GDS Associates, Inc.
ENGINEERS & CONSULTANTS

# MEMORANDUM

**TO** Nichol Tyc, Eversource

**CC** Mounaim Hamim, Eversource

**FROM** Alyssa Gianotti, GDS Associates

**DATE** September 29, 2023

**RE** Town of Henniker, Scoping Study Memo

GDS Associates, working on behalf of Eversource, has conducted a scoping study of three municipal buildings serving the Town of Henniker: Transfer Station/Recycling Center located at 1393 Weare Road (Route 114), the Fire and Rescue Station located at 216 Maple Street, and the Highway Garage located at 209 Ramsdell Road. GDS performed the following major activities:

- Performed site visits on April 11th and 12th to document existing conditions.
- Identified loads and potential energy conservation measures (ECMs).
- Collected and benchmarked historical electric consumption to understand usage profiles.
- Developed high-level savings and cost estimates.

This scoping study provides a description of potential electric ECMs that were identified during the site visit and outlines next steps for further developing the measures based on the Town's interest. Table 1 provides a summary of estimated costs and savings[1].

**TABLE 1. SUMMARY OF SCOPING STUDY OPPORTUNITIES**

| Measure | Installation Cost[1,2] | Annual Electric Savings (kWh) | Annual Propane Savings (Gal) | Annual Cost Savings | Simple Payback (years) |
|---|---|---|---|---|---|
| **ECM-1: Fire Station - Pipe Insulation** | $100 | 370 | 0 | $63 | 1.6 |
| **ECM-2: All Buildings - Lighting Upgrades** | $5,400 | 5,900 | 0 | $1,003 | 5.4 |
| **ECM-3: Fire Station and Transfer Station Weatherization** | $2,400 | 880 | 42 | $300 | 8.0 |
| **ECM-4: Transfer Station (Hopper) - Ductless MSHP** | $8,500 | 6,300 | 0 | $1,071 | 7.9 |
| **ECM-5: Fire Station - Ducted ASHP** | $65,400 | -23,000 | 2,700 | $5,729 | 11.4 |
| **Total** | **$81,800** | **-9,550** | **2,742** | **$8,165** | **10.0** |
| **[1] Budgetary costs estimated based on past experience** | | | | | |
| **[2] Installation cost assumes each measure is a retrofit and the total cost is eligible** | | | | | |

## PROJECT OVERVIEW

Town of Henniker has nine municipal buildings, excluding schools. Of these nine, the Energy Committee selected three to receive scoping studies:

- Transfer Station at 1393 Weare Road
- Fire and Rescue Station at 216 Maple Street

[1] The costs and savings provided are estimates and require further refinement prior to implementing ECMs for incentive eligibility.

- Highway Garage at 209 Ramsdell Road

## Transfer Station

The Transfer station and Recycling Center has multiple small buildings associated with the operations. Each of the three buildings has their own electric meter. The recycle building is a metal framed building with multiple doors for town residents to pass through recyclable materials. Materials are sorted and placed in one of four compactors. The building is heated by a waste oil heater controlled by a manual thermostat. The high bay lighting has been converted to LED. One T12 fixture was found in the bathroom. Other process electric loads include an air compressor and wire tripper that are used infrequently.

The Parks Barn is an unheated storage building with LED strip fixtures lighting much of the interior. A few examples of incandescent bulbs were found in the storage garages and one high pressure sodium (HPS) bulb was observed in a wall mounted exterior fixture.

The Hopper building has two parts, a conditioned office space and the unheated drop space where trash goes down the chute to the compactor that fills trailers to be hauled offsite. The motor on the compactor is 30HP with a NEMA nominal efficiency of 91-percent. Interior lighting throughout both parts of the building is LED. Most of the wall packs are LED with daylight and motion sensing. One non-LED wall pack was noted but may be out of service. The office portion of the Hopper building has electric resistance baseboard heat and window air conditioner that stays in the window year-round. Both systems are controlled manually. The roof of the office is partially damaged, and the windows and door have inconsistent weatherstripping.

### *HISTORICAL ENERGY CONSUMPTION AND BENCHMARKING*

The building is served by electricity. Figure 1 shows the historical electric use by month for 2020 through 2022. The use profile is consistent with an electric heating load.

