Pathways to zero carbon home heating

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Poll

What are we doing already?

- I have changed my diet
- I have changed my travel habits
- I have changed my buying habits
- I have energy saving lights and appliances
- I have changed my home heating
- Other – put it in the chat

I am likely to replace my high carbon heating system:

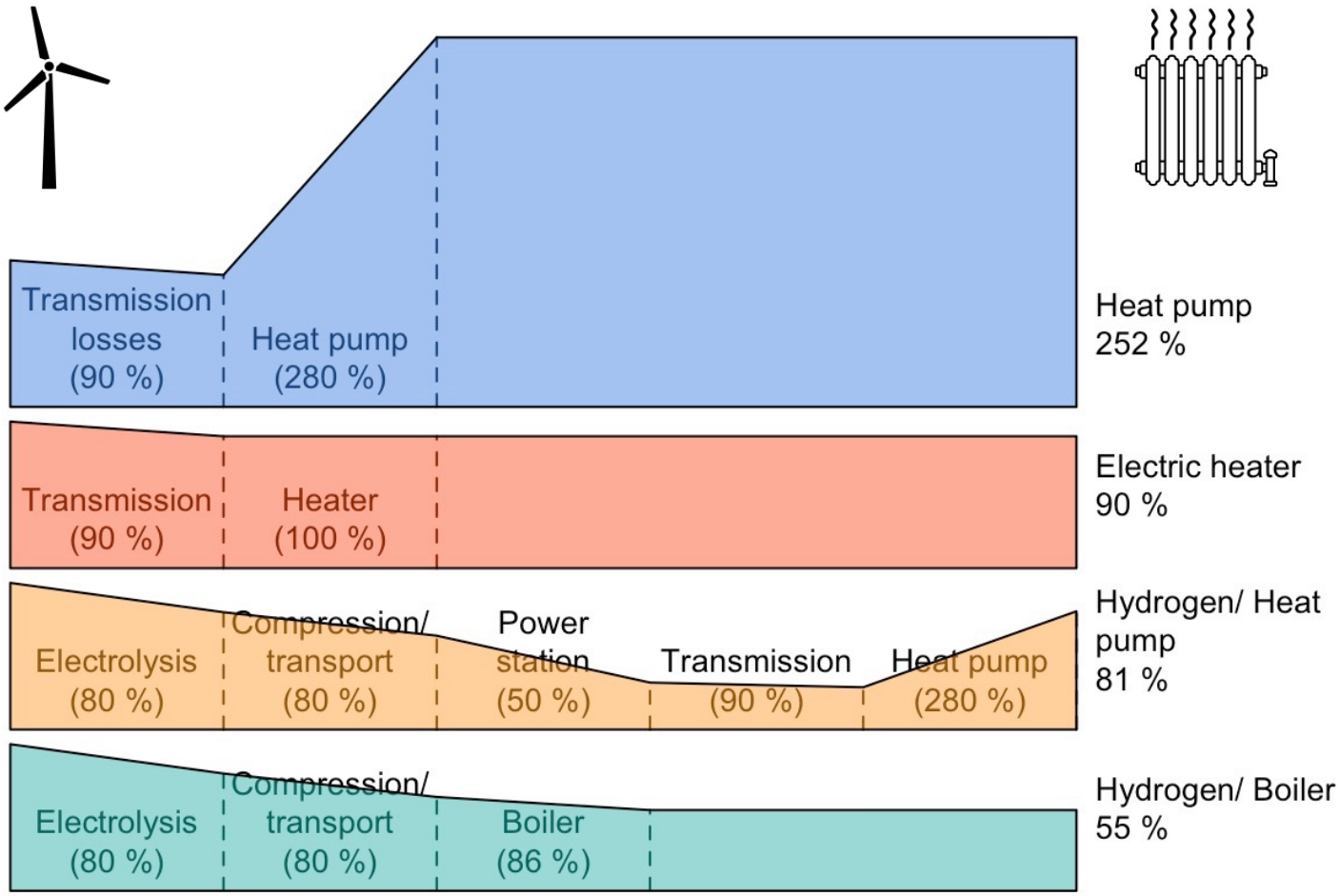
- Next 2-3 years
- Next 10 years
- Later
- I already have low carbon heating!

Bio-methane - some

Hydrogen – sometime?

Electricity - lots

From renewable electricity to heating: overall efficiency



Does efficiency matter?

- Upgrades to network and generation infrastructure
- Time to build
- Cost!

Electricity is expensive so…

Efficient

Air source heat pump supplies hot water - you will need a hot water cylinder.

