Breakfast Sessions Tuesday Oct 16th

Harold Orr C.M. P. Eng.(retired)

How did we get were we are today

- Where did we come from?
- Where should we be going?

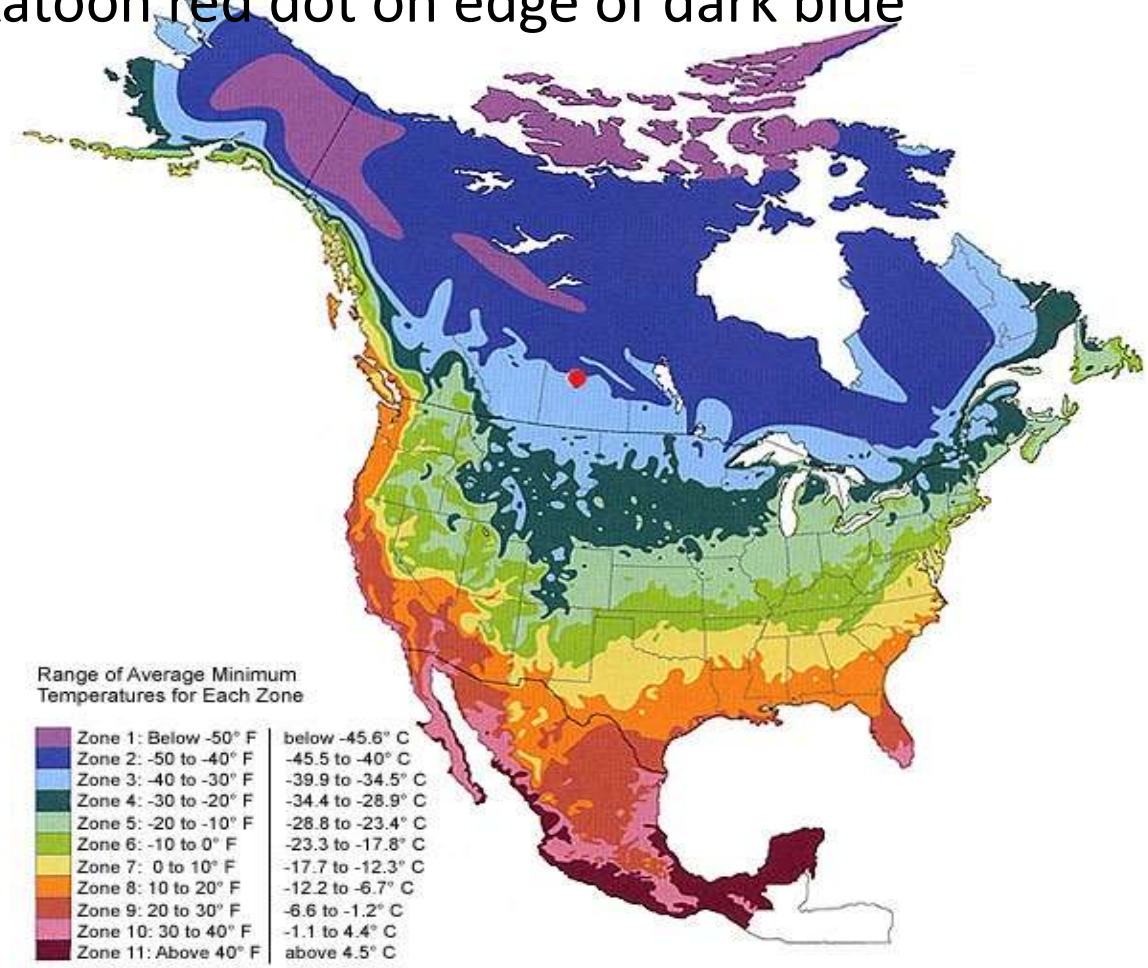
USA vs Canada

- Some differences are Cultural

"Welcome to America. Here's your complimentary bulletproof vest."

Some differences are Climatic and some are negotiation ability

- Notice most of the blue is north of the border ?
- Trump says he created art of the Deal ? #fakenews #1818
- Saskatoon red dot on edge of dark blue



Saskatchewan Housing 10,000 BC-1800's

- 0 insulation
- 0 tightness
- portable

Saskatchewan 1890-1930

- O insulation
- Air-tightness poor

My Childhood

- I remember a pot of water on the stove freezing over night

House I lived in circa 1943

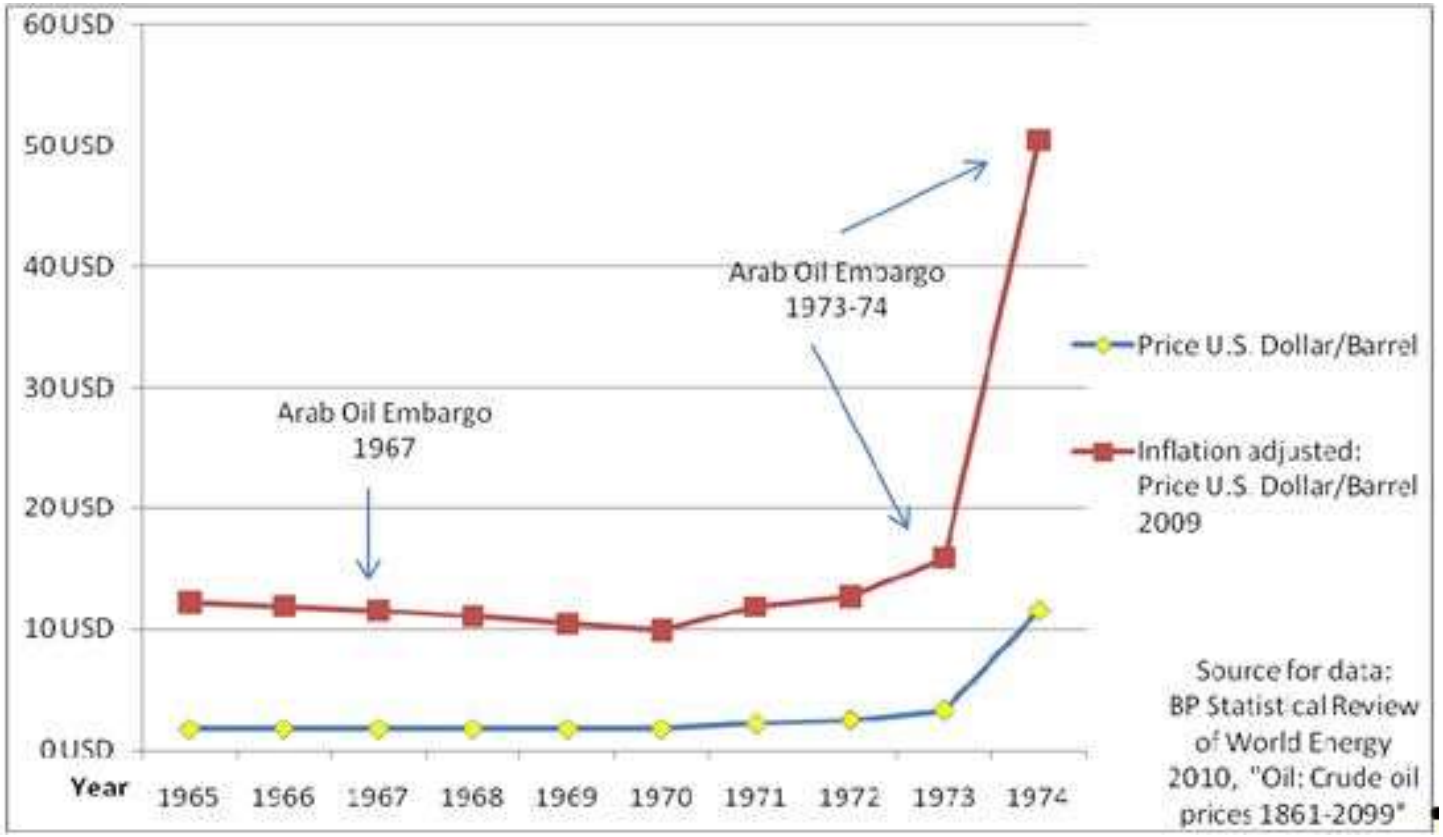
- High thermal mass Rammed earth
- 18” thick walls
- 0 Insulation

House I live in 1963 - today

- Built in 1963
- 2x4 wall
- At the time the Standard was R7 batt
- Paid extra for the R10 thick full batt - $25 cost for the entire house
- At the time was told it would never pay for itself. Currently ~$400/year saving
- Good when Oil is $3/barrel

