Experience of using heat pumps

Chris Ford

cjbf@cam.ac.uk

What is a heat pump?

- It’s the opposite of a fridge!
- A heat pump uses *some* electricity to pump *more* heat into the house
  - You get 3—5 times as much heat energy as the electrical energy used
- Electricity can be generated from renewables, or at least uses much less gas in a power station than in a gas boiler, so the **carbon footprint** is at least 3 times lower
- The price of electricity is about 4 times more than gas, so the operating cost is similar
  - But it can be reduced using solar panels and/or batteries to store cheap electricity for use in peak periods
- We will all have to install a heat pump eventually, so it’s best to do so years before your boiler might fail completely and need replacing urgently!

Types of heat pump

- Air-source heat pump (ASHP)
  - Takes heat out of the air
  - You need a suitable place outside the house, not necessarily right next to it
- Ground-source heat pump (GSHP)
  - A long pipe buried in the ground under the lawn or drilled vertically into the ground
  - Expensive and rarely cost-effective

Cost and Grants

- The Government's Boiler Upgrade Scheme (BUS) provides a £7,500 grant to householders and landlords to replace an oil or gas boiler with a heat pump
  - The installer will handle the grant for you, only charging you the remainder
- The remaining cost of an air-source heat pump is likely to be £3,000—5,500, depending on the amount of work that has to be done (which may include replacing some radiators, groundwork, etc)
  - Replacing a gas boiler costs £2200—3700, somewhat less
  - Octopus suggests an annual saving of at least £300 using one of its variable tariffs
  - So it could pay back in between 3 and 7 years, but perhaps longer
- Prices of gas and electricity will fluctuate so fitting a heat pump isn't about saving money (that's a bonus if it happens!), but helping to save the planet

Planning ahead

- Is your gas boiler getting old (10—20 years)?
  - But apparently boilers should last over 20 years and repair is cheaper than a new boiler (£2200—3700) [www.theheatinghub.co.uk/articles/boiler-lifespans]
- Don't wait until the boiler fails completely before installing a heat pump!
  - A heat pump takes up to 10 days to install, not good in winter if the boiler has failed!
- Is the greenest thing to do to scrap a gas boiler when it has many years of life left?
  - The embodied carbon in manufacturing is less than about two year's emissions, so the answer is probably yes
- Certainly don't install a new gas boiler in future without serious consideration of getting a heat pump instead

Insulate your house

- Loft insulation, draft-proofing, cavity-wall insulation etc are quite cheap and pay for themselves quickly
- Double-glazing is more expensive but greatly reduces heat losses and drafts
- Retrofitting insulation on walls is expensive and needs to be done professionally to avoid condensation and serious damp problems
- By reducing heat losses, you save energy and make boilers and heat pumps cheaper to run by running radiators at a lower water temperature

Do some tests before getting quotes

- Heat pumps are most efficient if you run radiators *warm* (35—45°C) rather than *hot* (over 60°C)
- To find out whether you can heat your house with *warm* radiators, **turn down the 'flow' temperature on the boiler** and **set any time controls to come on earlier**, as rooms will take longer to warm up. Run for one winter like that to see what temperature you need during the coldest periods, as well as what is adequate the rest of the winter—keep some notes
  - Condensing boilers work better below 60°C anyway [www.theheatinghub.co.uk/articles/turn-down-the-boiler-flow-temperature]
  - You only need the highest temperature in cold spells, so reduce the flow temperature the rest of the time
- You may find that some radiators need to be replaced with larger ones as part of the heat pump installation, but you may find it's not really necessary (if your insulation is good enough and your tests show you can run with a flow temperature below 45 or 50°C)

Get multiple quotes

- There are a lot of heat-pump installers, and it is hard to know which to trust
  - Check online for reviews and local recommendations
- Get quotes from about three installers
  - Prices will vary, but be careful to choose a reputable installer rather than just choosing the cheapest
  - Showing the installer around (while they survey each room to estimate heat losses) gives you a chance to talk to them about potential problems with insulation and radiator size, and to judge whether they are just trying to sell you as many things as possible
- National energy companies: Octopus, etc have online quotes before arranging a call and home visit
- Local installers: Infinite Heating & Energy (Cambourne) did a good job for me

