NY STATEWIDE CLEAN HEAT CALCULATOR HEAT RECOVERY CHILLERS (HRC) HEAT PUMP CHILLERS (HPC) Version 1.2 USER GUIDE June 1, 2024

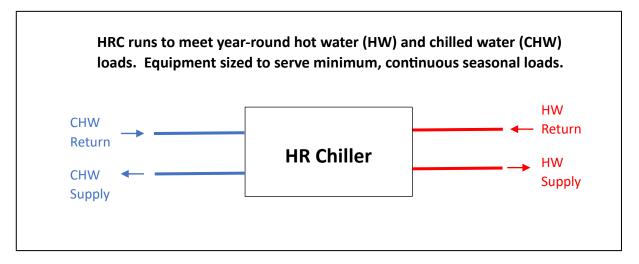
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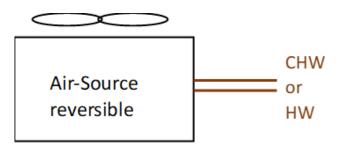
Summary

The Statewide Clean Heat Program Heat Recovery Chiller (HRC) Savings Calculator (Clean Heat HRC Calculator) is an excel based tool that is being developed to assist participating contractors applying to the New York State Clean Heat Program (Clean Heat Program) with calculating custom energy savings for the following heat recovery chiller technologies:

Heat Recovery Chiller (HRC) – chiller operating in mode where heat is moved between HW and CHW loops within the thermal envelope in buildings requiring simultaneous cooling and heating. Unit provides heating and cooling at the same time. Note: exempt from minimum annual heating thresholds applicable to each program.



Heat Pump Chiller (HPC) – chiller operating in mode where heat sink or source is outside of the building (i.e.air source of hot or cold water for the building). Unit provides either heating or cooling but not both at the same time.



This version enables users to quantify savings for specific HRC <u>**OR**</u> HPC applications <u>**ONLY**</u> as indicated below. It also allows users to get a rough estimate of the savings for projects in the early stages to get a feasibility check on pursuing the project further.

When to Use this Calculator:

The Clean Heat HRC Calculator should be used as the default method to calculate energy savings for the technologies mentioned above if one or more of the following statements are true:

- The project involves installing water-source HRCs that meet or exceed the applicable minimum efficiency requirements in Table 6.8.1-16 of ASHRAE 90.1 2022.
- The project involves installing air-source HPCs that meet or exceed the applicable minimum efficiency requirements in Table 6.8.1-16 of ASHRAE 90.1 2022.
- The Operating Mode for the HRC is: Simultaneous Heating and Cooling.
- The Operating Mode for the HPC is: Heat Pump Heating or Cooling.

In addition, the Version 1.2 Clean Heat HRC Calculator must be used for projects that have not yet received a **Preliminary Incentive Offer Letter** before June 1, 2024, superseding previously approved calculation results.

Revisions and Updates:

The following are the summary of updates from the last version of the Statewide Clean Heat HRC calculator:

				Summary of
Version	Date	Tab	Section	Revisions
				EFLH cell was
				removed. EFLH is
			System	now calculated
1.1	12/120/23	Project Info	Characteristics	using a BIN Model.
				Removed this section
1.1	12/1/2023	Equipment Info	Savings Calculation	from the tab.
				Added Tab to allow
				user input of HRC
				efficiency curve;
				HW and Chilled
				Water Return
				Temperatures.
	10/1/0000			Default values are
1.1	12/1/2023	Operational Data	All	pre-populated.
				Added compatibility
				for air-source heat
				pump chillers.
				"Rated Inputs per
				unit" revised to
				require inputs
				based on ASHRAE
				90.1 – 2022
1.2	6/1/2024	Equipment Info	All	compatibility.

Exceptions to Using Calculator:

Under certain circumstances, applicants may bypass this calculator, opting instead to calculate savings using their own custom approach, even when one of the above statements is true. Justifiable reasons for doing so include, but are not limited to:

- The applicant has prepared a whole building energy model using one approved modeling software listed in the Clean Heat Program Guide.
- The project proposes installing an HRC/HPC technology that does not fall into one of the above applicable categories available in the clean heat calculator and no prescriptive TRM methodology is available for calculating savings.

All calculation approaches must use NYS ECC code minimum efficiencies and minimum efficiency requirements in Table 6.8.1-16 of ASHRAE 90.1 – 2022 for baseline HRC/HPC systems.

