Low Carbon Heating Options

An OEH online talk

OPEN eco HOMES

Cambridge Carbon Footprint

South Cambridgeshire District Council

CAMBRIDGE CITY COUNCIL

rhp

CFCI

Ecology Building Society

rixon architecture

Mole

McCarthy Architectural Design

GV HARRISON BUILDING CONTRACTORS LTD

MR RTBA

cambridge sashcraft

Ac

Our Panel

Nicola	Air source heat pump
John	Air to air heat pump
Dave	Wood stoves
Peter	Tepeo - zero emissions boiler with storage
Paul	Radiant heating and Mixergy hot water
Andy	Sunamp hot water

- Each panel member will introduce their approach
- Questions

Air source heat pump
Nicola

Starting point

- Victorian Semi-D well insulated during earlier building work
  - mix of EWI and IWI
- MVHR
  - but not as air-tight as we would like
- Solar hot water panels
- Solar PV (but only 1.7 kWp)
- We are retired/work from home
- Small garden, very sheltered

What we did

- ASHP for efficiency
- Doubting beloved with veto
- Solution – hybrid with boiler as backup
- Two winters on – beloved convinced
- Efficiency close to prediction SCOP 3.0

If we did it again:

- Too big! (should have checked the heating demand from the survey report)
- Standard hybrid solutions are available https://www.goeconic.com/
- For the future: better optimization from a Homely thermostat https://www.homelyenergy.com/

Blog posts about my heat pump

Air to air heat pump
John

SuperHomes

Owners: John and Claire Somerville

House Type: Victorian two storey detached

Carbon Saving: 73%

Installed Measures:

- Cavity walls retrofitted with 50mm platinum polystyrene bead Cavity Wall Insulation (k=0.032).
- Solid walls retrofitted with external insulation with 80mm Phenolic foam (k=0.022).
- Existing UPVC double glazing, gradually replacing with triple glazed (Uw=0.8).
- Main loft insulation – fibre-glass 250mm thickness topped up with further 100mm rockwool.
- Second roof insulation – 50mm fibre-glass replaced with 150mm Celotex
- Polypipe HR01LB SAP compliant rigid ducted MVHR (whole house heat recovery ventilation).
- 'Warm' draft lobby (porch).
- Cooker hood converted to re-circulating (internal) with carbon filters.
- Extensive draft-proofing.
- Solar PV – 16x Canadiansolar 250W panels – 4kWp with Sunnyboy transformerless inverter.
- 4kW wood burner (78% efficient).
- 100% Low energy lighting (CFL and LED).
- Rainwater to soak-aways and water butts.

Fujitsu Keta units with WiFi integration
1.1-5.5kW outside and 0.9-4.0kW downstairs unit and 0.9-3.2kW upstairs.

Pros:
+ Fitted in a day, little complicated system design, Good SCoP >4
+ Can have multiple internal units to provide multiple sources of heating
+ £2.8k for one external, two internal ‘split’ units (no subsidy)
+ Can do summer cooling

Cons:
- Not really ‘central heating’:
- Need separate hot water heating
- Doesn’t heat every room
- Can leave doors open and let the heat spread but may need to supplement
- ‘2C per doorway’ (house dependent observation)
- Less ‘usual’ & less service engineers

