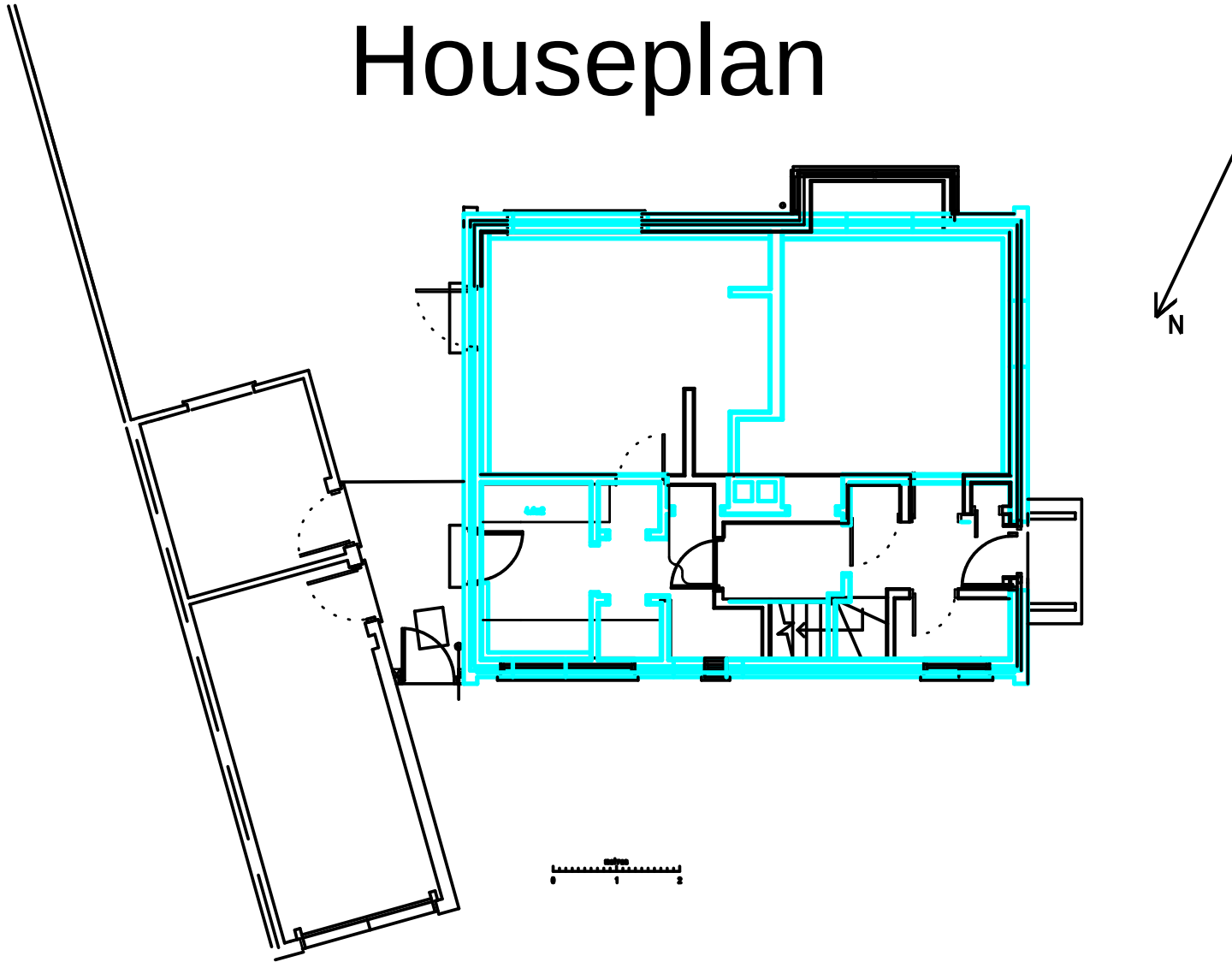


DIY 1960s EnerPHit Retrofit



Houseplan



Previous House



Nomenclature

- U-value: Area heat-loss. 5 is terrible, 0.1 is good
- Psi-value: Linear heat-loss (e.g around windows)
- IWI: Internal wall insulation
- EWI: External wall insulation
- MVHR: Mechanical Ventilation and Heat Recovery
- EPS: Expanded polystyrene
- XPS: Extruded polystyrene
- PUR/PIR: Polyurethane/Polyisocyanurate foam (celotex/ecotherm etc)
- AECB: Association of Environmentally Conscious Builders
- PHPP: Passivehouse Planning Package
- SAP: Standard Assessment Procedure

Retrofit levels

Carbonlite/AECB Retrofit, Enerphit, Passivehouse

	Annual avg heat load (kWh/m ²)	Energy per annum (kWh)	Airtightness (airchanges per hr)
As built	377	36,400	10+
As bought	120	11,500	5-8(?)
AECB retrofit	<50	3900	<2
EnerPHit	<25	2400	<1
Passivehouse	<15	1450	<0.6

Lots of things improved

- **Skeiling EPS (2007-04)**
- Bike shed (2007-04)
- Loft platform/walkway (2007-05)
- Bay roof (2007-09)
- **Moved/new boiler (2007-12)**
- Removed ancient boiler pipes on roof. (2008-01)
- **Solar thermal (2008-05)**
- Insulation over kitchen back door (2008-11)
- Raised beds (timber) (2008-11)
- Loft hatch (2008-11)
- **Internal Wall Insulation** (Lounge - 2009-06)
- **Front door** U=1.4 (2009-05)
- **PV (2009-10)**
- Remove header tank (2010-06)
- **Extension (2011-2014)**
- **Garage/shed walls (2011-12)**
- Garage door (2012-02)
- Garage LEDlights (2013-01)
- Clean cavity (2013-06)
- Rooflight mirror (dec 2013)
- Extension LEDlights (2014-04)
- Insulate spare flue (2014-04)
- Extension UFH (2014-05)
- Extension screed (2014-06)
- Extension window taping (2014-10/11)
- Extension ceiling (2014-12)
- Extension floortiles (2015-03)
- Air testing (2015-09)
- **MVHR (2015-12)**
- Replace greensteps weatherbars (2016-05)
- Lounge reveal chop (2016-09)
- **Bedroom IWI + ceiling (2016-10)**
- Bedroom floorpaint (2017-03)
- Solar thermal refurb PHE (2017-06)
- **Finish lounge IWI (2017-12)**
- Break under stairs (2018-02)
- Extension internal window (2018-06)
- Perimeter drains replumb (2019-02&03)
- Understair airtightness (2019-04?)
- Brick up pantry window (2019-05)
- Extend gable (2019-06)
- **Perimeter insulation (2019-10)**
- Remove porch (2019-11)
- Front door threshold+perimeter (2019-12)
- Loo window shrink (2019-12)
- South perimeter (2020-11)
- Floor ins in pantry (2019-03)
- **3G Windows (2020-06)**
- **External Wall Insulation (2020-08&09)**