General

Users shall review the 'Project Information, and 'Equipment Information' tabs and input project-specific details where needed. Cells requiring user input are highlighted in yellow. Cells in white will auto-populate based on the inputs the user enters. Red cells indicate there may be an issue with project or equipment eligibility. Users can fill in the costs and related data in the 'Results Summary Tab'



								Co	mpliance Check	
Entering / Leaving Heating Liquid Temperature*	Cooling Capacity (Tons)*	Heat Recovery Capacity (MBtu/h)*	Cooling kW/ton IPLV	Cooling kW/ton FL*	Heating COP*	Simultaneous Cooling and Heating COP*	Cooling Efficiency kW/ton - Baseline	Heating COP - Baseline	ASHRAE Simultaneous Heating and Cooling Load Efficiency COP per AHRI 920	ASHRAE Compliance Check
High 120°F/140°F	50.00	854.80		1.497	3.35	4	0.5263	0.80	4.42	Not Complia
	50.00	854.80		1.497			0.5263	0		Not Complia

When a row highlights in red, there may be an eligibility issue.

Tabs should be completed in the following order:

- 1. Project Information (Info) (highlighted cells only)
- 2. Equipment Information (highlighted cells only)
- 3. Operational Data (all or use default values)
- 4. Results Summary (highlighted cells only)

Tab: Project Information

SECTION 1: Building Characteristics

Yellow shaded cells indicate user input is required.

Project Deta	ails
Program Name	
Tool Generation Date	
Estimated Installation Date	
Utility Name*	Con Edison
Program Type*	Commercial and Industrial

- Program Name Clean Heat Program
- Tool Generation Date current date
- Estimated Installation Date enter projected installation date
- Utility Name* chose from dropdown menu
- Program Type* Commercial & Industrial (default)

* Indicates a required field.

SECTION 2: Building Characteristics

Building Characteristics							
Building Type							
Heating System Type							
Cooling System Type							
Heating Fuel Type							
Distribution System Type							
Construction Type*							
Year of Construction/ Renovation							
Gross Building Area Impacted by SOW (SF)							
Billing Data: Annual Cooling Energy Use (kWh)							
Billing Data: Annual Heating Energy Use (MMBtu)*							
Scope of Work*							
Project Zipcode*							

- Building Type Select the appropriate building type from the drop-down menu. Selection should correspond to the building type that the HRC will be serve. Building profiles have been derived from ASHRAE 90.1 Typical Occupancy Schedule and the New York State Technical Reference Manual Appendix A for several building types.
- Heating System Type Select current heating system utilized from the drop-down menu.
- Cooling System Type Select current cooling system utilized from the drop-down menu.
- Heating Fuel Type Select current fuel type utilized from the drop-down menu.
- Distribution System Type Not Applicable
- Construction Type* Select from the following drop-down options depending on the project facility application:

1) New Construction (not applicable)

- 2) Existing Building -Retrofit
- 3) Gut Renovation¹

¹Gut renovation is any renovation that removes material down to structural load-bearing beams.

Version 1.2 June 1, 2024

- Year of Construction / Renovation
- Gross Building Area Impacted by SOW (SF) area (square feet) impacted by measure
- Billing Data Annual Cooling Energy Use (kWh)
- Billing Data Annual Heating Energy Use (MMBtu)*
- Scope of Work chose the Clean Heat Program Incentive Category applicable to the project:
 - Category 4 Custom Full Load Space Heating Applications
 - Category 4a Custom Full Load Space Heating Applications + Envelope
 - Category 6 Custom Hot Water Heating Applications
 - Category 10 C&I Custom Partial Load Space Heating Applications
- Project Zip Code*

* Indicates a required field.

SECTION 3: System Characteristics

System Characteristics							
Facility Type (Applicable to Existing Only)							
BCL (MBtu/h)							
BHL (MBtu/h)							
Minimum CHW Demand (MBtu/h)*							
Minimum Heating Demand (MBtu/h)*							
Annual Baseline Heating or Domestic Hot Water (DHW) (MMBtu)							
Annual Baseline CHW (MMBtu)							

- Facility Type (Applicable to Existing Only)
- BCL (MBtu/hr) Building total sensible and latent heat gain in British Thermal Units per hour (MBtu/h) at the peak design temperature.
- BHL (MBtu/hr) Building heat loss in British Thermal Units per hour (Btu/h) at the peak design temperature.
- Minimum CHW Demand (MBtu/hr)* enter minimum historic, calculated or modeled chilled water load required for the space being conditioned by the measure.
- Minimum Heating / DHW Demand (MBtu/hr)* enter minimum historic, calculated or modeled heating or domestic hot water loads required for the space being conditioned or serviced by the measure.
- Annual Baseline Heating / DHW (MMBtu) enter the annual historic, calculated or modeled heating or domestic hot water consumption required for the space being conditioned or serviced by the measure.
- Annual Baseline CHW (MMBtu) enter annual historic, calculated or modeled chilled water load required for the space being conditioned by the measure.

* Indicates a required field.

SECTION 4: Account Holder Information

Account Holder Information							
Account Name							
Account Number (15 Digits)							
Title							
Mailing Address							
Unit Number							
City							
Zip							
Contact Person							
Phone							
Email							

• Please complete all fields highlighted in yellow prior to submittal for review.

