itron policy to leave this data as is unless an incorrect wiring problem is found. In that case, a technician will go on-site to fix the wiring problem and the prior data will be removed.

10.3 Bias Monitoring

For program segments that divide the M&V sample into two groups and alternate curtailment of these groups in order to estimate load reduction, Itron monitors the bias between the average whole home loads of these groups during the curtailment season. For this program during the 2018 curtailment season, the bias will be monitored by calculating the Sum of Squared Differences (SSD) for a particular day:

$$SSD = \sum_{i=1}^{N} (A_{\text{avg}} - B_{\text{avg}})^2$$

N is the number of program hours during the day, Aavg is the average hourly load in kW for group A, and Bavg is the average hourly load in kW for group B. If the bias is measured to be excessive for days where temperature is above a certain threshold, then a change in group assignments may be considered to balance the group loads. An excessive bias is one that measures more than a historical average for the program.

11 Communications Analysis

11.1 IntelliSOURCE Telemetries Data Analysis

The two-way thermostats are programmed to report data to the IntelliSOURCE server. *Figure 14* presents the number of active devices that are reporting telemetries data by day. Cases where there is a drop in the expected number of reports are investigated. In July an automated script was implemented to ensure thermostats are set to send telemetries data. Since the thermostats are Wifi-enabled, they are subject to the internet connection of the end customer.

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Figure 14: FIGURE REDACTED

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11.2 DR Network Messaging Service Provider

Itron has contracted with Central Vermont Communications (CVC) for messaging services, at a carrier frequency of 157.74 MHz, for the Central Hudson Peak Perks program. CVC serves the northeastern United States including Vermont, New Hampshire, Massachusetts, Connecticut, and western Maine with extended coverage in Eastern New York, Eastern Pennsylvania, New Jersey, and Delaware as is presented in *Figure 15*.

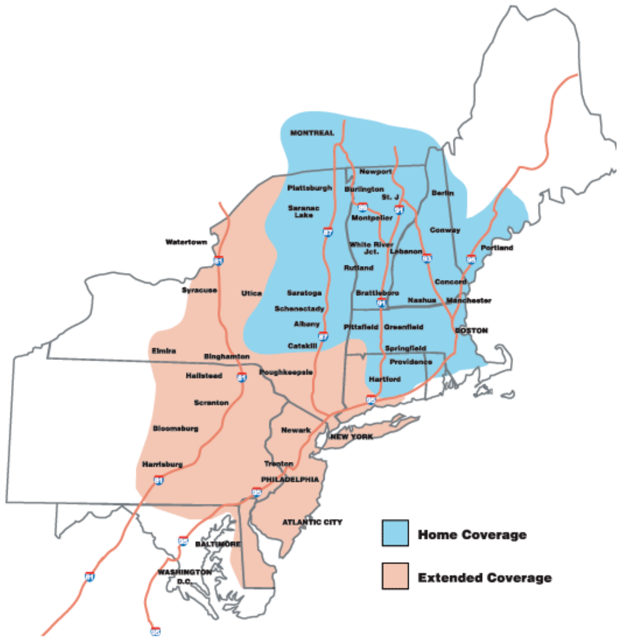

Figure 15: Central Vermont Communications Paging Service Area

11.3 Remote Terminal Monitoring

Near real time performance of the Itron RF paging network is monitored using Remote Terminal Monitor (RTM) paging receivers. RTMs provide verification that a valid message has been transmitted on the RF paging network. All valid messages that are received by the RTM are recorded and reported back to the IntelliSOURCE server. A typical RTM log is presented in *Figure 16*.

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Figure 16: FIGURE REDACTED

11.4 RF Coverage Simulation

A typical RF signal coverage model for this DR program is presented in *Figure 17*. This model is developed, and maintained using EDX SignalPro, an RF simulation wireless network engineering software package. The model is utilized to estimate signal availability over the DR coverage area.

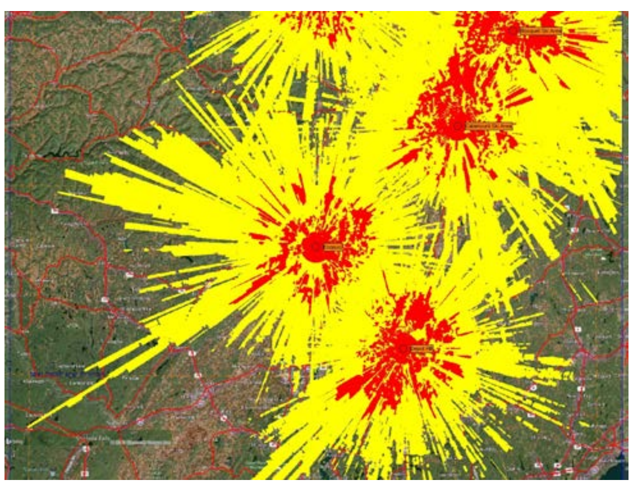

Figure 17: RF Coverage Map for Paging System

11.5 DR Network Performance Maintenance

Additionally, Strategic Analytics conducts annual RF coverage field studies. The purpose of the yearly field test is to evaluate the RF signal quality in the DR service area. The field test is conducted using an RF spectrum analyzer with an Itron DCU used to monitor message decoding when necessary. The test network is shown in *Figure 18*. The arrows in the figure show the direction of the paging messages.

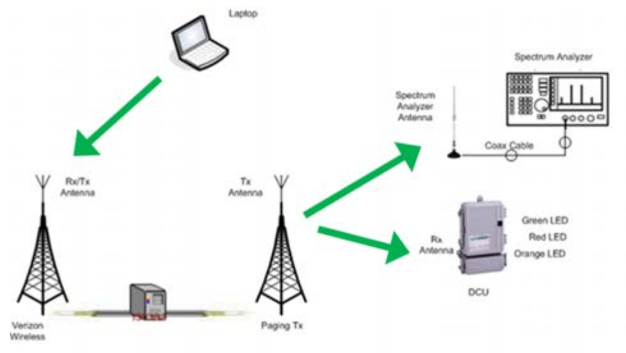

Figure 18: Network Testing

The locations selected for measuring RF paging signal strength depend on the utility company's service territory, house density, the surrounding terrain and access to the community (residential areas, etc.). Following are location selection guidelines:

- To verify signal levels from RF VHF paging transmitter towers measurements are conducted as close as possible to selected Itron DR curtailment installation sites.
- For hilly and mountainous terrains, receive signal strength is taken at different locations depending on paging tower location.
- Multiple test pages are transmitted and the receive success rate is recorded.
- Tower locations and measurement locations are determined using a GPS receiver and map coordinates. All measurement location LATITUDE and LONGITUDE coordinates are accurately recorded and referenced to the corresponding measurement file.

A typical paging signal RF spectrum analyzer measurement collected from a location in the program area is shown in *Figure 19*. The figure presents the frequency domain trace of a paging message captured using an Agilent spectrum analyzer. The trace is centered on the frequency of the carrier frequency. There are well-defined peaks on either side of the carrier frequency and present a well-formed signal.

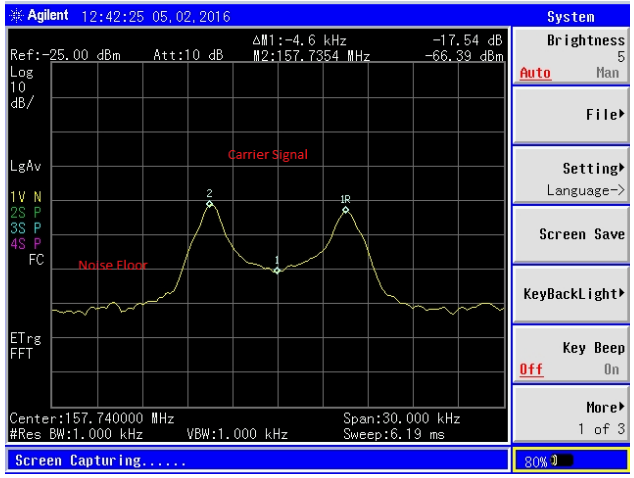

Figure 19: RF Signal Measurement- Spectrum Analyzer Trace

A table of the most recent receive signal strength (RSSI) results of a Spring 2018 field study is detailed in *Table 27*.

Itron Proprietary Information Deleted.

Table 27: Paging Field Study

Site	Measured RSSI (dBm)	Messages Sent	Messages Received
1	-95.5	2	0
2	-87.5	2	2
3	-98.9	2	0
4	no signal		
5	-84.5	3	3
6	-60.7	2	2
7	-94.5	2	0
8	-67.2	2	2
9	-73.6	2	2
10	-72.4	2	2
11	-74.2	2	2
12	-75.9	2	2
13	-84.7	4	4
14	-74.3	2	2
15	-84.3	3	3
16	-67.3	2	2
17	-79.0	2	2
18	-83.7	3	3
19	-77.7	2	2
20	-75.9	2	2
21	-84.3	4	2
22	-71.7	2	2
23	-64.6	2	2
24	-90.4	4	3
25	-75.5	2	2
26	-86.7	4	4
27	-78.6	2	2
28	-85.6	2	2
29	-80.4	2	2
30	-80.5	2	2
31	-83.0	2	2
32	-68.6	2	2
33	-85.3	4	4
34	-77.5	2	2
35	-87.7	4	4
36	-80.1	2	2
37	-86.4	4	4

12 Demand Response Calculations

12.1 Residential / Small Commercial Event Day Details

For the 2018 curtailment season, there were a total of eight curtailment event days for residential and small commercial populations, as presented in *Table 28* below. A qualifying curtailment day for the residential and small commercial populations is defined as those days in which there is an average of at least a 2.25 kW adjusted baseline for the residential thermostat population during the event hours. The baseline is an indicator of the system load constraints that the program was designed to alleviate. The 2.25 kW threshold allows for testing to occur on warm days when the system load is not at its peak, without unduly impacting seasonal performance. As shown in *Table 28*, there were four qualifying curtailment days. One of the qualifying curtailment days (July 5th) experienced paging and addressing issues, resulting in inadequate data. As such, this qualifying curtailment day is excluded from seasonal performance calculations.

Table 28: Event Dates Summary

Date	Start Time	End Time	Notes	Qualifying Day
07/05/2018	16:00	17:00	Residential DCUs	Yes*
07/16/2018	15:30	18:00	Residential Thermostats, AMI DCUs (Group A)	Yes
08/06/2018	15:45	18:15	Thermostats, Pool Pumps, Residential DCUs (Group B)	No
	16:45	18:15	WHGs (Whole Home Generators)	
08/09/2018	16:45	17:15	Thermostats, Pool Pumps, Res DCUs (Group B), WHGs	No
08/16/2018	15:45	18:15	Thermostats, Pool Pumps, Residential DCUs, WHGs	No
08/17/2018	15:45	18:15	Thermostats, Pool Pumps, Residential DCUs, WHGs	No
08/28/2018	14:45	17:15	WHGs (Whole Home Generators)	Yes
	15:45	17:15	Small Commercial Thermostats	
	15:45	18:15	Residential Thermostats, Pool Pumps, Residential DCUs	
09/06/2018	15:45	18:15	Thermostats, Residential DCUs	Yes

* July 5th experienced paging and addressing issues, resulting in inadequate data. As such, this qualifying curtailment day is excluded from seasonal performance calculations

12.1.1 Residential A/C Thermostat Event Day Load Shapes

Figure 20 through *Figure 26* show the average event day kW load, the average unadjusted baseline kW load, and the average adjusted baseline kW load for each of the days the residential thermostat segment was curtailed. The green-shaded area identifies the event time period and the yellow-shaded area identifies the adjustment window.

