

# Utility and Environmental Conservation measures and the impact on the Hightstown Housing Authority

The Hightstown Housing Authority has undertaken several projects in the last 3 years with a goal of reducing the carbon footprint of the Housing Authority and reducing operating expenses. Shrinking budgets due to lack of funding from the federal government have left major gaps in the budgets of every federally funded agency. In order to survive in the new normal of federal funding, The Hightstown Housing Authority completed the following projects.

## Electricity

**Condition:** The majority of the electrical demand at the Hightstown Housing Authority is for site and unit lighting. Existing apartment fixtures are incandescent and or T-12 fluorescent lighting. Outside balcony fixtures that are on daylight sensors are 2 bulb incandescent fixtures. Larger site and security lights that operate on daylight sensors are either mercury vapor or metal halide fixtures. The average electric bill is \$8,000 per month.

**Solution:** The HA is under taking projects to reduce electrical consumption. These include removing 70 exterior balcony lights and replacing them with new LED fixtures. By changing each of these 120Watt fixtures with new 17Watt fixtures, we will save approximately \$350 dollars per month in electric, paying for the new fixtures in just 11.5 months. The next phase is replacing all of the exterior site lighting with LED. We currently use 34263 watts of power each year with our current fixtures. Once replaced with LED, our consumption will decrease to just over 1680 watts. Annually this will save over \$4,500 in electric. Payback is approximately 3 years. The third project has a longer payback and will be done upon turnover. We anticipate this taking approximately 5 years and will involve replacing all the ceiling mounted fixtures in the apartments with new LED fixtures. The payback period will be approximately 10 years, saving just over \$250 dollars per month.

Additional projects include replacing all laundry room lighting with LED fixtures on motion sensors.

**Results:** We will monitor our monthly usage and report our progress

**Where do we go from here?** This process will take up to 5 years to fully implement. We will carefully monitor the costs as we install new fixtures.

**Global Impact:** Each day, your local utility plant will burn coal, oil, or gas to generate electricity for your lighting system and your other electrical needs. While burning these fossil fuels produces readily available and instantaneous supply of electricity, it also generates air pollution. Hightstown, NJ is located in the EPA region 2. The following projections are based on data provided by the EPA for our region. By reducing our consumption, we are having the global equivalent impact annually of:

- Planting 16.48 Acres of trees annually
- Permanently removing 8 cars from the road
- Saving 5167 gallons of gasoline from being burned
- Preventing 20.46 tons of CO2 from going into the atmosphere.

## Natural Gas

**History:** Natural gas is consumed on the site for 3 purposes. The first is cooking gas for the individual units, second is for domestic hot water and finally is space heating. The Housing Authority historically use approximately 73,000 CCF of natural gas per year for these purposes. This average is taken over a 5 year period which allows for fluctuation in weather. Each CCF of natural gas produces 122 lbs of CO2 when burned. Annual, the Housing Authority was producing 4453 tons of CO2 for heating and hot water.

**Domestic Hot Water:** The production of hot water was done one of 2 ways. In the summer the HA has 3 Lochinvar high efficiency boilers and 8 super insulated storage tanks which feed all the residential buildings as well as the laundry facilities with domestic hot water. In the winter, when the main boilers are operating, the heat exchangers were opened and the main boilers were used to supply hot water. We have eliminated the use of the boiler heat exchangers in the winter. The Lochinvar boilers are 10-12% more efficient than our main boilers and we no longer lose up to 20% of the energy produced by the main boilers by using the heat exchangers. Plus we are able to reduce our daily operating boiler temperatures, as the boilers must run at 180 degrees to produce domestic hot water.

**Solution:** Low flow aerators and shower heads were installed in every residential apartment, reducing the demand for hot water. This should reduce the consumption of natural gas for the production of hot water in half. The new laundry facilities are "Cold Water" only machines that will not use hot water. There is notable savings from this solution, which will only be determined by monitoring and comparison due to the fact we do not know historically how many loads of laundry were done in hot water. We can surmise the baseline usage of natural gas over the last 10 years is 1270 CCF per month for cooking and hot water based on 0- degree day months where all gas used would be for those purposes. With the installation of the "Cold Water" wash laundry, we will monitor the consumption of natural gas during the 0-degree day periods to determine the new consumption standard.

**Residential Space Heating:** The Hightstown Housing Authority has 3 centralized boiler rooms, each of which contain 2 boilers capable of approximately 1.9 to 2.1 million BTU for a total BTU capacity of 4.0 million BTU per boiler plant. After careful study by 2 independent energy auditors, it was determined the boilers are running at an efficiency of 81-83% annual **fuel utilization efficiency (AFUE)** is a thermal efficiency measure of combustion equipment like furnaces, boilers, and water heaters. The AFUE differs from the true 'thermal efficiency' in that it is not a steady-state, peak measure of conversion efficiency, but instead attempts to represent the actual, season-long, average efficiency of that piece of equipment, including the operating transients.- It is a dimensionless ratio of useful energy output to energy input, expressed as a percentage. For example, a 90% AFUE for a gas furnace means it outputs 90 BTUs of useful heating for every 100 BTUs of Natural Gas input (where the rest may be wasted heat in the exhaust).

**Solution:** This equipment is considered to be in the mid-range of efficiency but nearing the end of its useful lifecycle. All of the equipment is scheduled to be replaced in the summer of 2017. To maximize the efficiency of the current equipment, we have installed new controls on the units that will allow us to monitor the heating loop water temperatures and adjust that against the current outdoor temperature with a base indoor comfort level ( $\Delta T$ ). As an example, on a 40 degree day, the boilers may only fire the loop temperature to 135 degrees, whereas at 20 degrees outdoor air temperature, the loop temperature may run at 155 degrees. This insures an adequate amount of heat is being produced to meet the demand in the units. The new heating plants will be a series of modular cast iron sectional boilers that will fire in sequence with overall efficiency of 90-91%. A decision was made not to use super high efficiency condensing boilers due to the shortened life cycle, and nearly double the initial cost. The payback on going with the highest efficiency equipment exceeded 25 years, and deemed not feasible.

**Results:** We have experienced much higher efficiency during the moderate demand days. By modifying the loop temperatures based on outdoor air temperatures, we are able to gently warm the interior spaces instead of overheating them.

**Condition:** Each apartment unit has between 3 and 7 radiators based on the unit's size. There was no way to thermostatically control the amount of heat coming from each radiator. The tenants traditionally would open the window when the unit becomes too warm. This was especially prevalent during the moderate demand days when the boilers would be running at 180 degrees. Most of the energy being expended was being wasted and the residents were never really comfortable.

**Solution:** In 2013 we installed 528 individual thermostatic radiator valves, one each radiator on the property. This project was partially funded through a grant from the State of NJ, and the Housing Authority contributed just over \$17,000. The total as built cost was approximately \$82,000. The thermostatic valves have been a great success, with our overall consumption dropping from approximately 11.5 CCF per day to approximately 8.5 CCF per day over the course of the year. This of course is degree day adjusted with the cooking and hot water usage removed. This one project has reduced the cost of natural gas to the property by just over \$20,000 dollars per year.