Principles

- Airtightness
- Thermal Bridging
- (Vapour movement)
- Thermal Mass
- Solar Gain

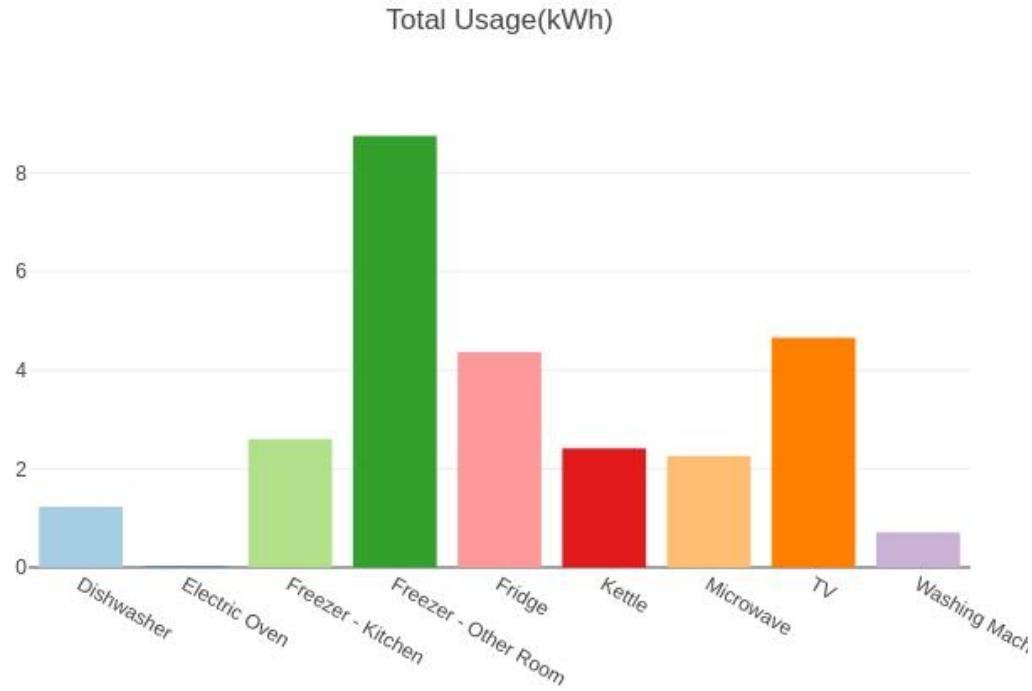
Boiler move (2007)



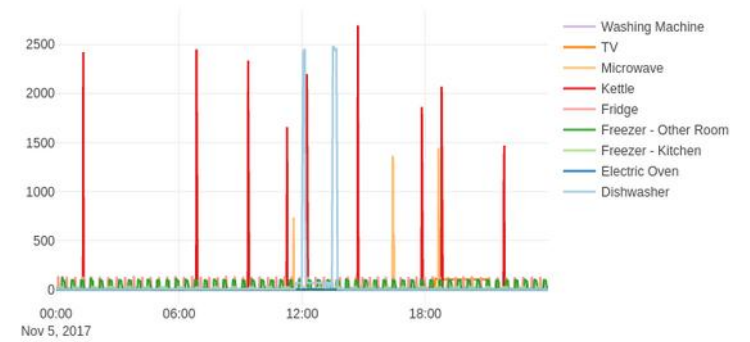
Boiler Move (2007)



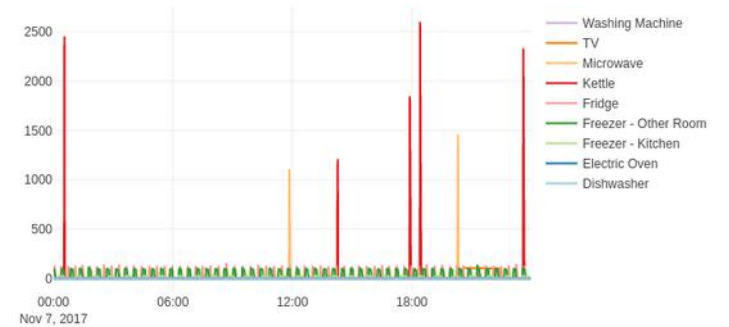
Electricity



Average Power(W) - 05 Nov 2017



Average Power(W) - 07 Nov 2017



Solar Thermal (2008)



Solar Thermal (2008)



Loft + Hatch (2007/8)

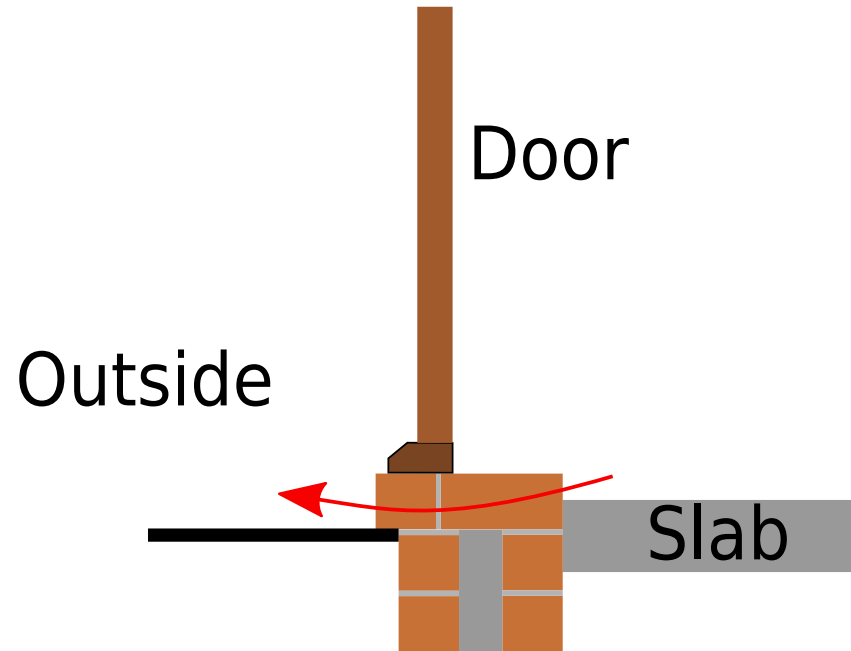


Solar PV (2010)



