Energy Efficiency
for
Historic Buildings & Houses

Why Retrofit for Energy?

Retrofitting historic Main Street buildings for energy efficiency is critical to sustain the cultural and economic health of any community

Why Retrofit for Energy?

In order to adaptively reuse historic buildings we must be able to cost effectively retrofit them with energy efficient systems so we can afford to operate them

Why Retrofit for Energy?

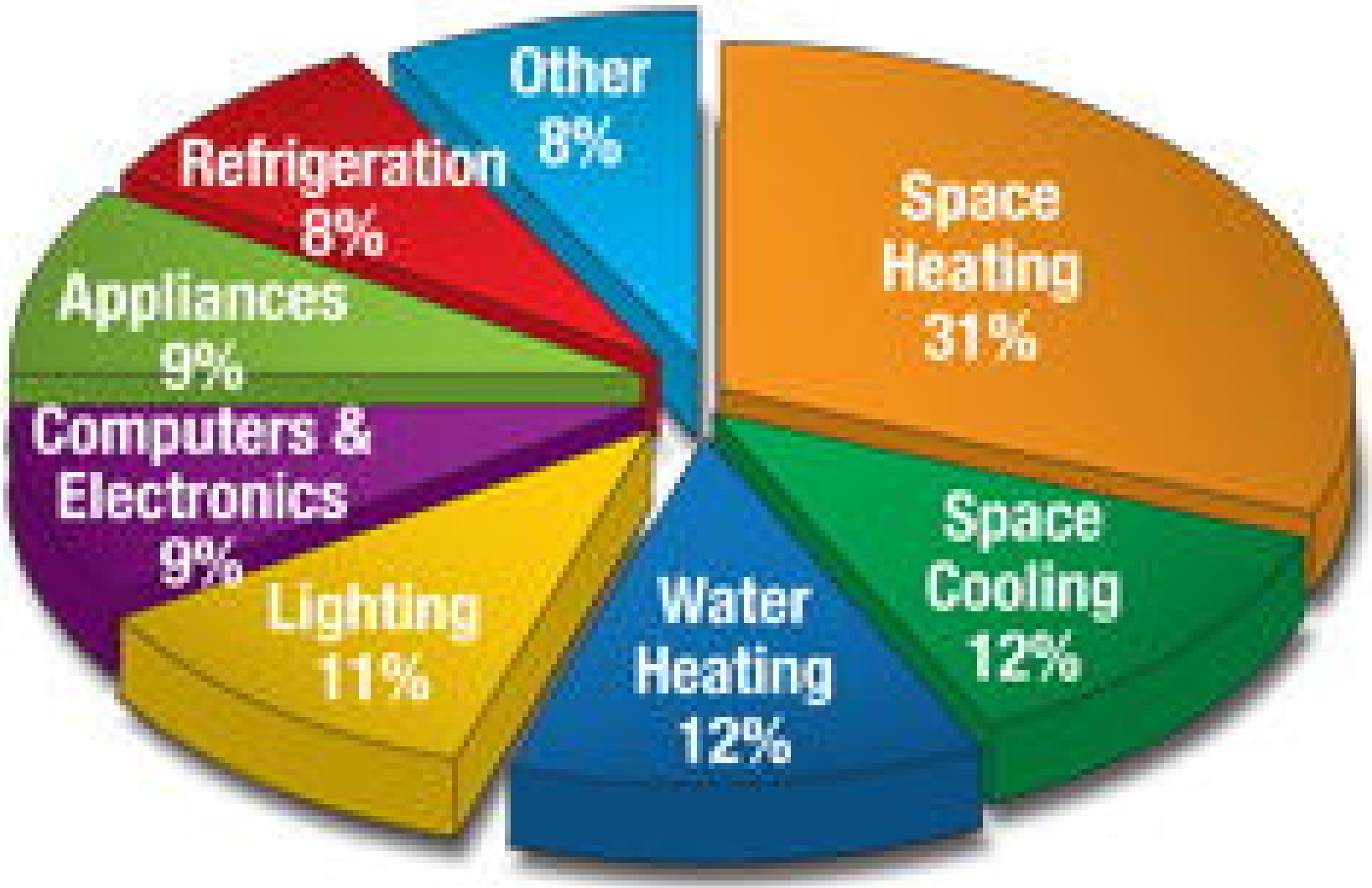
The good news is that this can be done while retaining important architectural integrity of the building and its historic elements.

