Energy Audit Report
Lee Town Hall
7 Mast Road, Lee NH
August 16 & 17, 2011

SDES Group
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SDES Group
Sustainable Development & Energy Systems

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Lee Town Hall

Description:

Building: 1.5 Story
Year built: 1850
Foundation: Granite slab
Framing: Wood
Roof: Gable
Exterior: Brick (1st floor); Cedar Siding (2nd floor)

Interior: Wall Board, Drywall
Flooring: Hardwood
Bathrooms: two
Heat: Propane Gas, Forced Hot Water
A/C: No

Finished area: 2,891 Sq. Ft.

Test Results:

Blower Door Reading
Winter-time conditions: 7204 CFM 50

Air Sealing Limit
Building Airflow Standard: 2310 CFM 50
Ventilation required for occupants: 150 cfm
Ventilation required for building: 134 cfm

Crawl-Space:

Existing Conditions:

The crawl space walls are granite slabs, dry fit, with no mortar and many gaps/air spaces. The first floor and rim joists are wood framed. There is 6" of fiberglass batt insulation in the floor joist bays, in poor condition, with the Kraft paper facing incorrectly to the outside. Some areas have no insulation – floor boards are exposed to outside conditions in the crawl space.

Recommendation:

- Install, 6 mil poly sheeting as a vapor barrier over the dirt floor and 1 ft. up the foundation walls.

- Install 2” of Urethane spray foam on the foundation walls from the dirt floor to the subfloor (as an air and vapor barrier, and secondarily as a thermal barrier).
- Remove the existing fiberglass batt insulation from the joist bays.
- Air Seal the crawl space ceiling / subfloor
- Install R-30 fiberglass batts between the joist bays (with the vapor barrier facing the subfloor).
- Add 2” of rigid foam board insulation at the bottom of the floor joists, and foam the joints, enclosing the
- This method creates a vapor barrier at the dirt floor and along the walls, significantly reducing the moisture level in the crawl space area. The 2” of spray foam on the walls continues the vapor barrier and creates an air barrier, (and provides some additional insulating value). The primary thermal barrier is at the subfloor, continuous with the rest of the building envelope.

Note: An alternative recommendation is:

- Install min. 3” (consider cost/benefit of 4”- 5”) of closed cell spray foam insulation in the joist bays, and cover the remainder of the joists and beams with a 1” minimum.
- This method effectively provides an air and vapor barrier as well as insulation (6.2 R-value per inch).
- Cost and accessibility for spray foam installation is the primary concern. The crawl space ceiling is approximately 1900 sq. ft. versus the crawl space walls at approximately 510 sq. ft. A cost comparison and consultation with the installer regarding installation may be warranted.

Attic – Knee-wall space.

Existing Conditions:

The soffit vents at the eaves are effectively sealed with paint (from the exterior) preventing ventilation to the attic area. The knee-wall space of the second floor is unfinished and Unconditioned. The thermal envelope is at the 2nd floor level, and consists of 8” fiberglass batt insulation in the joist bays and 2” -3” of loose-fill fiberglass above. The knee-walls are insulated with fiberglass batt insulation. The 7” rafter bays are open from the eave through to the attic space above.

Recommendation:

- Install closed cell spray foam insulation in the 7” rafter bays, from the eaves, closing the soffits, to above the second floor knee-wall through to the floor insulation in the attic area. This reestablishing the thermal boundary from the floor and knee-wall to the roof slope, at an approximate R- value of 6.0 per inch.

Attic – Furnace Room and Computer Room

Existing Conditions:

The soffit vents at the eaves are effectively sealed with paint (from the exterior). The rafter bays are insulated with Kraft-faced fiberglass batt insulation from the eaves to the attic area. There is a section of the rafter bay insulation in the furnace room where the insulation has been removed away from the furnace ventilation pipe. The attic floor extending the hallway partition walls to the rafters is partially framed and open to the attic above. The furnace ventilation pipe is not secured.

Recommendation:

- Seal all joints in the furnace ventilation pipe, replace the hangers and secure the ventilation pipe.
- Complete the framing of the second floor ceiling from the hallway partition walls to the roof slope.
- Remove the insulation in the area of the furnace ventilation pipe and install 5/8” fire-rated gypsum board, according to code.
- Urethane spray foam at the eaves, closing the soffits.
- Add 2” Poly-isocyanurate rigid board insulation (R-value 7.0 per inch) to the rafters (in the computer room and furnace room, from the eaves/soffit area to the second floor ceiling, and air seal the joints.
- Replace the pipe wrap in the furnace room with closed cell pipe wrap and install closed cell pipe wrap on the copper pipes in the computer room and throughout the building where accessible.

Attic:

Existing Conditions:

There is an existing roof leak at the dormer (east side) in the middle section of the building. The rafter bays are insulated with Kraft-faced fiberglass insulation to the ridge. There is an attic floor/second floor ceiling in the front and middle section of the building, and the hallway of the back section. The attic floor / second floor ceiling in the back section, where the computer room and furnace room are located, is partially framed. There is no access to the attic area.