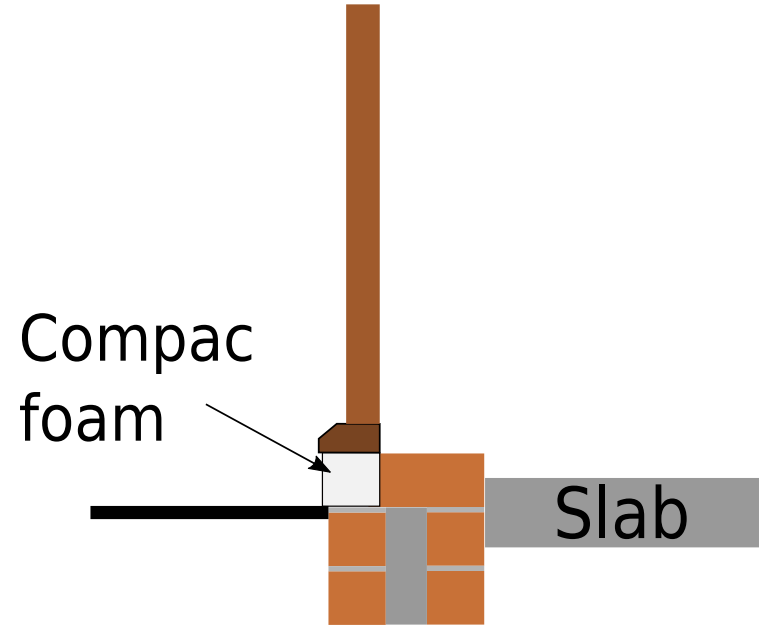
Door Thermal Bridge

(2009, 2019)



Door Thermal Bridge

(2009, 2019)



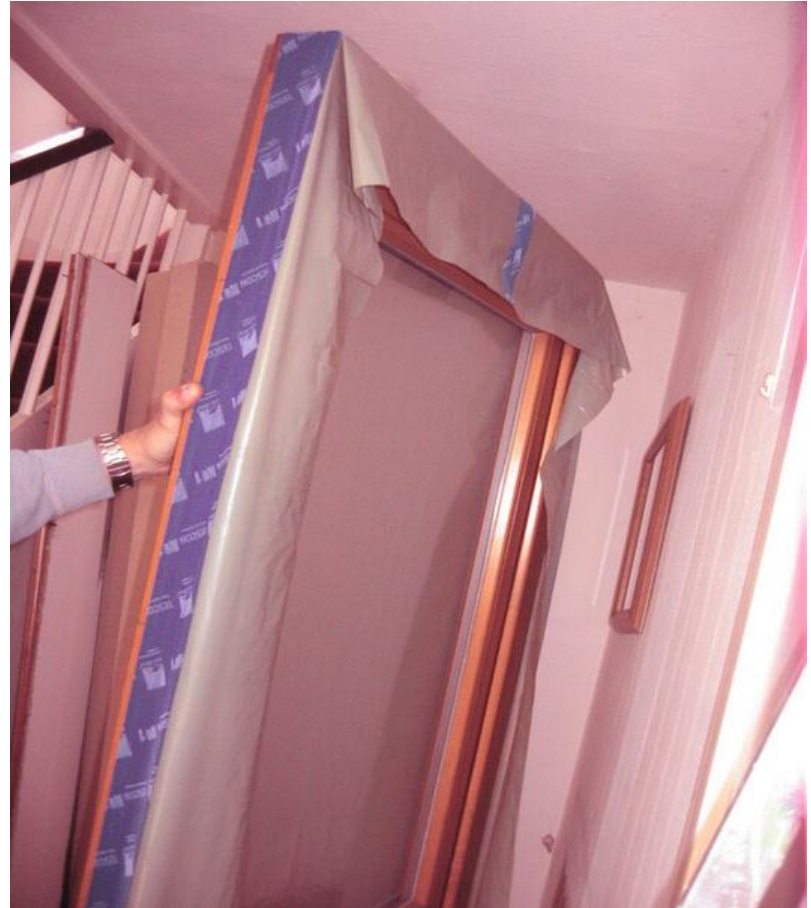
Window reveals



Reveals



Door Fitting (2009)





Door Upgrading (2019)

