

### TRI-STATE SMART HOME SOLUTIONS LLC 888-970-1791 sales@smart-homesolutionsllc.com https://smart-homesolutionsllc.com



## HOME ENERGY AUDIT

## 1234 Main Street Gallipolis, OH 45631

Buyer Name 07/31/2023 9:00AM



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# 1: INSPECTION DETAILS

### Information

#### **Energy Audit - General Information: Purpose and Process**

#### Purpose of Energy Audit

The customer requested an Audit for the following primary reasons:

- High energy bills
- The master bedroom and playroom are always colder than the rest of the house

#### Audit Process Overview

The following high-level steps were performed as part of the Audit:

- A complete visual inspection of all readily accessible areas of the house both internally and externally was performed.
- A blower door pressurization test was performed. The home was then inspected on the outside with a Thermal Imaging camera and by observing and feeling for air leaks created by the internal pressure. (Inside air leaking out)
- A blower door depressurization test was performed. The home was then inspected on the inside with a Thermal Imaging camera and by observing and feeling for air leaks created by the vacuum depressurization. (Outside air leaking in)
- All visible devices that consume electricity and gas were documented.
- Both attic spaces were entered and traversed. Specific attention was given to attic insulation and attic ventilation.
- The entire process has been documented with digital and thermal imaging pictures.
- Written observations, major findings, and recommendations are provided in this report along with supporting pictures.
- There are attachments to this report that provide extensive details on the major topics discussed in this report.

#### Summary of Findings: Major Observations

#### HVAC Utility Usage

- Your bills indicate that central heating and air conditioning systems (HVAC) are the largest consumer of electricity and gas in your home. They make up a higher-than-average amount of your utility bills than is typical.
- This analysis alone points to insulation and air tightness as having a large impact on your utility bills.

#### **Blower Door Results**

The fan was unable to reach 50 pascals of differential pressure on your home in both tests. The highest differential pressure attained was ~35 pascals. This indicates a very leaky home.

<u>Test</u>	Target	Actual Reading
Pressurization Test	4651	7671
Depressurization Test	4651	7386

#### <u>Air Tightness</u>

• The exterior doors in the home are leaking. Two factors are contributing to this, some of the doors are out of square, and the weatherstripping is damaged or out of place.

• The windows are also leaking. The sealant on the exterior of the windows has deteriorated. The windows themselves appear to not be providing good air-tight seals around the sashes. It also appears that in some cases the insulation around the window frames may be inadequate.

• All receptacles, switches, and cable/ phone connections in exterior walls are leaking and are poorly insulated.

#### <u>Insulation</u>

- Insulation is missing and is out of place in both attic spaces.
- The exterior walls in the basement do not appear to be insulated. Looking inside the area where the main electrical panels are located, no insulation is present.
- It appears that there is no insulation present in the cavities at the end of the floor joists in the ceiling of the basement. The infrared analysis on the exterior of the home indicates a large amount of heat loss around the ground-level concrete of the house.

#### <u>HVAC Systems</u>

• The HVAC ductwork appears to be improperly sealed. During the depressurization blower door test, the return register in the 2nd-floor furnace room and the 1st-floor return outside the master bedroom door were both blowing very large amounts of air.

• When the 2nd-floor furnace is running, the furnace room gets extremely warm. This also indicates the potential for leaky ductwork or there is a heat register in this room, which is unnecessary.

• Heating temperatures at registers are out of balance. The measured temperatures on the first floor ranged from ~85 degrees in the master bedroom and playroom to over ~111 degrees in the living room. This 26+ degree temperature variance is a concern and one of the major contributing factors to the master bedroom and playroom being cold (they would likely be warm in the heat of summer).

- Another contributing factor to the temperature variances in the playroom is that there is only one HVAC register.
- There are also air flow imbalances in the HVAC distribution systems. This was not scientifically measured the evidence is anecdotal from the inspector's experience.