Wood stoves
Dave

Tepeo (Zero emissions electric boiler)
Peter

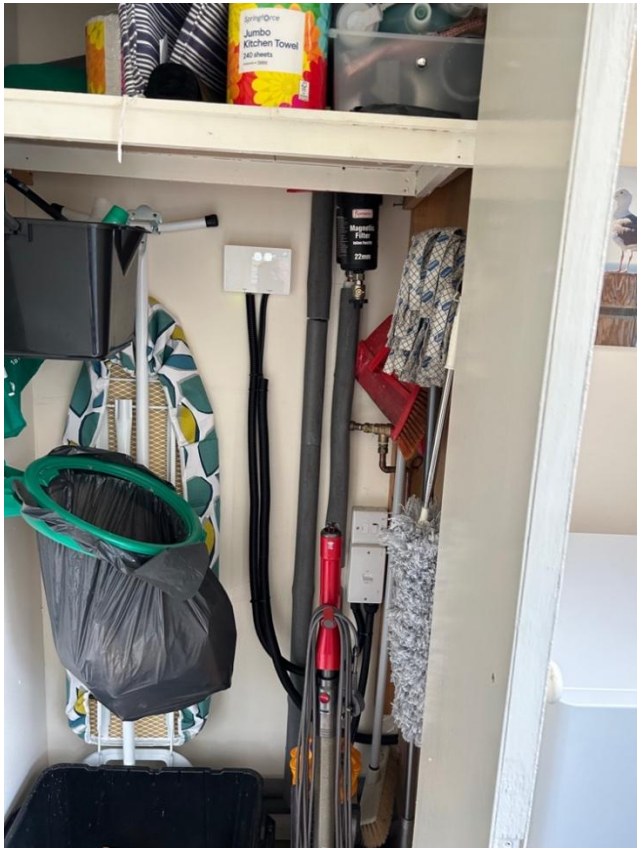
Low Carbon Heating Options

Tepeo – Zero Emissions Electric Boiler

- The ZEB is powered by off-peak low carbon electricity that creates heat from heating elements that is stored in a “core” inside the ZEB
- Utilises heat-management technology that can heat to existing radiators, underfloor heating and water tank when a thermostat calls for it.