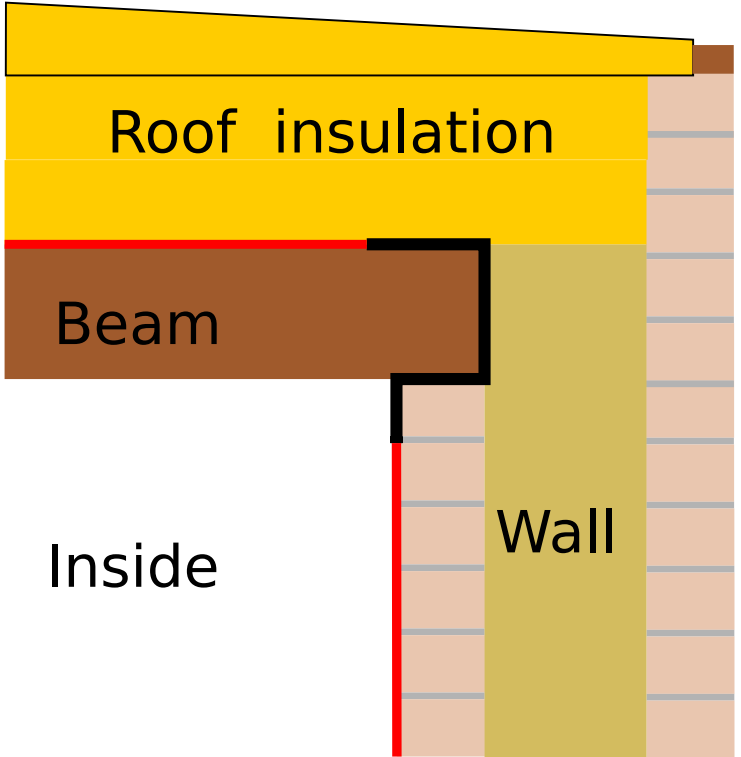
Airtightness



Airtightness2



Airtightness – Tony tray



Airtightness: Inside



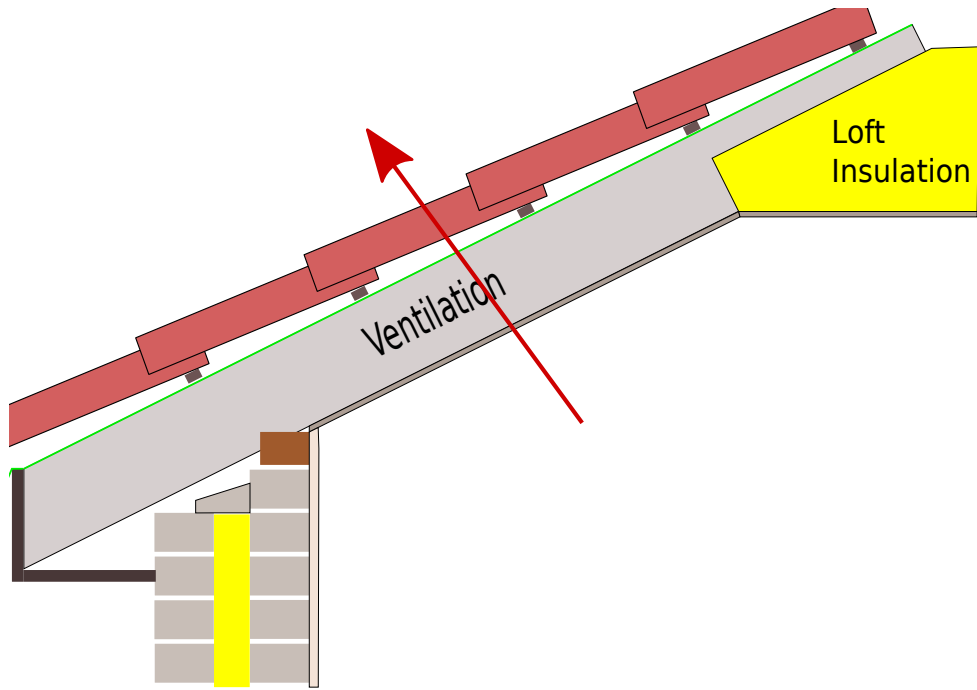
Airtightness3



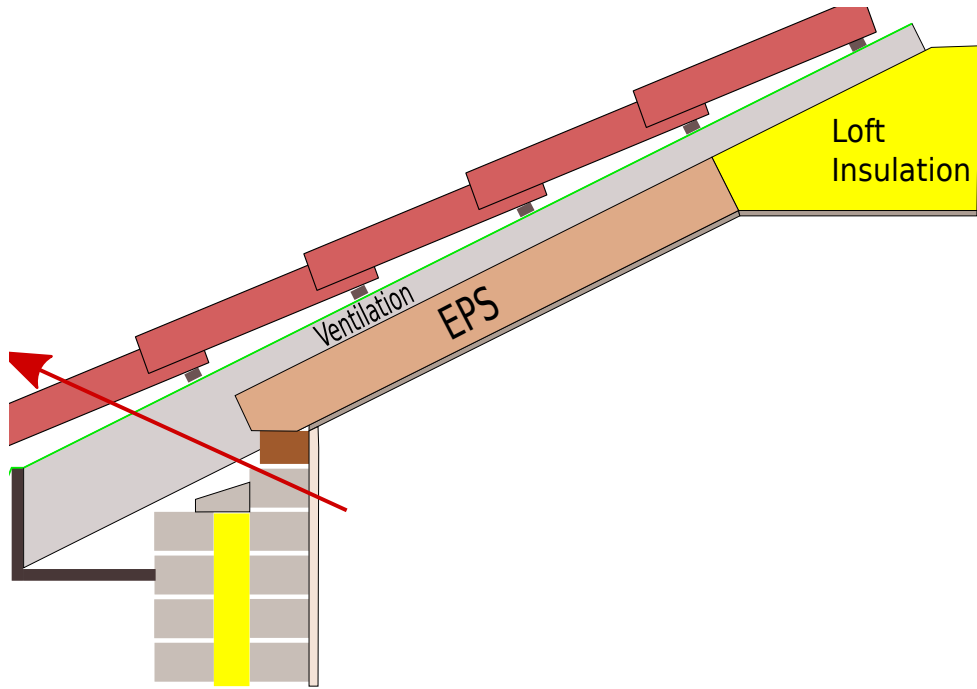
MVHR (2015)



Skeilings (2009)



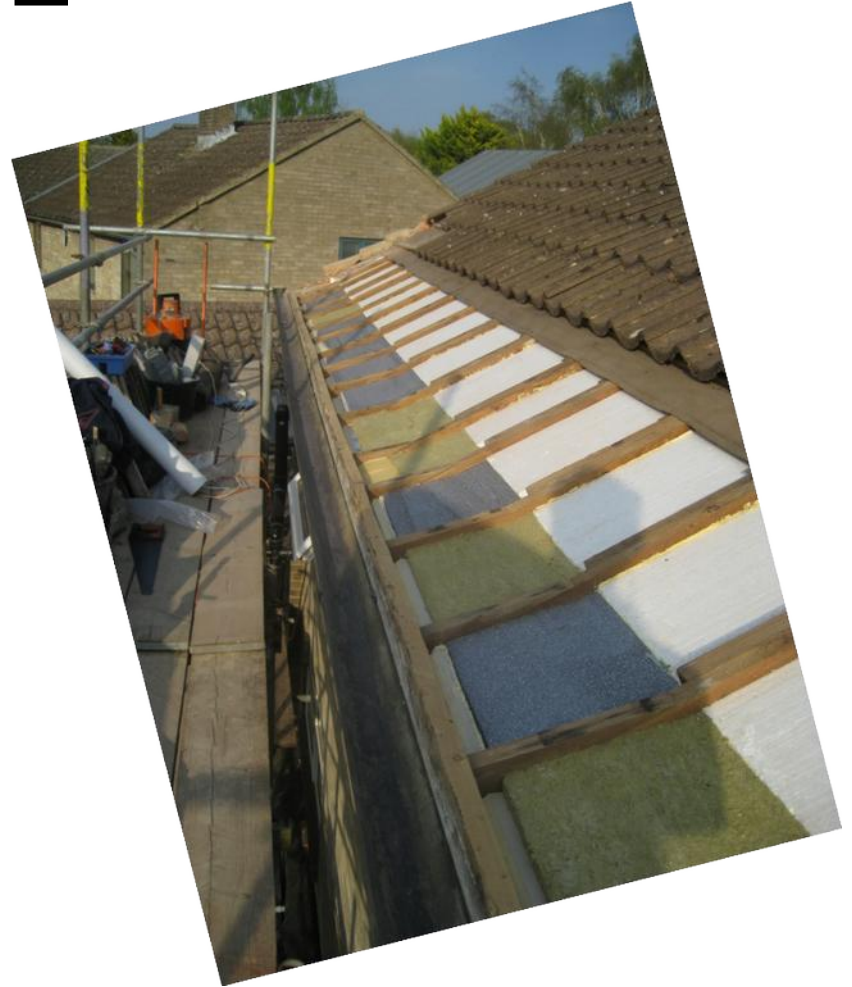
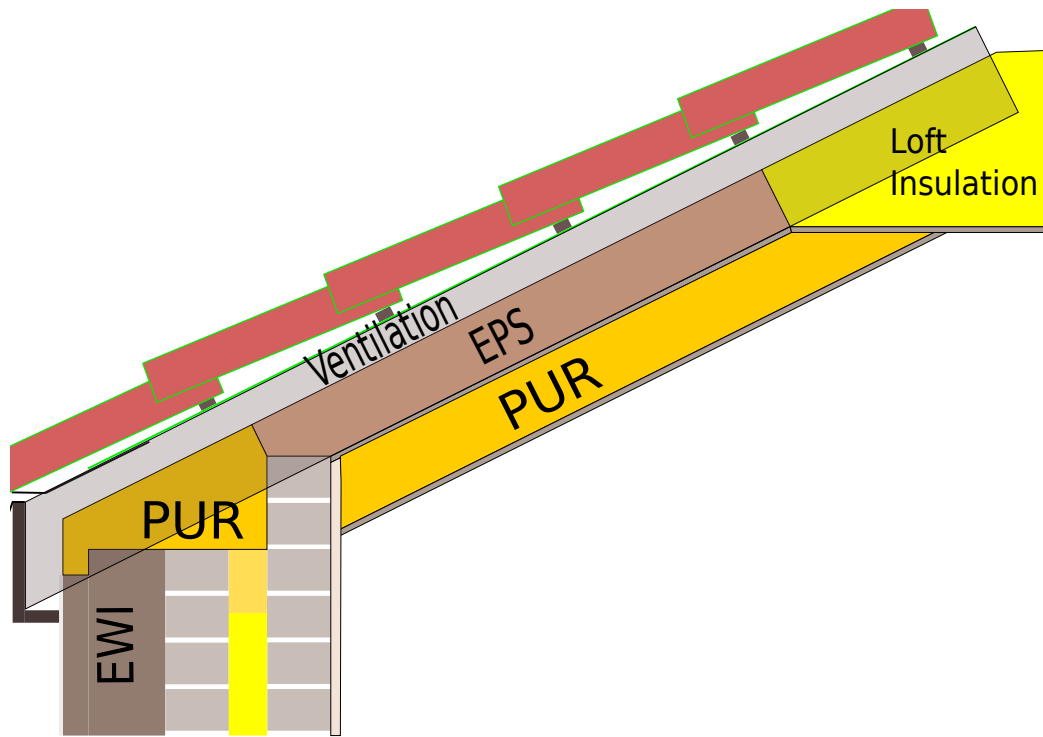
Skeilings (2016, 2019)