#### <u>Fireplace</u>

• The living room fireplace is vented to the exterior (the basement fireplace is not). The damper has a stopper mechanism that is preventing it from closing all of the way when not in use. This can contribute to air infiltration and exfiltration year-round.

#### **Recommendations:**

#### **RECOMMENDATION #1:**

#### Airtightness: Seal Air Leaks in Home

- Leaky houses waste energy because heated or cooled air can easily escape. Tightening up a leaky house will reduce the heating and cooling bills. Recent advancements in air sealing technology allow specialists to go beyond the old techniques of caulking and weatherstripping around obvious places such as doors and windows.
- The primary identified areas include; door seals, windows, receptacles and switches, and fireplace damper.

#### Windows

• The windows in your home are not significantly deficient. They appear to have leakage in the most common areas that the inspector sees in almost every home energy audit. Over 25+ years since your home was built, window technology and installation methods have improved.

• Proper installation and sealing of the windows during installation are equally important to the insulating ability of the windows themselves

• There is insufficient ROI to recommend the replacement of the windows. Completing the other items identified in this report will likely address the energy consumption and comfort you are looking to achieve, at a lower cost with a better ROI.

#### BENEFITS:

Having a professional seal the air leaks in your home can make your home more comfortable, reduce the risk of moisture damage, improve indoor air quality and fire safety, and help to prevent frozen water pipes.

**Goal** - Achieve a blower door number of 4561 or below or as low as practical.

TIPS:

• To get the best results, hire a qualified contractor, preferably a "building performance contractor".

• Make sure your contractor tests the leakage rate after completing the sealing, not only to determine the degree of improvement but also to ensure that the ventilation in your home is adequate.

If you choose to do the work yourself, follow the guidance in ENERGY STAR's guidelines attached to this report.

#### **RECOMMENDATION #2:**

#### **Insulation: Install and Correct Insulation Deficiencies**

**Attic** - Recommend a complete audit of the insulation in both attic spaces. Add and replace all insulation that does not achieve at least an R-38 insulation factor.

**House** - Recommend improving wall insulation around the windows, doors, electrical receptacles, and light switches to obtain a close to an R-19 insulating factor for the walls.

**Basement** - Recommend consulting with a building performance contractor regarding insulating the exterior basement walls and the floor system (R-19), especially along the spaces adjacent to exterior walls (R-25).

**Goal** - Achieve R-38+ in the entire attic, R-19+ in all the exterior walls, and R-25+ under the entire floor system including the spaces toward the exterior.

TIPS:

• Make sure all holes in the attic floor are sealed before you install insulation. Make sure there is a vapor retarder between the attic floor and the insulation to help prevent excess moisture from condensing on the insulation. However, if you are adding insulation on top of the pre-existing insulation, don't install a vapor retarder on the new insulation, since it may trap moisture in the old insulation underneath.

- Make sure the insulation does not block the attic vents, and that it is even and free of gaps.
- When comparing contractors' bids, make sure they are for the same insulating value R-value, not just the same number of inches.
- If you are doing the installation yourself, consider using cellulose. Cellulose insulation is less expensive and has a higher R-value per inch than fiberglass, and will not irritate your skin and lungs.

#### TIPS:

• Look for ENERGY STAR qualified and National Fenestration Rating Council (NFRC) certified products and professionals qualified in their installation.

#### **RECOMMENDATION #3:**

#### Improve HVAC Distribution Sytems (Ductwork)

This process should follow the following order; confirm that the system has been properly designed first through temperature and flow meter tests and using proper HVAC distribution design principles. (see the attached document, also linked below)

Flow Test

- Recommend conducting a Flow Test on the HVAC distribution systems. This will assist in confirming the system design.
- Goal To achieve relatively consistent air flow and temperatures from the registers throughout each system, the upper level and lower level systems.