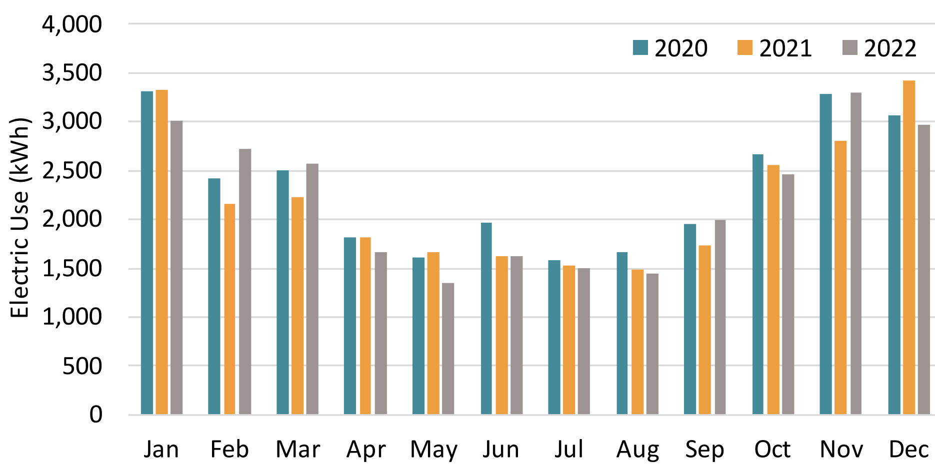


***FIGURE 1. HISTORICAL ELECTRIC CONSUMPTION: TRANSFER STATION***

Benchmarking the energy use of the facility against buildings of similar type is critical to assess the energy savings potential and performance of the end-use equipment. The energy use intensity (EUI) is used for benchmarking since it represents a normalized use per facility area and allows similar buildings to be compared directly.

Figure 2 shows historical and benchmark[2] electric EUI. The use of the facility is slightly above the electric benchmark use which indicates opportunity for energy savings.

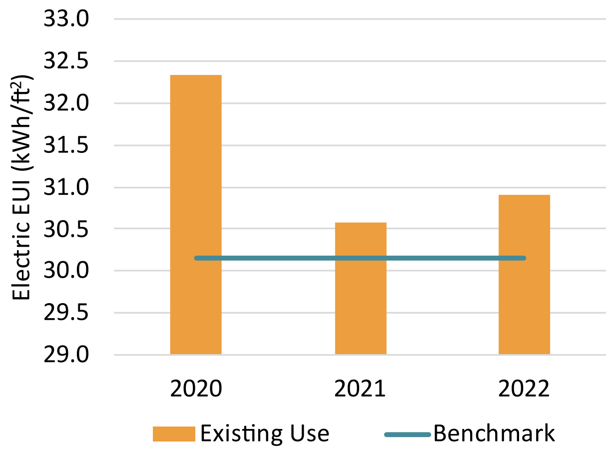


***FIGURE 2. HISTORICAL AND BENCHMARK ELECTRIC EUI COMPARISON: TRANSFER STATION***

The electric use is not related to warmer outside air conditions, as shown in Figure 3. The cooling degree days (CDDs) are a representation of how much cooling is required when outside air temperatures are above the balance point of 65°F. As CDDs increase the electric use does not correlate, indicating there is a non-weather dependent cooling use.

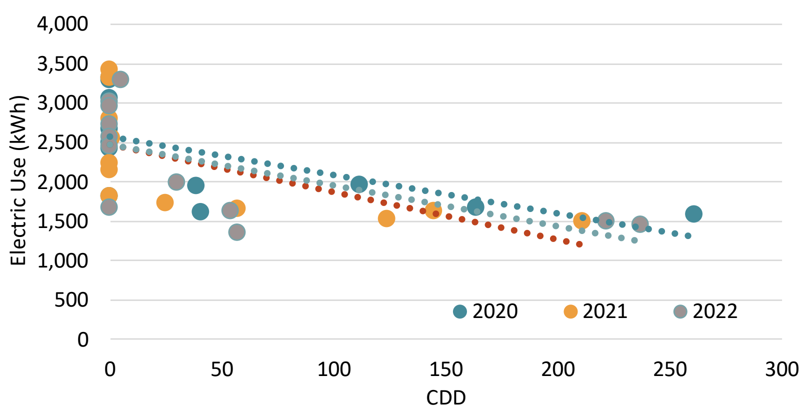


***FIGURE 3. ELECTRIC USE COMPARED TO COOLING DEGREE DAYS: TRANSFER STATION***

Electric use is, however, related to colder outside air conditions as shown in Figure 4. The heating degree days (HDDs) are a representation of how much heating is required when outside air temperatures are below the balance point of 65°F. As HDDs increase electric use trends higher, indicating there is weather-dependent heating use.