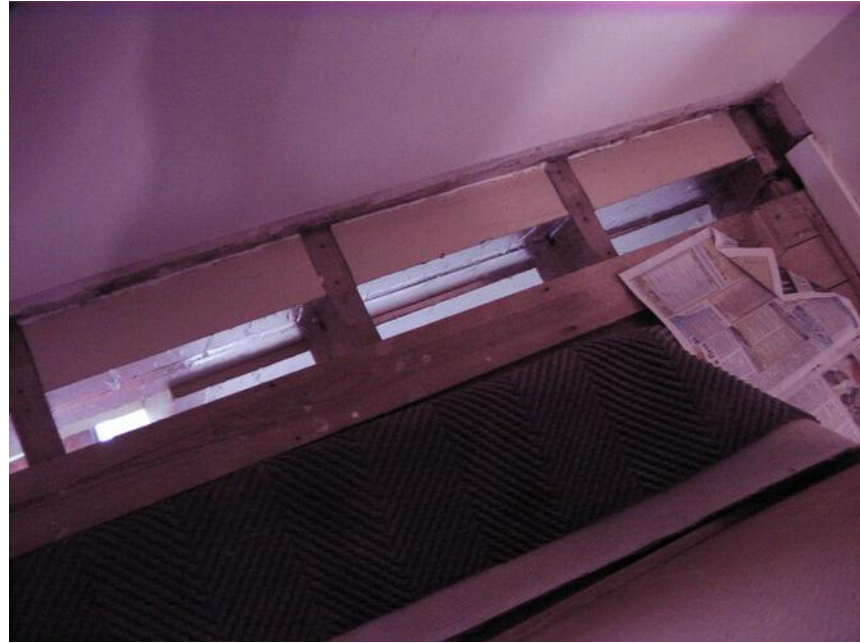
Eaves (2019)



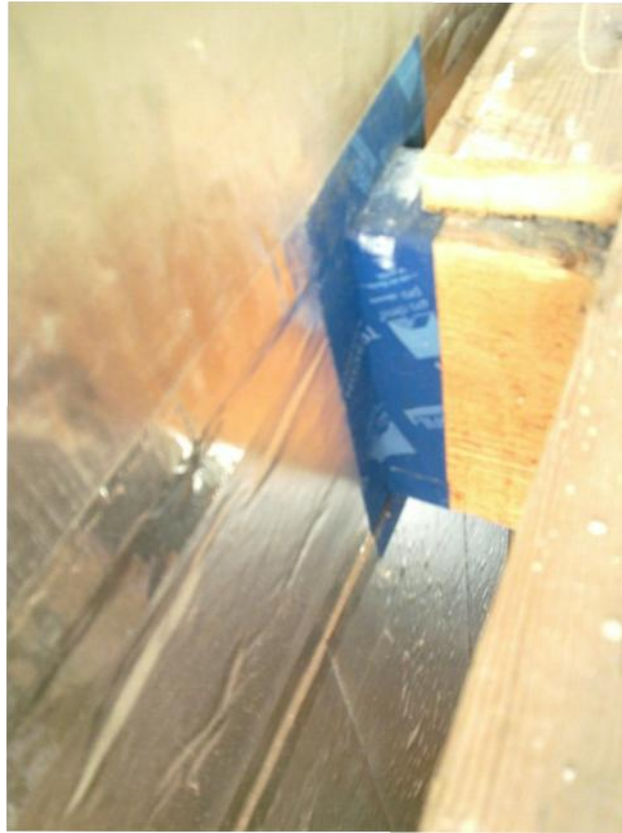
Eaves2



IWI detailing (2010-2016)



IWI detailing – joist sealing

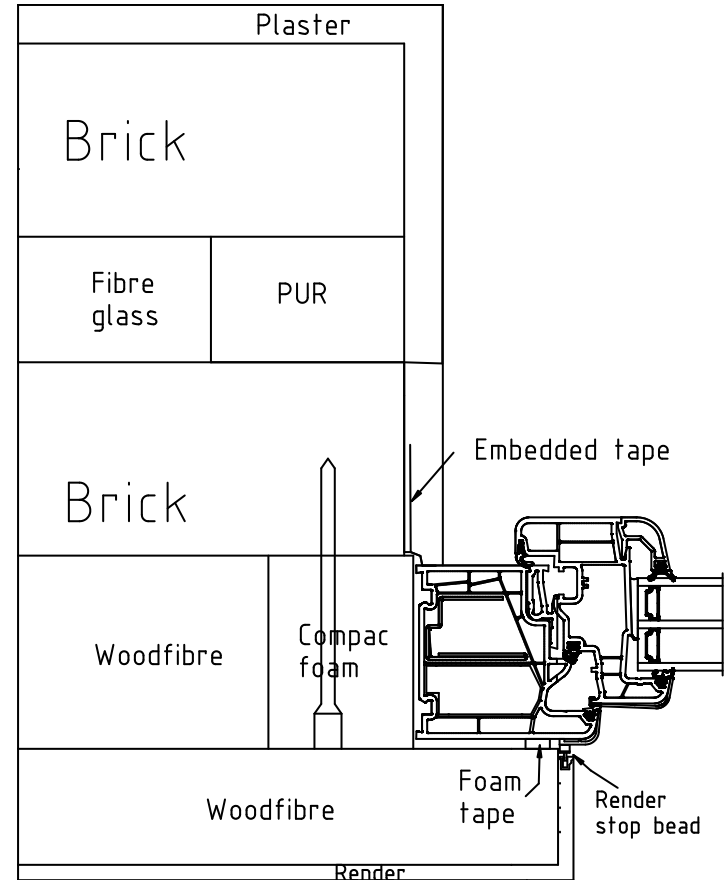


EWI (2020)