Relatively low temperature heat so you may need to upgrade radiators too

Air to air heat pump supplies warm air

Off-peak

Storage heaters

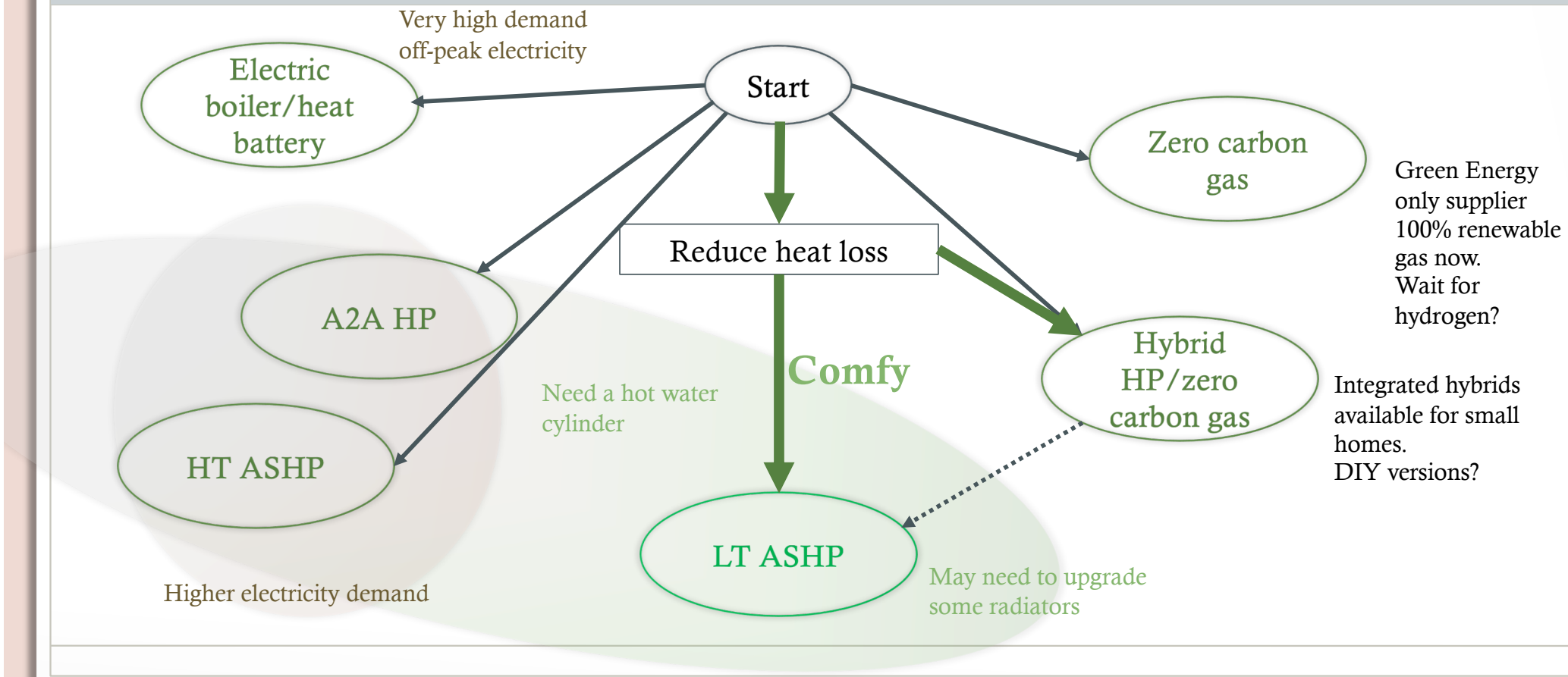
Heat battery (supplies instant hot water too)

Remember ventilation

Heat pumps are like people – they work best in cosy homes!

A cosy home has smaller bills, needs a smaller heat battery, can run radiators at a heat pump friendly temperature ….

Pathways


Very high demand
off-peak electricity
Electric boiler/heat battery
Start
Zero carbon gas
Green Energy only supplier 100% renewable gas now.
Wait for hydrogen?
Reduce heat loss
A2A HP
Comfy
Hybrid HP/zero carbon gas
Integrated hybrids available for small homes.
DIY versions?
Need a hot water cylinder
HT ASHP
LT ASHP
May need to upgrade some radiators
Higher electricity demand

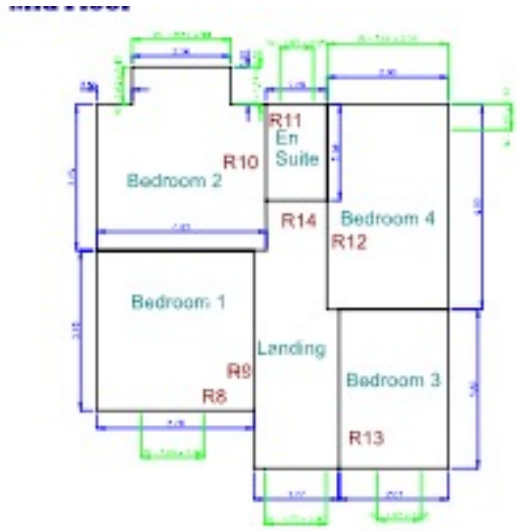
Is my home ready for a LT ASHP?

