

Air Source Heat Pumps – Some Notes and Links

Topic: Air Source Heat Pumps

Mark Wooler of local business “Greenhome Heating Ltd¹” came to talk to to Our Environment group about Air Source Heat Pumps (ASHPs) answering our questions about them and standard gas combi-boilers.

The Q&A session with Mark was very informative, he didn’t do a “hard sell”, in fact he highlighted that there are situations where an ASHP would definitely NOT be a sensible option. However, for the elements that are “standard” (i.e. the information about ASHPs that is available from reputable sources) I have just given links to go to.

Mark’s information:

What he told us is available on his website (not easy to find on his main site/menu). So these are links to go to:

- What is a heat pump?
 - <https://greenhomeheating.co.uk/what-is-a-heat-pump/>
- Should I Install a Heat Pump Instead or a Gas Boiler?
 - <https://greenhomeheating.co.uk/gas-boiler-vs-heat-pumps/>

He recommended anyone interested in understanding the topic and wanting to get into detail should look at the Heat Geek website and Youtube videos – I’ve done both and they are full of useful insightful information – but can become overwhelming (I ended up down a rabbit hole as usual).

- <https://www.heatgeek.com/>
- <https://www.youtube.com/@HeatGeek/videos>

Q&A session with Mark.

Gas boilers:

- Combi-boilers are typically about 85% efficient.
- This is despite being advertised as 90-95% efficient because the standard temperature setting on the boiler is usually at 80°C. For the condenser in the boiler to activate the temperature setting on the boiler needs to be much lower, 55-60°C.
- So, if you have a combi-boiler check your temperature settings for best efficiency.

ASHP:

- The efficiency of these, when installed correctly, should be in excess of 300%.
- Their efficiency depends on a series of parameters, key to these are the thermal capacity of the ASHP and the flow temperature through the house. (See the table below for some figures). SCOP = Seasonal Coefficient of Performance. This tells you the average efficiency of your heat pump across the whole heating season.
- The highlighted SCOP on this table of 3.77 (377%) is the minimum that Mark’s own home set-up should give him as he has a 5kW ASHP and runs the temperature flow through his system (radiators, pipes) at 45°C.

¹ <https://greenhomeheating.co.uk>

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- His house is occupied almost constantly. Therefore their decision is to leave the settings for the ASHP set all year to keep the house at a stable 21°C all year round. This is both comfortable for those living there and efficient.

Air-to-water heat pumps

SCOP and heating output

aroTHERM output		35°C flow		40°C flow		45°C flow		50°C flow		55°C flow	
		Output	SCOP	Output	SCOP	Output	SCOP	Output	SCOP	Output	SCOP
3.5kW	-5°C	4.2	4.41	4.1	4.03	4	3.65	3.9	3.37	3.8	3.10
	-3°C	4.6		4.4		4.3		4.2		4	
	0°C	4.7		4.7		4.6		4.5		4.4	
	2°C	4.9		4.9		4.9		4.7		4.6	
5kW	-5°C	6.3	4.48	6	4.13	5.6	3.77	5.5	3.41	5.4	3.06
	-3°C	6.8		6.4		6.1		5.9		5.8	
	0°C	6.9		6.7		6.6		6.4		6.2	
	2°C	7.1		7		6.9		6.7		6.5	
7kW	-5°C	8.2	4.36	8.1	4.13	8	3.91	7.5	3.65	7	3.39
	-3°C	8.8		8.6		8.4		7.9		7.4	
	0°C	9.5		9.3		9.1		8.6		8.1	
	2°C	10		9.8		9.6		9		8.5	
10kW	-5°C	9.9	5.03	9.7	4.58	9.4	4.13	9.1	3.85	8.8	3.58
	-3°C	10.7		10.3		10		9.6		9.2	
	0°C	11.9		11.6		11.3		10.7		10.2	
	2°C	12.8		12.5		12.1		11.5		10.9	
12kW	-5°C	13.1	4.88	12.8	4.55	12.5	4.21	11.7	3.92	10.8	3.63
	-3°C	13.9		13.4		12.9		12.1		11.2	
	0°C	15.2		14.6		14.1		13.2		12.3	
	2°C	16		15.5		14.9		13.9		13	

Houses and householders have to adapt to using ASHPs

- It is very important NOT to zone heating when using an ASHP. This is one of the differences people have to adapt to when moving from combi-boilers to ASHPs. This is something any good installer should be aware of.
- The ASHP uses pressurised water. Therefore, the highest efficiency is achieved when the pump runs at the lowest output temperature (see the table above for some figures).
 - This is one of the reasons that retrofitted properties can need to have larger radiators installed – as the heat transported by the system is lower than in a conventional gas central heating system.
 - However, older properties can often take an ASHP system without needing a change to pipework or radiators because (i) the pipework is of the correct bore and material, (ii) the radiators may be oversized for the property – having been installed when houses had single-glazing and little insulation.
- The major energy use of an ASHP is in starting up the pump. That is why start/stop usage (common with combi-boilers) and zoned system is wasteful of energy.
- The heat needs to be provided consistently “trickle heating”.
- An ASHP system does not directly provide hot water. Therefore one element that frequently has to be installed is an insulated hot-water cylinder – which can keep the water heated (at least sporadically) to 60°C to avoid Legionella².

