HEAT PUMP RETROFIT
FOR
EXISTING BOILER HEATING SYSTEM

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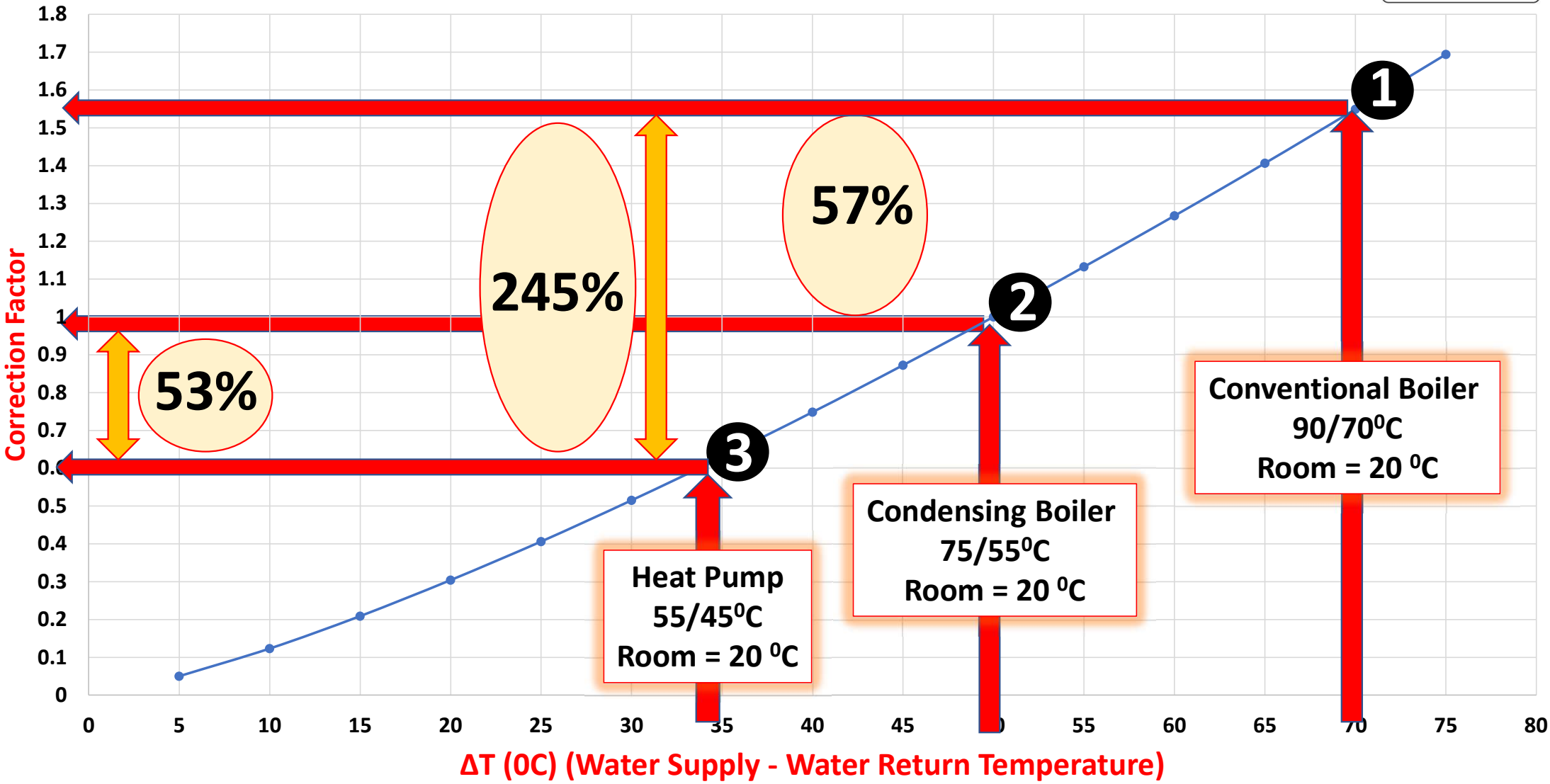
RADIATORS

Radiator Selection Correction Factor against Δ (^{0}C)



Heat emissions (watts)

Length (mm)	Height (mm)	400		600		900	
	Ventilator speed	Stand-by	Dyn. max	Stand-by	Dyn. max	Stand-by	Dyn. max
	n exponent	1,3273	1,2046	1,3494	1,2359	1,3915	1,2705
500	55/45/20°C	278	416	377	530	514	697
	45/35/20°C	162	256	218	321	292	416
	35/30/20°C	87	145	116	180	152	229
600	55/45/20°C	334	500	453	636	616	836
	45/35/20°C	195	307	262	385	351	499
	35/30/20°C	104	174	139	215	182	275
700	55/45/20°C	389	583	528	742	719	975
	45/35/20°C	227	358	306	449	409	583
	35/30/20°C	122	203	162	251	213	321
800	55/45/20°C	445	666	604	848	822	1115
	45/35/20°C	260	409	349	514	467	666
	35/30/20°C	139	232	185	287	243	366
900	55/45/20°C	501	750	679	954	924	1254
	45/35/20°C	292	460	393	578	526	749
	35/30/20°C	157	261	208	323	273	412
1000	55/45/20°C	556	833	755	1060	1027	1393
	45/35/20°C	325	511	437	642	584	832
	35/30/20°C	174	290	232	359	304	458
1100	55/45/20°C	612	916	830	1165	1130	1532
	45/35/20°C	357	562	480	706	643	916
	35/30/20°C	191	319	255	395	334	504
1200	55/45/20°C	668	999	906	1271	1233	1672
	45/35/20°C	390	613	524	770	701	999
	35/30/20°C	209	348	278	431	365	550
1400	55/45/20°C	779	1166	1057	1483	1438	1950
	45/35/20°C	455	715	611	899	818	1165
	35/30/20°C	244	406	324	503	425	641
1600	55/45/20°C	890	1333	1208	1695	1644	2229
	45/35/20°C	520	818	699	1027	935	1332
	35/30/20°C	278	464	371	575	486	733
1800	55/45/20°C	1001	1499	1359	1907	-	-
	45/35/20°C	585	920	786	1155	-	-
	35/30/20°C	313	522	417	646	-	-
2000	55/45/20°C	1113	1666	1510	2119	-	-
	45/35/20°C	650	1022	874	1284	-	-
	35/30/20°C	348	580	463	718	-	-