SECTION 5: Contractor Information

Contractor Information							
Installation Completed By							
Company Name							
Contact Name							
Title							
Tax ID							
Mailing Address							
Phone							
Email							

• Please complete all fields highlighted in yellow prior to submittal for review.

Tab: Equipment Information

A. Heat Recovery Chiller

This tab is utilized to enter equipment information, checks availability and displays the anticipated energy savings for the proposed project based on inputs entered by the user on this and previous tabs.

Section 1 – Inputs

System No.	Make / Model	Quantity*	Chiller Type	Equipment Type*	Heating Operation Type*
-	*	-	•	-	*
1	Multistack MSH070	2	Water-Cooled	Positive Displacement	Simultaneous Heating and Cooling
Total		2			

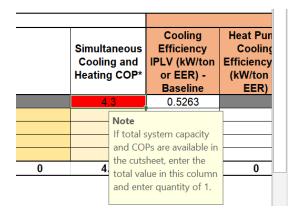
- System Number enter each equipment / measure.
- Make / Model enter full make and model number.
- Number of units quantity of identical equipment to be installed.
- Chiller Type drop-down menu: air/water cooled (only water-cooled is applicable for heat recovery chiller)
- Equipment Type compressor type drop-down menu: Positive Displacement or Centrifugal
- Heating Operation Type drop-down menu: Heat Pump Heating/Simultaneous Cooling and Heating/Heat Recovery Heating (<u>Heat Recovery Heating not available on this calculator</u>).

			Rated In	outs per unit					
Entering / Leaving Heating Liquid Temperature*	Cooling Capacity (Tons)*	Heat Recovery Capacity (MBtu/h)*		Cooling Efficiency IPLV (kW/ton)	Cooling Efficiency FL (kW/ton)*	Heating COP at 44oF Liquid Leaving Temp*		Simulta Coolir Heating	ng and
High 120°F/140°F	49.95	854.80			1.498	2.35		5.	.7
	49.95	854.80	0.00	0	1.498	2.35	0	_	7

- Entering / Leaving Heating Liquid Temperature drop-down menu
 - Low (95F/105F)
 - Medium (105F/120F)
 - High (120F/140F)
 - Boost (120F/140F) only available on heat recovery chillers
- Cooling Capacity (tons) enter cooling capacity of each equipment unit
- Heat Recovery Capacity (MBtu/hr or 1,000 Btu/hr) enter hourly maximum heat output capacity
- Cooling Efficiency IPLV (kW/ton) enter integrated part load cooling efficiency
- Cooling Efficiency FL (kW/ton) enter full load cooling efficiency

When this value highlights in red, there may be an inconsistent cooling or heating COP value entered or the equipment is not eligible (not compliant with ASHRAE Standards).

- Heating COP at 44°F Liquid Leaving Temp enter heating COP at °44 leaving water temperature
- Simultaneous Cooling and Heating COP enter COP in specific heat recovery operating mode.



Please note sample manufacturer's specification sheet for values referenced in above calculator.

Accessory Modules: (1) MSH070XNHCIEAAE Check units on specification sheet – this heating capacity units should read MMBtu/hr													
						SUN	MARY PERF	ORMANCE D	ATA				
			Ľ.				EV	APORATOR			CONDENS	SER	
Load	Capacity (tons)	kW	THR (MBtu/h	kW/Ton	EER (Btu/ Wh)	COP (kW/k W)	Flow Rate (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Cond Flow (GPM)	Entering Temp. °F	Leaving Temp. °F	ΔP (ft H2O)
100%	49.95	74.82	0.8548	1.498	8.012	2.350	85.60	42.00	6.039	85.48	120.0	140.0	4.653
75%	37.47	56.12	0.6411	1.498	8.012	2.350	85.60	42.00	6.039	85.48	125.0	140.0	4.653
50%	24.98	37.67	0.4283	1.508	7.956	2.330	85.60	42.00	6.039	85.48	130.0	140.0	4.653
25%	12.49	20.06	0.2183	1.606	7.470	2.190	85.60	42.00	6.039	85.48	135.0	140.1	4.653
he 25	50 % points	have inco	orporated a	cycling penal	ty per AHR	RI 550/590).						