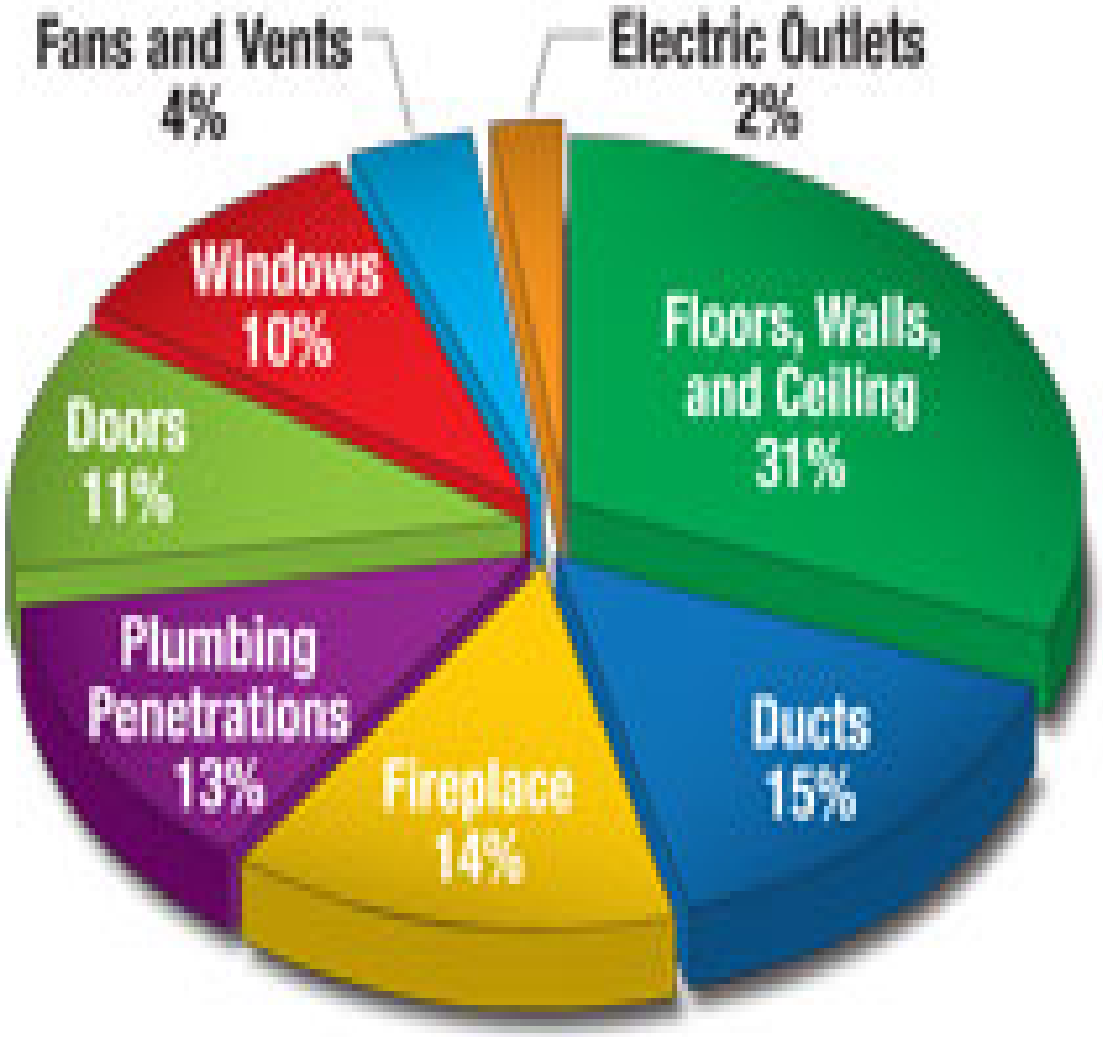
Where to Start

When considering energy retrofits it is critical to first have the structure analyzed for its current energy footprint.