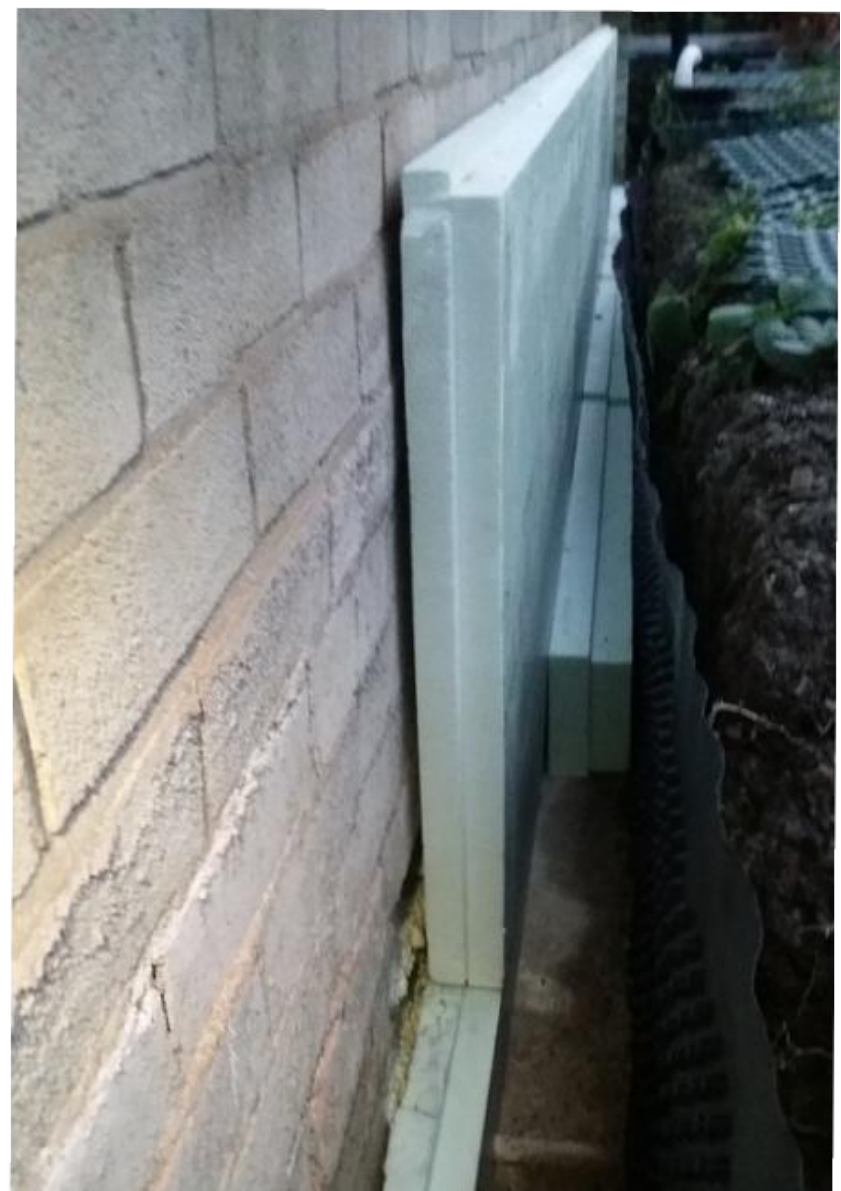
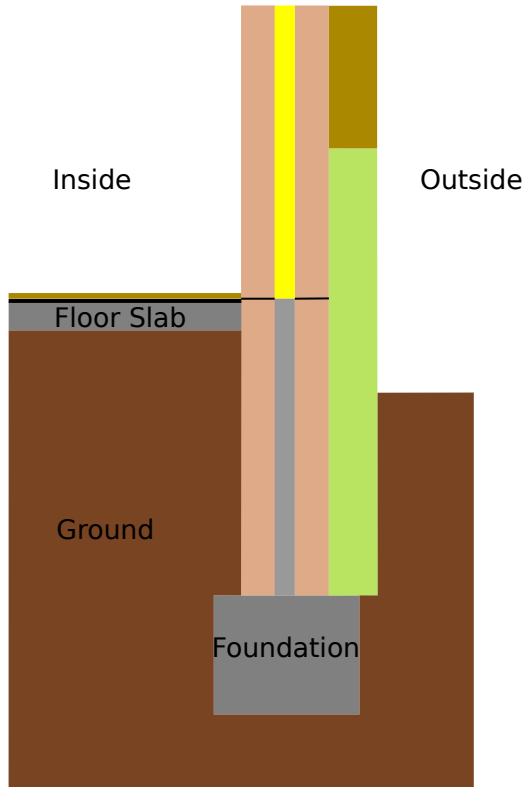
EWI (2020)