1973 OPEC Oil embargo got everyone's attention

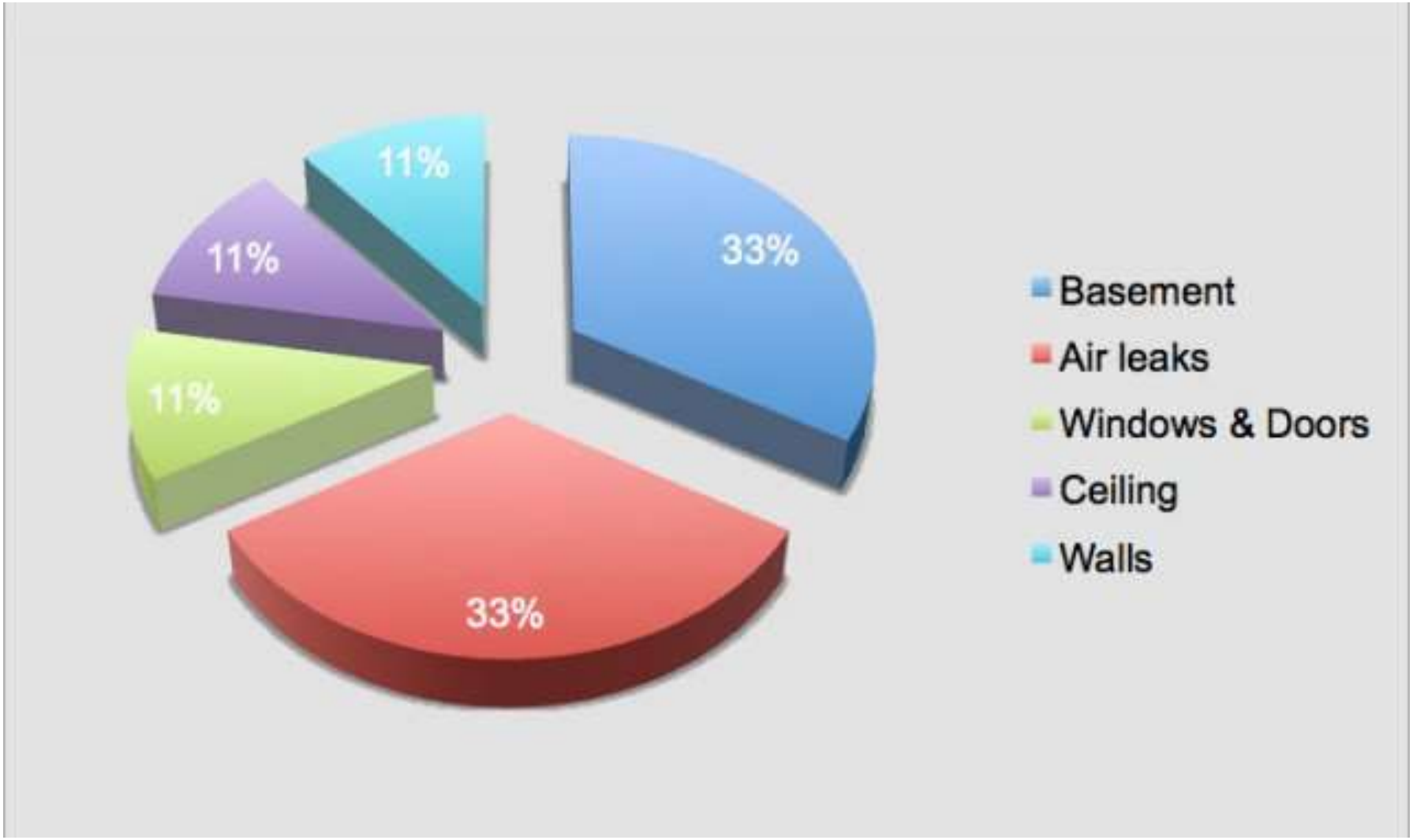
- Fuel Increased in price 3x and was in shortage
- from $3.56 a barrel in Oct 1973 to a record $11.65 by Jan 1974



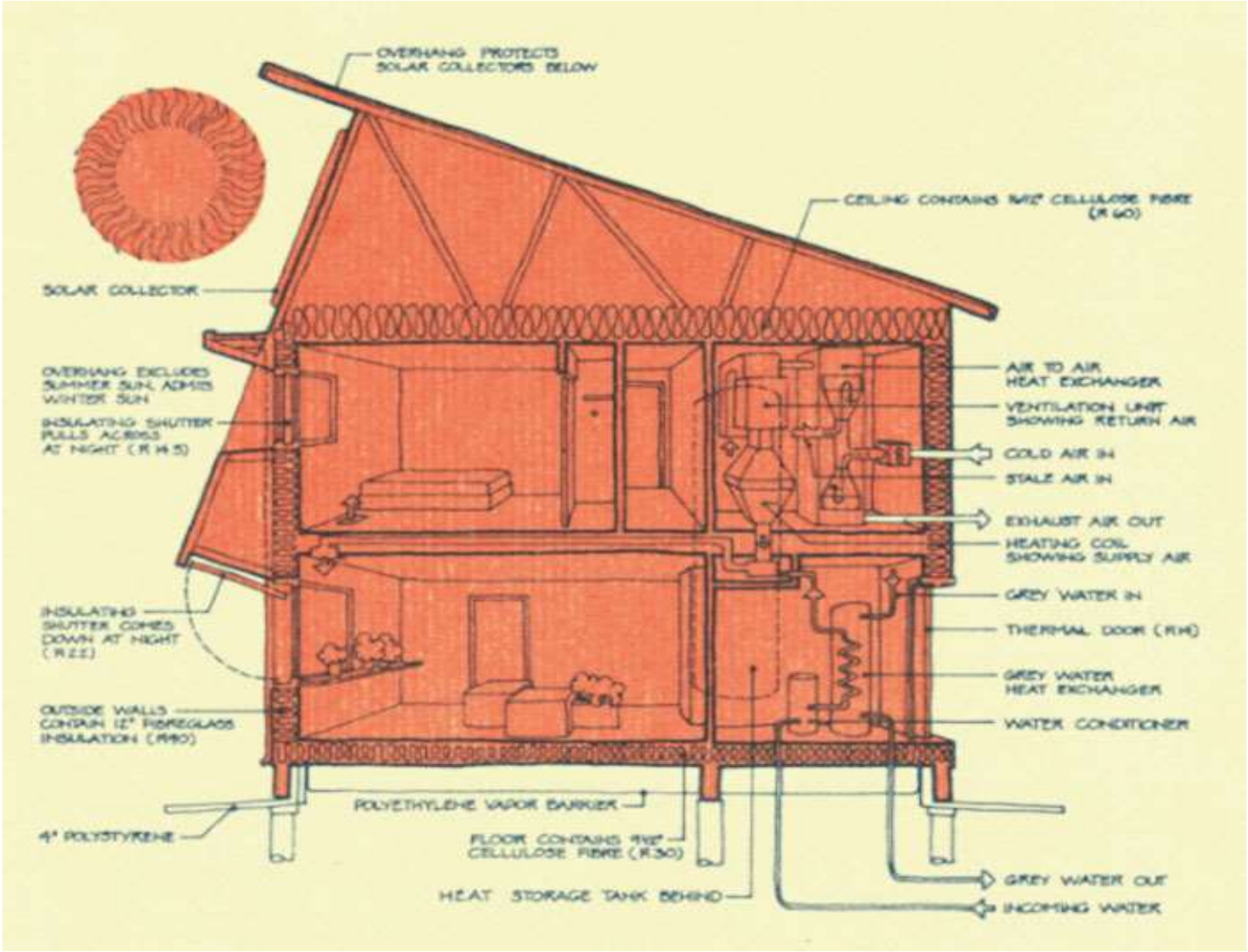
4 years later we had in 1978 Saskatchewan Conservation House

- 0.5 air-change @50 Pa
- R44 walls
- R60 ceiling
- R30 Floor
- Insulated shuttered windows
- Solar

Heat loss in average home



- First Air to Air residential HRV



Things which were developed in this era

- First proof of concept superinsulation and very tight homes
- Blower door for tightness testing vs previous gas molecule tests multiple day duration.
- First residential air to air heat exchangers
- Software tools to quickly evaluate designs HotCan
- Stopped putting solar on houses in Saskatchewan

- This led to the Formation of the EEBA; R2000 in Canada and Passive House in Europe

