

Narrative Description - Mid Term Modification Request for National Grid Electric:
Refrigerant Management for the Commercial and Industrial Sector

This research is intended identify specific ways in which the energy efficiency programs can be leveraged to reduce both direct and indirect greenhouse gas emissions from grocery stores in Massachusetts. The principles demonstrated through this proposal could be broadly applicable to Heating, Ventilation, and Air Conditioning (“HVAC”) and refrigeration (“HVACR”) technologies across sectors. Grocery stores, however, are proposed as the focus of this research given their unusually high emissions related to refrigerant leaks. National Grid will demonstrate through this research the importance and interactivity between system energy performance and refrigerant management. Further, this proposal will demonstrate how progress towards state climate goals can be accelerated, quantified, and tracked at a granular level when refrigerant emissions are considered as complements within the Program Administrators’ portfolios.

Pursuant to the Energy Efficiency Guidelines, section 3.9.1, the Department of Public Utilities (the “Department”) requires all Mid-Term Modifications (“MTM”) for Demonstration projects to meet four criteria for Department approval:

1. reasonableness of the size, scope, and scale of the proposed project in relation to the likely benefits to be achieved;
2. adequacy of the evaluation plan;
3. extent to which there is appropriate coordination among Program Administrators; and
4. bill impacts to customers.

The Company believe that the proposed demonstration project meets all four of these criteria as:

1. the scale and scope of the demonstration is within the scope of the energy efficiency plans and sized appropriately to determine whether results will be cost effective and can be scaled to be a full program offering. The Company also believes that this focused demonstration proposal, which complements other cost effective efforts, is within the scope of the energy efficiency plans, especially given the now statutorily mandated Greenhouse Gas (GHG) goals set by the Secretary of Energy & Environmental Affairs. While refrigerant emission reductions may not, on their own, lead to direct energy or customer utility bill savings (although after the fact evaluations may show they do), the Company does believe that such a program could produce GHG reductions at a level of cost efficiency that compares favorably to other measures currently supported through the Department approved Three Year Plan. Further, availability of refrigerant emission mitigation measures could increase participation in other energy efficiency program offerings as customers seek to implement comprehensive decarbonization plans. These benefits would align this proposal with Company obligations to achieve mandated GHG reductions at lowest possible cost to customers.

2. the Company has included a robust evaluation plan with a third-party vendor to evaluate this demonstration;
3. the Company has provided this proposed MTM to other Program Administrators to review and determine whether or not they would like to jointly participate; and
4. the Company contends it can do this within existing approved Commercial and Industrial (“C&I”) budgets, thus no additional funds asked of the Department outside of the approved budgets of the 2022-2024 Three Year Energy Efficiency Plan.

Massachusetts is home to roughly 900 medium and large grocery stores, which represent hundreds of thousands of metric tons of CO₂ equivalent (MT CO₂eq) emissions on an annual basis. Using EPA estimates for typical grocery store conditions, adjusted for Massachusetts emission factors, a grocery store may emit 75% of their annual emission from refrigerant leaks and only 25% from electric and gas consumption. Recent federal and state regulations limit refrigerants used in certain new HVACR equipment and will phase down the production of certain high Global Warming Potential (“GWP”) hydrofluorocarbon (“HFC”) refrigerants. There are, however, few direct regulations requiring customers to reduce their emissions on existing refrigeration systems and even fewer resources to help them do so. National Grid proposes that with the application of the Social Cost of Carbon to Non-Energy GHG emissions, such as those produced by refrigerants, cost effective decarbonization measures and programs can be implemented to significantly drive down both direct non-energy emissions and indirect energy emissions for the grocery segment.

National Grid proposes two decarbonization measures as part of this demonstration:

- 1) **Refrigerant Leak Reduction - Leak Detection Survey and Repair** – Qualified refrigerant technicians provide a robust and detailed leak detection survey at participating locations. Identified leaks will be measured and repaired. This demonstration will focus on parallel rack direct expansion systems using a high GWP refrigerant.
 - a. **Prior On-Site Research** – National Grid engaged third-party vendors to perform three¹ Measurement and Verification (“M&V”) projects exploring the energy savings related to Refrigerant Leak Reductions. The proposed demonstration would improve upon and expand the prior research to provide a more robust energy, refrigerant, and process analysis.
 - b. **Expected Cost per Project and Incentive Support** – Refrigerant leak detection survey and repair projects are expected to cost between \$8,000-\$13,000 per site. This cost is inclusive of both labor and cost of refrigerant added to the system after the repairs are complete. The cost of added refrigerant represents roughly 30-45% of the total customer

¹ One additional site from Rhode Island is included in the M&V report.

cost. To encourage participation National Grid proposes covering full project costs for customers participating in this demonstration.