Window fitting



Perimeter insulation



Perimeter Insulation1



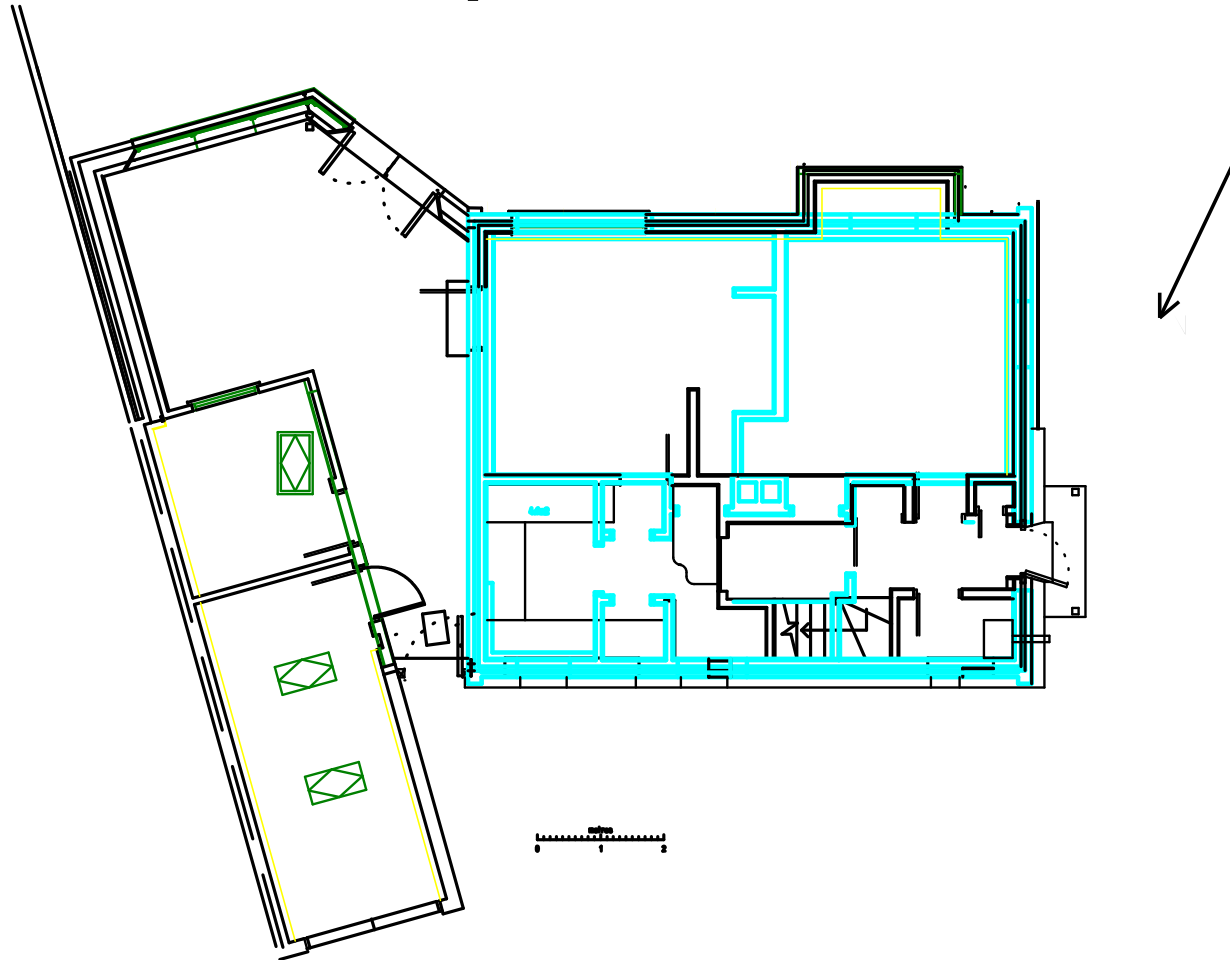
Perimeter insulation



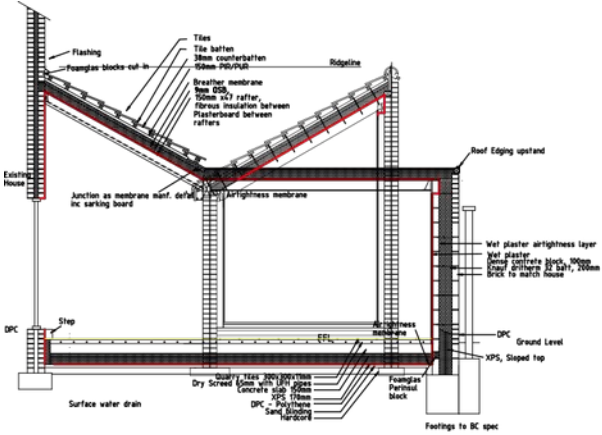
Extension (2011-2014)



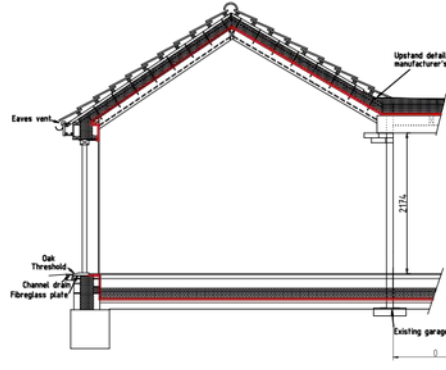
House plan afterwards



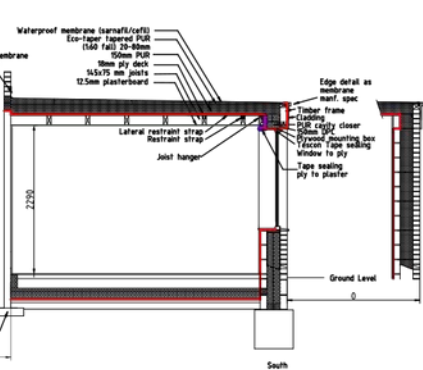
Extension: Process



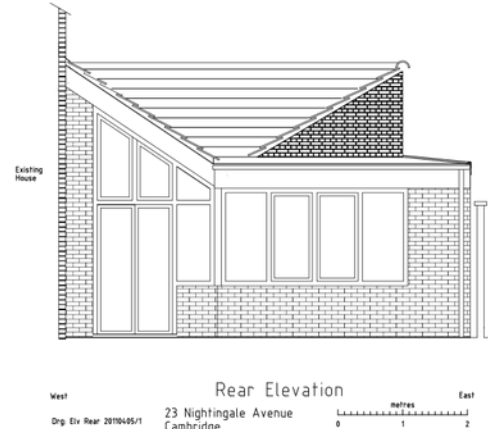
Section house to boundary wall
 23 Nightingale Avenue
 Cambridge



Section Garage corner and connecting roof detail
 23 Nightingale Avenue
 Cambridge



Section Garage to Garden SSE wall
 23 Nightingale Avenue
 Cambridge



Rear Elevation
 23 Nightingale Avenue
 Cambridge

Extension



Extension: Design



200mm cavity $U=0.15$



Underfloor insulation – always do this!