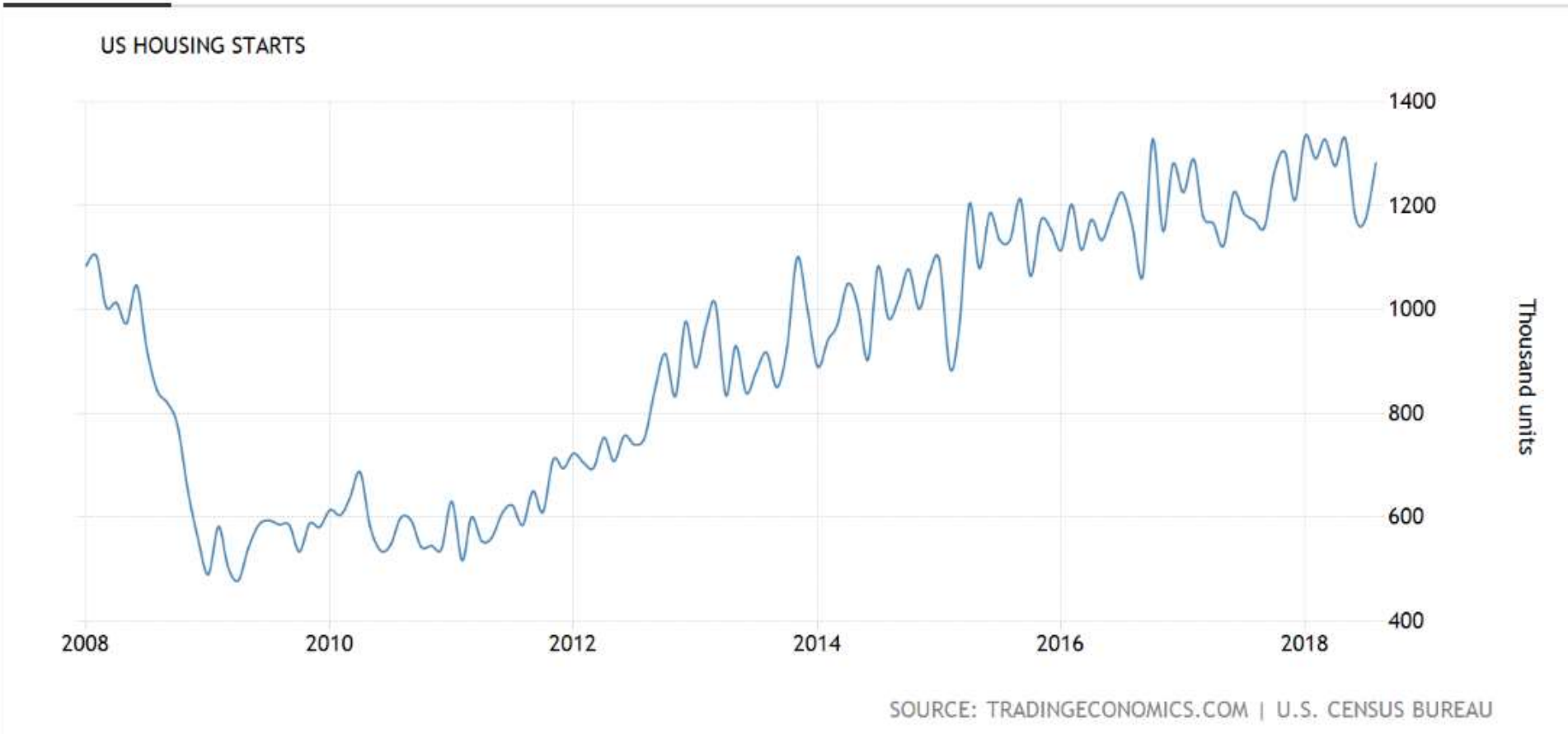
- From the EEBA web site “A small contingent of building professionals representing the United States, Canada, and Sweden, gathered in Pine Island, Minnesota in early 1982 to develop criteria for the construction of buildings that were more energy efficient. These forward-thinking pioneers created the Energy Efficient Building Association.”

Some historical Items I found from that Era conferences in Rochester 1984 & 1985


Presented to
Harold Orr
In Recognition and Appreciation
for his Dedicated Service to the
ENERGY EFFICIENT BUILDING ASSOCIATION
Charter Member, Original Incorporator,
Board Member and President
1985 - 1989
EEBA

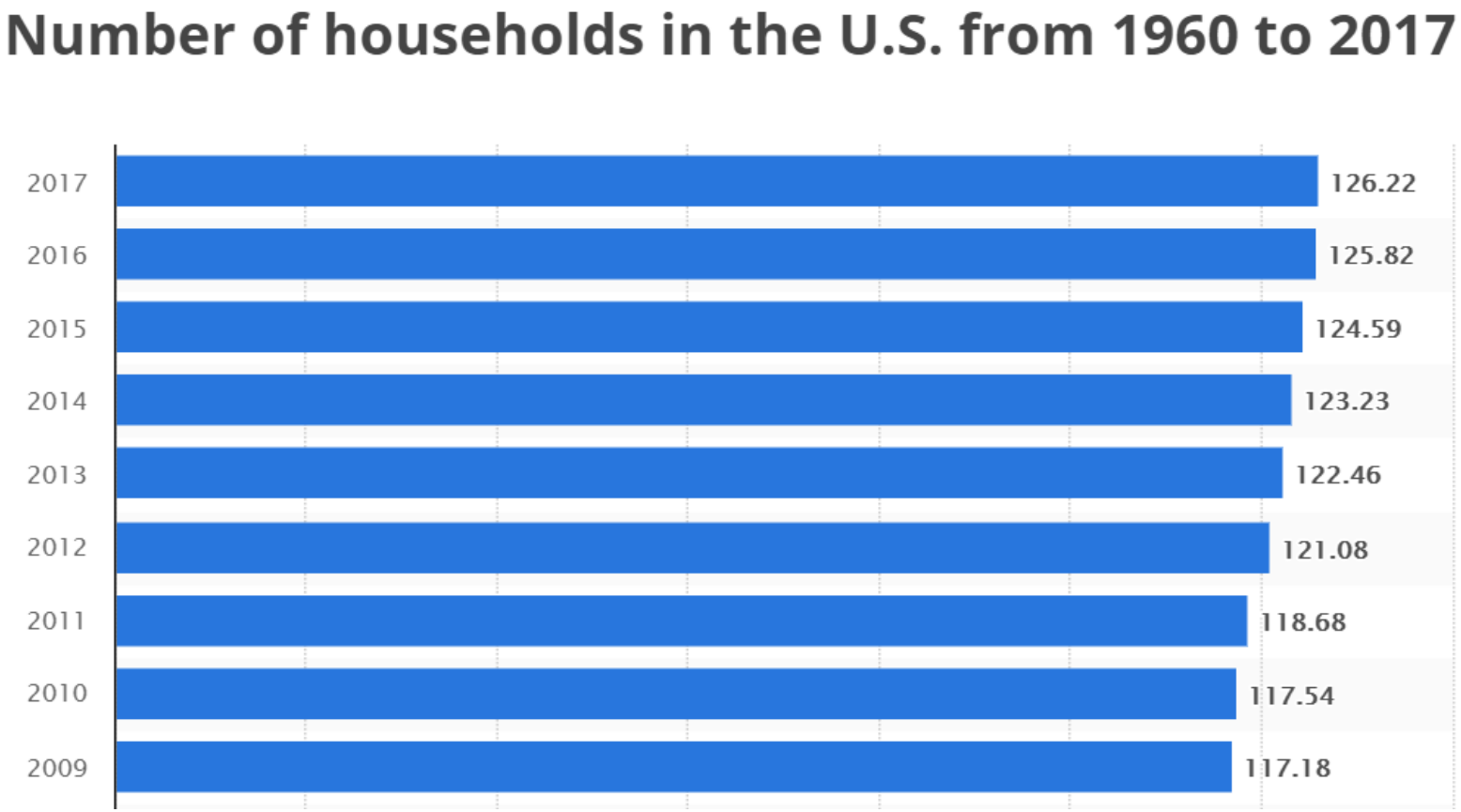
What is the current opportunity and need for education of course we look to new build

- California net zero initiative
- New home construction ~1.2m/yr lets say approx. $400 billion



What can be done with Existing home inventory

- Currently 126 million existing 100 x annual new build



What to do with Existing Homes

- Usual in Canada we will strap the walls and place 2 inches of SM and replace the windows
- My solution -I like to call it the

Chainsaw retrofit

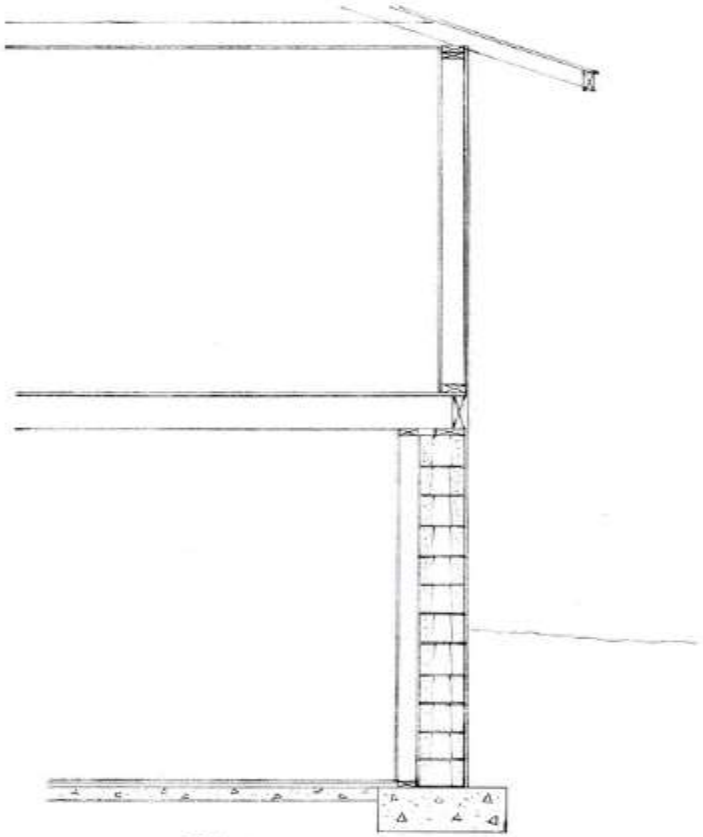
Retrofit Examples from Saskatchewan

- First house done early 1984 31 Deborah Cres Saskatoon. The same time EEBA was started
- Results – Airchanges down to 0.29@50Pa
- Slides below are a 4 plex in Regina done in 2008-2009 -25 years later.