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[2] Using Commercial Buildings Energy Consumption Survey data compiled by the U.S. Energy Information Administration.

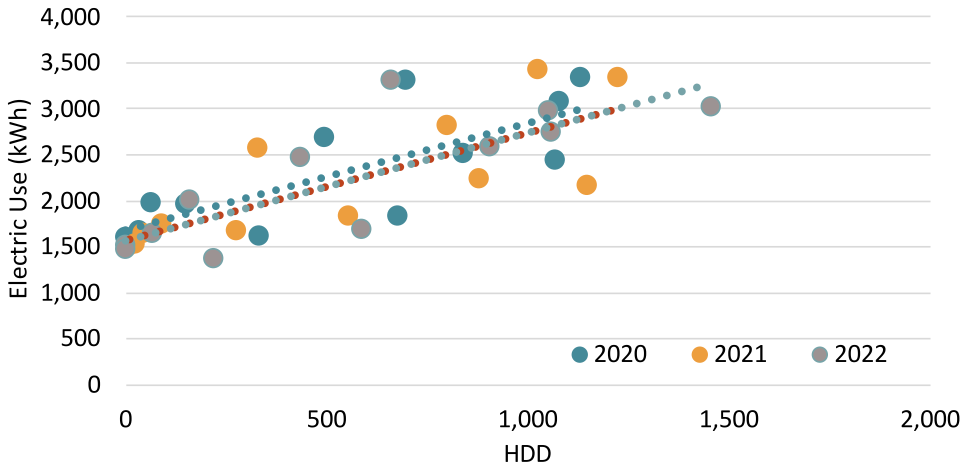


***FIGURE 4. ELECTRIC USE COMPARED TO HEATING DEGREE DAYS: TRANSFER STATION***

## Fire and Rescue Station

The Fire Station is a slab-on-grade building with wood framing and ventilated pitched attic. The building was constructed in 1994. The attic has received additional insulation since the original construction. The windows, man doors, and most of the garage doors are original. The six overhead doors appeared to be in adequate condition. Air gaps were observed around exterior man doors. The seals around the wood windows are also worn from age. The two propane furnaces with split system direct expansion (DX) air conditioning serving the non-garage areas were noted as original. These systems were efficient at the time of construction; however, more energy efficient technology is available today. The systems are controlled by programmable thermostats that are not programmed for setbacks. Domestic hot water (DHW) is provided by a 50-gallon tank-style electric water heater that was installed in January 2020. The DHW piping is uninsulated. Lighting throughout the interior and exterior of the building has been replaced with efficient LED technology. Occupancy sensors have been installed adequately in rooms with infrequent utilization.

The garage is heated by propane unit heaters. There is one thru-wall exhaust fan controlled by a timer located by the workbench. The garage has an efficient engine exhaust removal system[3] that filters particulates from the air without exhausting conditioned air from the space. The system is triggered when the garage doors open and runs on a timer currently set to 15 minutes. All vehicles in the garage are plugged in to charge all on board equipment batteries 24/7. Other electric loads in the garage include an air compressor, a residential sized washer and dryer, and a washer and dryer specifically designed for fire fighter gear. The building is occupied at all times, though certain spaces are used more than others.

### *HISTORICAL ENERGY CONSUMPTION AND BENCHMARKING*

The building is served by electricity and propane. Only electric data was available for analysis. The fire station has two electric meters, one for the station and another for the radio tower. Figure 5 shows the historical electric use by month for 2020 through 2022 for the fire station. The use profile is consistent with a significant electric baseload and a summer cooling load.