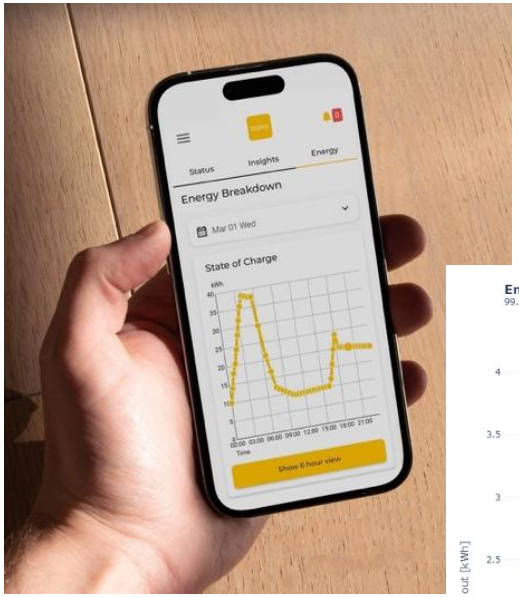
Low Carbon Heating Options

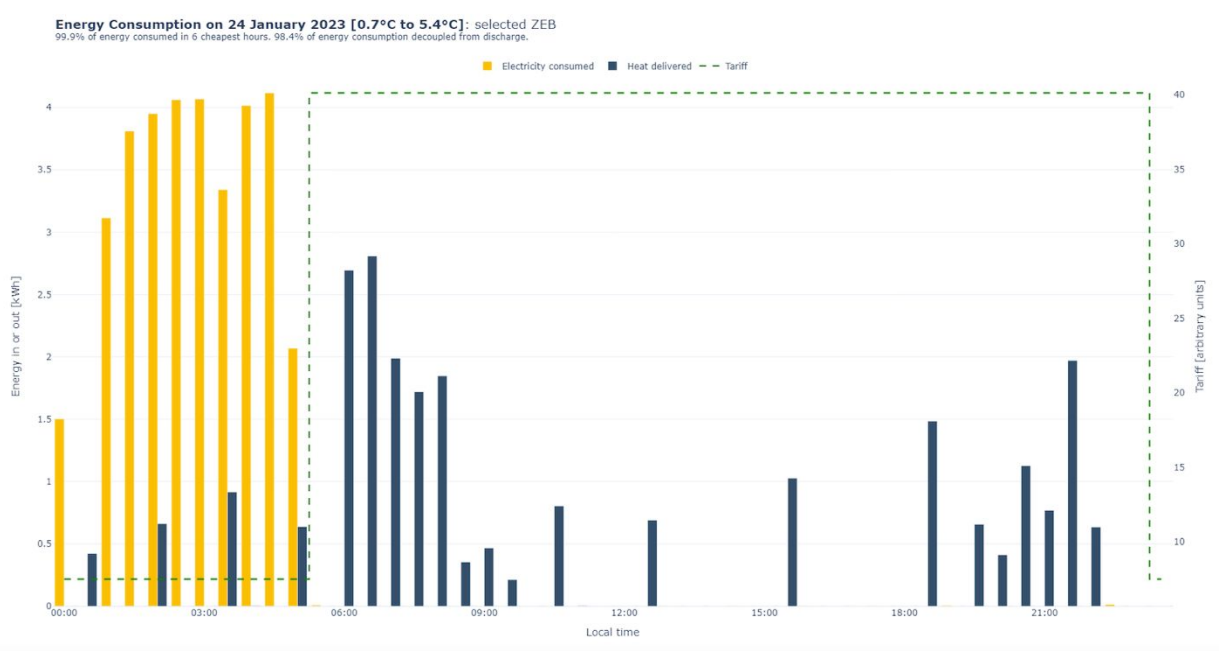
Tepeo – Zero Emissions Electric Boiler



Low Carbon Heating Options

Tepeo – Zero Emissions Electric Boiler





Radiant heating and Mixergy cylinder
Paul

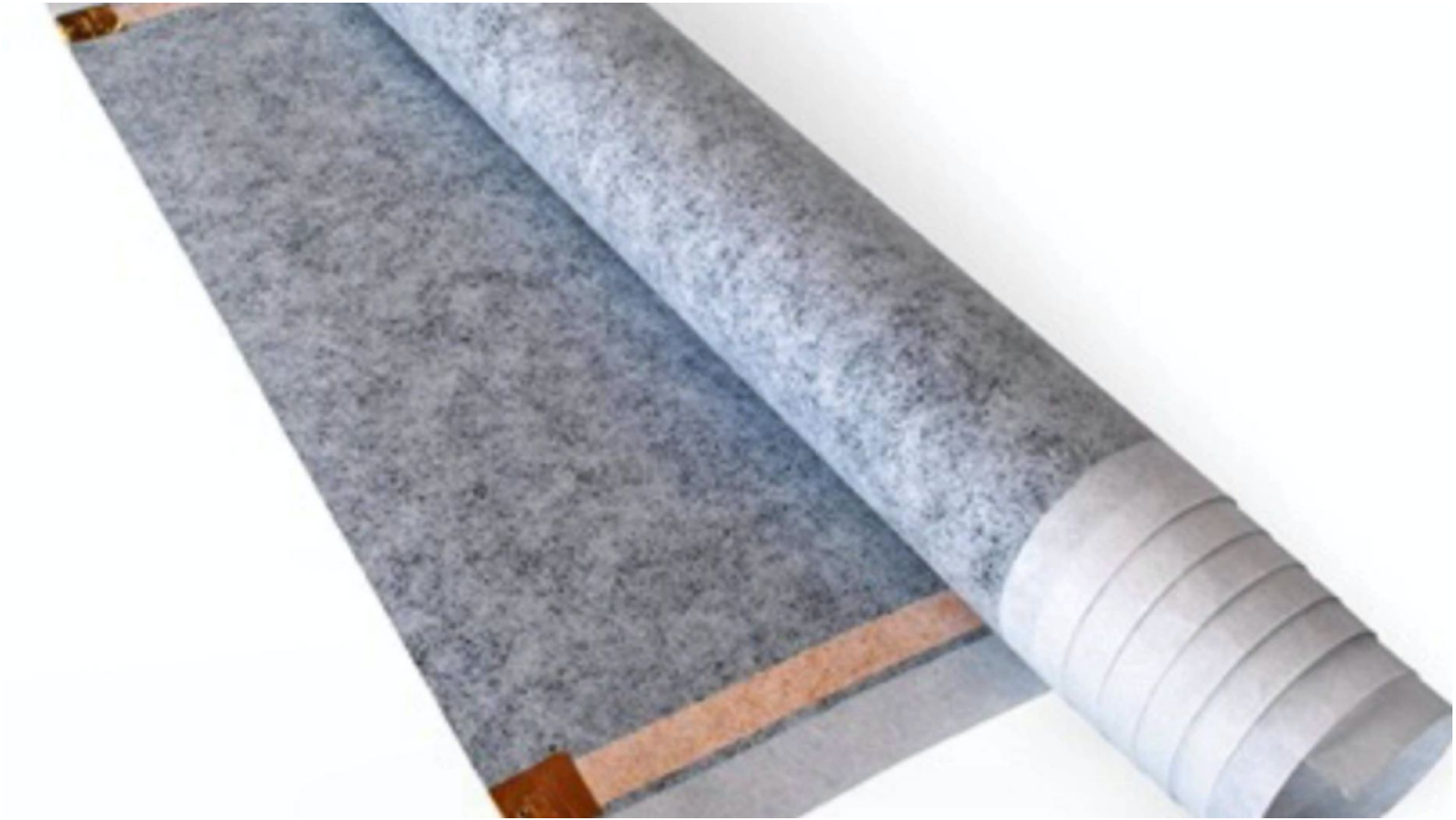
Infrared Heating

White

Mirror

Picture

Towel Rail



Pros and cons

- Lower capital cost
- 60% saving on regular electric heating
- Easy installation, DIY
- Can suit tricky installations
- Instant heat
- Draft resistant
- Can make holes in wallpaper

- COP nowhere near a Heat Pump
  - so, higher running costs
