Gunn Memorial Library

Washington, CT

Energy Audit Report

Introduction

An energy audit was conducted at the Gunn Memorial Library on May 4, 2011 by Home Energy Technologies LLC. The audit scope included blower door tests to assess the air-tightness of the building and an infra-red imaging survey to identify thermal defects and areas of air infiltration during the blower door test. The audit results will be used to inform a planned replacement of the heating system and other future measures.

Methodology

- Air infiltration was measured at 29,634 CFM50 for the main 3 levels of the library. The Basement level air infiltration was tested separately at 3,070 CFM50. Since there appears to be some connection between the main library and the basement (primarily through the elevator shaft) the total infiltration for the building is estimated to be approximately 32,000 CFM50.
- Infra-red thermographic imaging was used before and during the blower door test to identify defects in the thermal envelope and to identify points of air infiltration. Selected images with comments are included in the companion report Gunn Library IR Images.

Observations

- For this analysis it is appropriate to consider the library in two parts, the old building and the new building. The old building is the third floor reading room and classroom area while the new building includes the Connecticut Room on the third floor and all spaces on the second floor and the floors below
- The old building is responsible for about half of the total building air leakage. A blower door test conducted with the door closed between the old building and the third floor lobby showed infiltration of 16,474 CFM50. Visual and thermographic inspection (images 114 and 124-128) showed a number of sources
    - By far the largest source of air leakage appears to be the ceiling, particularly the coffered ceiling in the reading room. The 40 recessed lights act as little chimneys while air is also seen leaking around the coffering in the reading room and around the crown molding in the classroom area
    - There are visible gaps between the exterior door and its frame

    - Leakage can be seen around the windows, particularly on the north wall. New storm windows are being installed and this should reduce this source
    - A significant leakage was observed from the air handler enclosure above the kitchen/storage area
    - Some leakage was seen around the baseboard/wainscoting and from under the seat adjacent to the exit door
- The new building is responsible for the other half of the building air leakage. However based on our observations it appears that a significant proportion of this leakage may be attributable to two major sources:
    - Significant infiltration was seen and felt around the elevator doors (image 135). Apparently there is an opening to the outside at the top of the elevator shaft that would be responsible for this
    - Air is infiltrating from the outside through the HVAC system. This is shown in image 129 that shows outside air being drawn into the building through the return in the main atrium. This is most likely because the manually controlled dampers designed to allow fresh air to be drawn into the building in the summer are open or are leaking.
    - Other lesser sources that are also responsible for some of the leakage include:
        - Inadequate weather stripping around doors (e.g. image 123)
        - Gaps between trim and drywall (e.g. images 131, 142, 144)
        - Inadequate air sealing at envelope penetrations (e.g. image 137)
- Overall the insulation installed in the new building appears to be reasonably well installed although some defects were observed (e.g. images 103,134,138,139,145). There would be minimal benefit from addressing these defects in the short term unless walls are to be opened up as part of other projects
    - Image 118 shows a gap in the structure where the uninsulated roof deck is visible. The ceiling tiles had been removed in this area apparently in search of a water leak. As part of the leak repair the gap that allows cold air from the attic to enter the story room ceiling should be sealed. The same problem is likely to be found on the S side of the room.
- Because of the high level of air infiltration it was difficult to get a good sense of the insulation in the old building. However it can be seen that there is at least some insulation in the classroom area ceiling because two areas of missing insulation can clearly be seen (image 114)

Recommendations

We would recommend three initiatives to reduce energy costs resulting from excessive air infiltration at the Gunn Memorial Library

- Air sealing and weatherization of the new building including
    - Elevator shaft
    - Weather-stripping repair or replacement on doors

    - Repair and/or caulk any significant gaps around hatches, windows etc.
    - Caulk/seal all envelope penetrations
- Install modern ventilation controls
    - As part of the planned HVAC project the ventilation system should be upgraded. The current system using manually operated dampers leads to under and over ventilation resulting in occupant discomfort and excessive energy use
- Air sealing of the old building
    - This is the most challenging project due to the historic nature of the building. Ideally the coffering and crown molding would be removed so that the ceiling could be air sealed but this is a major undertaking. It is possible that replacing the reading room lights with sealed units may alone make a significant impact but this would require additional testing to verify. The new storm windows will also reduce infiltration as should weather-stripping exterior doors and air sealing the air handler enclosure in the kitchen area.