Where to Start

To start with, have an energy audit which includes blower door testing and infrared testing. Be sure to have an analysis of the existing HVAC system as well


Other
8%
Refrigeration
8%
Appliances
9%
Computers &
Electronics
9%
Lighting
11%
Water
Heating
12%
Space
Cooling
12%
Space
Heating
31%


Fans and Vents
4%
Electric Outlets
2%
Windows
10%
Floors, Walls,
and Ceiling
31%
Doors
11%
Plumbing
Penetrations
13%
Fireplace
14%
Ducts
15%

Air Infiltration

Excessive air infiltration is one of the primary energy loss aspects in historic buildings.

Stopping this is cost effective and as such, will deliver one of the biggest paybacks available

Windows Realities

Typically windows comprise only 10% to 15% of the energy footprint of any historic building.


STOP
YOU NEED TO REPLACE YOUR WINDOWS IF...
Your windows are 15 years or older.
- New windows could save you over 20% per year on heating and cooling costs!*
Your windows are difficult to operate.
- New windows are easy to open, close and clean!
Your windows are drafty or have cloudy glass.
- New windows eliminate drafts, look great and add value to your home!
BEST SELECTION. BEST PRICES. PERIOD.
YOUR WINDOW EXPERIENCE STARTS HERE!

1930's Movie Theater Great Windows

2015 = Windows Gone


2002 9 9


EDWARDS
BELT
EMY
573


eal Estate
-1212
ENROL
NOW

Windows Realities

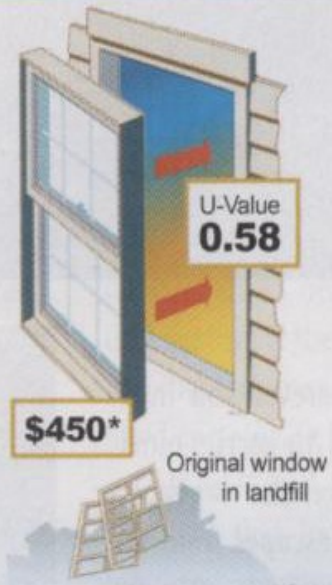
The two primary questions with any window are, what is the U-value and air infiltration?

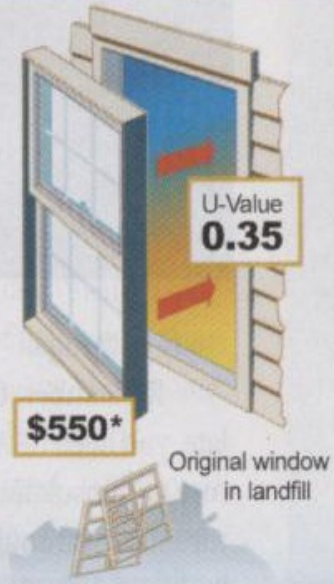
Windows Realities

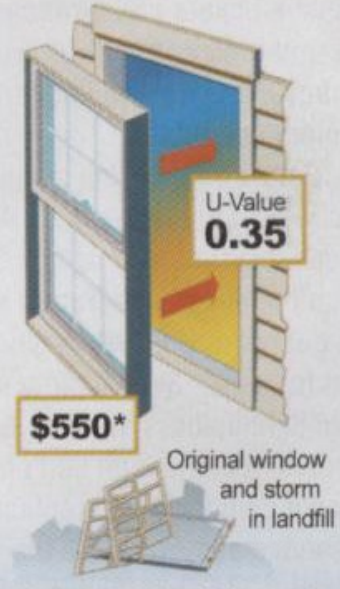
U-values are a calculation of how much energy passes through a one square foot area of a window in one hour.