Section 2 – Compliance Check and Savings

	ASHRAE 90.1-2022 Compliance Check										
Cooling Efficiency IPLV (kW/ton or EER) - Baseline	Heat Pump Cooling Efficiency FL (kW/ton or EER)	Heating COP - Baseline	Heat Pump Heating COP at 47 ⁰ F OAT	Heat Pump Heating COP at 17 ⁰ F OAT	ASHRAE 90.1 Simultaneous Heating and Cooling Load Efficiency COP per AHRI 550/590	ASHRAE Compliance Check					
0.5263		0.80			4.42	Compliant					
0.5263	0	0.8	0	0	4.42	Compliant					

- <u>Cooling Efficiency kW/ton Baseline</u> automatically populates based on:
 - Equipment Type
 - Cooling Capacity
 - Path B IPLV (from ASHRAE 90.1–2022–Attachment B)
- <u>Heat Pump Cooling Efficiency FL</u> not applicable for heat recovery chillers
- Heating COP Baseline automatically populates based on:
 - Equipment Type
 - Cooling Capacity
 - Heating Operation Type
 - Entering / Leaving Heating Liquid Temperature
- Heat Pump Heating COP at 47°F OAT not applicable for heat recovery chillers
- <u>Heat Pump Heating COP at 17°F OAT</u> not applicable for heat recovery chillers
- <u>ASHRAE 90.1 Simultaneous Heating and Cooling Load Efficiency COP per AHRI 550/590</u> from ASHRAE 90.1–2022–Attachment B
- <u>ASHRAE Compliance Check</u> automatically populated based on eligibility criteria. If equipment is deemed "Not Compliant" Annual Energy Savings are not calculated.

B. Heat Pump Chiller

This tab is utilized to enter equipment information, checks availability, and displays the anticipated energy savings for the proposed project based on inputs entered by the user on this and previous tabs.

Section 1 – Inputs

	System Configuration							
System No.	Make / Model	Number of Units*	Chiller Type*	Equipment Type*	Heating Operation Type*			
1	LG ACHH060HBAB	3	Air-Cooled		Heat Pump Heating			
Total		3						

• System Number - enter each equipment / measure.

- Make / Model enter full make and model number.
- Quantity quantity of identical equipment to be installed.
- Chiller Type drop-down menu: air/water cooled (only air-cooled is applicable for this calculator)
- Equipment Type compressor type drop-down menu: not available for Air-Cooled Chiller Types
- Heating Operation Type drop-down menu: Heat Pump Heating

	Rated Inputs per unit							
Entering / Leaving Heating Liquid Temperature*	Cooling Capacity (Tons)*	Heating Capacity (MBtu/h) at 47oF OAT*	Heating Capacity (MBtu/h) at 17oF OAT*	Cooling Efficiency IPLV (EER)	Cooling Efficiency FL (EER)*	Heating COP at 47oF OAT*	Heating COP at 17oF*	Simultaneous Cooling and Heating COP*
Low 95°F/105°F	16.21	204.70	163.80	19.46	10.560	3.65	2.22	
	16.21	204.70	163.80	19.46	10.56	3.65	2.22	5.7

- Entering / Leaving Heating Liquid Temperature drop-down menu
 - Low (95F/105F)
 - Medium (105F/120F)
 - High (120F/140F)
- Cooling Capacity (tons) enter cooling capacity of each equipment unit.
- Heating Capacity (MBtu/hr or 1,000 Btu/hr) at 47°F OAT enter hourly maximum heat output capacity at 47°F outside air temperature.
- Heating Capacity (MBtu/hr or 1,000 Btu/hr) at 17°F OAT enter hourly maximum heat output capacity at 17°F outside air temperature.
- Cooling Efficiency IPLV (EER) enter integrated part load cooling efficiency.
- Cooling Efficiency FL (EER) enter full load cooling efficiency
- Heating COP at 47°F OAT enter heating COP at 47° outside air temperature
- Heating COP at 17°F OAT enter heating COP at 17° outside air temperature
- Simultaneous Cooling and Heating COP Not available for Heat Pump Chillers

Please note sample manufacturer's specification sheet for values referenced in above calculator.

			20	ACHH* 8-230V/	**VBAB /60Hz/3	РН	
Model Number		017	020	033	040	050	060
Cooling Capacity ¹	(TR)	16.21	18.48	32.42	36.96	48.62	55.45
Power Input ¹	(kW)	18.42	21.91	36.84	43.82	55.26	65.73
EER ¹	(Btu/kW)	10.56	10.12	10.56	10.12	10.56	10.12
IPLV ¹	(EER)	19.46	19.46	19.46	19.46	19.46	19.46
Energy Efficiency	(kW/TR)	0.617	0.617	0.617	0.617	0.617	0.617
Heating Capacity 47°F /105	^e F LWT (MBH)	204.7	238.8	409.4	477.6	614.1	716.4
COP 47°F /105°F LWT ²	(W/W)	3.65	3.59	3.65	3.59	3.65	3.59
Heating Capacity 17°F /105	^e F LWT (MBH)	163.8	203.0	327.6	406.0	491.4	609.0
COP 17°F /105°F LWT2	(W/W)	2.22	2.16	2.22	2.16	2.22	2.16
Heating Capacity 47°F /120	°F LWT (MBH)	204.7	238.8	409.4	477.6	614.1	716.4
COP 47°F /120°F LWT2	(W/W)	3.15	3.10	3.15	3.10	3.15	3.10
Heating Capacity 17°F /120	PF LWT (MBH)	153.5	191.1	307.0	382.2	460.5	573.3
COP 17°F /120°F LWT2	(W/W)	2.01	1.96	2.01	1.96	2.01	1.96
Sound Pressure Cooling 30	at feet ³ db(A)	51	51	54	54	56	56
Sound Pressure Heating 30	at feet ³ db(A)	55	55	58	58	60	60
Frames		Single	Single	Double	Double	Triple	Triple