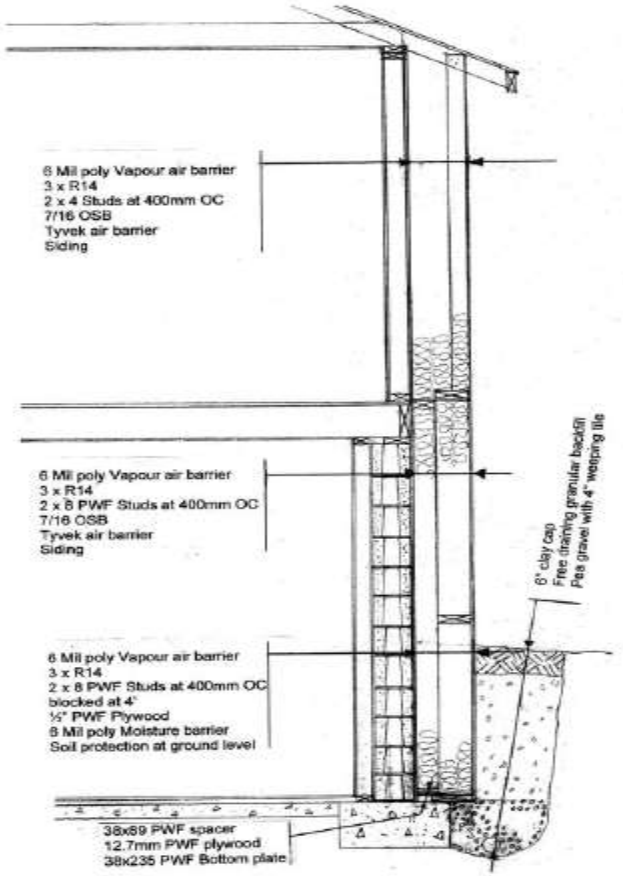
Why retrofit?

- Except for foundation, Structure is sound
- Very high energy use
- Very uncomfortable
- Need new heating system
- Need new windows and doors
- Need new exterior finish
- Unable to rebuild because of zoning

Basement and Walls



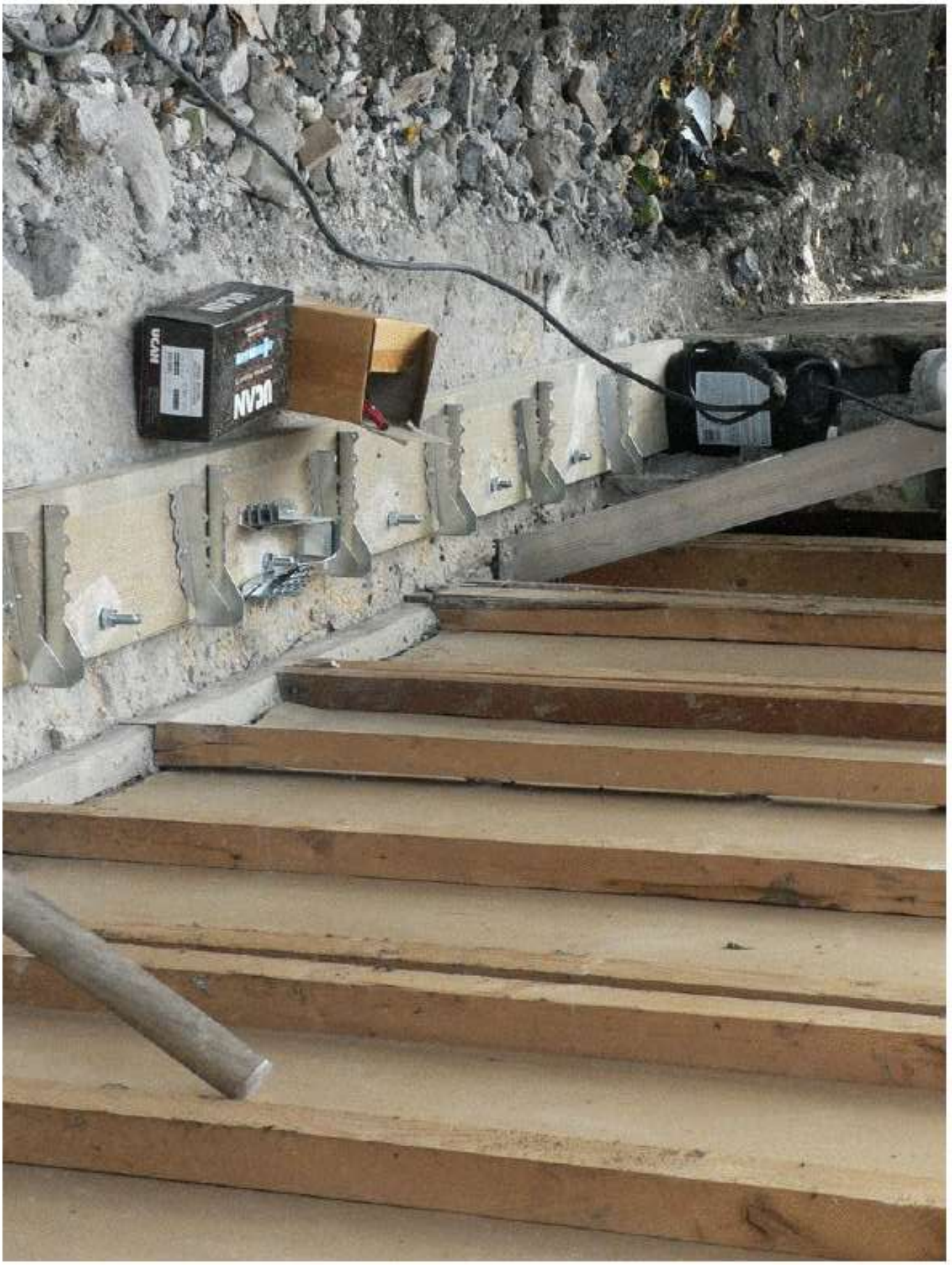
Existing



When you do a retrofit you always find things you don’t want; in this case foundation problems


10" Concrete block foundation


DEERE
Brandt
Cost 23.86/ft Removal of materials
and supply of granular drainage


VARTA
NV24

The genius of this solution
Continuous Vapor Barrier

Notice vapor barrier details at transition from basement to upper floor; this will be covered with R42