- One manufacturer uses SmartThings app to control heaters
- If faults occur, wallpaper hard to access

mixergy Hot Water Cylinder

Higher efficiency
More efficient heat transfer optimises the COP of your heat pump by up to 10%

Hot water on demand
Build a schedule that ensures you always have enough hot water available

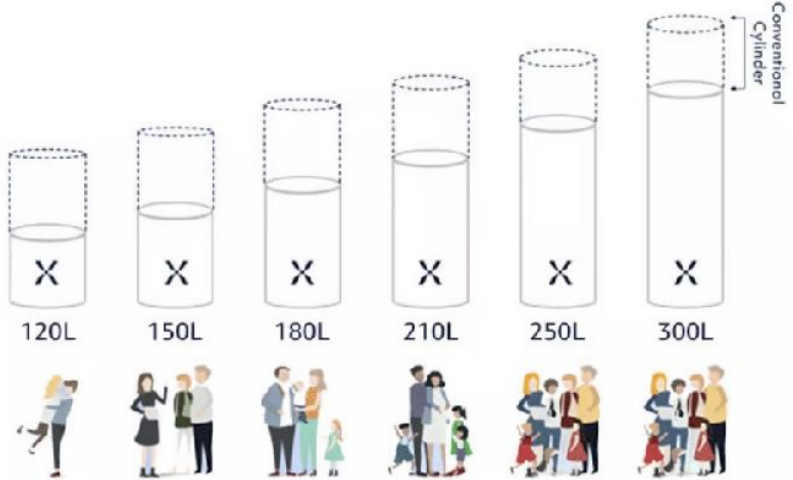
Smart tariff ready
Integrate with off-peak renewable energy tariffs

Compact & slimline
Typically 40% smaller and available as slimline option

Heat pump flexibility
Compatible with any heat pump

Easy maintenance
The external plate heat exchanger design means easier servicing and maintenance