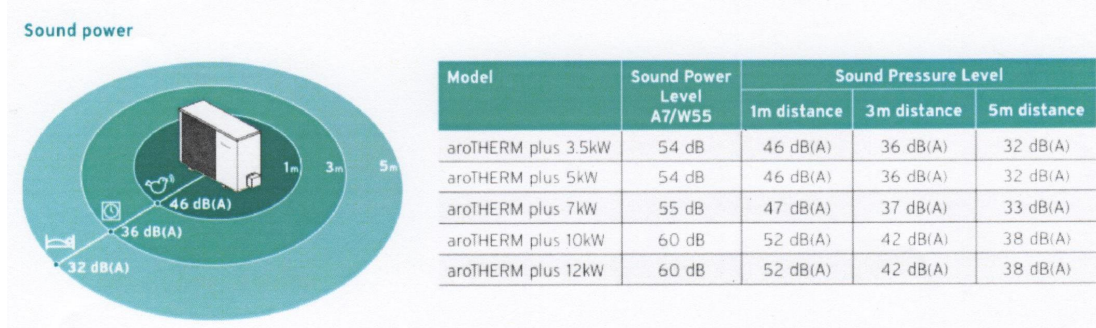
Practicalities

- There is a current grant of £7,500 available from the government. For a standard conversion of pipework, radiators, hot water cylinder plus ASHP installation you can expect to pay an additional £5,000.
- There is disruption for most people – but the extent varies based on individual circumstances.

² The Heat Geek Youtube channel has a detailed discussion about hot water cylinders, safety and temperature requirements – another rabbit hole! See https://www.youtube.com/watch?v=oJeyc_cGIMU

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- The time to think about make the change is when your current combi-boiler is reaching the end of its life, or you intend making significant changes that this would fit into.
- It is important to have a specialist installer who treats your property as an individual case. They should come out to measure all rooms and assess the building before making the calculations necessary to determine what type of installation is appropriate.
 - Mark recommended looking for heating engineers who have trained with Heat Geek (there is a map of these at <https://www.heatgeek.com/find-a-heat-geek/>).
- Currently there is a 7 year manufacturer's guarantee on an ASHP and annual maintenance is currently around £200 (in Mark's view this is mainly because of the lack of qualified ASHP maintenance engineers, meaning they may have longer distances to travel and therefore do fewer jobs per day: he expects this to change over the coming years).
- You can expect an ASHP to last a minimum of 20 years.
- They are fitted externally, so you need space, but they are quiet (the diagram below demonstrated this).



Other trustworthy locations for information about ASHPs

- Heat Geek
 - <https://www.heatgeek.com/homeowners/>
- Energy Saving Trust
 - <https://energysavingtrust.org.uk/energy-at-home/heating-your-home/heat-pumps/>
- Which?
 - <https://www.which.co.uk/reviews/ground-and-air-source-heat-pumps/article/air-source-heat-pumps-explained-al5MC4f773Zq>

Finally

General info about the efficiency, cost and environmental impact of different fuels is given in the table below.

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Heating Type	Efficiency %	Annual Energy Demand kWh			Pence per kWh	£ / kWh	Total annual running cost	CO2 emissions	
		Hot water	Heating	Total				factor (kg/kWh)	Total kg
Oil	85%	13140	9951.74	23091.74	6.28	0.06	£1593.32	0.314	7250.81
Mains Gas	85%	13140	9951.74	23091.74	6.82	0.07	£1858.88	0.227	5241.82
LPG	90%	13140	9951.74	23091.74	7.03	0.07	£1778.06	0.259	5980.76
Direct Electric	100%	13140	9951.74	23091.74	26.58	0.27	£6234.77	0.233	5380.38
Biomass Wood Pellets	90%	13140	9951.74	23091.74	5.21	0.05	£1270.05	0.08	1847.34
Biomass Logs	90%	13140	9951.74	23091.74	3.66	0.04	£1016.04	0.018	415.65
Biomass Chips	90%	13140	9951.74	23091.74	2.86	0.03	£762.03	0.018	415.65
Air Source Heat Pump	see SCOP	9855	9951.74	19806.74	26.58	0.27	£1582.28	0.233	1365.45
Ground Source Heat Pump	see SCOP	9855	9951.74	19806.74	26.58	0.27	£1595.77	0.233	1377.09