Above grade didn’t need treated wood so OSB was used

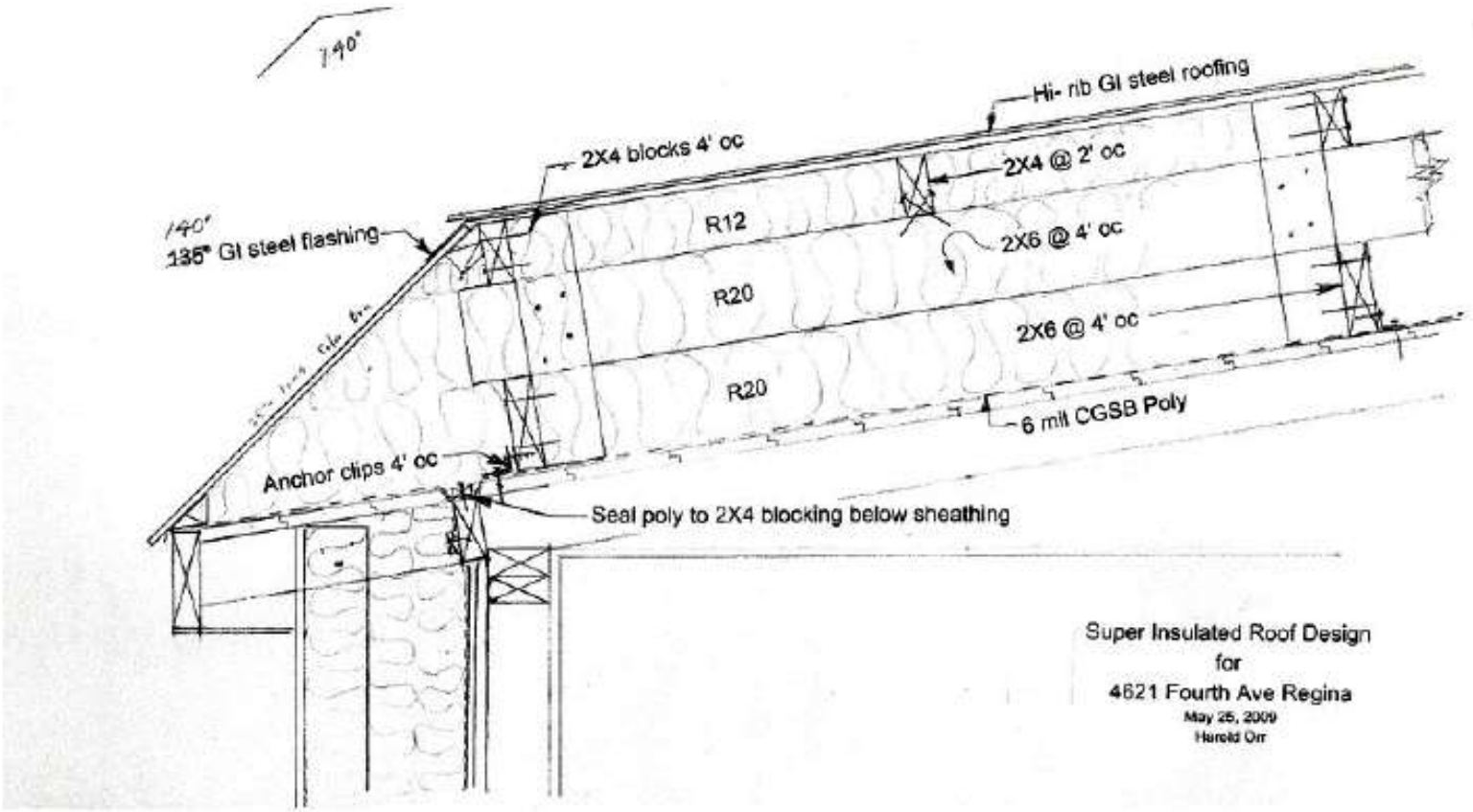
No chainsaw in this case we left the eave and sealed the roof vapor Barrier to the wall through blocking, you will see in later wall section

Notice upper wall vapor barrier sealed to basement vapor barrier with insulation cavity to keep warm and straps/girt to support wall

End of season 1

Time to start the Roof

The Roof- end up with R52 - wall/roof vapor barriers sealed thro wood member

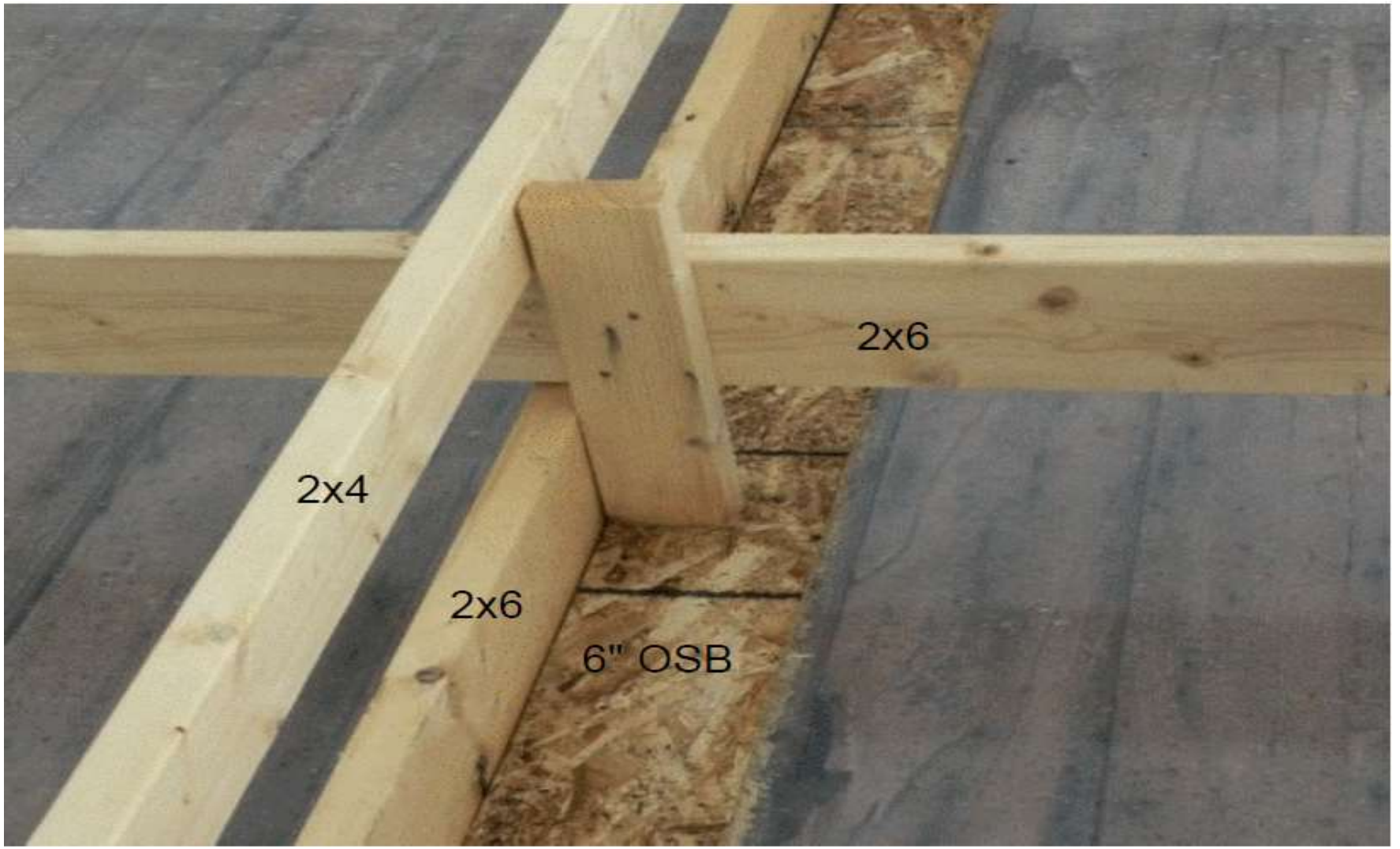


Sure put poly on roof cover it with insulation and all good but practically how do you do it so you don't fall off? #nosafetygear

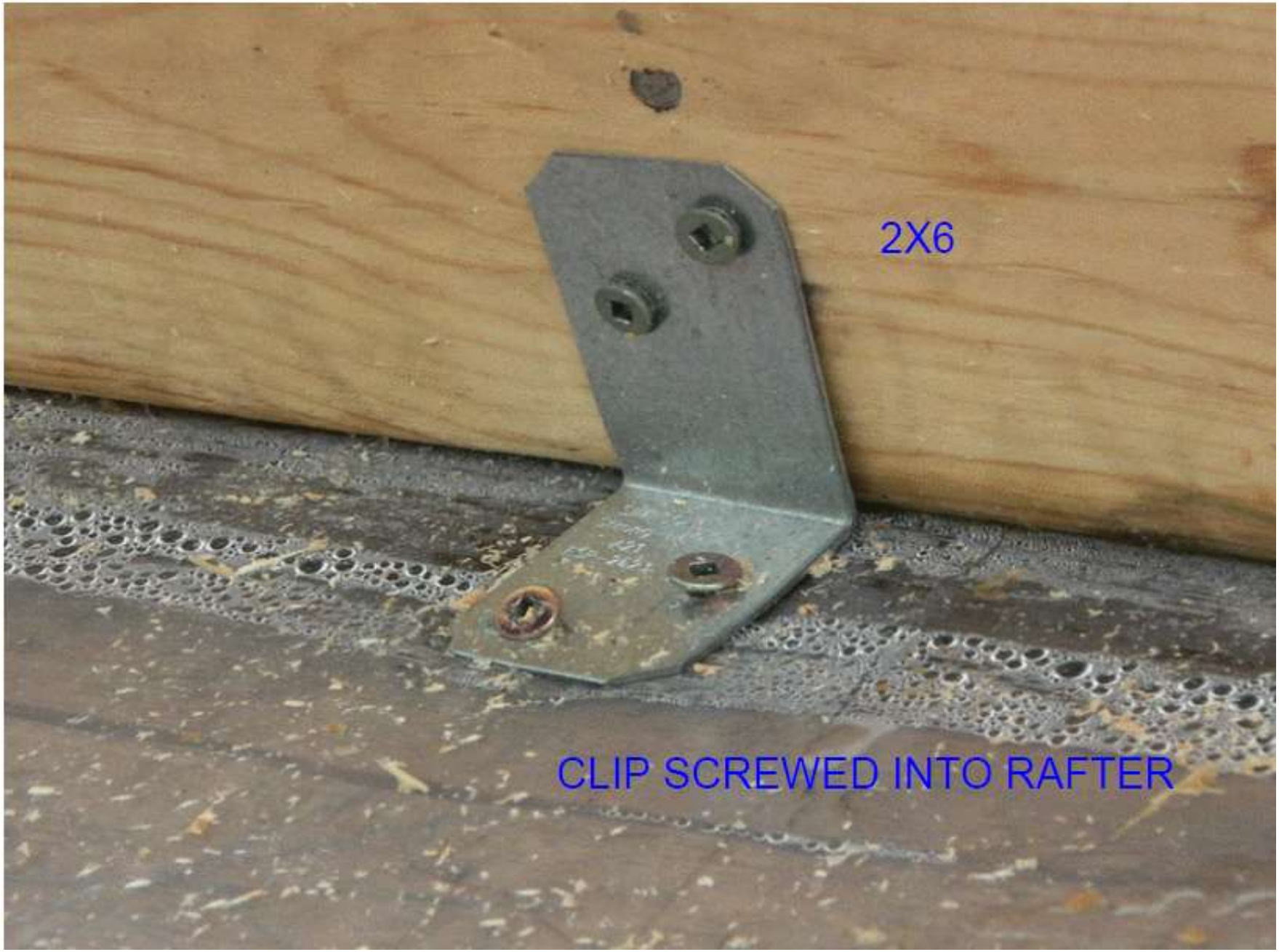
Here is the genius of this solution;
we now have a continuous vapor barrier all joints sealed not trying to chase cracks in attic; leads to very tight house