Solar gain & thermal mass



Avoiding Thermal Bridges



Foamglass



Fibreglass



Before and After



Workshop (2011-12)



Workshop Door (2012)



$U=0.35$

Costs

- Solar thermal £1,000
- IWI £1,500
- Front Door £800
- Boiler +plumbing £1,600
- Loft £300
- MVHR £1,000
- Airtightness £350
- LED Lighting £200
- Workshop £500+£1,000 custom door
- UFH £700
- Windows: £11,800+£2,400 delivery+fitting
- EWI: £8,000
- Perimeter £2,000

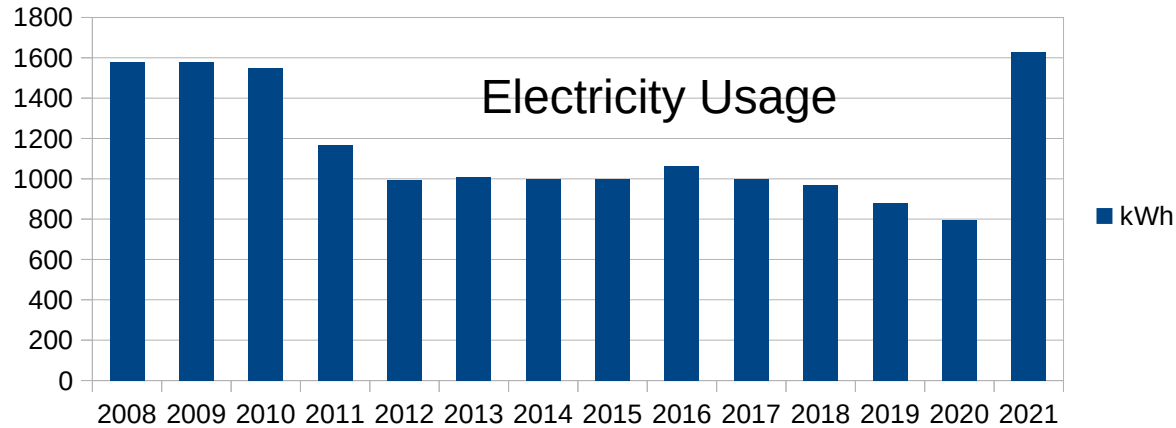
Total retrofit: £33,150 (Spend: £2,400/yr over 14 years)

Extras:

PV £10,500 (-£20,000 by 2030, 4% is usage saving)

Extension £43,400

Outcomes



Gas usage is 252kWh/yr (£12.60/yr)

Woodburner from 1000 kWh/yr to 200 kWh/yr

Comfort:

- No draughts
- No cold spots
- Very steady temperature
- Warm in winter
- Cool in summer
- Very quiet
- No condensation
- Air quality
- Good for allergies

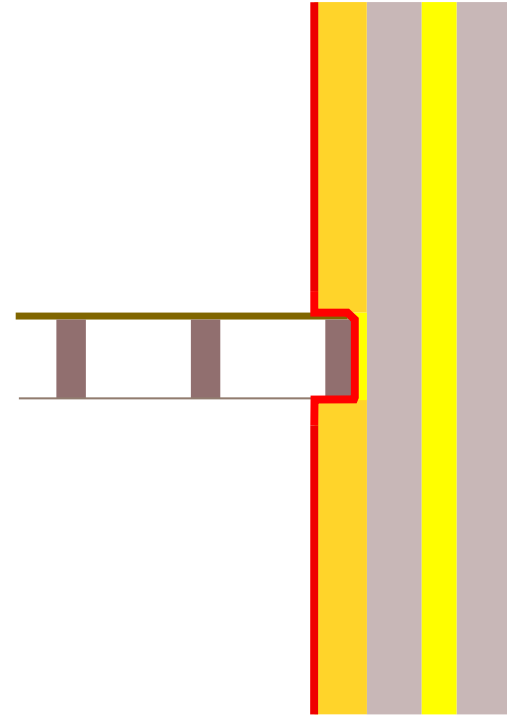
Disadvantages:

- Staying elsewhere seem a bit cold/draughty/damp!

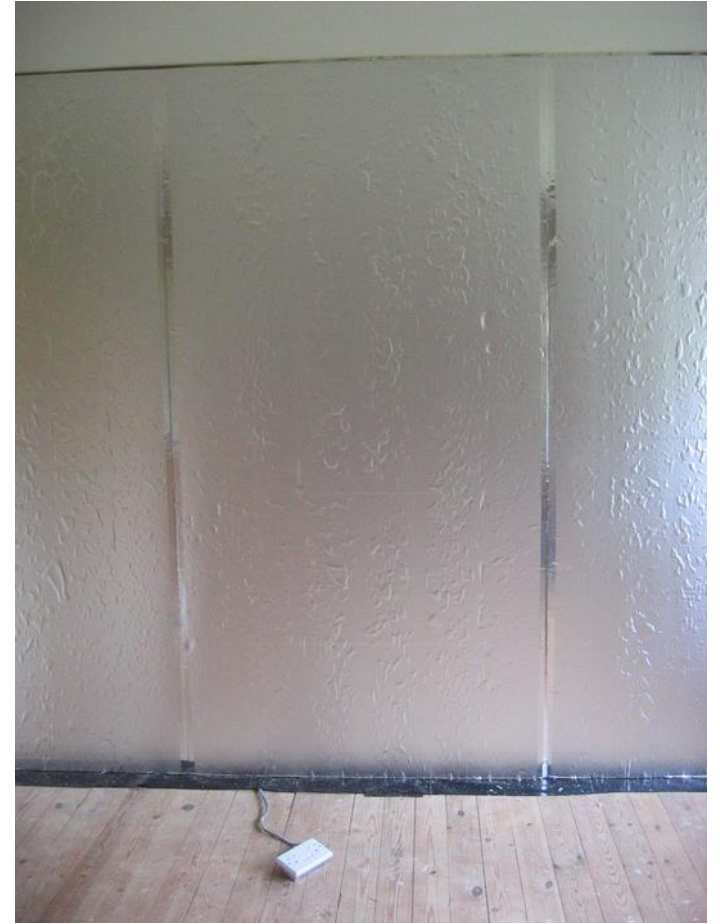
Advice

- Even if not DIYing, learn the difference between good, bad and excellent.
- Builders assume you want cheapest.
- Specify an airtightness test
- Take a long-term view

IWI detailing



IWI detailing



Next steps

- Please give quick feedback: form.jotform.com/211853362329052
- Make a donation: cambridgecarbonfootprint.org/donate/
- Share on social media: #OpenEcoHomes

Thank you for your support!



2021 Autumn Season
Mon 13 Sep - Fri 15 Oct
2 new builds
6 retrofits
5 expert talks



Booking now open

Further Resources

- Talk in more detail: [AECB retrofit pubmeets](#)
- [More details on this retrofit](#)
- Find out how you can [get started with your retrofit](#)
- [Book another tour or talk](#)
- [Case Studies](#): Research our past homes
- [Borrow a thermal imaging camera](#) and get training
- Use Transition Cambridge's [personalised home energy advice tool](#)
- Take political Action e.g. [Households Declare!](#) and their [resources](#)



2021 Autumn Season

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2 new builds

6 retrofits

5 expert talks



Booking now open

Cavities



Cavities



Orcon and Tescon



Raised Beds

(2008 + 2012)



Lintels

(2008 +2012)



More details at <http://wookware.org/house/retrofit/>