Section 2 – Compliance Check and Savings

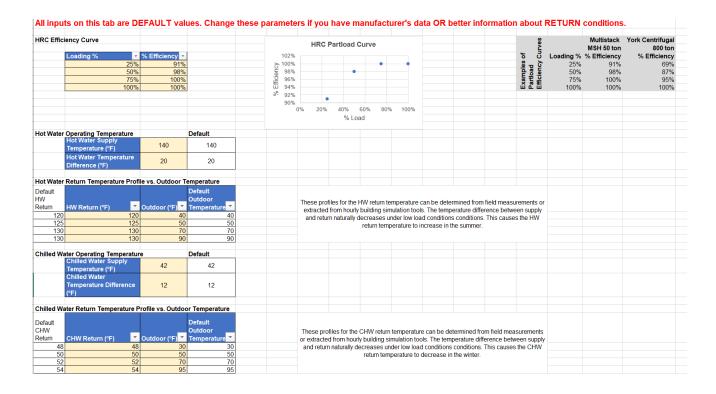
	ASHRAE 90.1-2022 Compliance Check							
Cooling Efficiency IPLV (kW/ton or EER) - Baseline	Heat Pump Cooling Efficiency FL (kW/ton or EER)	Heating COP - Baseline	Heat Pump Heating COP at 47 ⁰ F OAT	Heat Pump Heating COP at 17 ⁰ F OAT	ASHRAE 90.1 Simultaneous Heating and Cooling Load Efficiency COP per AHRI 550/590	ASHRAE Compliance Check		
13.0200	9.5950	0.80	2.31	1.48		Compliant		
13.02	9.595	0.8	2.31	1.483	0	Compliant		

• <u>Cooling Efficiency IPLV – Baseline</u> – automatically populates based on:

- Equipment Type
- Cooling Capacity
- Path B IPLV (from ASHRAE 90.1–2022–Attachment B)
- Heat Pump Cooling Efficiency FL- automatically populates based on:
 - Equipment Type
 - Cooling Capacity
 - Path A IPLV (from ASHRAE 90.1–2022–Attachment B)

- <u>Heating COP Baseline automatically populates based on:</u>
 - Equipment Type
 - Cooling Capacity
 - Heating Operation Type
 - Entering / Leaving Heating Liquid Temperature
- Heat Pump Heating COP at 47°F OAT –automatically populates based on from ASHRAE 90.1– 2022–Attachment B
- <u>Heat Pump Heating COP at 17°F OAT</u> automatically populates based on from ASHRAE 90.1– 2022–Attachment B
- <u>ASHRAE 90.1 Simultaneous Heating and Cooling Load Efficiency COP per AHRI 550/590</u> not applicable for heat pump chillers
- <u>ASHRAE Compliance Check</u>- automatically populated based on eligibility criteria. If equipment is deemed "Not Compliant" Annual Energy Savings are not calculated

Tab: Operational Data – Only Applicable for HRC



• <u>HRC Efficiency Curve:</u> % Efficiency Default values may be changed based on submitted manufacturer's specification sheets.

Loading %	•	% Efficiency
25	5%	91%
50)%	98%
75	5%	100%
100)%	100%

• <u>Hot Water Operating Temperature:</u> use default or enter project specific values.

Hot Water Operating Temperature		Default
Hot Water Supply Temperature (ºF)	140	140
Hot Water Temperature Difference (ºF)	20	20

• <u>Hot Water Return Temperature Profile vs. Outdoor Temperature:</u> use default or enter project specific values.

These profiles for the HW return temperature can be determined from field measurements or extracted from hourly building simulation tools. The temperature difference between supply and return naturally decreases under low load conditions conditions. This causes the HW return temperature to increase in the summer.

Hot Water	Hot Water Return Temperature Profile vs. Outdoor Temperature						
Default HW			Default Outdoor				
Return	HW Return (ºF)	Outdoor (ºF) 🔽	Temperature 🔽				
120	120	40	40				
125	125	50	50				
130	130	70	70				
130	130	90	90				

• <u>Chilled Water Operating Temperature:</u> use default or enter project specific values.

Chilled Water Operating Temperature	e	Default
Chilled Water Supply Temperature (^o F)	42	42
Chilled Water Temperature Difference (ºF)	12	12

• <u>Chilled Water Return Temperature Profile vs. Outdoor Temperature:</u> use default or enter project specific values.

These profiles for the CHW return temperature can be determined from field measurements or extracted from hourly building simulation tools. The temperature difference between supply and return naturally decreases under low load conditions conditions. This causes the CHW return temperature to decrease in the winter.