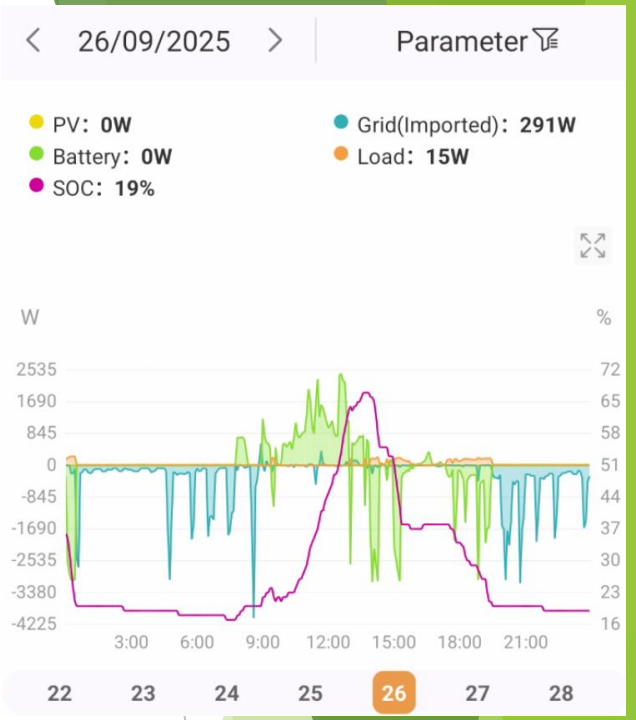
Assessing quotes

- Did you get a good feeling about the person who came to quote?
- Does the company get good reviews/testimonials when you search the web? Check uk.trustpilot.com too
- Is the quote over-specifying?
  - Do you need everything they say?
  - To cover their backs, the company may err on the side of installing a larger heat pump than really necessary, and/or upgrading radiators (run the tests described a few slides back, over one winter), or fitting a buffer tank
  - My installation has a double compressor (two fans) so it can provide much more heat than I usually need, which means it turns off after a short period rather than running for long periods more efficiently. Probably a single compressor running continuously would be adequate and cheaper to run
  - I have a buffer tank in the loft so the heating fluid from the ASHP heats the central heating water in the tank, rather than going to the radiators directly, which means I need a slightly higher temperature from the heat pump

Running a heat pump efficiently

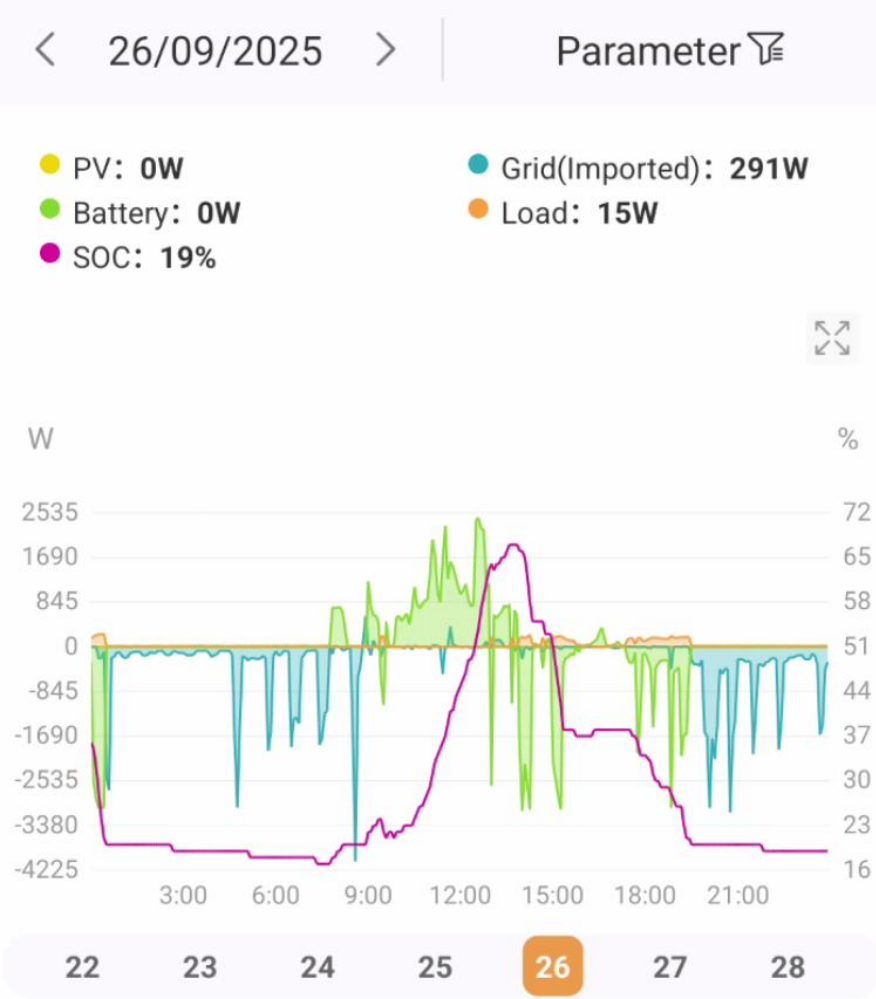
- The coefficient of performance (heat energy produced divided by electrical energy used), called COP, depends on the difference in temperature between the heating liquid coming from the heat pump, and the temperature outside (air for an ASHP, deep in the ground for a GSHP)
  - i.e., pumping heat up a higher ‘hill’ costs more electrical energy
  - So always try to keep the radiator temperature as low as possible
    - Insulate!
    - Bigger radiators?
    - Keep on for longer, perhaps nearly all the time, with slight reduction over night
  - Heating unused rooms may actually help, as you have more radiators and no source of cold air from the unheated room—but experiment to see what works for you!
  - How warm does your house really need to be?
  - Dividing the house into zones with radio-controlled radiator valves gives you lots of control, putting the heat only where and when it’s needed, which can be useful if one room needs to be much warmer than others