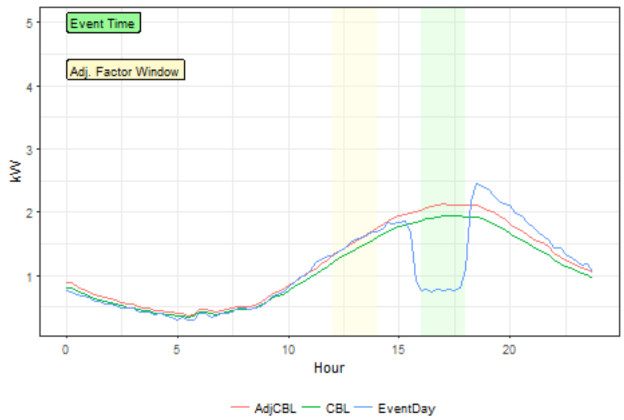

Figure 20: Residential Thermostat M&V Load July 16, 2018

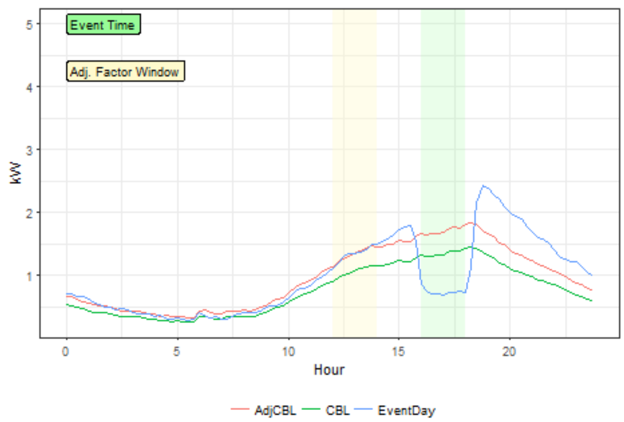

Figure 21: Residential Thermostat M&V Load August 6, 2018

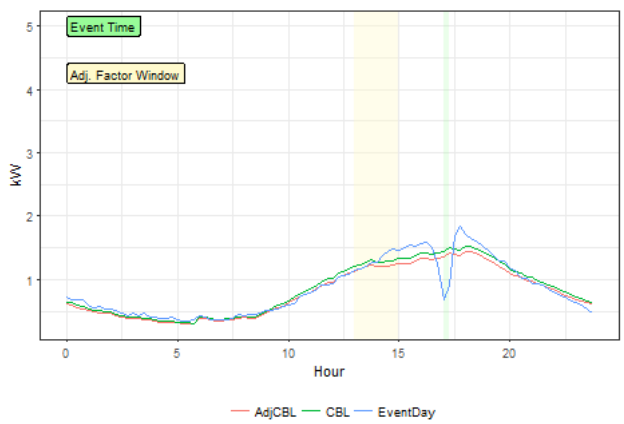

Figure 22: Residential Thermostat M&V Load August 9, 2018

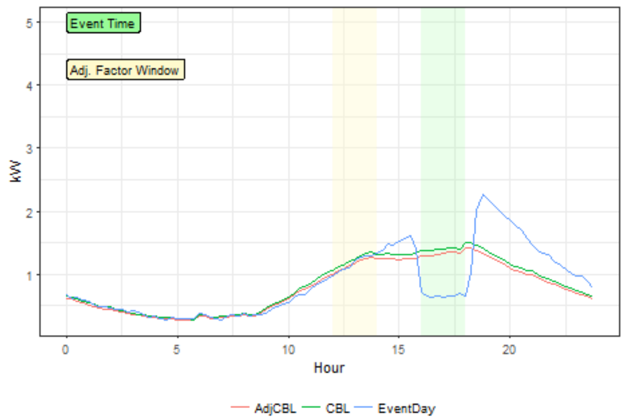

Figure 23: Residential Thermostat M&V Load August 16, 2018

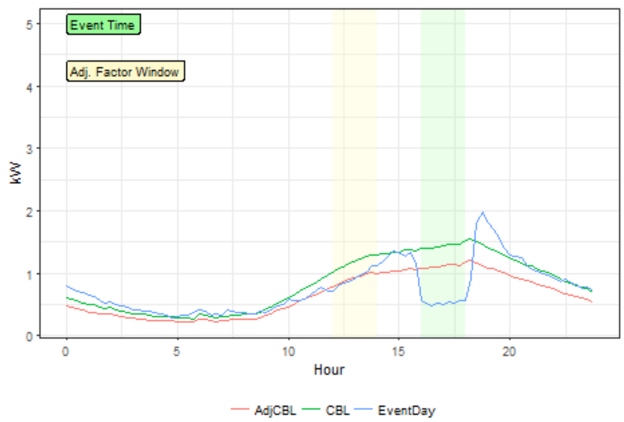

Figure 24: Residential Thermostat M&V Load August 17, 2018

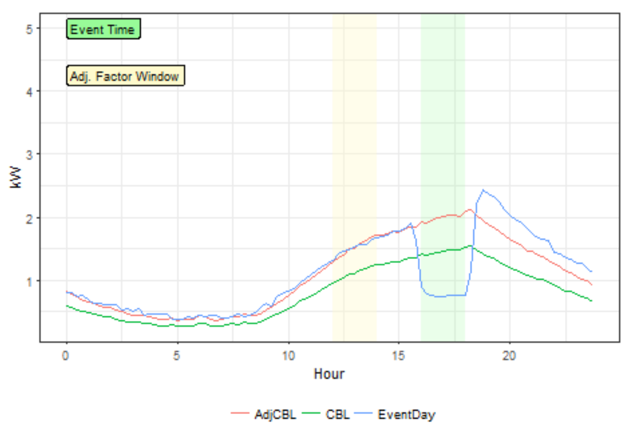

Figure 25: Residential Thermostat M&V Load August 28, 2018

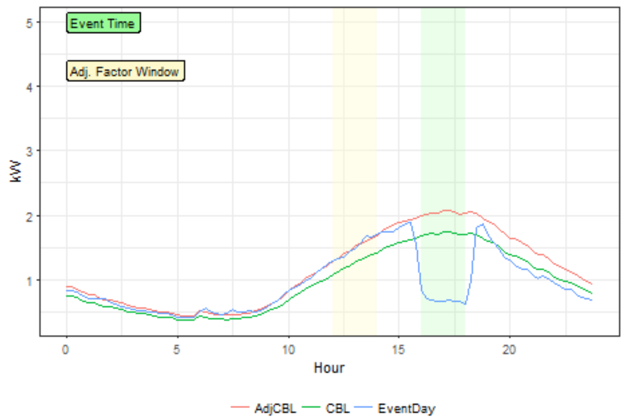

Figure 26: Residential Thermostat M&V Load September 6, 2018

12.1.2 Residential A/C DCU Event Day Load Shapes

Figure 27 through *Figure 34* present the event data for the residential DCU segment.

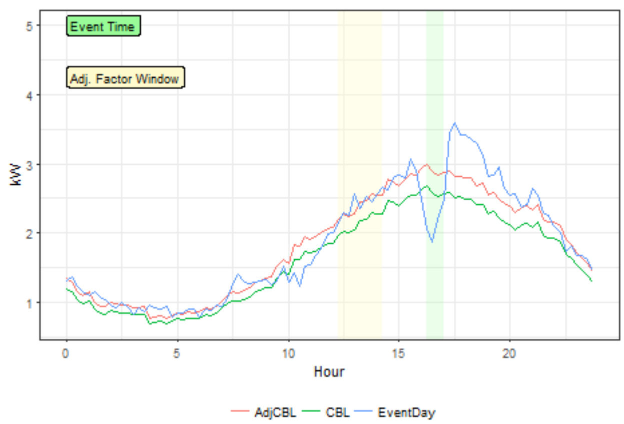

Figure 27: Residential DCU M&V Load July 5, 2018

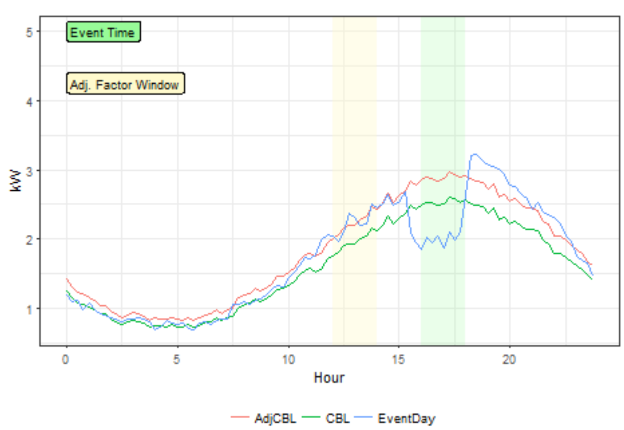

Figure 28: Residential DCU M&V Load July 16, 2018

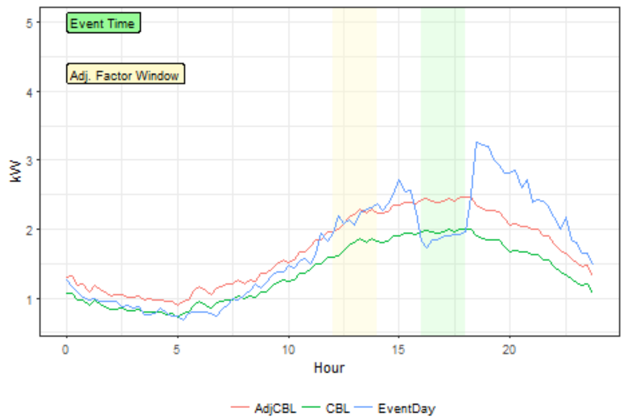

Figure 29: Residential DCU M&V Load August 6, 2018

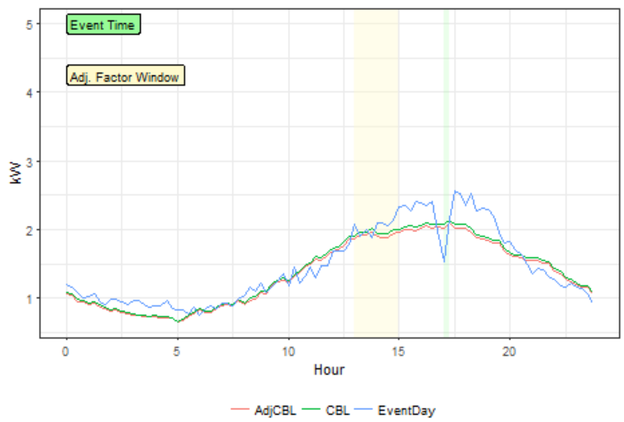

Figure 30: Residential DCU M&V Load August 9, 2018

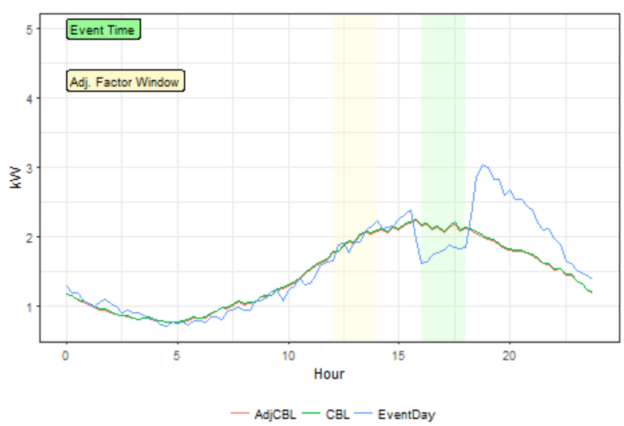

Figure 31: Residential DCU M&V Load August 16, 2018

Figure 32: Residential DCU M&V Load August 17, 2018

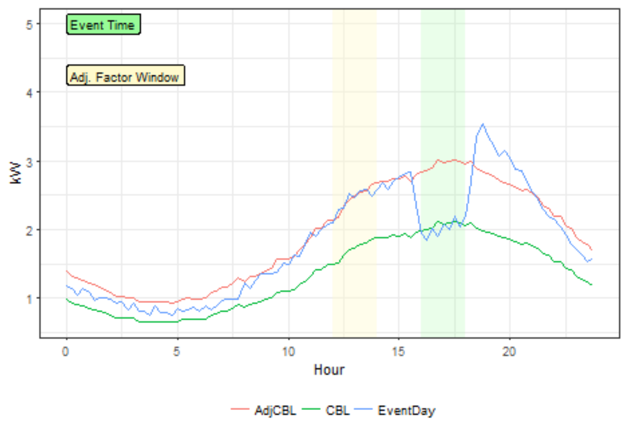

Figure 33: Residential DCU M&V Load August 28, 2018

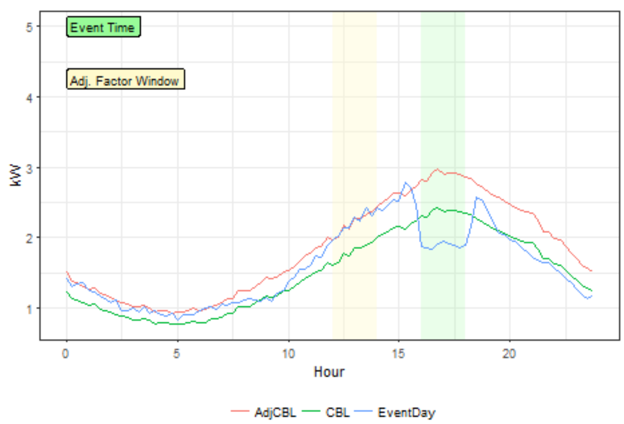

Figure 34: Residential DCU M&V Load September 6, 2018

12.1.3 Residential Pool Pump DCU Event Day Load Shapes

Figure 35 through *Figure 39* present the event data for the residential pool pump segment.

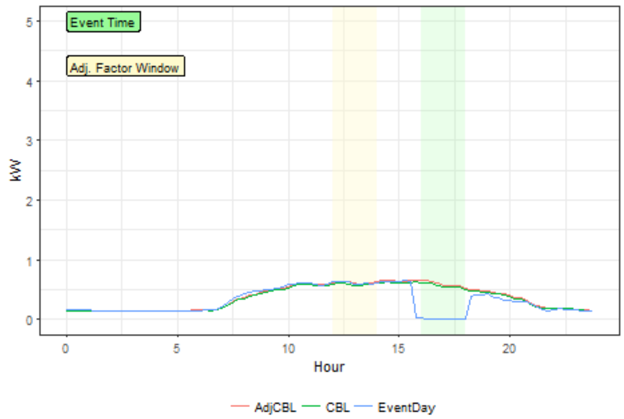

Figure 35: Residential Pool Pump M&V Load August 6, 2018

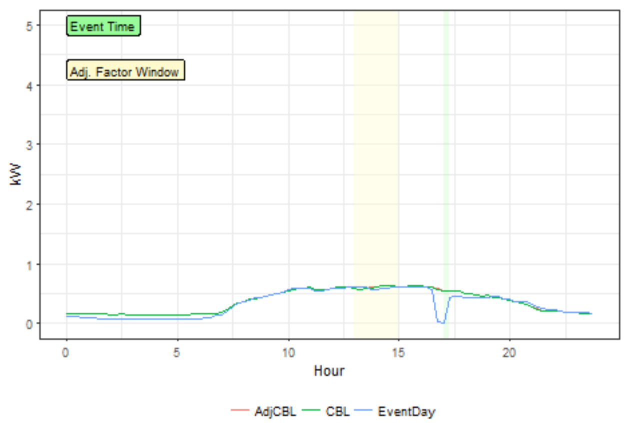

Figure 36: Residential Pool Pump M&V Load August 9, 2018

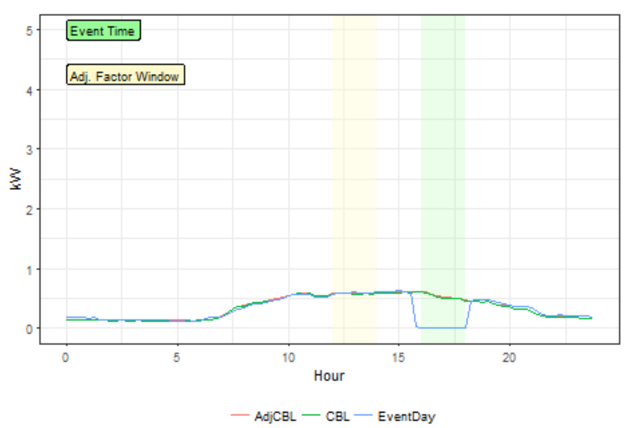

Figure 37: Residential Pool Pump M&V Load August 16, 2018

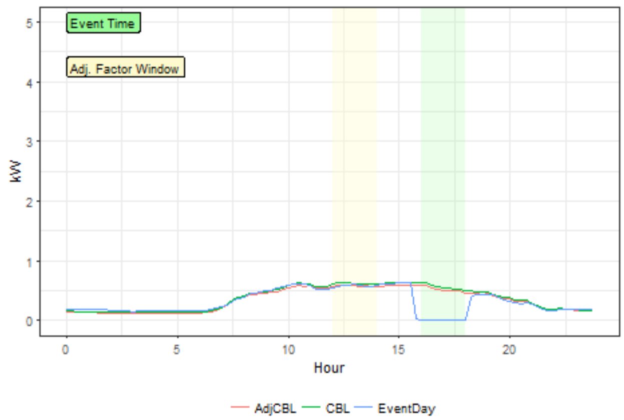

Figure 38: Residential Pool Pump M&V Load August 17, 2018

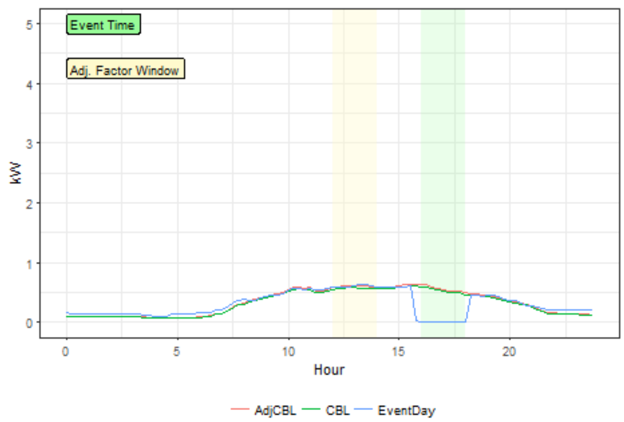

Figure 39: Residential Pool Pump M&V Load August 28, 2018

12.1.4 Residential Whole Home Generator Event Day Load Shapes

Figure 40 through *Figure 44* present the event data for the residential whole home generator segment.

