Technical Description and Impact

This proposal involves multiple project partners. This proposal combines technical, social, and financial aspects of energy efficiency in a specific sub-community within one Massachusetts town. The technical aspect focuses on the conversion of fossil fuel heating systems and electric resistance heating to air-source heat pumps in the Edgemere Mobile Home Park in Shrewsbury, Massachusetts. The social aspect focuses on proper client selection and subsequent communication and client education throughout the entire project. The financial aspect addresses the management and allocation of funds that will impact and reduce the energy burden faced by income-challenged residents of the Edgemere mobile home park.

Feasibility:

Air-Source Heat Pumps:

Energy staff at our partner Subgrantee WAP agency, SMOC, have been involved with installing air-source heat pumps more over the past 1-2 years than in the past. As the trend continues to transform the heating/cooling market towards electrification, agencies are becoming more experienced with these types of installations compared to standard fossil fuel systems.

It is important to note that each air-source heat pump installation is a customized project based on both the dwelling's characteristics and the client's needs. There is no "one-size fits all" process for installing air-source heat pumps. When an Energy Auditor conducts a design walk-through of a residence, their main goal should be to start with trying to achieve a full house displacement. The Energy Auditor will then look at all options for each heated space according to accesses for line-sets and head/duct placements. Some situations can only have one option with no place for duct work, so there is not much thought needed in those situations. In cases where there are multiple options, individual heads, ducted, or combinations of both, it would be a client and dwelling specific design. The benefit of individually placed heads is the ability to control areas to different levels of heating and cooling (in a case where there are three bedrooms with different kids wanting different temperatures) and they usually are more efficient as long as they are designed properly. The disadvantages of the heads are sometimes in small private areas they might be oversized a bit as they only come in certain sizes (BTUs), and most of the time the smallest head is big enough to power multiple small bedrooms without a great way to travel to and from the separated rooms. That is when the Energy Auditor would need to see if a small ducted midsize air handler or ducted unit would be better, especially in a case where there is an elderly person only using one (1) of three (3) bedrooms and we can give all bedrooms the same temperature via ducts. Ducted units are less efficient because of duct work heat loss, and obviously they lose the ability to control those connected rooms individually. There also needs to be access/space for placement of duct work and air handlers Multiport units are really meant for one level multi-room heated areas, and when designing a system, an Energy Auditor needs to be aware of BTUs per head, as well as outdoor unit BTUs, so each head is using a proper load and not performing what is called "a heat dump" in unwanted areas of excess BTUs, as this will cause overheating and short cycling which can damage or even reduce the lifespan of the unit. This is a basic technological description showing why each dwelling unit is unique and must be designed individually.

The air-source heat pump installation work will be funded partially with SERC funds and partially with HEARTWAP leveraged funds through the annual LIHEAP set-aide within DHCD. The typical amount of funding provided by HEARTWAP for a new heating system in a municipal utility service territory is $7,000. Most of the selected dwellings will have no access to utility funds, but if there are dwelling units that are eligible for either municipal utility funds or natural gas utility funds, those funds will be leveraged with SERC and HEARTWAP funds for heating/cooling system services.

Additionally, full-scale weatherization measures will be leveraged and completed under the PY 23 Community Scale Pilot Project grant awarded to DHCD to undertake these measures on eligible units in this same mobile home park.

Electrical upgrades: With a conversion from fossil fuel heating systems, an upgrade to the dwelling's electric panel structure may be necessary. The electric load of the residence will be evaluated as part of the initial assessment of the dwelling unit. The panel will be evaluated from both a capacity and safety perspective. If any alteration, addition, or replacement is warranted, a certified electrician will perform the work.

Given the move towards electrification in Massachusetts, it is pragmatic to plan for the future when evaluating and addressing any upgrade to the electric panel structure of a dwelling unit. As part of any upgrade, consideration of future electrical load will be taken into consideration. This will take into account such possibilities as future renewable energy installations (i.e., solar, residential wind, heat pump water heaters technology, and/or electric vehicle charging at the residence).

The electric panel structure upgrades will be funded entirely with SERC funds.