[3] http://www.airvac911.com/system.html

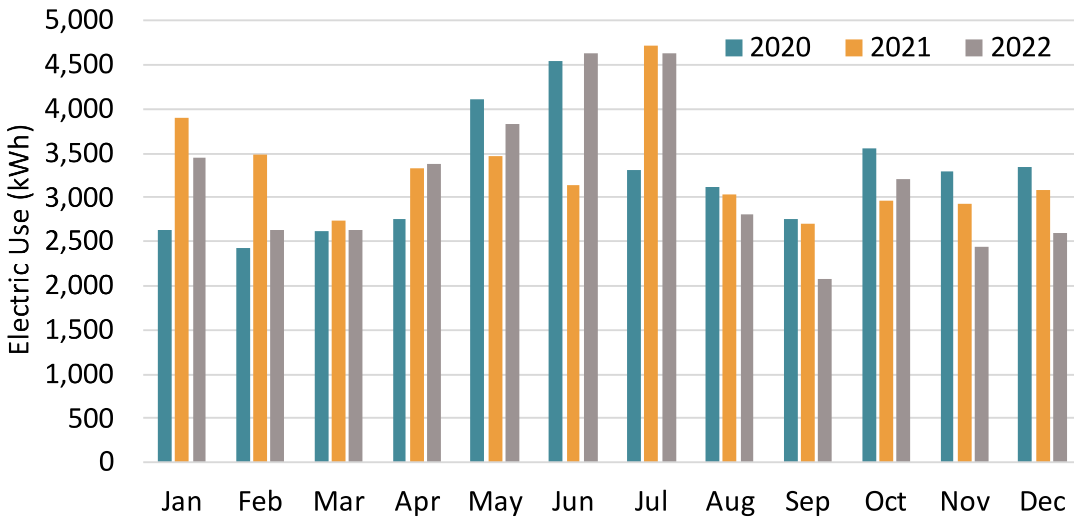


***FIGURE 5. HISTORICAL ELECTRIC CONSUMPTION: FIRE AND RESCUE STATION***

Figure 6 shows historical and benchmark electric EUI. The use of the facility is below the electric benchmark.

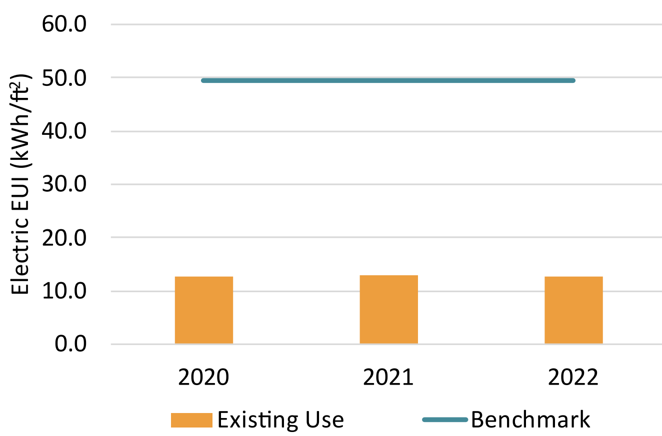


***FIGURE 6. HISTORICAL AND BENCHMARK ELECTRIC EUI COMPARISON: FIRE AND RESCUE STATION***

The electric use is somewhat related to warmer outside air conditions as shown in Figure 7. As CDDs increase the electric use does correlates, indicating there is weather dependent cooling use.