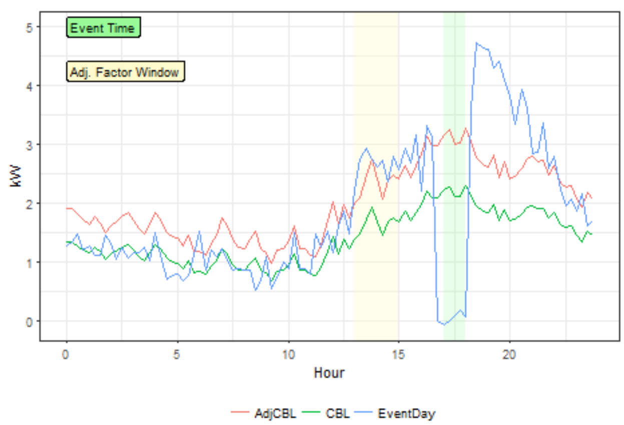

Figure 40: Residential Generator M&V Load August 6, 2018

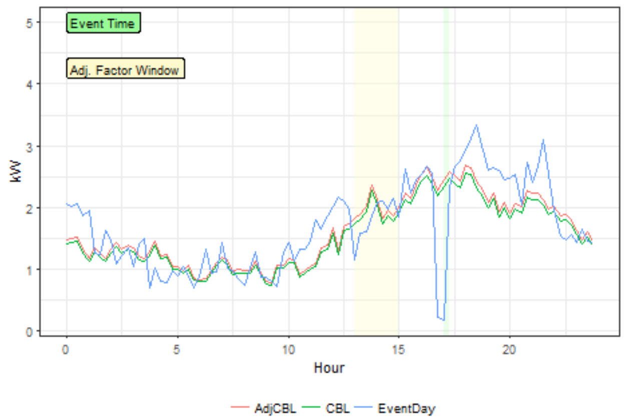

Figure 41: Residential Generator M&V Load August 9, 2018

Figure 42: Residential Generator M&V Load August 16, 2018

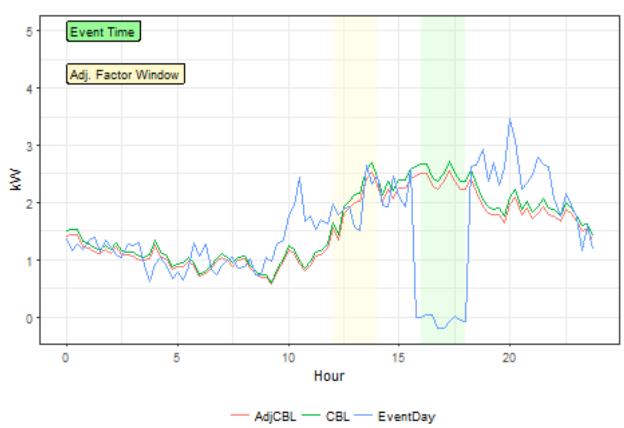

Figure 43: Residential Generator M&V Load August 17, 2018

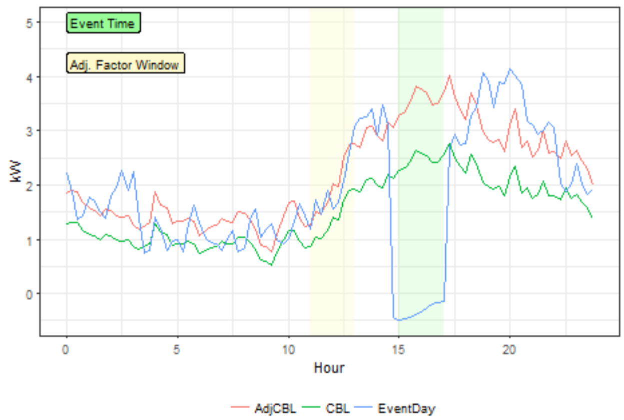

Figure 44: Residential Generator M&V Load August 28, 2018

12.1.5 Small Commercial A/C Thermostat Event Day Load Shapes

Figure 45 through *Figure 50* present the event data for the small commercial thermostat segment.

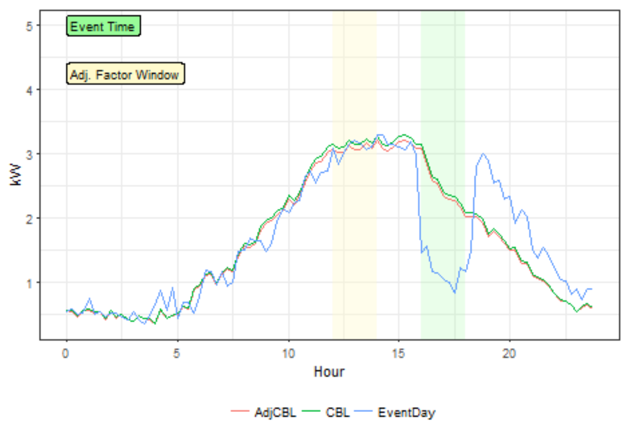

Figure 45: Small Commercial Thermostat M&V Load August 6, 2018

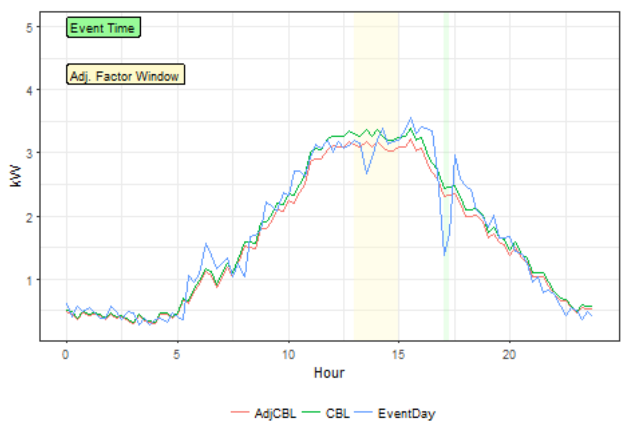

Figure 46: Small Commercial Thermostat M&V Load August 9, 2018

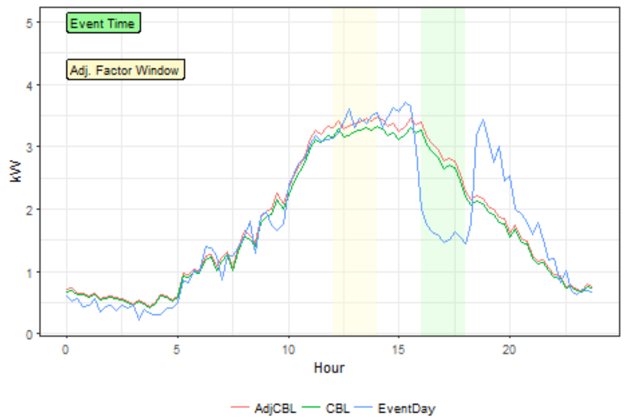

Figure 47: Small Commercial Thermostat M&V Load August 16, 2018

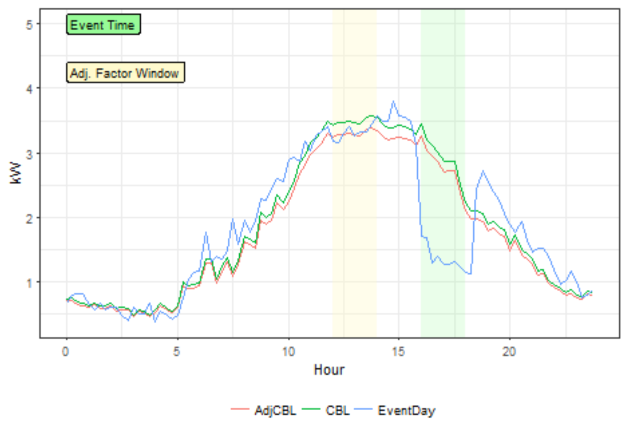

Figure 48: Small Commercial Thermostat M&V Load August 17, 2018

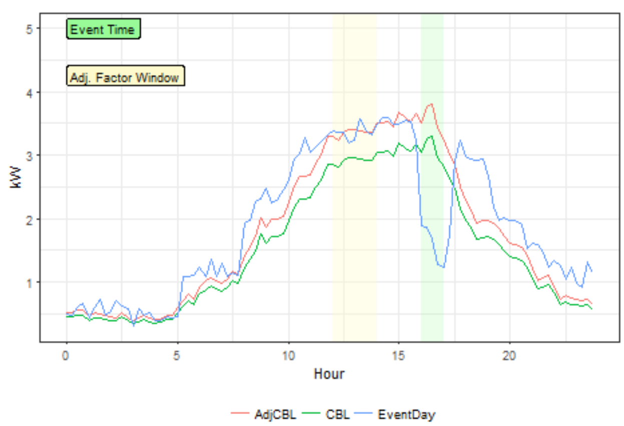

Figure 49: Small Commercial Thermostat M&V Load August 28, 2018

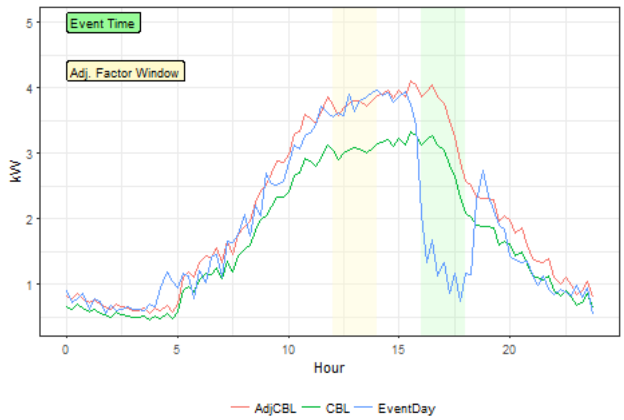

Figure 50: Small Commercial Thermostat M&V Load September 6, 2018

12.2 Residential / Small Commercial Load Reduction Results

The residential and small commercial load reduction estimates in 2018 were calculated for each event initiated by CHGE during the summer. First the load reduction for each 15-minute interval during the event is estimated by taking the difference between the average adjusted baseline and the average event day load for each segment that was curtailed. Then the 15-minute reductions are averaged across the entire event period to estimate the load reduction for each event.

The Strategic Analytics team engaged in a vigorous data validation process and made any necessary adjustments to the data based on blackouts, incorrect wiring, or other scenarios that would affect data quality.

12.2.1 Residential A/C Thermostat Load Reduction Results

Table 29 summarizes the residential thermostat segment load reduction results for each event. Using the adjusted baseline approach, the average reduction per device for the residential thermostat population is 1.29 kW. The numbers presented below include an 89.1%, 88.4%, 87.5%, 87.4%, 86.7%, 88.5%, and 88.5% adjustment for 7/16, 8/6, 8/9, 8/16, 8/17, 8/28, and 9/6 respectively, to account for offline devices that were not curtailed.

Table 29: Residential Thermostat Summary of 2018 Events

TempF	Date	StartTime	EndTime	kW	Qualifying Day
89	07/16/2018	16:00	18:00	1.33	Yes
90	08/06/2018	16:00	18:00	0.96	No
84	08/09/2018	17:00	17:15	0.68	No
88	08/16/2018	16:00	18:00	0.66	No
84	08/17/2018	16:00	18:00	0.59	No
92	08/28/2018	16:00	18:00	1.21	Yes
76	09/06/2018	16:00	18:00	1.35	Yes
				1.29	Average Qualifying

12.2.2 Residential A/C DCU Load Reduction Results

Table 30 summarizes the residential A/C DCU segment load reduction results for each event. Using the adjusted baseline approach, the average reduction per device for the residential A/C DCU population is 0.95

kW. The DCU AMI data is collected is per home. The numbers presented below include an adjustment for number of devices per home of 1.27, 1.30, 1.28, 1.28, 1.28, 1.29, 1.28, and 1.29 for 7/5, 7/16, 8/6, 8/9, 8/16, 8/17, 8/28, and 9/6 respectively, to convert the savings to a per device value. An offline adjustment factor is not required since the load associated with a non-curtailed device is included in the whole-home AMI data.

