Municipal Energy Analysis Report - Cohasset, MA

Prepared by
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The cohasset town hall was originally built in 1857 and in 1987 an addition was built to expand the existing space and accommodate the growing community.
While visiting the town hall, plans to renovate the old section were discussed which included a replacement of the existing roof and an interior rehab which involved dropping the existing ceiling, with the thought of potentially using the attic space for storage. In the newer section of the town hall sub poor envelope performance and a facade that clearly clashes with the historic exterior of the existing town hall has been a concern for many of its occupants.
The analysis we do for this is based on actual data which you can see is highly correlated. We used this to find the building's actual heat loss characteristics, it helps use to ensure we aren’t over or under estimating our measures.
Moisture Control

Current Wall system holds moisture and is rotting exterior facade

Currently moisture is able to enter the wall system and stay within the wall system which will eventually cost the rotting of the exterior siding and destruction of the paint in its surface as the water moves through the wood and isn’t allowed to pass through the what is presumed to be oil based paint. while we established this was not a led paint on the town halls exterior this helps us to create a solution for the wall assembly that will allow any moisture that builds within the wall assembly a way of existing.
Existing Conditions and Problems - Old Section

**Single Pane Windows**

- Leaky windows
- Poor insulating value

Windows currently in use throughout the old and new section of the building are inefficient and contribute to the building significant heat use and loss throughout the year.
Within the current wall system of the old section of the town hall there appears to be little to no insulation along with a lack of an air barrier creating a conditioned environment that loses a large majority of its heat to the exterior in colder months and its cooling in warmer months.
This wall assembly addresses the previously stated issues, both insulating and creating a plane within the wall system which allows for air flow and moisture drainage to the exterior. Illustrated in the image you can see how a detailed implementation of this system will allow for any moisture which enter the wall system to drain externally eliminating the moisture issue within the wall assembly. Regarding the interior gutting while implementing the new drainage system it is essential to make sure the wall assembly is insulated properly. Filling the existing cavity with Closed cell spray foam helps to air seal the wall and well as properly insulate. by bumping the wall assembly out an additional 2” (2x4 Furring and .5” drywall. allows for an easy acces for electricians to run all new wiring throughout the building which can then be back by rockwool to create an almost continously insulated wall assembly. which helps dramatically in keeping the R-value of the wall as high as possible.
with current plans for interior rehab of the old section of the town hall this system only requires a slightly higher cost to incorporate the drainage plane within the wall assembly and to further increase the insulating value of the wall. The additional cost of ramping up the wall assembly is easily paid back with the saving found by creating a wall system which functions efficiently.
With the new ceiling dropped, the air barrier can be linked to the wall system simply by taping the corners of the ceiling to wall connection, from this point the new ceiling assembly should be air sealed with an inch of closed cell spray foam and covered by 18+ inches of loose packed cellulose (all of this would need to be done to bring the building up to code regardless once the ceiling is dropped)

With the new roof installed as currently planned it is important to properly ventilate the attic by creating soffit vents to the exterior and a ridge vent when replacing the existing roof. Capping the existing ventilation system which is ducted into the attic will help to seal off the conditioned space throughout the old section of the building.
With the new wall assembly it only make sense to replace the existing windows with triple pane windows to help meet code as well as to create a higher overall wall R-value. Architectural windows can be found that are built to be efficient as well as match aesthetic of older building to help keep historical value. Before moving on it is important to mention that our suggestions require minimal extra work since the building is already planning to have work done to its interior. Our plan helps to address moisture issues which eliminate the need to repaint the town hall every five years. The increased insulating value of the wall assembly helps to reduce energy usage significantly and reduce energy demands.
1. addition was added in 1987
2. Asthetically does not match the old style - window trim and sill are different as well as over hangs
3. does not perform well
Issues of the New Building

- Suffering from ice dams
- Failing siding
- Air leakage at gable vents
- Lacking insulation in the walls and roof
- Moisture build up in the basement
Existing Conditions and Problems - New Section

Failing Siding

1. point out the failing siding on the right
2. explain the thermographic camera; purples and blues are colder temperatures and as you move up on the scale the temperature increases
3. the purple spot is actually moisture that is trapped in the wall assembly which is causing the clapboards the pull and fail
4. The windows are not properly flashed and wrapped so they are especially problem areas
5. design the building knowing that it will get wet but it has the ability to dry out.
1. on both the new and old buildings, the roof needs to be replaced.
2. the picture on the right looks at the insulation on the interior of the new buildings roof. this is a foil faced insulation held up with chicken wire that also does not have an air barrier so there is no thermal boundary.
3. the current conditions allow for conditioned air to escape through the roof.
4. existing skylights and roof penetrations are problem areas as well
1. The current building assembly is lacking an air barrier and the conditioned area is open to the exterior through the gable vents within the attic meaning a large of amount of heat loss is occurring. Sealing these off and creating the thermal boundary will help to further increase the efficiency of the newer section of the building.
1. moisture in the basement is caused by rain run-off getting dumped too close to the building.