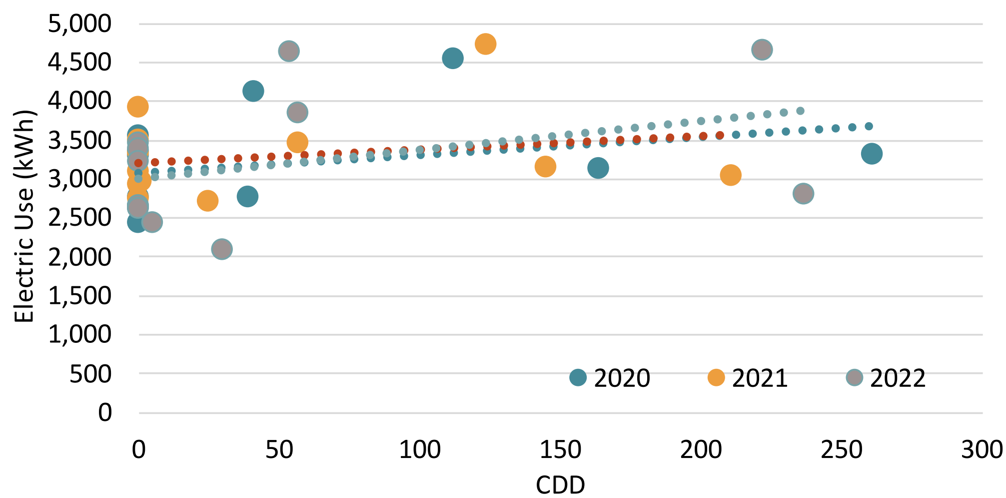


***FIGURE 7. ELECTRIC USE COMPARED TO COOLING DEGREE DAYS: FIRE AND RESCUE STATION***

## Highway Garage

The Highway Garage building was constructed in 2016. Its envelope, lighting, DHW, and HVAC are all modern and efficient for their age. All but one garage bay has radiant floor heating. Heating hot water (HHW) is produced by a wood pellet boiler and distributed by pumps with integrated VFDs. The garage bays have back up propane unit heaters. The thermostats for both systems are programmable although they are set to hold one temperature. The radiant floor thermostats are set to 64°F while the unit heaters are set to 60°F to help raise the temperature in the space when it drops after bay doors are opened. There are multiple exhaust fans and louvers set to run off carbon monoxide levels.

Electric process loads in the building include an air compressor and a welder. The Highway Department is busiest in the winter months for road clearing activities. Operations are generally one shift per day with crews in and out of the building depending on the season and work to be done. The lighting in the garage bays is controlled by manual switches. The work in these areas necessitates that lighting is not shut off for safety, however, manual controls can lead to long periods of lighting runtime when lighting is not switched off before a shift on the roads.

The small office and breakroom area in the building are heated and cooled by a ductless multizone heat pump system. This system has occupancy sensors and a programmable thermostat that is set to hold at 70 degrees. The lighting in the area is controlled by an occupancy sensor.

### *HISTORICAL ENERGY CONSUMPTION AND BENCHMARKING*

The building is served by electricity, wood pellets, and propane. Only electric data was available for analysis. Figure 8 shows the historical electric use by month for 2020 through 2022. The use profile is inconsistent over time. This is reasonable considering that the highway department is as busy as the weather conditions dictate. The greater electric loads in the winter could be indicative of long lighting runtimes during the busy season or the heat pumps running on electric resistance backup heat.

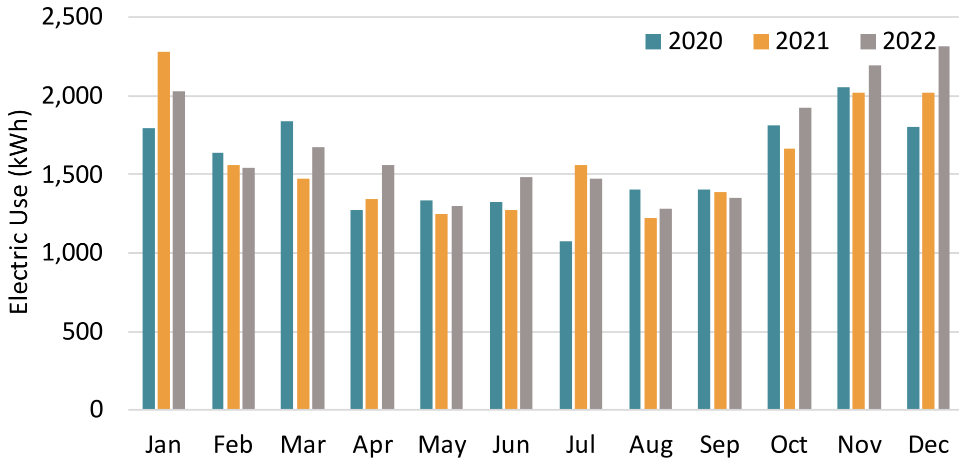


***FIGURE 8. HISTORICAL ELECTRIC CONSUMPTION: HIGHWAY GARAGE***

Figure 9 shows historical and benchmark electric EUI. The use of the facility is below the electric benchmark use.