Table 30: Residential DCU Summary of 2018 Events

TempF	Date	StartTime	EndTime	kW	Qualifying Day
90	07/05/2018	16:15	17:00	0.86	Yes*
89	07/16/2018	16:00	18:00	0.90	Yes
90	08/06/2018	16:00	18:00	0.56	No
84	08/09/2018	17:00	17:15	0.49	No
88	08/16/2018	16:00	18:00	0.36	No
84	08/17/2018	16:00	18:00	0.28	No
92	08/28/2018	16:00	18:00	0.94	Yes
76	09/06/2018	16:00	18:00	1.01	Yes
				0.95	Average Qualifying

12.2.3 Residential Pool Pump DCU Load Reduction Results

Table 31 summarizes the residential pool pump segment load reduction results for each event. Using the adjusted baseline approach, the average reduction per device for the residential pool pump population is 0.57 kW. The numbers presented below include an 87.7%, 85.3%, 83.3%, 87.9%, 84.6%, adjustment for 8/6, 8/9, 8/16, 8/17, and 8/28 respectively, to account for offline devices that were not curtailed.

Table 31: Residential Pool Pump Summary of 2018 Events

TempF	Date	StartTime	EndTime	kW	Qualifying Day
90	08/06/2018	16:00	18:00	0.60	No
84	08/09/2018	17:00	17:15	0.56	No
88	08/16/2018	16:00	18:00	0.55	No
84	08/17/2018	16:00	18:00	0.54	No
92	08/28/2018	16:00	18:00	0.57	Yes
				0.57	Average Qualifying

12.2.4 Residential Whole Home Generator Load Reduction Results

Table 32 summarizes the residential whole home generator segment load reduction results for each event. Using the adjusted baseline approach, the average reduction per home for the residential whole home generator population is 3.9 kW. The residential whole home generator AMI data is collected is per home. No per device adjustment is needed as each home only has one device. An offline adjustment factor is not required since the load associated with a non-curtailed device is included in the whole-home AMI data.

Table 32: Residential Whole Home Generator Summary of 2018 Events

TempF	Date	StartTime	EndTime	kW	Qualifying Day
89	08/06/2018	17:00	18:00	3.06	No
84	08/09/2018	17:00	17:15	2.29	No
88	08/16/2018	16:00	18:00	2.33	No
84	08/17/2018	16:00	18:00	2.44	No
93	08/28/2018	15:00	17:00	3.90	Yes
				3.90	Average Qualifying

12.2.5 Small Commercial A/C Thermostat Load Reduction Results

Table 33 summarizes the small commercial thermostat segment load reduction results for each event. Using the adjusted baseline approach, the average reduction per device for the small commercial A/C thermostat population is 2.21 kW. The numbers presented below includes an 81.5%, 88.2%, 88.3%, 85.6%, 87.2%, and 84.6% adjustment for 8/6, 8/9, 8/16, 8/17, 8/28, and 9/6 respectively, to account for offline devices that were not curtailed.

Table 33: Small Commercial Thermostat Summary of 2018 Events

TempF	Date	StartTime	EndTime	kW	Qualifying Day
90	08/06/2018	16:00	18:00	1.34	No
84	08/09/2018	17:00	17:15	0.94	No
88	08/16/2018	16:00	18:00	1.29	No
84	08/17/2018	16:00	18:00	1.43	No
92	08/28/2018	16:00	17:00	1.95	Yes
76	09/06/2018	16:00	18:00	2.35	Yes
				2.21	Average Qualifying

12.3 C&I Event Day Details

For the 2018 curtailment season, there was one test event and one retest event. A retest was performed for two of the participants in Northwest Corridor due to under-performance in first test event. The event details are presented in *Table 34*.

Table 34: C&I Event Dates Summary

Date	Start Time	End Time	Notes
08/28/2018	16:00	17:00	Large Commercial & Industrial Test Event
09/27/2018	16:00	17:00	Large Commercial & Industrial Retest Event

Table 35 summarizes the C&I population load reduction results for each event hour. The total reduction for the C&I population is 5.2 MW.

Table 35: C&I Summary of 2018 Events

Date	Start Time	End Time	Zone	CBL (kW)	Event Hour Usage (kW)	Load Reduction (kW)
08/28/2018	16:00	17:00	NW Corridor	5403	1074	4328
08/28/2018	16:00	17:00	Merritt Park	619	141	478
08/28/2018	16:00	17:00	Fishkill	223	3	219
09/27/2018	16:00	17:00	NW Corridor	494	317	176

12.4 Final kW Calculation

The residential segment load reduction estimates in 2018 are based on those events that exceeded the 2.25 kW adjusted baseline threshold for the residential thermostat segment and therefore represent a scenario of load constraint. The thermostat and pool pump load reduction estimates are obtained from those sites that reported telemetries data on all the days used in the load reduction calculation. Similarly, the AMI load reduction estimates are obtained from those sites that had valid AMI data on all the days used in the load reduction calculation. The reduction for each 15-minute interval, during the event hour, is estimated by taking the difference between the average adjusted baseline and the average event day load. The first 15-minute interval for each event is excluded as this time interval is when the population is ramping into curtailment.

For the 2018 curtailment season, there were a total of three qualifying curtailment events used to calculate the kW factors for the residential and small commercial populations. In addition, there was one event and one retest event for the C&I participant population.

Tables 36 through *38* present the total MW savings the 2018 control season by region. As shown in the tables below, the demand response reduction for the Fishkill, Merritt Park, and Northwest Corridor regions are 3.073, 0.774, and 5.732 MW, respectively. These savings numbers are based on the total number of end points installed in Central Hudson Peak Perks program as of September 30th, 2018.

Table 36: Summary of Reduction: Fishkill/Shenandoah

Population	Device	Active end points as of 10/01/18	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	878	1.295	1.137
Residential	DCU - A/C	1414	0.949	1.342
Residential	DCU - Pool Pump	36	0.570	0.021
Residential	DCU - Generator	10	3.896	0.039
Small Commercial	Thermostat - A/C	93	2.215	0.206
Small Commercial	DCU - A/C	87	1.250	0.109
Large C&I	Curtailment			0.219
Total				3.073

Table 37: Summary of Reduction: Merritt Park

Population	Device	Active end points as of 10/01/18	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	65	1.295	0.084
Residential	DCU - A/C	183	0.949	0.174
Residential	DCU - Pool Pump	0	0.570	0.000
Residential	DCU - Generator	7	3.896	0.027
Small Commercial	Thermostat - A/C	5	2.215	0.011
Small Commercial	DCU - A/C	0	1.250	0.000
Large C&I	Curtailment			0.478
Total				0.774

Table 38: Summary of Reduction: NW Corridor

Population	Device	Active end points as of 10/01/18	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	132	1.295	0.171
Residential	DCU - A/C	996	0.949	0.945
Residential	DCU - Pool Pump	32	0.570	0.018
Residential	DCU - Generator	1	3.896	0.004
Small Commercial	Thermostat - A/C	22	2.215	0.049
Small Commercial	DCU - A/C	33	1.250	0.041
Large C&I	Curtailment			4.504
Total				5.732

Table 39, below, presents the total MW reduction for the 2018 control season by segment. The demand

response reduction for the residential and small commercial populations is 4.378 MW, based on a total of 3,994 end points installed in Central Hudson Peaks Perks program service area as of September 30th, 2018. The demand response reduction for the C&I population is 5.201 MW based on the curtailment performance of nine customers. The demand response reduction for the entire Peak Perks program is 9.579 MW.

Table 39: Summary of Reduction: All Zones

Population	Device	Active end points as of 10/01/18	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	1075	1.295	1.392
Residential	DCU - A/C	2593	0.949	2.461
Residential	DCU - Pool Pump	68	0.570	0.039
Residential	DCU - Generator	18	3.896	0.070
Small Commercial	Thermostat - A/C	120	2.215	0.266
Small Commercial	DCU - A/C	120	1.250	0.150
Large C&I	Curtailment			5.201
Total				9.579

13 Participant Impact

13.1 Opt-Outs

The number of opt-outs, defined as either a program opt-out or an opt-out for the day, as the season progresses is monitored. An opt-out is defined as when the customer no longer wants to participate in the program. *Figure 51* shows the cumulative opt-out rate as a percentage of the number of active customers as of September 30, 2018.

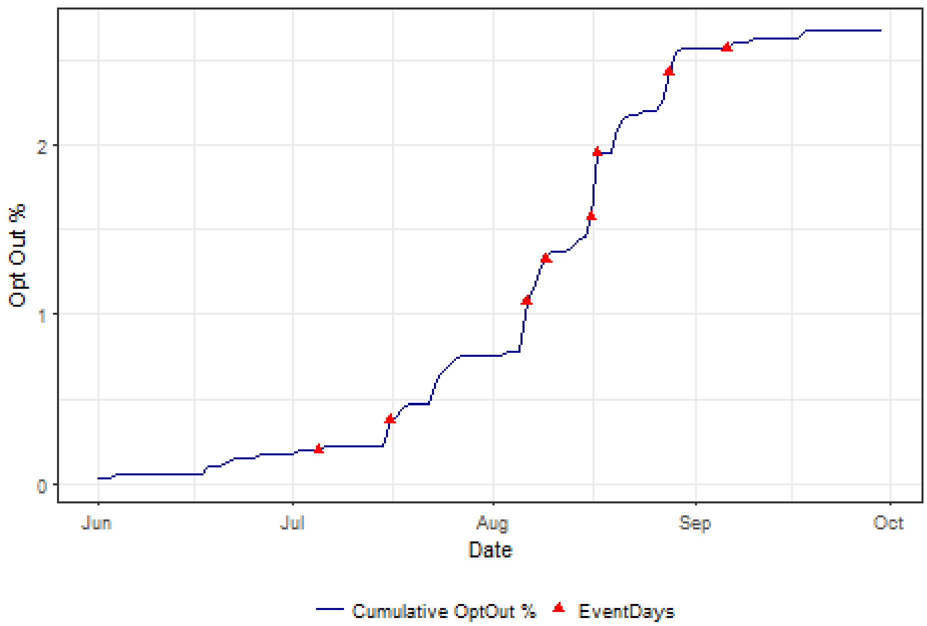

Figure 51: Cumulative Opt-Out as a Percent of Population

14 Comparison with Prior Years' Results

Table 40 presents a summary of results for the program for 2018 and 2017.

Table 40: kW Factor History

Population Segment	2017	2018
Residential - Thermostat A/C (kW)	1.46	1.29
Residential - DCU A/C (kW)	1.46	0.95
Residential - DCU Pool Pump (kW)	0.74	0.57
Residential - Whole Home Generator (kW)		3.9
Small Commercial - Thermostat A/C (kW)	2.67	2.21
Small Commercial - DCU A/C (kW)	2.67	1.25
Average Total Estimated Load Reduction (MW)	4.569	4.378

Notes: For 2018, all the kW factors are the average reduction over all event hours, excluding the first 15-minutes of the event.
An adjustment factor is applied to thermostats to account for offline devices based on the actual offline devices at the time of the event.
An A/Cs per home ratio is applied to the residential A/C DCU data to calculate a per device kW factor from the Insights+ whole home data.

14.1 Load Reduction kW Factor for 2017

Table 41 summarizes the load reduction results for 2017. For the 2017 curtailment season there were two curtailment events. The calculated reduction for the residential thermostat population was 1.46 kW. The estimated reduction for the residential DCU population was based on the residential thermostat population. The maximum hour reduction for the residential pool pump population was 0.74 kW. The calculated reduction for the small commercial thermostat population was 2.67 kW. The estimated reduction for the small commercial DCU population was based on the small commercial thermostat population. This resulted in a 4.569 MW demand response reduction estimate when applying the kW factor estimate to the active number of end points at the end of the season for each population.

Table 41: 2017 kW Reduction Results

Population Segment	kW Factor
Residential - Thermostat A/C (kW)	1.46
Residential - DCU A/C (kW)	1.46
Residential - DCU Pool Pump (kW)	0.74
Small Commercial - Thermostat A/C (kW)	2.67
Small Commercial - DCU A/C (kW)	2.67
Average Total Estimated Load Reduction (MW)	4.569

14.2 Load Reduction kW Factor for 2018

Table 42 summarizes the load reduction results for 2018. For the 2018 curtailment season there were three qualifying curtailment events used to calculate these load reduction results. The calculated reduction for the residential A/C thermostat population is 1.29 kW. The calculated reduction for the residential A/C DCU population is 0.95 kW. The calculated reduction for the residential pool pump population is 0.57 kW. The calculated reduction for the residential whole home generator population is 3.9 kW. The calculated reduction for the small commercial thermostat population is 2.21 kW. The estimated reduction for the small commercial DCU population is based on the relationship of residential thermostat to DCU savings per ton (i.e. SmallCommTstat/Ton * [(ResDCU/Ton)/(ResTstat/Ton)]*SmallCommDCU_AveTon). This resulted in a 4.38 MW demand response reduction estimate when applying the kW factor estimate to the active number of end points at the end of the season for each population.

Table 42: 2018 kW Reduction Results

Population Segment	2018
Residential - Thermostat A/C (kW)	1.29
Residential - DCU A/C (kW)	0.95
Residential - DCU Pool Pump (kW)	0.57
Residential - Whole Home Generator (kW)	3.9
Small Commercial - Thermostat A/C (kW)	2.21
Small Commercial - DCU A/C (kW)	1.25
Average Total Estimated Load Reduction (MW)	4.378

Notes: For 2018, all the kW factors are the average reduction over all event hours, excluding the first 15-minutes of the event.
An adjustment factor is applied to thermostats to account for offline devices based on the actual offline devices at the time of the event.
An A/Cs per home ratio is applied to the residential A/C DCU data to calculate a per device kW factor from the Insights+ whole home data.

15 Load Available for Curtailment

15.1 Temperature vs. Load Regression

Analysis of the temperature and the load data from the M&V sites indicates a strong positive correlation between these two variables. The available load can be estimated by regression analysis. *Figure 52* shows the hourly average load versus the temperature for the residential thermostat population. The hourly average load is calculated for non-holiday, non-event weekdays between June 1, 2018 and September 30, 2018 for the hours between 2-8PM EDT. The hourly temperature is from the NOAA KPOU weather station in Poughkeepsie, NY. The regression analysis indicates that there is approximately a 0.075 kW increase in load for every one-degree F increase in temperature based on data at or above 70°F. Based on these models, a temperature of 95°F would yield a load of about 2.34 kW on average.