Mixergy
Mixergy
Mixergy


Conventional Cylinder
120L
150L
180L
210L
250L
300L

Conventional Tank


PV Switch
mixergy


Mixergy®

Pros and Cons

- Uses various energy sources, making it flexible & future-proof
- Compared to a Heat Pump only cylinder it provides 20% more hot water and can boost COP 10%
- Small size
- Fastest re-heat of tank in market, up to 10x
- Smart features

- When in Heat Pump mode it has to heat the whole cylinder
- Installers

Sunamp heat battery
Andy

30 NEALE CLOSE

ELECTRIC SPACE & WATER HEATING

- THE BUILDING
- ENERGY SOURCES
- WATER HEATING
- SPACE HEATING

Low demand

INSULATE OVER, UNDER AND ALL AROUND

Insulated raft, SIPS + external insulation, insulated flat roof

GOOD GLAZING

Triple glazed, and oriented for solar gain

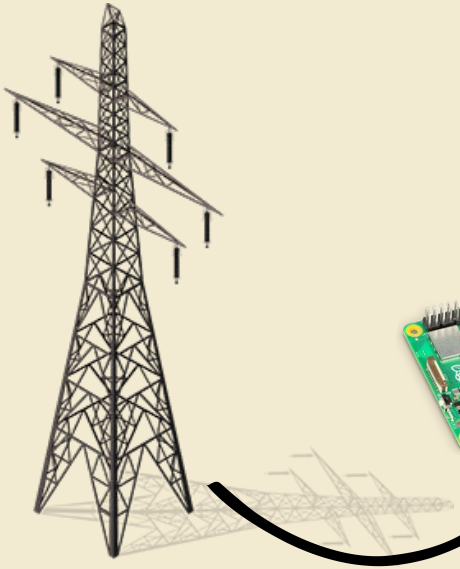
AIRTIGHT WITH MVHR

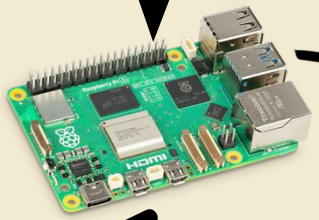
Pay lots of attention to the gaps

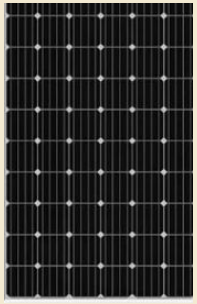
Heating system

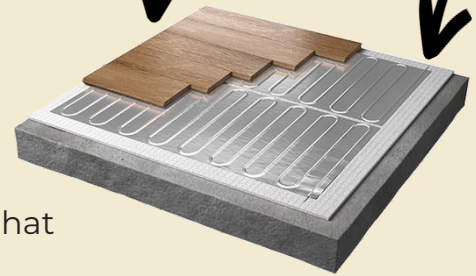
BIG PV ARRAY

We have a 10kW array, generating far more than we need most of the time. Over 95% of our hot water is from PV







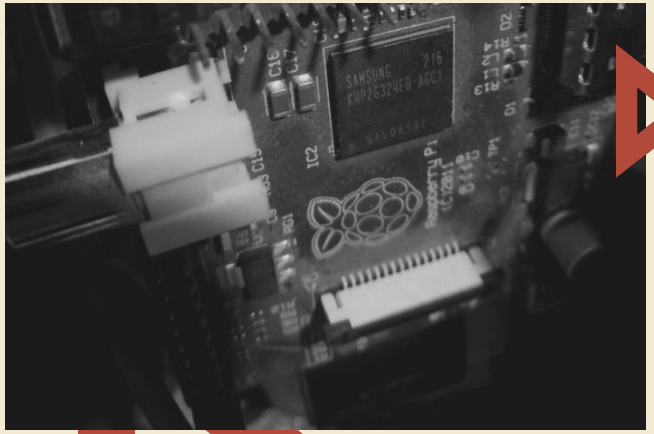


VARIABLE TARIFFS

Electricity can be cheap (at times free) on variable tariffs . You can take advantage of that for heating if you have plenty of thermal mass.

