



Request for Proposal  
RFP NEEP9075

## **Field Validation of Variable Refrigerant Flow System Performance in Cold Climates**

**Issued by:**  
**Northeast Energy Efficiency Partnerships, Inc.**  
**March 22, 2021**

**Responses Due:**  
**April 12, 2021**

This RFP has been released to solicit proposals regarding the field measurement of VRF system energy efficiency and refrigerant leakage in connection with DOE project (DE-EE0009075/BASE) Northeast Energy Efficiency Partnerships, Inc. (NEEP), "Field Validation of Variable Refrigerant Flow System Performance in Cold Climates."



**I: ABOUT NEEP**

NEEP was founded in 1996 as a non-profit whose mission is to serve the Northeast and Mid-Atlantic to accelerate regional collaboration to promote advanced energy efficiency and related solutions in home, buildings, industry, and communities. Our vision is that the region’s homes, buildings, and communities are transformed into efficient, affordable, low-carbon resilient places to live, work, and play.

**II. BACKGROUND INFORMATION**

Northeast Energy Efficiency Partnerships (NEEP) is issuing this Request for Proposal (RFP) for qualified engineering firms to lead in-field metering to measure actual energy performance and refrigerant leakage of selected Variable Refrigerant Flow (VRF) systems. NEEP is aiming to meter five sites in cold climates, defined as IECC zone 5 and higher. In October 2020, NEEP issued a Request for Information (RFI) to identify current industry methods and practices, which was used to develop an assessment report of the existing body of knowledge in relation to VRF in-field performance and performance testing protocols, and inform this RFP.

NEEP leads a team of project partners that includes VEIC, NYSERDA, Mass CEC, BPA, METUS, Dakin, Winn Companies, and UMass. Collectively, this group will serve as an Advisory Committee to the project and will be involved in helping to guide NEEP and the work of the contractor throughout the length of the project.

**III. SCOPE OF WORK**

NEEP seeks engineering firms to provide the following tasks and deliverables. In developing workplans and budgets, bidders should roughly allocate the specified percentage of the budget to the specified tasks. While the project will involve the metering of five unique sites, bidders may propose to be involved in as few as two sites.

Tasks	Deliverables	Schedule	Estimated budget allocation
1. Project Management	<ul style="list-style-type: none"> <li>Participate in monthly check-in meetings</li> </ul>	ongoing	<5%
2. Performance/Leakage Measurement Protocols	<ul style="list-style-type: none"> <li>Measurement Protocols for performance/refrigerant leakage measurement (Protocols to be finalized in partnership with the Project partners. Elements of the protocols can be found later in the RFP)</li> </ul>	Q2 2021	<5%
3. Site Selection	<ul style="list-style-type: none"> <li>Assist in identifying and selecting VRF system sites</li> </ul>	Q2 2021	<5%
4. Support performance modeling	<ul style="list-style-type: none"> <li>Collect site data to support VEIC modeling exercise of expected energy performance. Data includes general summaries of</li> </ul>	Q2 2021	<5%



	<p>constructions, HVAC systems, lighting systems, and specialized use spaces (kitchens, server rooms, etc.)</p>		
<p>5. In-field VRF performance/leakage measurement</p>	<ul style="list-style-type: none"> <li>• Provide all necessary metering hardware for five selected sites</li> <li>• Install monitoring hardware at selected sites</li> <li>• Commission monitoring hardware and data collection systems</li> <li>• Collect in field monitoring data of energy performance and refrigerant leakage for 12 months at five sites according to the measurement protocols</li> <li>• Remove all monitoring equipment</li> </ul>	<p>Q3 2021 – Q2 2022</p>	<p>75%</p>
<p>6. Data Analysis</p>	<ul style="list-style-type: none"> <li>• Complete a VRF Performance Analysis report that includes a copy of all the metered data collected with a summary table identifying the heating season &amp; summer season VRF performance (COP), % of the time that the space set point was met, graph of capacity vs OA temperature and any additional data analysis identified between the contractor and NEEP.</li> </ul>	<p>Q3 2022</p>	<p>10%</p>
<p>7. Reporting</p>	<ul style="list-style-type: none"> <li>• Contractor will support NEEP with the final reporting of results including detail of protocols used and identification of any specific findings, barriers or recommended strategies for field measurements of VRF performance in the future.</li> </ul>	<p>Q4 2022</p>	<p>5%</p>

**IN-FIELD PERFORMANCE/REFRIGERANT LEAKAGE MEASUREMENT TASK**

The selected firm(s) will be expected to meter the entirety of the HVAC system energy consumed, the entirety of the delivered capacity (btu/h) and associated outdoor conditions in intervals of five minutes or less. The time interval of metered data shall be sufficient to accurately calculate the coefficient of performance (COP) of the VRF system. HVAC loads that are not the VRF system, such as ventilation or auxiliary heat, must also be metered to calculate the energy performance of the HVAC system. Metering is expected to begin in Q3 2021 and continue for one year.

