



## NJ Cool Program - Emissions and Energy SOP

Applicants to the NJ Cool Program are required to provide an estimate of projected operational greenhouse gas emissions reductions resulting from the proposed project being funded by the NJEDA grant award. All greenhouse gas emissions projections are to be reported in both annual and lifetime avoidance of greenhouse gases in carbon dioxide equivalent metric tons (MT CO<sub>2</sub>e).

In addition, where relevant, estimates for annual and lifetime emissions avoidance of co-pollutants are also required. This reporting is required by the Regional Greenhouse Gas Initiative (RGGI), the source of funding for the NJ Cool Program. These co-pollutants include:

- NO<sub>x</sub> (Nitrogen oxides)
- PM<sub>2.5</sub> (Fine particulate matter)
- PM<sub>10</sub> (Particulate matter)
- VOC (Volatile organic compounds)
- CO (Carbon monoxide)
- SO<sub>x</sub> (Sulfur oxides)

Please note, greenhouse gas emissions and co-pollutant reductions projections for the NJ Cool Program are calculated relative to on-site activities only and do not account for source power or associated grid emissions. Additional information is collected regarding overall building electricity consumption and will be used by NJEDA to determine overall programmatic emissions impacts. Every project will not have avoided emissions in each avoidance category as these are dependent on what project scope is included.

**These estimates are for program reporting and tracking purposes. The magnitude of the projected emissions avoidance does not affect program eligibility or potential award size.**

Projections should include supporting documentation and/or calculations as appropriate. Calculations can include modeling software application outputs. Projections must be prepared by one of the following:

- Licensed engineer (NJ state professional engineer or other state's equivalent)
- Licensed architect (NJ state registered architect or other state's equivalent)
- Certified Energy Auditor (CEA certification from Association of Energy Engineers)
- Certified Energy Manager (CEM certification from Association of Energy Engineers)
- Energy Management Professional (EMP certification from Energy Management Association)
- Building Energy Assessment Professional (BEAP certification from ASHRAE)
- Similarly qualified building design or energy professional



**Summary of Information Requested:**

**A) Building Systems Details**

*Details on existing and proposed building systems used for heating and cooling (fossil fuel-based and alternatives), as well as any other fossil fuel combustion-based systems used for other applications (cooking, laundry, etc.).*

**B) Projected Reduction in Operating Emissions due to Heating Fuel Switching**

*Calculation on reduction in emissions achieved by replacing combustion-based heating system(s) with non-combustion alternatives.*

**C) Projected Reduction in Operating Emissions due to Refrigerant Replacement**

*Calculation on reduction in emissions achieved by replacing high global warming potential (GWP) refrigerant(s) with lower GWP alternatives.*

**D) Projected Reduction in Operating Emissions due to other Measures**

*Calculation on reduction in emissions achieved by replacing other fossil fuel combustion applications in the building (other than those used for space heating) and/or through other energy efficiency measures.*

**E) Estimated Total and Lifetime Reduction in Operating Emissions**

*Summation of calculations B, C, and D and projection of total project lifetime emissions reductions.*

**F) Overall Electricity and Fuel Consumption**

*Information on the building's projected total annual electricity and overall fuel consumption before and after the project is completed.*



## **A. BUILDING SYSTEM DETAILS:**

### **1) Existing Building Systems:**

*Provide the following information for each existing building system. Building systems are permanently installed, stationary equipment. Include both primary and supporting systems. Please indicate whether each existing building system is to remain in service or be replaced as part of the project.*

- Space Heating
- Water Heating
- Space Cooling
- Systems used for other applications (cooking, laundry, etc.) that utilize fossil fuel combustion

Equipment Type:

Quantity:

Equipment Manufacturer and/or Brand:

Equipment Model/Description:

Equipment Model Year:

Capacity/Size:

To Remain/To be Replaced:

### **2) Proposed Building Systems:**

*Provide the following information for each proposed building system to be installed as part of the project. Include both primary and supporting systems:*

- Space Heating
- Water Heating
- Space Cooling
- New equipment/systems replacing existing fossil fuel powered equipment for other applications (cooking, laundry, etc.)

Equipment Type:

Quantity:

Equipment Manufacturer and/or Brand:

Equipment Model/Description:

Equipment Model Year:

Capacity/Size:



**3) Existing Refrigerant Usage:**

*Provide the following information for each high GWP (100-year GWP of 2000 or greater) refrigerant system utilized in the building, including both primary and supporting refrigerant usage. Please indicate whether each high GWP existing building system is to remain in service or be replaced.*

- Equipment Type:
- Equipment Manufacturer and/or Brand:
- Equipment Model/Description:
- Equipment Model Year:
- Equipment Use:
- Temperature Classification [Low (frozen products)/Medium (chilled products)/Other]:
- Full Charge (lbs.):
- Annual Leak Rate (%/year):
- Operational Year(s) for which annual leak rate is based on:
- Refrigerant Type Used:
- Refrigerant GWP:
- GWP Data Reference/Source:
- Date of Installation (estimated if unknown):
- To Remain/To be Replaced:

**4) Proposed Refrigerant Usage:**

*Provide the following information for each new refrigerant system proposed to be installed during the project, including both primary and supporting refrigerant usage:*

- Equipment Type:
- Equipment Manufacturer and/or Brand:
- Equipment Model/Description:
- Equipment Model Year:
- Equipment Use:
- Temperature Classification ([Low (frozen products)/Medium (chilled products)/Other]:
- Full Charge (lbs.):
- Estimated Annual Leak Rate (% loss/year) \*:
- Refrigerant Type Used:
- Refrigerant GWP:
- GWP Data Reference/Source:

\*Note, if the same refrigerant system is being used without any additional improvements/repairs and only the refrigerant itself is being replaced, use the same leak rate for proposed as existing. If a new system is being installed, please refer to manufacturer guidance for estimated leak rate. If this is not available, please refer to estimates below determined from US EPA guidance:

<b>Equipment</b>	<b>Assumed Annual Operational Leak Rate (%)</b>
Stand-Alone or Self-Contained Systems	< 1%
Remote Condensing Unit Systems	12.5%
Multiplex Rack Systems	22.5%
Small Split AC	2.5%
Single Split and Multi-Split (Large)	2.5%
VRF Systems (Large)	3%
Ducted Systems (Large)	4%
Small/Medium Chillers	3%
Large Chillers	3%

Source: <https://www.epa.gov/ozone-layer-protection/transitioning-low-gwp-alternatives-commercial-refrigeration>



## B. HEATING FUEL SWITCHING EMISSIONS REDUCTIONS

Calculate the projected annual emissions avoided per reduction in fuel quantity combusted for each fossil fuel or other combustion-based heating system replaced with a non-combustion alternative. Note, if a hybrid heating system is installed to manage peak loads or allow for system redundancy, include assumptions for the percentage of annual emissions avoided for the portion of building heating loads to be provided by the proposed non-combustion emission system. Note, at least 75% of total building heating loads must be handled by non-combustion systems for the overall project to be eligible for grant award. If the Applicant is a tenant, the minimum 75% heating load requirement will only apply to portions of the building within the tenant’s lease.

If replacing a system that burns more than one fuel type, calculate the potential emissions based on a proportional emissions factors accounting for the ratio of different fuel types historically used by the system. If information is unavailable on how different fuel sources were used by the system, utilize the compatible fuel source with the highest emissions factor.

$$\text{Annual Avoided Emissions (MT or lbs)} = \text{Annual Reduction in Fuel Consumption} * \frac{\text{Emissions Factor}}{\text{Unit of Fuel}}$$

### Emission Factors for Common Heating Fuels:

<b>Fuel (unit)</b>	<b>CO<sub>2</sub>e (metric tons)</b>	<b>NO<sub>x</sub> (pounds)</b>	<b>PM<sub>2.5</sub> (pounds)</b>	<b>PM<sub>10</sub> (pounds)</b>	<b>VOC (pounds)</b>	<b>CO (pounds)</b>	<b>SO<sub>x</sub> (pounds)</b>
<b>Natural Gas (therm)</b>	0.00525	3.083 X 10 <sup>-3</sup>	7.322 X 10 <sup>-4</sup>	7.322 X 10 <sup>-4</sup>	5.299 X 10 <sup>-4</sup>	3.854 X 10 <sup>-3</sup>	5.780 X 10 <sup>-5</sup>
<b>Distillate Heating Oil (gallon)</b>	0.01024	2.000 X 10 <sup>-2</sup>	1.541 X 10 <sup>-3</sup>	2.293 X 10 <sup>-3</sup>	3.400 X 10 <sup>-4</sup>	5.000 X 10 <sup>-3</sup>	2.160 X 10 <sup>-4</sup>
<b>Propane (gallon)</b>	0.00574	1.300 X 10 <sup>-2</sup>	7.000 X 10 <sup>-4</sup>	7.000 X 10 <sup>-4</sup>	8.000 X 10 <sup>-4</sup>	7.500 X 10 <sup>-3</sup>	4.872 X 10 <sup>-5</sup>

For any other heating fuels beyond the common ones listed above, please determine relevant emission factors from the EPA sources listed below. If using alternative emission factors based on the unique configuration of the building’s heating system, please provide source reference and justification.

EPA Greenhouse Gas Emissions Factors Hub: <https://www.epa.gov/climateleadership/ghg-emission-factors-hub>

EPA AP-42 Air Emission Factors: <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-1-external-0>



**C. REFRIGERANT REPLACEMENT EMISSIONS REDUCTIONS:**

Calculate the projected annual lifetime MT CO<sub>2</sub>e emissions avoided per each high GWP refrigerant replaced by the project. Note, at least 75% of existing high GWP refrigerants must be switched to low GWP alternatives for the overall project to be eligible for grant award. If the Applicant is a tenant, the minimum 75% refrigerant replacement requirement will only apply to the refrigerants that impact the tenant’s leased space.

$$\text{Annual Avoided Emissions (MT CO}_2\text{e)} = \frac{(\text{GWP}_E * \text{Charge}_E * \text{Leakage}_E) - (\text{GWP}_R * \text{Charge}_R * \text{Leakage}_R)}{2204.6}$$

Where,

GWP<sub>E</sub> = GWP of the refrigerant in the existing system (100-year GWP)

Charge<sub>E</sub> = pounds of refrigerant charge of the old refrigerant (lbs.)

