Case Study

Syracuse, NY
Preliminary

- Single Family Home
- Syracuse, NY
  - 7533 HDD
  - 230 CDD
- 63 years old
- 1446 Square Feet
- Household of 6
• Gas Forced Air Furnace
• Gas Domestic Hot Water
• Refrigerator – 8 yrs. Old
• Freezer- 14 yrs. Old
• Washer and Dryer – 14 loads per week
• Space Heaters
Electric Usage
Gas Usage
### BTU(HNAC)/Sq. Ft./HDD

#### Winter Usage (2013)

<table>
<thead>
<tr>
<th>Date</th>
<th>Therms</th>
</tr>
</thead>
<tbody>
<tr>
<td>December</td>
<td>296</td>
</tr>
<tr>
<td>January</td>
<td>302</td>
</tr>
<tr>
<td>February</td>
<td>277</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>875</strong></td>
</tr>
</tbody>
</table>

#### Summer Usage (2013)

<table>
<thead>
<tr>
<th>Date</th>
<th>Therms</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>22</td>
</tr>
<tr>
<td>July</td>
<td>26</td>
</tr>
<tr>
<td>August</td>
<td>22</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>70</strong></td>
</tr>
</tbody>
</table>

805 Net Therms $\times$ 100,000 BTU’s per Therm = 80,500,000 BTU’s

$$80.5 \text{ MBTU} / 1446 / 3,257 \text{ (HDD Dec-Feb 2013)} =$$

17.09 Btu/ft2/HDD
The Audit
Exterior Inspection
Interior Inspection
Infrared Camera

- Determine insulation quantity and quality
- Find water leakage
- Find air leakage with blower door assist.
- Check Electric panel integrity
Blower door

- Whole house leakage
- Duct leakage
- Zonal Pressure Diagnostics
- Infrared assistance
Blower Door and Zonal #’s

Pre Blower Door: 7,200 @cfm50
Zonal
Initial test

3827 CFM path

32 Pa.

7200 CFM

-50 Pa.

3694 CFM path

25 Pa.
Near perfect house

50 Pa.

-50 Pa.

1500 CFM

5 Pa.
The Dreaded Basement
Furnace Inspection
Distribution System Inspection

• When should ductwork air sealing be started and why?
  • Impact Zonal Pressure Diagnostics
  • Impact Combustion Appliance Zone
  • Impact Overall Blower Door Numbers
  • Impact Life of Unit and Efficiency (heat rise test)
Options:

Duct Blaster
Pressure Pan
Heat Rise
Pressure Pan can be used for:

- Finding Ductwork leaks
- System Balancing
- ASHRAE Compliance
Temperature Rise/Delta T

- Difference between supply air and return air
- Usually between 40 and 70 degrees F
- Appliance name plate will give you designed temperature rise
Out of line of sight of radiant heat
Troubleshooting Air Flow

Temperature rise high?
  – Air flow problems
  – Slow fan speed
    Over fired appliance

Temperature rise low?
  – Fan speed too high
  – Returns connected to outside
  – Under fired appliance
Health, Safety and Codes
The Work

• Rebuild Trunk Line and Takeoff’s
• Air Seal Attic/Basement
• Spot Insulation
• CFL’s
• Health and Safety
  • Move DHW
  • Gas Leaks
Cracked Heat Exchanger

- Forced furnace shutdown
- Supplied Space heaters
- Total Reevaluation of the job
- Approval required to continue
Air Sealing, Zonal, Insulation
Intermediate test #1
After furnace and ductwork repair

- 3031 CFM path
  -32 Pa.
- 5100 CFM path
  -50 Pa.
- 1554 CFM path
  -22 Pa.
Intermediate test #2
After basement air-sealing

- 2764 CFM path
  - 37 Pa.

- 4936 CFM
  - -50 Pa.

- 1554 CFM path
  - 19 Pa.
Zonal Test Out
Final test
Attic air-sealing and dense-pack, windows

900 CFM path

46 Pa.

3100 CFM

1300 CFM path

-50 Pa.

17 Pa.
Workscope Recap and Costs

**Energy Related:** $7,020

- Energy audit/ed. session
- Attic insulation
- General air sealing
- Ductwork overhaul
- ½ cost of furnace

**Health & Safety:** $3,650

- Repair multiple gas leaks
- Move domestic hot water
- Vent dryer
- ½ cost of furnace

**Total Project Cost:** $10,670
Initial Savings-Post HVAC

17.09 Btu/ft2/HDD - Initial
13.10 Btu/ft2/HDD – Post HVAC

23% Reduction in HNAC Usage

• 10% - Attributed to New Furnace
• 13% - Attributed to Distribution Rework
Interim Savings -
Post HVAC to Final Completion

13.1 Btu/ft²/HDD - Post HVAC
9.2 Btu/ft²/HDD - Final

Additional 29% Reduction in HNAC Usage
Total Savings

Numbers Start to Finish

17.0 Btu/ft²/HDD - Preliminary
13.1 Btu/ft²/HDD - Post HVAC
9.2 Btu/ft²/HDD - Final

Total Customer Savings From All Measures – 46%
Payback and SIR’s: Ductwork

Installed Cost: $2,000
Net Savings from Ductwork Install: 13%
Ductwork Savings to Customer: $240/year

SIR: 2.02
Payback and SIR’s: Overall

Energy Related Investment = $7,020

- (Included: audit, client ed., attic ins, air sealing, ductwork, cfl’s, ½ cost of furnace)

- HNAC Savings = $526/year
- SIR = 1.26
Total Usage Energy Factor

Btu/ft²/HDD
Questions?