Let the Numbers Convince You: Do the Math

U-Value = A measure of air-to-air heat transmission (loss or gain) due to thermal conductance and the difference in indoor and outdoor temperatures







TUNE-UP STRATEGIES	Storm window over single-pane original window	Double-pane thermal replacement of single-pane window	Low-e glass double-pane thermal replacement of single-pane window	Low-e glass double-pane thermal replacement of single-pane window with storm window
ANNUAL ENERGY SAVINGS	722,218 Btu	625,922 Btu	902,772 Btu	132,407 Btu
ANNUAL SAVINGS PER WINDOW**	$13.20	$11.07	$16.10	$2.29
SIMPLE PAYBACK	$50/$13.20 = 4.5 Years	$450/$11.07 = 40.5 Years	$550/$16.10 = 34 Years	$550/$2.29 = 240 Years

JOHN VAN PELT

*Cost of 3' x 5' window, installed
**Assuming gas heat at $1.09/therm

U-Value = A measure of air-to-air heat transmission (loss or gain) due to thermal conductance and the difference in indoor and outdoor temperatures

Source: Keith Haberern P.E., R.A.
Collingswood Historic District Commission

MISSOURI DEPARTMENT OF NATURAL RESOURCES
ENERGY CENTER - ENERGY LOAN PROGRAM
WINDOW REPLACEMENT WORKSHEET

BUILDING	LOCATION	DATE
Main Street	USA	6-11

To estimate the savings of replacing existing windows with efficiency upgrades, the following information must be known:

The U-Factor of the existing window (See U-Value table below).
The U-Factor of the replacement window (See U-Value table below).
The total area of the windows being replaced (square feet).
The heating energy cost ($/million Btu).
The heating plant efficiency (in percent).

SAVINGS CALCULATIONS

1.	Enter the U-Factor of the existing windows	.44	
2.	Enter the U-Factor of the replacement windows	.55	
3.	Subtract line 2 from line 1	-0.11	
4.	Add 0.86 to line 3	.75	
5.	Enter the total area of the windows to be replaced	21 s.f.	
6.	Multiply line 4 by line 5	15.75	
7.	Multiply 0.1 by line 6	1.58	
8.	Enter the heating plant efficiency (percent divided by 100)	.93	
9.	Divide line 7 by line 8	1.69	
10.	Enter the energy cost ($/million Btu)	4.63	

YEARLY SAVINGS

11. Multiply line 9 by line 10 — $ 7.84 /year

PROJECT COST

12. Enter the total cost of the window replacement including material, labor and design — $ 1,600

SIMPLE PAYBACK

13. Divide line 12 by line 11 — 204.08 years

WINDOW U-VALUE TABLE

Window System Type	U-Factor*
Single Glass	1.10
Single Glass with storm window	0.50
Single Glass, low E coating	0.91
Single Glass, low E coating with storm window	0.44
Insulating Glass (double glass)	0.55
Insulating Glass (double glass) with storm window	0.35
Insulating Glass (double glass), low E coating	0.38
Insulating Glass (double glass), low E coating with storm window	0.32
Insulating Glass (triple glass)	0.35
Insulating glass (triple glass) with storm window	0.25

* U-Factor values adapted from the 1985 ASHRAE Fundamentals Handbook.

MO 780-1363 (5-98) DNR/TAREQV 3.5 (5-98)

Fig. 2. Many excellent worksheets are available for calculating payback of replacement windows; this one is produced by the Missouri Department of Natural Resources. Results of payback calculations often reveal grossly overstated claims. Courtesy of the Missouri Department of Natural Resources.

Windows Realities

$20 and $60 worth of weather stripping and a $400 wooden, exterior storm window, with low-e glass, you can expect the U-value to go from the stated 0.44 down to a 0.34 to 0.40.

Windows Realities

Total restoration to safely remove old lead paint and putty as well as adding new weather stripping, should run between $750 to $1,200 for commercial and $450 to $700 for residential.

Original Windows Should Be Kept

Awnings

US Department of Energy says, "Window awnings can reduce solar gain in the summer up to 65% on south-facing windows and 77% on west-facing window."