THERMAL MASS

Raft foundation with a polished concrete floor gives a high thermal mass. Nice and cool in the height of summer! Resistive heating coils embedded in the concrete for gentle winter heat.



INTELLIGENT HEAT DUMPING

Excess PV power is diverted first into the Sunamp for hot water, then into warming the floor in winter once the Sunamp is full.

A Raspberry pi also controls the heating coils, dumping in heat when a time-of-use electricity tariff is cheap.

SUNAMP THERMAL BATTERY

Immersion or heating coil

Compact (less than half size of equivalent cylinder)

More convenient shape

Vacuum insulation

Low heat loss

Only coils are pressurised

Simple to install

No legionella cycle

Works with heat pumps, but a high flow temp is needed

Relatively expensive

Direct Electric

Is it a good idea?

NO! Heat pumps are much better. With a well-designed system you will get 4x as much heat as we get for the same electrical input. But...

We have a very well insulated house
We have a lot of thermal mass
We have lots of spare PV energy
We wear jumpers except on windy nights when electricity is cheap or free

... so we spend very little on keeping warm. It would take many years to repay the cost of a heat pump.

Cambridge
Carbon
Footprint

Questions

Please put your questions into the chat

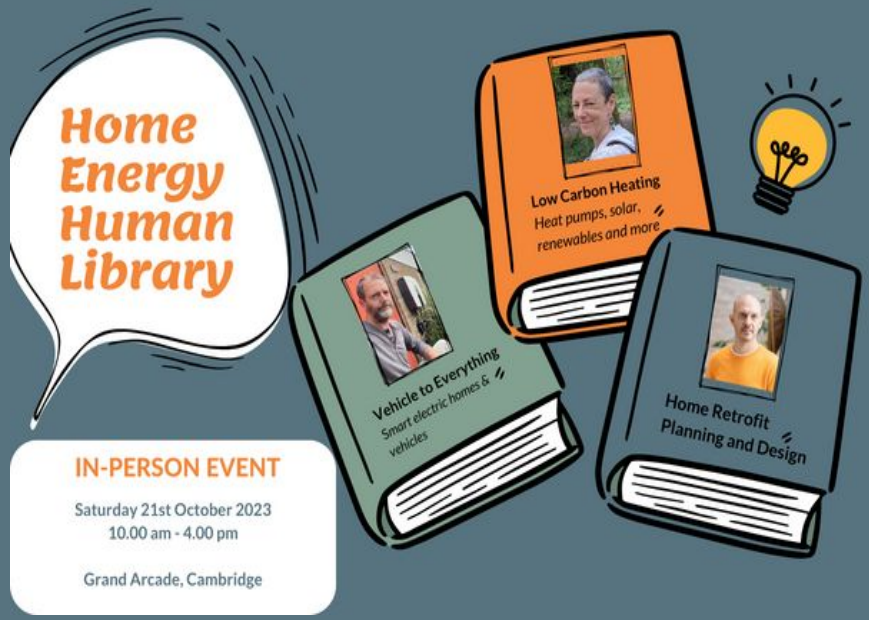
Can you help us?

- Make a donation to help us run more Open Eco Homes tours: cambridgecarbonfootprint.org/donate
- Share your experiences on social media: #OEH2023

Thank you for your support!

Your next steps

- Find out how you can get started with your retrofit
- Book another tour or talk
- Research our past case studies
- Book a training session and borrow a thermal imaging camera
- Use Transition Cambridge's personalised home energy advice tool



OPEN eco HOMES

Cambridge Carbon Footprint

South Cambridgeshire District Council

CAMBRIDGE CITY COUNCIL

rhp

CFCI

Ecology Building Society

rixon architecture

Mole

McCarthy Architectural Design

GV HARRISON BUILDING CONTRACTORS LTD

MR RIBA

cambridge sashcraft

Ac