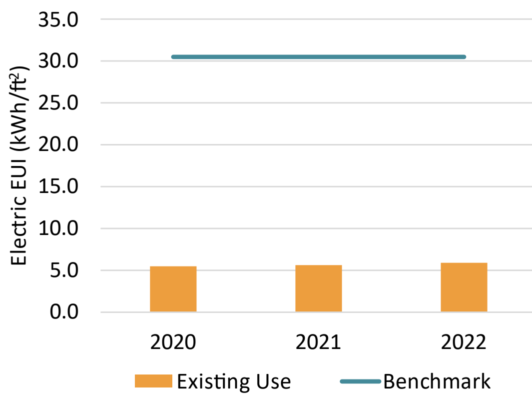


***FIGURE 9. HISTORICAL AND BENCHMARK ELECTRIC EUI COMPARISON: HIGHWAY GARAGE***

The electric use is not related to warmer outside air conditions as shown in Figure 10. As CDDs increase the electric use does not correlate indicating there is a no weather-dependent cooling use.

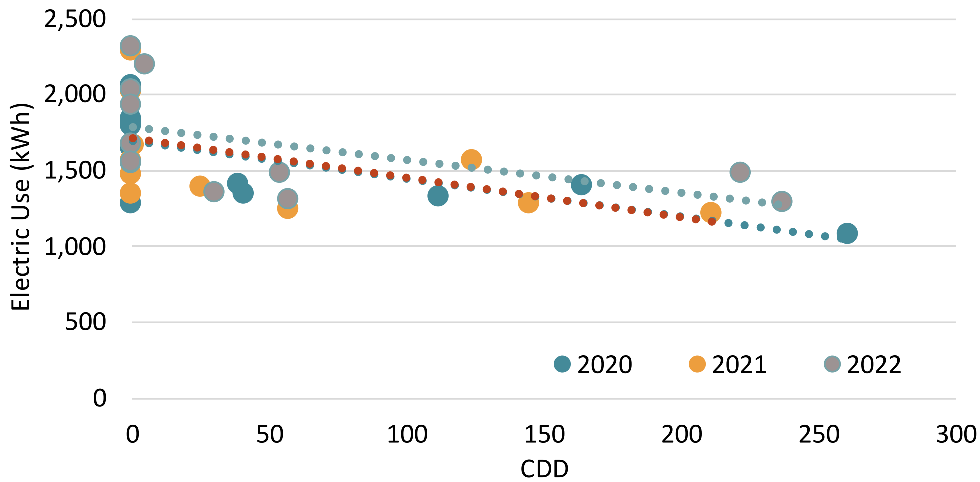


***FIGURE 10. ELECTRIC USE COMPARED TO COOLING DEGREE DAYS: HIGHWAY GARAGE***

## PRELIMINARY ENERGY CONSERVATION MEASURE

### ECM-1: Fire Station - Pipe Insulation

The DHW piping in the fire station was bare copper pipe. GDS recommends insulating the DHW piping to decrease heat loss and more efficiently deliver hot water to the building.  Due to the relatively low cost of the piping insulation, the payback for this measure is generally low. Insulating bare pipes or pipes with failed insulation will cost-effectively reduce electric use and protect staff from unsafe high-temperature surfaces.

### ECM-2: All Buildings - Lighting Upgrades

The majority of the lighting throughout all three buildings has been converted to LED and is controlled efficiently by occupancy sensors. A few non-LED fixtures were noted at the Transfer station. These fixtures have low run hours, however, changing over to LEDs will result in electric savings. Additionally, the Highway Garage has manual controls for the lighting in the garage bays. Infrequent occupancy patterns in this building may lead to long lighting runtimes when the lights are left on after workers leave to do work outside of the building. Installing occupancy sensors or another auto-off device would reduce the runtime of the lighting in the bays when they are not in use.

### ECM-3: Fire Station and Transfer Station Weatherization

Small gaps around doors and windows are a source of air infiltration into the building. Air infiltration introduces unconditioned air that increases the load on heating and cooling systems necessary to maintain temperature set points. Weatherization includes installing weatherstripping on doors and windows, caulking gaps in the envelope and air sealing any unnecessary penetrations. GDS recommends conducting a thorough survey of the fire station and Hopper building at the transfer station to identify and address weatherization opportunities that will reduce energy costs.