- c. Expected Energy Savings per Project** – Refrigerant leak detection survey and repair measures in other jurisdictions estimate around 15,000 kWh annual savings. The National Grid M&V project found an average of about 5% system savings, or about 17,000 kWh average annual savings, across participating facilities. However, due to questions on standard maintenance, limitations in participation, and metering data available, reviewing engineers believed that estimate to be high. The Demonstration will resolve questions raised by reviewing engineers by identifying an appropriate measure baseline considering the Evaluation Baseline Framework, EPA refrigerant regulations and requirements, and typical maintenance practices.
 - d. Expected Direct GHG Savings per Project** – Direct emissions will be strongly influenced by the type of refrigerant used on site and the site’s historic annual leak rate. Refrigerant leak detection survey and repair measures in other jurisdictions estimate around 62 MT CO₂eq emission reductions. The National Grid M&V project estimated around 118 MT CO₂eq average annual savings across participating facilities. The National Grid estimates are higher than expected due to two participants with historic annual leak rates well above EPA limits, which illustrates the very real, on-site conditions that can be improved upon by this measure.
- 2) High Global Warming Potential (GWP) Refrigerant Retrofits** – Existing refrigeration systems using a high GWP HFC refrigerant will be retrofitted with a lower-GWP refrigerant. To qualify for this opportunity, existing systems must not be near end of life, and the proposed low-GWP refrigerant must have the expectation of improving system efficiency.
- a. Prior On-Site Research** – National Grid has not performed any prior on-site research on refrigerant retrofits, however the intervention has been research and field testing has occurred in other jurisdictions.
 - b. Expected Cost per Project and Incentive Support** – Refrigerant retrofit costs will vary depending on the cost of the refrigerant itself, which has risen significantly in recent years. National Grid anticipates a whole system refrigerant retrofit project to cost the customer \$30,000-\$80,000 per site, depending on the system size. To encourage participation, National Grid proposes covering full project costs for customers participating in this demonstration.

- c. **Expected Energy Savings per Project** – Based on research performed in other jurisdictions, National Grid anticipates retrofits of medium temperature systems to produce about 12% system energy savings, or 40,000 kWh annual savings, and retrofits of low temperature systems to produce about 3% system energy savings, or 10,000 kWh annual savings. Energy savings in other jurisdictions are estimated at about 30,000 kWh annual savings.
- d. **Expected Direct GHG Savings per Project** – Direct emission reductions will be strongly influenced by the existing system charge, refrigerant type, and annual leak rates. In other jurisdictions, direct emission reductions are estimated to be 424 MT CO₂eq.

Program fit and context – National Grid provides robust and comprehensive energy efficiency incentives to the grocery segment.² If the Demonstration shows cost effective savings, National Grid will offer these measures within the context of the existing EnergySmart Grocer delivery effort. The EnergySmart Grocer offer is delivered through the National Grid Existing Building Retrofit custom electric programs.

Benefit Cost Ratio with and without non energy GHG benefits – The following table summarizes the benefit cost ratios for both measures with and without the non-energy GHG savings related to refrigerant emissions. Please see Exhibit NG-2 for the Benefit Cost Model used to calculate these savings.

Measure	Measure Life	TRC	Annual Savings		Benefit Cost Ratio	
			Energy (kWh)	Non-Energy (MT CO ₂ eq)	Without Non-Energy	With Non-Energy
Refrigerant Leak Survey and Repair	5	\$12,000	15,000	62	0.83	4.39
Refrigerant Retrofit	10	\$70,000	30,000	424	0.56	9.15

² <https://www.energysmartgrocer.org/ne/national-grid/index.html>

Demonstration Evaluation Plan - National Grid will engage an existing third-party evaluation vendor to evaluate this demonstration. CLEAResult, the provider that administers the National Grid EnergySmart Grocer delivery effort, is expected to assist in customer identification and recruitment, providing early feedback of customer interest in participation. However, a third-party firm, with appropriate Energy Efficiency Advisory Committee (“EEAC”) input, will be employed to develop and execute the evaluation plan.

As a preliminary plan, subject to change pending the selection and input of an appropriate evaluation firm, National Grid will seek 5 customers to participate in the refrigerant leak survey and repair effort and 5 customers to participate in the refrigerant retrofit effort. The preliminary evaluation proposes both impact evaluation and process evaluation components to collect robust qualitative and quantitative insights. This evaluation effort will be completed through the Program Administrators evaluation, measurement, and verification (“EM&V”) framework and will allow for the participation of the EEAC consulting team if they choose to participate. The evaluation plan includes weather dependent metering. The reliability and timely availability of the evaluation results will be influenced by the timing of DPU’s ruling and speed of customer recruitment. Please see Exhibit NG-3 for the evaluation plan put forward by the Company.

Demonstration Budget - In order to move forward with these offerings, National Grid is seeking approval of \$950,000 in funding for this proposal. While the funding can be utilized within existing approved budgets, the proposal may require shifts from C&I programs to the C&I R&D hard to measure core initiative. The budget will fund customer incentives for participation, robust evaluation of energy and emission reductions related to the decarbonization measures, evaluation of cost effectiveness, and overall assessment of the feasibility of these measures within the energy efficiency programs.

Cost breakdown

	PP&A	Marketing & Advertising	Participant Incentives	Sales, Technical Assistance & Training	EM&V	Total
Refrigerants Demonstration	\$-	\$-	\$490,000	\$10,000	\$450,000	\$950,000