Recommendation:

- Repair the roof leak at the dormer.
- Create temporary access to the attic area
- Complete framing the attic floor / second floor ceiling in the computer and furnace rooms from the hallway partition wall to the roof slope.
- Air-seal penetrations through the second floor ceiling.
- Remove the 6” fiberglass batt insulation from the rafter bays in the attic area and install at the attic floor.
- Add 8” of blown-in cellulose insulation (R-value 3.7 per inch) on top of the fiberglass batts at the attic floor.

Walls

Existing Conditions:

The walls of the main building are brick/masonry exterior and wallboard and drywall on the interior.

Recommendation:

The greatest benefit per cost is derived from air sealing and insulating at the basement/crawl space and the attic level – where the building pressures and air infiltration and exfiltration are the greatest. The benefit per cost of accessing and installing additional wall insulation is marginal and is not recommended at this time.

Windows

Existing conditions:

The windows on the main building are double hung, vinyl frame replacement windows – double glazed. One window in the front of the building was removed and is covered with a wood panel and antique style metal brackets. The windows in the addition, at the back of the main building, are single glazed with storm windows. There is a window on the East wall (toward the back) with a temporary panel and flex-tube exhaust pipe to the outside.

Recommendation:

- Air seal and insulate the window opening with the wood panel covering in the front of the building.
- Replace the temporary panel and flex-tube ventilation pipe through the window opening with a permanent hard pipe ventilation through the wall; then air seal and insulate.

Doors

Existing Conditions:

Front/South: The front door is not in use. The front door is a wood panel door (4 wood panels, 2 window panels). There is an enclosed entry has metal storm door.
Back/North: At the first and second floor, there is a metal exterior door with a 21” x 35” window – double hung, double glazed with a storm/screen window. To the left of the first floor door is a metal mail slot.
Side/East: A metal exterior door with a 21” x 35” window – double hung, double glazed with a storm/screen window.

Recommendations:

- Install weatherization door kits at the four doors (front, side, back 1st floor and 2nd floor).
- Remove the mail slot (to the left of the back door – 1st floor), air seal and insulate.

Lighting – Exterior:

Existing Conditions:

- Three quartz halogen type flood lights (approx. 7" H x 11" W x 4" D, with 500 watt bulb – estimated)
- One quartz halogen type flood light at the back/north wall, 2nd floor door location (approx. 4" H x 5" W x 4 " D, with a 150 watt bulb – estimated)
- Three incandescent type flood lights at three door locations with 150 watt bulbs – estimated)

Recommendation:

- Replace all incandescent bulbs with Compact Fluorescent Lights (CFL's) or other high efficiency exterior lights (e.g. LED's)
- Consult with a lighting specialist for high efficiency flood lights.

Lighting – Interior:

Existing Conditions:

- First Floor:
  - Main Room: There are 8 fluorescent light panels – 4 ft. length with 2 bulbs each
  - Tax Assessors Office – estimated 4 fluorescent light panels – 4 ft. length with 2 bulbs each
  - Hallway: 2 recessed lights; 1 fluorescent light 4' length with 1 bulb
  - Restrooms: 2 incandescent bulbs
- Second floor:
  - Front Room: 1 fluorescent light panel – 4 ft. length with 2 bulbs
  - Middle Room: 4 fluorescent light panels – 4 ft. length with 2 bulbs each.
  - North Hallway: 1 incandescent bulb
  - Furnace and Computer Rooms: 1 incandescent bulb each.

Recommendation:

- Replace all incandescent lighting with Compact Fluorescent Lighting (CFL). There are many new colors and designs that don't flicker or cause headaches!

Mechanical – Heating Ventilation and Air Conditioning (HVAC)

Existing Conditions:

Furnace: Liquid Propane fired Weil-McLane furnace, 167,000 Btu/hr capacity

Air conditioner units: four window units

- One in the North/back wall (under the stairs)
- Two on the West wall, one on the first floor, one in the second floor dormer
- One in the South/front wall at the second floor.

Recommendation:

- Ensure that floor, ceiling or wall registers are not blocked by furniture or other related items. If they are blocked the heating or cooling system will not function to its peak performance when it was installed.

Electrical Machines and Appliances

Existing Conditions:

Office area:

- One large copier
- Six printers
- Six desktop computers
- Poland Springs water fountain

Kitchen area:

- Large refrigerator
- Microwave
- Curator
- Toaster oven

Recommendation:

- When replacing these units opt for an energy star unit. (Energy Star units are certified by the federal government to have met certain energy reduction criteria.)
- Utilize automatic computer shutdown systems to turn off all computers at the end of each day
- Turn off all, printers, cable modems, TVs and other media equipment when not in use.
- Quarterly clean refrigerator coils. This will ensure the appliance is running in its intended condition.
    - A good way to remember this, is when you get your property tax you'll know it's time to clean the refrigerator coils!