- Good insulation in walls/roof (150mm or more)
- At least double glazing throughout
- Good draught proofing (consider ventilation too)
- EPC grade C (without benefit of PV) should be OK, maybe some changes to radiators
- Space for the heat pump (planning considerations, noise)
- Space for a (large) hot water tank (Sunamp would reduce the size)

Preparing for a heat pump

Location of heat pump
Location of cylinder or heat battery for hot water
Plumbing runs

Survey to calculate *maximum* heat demand and radiator capacity for each room.



Agree maximum flow temperature and which radiators need upgrading

Radiator temperature

Low efficiency
Smaller radiators

High efficiency
Bigger radiators

Weather compensation controls reduce flow temperature when less heat is needed

Links for further information

Open Eco Homes – 'Getting off Gas' video
http://openecohomes.org/events/victorian-terrace/

Transition Cambridge advice pages: Low carbon heat
https://www.transitioncambridge.org/wiki/TTEnergy/LowCarbonHeat

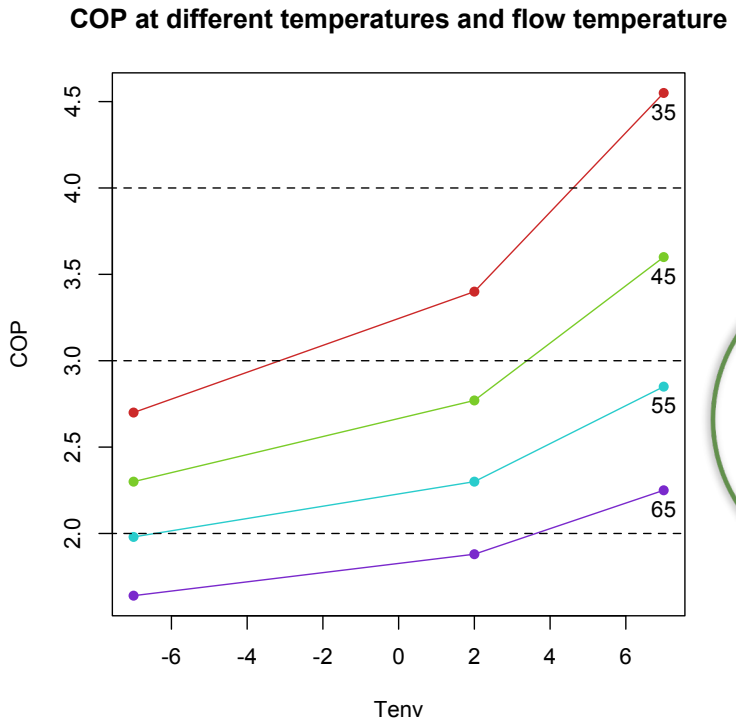
Open Eco Homes
2021 Tours and talks
https://cambridgecarbonfootprint.org/what-you-can-do/open-eco-homes-events/

Ecofurb Low Carbon Home Service
Parity Projects/RetrofitWorks
https://www.ecofurb.com/

Pros and cons of electric options

Electric boiler/heat battery	Directly replace gas boiler. Storage allows you to use cheap(ish) TOU tariffs.	Physically large and **much** less efficient. Good for small homes with low heat demand.
HT ASHP	Directly replace gas boiler. SCOP ~ 2.0 - 2.5	Physically large. Expensive to install, less efficient than other heat pumps.
A2A HP	Warm air heating, good for small/large draughty/ intermittent heating	Noisy? Dry? Cheaper to install. Can be installed internally in small flats. Need to remove wet heating system.
LT ASHP	Runs radiators at a low temperature or underfloor heating. More efficient SCOP ~ 3.0-3.5	Needs well insulated home/large radiators/forced convection rads/ underfloor heating
Hybrid LT ASHP/gas boiler	Heat pump supported by boiler when necessary. Gas could be bio-methane or green hydrogen. Can use existing boiler.	Good with TOU tariff. Can choose a smaller heat pump and insulate later to reduce demand. Less need to upgrade the grid. Continue to pay gas standing charge.