Now the osb walking strips and the 2x6 members make sense

Room for R52 insulation




Poly sealed around
plumbing stack


2X6
CLIP SCREWED INTO RAFTER


JM
R20

I hate shingles but with that amount of insulation the metal roof is not loud inside when it rains.


BEFORE

See the roof detail - we didn’t actually chainsaw this one and the front and rear entries were left original which explains some of our lower than hoped for blower door readings

Materials for Basement Retrofit

Basement retrofit	Units	Price/unit	Cost
2x8 PWF	180	9.6000	$1,728.00
B PLATES	45	7.2000	$324.00
T PLATES	45	4.9050	$220.73
6 MIL POLY	1440	0.0380	$54.72
R14 +R14 + R14	4320	0.4518	$1,951.60
1/2 PWF	855	1.0303	$880.92
7/16 OSB	720	0.4869	$350.55
TYVEK	1440	0.1188	$171.00
VINYL SIDING	720	0.5930	$426.96
Sub total			$6,108.47

$4.24/sq ft

Materials for Top Floor Retrofit

Top floor retrofit	Units	Cost/unit	Totals
2 X 4 STUDS	90	4.1000	$369.00
6 MIL POLY	1746	0.0380	$66.35
R14 +R14 + R14	4320	0.4518	$1,951.60
7/16 OSB	720	0.4869	$350.55
TYVEK	1440	0.1188	$171.00
VINYL SIDING	720	0.5930	$426.96
J CHANNEL	190	0.4570	$86.83
SOFFIT	184	0.6719	$123.62
FACIA	184	0.5908	$108.71
DRIP EDGE	190	0.6000	$114.00
J CHANNEL	190	0.3350	$63.65
2 X 4 RIM RAFTER	190	0.4100	$77.90
			$3,910.18

$2.72/sqft including Vinyl siding

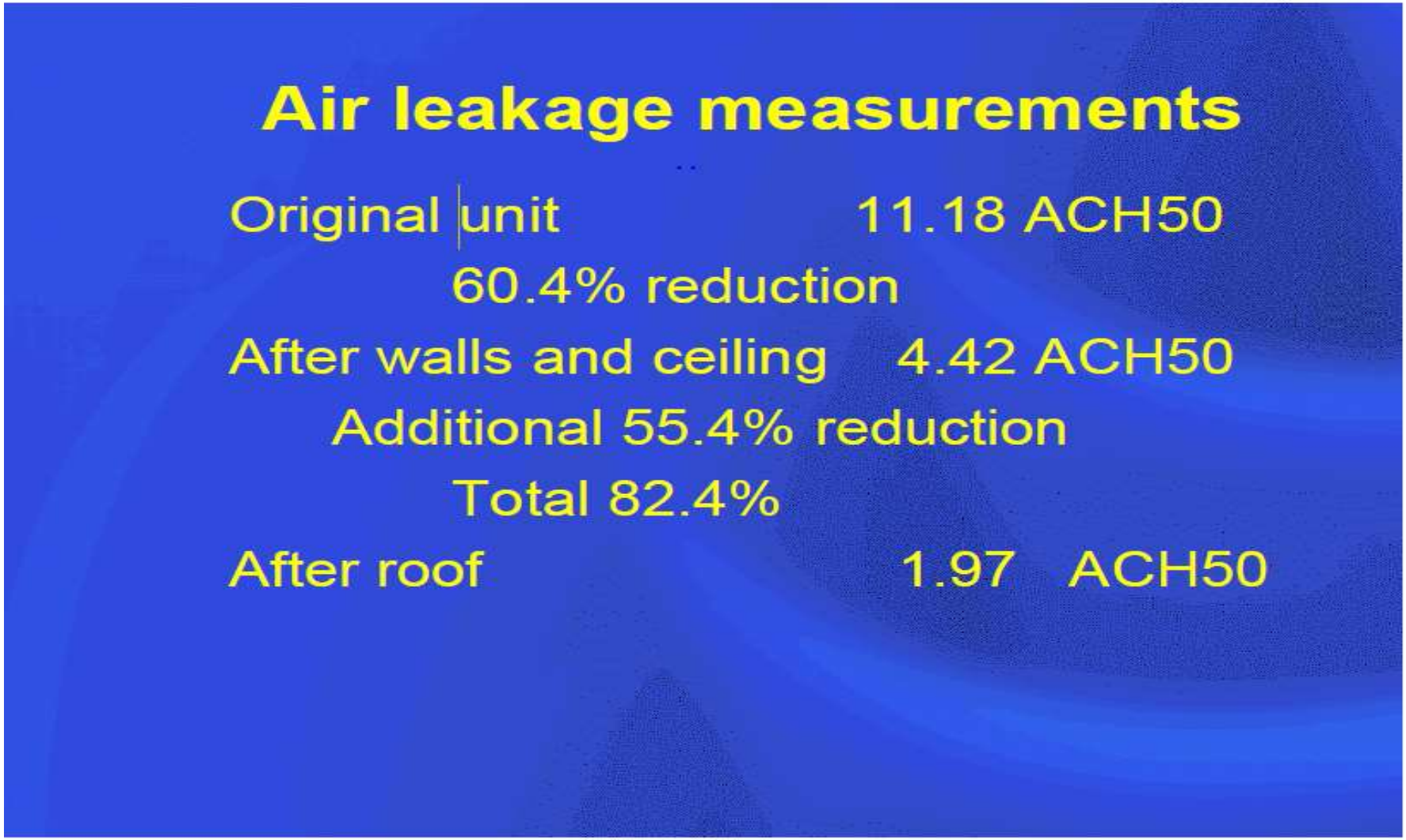
Materials for Roof Retrofit R52

NUMBER	ITEM	UNIT PR	TOTAL
1856	Hy-rib steel roofing	1.2500	$2,320.00
65	7/16 osb	15.5808	$1,012.75
118	Ridge cap	2.0000	$236.38
88	anchors	1.0000	$88.00
82	2x4 12 spf 2 or b	2.5500	$209.52
30	2x6 16 spf 2 or b	5.6500	$166.68
24	2x6 12 spf 2 or b	4.6000	$110.40
2	6 mil poly	59.7500	$119.50
2	Tyvek	109.2700	$218.54
3712	JM White R20	0.7243	$2,688.78
1856	JM White R12	0.3563	$661.30
			$7,831.86