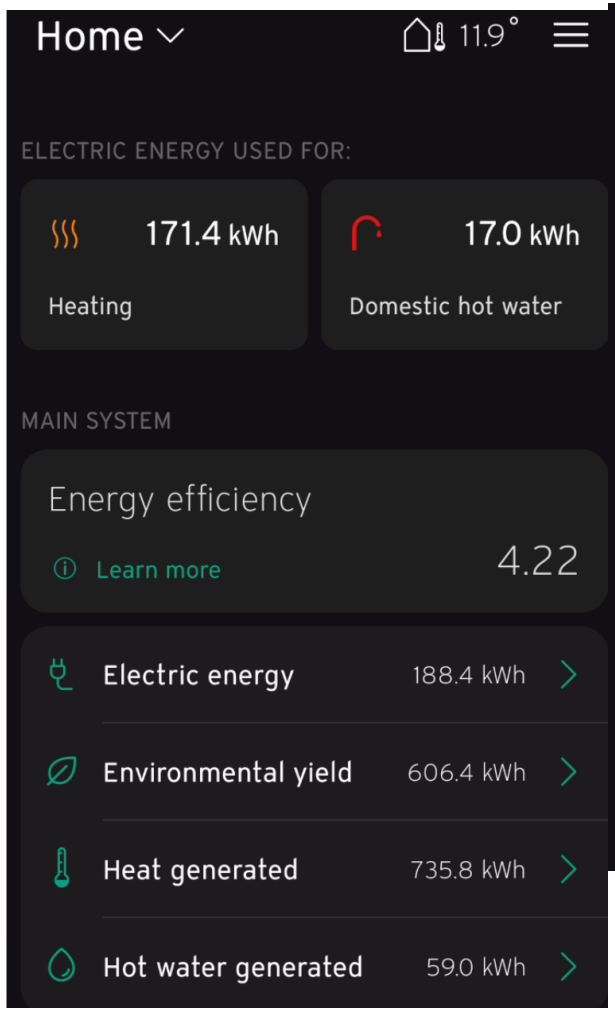
Solar panels and batteries

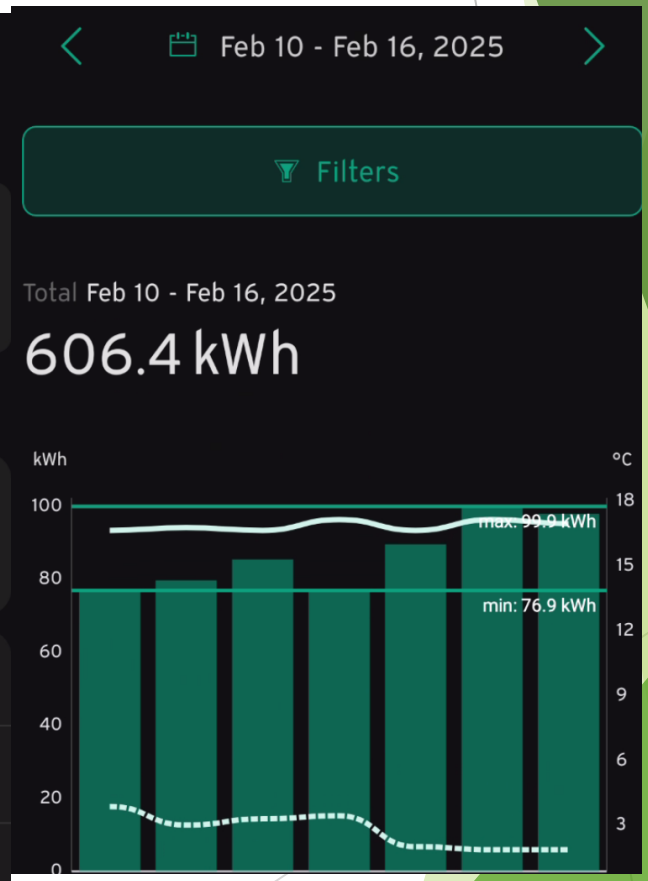


- If you have solar panels, consider getting a home battery
  - that the electricity you use in winter for the heat pump can be taken from the battery when it most expensive (4-7pm for Octopus Agile tariff), and the battery charged when electricity is cheap (12am-6am, 11am-3pm)
  - set it to charge from the mains once or twice a day **in winter only**
  - As spring comes, look at your battery's phone app to see how much the battery is discharged and whether you can reduce how much you charge the battery
  - In summer, the panels and battery can make you almost self-sufficient for all your hot water heating, cooking (on an electric hob) etc.
- Even without panels/battery, if you have an agile (time-of-use) tariff, heat the house before the peak price periods and schedule the heat pump to turn off during those peak periods

Enjoy looking at your apps!







Solar panel app