The field-verified energy performance of VRF systems has historically been difficult to measure, and must be approached with either air-side or refrigerant metering. For the purpose of this study, NEEP recommends the



refrigerant metering methodology due to improved accuracy, but leaves the proposed metering plan and method to the discretion of the bidding firm. Alternative proven non-invasive strategies and sensors (e.g. ClimaCheck) may be used to meter refrigerant flow without cutting into the refrigeration circuit. Only the effect of heat recovery between indoor units can be ignored for the purpose of the study, as it is deemed too difficult to measure. The NEEP RFI responses highlighted the need for collaboration with VRF manufacturers to increase access and visibility to VRF equipment. It is expected that the VRF energy performance metering protocol will include a combination of third-party sensors and meters, on-board VRF system controls, and Building Management Systems trended data. The selected field engineers are responsible for coordinating the source and method of each measurement. In the absence of direct measurement of refrigerant (pounds) during the project performance period, refrigerant leakage can be evaluated based on the documentation of VRF performance degradation over the metering period, and reporting the weight of any refrigerant added as part of the system repairs. The table below includes a list of recommended technical data points to accurately measure field performance of VRF systems.

<b>VRF DOE Field Validation Project – Project Technical Data</b>	
Technical Data gathered during the project may include, but is not limited to, the following list of performance metrics.	
<u>Project Technical Data</u>	<u>Units</u>
Compressor frequency	Hz
Outdoor unit power (each)	kW
Indoor unit power (aggregated)	kW
Space temperature set point	deg F
Space temperature	deg F
Space humidity	%RH
Space CO2	ppm
Outdoor temperature	deg F
Outdoor humidity	%RH
<u>Refrigerant Measurements</u>	
Refrigerant flow	lbs/Hr
Refrigerant pressure (head and suction)	PSI
Refrigerant temperature (head and suction)	PSI



<u>Airside Measurements</u>	
Supply airflow	CFM
Supply fan speed	Low/med/high
Supply air temperature	deg F
Supply air humidity	%RH
Entering air temperature	deg F
Entering air humidity	%RH

**RESEARCH SITES**

NEEP is encouraging the manufacturers participating in the project advisory committee to recommend potential VRF installation sites ([NEEP VRF Sites](#)), but engineering firms are encouraged to recommend alternative sites. Final site selection will be determined by NEEP on the basis of best fit to the project objectives and available funding. To be eligible for the study, site owners and field engineers must provide all data necessary to complete building energy modelling, and sign onto the project Intellectual Property Management Plan (attached). Energy modelling for each site will be performed by NEEP’s contractor, VEIC.

Preferred sites will include the following characteristics:

- Located in IECC zone 5 and higher
- Access to: VRF installation documentation (as-builts and start up or commissioning reports), service history, Building Automation System trended data, utility data
- Simple building configuration without excessive glazing area
- Existing building energy modeling

**CONFIDENTIALITY OF DATA**

Project Technical Data is subject to the project’s Intellectual Property Management Plan, which ensures that collected data is not shared between sites, manufacturers, or field engineers. Data will only be presented in aggregate after analysis, and will be used solely for the DOE project.

**IV. SELECTION PROCESS AND EVALUATION CRITERIA**

NEEP and the Advisory Committee will base their evaluation of proposals on a mix of criteria including;

- Technical approach
- Management Approach
- Qualifications and experience
- Cost



The qualifications of key staff (principals) assigned to lead this Project and the amount of time (commitment) they commit to the Project will be weighed heavily.

**V. SUBMISSION and CONTACT INFORMATION**

Please address any questions and responses to Ben Hiller at [bhiller@neep.org](mailto:bhiller@neep.org) and include “RFP NEEP9075” in the subject line. If you apply as a team, please identify a prime for a single point of contact. Please include in any proposal submission:

- Work scope and schedule
- Budget
- Staffing plan (including subcontractors if applicable)
- Qualifications and Experience