CAMBRIDGE RETROFIT HUB

Why Airtightness Matters

- Background and heat in air
- How drafty is your house?
- Heat history and heat loss calc
- Leaky floors
- Leaky walls
- Leaky ceilings
- Tapes and membranes
- Then ventilate

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Cambridge Retrofit Hub background

We take homes and make them more energy efficient



For 90% of homes, a heat pump & cheap fix is best 

Some want a full efficiency makeover – we're for them.

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Air carries heat

- Cycling in winter without gloves?
- Polar explorers – frostbite in under 2 minutes
- Air is heavy;
  3 bed semi = 73m2, 176m3, 210kg = 3 sheep



WIND CHILL TEMPERATURE INDEX
Frostbite Times are for Exposed Facial Skin

Air Temperature (°C)

Wind Speed (km/h)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	-38	-44	-51	-57	-64	-70
30	0	-6	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	-76
55	-2	-8	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

FROSTBITE GUIDE

Increasing risk of frostbite for most people in 10 to 30 minutes of exposure
High risk for most people in 5 to 10 minutes of exposure
High risk for most people in 2 to 5 minutes of exposure
High risk for most people in 2 minutes of exposure or less

- Cp = 1.0 kJ/kgK for dry air. (specific heat capacity)
- Winter day, 10 ACH = 2100kg of air to be heated / hr x 20C = 11kW

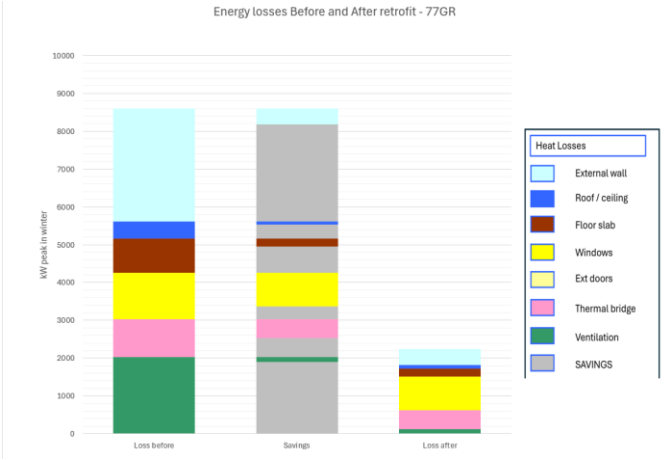
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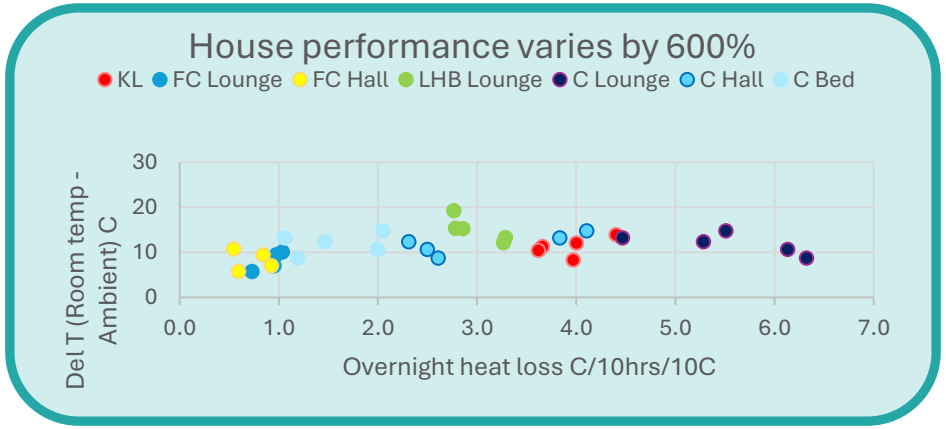
How efficient is your house?

- Heat Punk thermal analysis
- Before and after peak heat loss in winter
- Green bit on bar is ventilation losses (can be half of total losses if ignored)

- Turn off CH, leave on 3kW fan heater for 12 hours (is house comfortable?). Or smart gas meter?

- Temp loss in 10 hrs with 10C delta T:
  - Under 1C – Passive House
  - 3-5 C – not too bad
  - Over 5C – Look at drafts / insulation





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How leaky is your house?