#### Install Additional HVAC Register(s)

- In the playroom, there is a single HVAC register. This room is approximately 16 feet by 12 feet, approximately 200 square feet. In addition, the room has nearly 3 exterior walls and a wall full of windows. All of these factors lead the inspector to believe one register is insufficient for this room.
- As part of the HVAC distribution system analysis recommend having this room (and the master bedroom) evaluated for system design and adequacy of the distribution system to meet the very specific needs of these rooms. Exterior walls and windows, even the direction the windows are facing, all have an impact on the design of an HVAC distribution system.

Here is a link to an excellent US Department of Energy document on HVAC system design: US DOE - HVAC System Design Document

#### Seal Test

• After the system design has been corrected/ modified, recommend a ductwork seal test. Duct testing involves sealing off the entire ventilation system and then pressuring it in order to determine how airtight it is. Qualified technicians determine how much air pressure is escaping from the ductwork and then trace down the locations so they can repair and/or seal them. Technology exists to seal ductwork from the inside, making repairs easier in existing homes such as yours.

- Goal A total leakage reading of 0.08 CFM25 x floor area (in square feet) served by each of the two systems.
- Here is a link to a video showing an example of the technology that exists: Example HVAC Ductwork Sealing Technology
- Inside duct sealing works well for small leaks. Large leaks will need to be manually repaired first.

#### **Additional Energy Saving Recommendations**

- Install modern programable thermostats You can save money on your heating and cooling bills by simply resetting your thermostat when you are asleep or away from home. You can do this automatically without sacrificing comfort by installing an automatic setback or programmable thermostat.
- Reduce the water heater setting Turning down the hot water tank temperature by about 20 degrees from 140 to 120 Fahrenheit can provide a cost savings of about 6 to 10 percent depending on the efficiency of the unit.

# 2: ENERGY USAGE ANALYSIS

## Information

#### **Energy Usage Analysis**



- Central heating and air conditioning systems (HVAC) are the single largest consumers of electricity and gas in your home. On average, 65% of a household's utility bills are typically associated with HVAC. This percentage appears to be higher in your home.
- Your July 2022 summer utility bill was ~\$500, 86% electric/ 14% gas. The two central air conditioning units use electricity, no gas. The nominal gas usage would be from the pool heater, hot water tank, and cooktop in the kitchen.
- Your January 2023 winter utility bill was ~\$500, 17% electric/ 83% gas. The furnaces use gas for heating and a lesser amount of electricity to run the blower. This indicates that electricity usage in the home is relatively low when the air conditioner is not running.
- The October 2022 fall weather bill was ~\$300, 64% electricity/ 36% gas. The pool heater was turned off this month and the heat was turned on as the cooler weather arrived. This bill is more indicative of your usage when HVAC is less of a factor. This will likely occur again through March-April-May for the summer heat arrives.

This analysis alone points to insulation and air tightness as having a large impact on your utility bills.

In Ohio, the average cost of electricity is \$.07 cents per square foot. With your house having 4561 square feet this works out to ~\$319 per month for electricity, on average.

There are ~165 light fixtures in your home. The majority of the visible light bulbs appeared to be LED.

CCF - Centum Cubic Feet. The volume of 100 cubic feet (cf)

Therm: Equal to 1 CCF or 100,000 Btu

#### **Utility Bill Information**



## **3: BLOWER DOOR TESTS**

eb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb

February 2023

Current Month Feb 2022 12-Month Usage Avg Monthly Usage

N/A

52° 43°

1,625

76° 73°

verage temperature in degrees

67° 72°

843

12-month usage based on most recent history

34° 46° 52°

lectric (kWh)

### Information

#### **Blower Door Test Details**

A blower door is a diagnostic tool to determine how much air is entering or escaping from your home. The blower door test is used to help determine a home's airtightness. The home is pressurized and depressurized to 50 pascals. 50 pascals is the equivalent of a 20-mph wind blowing on all sides of your home at the same time.

A good rule of thumb is that your home should have a blower door number less than or equal to its square footage. In your case, we would be looking for a number of around 4561. This means it should take the auto-controlled fan 4651 CFM to reach the 50 pascals of differential pressure in both tests.