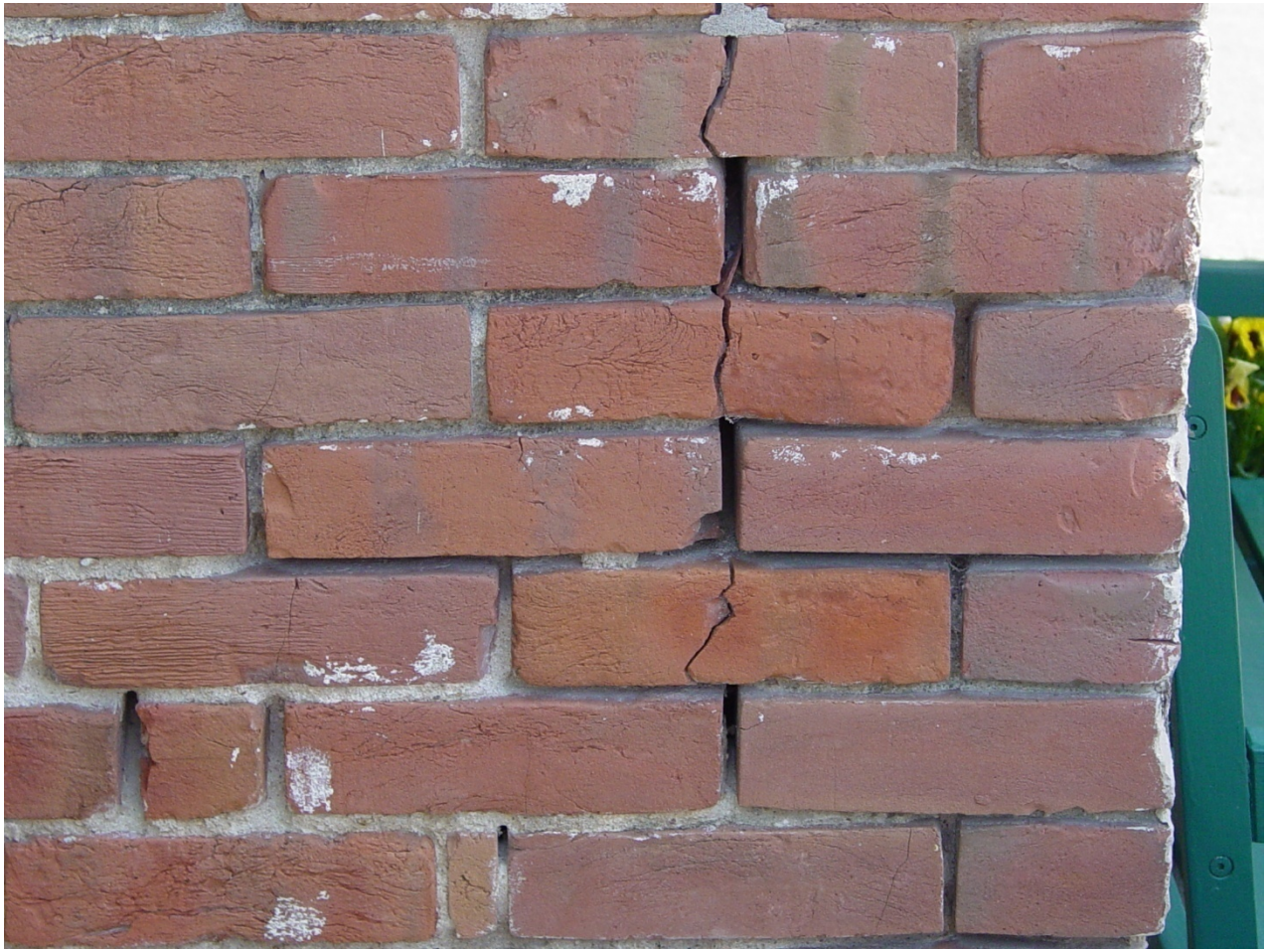
Awnings

While every building is different and orientation to the sun varies, awnings can potentially save 10% to 25% on energy costs per year.