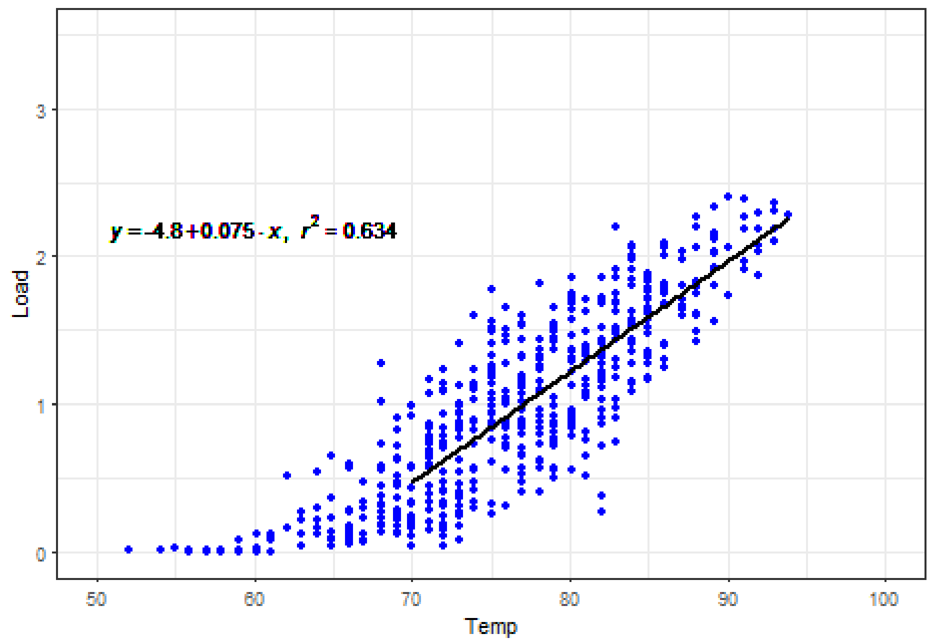

Figure 52: Residential Thermostat Temperature vs. Load

Figure 53 shows the hourly average load versus the temperature for the residential DCU population. The regression analysis indicates that there is approximately a 0.09 kW increase in load for every one-degree F increase in temperature. Based on these models, a temperature of 95°F would yield a load of about 3.59 kW on average. The data shown in the figure below illustrates the average whole home load. This load can contain multiple A/Cs (with multiple curtailment devices) as well as all other load in the home, and when a participant has solar it can contain negative load if the customer is pushing electricity back to the grid. The graph below does not present the total A/C load available for curtailment, it presents the total home load (of which the A/C load(s) is/are some portion).

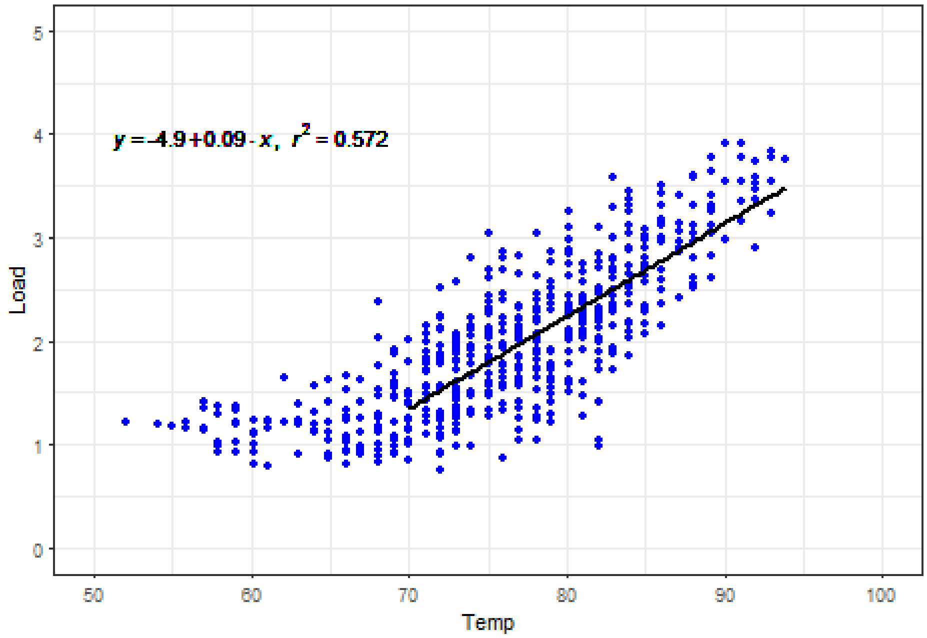

Figure 53: Residential DCU Temperature vs. Load

Figure 54 shows the hourly average load versus the temperature for the small commercial thermostat population. The regression analysis indicates that there is approximately a 0.131 kW increase in load for every one-degree F increase in temperature. Based on these models, a temperature of 95°F would yield load of about 4.54 kW of average load.

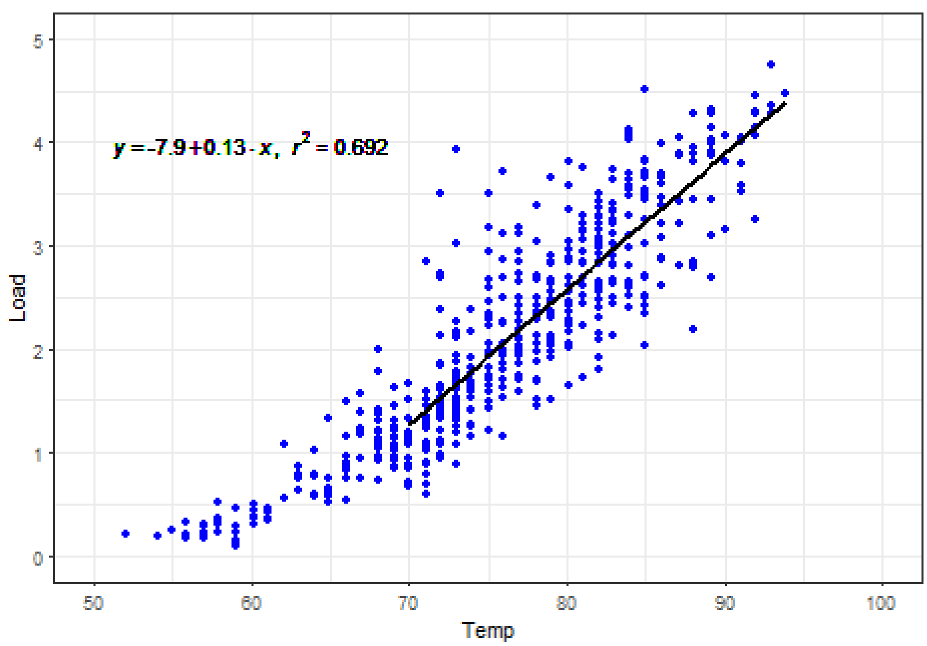

Figure 54: Small Commercial Temperature vs. Load

15.2 Estimate of Residential Thermostat Demand Response

Using the regression model from *Section 15* for the residential thermostat population, the available load for curtailment is estimated using different curtailment strategy percentages and a reception percentage of 90%. *Figure 55* shows the modeled available load from the regression model and the estimated load reduction using 25%, 50%, and 75% ADI curtailment methodologies. The estimated load reduction is calculated as:

$$Estimated\ Load\ Reduction\ (kW) = (Available\ Load\ (kW)) * (Curtailment\%) * (Reception\%)$$

For a temperature of 95°F, the 50% ADI load reduction is estimated as 1.05 kW. Note that in the 2018 control season most higher temperature days were either on weekends, holidays, or during curtailment events and are therefore not included in this regression analysis.

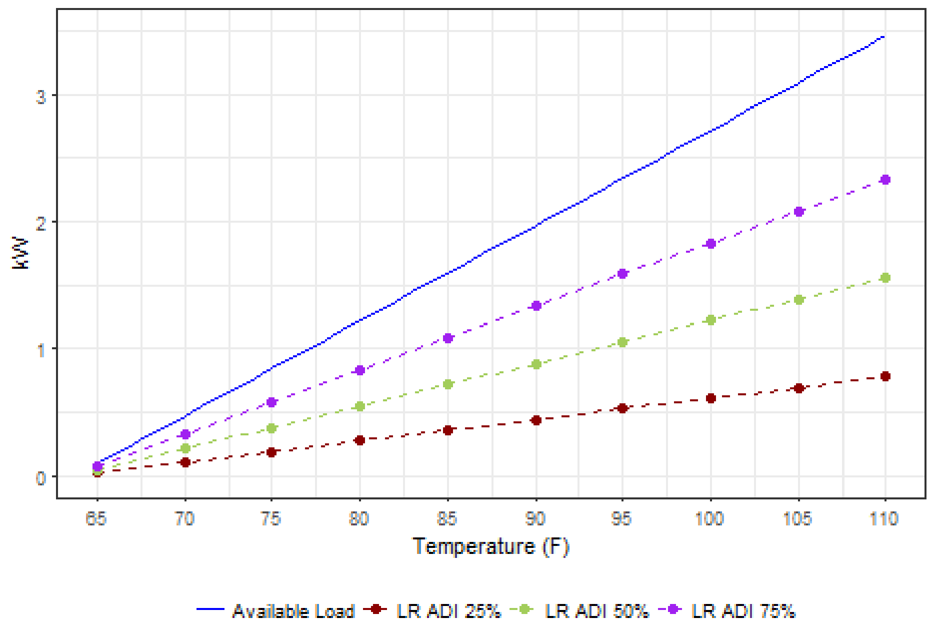

Figure 55: Residential Estimated Load Reduction

Table 43 presents the load reduction estimate for the residential thermostat population for select temperatures.

Table 43: Residential Thermostat Estimated Load Reduction

Cycling Level	85	87	89	91	93	95	97
ADI 25%	0.36	0.39	0.43	0.46	0.49	0.53	0.56
ADI 50%	0.72	0.78	0.85	0.92	0.99	1.05	1.12
ADI 75%	1.08	1.18	1.28	1.38	1.48	1.58	1.68
ADI 100%	1.43	1.57	1.70	1.84	1.97	2.11	2.24

16 Conclusions

For the 2018 curtailment season, Central Hudson called a total of eight curtailment events for the residential and small commercial populations and one test event and one retest event for the large commercial & industrial (C&I) population.

Table 44, below, presents the total MW reduction for the 2018 control season by segment. The demand response reduction for the residential and small commercial populations is 4.378 MW, based on the total installed end points of 3,994 throughout Central Hudson Peaks Perks program service area as of September 30th, 2018. The demand response reduction for the C&I population is 5.201 MW based on the curtailment performance of nine customers. The demand response reduction for the entire Peak Perks program is 9.579 MW.

Table 44: Summary of Reduction

Population	Device	Active end points as of 10/01/18	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	1,075	1.295	1.392
Residential	DCU - A/C	2,593	0.949	2.461
Residential	DCU - Pool Pump	68	0.570	0.039
Residential	DCU - Generator	18	3.896	0.070
Small Commercial	Thermostat - A/C	120	2.215	0.266
Small Commercial	DCU - A/C	120	1.250	0.150
Large C&I	Curtailment	9		5.201
Total		4,003		9.579

Note: Small Commercial DCU devices were not evaluated. The kW factor for this segment is estimated based on the relationship of residential thermostat to DCU savings per ton.

Sign Off Sheet

Pursuant to the contract between Central Hudson Gas & Electric Corporation and Itron Inc. for the Peak Perks Load Control Program ("Contract"), the undersigned hereby acknowledge and accept the M&V impact results for the Peak Perks program to be 1.29 kW for the residential A/C thermostat population, 0.95 kW for the residential A/C DCU population, 0.57 kW for the residential pool pump DCU population, 3.9 kW for the residential whole home generator population, 2.21 kW for the small commercial A/C thermostat population, and 1.25 kW for the small commercial A/C DCU population. The undersigned further acknowledge and agree that these calculations were made according to the methodologies and procedures prescribed in the Contract and accept the results to be valid for the Contract year ended September 30, 2018.

Signature: ______________________________

Name: Jean Shelton, Ph.D.

Title: Director, Strategic Analytics

Company: Itron, Inc.