Chilled Wa	Chilled Water Return Temperature Profile vs. Outdoor Temperature						
Default CHW			Default Outdoor				
Return	CHW Return (ºF)	Outdoor (ºF) 🔽	Temperature 💌				
48	48	30	30				
50	50	50	50				
52	52	70	70				
54	54	95	95				

Tab: Results Summary

Technology	Material Cost	Labor Cost	Total Cost
Heat Recovery Chiller			\$-

- Enter Material and Labor Costs for each Measure.
- <u>Total Cost</u> = Material + Labor Costs

Net MMBtu Savings	Heating Electrification Savings (kWh)	Cooling Savings (kWh)	Net kWh savings	kW Savings	Therms Savings
14,549.9	-	(673,526.8)	(673,526.77)	(85.4)	168,481.1

- Net MMBtu Savings = Annual Energy Savings (MMBtu) calculations described in Attachment C
- <u>Heating Electrification Savings (kWh)</u> = HRC Heating Energy = Zero (0) Free Heating calculations described in Attachment C
- <u>Cooling Savings (kWh)</u> calculations described in Attachment C
- Net kWh savings calculations described in Attachment C
- <u>kW Savings</u> calculations described in Attachment C
- Therm Savings calculations described in Attachment C

Effective Useful Life (years)	Lifetime Net MMBtu Savings	Capped Incentive	
-	-	\$-	

- <u>Effective Useful Life (years)</u> Source NYS TRM Version 10 Appendix P
- Lifetime Net MMBtu Savings Net MMBtu Savings x Effective Useful Life
- <u>Capped Incentive</u> Total incentive automatically populates and includes all compliant measures based on calculated Net MMBtu Annual Savings, project information and location. Applicable program caps are applied.
- <u>The incentive value should not be construed as a Preliminary Incentive Offer</u> <u>Letter (PIOL). A PIOL will be offered after the project is reviewed by the</u> <u>participating utility.</u>

Appendices

A. Definitions

- Air-Conditioning, Heating, and Refrigeration Institute (AHRI): A trade association representing manufacturers of heating, ventilation, air-conditioning, refrigeration, and water heating equipment. AHRI provides the database of equipment performance specifications, which is used in this program to determine the rebate amount.
- Building Heating Load (BHL): Building heat loss in British Thermal Units per hour (Btu/h). For residential buildings, BHL shall be calculated using ACCA Manual J or another code-approved methodology. For commercial buildings, BHL shall be calculated following ANSI/ASHRAE/ACCA Standard 183-2007(RA2017), or other code-approved equivalent computational procedure. Calculation of the building's design heating load shall be at the 99% dry bulb heating design temperature for the most relevant ASHRAE 2017 location.
- Building Cooling Load (BCL): Building total sensible and latent heat gain in British Thermal Units per hour (Btu/h). For residential buildings, BCL shall be calculated using ACCA Manual J or another code-approved methodology. For commercial buildings, BHL shall be calculated following ANSI/ASHRAE/ACCA Standard 183-2007 (RA2017), or other code-approved equivalent computational procedure. Calculation of the building's design cooling load shall be at the 1% dry bulb cooling design temperature for the most relevant ASHRAE 2017 location.
- **Coefficient of performance (COP)**: COP is the ratio of work or useful energy output of a system versus the work or energy input, measured in the same units. It is a measure of performance often used for electrically powered heating and cooling equipment, with the higher the system COP corresponding to the more efficient operation.
- Energy Efficiency Ratio (EER): A measure of how efficiently a cooling system will operate when the outdoor temperature is 95 degrees Fahrenheit. It is calculated by dividing the rated cooling output at 95 degrees Fahrenheit by the watts used by the AC/HP system. A higher EER means the system is more efficient. It is an instantaneous measure of electrical efficiency, unlike SEER (Seasonal Energy Efficiency Rating), which is an averaged value of efficiency. This is a term applied to air conditioning equipment.
- **Full Load Heating System**: A system installed as a building's primary heating source, with a total system heating capacity that satisfies a minimum of 90% of building heating load (BHL).
- Heat Pump Chiller (HPC) chiller operating in mode where heat sink or source is outside of the building (i.e., well field, air or chilled water loop as source of hot or cold water for the building). Unit provides either heating or cooling but not at the same time. Savings from HPC projects will be evaluated on a case-by-case basis as part of the review of the custom project under the purview of the Program Administrator.
- Heat Recovery Chiller (HRC) chiller operating in mode where heat is moved between HW and CHW loops within the thermal envelope in buildings requiring simultaneous cooling and heating. Unit provides heating and cooling at the same time. Note: HRC are exempt from minimum annual baseline heating consumption displacement thresholds applicable to each program. This calculator may be utilized for HRC projects as described in the schematic below. The project would still retain the option to be evaluated on a case-by-case basis as part of the review of the custom project under the purview of the Program Administrator.
- Heat Pump Chiller/ Heat Recovery Chiller (HPC+HRC) chiller that will operate in both of the above modes for a project. This calculator does not currently have the capability to calculate savings for HPC+HRC projects. Savings from HPC+HRC projects will be evaluated on a case-by-case basis as part of the review of the custom project under the purview of the Program Administrator.

