EXAMPLE - Home Performance Report

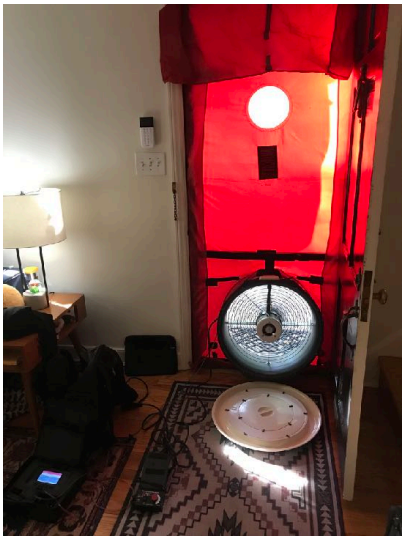
11-5-2021

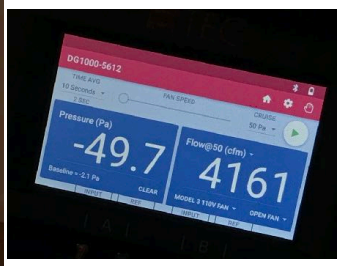
Home performance consult with homeowner goals:

1) Electrify everything at time of replacement

2) Fix wintertime 1st floor discomfort, especially in the living room.

3) Improve indoor air quality, especially for allergies. Existing furnace filter is notable concern.





“Blower door” air leakage test result: 4,161cfm at the test pressure difference of 50Pascals (Pa). Leakage-to-floor-area ratio for the home is ~3.4. We would give the home a “F” on an A-F grading scale for air-tightness.

Improved air-tightness yields better comfort, lower energy use and improved indoor air quality (when combined with controlled ventilation). Biggest opportunities for improved air-tightness are in the crawlspace and the attic/rooflines (details follow).

Existing heating + cooling equipment serving both floors: 60,000 Btu/hr methane gas furnace + 2.5-ton(?) AC outdoor unit from 1988…definitely ripe for replacement. Leaky ductwork is in between floors, as well as in the attic and in the crawlspace.

I did 2 iterations of heating/cooling load calculations and preliminary equipment selections: 1 for the house with existing conditions, but with new ductwork (including MERV-13 or MERV-16 filtration), and 1 for the house with sealed/insulated crawlspace + spray foam sealed/ insulated roofline (minimum 30% air tightness improvement). While there’s a significant difference in heating load between the 2 iterations, there’s less of a difference in cooling load…and not enough of difference between the scenarios to justify a drop in equipment capacity. For both scenarios, I’d recommend a 1.5-ton cold climate heat pump with ~5kW supplemental heat kit (1.5-ton Mitsubishi “Hyperheat” ducted heat pump is our preferred equipment).

Neil C. will provide a quote for this work, along with a preliminary description for a new ductwork strategy that would serve just the 1st floor.

Existing water heater is a methane gas-fired 30-gallon tank from 2003 with low efficiency (0.57EF). We recommend replacing with a 50-gallon heat pump water heater (Rheem or AO Smith brand).

Replacing the water heater with an electric model (heat pump or standard) is required in order to easily + safely reconfigure new ductwork for a new heat pump.

Neil C. will provide a quote for this work.

Mitsubishi 2-ton multi-split outdoor unit with a pair of 1-ton ductless wall mount indoor units (1 in each upstairs bedroom). This system currently provides supplemental heating/cooling to the 2nd floor. But with a new heat pump system serving just the 1st floor, this system would become the primary heat/cool source for the 2nd floor.

This system is rated for operation only down to 5F outdoor temperature. In very extreme cold weather, you may need to use supplemental electric resistance heaters in the upstairs bedrooms (1500W plug-in heaters cost as low as about $50/ea).

Down the road, at time of replacement, the outdoor unit could be upgraded to a “Hyperheat” cold climate model for better performance in extreme cold temperatures.

Existing fireplace use methane gas for fuel. If you electrify space heat and hot water, this would be the last remaining gas-fired appliance. If you choose to decommission this as well, then you could have your gas service shut off and save ~$150/yr in gas meter/customer fees.

In any case, we recommend installing a “low-level” carbon monoxide (CO) monitor/alarm for improved safety if you use the fireplace in the meantime.

Here’s an example ($200): https://www.trutechtools.com/Defender-LL6170-Low-Level-Carbon-Monoxide-Monitor-Alarm

The crawlspace is low (<2-ft clearance) with no vapor barrier over the dirt, and no insulation at the foundation walls or in between floor joists. This lack of insulation, combined with the extreme air leakage are likely the biggest factors making the 1st floor uncomfortable in the winter.

We recommend creating a sealed, insulated + conditioned crawlspace (similar to modern basement construction…just shorter/smaller!).

Neil C. will provide a quote for this work.

Attic spaces are insulated at the roofline with poorly installed fiberglass batts (R-19 rated insulation value). Given the air leakage measurements, it's likely there is significant air bypass of this insulation, rendering it much less effective than its printed insulation rating.

We recommend removing the existing insulation and using spray foam at the roofline (approximately R-30) to address the air leakage issues in the attic/roofline areas, and to re-insulate.