#### **Blower Door Test Results**

Test	<u>Target</u>	Actual Reading
Pressurization Test	4651	7671
Depressurization Test	4651	7386

Higher numbers are worse. It's a linear scale, so 2000 is twice as bad as 1000. Here are some things to know:

• Every 10 points on the blower door translates to about 1 square inch of air leak in the home.

• Your ~7528(avg) cfm50 blower door number is about 5.22 square feet of air leakage across the home. That is like having a large window wide open all the time. (7528/10 = 752 square inches/144 square inches/square foot = 5.22 square foot)

• Your home is ~4651 square feet with a blower door number of ~7528 (avg). A target blower door number of ~4651 is a great place to start, that would reduce your number by nearly 40%.

• The tipping point for air leakage is about 1:1 square footage to air leakage. Get below it and significant comfort and efficiency savings start to occur. The ability to achieve 1:1 or less varies greatly by the home and the investments made to improve air tightness.

For more information on Blower Door testing, see this link from the US Department of Energy (Link).

#### **Blower Door Pictures**



Pressurization Test

Depressurization Test



Depressurization Test Results

# 4: INFRARED ANALYSIS

### Information

#### **Infrared Analysis Details**

The bright orange to yellow colors indicates "warm". The brighter the yellow the warmer the temperature. The dark purple color indicates "cold". The darker the purple the colder the temperature. When inside the house on a colder day (such as the day of the audit, it was ~55 degrees), you do not want to see purple or very little of it.

There is an extensive amount of "purple" inside the house. Mostly from poorly insulated ceilings, walls, and leaks around exterior doors, and windows.

The interior pictures below are in pairs. The first picture is the infrared picture, the second is a digital picture so you can identify the location of the picture more accurately.

#### **Exterior Analysis: Exterior Infrared Analysis Reference Pictures**











### **Interior Infrared Analysis Reference Pictures**





1234 Main Street

























1234 Main Street





















1234 Main Street















# 5: REFERENCE CONTENT

## Information

#### **Reference Pictures**



























## Summary of Utility Consumers In Your Home: Electric and Gas Operated Devices

Component	E/G	Age
Furnace - 1st Floor	Gas	2012
Furnace - 2nd Floor	Gas	2008
AC - 1st Floor	Electric	2012
AC - 2nd Floor	Electric	2009
Water Heater	Gas	2010
Pool Heater	Gas	
Pool Heater MBR Space Heater	Gas Electric	
Pool Heater MBR Space Heater Refrigerator - Kitchen	Gas Electric Electric	
Pool HeaterMBR Space HeaterRefrigerator - KitchenRefrigerator - Basement	Gas Electric Electric Electric	
Pool Heater MBR Space Heater Refrigerator - Kitchen Refrigerator - Basement Microwave	Gas Electric Electric Electric	

Toaster	Electric
Toaster Oven	Electric
Oven	Gas
Cooktop	Gas
Kitchen Exhaust Fan	Electric
Washer	Electric
Dryer	Electric

## Approximate Number of Lights/ Light Bulbs

Lighting	Recs d	4' Flsn t	Fixture s	Ceiling Fa n	Exhaust Fa n	Chandelier
Basement	37	4				
Office						18
1st Hall and 1/2 Bath	2				1	
Closets	2					
Master Bedroom			2	4		
Master Bathroom	3				2	5
Master Bathroom Closet	4					
Living Room				5		
Sunroom				4		

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Dining Room						6
Kitchen	11		4			
Playroom				4		
Playroom Bathroom	4				1	
Laundry Room		1				
Stairs			3			
2nd Floor Hallway			2			
Lego Bedroom & Closet	3			4		
Jack and Jill Bathroom	3				1	
Pink Nursery & Closet	2			4		
Gray Nursery & Closet	1			4		
2nd Floor Bathroom	3				1	
Closets to Attic			2			
Attic			2			
2nd Floor Storage/ HVAC Roo m			2	1		
Garage		5	2			
Landscape Lighting			8			
Front Porch	3					
Outside Lights	2		7			