### ECM-4: Transfer Station (Hopper) – Ductless MSHP

The Hopper office is currently heated with an electric resistance baseboard and cooled by a window air conditioning unit. Both systems are inefficient and could be replaced by a ductless mini-split heat pump (MSHP) Heat pumps provide heating and cooling using only electricity and transfer energy from outside using a refrigeration cycle. When considering new high efficiency equipment, ensure the units have the highest SEER, EER, and/or HSPF rating available to maximize energy savings and provide the greatest economic return on the cost.

### ECM-5: Fire Station - Ducted ASHP

The Fire Station offices and dormitory are served by aging propane furnaces with DX cooling. Both systems are inefficient by today's standards and could be replaced by a ducted air source heat pump (ASHP) system. Heat pumps provide heating and cooling using only electricity and transfer energy from outside using a refrigeration cycle. When considering new high efficiency equipment, ensure the units have the highest SEER, EER, and/or HSPF rating available to maximize energy savings and provide the greatest economic return on the cost.

## ADDITIONAL MEASURES FOR CONSIDERATION

The measures identified in Table 3 below are recommended for future consideration. However, additional information is required to develop estimated costs and any associated benefit.

**TABLE 2. SUMMARY OF ADDITIONAL MEASURES FOR CONSIDERATION**

| Measure | Location | Summary | Typical Payback (years)[1] |
|---|---|---|---|
| **1** | Fire Station and Highway Garage | **Review Thermostat Scheduling**: Programable thermostats are installed in multiple building however, they are not currently programmed with temperature setbacks. Implementing temperature setbacks will save energy by reducing the load during unoccupied periods. Typically, a temperature setback of five degrees can reduce annual energy use by around 15 percent.<br>Confirming thermostat settings match occupancy schedules on a regular basis is also recommended. Frequently, occupants will manually override thermostat setpoints and schedules to address their specific comfort needs and forget to return the settings back to normal. Performing this review on a regular basis will help to maintain occupant comfort and ensure energy savings are realized. | n/a |
| **2** | Transfer Station | **Programmable Thermostats:** Manual thermostats control the waste oil heat in the Recycle building and the electric resistance baseboards in the Hopper office. Installing programable thermostats and implementing temperature setbacks will save energy by reducing the load during unoccupied periods. | 1-2 |
| **3** | Transfer Station and Fire Station | **EnergyStar Appliances (end-of-life)**: When it comes time to replace residential style appliances like refrigerators or laundry machines, choose high efficiency appliances. Most high-efficiency units can be identified by ENERGY STAR® ratings. | 3-4 |
| **4** | Fire Station | **Automatic Battery Charger**: All emergency vehicles are plugged in after returning from a call to recharge all batteries on board. They remain connected to power 24/7 until they leave for the next call. Investigating to determine if smart charging systems exist to reduce electric demand when charging is not required, or charge more efficiently is recommended. | 4-5 |
| **5** | Fire Station | **Heat Pump Water Heater (end-of-life)[2]**: Upgrading the existing electric domestic water heater with a heat pump water heater (HPWH) will more efficiently produce hot water. HPWHs reduce energy use by transferring heat from the surrounding space into the water rather than using an electric resistance heating coil. HPWHs provide efficiency ratings that are two to three times an electric resistance unit. As a result of transferring heat from the ambient air, HPWHs provide cool exhaust air | 4-5 |

| | | | |
|---|---|---|---|
| | | that can be ducted to spaces to offset cooling loads further reducing energy use. | |

The payback provided is an estimate and requires further refinement prior to implementing ECMs for incentive eligibility.
[2] These measures are recommended when equipment fail or are nearing end of useful life. Potential incentives would be based on the incremental cost difference between code-compliant and high efficiency equipment. Only high efficiency equipment is eligible for incentives.

## RECOMMENDED NEXT STEPS

GDS will review the identified ECMs with the Town of Henniker to determine which, if any, are of interest to pursue. Once ECMs are selected for implementation, the Town has the following options:

- Solicit proposals from preferred contractors and coordinate with Eversource to submit an NHSaves Custom application.
- Request GDS or preferred engineering vendor perform a Technical Assistance (TA) study which would be cost shared between theh Town of Henniker and Eversource. GDS would coordinate with preferred contractors or existing partners to determine ECM cost, develop custom energy savings analyses, and assist the Town of Henniker with completing NHSaves Custom application and program documentation.