Heat pump/radiator efficiency

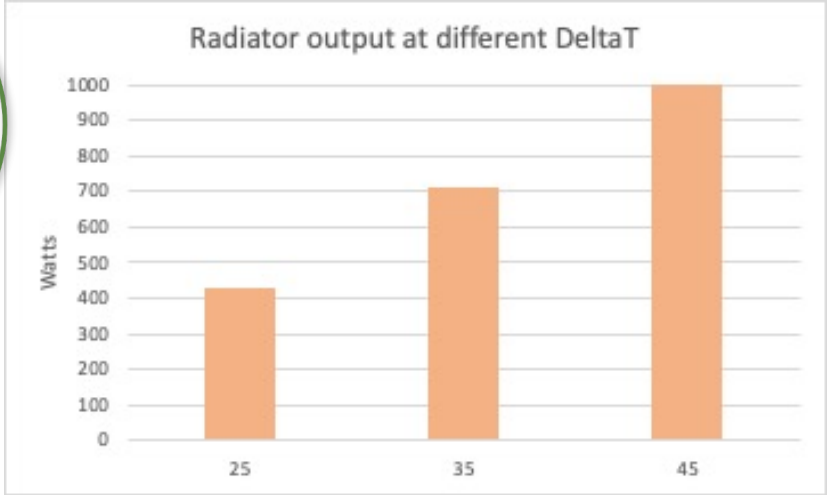


Data from a Panasonic high temperature heat pump in 2012.

35 °C – underfloor heating
45 °C – likely to need to upgrade radiators
55 °C – often OK for radiators with typical oversize
65 °C – typical for radiators with a boiler

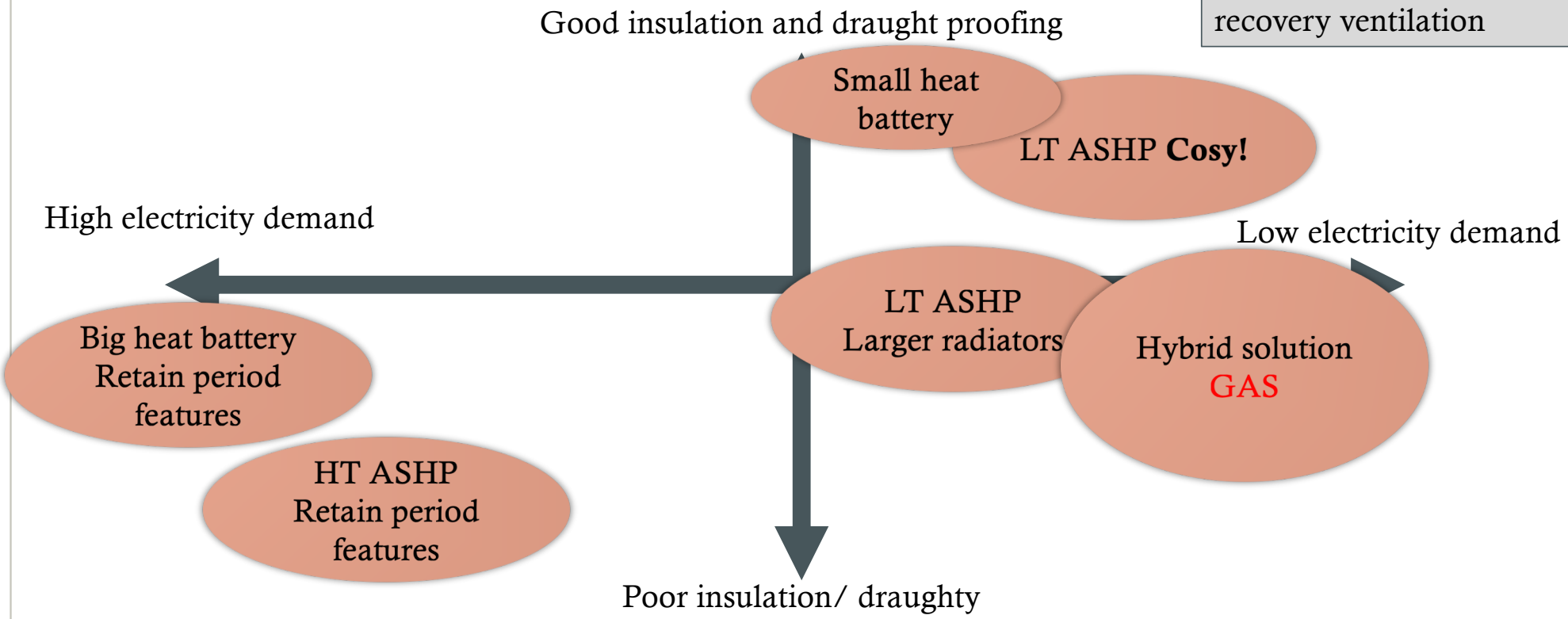
Radiator outputs are rated at DeltaT = RadT – RoomT.

Weather compensation controls lower temperatures when possible



Flow 45C

Flow 65C

Choice – compromise

Additional options – fabric measures, PV panels, electric battery, thermal store; heat recovery ventilation