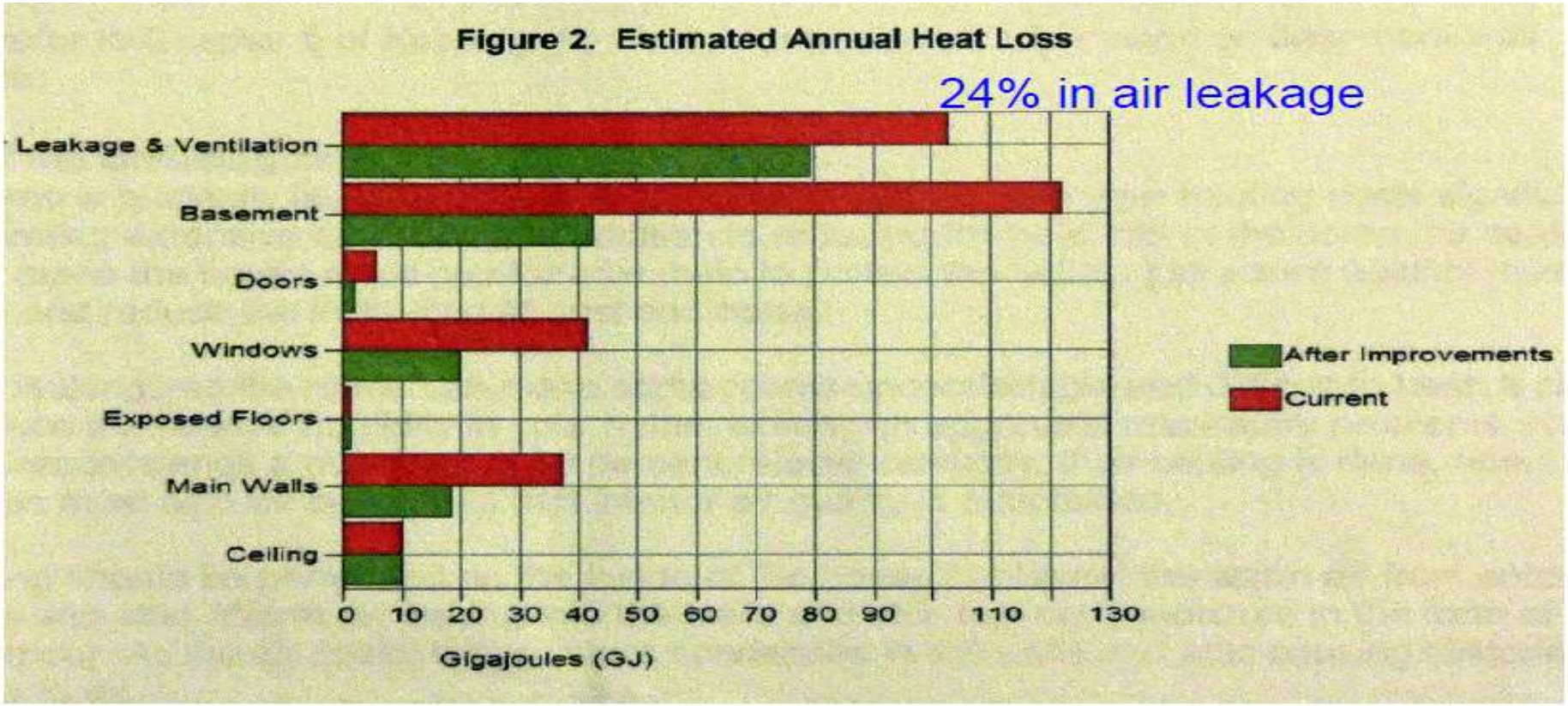
$3.79/sqft including steel roofing

Results

Final tightness 1.97 vs 0.29 which we received at Deborah 25 years earlier but still 5.5x reduction from original 11.18



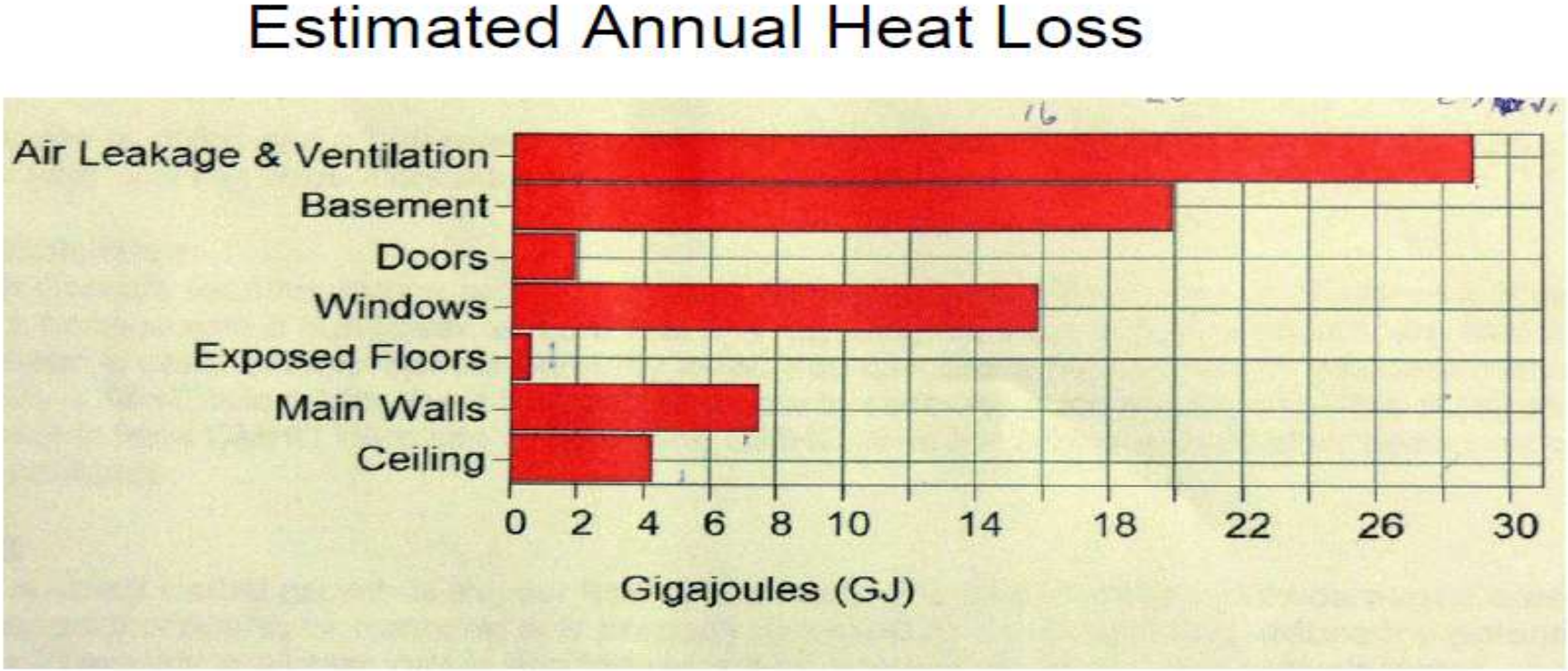
Original case in Red;
end of year 1 construction in Green