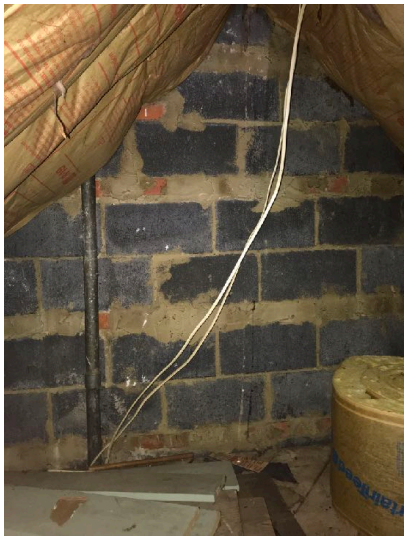
We don't do spray foam work directly, but if desired, Neil can provide "owner's rep" services to you for $125/hr to bring in a spray foam insulation contractor/s to provide quotes, provide oversight of their work, and conduct follow-up blower door air-tightness testing to confirm air-tightness goals are met.

Proper installation of spray would involve some cutting/ patching of the flat ceiling in order to access the roof peak, as well as the sloped ceiling in any inaccessible areas (possibly over the stairway, for example).

We suspect the tape that was used to seal some of the joints in the attic ductwork may contain asbestos.

If removal of the attic ductwork is part of the overall plan, then the tape would probably need to be tested…and if it contains asbestos, removed by a certified specialist before we could proceed with further ductwork removal.

There may also be some hidden ductwork in between floors with the same tape.



Attic gable ends as well as the mechanical room on the 1st floor are uninsulated. The gable ends can be insulated as part of a spray foam package.

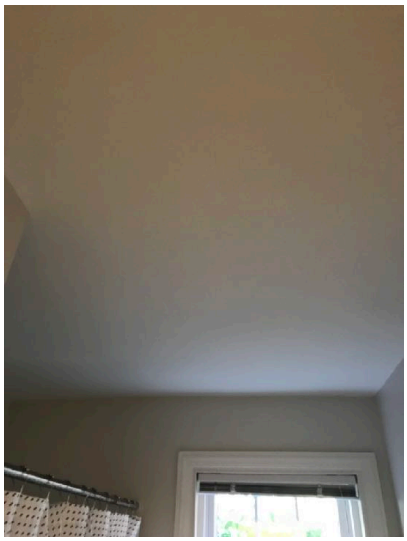
As for the mechanical room, Neil can probably offer an insulation + air-sealing option that could go in conjunction with heat pump + water heater work in that room.

View from the enclosed porch attic toward the floor joists over the kitchen. There is no air barrier or insulation separating the kitchen ceiling from the unconditioned porch attic.

At least a couple of attic knee wall doors showed signs of mold growth on the backs of the doors. This is likely happening in the summer…due to the very high air leakage rate, hot, humid air from outside can migrate into the attics, with moisture accumulating on the cool surfaces that are adjacent to the air-conditioned rooms.

With enough moisture accumulation, mold growth can occur.

Neil can offer a clean-up option for these doors - remove mold with wire brush + HEPA vacuum…optional repaint?

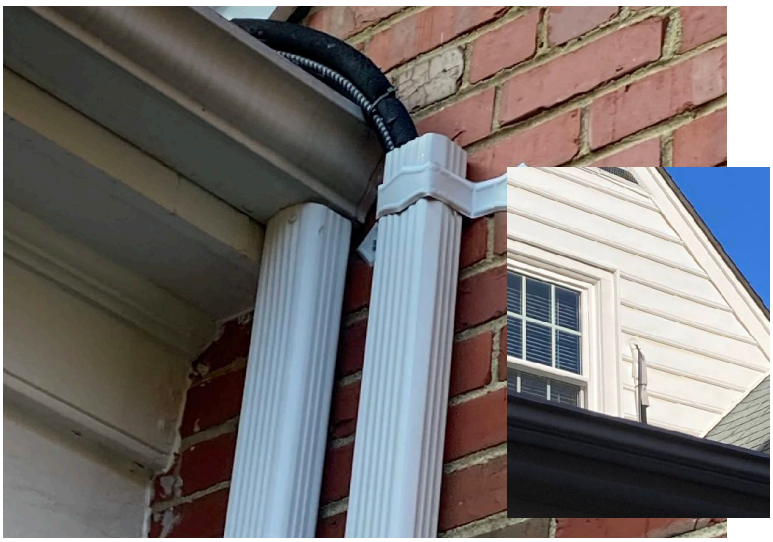


The 1st floor bath fan does not currently have an exhaust fan. Neil can quote adding a quiet and effective exhaust fan to this room if desired.

The kitchen microwave range hood recirculates air to the kitchen, rather than exhausting to the outdoors.

Although electric cooking is less polluting than gas cooking, best practice is to vent the range hood to the outdoors and to use it every time you cook in order to remove fine particulates and other pollutants generated by cooking.

We didn't look at potential duct routing for a retrofit duct to the outdoors, but can do so at a follow-up visit, if desired.



The insulated refrigerant pipes that run from the E/SE 2nd floor bedroom to the Mitsubishi multi-split outdoor unit have several sections that are unprotected from UV radiation (from sunlight). The insulation is starting to degrade (easiest to see in person from the bedroom window, looking down to the enclosed porch roof).

We recommend replacing the degraded sections of insulation, and installing a protective covering (PVC "lineset hide"…looks similar to a downspout gutter, is typical).

Existing electrical panel is outdoors, with 200A main breaker and several open circuit slots.

Should be no problem in terms of heating/cooling + hot water electrification…with plenty of room/capacity leftover for future electric vehicle charging infrastructure and/or whole-house battery backup.

We recommend that all households use an indoor air quality monitor that monitors/displays temperature, relative humidity, fine particles (“PM2.5”) and CO2 (carbon dioxide is a proxy for ventilation levels).

Our current preferred device is the $200 Kaiterra Laser Egg CO2: https://www.kaiterra.com/en/laser-egg-co2/