FANCY GROCERIES
FIELD AND GARDEN SEEDS
E.T.CAMERON.CASH GROCERY
STAR


JAVA
Jive

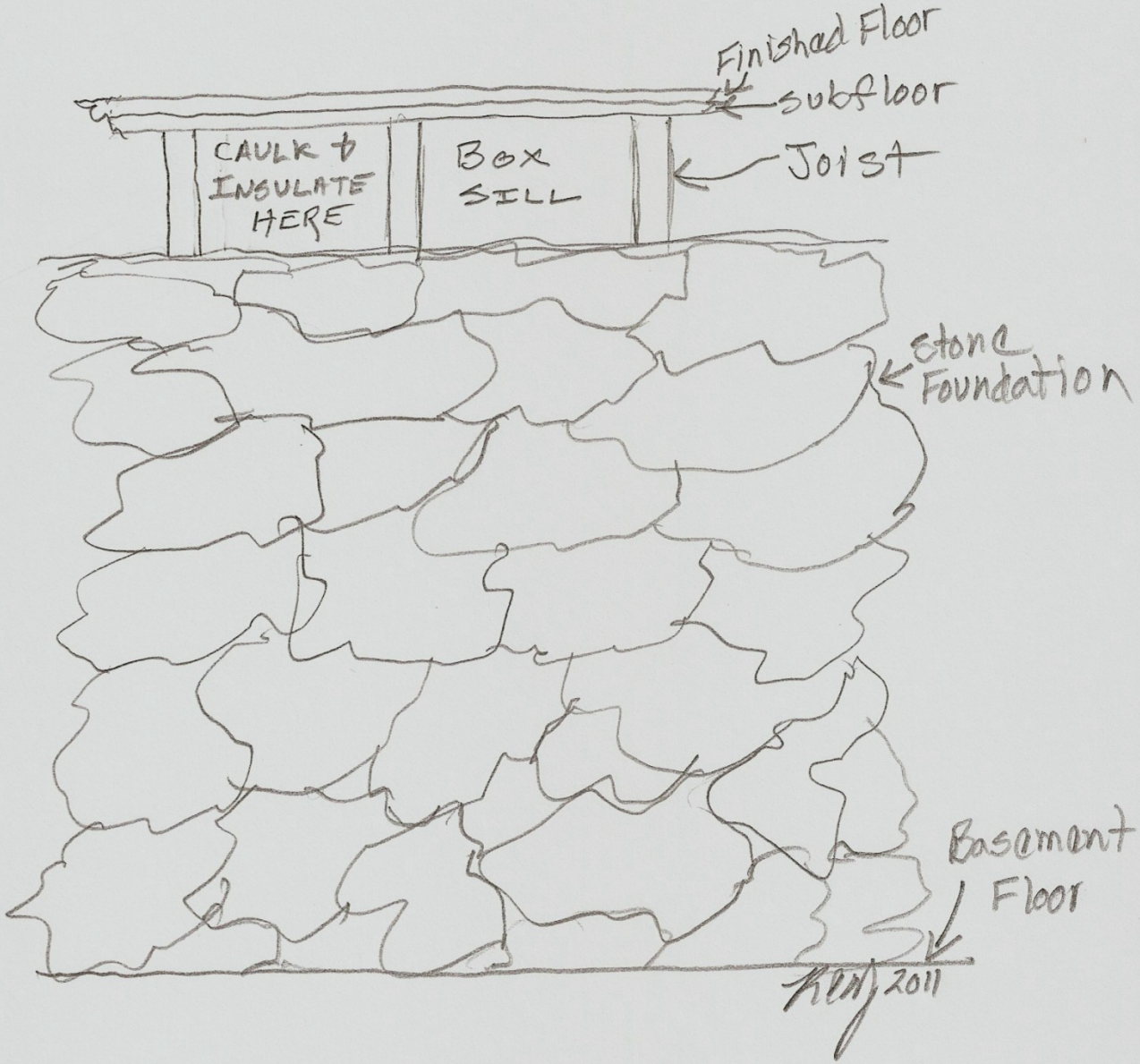
Masonry



Insulating Your Building

The idea is to make the building as energy efficient as possible while doing no harm to the structural and architectural elements.