Signature: ______________________________

Name: Mark Sclafani

Title: Program Manager

Company: Central Hudson Gas & Electric Corporation

Glossary

Term	Definition
A/C	Air Conditioner
AA	The Adaptive Algorithm is an Itron innovation, which insures that significant load reduction is contributed by each load management switch in the system even if the A/C system is running considerably under its maximum capacity before and during the curtailment period. The objective of the algorithm is to obtain a similar run time percentage reduction from A/C systems running at capacity as well as from those running at a rate somewhat less than full capacity. However, if an A/C system runtime is measured at less than 10% of the time, the algorithm assumes that the unit is off and a default reduction is implemented. The DCU is continually recording the run time of the A/C compressor for the previous hour. Assuming the measured run time of Y% and > 10%, when an AA curtailment message is received by the DCU for X% then the A/C is allowed to run (100%-X%)*Y% for a 30 minute interval. If Y% is < 10% then the A/C is allowed to run at 100%-X% for a 30-minute interval, the default reduction.
ADI	Adaptive Distributed Intelligence (ADI) is a method of performing Direct Load Control (DLC) with a randomized start time based on the actual usage of the attached appliance.
ArcGIS	A geographic information system (GIS) developed by ESRI of Redlands, CA. A GIS database integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.
BYOT	Bring Your Own Thermostat
CBL	Customer Baseline
CL	Connected Load. The Connected Load is set to the 99th percentile operating A/C load over the entire summer for those intervals that were greater than 700 Watts. If the nominal capacity of the A/C is known and the 99th percentile is 1.5 times greater than that value, then the 95th percentile was used to remove unreasonably high loads.
DENT	DENT Data Loggers are end-use metering devices. They are portable and can be used on a single or three phase system using a 80-600V phase-to-phase (AC or DC) services when line powered or 0-600V (AC or DC) when externally powered. The Meter Communication Module measures energy parameters (instantaneous voltage, current, power and power factor, and accumulated energy usage). The DENT ELOG program retrieves and stores the data.
DI	Distributed Intelligence (DI) is a method of performing Direct Load Control (DLC) with a randomized start time to provide a smooth load shed ramp over the population.
DR	Demand Response

Continued on next page

Term	Definition
EDX SignalPro	EDX® SignalPro® is the principal building block of EDX s comprehensive line of wireless network engineering tools. It offers all of the study types needed to design a basic wireless network, including area studies, link/point-to-point studies and route studies. EDX SignalPro also incorporates the telecom-specific mapping features, equipment data storage capabilities and convenient utility functions. Basic EDX SignalPro can be extended to become a fully featured and comprehensive network design tool by attaching the EDX network design and indoor modules, specialized query toolkits and data management products.
FSR	Field Service Request.
IntelliPEAK Switch	Highly reliable load control switch designed for electric utilities running demand response programs. Combining multiple relay outputs and a robust set of control strategies, a single devices can control multiple appliances, including HVAC units, electric water heaters, or pumps.
IntelliSOURCE	The Itron IntelliSOURCE platform is an enterprise-class software server and operating environment for energy management. IntelliSOURCE provides a two-way communication link to residential and commercial and industrial customers and supports direct load, dynamic pricing controls, and next generation upgrades such as variable pricing, renewable energy management, and electric vehicle charging. Key features include: Communications to existing back office infrastructure and support for third-party systems. Command and control: Handles grouping and addressing structures; algorithms and curtailment operations; device management and configuration; and event generation and control. Data management. Analysis and evaluation of the performance of DR programs.
IntelliTEMP DirectLink	Smart thermostat which combines a streamlined design with a modular Wi-Fi radio that eliminates the need for third-party products to deliver two-way communications between a utility and end user. The use of IP-based communications provides near real-time feedback, near real-time presence, and constant telemetry of IntelliTEMP DirectLink devices to give utilities a clearer view of currently available load.
kW	Kilowatt: One Kilowatt equals 1000W.
M&V	Measurement and Verification.
MW	Megawatt: One Megawatt equals 1000 kW
NAESB	North American Energy Standards Board
NOAA	National Oceanic and Atmospheric Administration
NYISO	New York Independent System Operator

Continued on next page

Term	Definition
OTA	Over-the-air (OTA) messaging provides remote control of curtailment devices for service and subscription activation, personalization and programming of a new service and device features.
PCT	Programmable Control Thermostat.
PowerCAMP	PowerCAMP was developed by Itron to allow for data collection from M&V sites.
QA/QC	Quality Assurance/Quality Control
R	A programming language and software environment for statistical computing and graphics.
R2	R2 is the square of correlation coefficient (measure of the strength of linear dependence between two variables) between the observations (outcomes) and their predicted values and is described by the following formula: R2 = {Sum of Squares of Residuals (sum or squared errors of predictions}/{Sum of Squares of the difference of the dependent variable and its mean (variance)}
RDLC	Repeating Direct Load Control is a method of Direct Load Control (DLC) whereby all devices start curtailment at the same time and have a +/- 1.5 minute randomized ramp out of curtailment.
RTM	The Remote Terminal Monitor (RTM) receives all of the pages transmitted and forwards this information back to PowerCAMP/IntelliSOURCE. A comparison is made to verify that each message transmitted is received in the project area. The system is programmed to listen for messages with the specific CAPCODE assigned to the project. If an expected message is not received then program operators are alerted by the system.
SOC	The Itron Solution Operations Center (SOC) monitors the servers (PowerCAMP and IntelliSOURCE) to ensure the applications required to collect the data are running and monitors the curtailment events.
THI	Temperature Heat Index
Tonnage, A/C Ton	A measure of curtailment capacity of an A/C. One Ton equals 12000 BTUs/hr

A Event Day Reduction Tables

For the 2018 curtailment season for the residential and small commercial populations, there were eight curtailment events. This Appendix details the 15-minute reductions using the baseline adjustment method. The graphs for these events are presented in *Section 12*.

A.1 Residential A/C Thermostat

Table 46: Residential Thermostat 15-minute Load Reductions July 16, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	89	0.75	1.86	2.03	1.28
16:15	89	0.77	1.89	2.07	1.30
16:30	89	0.74	1.90	2.08	1.34
16:45	89	0.78	1.93	2.11	1.33
17:00	89	0.75	1.94	2.12	1.37
17:15	89	0.78	1.93	2.11	1.33
17:30	89	0.76	1.93	2.12	1.36
17:45	89	0.79	1.94	2.12	1.32

Table 47: Residential Thermostat 15-minute Load Reductions August 6, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	90	0.86	1.31	1.66	0.80
16:15	90	0.74	1.30	1.64	0.90
16:30	90	0.70	1.31	1.65	0.95
16:45	90	0.71	1.32	1.67	0.96
17:00	89	0.69	1.33	1.68	0.99
17:15	89	0.72	1.39	1.75	1.03
17:30	89	0.72	1.39	1.76	1.04
17:45	89	0.74	1.38	1.74	1.00

Table 48: Residential Thermostat 15-minute Load Reductions August 9, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	84	0.67	1.44	1.36	0.68

Table 49: Residential Thermostat 15-minute Load Reductions August 16, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	88	0.72	1.37	1.30	0.58
16:15	88	0.65	1.38	1.30	0.65
16:30	88	0.63	1.37	1.29	0.66
16:45	88	0.64	1.39	1.31	0.67
17:00	88	0.62	1.40	1.33	0.70
17:15	88	0.66	1.43	1.35	0.69
17:30	88	0.65	1.43	1.35	0.70
17:45	88	0.69	1.40	1.33	0.64

Table 50: Residential Thermostat 15-minute Load Reductions August 17, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	84	0.56	1.40	1.09	0.53
16:15	84	0.52	1.40	1.08	0.57
16:30	84	0.48	1.40	1.09	0.61
16:45	84	0.52	1.42	1.10	0.58
17:00	84	0.49	1.44	1.12	0.62
17:15	84	0.54	1.47	1.14	0.60
17:30	84	0.53	1.47	1.14	0.61
17:45	84	0.56	1.45	1.13	0.56

Table 51: Residential Thermostat 15-minute Load Reductions August 28, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	92	0.88	1.41	1.93	1.04
16:15	92	0.78	1.39	1.91	1.13
16:30	92	0.77	1.42	1.95	1.18
16:45	92	0.74	1.44	1.98	1.24
17:00	91	0.74	1.47	2.01	1.27
17:15	91	0.76	1.48	2.03	1.27
17:30	91	0.76	1.48	2.03	1.27
17:45	91	0.77	1.47	2.02	1.25

Table 52: Residential Thermostat 15-minute Load Reductions September 6, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	76	0.82	1.68	2.00	1.18
16:15	76	0.70	1.69	2.02	1.32
16:30	76	0.69	1.71	2.04	1.35
16:45	76	0.66	1.70	2.02	1.36
17:00	75	0.67	1.75	2.08	1.42
17:15	75	0.68	1.75	2.08	1.40
17:30	75	0.65	1.73	2.06	1.41
17:45	75	0.66	1.69	2.02	1.36

A.2 Residential A/C DCU

Table 53: Residential DCU 15-minute Load Reductions July 5, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:15	90	2.07	2.67	3.00	0.93
16:30	90	1.88	2.58	2.89	1.01
16:45	90	2.20	2.52	2.83	0.63

Table 54: Residential DCU 15-minute Load Reductions July 16, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	89	1.86	2.50	2.85	0.99
16:15	89	2.02	2.53	2.89	0.87
16:30	89	1.96	2.53	2.88	0.93
16:45	89	2.05	2.48	2.83	0.78
17:00	89	1.86	2.52	2.87	1.01
17:15	89	2.09	2.60	2.97	0.87
17:30	89	1.99	2.58	2.94	0.95
17:45	89	2.11	2.53	2.89	0.78

Table 55: Residential DCU 15-minute Load Reductions August 6, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	90	1.82	1.97	2.42	0.60
16:15	90	1.73	1.98	2.44	0.71
16:30	90	1.84	1.96	2.41	0.57
16:45	90	1.84	1.95	2.39	0.56
17:00	89	1.90	1.96	2.41	0.51
17:15	89	1.91	1.99	2.45	0.54
17:30	89	1.93	1.96	2.42	0.49
17:45	89	1.92	2.00	2.46	0.54

Table 56: Residential DCU 15-minute Load Reductions August 9, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	84	1.54	2.07	2.03	0.49

Table 57: Residential DCU 15-minute Load Reductions August 16, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	88	1.61	2.17	2.15	0.54
16:15	88	1.63	2.18	2.16	0.53
16:30	88	1.72	2.11	2.09	0.36
16:45	88	1.76	2.14	2.12	0.36
17:00	88	1.80	2.08	2.06	0.26
17:15	88	1.88	2.15	2.12	0.24
17:30	88	1.84	2.20	2.18	0.34
17:45	88	1.83	2.10	2.08	0.25

Table 58: Residential DCU 15-minute Load Reductions August 17, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	84	1.54	2.34	1.95	0.41
16:15	84	1.48	2.35	1.96	0.48
16:30	84	1.58	2.29	1.91	0.33
16:45	84	1.67	2.30	1.92	0.25
17:00	84	1.71	2.23	1.86	0.15
17:15	84	1.72	2.29	1.91	0.19
17:30	84	1.78	2.33	1.94	0.17
17:45	84	1.67	2.26	1.89	0.22

Table 59: Residential DCU 15-minute Load Reductions August 28, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	92	1.93	1.98	2.83	0.90
16:15	92	1.84	2.00	2.86	1.02
16:30	92	2.02	2.02	2.89	0.87
16:45	92	1.91	2.11	3.02	1.11
17:00	91	2.09	2.08	2.97	0.88
17:15	91	2.00	2.10	3.00	1.00
17:30	91	2.19	2.11	3.02	0.83
17:45	91	2.05	2.09	3.00	0.95

Table 60: Residential DCU 15-minute Load Reductions September 6, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	76	1.88	2.31	2.82	0.95
16:15	76	1.85	2.29	2.80	0.96
16:30	76	1.84	2.39	2.92	1.07
16:45	76	1.92	2.43	2.97	1.05
17:00	75	1.94	2.37	2.90	0.95
17:15	75	1.92	2.39	2.93	1.01
17:30	75	1.89	2.39	2.92	1.03
17:45	75	1.86	2.37	2.89	1.03

A.3 Residential Pool Pump

Table 61: Residential Pool Pump 15-minute Load Reductions August 6, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	90	0.02	0.62	0.65	0.63
16:15	90	0.00	0.62	0.65	0.65
16:30	90	0.00	0.61	0.64	0.64
16:45	90	0.00	0.58	0.61	0.61
17:00	89	0.00	0.55	0.58	0.58
17:15	89	0.00	0.55	0.58	0.58
17:30	89	0.00	0.54	0.57	0.57
17:45	89	0.00	0.55	0.57	0.57

Table 62: Residential Pool Pump 15-minute Load Reductions August 9, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	84	0	0.56	0.56	0.56

Table 63: Residential Pool Pump 15-minute Load Reductions August 16, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	88	0.00	0.61	0.61	0.61
16:15	88	0.00	0.60	0.61	0.61
16:30	88	0.00	0.57	0.57	0.57
16:45	88	0.00	0.54	0.54	0.54
17:00	88	0.00	0.51	0.52	0.52
17:15	88	0.00	0.51	0.52	0.52
17:30	88	0.00	0.50	0.51	0.51
17:45	88	0.01	0.50	0.51	0.50

Table 64: Residential Pool Pump 15-minute Load Reductions August 17, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	84	0.00	0.64	0.60	0.60
16:15	84	0.00	0.64	0.60	0.60
16:30	84	0.00	0.60	0.56	0.56
16:45	84	0.00	0.56	0.53	0.53
17:00	84	0.00	0.54	0.51	0.51
17:15	84	0.00	0.54	0.51	0.51
17:30	84	0.00	0.53	0.50	0.50
17:45	84	0.00	0.53	0.49	0.49

Table 65: Residential Pool Pump 15-minute Load Reductions August 28, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	92	0	0.60	0.63	0.63
16:15	92	0	0.60	0.63	0.63
16:30	92	0	0.57	0.59	0.59
16:45	92	0	0.55	0.58	0.58
17:00	91	0	0.52	0.54	0.54
17:15	91	0	0.51	0.53	0.53
17:30	91	0	0.50	0.52	0.52
17:45	91	0	0.50	0.52	0.52

A.4 Residential Whole Home Generator

Table 66: Residential Whole Home Generator 15-minute Load Reductions August 6, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	89	-0.08	2.23	3.17	3.25
17:15	89	-0.00	2.28	3.25	3.25
17:30	89	0.10	2.11	3.01	2.91
17:45	89	0.18	2.12	3.02	2.84

Table 67: Residential Whole Home Generator 15-minute Load Reductions August 9, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	84	0.17	2.35	2.46	2.29

Table 68: Residential Whole Home Generator 15-minute Load Reductions August 16, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	88	-0.14	2.68	2.36	2.50
16:15	88	-0.04	2.67	2.35	2.40
16:30	88	-0.19	2.44	2.15	2.34
16:45	88	-0.14	2.37	2.08	2.22
17:00	88	-0.12	2.51	2.21	2.33
17:15	88	-0.08	2.71	2.38	2.47
17:30	88	-0.05	2.51	2.21	2.26
17:45	88	-0.03	2.37	2.08	2.11

Table 69: Residential Whole Home Generator 15-minute Load Reductions August 17, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	84	-0.01	2.68	2.52	2.53
16:15	84	0.04	2.67	2.52	2.48
16:30	84	0.05	2.44	2.30	2.25
16:45	84	-0.18	2.37	2.23	2.41
17:00	84	-0.20	2.51	2.36	2.56
17:15	84	-0.07	2.71	2.55	2.62
17:30	84	0.01	2.51	2.36	2.35
17:45	84	-0.05	2.37	2.23	2.28