B. Applicable ASHRAE 90.1 – 2022 Efficiency Requirements

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	Table 6.8.1-	16 Heat Pum	p and Heat Recove	ery Water-Chilling	Packages—Minim	um Efficier	ncy Requir	ements	H	ating Oper	ation Efficien	urey b.e.j						
AN			Cooling Operati	on Efficiency ^{a,d,e,j}		E	imp Heating fficiency (CO eaving Heati	OP _H) ^{f,h} , W/V	Ieating V	Sim Full-L	ultaneous Co oad Efficienc Leaving Heat	oling and He y (COP _{SHC})	,i,W/W	E	Recovery H fficiency (CC	OPHR) ^{c,j} ,W/	w	-
ANSI/ASHRAE/IES Standard 90.1-2022 (I-P)		Size Category Refrigerating	Air Source EER (Liquid-Source Pow	FL/IPLV), Btu/W·h er Input per Capacity), kW/ton _R	Heating Source Conditions	Low	Medium	High	Boost	Low	Medium	High	Boost	Low	Medium	Hot- Water 1	Hot- Water 2	
RAE	Equipment Type	Capacity ⁿ , ton _R	Path A	Path B	(leaving liquid) or OAT (db/wb) ^g , °F	95.00°F/ 105.00°F	105.00°F/ 120.00°F	120.00°F/ 140.00°F	120.00°F/ 140.00°F	95.00°F/ 105.00°F	105.00°F/ 120.00°F	120.00°F/ 140.00°F	120.00°F/ 140.00°F	95.00°F/ 105.00°F	105.00°F/ 120.00°F	90.00°F/ 140.00°F	120.00°F/ 140.00°F	Test Procedure
IES	Air source	<150.0	≥9.595 FL ≥13.02 <i>IPLV</i> .IP	≥9.215 FL ≥15.01 <i>IPLV</i> .IP	47.00 db 43.00 wb ¹	≥3.290	≥2.770	≥2.310	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP	AHRI 550/590
Stand					17.00 db 15.00 wb ¹	≥2.029	≥1.775	≥1.483	NAP	NA ^p	NA ^p	NA ^p	NA ^p	NAP	NA ^p	NAP	NA P	
lard 90.1		≥150.0	≥9.595 FL ≥13.30 <i>IPLV</i> .IP	≥9.215 FL ≥15.30 <i>IPLV</i> .IP	47.00 db 43.00 wb ¹ 17.00 db 15.00 wb ¹	≥3.290 ≥2.029	≥2.770 ≥1.775	≥2.310 ≥1.483	NA P NA P	NA ^p	NA ^p	NA ^p	NA ^p	NA ^p	NA ^p	NA ^p	NA P NA P	
-2022	Liquid- source	≥11.25 ^q and <150.00	≤ 0.7895 FL ≤0.6316 <i>IPLV</i> .IP	≤0.8211FL ≤0.5263	44.00 ^m	≥4.640	≥3.680	≥2.680	NAP	≥8.330	≥6.410	≥4.420	NA ^p	≥8.330	≥6.410	≥4.862	≥4.420	AHRI 550/590
? (I-P	electrically	<150.00 ≥150.0 and	≤0.0516 IPLV.IP ≤0.7579 FL	≤0.5203 <i>IPLV</i> .IP ≤0.7895 FL	65.00 ^m 44.00 ^m	NA ^P ≥4.640	NA ^P ≥3.680	NA. ^p ≥2.680	≥3.550 NA ^P	NA ^p ≥8.330	NA ^P ≥6.410	NA ^P ≥4.420	≥6.150 NA ^p	NA ^P ≥8.330	NA ^P ≥6.410	NA ^P ≥4.862	NA ^P ≥4.420	556590
3	positive displacement	<300.0	≤0.5895 <i>IPLV</i> .IP	≤0.7893 PL ≤0.5158 <i>IPLV</i> .IP	65.00 m	NA P	23.080 NA P	NA P	≥3.550	NA P	NA ^p	NAP	≥6.150	NAP	NAP	24.802 NA P	NAP	
		≥300.0 and <400.0	≤0.6947 FL ≤0.5684 <i>IPLV</i> .IP	≤0.7158 FL ≤0.4632 <i>IPLV</i> .IP	44.00 ^m 65.00 ^m	≥4.640 NA ^P	≥3.680 NA ^P	≥2.680 NA ^p	NA ^P ≥3.550	≥8.330 NA ^p	≥6.410 NA ^P	≥4.420 NA ^p	NA ^P ≥6.150	≥8.330 NA ^P	≥6.410 NA ^P	≥4.862 NA ^P	≥4.420 NA ^P	1
		≥400.0 and	≤0.6421 FL	≤0.6579 FL	44.00 ^m	≥4.930	≥3.960	≥2.970	25.550 NA P	≥8.900	≥6.980	≥5.000	20.130 NA P	≥8.900	≥6.980	≥5.500	≥5.000	-
		<600.0	≤0.5474 <i>IPLV</i> .IP	≤0.4316 <i>IPLV</i> .IP	65.00 ^m	NAP	NAP	NA ^p	≥3.900	NA ^p	NA ^p	NAP	≥6.850	NA ^P ≥8.900	NAP	NAP	NAP]
															≥6.980			