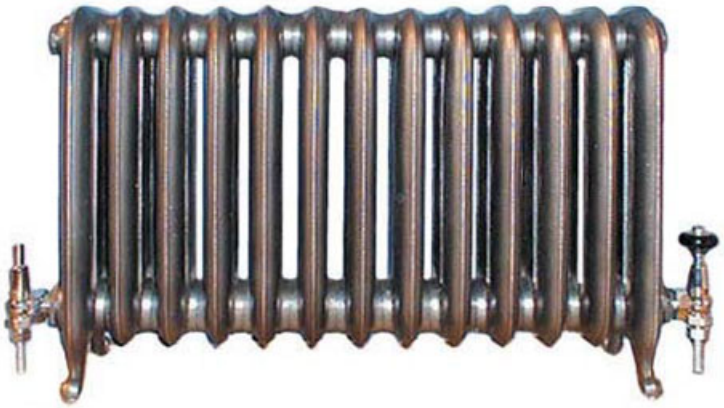
Insulation over a brick thermal mass is a waste of money


Finished Floor
subfloor
CAULK & INSULATE HERE
BOX SILL
Joist
Stone Foundation
Basement Floor
KEN 2011

HVAC

(heating, ventilation and air conditioning)

Have the existing heating and air conditioning systems inspected by a mechanical engineer before you make any decisions about replacing these systems.



Conventional Hot Water = 82%


MUNCHKIN


GREEN BUILDING SUPPLY
SAFE ▪ SUSTAINABLE ▪ SMART
KITCHEN
BATH
COUNTERS
HARDWOOD
FLOORING
PAINT
WINDOWS
DOORS
SOLAR
GREEN BUILDING Supply
100%
POWERED BY
SOLAR
GREEN BUILDING Supply
100%
POWERED BY
SOLAR
OPEN
OPEN
BUSINESS
34


GREEN BUILDING SUPPLY
W. BURLINGTON AVE

Geothermal can work in urban environments


QT
QT


Honeywell
ZD8X24
Automatic Rectangular Damper 8" L X 24" H
Zone # 1
0915
Automation and Control Solutions
Honeywell
M847D1004
Damper Actuator
24VAC 60 Hz 6W
Zoning
Switch
09 05
24VAC
60 Hz
Operator
Motor
24VAC 60 Hz
N314
Patent Number
US 7188481 B2
Honeywell
Made in Canada

Energy Retrofit Case Study

Lamb-Munger
Circa 1859
521 Bird Street
Hannibal, Missouri 63401

Energy Retrofit Case Study

Energy Retrofit Case Study

- **Square feet:**

  7,950.

- **Site:**

  Corner lot; Party wall on south

- **Construction:**

  Solid 3-brick thick, stone foundation, framed, hip roof

Energy Retrofit
Case Study

Circa 1859, Brick House, 7,950 square feet

Window restoration, $950 each x 42	$39,900
Weatherization & plugging air infiltration	$5750
Cost of Geothermal system after 30% fed tax credit	$29,400
Total energy retrofit costs	$75,050
Original Gas & Electric annual cost ($1,621.17 p/m x 12)	$19,452
Current Gas & Electric annual cost ($580 p/m x 12)	$6,960
Gas & electric annual savings	$12,492

Total years to payback energy retrofit investment = 6.01

Energy Retrofit Case Study

- **Original Use:**
  Commercial & residential
- **Work Began:**
  June 1, 2009
- **Work End:**
  90% complete-anticipated completion,
  June 1, 2014
- **Financing:**
  Commercial & private

Be an educated Energy consumer

Make The Point!

- ***Retrofitting*** historic houses & buildings for energy efficiency make them more affordable for building and homeowners to operate.

- ***Historic*** buildings can be made energy efficient, cost effectively.

- ***Energy*** retrofits around preservation are cost effective with fast paybacks.

- ***Preserving*** original windows costs less and is more energy efficient than replacement windows.

- ***Paybacks*** for window preservation run between 2 and 10 years

- ***Paybacks*** for replacement windows run between 34 & 240 years.

- ***Air Infiltration*** is the number one issue for energy efficiency.

- ***Replacement*** products are just that, products you have to replace over and over again.

- ***Exterior*** wall insulation is expensive and usually damaging to historic buildings.

- ***Historic*** masonry houses & buildings have a thermal mass that retains heat in the winter and cooling in the summer.

- ***Exposed Brick***, unless it was a warehouse, is not a good energy choice.

Plaster Removed from Ceiling and Front Wall of a Loft

Plaster removed with new trim showing gaps at brick

- ***Sustainability*** simply means doing good work that lasts.

- ***Preservation*** has been at the forefront of the “green movement” for 50 years.

- ***Nothing*** is more green or environmentally sound than an existing building.