Table 70: Residential Whole Home Generator 15-minute Load Reductions August 28, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	93	-0.50	2.27	3.28	3.78
15:15	93	-0.46	2.31	3.34	3.80
15:30	93	-0.44	2.45	3.55	3.98
15:45	93	-0.38	2.65	3.83	4.21
16:00	92	-0.34	2.60	3.76	4.10
16:15	92	-0.26	2.55	3.69	3.95
16:30	92	-0.20	2.41	3.48	3.68
16:45	92	-0.16	2.42	3.50	3.67

A.5 Small Commercial A/C Thermostats

Table 71: Small Commercial Thermostat 15-minute Load Reductions August 6, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	90	1.46	3.15	3.08	1.62
16:15	90	1.56	2.90	2.83	1.27
16:30	90	1.17	2.65	2.59	1.42
16:45	90	1.15	2.61	2.55	1.40
17:00	89	1.05	2.40	2.34	1.29
17:15	89	0.99	2.35	2.30	1.30
17:30	89	0.84	2.33	2.28	1.44
17:45	89	1.23	2.23	2.17	0.95

Table 72: Small Commercial Thermostat 15-minute Load Reductions August 9, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	84	1.38	2.44	2.32	0.94

Table 73: Small Commercial Thermostat 15-minute Load Reductions August 16, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	88	2.01	3.26	3.40	1.39
16:15	88	1.74	3.03	3.16	1.42
16:30	88	1.63	2.91	3.04	1.42
16:45	88	1.59	2.84	2.97	1.37
17:00	88	1.47	2.65	2.77	1.30
17:15	88	1.50	2.70	2.82	1.32
17:30	88	1.64	2.66	2.78	1.14
17:45	88	1.56	2.45	2.56	1.00

Table 74: Small Commercial Thermostat 15-minute Load Reductions August 17, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	84	1.72	3.44	3.26	1.54
16:15	84	1.70	3.20	3.03	1.33
16:30	84	1.30	3.11	2.95	1.65
16:45	84	1.40	3.02	2.86	1.46
17:00	84	1.27	2.87	2.71	1.44
17:15	84	1.28	2.87	2.72	1.44
17:30	84	1.32	2.88	2.72	1.41
17:45	84	1.23	2.50	2.37	1.14

Table 75: Small Commercial Thermostat 15-minute Load Reductions August 28, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	92	1.88	3.05	3.51	1.64
16:15	92	1.87	3.26	3.76	1.88
16:30	92	1.67	3.30	3.80	2.13
16:45	92	1.28	2.97	3.42	2.14

Table 76: Small Commercial Thermostat 15-minute Load Reductions September 6, 2018

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
16:00	76	2.06	3.13	3.86	1.80
16:15	76	1.32	3.20	3.95	2.63
16:30	76	1.68	3.28	4.04	2.36
16:45	76	1.13	3.12	3.85	2.73
17:00	75	1.32	3.04	3.75	2.43
17:15	75	0.85	2.83	3.48	2.63
17:30	75	1.17	2.63	3.24	2.07
17:45	75	0.73	2.33	2.87	2.13

B Residential A/C DCU A vs B Group Load Shapes

For the residential A/C DCU population, the M&V sample was grouped in an A/B design and was proportionally allocated based on the participant population distribution by region and A/C tonnage. These groups remained constant throughout the season except for changes needed to reduce bias between the groups or changes needed when sites were deactivated. The curtailment event scheduling alternated the group curtailed between successive events. For the July 16th event, only M&V group A was curtailed and for the August 6th event, only group B was curtailed. With whole-home AMI data, it is not possible to disaggregate the load contribution from each A/C. Therefore, it is difficult to separate the population into two groups of near-equal A/C load. When there are differences in consumption between the groups, it is not known if they are associated with the A/C. It was therefore determined that higher precision could be achieved by curtailing the entire M&V population simultaneously and utilizing a CBL methodology to estimate the load impacts.

Figure 56 and Figure 57, below, present the load shapes for the A and B groups for the July 16th and August 6th events.

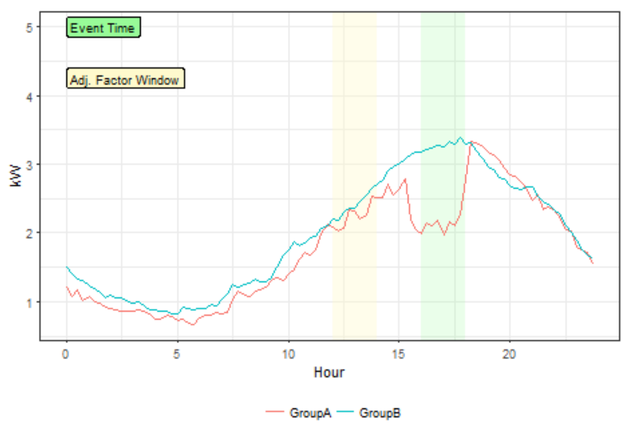

Figure 56: Residential A/C DCU A vs B Group M&V Load July 16, 2018

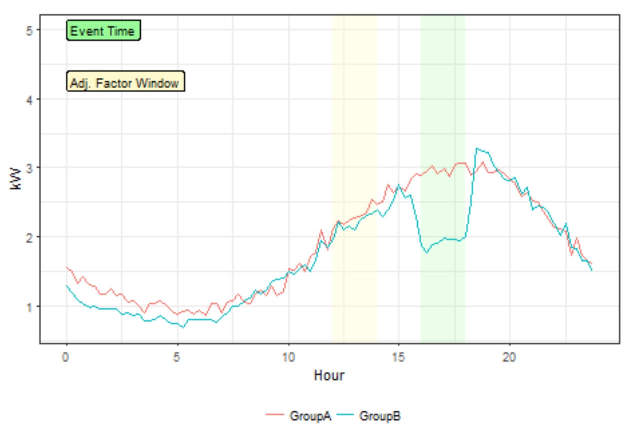

Figure 57: Residential A/C DCU A vs B Group M&V Load August 6, 2018

Operation Procedure for TDM Non-Wires Alternative (“NWA”) and Incentive Calculations:

Version 3.0

December 1, 2018

Central Hudson Gas & Electric

Non-Wires Alternative: Targeted Demand Management (TDM) Program Within Northwest Area, Fishkill, and Merritt Park

1. MW attainment

Central Hudson's NWA is designed to relieve load during times of constraint, effectively creating a capacity resource. Performance will be measured based on the attainment of capacity (i.e. load relief or load reduction) in the TDM Program. The approach will vary based on customer and equipment type. The measures utilized to relieve load fall into two categories, prescriptive direct load control ("DLC") measures, and non-prescriptive measures.

Prescriptive Direct Load Control (Measures)

A direct load control measure is a load reduction device which is operated by or on behalf of Central Hudson via remote communication during a curtailment event ("event"), without requiring any customer intervention. Within the TDM program, DLC devices include Wi-Fi enabled thermostats and Digital Control Units ("DCU"). DLC's are available to both residential and small commercial customers. Due to the high volume of DLC measures and relative uniformity of impact, a prescriptive level of load relief, or "load factor," will be used for the following DLC measures, shown in the table below.

Table 1: DLC Prescriptive Load Factors[1]

Device Type	Segment	Load Factor
Peak Perks WiFi Thermostat[2] – Central A/C	Residential	1.30kW
Peak Perks WiFi Thermostat – Central A/C	Commercial	2.22kW
Retail Thermostat[3] – Central A/C	Residential	0.50kW
Retail Thermostat – Central A/C	Commercial	0.50kW
Digital Control Unit[4] – Central A/C	Residential	0.95kW
Digital Control Unit – Central A/C	Commercial	1.25kW
Digital Control Unit – Water Heater	Residential	0.30kW
Digital Control Unit – Pool Pump	Residential	0.57kW
Digital Control Unit – Pool Pump	Commercial	0.57kW
Digital Control Unit – Whole Home Backup Generation[5]	Residential	3.90kW

[1] kW factors will be revised annually through the annual M&V report, filed on December 1st of each program year, which will supersede the kW factors in Table 1 for the purposes of calculating incentives.
[2] Itron IntelliTEMP model IT801
[3] Commercially available devices such as Honeywell, Nest, & Ecobee. Cycling strategies vary by device and manufacturer.
[4] Itron IntelliPEAK digital control unit
[5] Participating customers are automatically switched to backup generator power during an event using a digital control unit. Only propane and natural gas powered generators sized for the power needs of the customer's entire home will be eligible. Load factors are based on data from Central Hudson's existing load research metering sample. Because this is a curtailment program only, participants may not use generators to export energy onto the utility grid. Each participant will be provided with (6) LED bulbs at the time of installation.

These load factors have been deemed reasonable by at least one third party evaluation consultant for accuracy and consistency with similar programs in other jurisdictions. When additional measures are added into the program, unique load factors will be assigned and similarly vetted.

Central Hudson will calculate the MW attainment for the DLC measures based on the following formula utilizing load factors validated through the most recent M&V protocol and will provide to DPS Staff on an annual basis.

$$Peak\ Load\ Reduction = \sum_{i=1}^{n} \frac{Quantity_{Device\ Type\ i} \times Load\ Factor_{Device\ Type\ i}}{1 - Loss\%_{d\rightarrow r}}$$

Where:

$\mathbf{Quantity_{Device\ Type\ i}}$ is the number devices of a given type which are currently active within the TDM program.

$\mathbf{Load\ Factor_{Device\ Type\ i}}$ is calculated for each device type as the average kW reduction of all active devices during all events in a given season.

$\mathbf{Loss_{d\rightarrow r}}$ (%) represents the line losses which occur from the deferred infrastructure to the retail delivery point.

Prescriptive DLC Measurement & Verification

Measurement & Verification (M&V) will be used to perform reconciliations of these load factors for all DLC device types on an annual basis. A CBL[6] methodology will be used to perform M&V, using device telemetry data or secondary monitoring equipment. A detailed description of the M&V protocol has been included within Central Hudson's 2018 Annual TDM Program Report.[7] The final load impact estimates are the result obtained from a baseline methodology similar to those defined in the NYISO Emergency Demand Response Program Manual. One such methodology is entitled "The Average Day CBL for Weekdays".[8]

Non-Prescriptive Measures

Load relief within the TDM program can also be achieved through a variety of non-prescriptive load reduction measures. Large Commercial & Industrial (C&I) participants commit to reduce their energy usage when called upon utilizing a variety of customer initiated, site specific curtailment strategies. Direct load control devices in non-standard applications such as agricultural pumps are also considered non-prescriptive. Unique

[6] Customer Baseline Load

[7] Central Hudson Gas & Electric Corporation's 2018 Annual Report for the Targeted Demand Management (TDM) Program, a Central Hudson Non-Wires Alternative.

[8] New York Independent System Operator, "Emergency Demand Response Program Manual", Manual 7, October 2013, p. 5-4.

MW attainment values are assigned to each non-prescriptive device or participating facility to account for significant variances across these populations.

After each control season, each participating customer will be assigned a unique performance factor ("PF") based on performance in the annual 1-hour test event, or system-need-based events of up to 4 hours should they occur. The PF will be taken as the average participant performance of all event hours throughout the season.

The example below illustrates the PF calculation:

Table 2: Example PF Calculation

Event	Event Hour Ending	Enrollment (kW)	Performance (kW)	PF
Annual Test[9]	15:00	100	98	0.98
DR Event 1	14:00	100	97	0.97
DR Event 1	15:00	100	92	0.92
DR Event 1	16:00	100	96	0.96
DR Event 1	17:00	100	91	0.91
DR Event 2	15:00	100	101	1.01
DR Event 2	16:00	100	95	0.95
DR Event 2	17:00	100	97	0.97
Seasonal Performance Factor				**0.96**

Central Hudson will calculate the MW attainment for non-prescriptive measures based on the following formula utilizing the performance factors validated through the most recent M&V study and will provide to DPS Staff on an annual basis.

$$Peak\ Load\ Reduction = \sum_{i=1}^{n} \frac{Enrolled\ Capacity_{\ Participant\ i} \times PF_{Seasonal-Participant\ i}}{1 - Loss\%_{d \to r}}$$

Where:

Enrolled Capacity $_{\textbf{Participant i}}$ is the kW load relief commitment for an individual participant or premise.

$\mathbf{Loss_{d \to r}}$ (%) represents the line losses which occur from the deferred infrastructure to the retail delivery point.

[9] If a demand response event were to occur before the annual test within a given season, the annual test may then be canceled. Customers are entitled to one re-test after the annual test event.

$\mathbf{PF_{Seasonal-Participant\ i}}$	is the Seasonal Performance Factor for an individual participant or premise.

Non-Prescriptive Demand Response M&V

Baseline and performance data will be obtained through interval metering, DLC device telemetry, or other secondary measurement devices. A customer CBL[10] methodology will be used to perform M&V. A detailed description of the M&V protocol has been included within Central Hudson's 2018 Annual TDM Program Report.[11] The final load impact estimates are the result obtained from a baseline methodology similar to those defined in the NYISO Emergency Demand Response Program Manual. One such methodology is entitled "The Average Day CBL for Weekdays".[12]

When a non-prescriptive resource enrolls, interim MW attainment estimates will be used until M&V is performed during the first control season. These estimates will be based on C&I curtailment plans developed in accordance with each facility's operations, nameplate motor capacities, hours of operation, and other site-specific factors. MW attainment will later be updated based on the M&V results.

Energy Efficient Lighting

Efficient lighting has been deployed within Central Hudson's NWA to manage peak load. Existing inefficient lighting fixtures are identified and replaced with high efficiency systems or retrofitted where appropriate. The baseload reductions achieved through efficient lighting projects contribute to the peak load management goals of this NWA.

Energy Efficient Lighting M&V

Peak load reductions associated with energy efficient lighting projects are already well within the current Technical Reference Manual[13] ("Tech Manual"), based on the following modified formula:

$$\Delta kW_{loc} = \frac{(W\ x\ units)_{baseline} - (W\ x\ units)_{ee}}{1{,}000\ x\ \ (1 - Loss\%_{d \rightarrow r})}\ x\ (1 + HVAC_d)x\ CF_{loc}$$

[10] Customer Baseline Load

[11] Central Hudson Gas & Electric Corporation's 2018 Annual Report for the Targeted Demand Management (TDM) Program, a Central Hudson Non-Wires Alternative.

[12] New York Independent System Operator, "Emergency Demand Response Program Manual", Manual 7, October 2013, p. 5-4.