- Proper air test – door fan, 50Pa, accurate , £250
- ACH = Air Changes per Hour (at 50 Pa)
- Air permeability = m3/hr/m2 at 50Pa = building regs
- 3 bed semi volume = 176m3, surface area = 175m2, so ACH number is approx. same as Air Permeability
- (Part L for newbuild target 8m3/hr/m2)
  (pre 2022, Part L target was 10m3/hr/m2, sample only)
  (Passive House <0.6 ACH@50Pa)
  (50 Pa equals 20mph wind)





- CRH window fan - £300 for kit, borrow?
- Back of hand for drafts or
- https://www.pea-soup.com/buy-micro-rocket.shtml
  (micro smoke generator)

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Suspended Floor leaks

- Victorian houses = lino & rug
- Trendy – varnished drafts
- Cheap fix– taped air-tight membrane, insulated underlay, carpet
- Take up, insulate, draft proof, re-board, UFH?

- Insulated concrete?
- (good if rot in joists or flood risk)
- (6 hours, £5.8k)





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Wall leaks

- Wet plaster = OK
- (watch for holes for pipes, electrical etc)

- Dot and dab plasterboard **theory**
- Building regs ‘continuous perimeter seal’
- (fire safety)
- (Job priced on ‘price per m2’)

- Stourbridge Aug ’26 – **practice**
- No perimeter seal, 20mm gap behind boards.

- Reduce drafts by drilling 6mm hole every 100mm and injecting foam – every perimeter, window, electrical socket





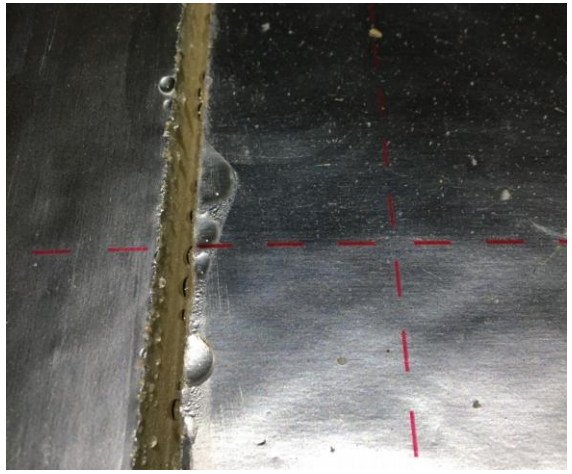
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Ceiling leaks

- Plasterboard is **not** airtight:
- Celotex laid over joists / mineral wool, before taping – condensation from moist room air

- Use ‘Thermohood’ at every downlighter.
- Check pipes through roof (airing cupboard)

- Tape airtight membrane above plasterboard, (consider service cavity for wiring and downlighters)







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Airtight all new work

- For all modifications, do what you can:
- Design a continuous airtight layer (‘red line’)
- Tape all new windows
- Tape floor/wall
- Tape wall / ceiling
- Window fan during retrofit to monitor progress
- Expanding foam tapes
- Liquid membranes

- Building movement?
- 10-30 year life?

- Don’t make a hole in it:
  Air tightness Champion
  Trades training (Elec / plumbing)



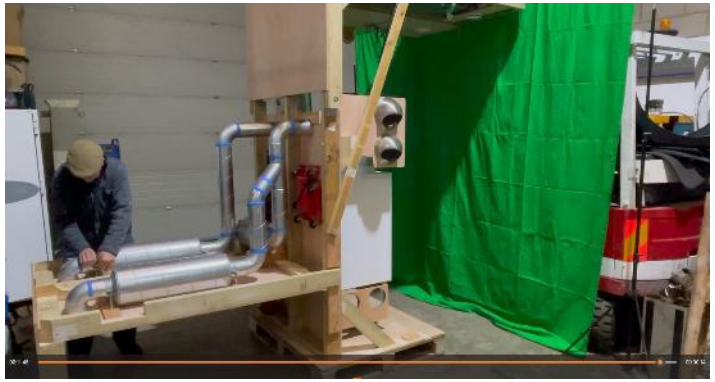


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Ventilate – MVHR or MEV

MVHR Mechanical Ventilation with Heat Recovery

- Design overview
- Installation techniques
- Commissioning
- Further training available



MEV Mechanical Extract Ventilation

- Aereco or similar
- Auto window inlets
- Auto extract outlets
- Half the install time (cheap / safe)
- No heat recovery