(*Turn Cycle Solutions does not permit or take responsibility of any of work that is done without a trained weatherized specialist or trained professional to oversee weatherization work stated above.)

Lee Town Hall – Energy Efficiency Recommendations

In order from highest to lower priority

1) Air sealing and insulation of basement crawl space

- Determine structural integrity of floor prior to all work
- Air Seal the crawl space ceiling / subfloor with expanding foam
- Remove the existing fiberglass batt insulation from the joist bays and install R-30 fiberglass batts between the joist bays (with the vapor barrier facing the subfloor).
- Add 2" of rigid foam board insulation at the bottom of the floor joists, and foam the joints, enclosing the floor's envelope.
- Install, 6 mil poly sheeting as a vapor barrier over the dirt floor and 1 ft. up the foundation walls.
- Install 2" of Urethane spray foam on the foundation walls from the dirt floor to the subfloor (as an air and vapor barrier, and secondarily as a thermal barrier).
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Note: An alternative recommendation is:

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- Cost and accessibility for spray foam installation is the primary concern. The crawl space ceiling is approximately 1900 sq. ft. versus the crawl space walls at approximately 510 sq. ft. A cost comparison and consultation with the installer regarding installation may be warranted.

2) Air seal and insulate attic

- Air-seal penetrations through the second floor ceiling.
- Repair the roof leak at the dormer.
- Create temporary access to the attic area
- Complete framing the attic floor / second floor ceiling in the computer and furnace rooms
  from the hallway partition wall to the roof slope.
- Remove the 6" fiberglass batt insulation from the rafter bays in the attic area and install at the attic floor.

- Add 8” of blown-in cellulose insulation (R-value 3.7 per inch) on top of the fiberglass batts at the attic floor.

Knee wall space

- Install closed cell spray foam insulation in the 7” rafter bays, from the eaves, closing the soffits, to above the second floor knee-wall through to the floor insulation in the attic area. This reestablishing the thermal boundary from the floor and knee-wall to the roof slope, at an approximate R- value of 6.0 per inch

3) Air seal and insulate Furnace Room and computer room

- Seal all joints in the furnace ventilation pipe, replace the hangers and secure the ventilation pipe.
- Replace the pipe wrap in the furnace room with closed cell pipe wrap and install closed cell pipe wrap on the copper pipes in the computer room and throughout the building where accessible.
- Complete the framing of the second floor ceiling from the hallway partition walls to the roof slope.
- Remove the insulation in the area of the furnace ventilation pipe and install 5/8” fire-rated gypsum board, according to code.
- Urethane spray foam at the eaves, closing the soffits.
- Add 2” Poly-isocyanurate rigid board insulation (R-value 7.0 per inch) to the rafters (in the computer room and furnace room, from the eaves/soffit area to the second floor ceiling, and air seal the joints.

4) Air seal and insulate windows

- Air seal and insulate the window opening with the wood panel covering in the front of the building.
- Replace the temporary panel and flex-tube ventilation pipe through the window opening with a permanent hard pipe ventilation through the wall; then air seal and insulate with expanding foam.

5) Doors

- Install weatherization door kits at the four doors (front, side, back 1st floor and 2nd floor).
- Remove the mail slot (to the left of the back door – 1st floor), air seal and insulate.

6) Lighting upgrades

- Replace all incandescent bulbs with Compact Fluorescent Lights (CFL's) or other high efficiency exterior lights (e.g. LED's)
- Consult with a lighting specialist for high efficiency flood lights.
- Replace all incandescent lighting with Compact Fluorescent Lighting (CFL). There are many new colors and designs that don't flicker or cause headaches!

7) HVAC maintenance

- Ensure that floor, ceiling or wall registers are not blocked by furniture or other related items. If they are blocked the heating or cooling system will not function to its peak performance when it was installed.
- Conduct annual heating system inspections and cleanings.

8) Electrical Machines and Appliances

- As aging units need replacement, opt for an energy star unit. (Energy Star units are certified by the federal government to have met certain energy reduction criteria.)

- Utilize automatic computer shutdown systems to turn off all computers at the end of each day or when idle.
- Turn off all, printers, cable modems, TVs and other media equipment when not in use.
- Quarterly clean refrigerator coils. This will ensure the appliance is running in its intended condition. Also, fill empty milk jugs to increase the mass inside the refrigerator, it will increase its efficiency and help it maintain a constant temperature.
    - A good way to remember this, is when you get your property tax you'll know it's time to clean the refrigerator coils!

9) Walls

- The greatest benefit per cost is derived from air sealing and insulating at the basement/crawl space and the attic level – where the building pressures and air infiltration and exfiltration are the greatest. The benefit per cost of accessing and installing additional wall insulation is marginal and is not recommended at this time.