Leakage<sub>E</sub> = annual leakage rate of the existing system (% loss/year)

GWP<sub>R</sub> = GWP of the new replacement refrigerant (100-year GWP)

Charge<sub>R</sub> = pounds of refrigerant charge of the new refrigerant (lbs.)

Leakage<sub>R</sub> = estimated future annual leakage rate (% loss/year)

2204.6 is a standard conversion factor from pounds to metric tons

*Note: Adopted from MassDEP Commercial Refrigeration Grant Program*

For refrigerants, please use the 100-year global warming potential (GWP) values available from the latest version of EPA’s published Emission Factors for Greenhouse Gas Inventories.

Source: <https://www.epa.gov/climateleadership/ghg-emission-factors-hub>

Alternatively: <https://www.epa.gov/climate-hfcs-reduction/technology-transitions-gwp-reference-table>

For any refrigerant or blend not included in this list, please refer to a similar credible 3<sup>rd</sup> party evaluation (such as IPCC AR or ASHRAE) for GWP value designation and provide the source of this value.

**D. OTHER OPERATING EMISSIONS REDUCTIONS:**

Calculate the projected annual emissions avoided per each fossil fuel or other combustion-based system (cooking, clothes dryers, hot water, etc.) replaced by the project with a non-combustion alternative and resulting reduction in fuel quantity combusted. Additionally, this section can account for any reduced fuel consumption due to other energy efficiency measures. See Section B for guidance on appropriate emissions factors for greenhouse gases and co-pollutants per fuel type.

$$\text{Annual Avoided Emissions (MT or lbs)} = \text{Annual Reduction in Fuel Consumption} * \frac{\text{Emissions Factor}}{\text{Unit of Fuel}}$$



**E. TOTAL ESTIMATED OPERATING EMISSIONS REDUCTIONS:**

Sum the projected operational lifetime emissions avoided by the entire project, including due to heating fuel switching, refrigerant replacement, or other fossil fuel equipment replacement/energy efficiency measures. **Please complete the table below on the corresponding “NJ Cool Emissions & Energy Summary Form.”** See **sample** reported numbers below:

$$\text{Total Annual Emissions Avoided (MT or lbs)} \\ = \text{Avoidance (Fuel)} + \text{Avoidance (Refrigerants)} + \text{Avoidance (Other Measures)}$$

$$\text{Lifetime Emissions Avoided (MT or lbs)} = 15 \text{ years projected project lifetime} * \text{Total Annual Avoided Emissions}$$

<u>Pollutant</u>	<u>Symbol</u>	<u>Unit</u>	<u>B. Annual Emissions Avoided due to Heating Fuel Switching</u>	<u>C. Annual Emissions Avoided due to Refrigerant Replacement</u>	<u>D. Annual Emissions Avoided due to Other Measures</u>	<u>E. Total Annual Emissions Avoided =B+C+D</u>	<u>Lifetime Emissions Avoided (15-year total) =E X 15</u>
Greenhouse gases	CO2e	metric tons	100	0	25	125	1875
Nitrogen oxides	NOx	pounds	2		1	3	45
Fine particulate matter	PM2.5	pounds	1		3	4	60
Particulate matter	PM10	pounds	0.5		0.5	1	15
Volatile organic compounds	VOC	pounds	2		4	6	90
Carbon monoxide	CO	pounds	3		5	8	120
Sulfur oxides	SOx	pounds	20		2	22	330

**F. OVERALL ELECTRICITY AND FUEL CONSUMPTION:**

**Please complete the table below on the corresponding “NJ Cool Emissions & Energy Summary Form.”** For average annual consumption pre-construction, please utilize a 3-year historical average if available. If for some reason a 3-year average is not available or representative (ex: equipment was upgraded in the 3-year window), please adjust accordingly and provide an explanation for the basis of the average annual consumption. See **sample** reported numbers below:

<u>Energy Source</u>	<u>Unit</u>	<u>Average Annual Consumption Pre-Construction</u>	<u>Estimated Annual Consumption Post Construction</u>
Electricity (grid supplied) <sup>1</sup>	kWh	1500	1720
Natural Gas	therms	800	20
Heating Oil	gallons	0	0
Propane	gallons	0	0
Other Fuel (please specify)	TBD	0	0

1. This value is total electricity demand supplied by sources external to the building or adjoining property (site). On-site electricity generation and/or storage installed as part of the project would not be accounted for in this number.