Totals 342GJ

209GJ

Final as built heat loss 79.2GJ vs 342 GJ



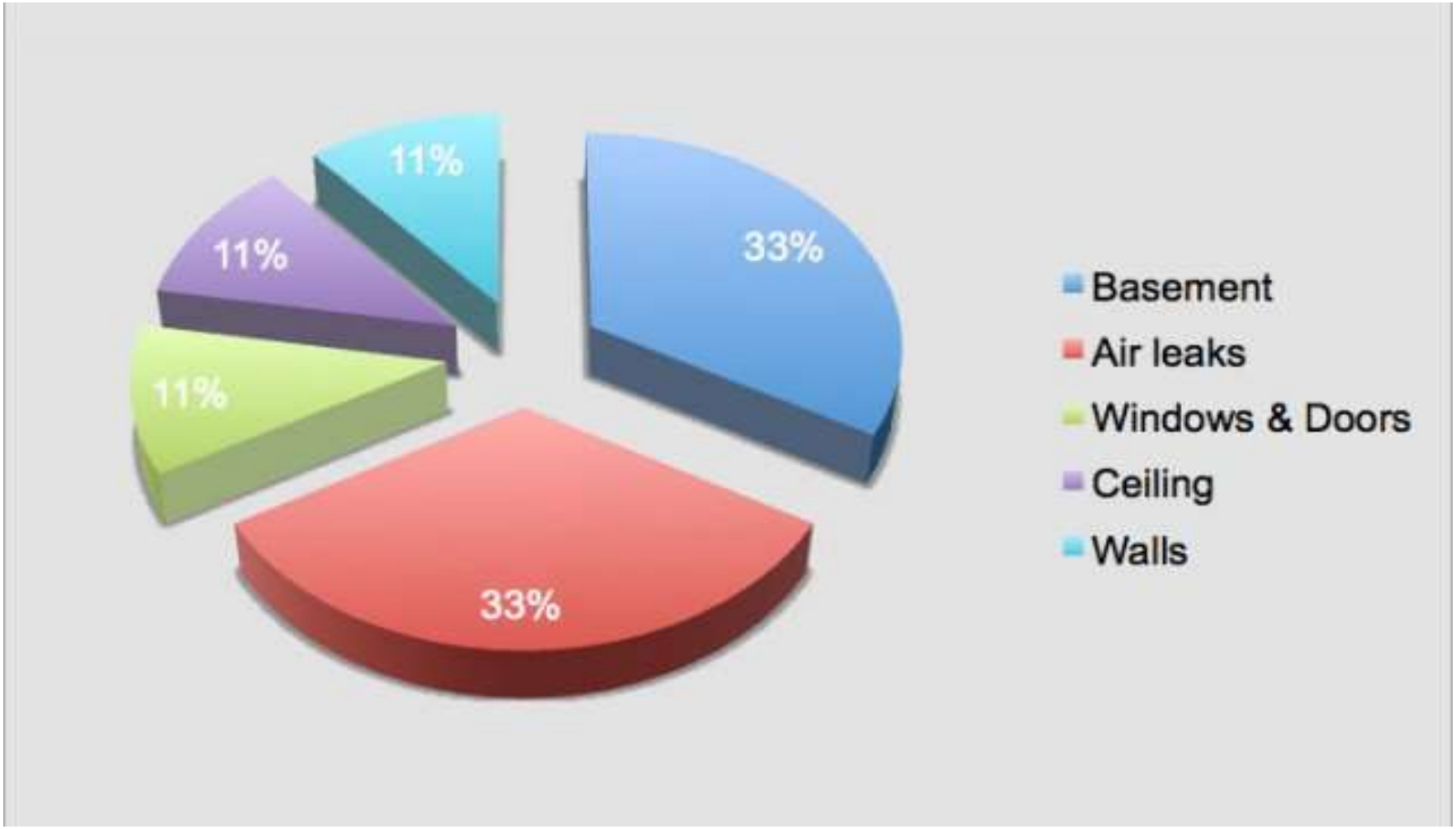
Total 79.2 GJ
a reduction of 85%

A reduction of 82%
in air leakage

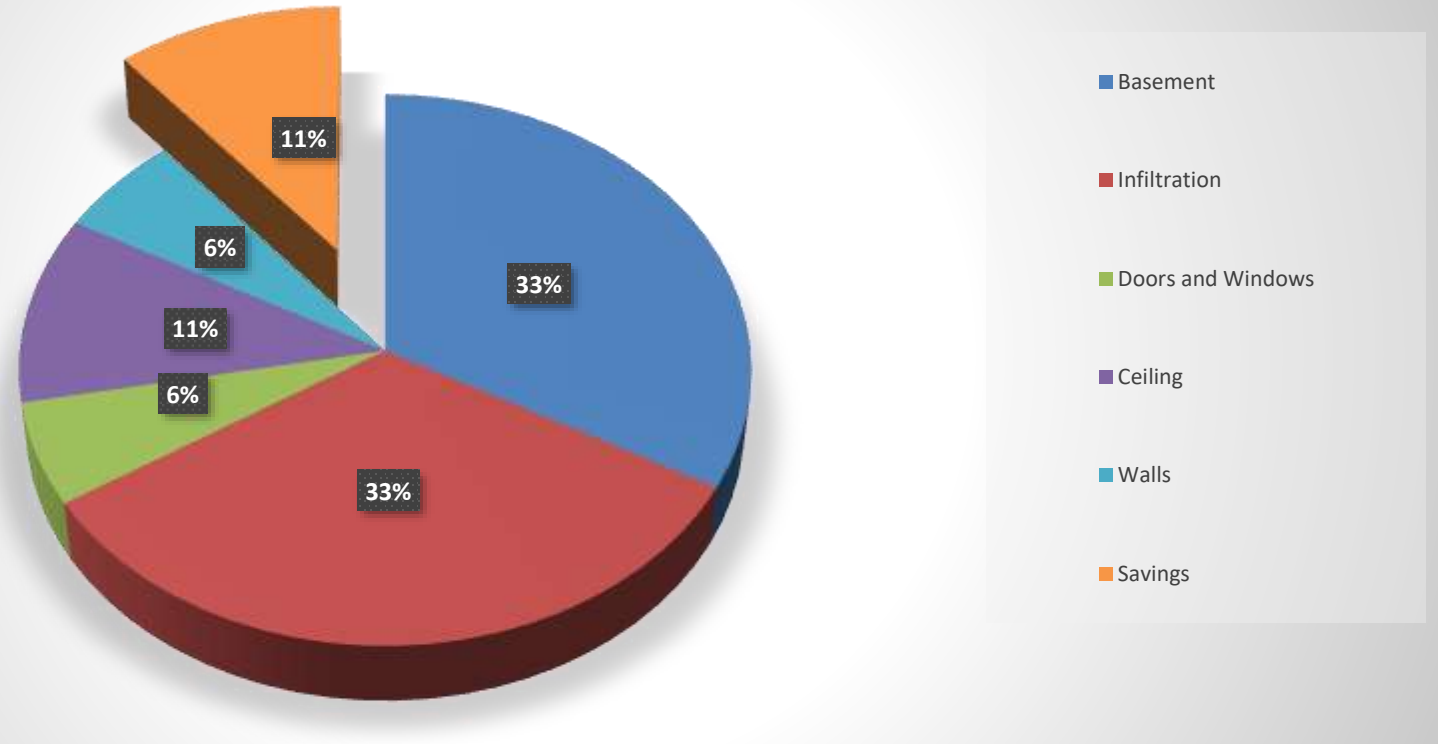
What have we learned?

1. Air tightness is of paramount importance.
2. Air tightness is best achieved on the outside.
3. A heat recovery ventilator is essential.
4. Extraordinary comfort.
5. Supreme quietness.
6. Point source heating works very well.

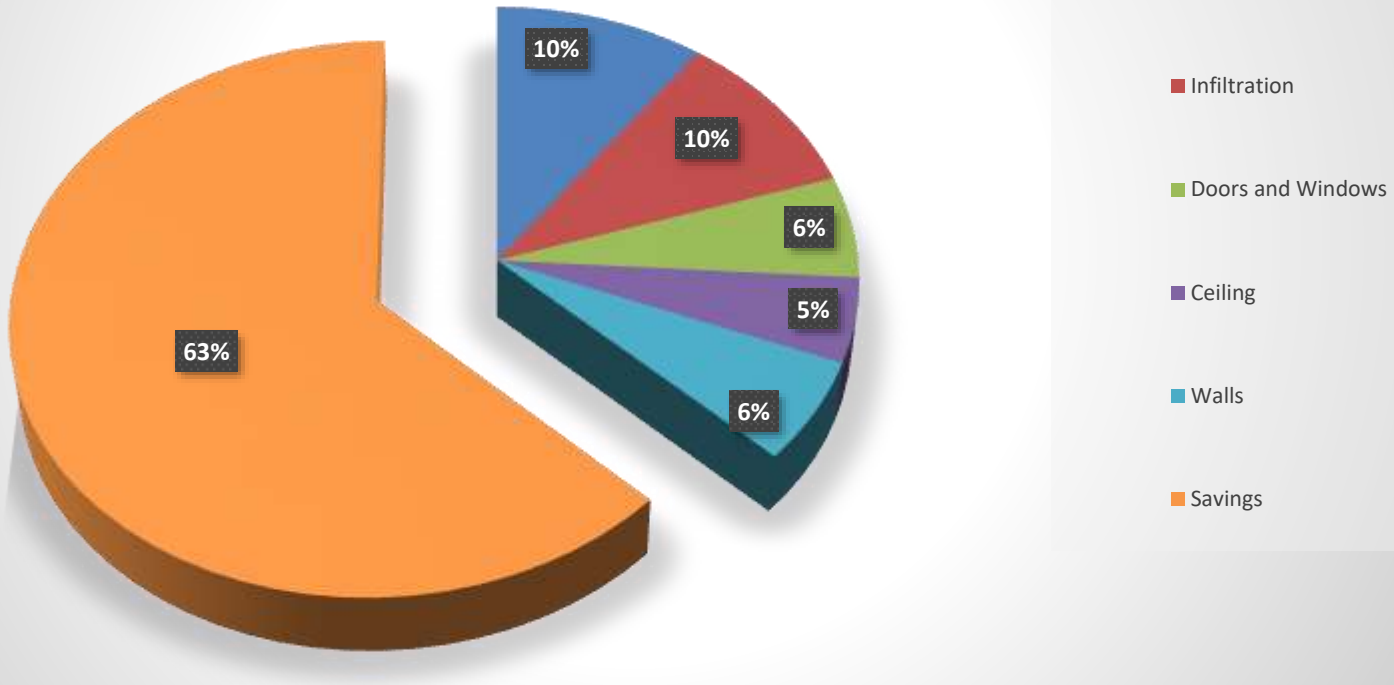
remember this slide ?
Heat loss in average home



Savings Conventional Retrofit siding along with 2” SM on walls and Window Replacement



Savings when doing a Chainsaw retrofit



Takeaways

- “build tight ventilate right”
- Don’t forget existing homes as we focus on new builds
- Sometimes the old guys knew what they were doing