[13] The New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs – Residential, Multi-Family, and Commercial/Industrial Measures, Version 5.2. Avoided line losses have been added for consistency with other measures within this NWA.

Where:

$\Delta kW_{loc}=$ Locational kW reduction

$\boldsymbol{W} =$ Fixture Watts

$\boldsymbol{HVAC_d} =$ HVAC Interactive Factor, as determined by the Tech Manual

$\boldsymbol{CF_{loc}} =$ Coincidence with locational peak

$\mathbf{Loss_{d \to r}}$ (%) = the line losses which occur from the deferred infrastructure to the retail delivery point

Tech Manual approach has been slightly modified for use in an NWA. The coincidence factor ("CF") within the Technical Manual is designed to represent coincidence with the NY bulk power system. For locational peak load reductions, this CF needs to be more granular and specific to each NWA. Central Hudson has developed coincidence factors associated specifically with this NWA project. The CF's were developed by comparing 7 years of historical temporal load data to typical usage profiles of commercial lighting. These profiles were weighted based on the historical business types that have participated in Central Hudson's commercial lighting programs. The results are shown below:

Table 3: Peak Coincidence

Metric	Northwest Area	Merritt Park	Shenandoah-Fishkill Plains
Average Peak CF ("CF")	58.6%	69.1%	58.4%

The Average Peak CF should remain fixed throughout the term of the NWA, since the program was designed to alleviate the initially identified constraint and will inherently affect the load shape over time as the need is met.

Energy Efficient Lighting Benefit/Cost Considerations

Because the energy efficient lighting initiative is associated with Central Hudson's energy efficiency portfolio, special considerations for benefit cost accounting must be made. The baseline costs and benefits associated with energy efficient lighting have already been accounted for within the energy efficiency portfolio. These baseline costs and benefits include administrative costs, incentive costs, carbon reduction, and wholesale capacity savings. Significant geographic targeting however, generates incremental costs and benefits associated specifically with this NWA. The incremental benefits come from higher adoption rates within NWA areas. The incremental costs come from enhanced incentives and marketing required to achieve higher adoption rates.

Reporting

Following each capability period (June 1st – September 30th) Central Hudson's program partner, Itron, will produce a seasonal M&V report detailing the load reduction performance of the overall program. Central Hudson will review and vet this report via a third party evaluator, and share with DPS Staff by December 1st of each year.

The M&V report will contain the following key pieces of aggregated or average performance data for each event:

- Date, Times, & Duration of Events
- CBL
- Weather Adjusted CBL
- Event Day Load
- Number of Connected Devices & Participants
- Event Average kW Reduction Per Device Type

These metrics will be used to determine a seasonal average kW reduction for each device type and customer segment with updated load factors and power factors in each annual M&V report. New load factors and power factors will take effect when the annual M&V report is filed, beginning in year 2017.

Following the attainment of the first capacity milestone of 8MW and the second capacity milestone of 16MW, Central Hudson will provide a report utilizing the same protocol described above, which details the source, devices and load factors validated through the most recent M&V protocol. This report may be provided as soon as 30 days following attainment of the capacity milestone.

2. Incentive Calculation (excluding wholesale capacity market benefits)

Central Hudson's Incentives will be determined as a share of net NWA program benefits. Central Hudson's incentive for deferring capital expenditures will equal 30% of the TDM program benefits, excluding wholesale capacity market impacts. The TDM program is comprised of three distinct zones. Incentives will be based on the MW attained in the aggregate of the three TDM zones. The incentive will be split evenly based on two milestones, with 50% of the incentive awarded when half the target MW of the portfolio (8.0 MW) is achieved. The remaining 50% of the incentive will be earned when the full MW target of the portfolio (16.0 MW) is achieved.

Net NWA program benefits are calculated as follows:

$$NWA\ Benefits_{net} = Benefits_{T\&D\ deferral} - Costs_{NWA\ Program}$$

Where $Benefits_{T\&D\ deferral}$ have been provided to Staff by Central Hudson. These values will be fixed for the purposes of this analysis throughout the NWA program period.

And $Costs_{NWA\ Program}$ include all fees paid to program providers, including fixed program support fees, capacity recruitment fees, and capacity maintenance fees. Actual costs and current projects will be utilized to calculate the incentive amount at the time of the milestone triggers. These costs are currently documented within the Master Services Agreement between Central Hudson and Itron. Additionally, $Costs_{NWA\ Program}$ include costs internal to Central Hudson to manage the program, as well as third party program evaluation and consulting support that is procured as needed. All program costs will be trued-up to actual expenditures at each milestone for the purposes of incentive calculation.

The NPV of the Costs of the NWA Program are capped at 120% of the program costs included in the Company's November 23, 2015 benefit cost filing, which allows for a reasonable level of contingencies while still resulting in a cost effective program. If projections resulting in an NPV of Program Costs exceeding 120%, Central Hudson will notify PSC Staff in order to determine if the program should be discontinued.

The following assumptions are used in calculating the net benefits of the program. These assumptions will remain fixed throughout the term of the NWA, per the July 15th Order.[14]

Fixed Assumptions

Equity Ratio	**48.0%**
ROE for earnings	**9.0%**
After Tax WACC	**6.62%**
DER-enabled deferral period	**10**
Income Tax Rate	**39.2%**
Inflation Rate	**2.1%**
DER depreciation book life (years)	**5.0**

See spreadsheet attached as Appendix A for detailed reconciliation methodology. Following the attainment of the first capacity milestone of 8MW and the second capacity milestone of 16MW, Central Hudson will record and amortize the incentive payout as detailed in the accounting procedure which has previously been filed confidentially.

[14] Case 14-E-0318, Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Electric Service, Order implementing with Modification The Proposal for Cost Recovery and Incentive Mechanism for Non-Wire Alternative Project ("July 15th Order") (issued July 15th 2016).

3. Wholesale Capacity Generation Benefits & Incentive

Through strategic utilization of demand response resources during the annual NYISO zone G-J peak hour, and during the NYCA (New York Control Area) statewide peak hour, Central Hudson can create a monetary wholesale capacity benefit by reducing the Company's UCAP requirement. Central Hudson has developed the following methodology to measure and report any benefits associated with the NWA impact on wholesale capacity cost.

$$\text{NWA Capacity Benefits}_{Yn} =$$

$$\frac{\Delta\text{PeakLoad}_{Yn-1,G-J}}{1-Loss\%_{b\rightarrow r}} * \text{Requirement }\%_{G-J} * 6\text{ months} * \{\text{Capacity Price}_{Yn,G-J,S} * \left(1-\text{Derating Factor}_{G-J,S}\right) + \text{Capacity Price}_{Yn,G-J,W} * \left(1-\text{Derating Factor}_{G-J,W}\right)\}$$

$$+$$

$$\frac{\Delta\text{PeakLoad}_{Yn-1,NYCA}}{1-Loss\%_{b\rightarrow r}} * \left(\text{Requirement }\%_{NYCA} - \text{Requirement }\%_{G-J}\right) * 6\text{ months} * \{\text{Capacity Price}_{Yn,NYCA,S} * \left(1-\text{Derating Factor}_{NYCA,S}\right) + \text{Capacity Price}_{Yn,NYCA,W} * \left(1-\text{Derating Factor}_{NYCA,W}\right)\}$$

The indices of the parameters in this equation include:

- o Yn = The capability year for which wholesale capacity benefits are being determined, from May 1 to April 30th.
- o G-J = NYISO capacity zones G,H,I & J
- o NYCA = NYCA capacity location (include all 11 internal NYISO load zones)
- o S = Summer
- o W = Winter
- o Yn-1 = The year preceding the capability year (Yn)

$\mathbf{\Delta PeakLoad}_{\boldsymbol{Yn-1,G-J}}$ ($\mathbf{\Delta kW}$) is the magnitude of load reduction which occurred as a result of the NWA during the preceding year's zone G-J peak hour, excluding reductions occurring at sites receiving electric service under the Hourly Pricing Provision. Load reductions will be calculated in accordance with Section 1.

$\mathbf{\Delta PeakLoad}_{\boldsymbol{Yn-1,NYCA}}$ ($\mathbf{\Delta kW}$) is the magnitude of load reduction which occurred as a result of the NWA during the preceding year's NYCA peak hour, excluding reductions occurring at sites receiving electric service under the Hourly Pricing Provision. Load reductions will be calculated in accordance with Section 1.

Capacity Price$_{Yn,G-J,S}$ ($/kW-month) is the average of the NYISO capacity market spot auction clearing prices for the G-J Locality, during the summer capability period (May 1st – October 31st) in the capability year.

Capacity Price$_{Yn,G-J,W}$ ($/kW-month) is the average of the NYISO capacity market spot auction clearing prices for the G-J Locality, during the winter capability period (November 1st – April 30th) in the capability year.

Capacity Price$_{Yn,NYCA,S}$ ($/kW-month) is the average of the NYISO capacity market spot auction clearing prices for the NYCA Location, during the summer capability period (May 1st – October 31st) in the capability year.

Capacity Price$_{Yn,NYCA,W}$ ($/kW-month) is the average of the NYISO capacity market spot auction clearing prices for the NYCA Location, during the winter capability period (November 1st – April 30th) in the capability year.

Requirement%$_{G-J}$ (%) is the Locational Minimum Installed Capacity Requirement (LCR) for the G-J Locality computed by the NYISO for the corresponding calculation year.

Requirement%$_{NYCA}$ (%) is the Minimum Installed Capacity Requirement for the NYCA Location computed by the NYISO for the corresponding calculation year.

Derating Factor$_{G-J,S}$ (%) is the derating factor established by the NYISO for the G-J Locality for the summer capability period to be used to translate ICAP values to UCAP values.

Derating Factor$_{G-J,W}$ (%) is the derating factor established by the NYISO for the G-J Locality for the winter capability period to be used to translate ICAP values to UCAP values.

Derating Factor$_{NYCA,S}$ (%) is the derating factor established by the NYISO for the NYCA Location for the summer capability period to be used to translate ICAP values to UCAP values.

Derating Factor$_{NYCA,W}$ (%) is the derating factor established by the NYISO for the NYCA Location for the winter capability period to be used to translate ICAP values to UCAP values

Loss$_{b\rightarrow r}$ (%) is the loss factor between the bulk system and retail delivery point, an average of 6.73% for Central Hudson's system, per the BCA Handbook Version 1.1

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4. Example Calculation

The following example illustrates the calculation of wholesale capacity benefits and associated incentives as outlined within this document.

For illustrative purposes, a hypothetical scenario in which Central Hudson's NWA achieved a 1.0 MW load reduction coincident with the 2015 NYISO zone G-J peak hour, occurring on 7/20/2015 in the hour ending 17:00, as well as a 0.5MW load reduction coincident with the 2015 NYCA peak hour occurring on 7/29/2015 in the hour ending 17:00. As such, clearing prices for the 2016 capability year will be utilized for the calculation. All calculation parameters, apart from the hypothetical coincident load reductions and line loss factors, have been obtained from the NYISO website[15].

Table 2: 2016/2017 Capability Year Spot Auction Clearing Prices

Year	Month	Clearing Price ($/kW-month)G-J	Clearing Price ($/kW-month)NYCA
2016	May	$ 9.36	$ 5.27
2016	June	$ 9.28	$ 4.89
2016	July	$ 9.25	$ 4.27
2016	August	$ 9.23	$ 3.64
2016	September	$ 9.15	$ 3.32
2016	October	$ 9.16	$ 3.12
2016	November	$ 3.69	$ 0.35
2016	December	$ 3.63	$ 0.55
2017	January	$ 3.53	$ 0.32
2017	February	$ 3.47	$ 0.54
2017	March	$ 3.30	$ 0.71
2017	April	$ 3.25	$ 0.35

Example Calculation Part 1

$\Delta\text{PeakLoad}_{Yn-1,G-J} = 1{,}000 \text{ kW}$

$\text{Capacity Price}_{Yn,G-J,S}$ \$9.24/kW-month (average of May-October)

$\text{Capacity Price}_{Yn,G-J,W}$ \$3.48/kW-month (average of November-April)

$\text{Requirement\%}_{G-J} = 90\%$

[15] Requirement percentage and derating factors obtained from:
http://icap.nyiso.com/ucap/public/ldf_view_icap_calc_selection.do

Capacity spot market auction clearing prices obtained from:
http://icap.nyiso.com/ucap/public/auc_view_spot_selection.do

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Derating Factor$_{G-J,S}$ = 7.93%

Derating Factor$_{G-J,W}$ = 5.80%

Loss %$_{b-r}$ = 6.73%

NWA Capacity Benefits$_{Yn,G-J}$ = 1,000 * 90% * 6 * {$9.24*(1-7.93%) + $3.48*(1-5.8%)} / (1-6.73%)

NWA Capacity Benefits$_{Yn,G-J}$ = $68,233.40

Example Calculation Part 2

ΔPeakLoad$_{Yn-1,NYCA}$ = 500 kW

Capacity Price$_{Yn,NYCA,S}$ $4.09/kW-month (Average of May-October)

Capacity Price$_{Yn,NYCA,W}$ $0.47/kW-month (Average of November-April)

Requirement%$_{NYCA}$ = 117.50%

Requirement%$_{G-J}$ = 90%

Derating Factor$_{NYCA,S}$ = 9.61%

Derating Factor$_{NYCA,W}$ = 7.25%

Loss %$_{b-r}$ = 6.73%

NWA Capacity Benefits$_{Yn,NYCA}$ = 500 * (117.5%- 90%)* 6 * {$4.09*(1-9.61%) + $0.47*(1-7.25%)} / (1-6.73%)

NWA Capacity Benefits$_{Yn,NYCA}$ = $3,655.65

Under this scenario, the overall NWA capacity benefits would equal $68,233.40 + $3,655.65 = $71,889.05

Central Hudson's incentive would then equal 30% of the overall monetary benefits, which equals $21,566.70

Wholesale capacity benefits occurring within the prior capability year cannot be fully established until April clearing prices are published by the NYISO. Once published, Central Hudson will determine the monetary impact as illustrated above and file an incentive calculation with DPS Staff. The Company will notify DPS Staff in writing 30 days prior to filing.