Fossil Fuel Tank and System Removal: as part of the conversion to air-source heat pumps, the existing heating system and fuel tanks will be removed in accordance with Massachusetts regulations regarding heating oil/propane tank removal and clean up. These funds are in included in the overall cost of installation of new systems.

Weatherization: DHCD recently received notice that our application for weatherization at this same mobile home park through a Community Scale Pilot Program grant was approved and awarded. The CSPP grant weatherization will happen in conjunction with the air-source heat pump conversions proposed in this grant.

Target Technical Specifications: Each air-source heat pump unit installed will strive to attain the following target specifications as part of this project.

– Unit will have a variable speed (compressor and fans)
– Heating Season Performance Factor (HSPF) > 10 (>9 ducted or mixed)
– Coefficient of Performance (COP) @ 5 degrees F >1.75 (at maximum capacity operation)
– Seasonal Energy Efficiency Ratio (SEER) > 15
– Include minimum/maximum operating data @ 5, 17, & 47 degrees F
    • Optional low temperature heating, often reported -13 degrees F
    • Also, minimum/maximum cooling at 82 & 95 degrees F

Technical Qualifications and Experience:

SMOC is an experienced weatherization Subgrantee with enough staff to be able to handle the added work with this SERC grant. SMOC will coordinate all client eligibility requirements through LIHEAP as well as coordinate all field work from energy audits to installation of measures to inspections of completed dwelling units. SMOC will utilize its current list of weatherization contractors to perform testing and installation of measures. SMOC staff includes:

- Greg Tutuny / Business Officer
- Jamie Stockbridge / WAP Program Director
- Mark LaPan / Technical Director / QCI
- Jack Barry / QCI
- Cora Graham / Energy Auditor
- Rob Zimmerman / Energy Auditor
- Josh Costigan / Energy Auditor
- Dave Bessette / HEARTWAP

Mark LaPan is also a certified BPI Proctor (1 of only 2 in the Massachusetts WAP network). SMOC also operates and oversees the weatherization training center for Massachusetts and the surrounding states: The Green Jobs Academy. Thus, SMOC can draw upon expertise from the training center and their Lead Trainer, Steve Antonini, as well.

Savings and Impacts

Cost Savings: Cost savings will be based on the WAP algorithm in the Annual Plan of 29.3 MBtus. If SELCO is able to gather the electric and fuel bills of clients served, the project team may be able to determine savings more accurately since the client base is on the smaller scale with this project. The access and experience possessed by SELCO staff and MMWEC staff will combine to add value to the project in determining actual savings.

Environmental Benefits: According to the National Academy of Sciences, residential energy use is responsible for approximately twenty percent (20%) of total greenhouse gas (GHG) emissions in the United States. Growing housing stock and continued use of fossil fuels to heat homes is making it more challenging to meet emissions reduction targets set forth by various states. Still, approximately eighty percent (80%) of housing stock is "existing dwellings". In Massachusetts, the goal outlined in the 2050 Decarbonization Roadmap is net zero greenhouse gas emissions by 2050. The project will use an emissions calculator similar to the EPA's Carbon Footprint Calculator to show the emissions reductions from dwelling's originally heated with fuel oil and propane.

Potential for Scalability

Mobile homes present a unique opportunity for converting fossil fuel heating and electric resistance heating to electric air-source heat pumps. Mobile homes are generally located in a cluster in a mobile home park and are usually smaller housing that often serves lower income individuals and families. By doing a project such as this, DHCD can see how to implement air-source heat pump conversions in these mobile parks and what benefits these conversions provide

to residents. According to our subgrantee agencies, most mobile homes heat with heating oil, propane, or electric resistance heat. These are traditionally the most expensive heating sources in Massachusetts according to the Massachusetts Department of Energy Resources.

This project will help provide a blueprint that DHCD can use to assist other subgrantees to elect air-source heat pump conversions in the mobile parks both in municipal utility territories and beyond.

In conclusion, DHCD believes this SERC grant will be an important part of our work going forward to assist traditionally under-served clients with limited access to energy efficiency funds reduce both their energy burden and energy inefficiency while improving their household's environmental impact, comfort, and safety.