â	Versions of ASHR	AES X 🔯 AS	≤0.5895 FL ≤0.5263 IPLV/IP re standard rating cond HRAE - Wrapper com/ASHRAE_PREVIEW nvironment Tod	× 🗈 NC_HVAC	_Guide_2017.pdf									NA ^P	NA ^P		≥5.000 NA ^P re in accorda	f ⊕ Powered by
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© Shap € €	Section 6. Versions of ASHR (a) https:// ing Tomorr) 134 / 468 Table 6.8.1-11 Equipment	AL 21. AL 21.	sol 3263 JPL/IP et standard rating cond restandard rating cond	x 000 TPLY10 X 000 TPLY10 X 00 X 000	65.00 ^{III} 550/590 (1-P), Table 4 550/590 (1-P), Table 4 550/590 (1-P), Table 4 550/590 (1-P), Table 4 550/590 (1-P), Table 4 Store 4 Conditions Heating Source Conditions (exing lisal) or	NA ^P except for list x Futur um Efficier Heat Pt Entering/Ld	NA ^P juid-cooled c accy Requir imp Heating fficiency (CC paving Heating 105.00°F/	NA ^P entrifugal chi actice Area 5 () ements Full-Load I DP ₂₀ ^(A) , W/V ng Liquid To	≥3 900 lling packag × ■ HRC HRC HRC HRC HRC HRC HRC HRC	NA ^P s which can Language for eating Oper Sim Full-L Entering/J	NAP adjust coolin Prog Manual Prog Manual	NA ⁷ g efficiency fo × • NVS acy, ^{b,e,j} soling and H cy (COP _{SHC} ting Liquid 1	≥6.850 er nonstandær CH_JMC_Meet M_JW/W Temperature Boost 120.00°F/	NAP drating cond org2023.08.01 Mea I Entering/I	NA ^P itions using k × + it Recovery 1 Efficiency (C Leaving Heat Medium 105.00°F/	NA ^P adj procedur A ^h Heating Ful OP _{HB}) ^d , W ting Liquid Hot- Water 1 90.00°F 1	I-Load	Powered by North Wrrt
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© Shap € €	Section 6. Versions of ASHRA https:// https:// https:// Normania. Equipment Table 6.8.1-11 Equipment Type Liquid source source Liquid	Af x & Af x A Af	so 3263 IPL/IP ex standard rating cond rest rest rest rest and Heat Recover Cooling Opporting and Heat Recover Cooling Opporting rest	x D NC.HVAC	65.00 ^m 550/590 (1-P), Table 4 550/590 (1-P), Table	NA P . except for list . except for list <	NA ^P mid-cooled c of Energy (Pr e of Energy (Pr mp Heating Heating 105.00°F (23.650 NA ^P	NA ³ entrifugal chi entrifugal chi ettrifugal chi ettrifugal chi gata proglation <	≥3 900 Illing package H H Harring V mperature Bosting V mperature NA ⁷ ≥3 550	NAP NAP swhich can Language for sim Fall-L Eatering/ 95.00°F/ 28.330 NAP	NA P adjust coolin Frog Manual ation Efficie utanos Coolin addition Efficie utanos Coolin add Efficie Leaving Hea Medium 105.00°F/ 120.00°F 26.410 NA P 26.410 NA P	NA ^P g efficiency for x Q NV3 x Q NV	≥6.50 enorstandar CH_JMC_Meet MA_WWC imperature Boott 120.00°F NAF ≥6.150 NAF ≥6.150	NA ^P I rating cond reg2023.08.01 EnteringT Low 95.00°F, 28.330 NA ^P 28.330 NA ^P	NA ^P itions using <i>k</i> × + At Recovery Efficiency (C Leaving Heat Medium 105.00° <i>F</i> / 120.00° <i>F</i> 26.410 NA ^P 26.410 NA ^P	NA ² MA ² MA ² Marking Ful Procedure Marking Ful Proceedure Marking Ful Proceedure Marking Ful Marking Ful M	NA ⁷ NA ⁷ Bay Now	Powered by Powered by Normality Test Powered by Test AHRI
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