2. the result is the need for constant dehumidification in the basement and the Vault room in particular

3. we did not have time to do a regression analysis but we have a strong suspicion based on past cases that there is a correlation between rainfall and dehumidification loads. we have seen in the past that rainfall can result in a spike in electricity used for dehumidification. Also looking at downspout conditions and runoff directions we have a good idea of why there is
1. so much moisture in the basement.
1. since there are no plans to touch the interior of the new sector, all the insulation will be done from the exterior
2. the roof will be stripped down to the sheathing and 6” of exterior PolyIso Foam board will be added along with an additional air barrier
3. this will increase the R-value to about R-55
4. R-Value is the capacity for an insulating material to resist heat flow. The higher the R value, the better the insulating power
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Addition of:

- 4” of PolyIso Foam

- Drainage Plane with Proper Air/Vapor Barrier

- Vented Rain Screen

1. since there is a need to replace the siding, it makes the most sense to strip everything and add 4” of polyiso as well as adding a vented rain screen
Vented Rain Screen

- Maximized Drying Potential and Thermal Performance

- Life expectancy of the wall system is drastically increased due to less wear from the sun and weather

fur out the wall and create a gap between the insulation we added and the siding
- New roof system allows for building facade to be adjusted to match the old building style which ties the building sections together.

With the changes being made to the envelope of the new section of the building this allows for the exterior aesthetic to be built to match the style of the old section of the town hall. (Historically society claps and applauds)
Solar Tubes in Replacement of Existing Skylights

- These replace existing skylights
- Provide sufficient lighting to any area
- Sealed and weather wrapped properly
Existing Conditions and Problems - Heating

- Currently provides no pathway to energy efficiency

- There is no way to create a new energy efficient building by trying to reuse the current heating system

- Results would be a high cost with little return!
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<th>GSHP’s Implementation</th>
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<td>- Replace current inefficient heating system</td>
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<td>- High initial cost but payback is rapid with energy savings</td>
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<td>- Paired with new building envelope allows for lowering operating temps, and lower heating demands</td>
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With the installation of a Ground source heat pump you eliminate the need for a boiler within the building system. A ground source heat pump is efficient in this environment for cooling and heating seasons, with refrigerant run to a hybrid branch controller the heat is then transferred to water which circulates through a radiant flooring loop installed within the gutted interior. The same hot water can be linked to the baseboard heater within the newer section of the building. Since the radiant floor can operate at a lower temperature rather than trying to increase the water temperature circulating throughout the baseboard of the new building, refrigerant can be run directly to overhead units to add the additional heating to the conditioned space. With a lower operating temperature we can get the highest efficiency out of the ground source heat pump.
Emitters can consist of a variety of systems including fan coils or a radiant floor system.

This system can be Split up as previously discussed (hybrid) to meet the heating and cooling needs of the new section of the town hall. However supplemental dehumidification is necessary in the old section of the town hall.
The radiant flooring system shown here provides necessary heat for the old section of the town hill in colder months, but can only provide sensible cooling in the warmer seasons.
A solution for this is to install an Enthalpy Recovery Ventilator connected to a condensing loop run by the GSHP. This system would draw in outdoor air and cool it providing the additional latent cooling needed throughout this portion of the town hall.
The graph shows the total reduction of millions of btu’s through the existing envelope and the suggested envelope.
energy usage reduction in BTU’s not the current bar account for electricity and gas usage (converted from therms to btu’s)
Estimated yearly cost saving with implementing new wall/ systems and replacing existing windows.
Thank You!

We would like to thank the Town Board members of Cohasset for making the trip out to hear our thoughts and ideas of the current issues they face with their town Hall.
We wish them the best with their efforts to create a more functional and efficient space for all those who use it.

-Clean Energy Corps