Emissions in watts (EN16430)

CONVENTIONAL BOILER SYSTEMS ① & ② $\Delta T_{(50^0C)}$

HEAT PUMP SYSTEM ③ $\Delta T_{(55/45^0C)}$

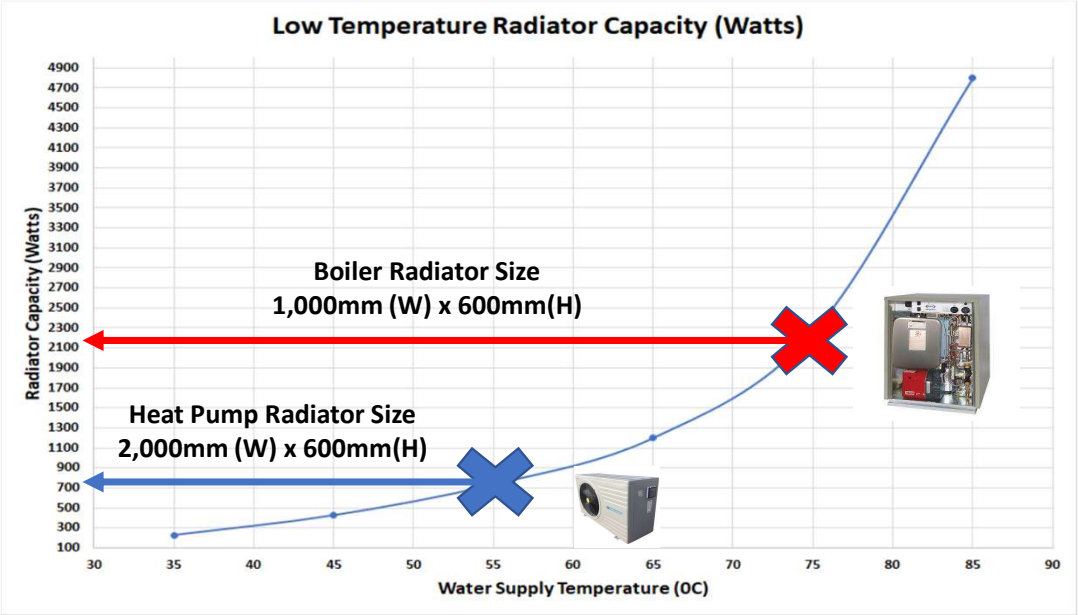
50 Δt (75/65/20°C)

Height mm	Length mm	Sections	P1 Stelrad UIN	P1 Heat output Watts	P1 Heat output Btu/hr	K1 Stelrad UIN	K1 Heat output Watts	K1 Heat output Btu/hr	P+ Stelrad UIN	P+ Heat output Watts	P+ Heat output Btu/hr	K2 Stelrad UIN	K2 Heat output Watts	K2 Heat output Btu/hr
300	500	15	-	-	-	8430	259	884	8436	388	1324	8442	506	1727
	1000	30	-	-	-	8431	517	1765	8437	776	2648	8443	1012	3454
	1500	45	-	-	-	8432	776	2648	8438	1164	3973	8444	1518	5181
	2000	60	-	-	-	8433	1034	3529	8439	1552	5297	8445	2024	6908
	2500	75	-	-	-	8434	1293	4413	8440	1940	6621	8446	2530	8635
	3000	90	-	-	-	8435	1551	5294	-	-	-	8447	3036	10362

① **Existing Radiator = K2 – 500 mm (506 W) designed for Oil Boiler 90/70°C conditions**

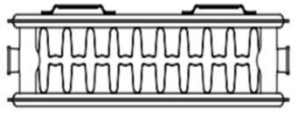
② **Existing Radiator = K2 – 500 mm (506*1.57 W) designed for Oil Boiler 90/70°C conditions**

③ **Existing Radiator = K2 – 500 mm (506*2.45 W) designed for Oil Boiler 90/70°C conditions**



RADIATORS TYPE

K2



CONVENTIONAL BOILER SYSTEMS

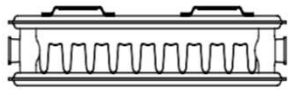
HEAT PUMP SYSTEM

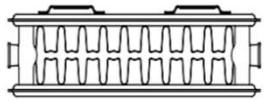
1 & 2 ΔT (50^0C)

3 ΔT ($55/45^0C$)

50 Δt

(75/65/20°C)





Height mm	Length mm	Sections	Stelrad UIN	Heat output Watts	Heat output Btu/hr	Stelrad UIN	Heat output Watts	Heat output Btu/hr	Stelrad UIN	Heat output Watts	Heat output Btu/hr	Stelrad UIN	Heat output Watts	Heat output Btu/hr
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1 Existing Radiator = K2 – 500 mm (506 W) designed for Oil Boiler $90/70^0C$ conditions

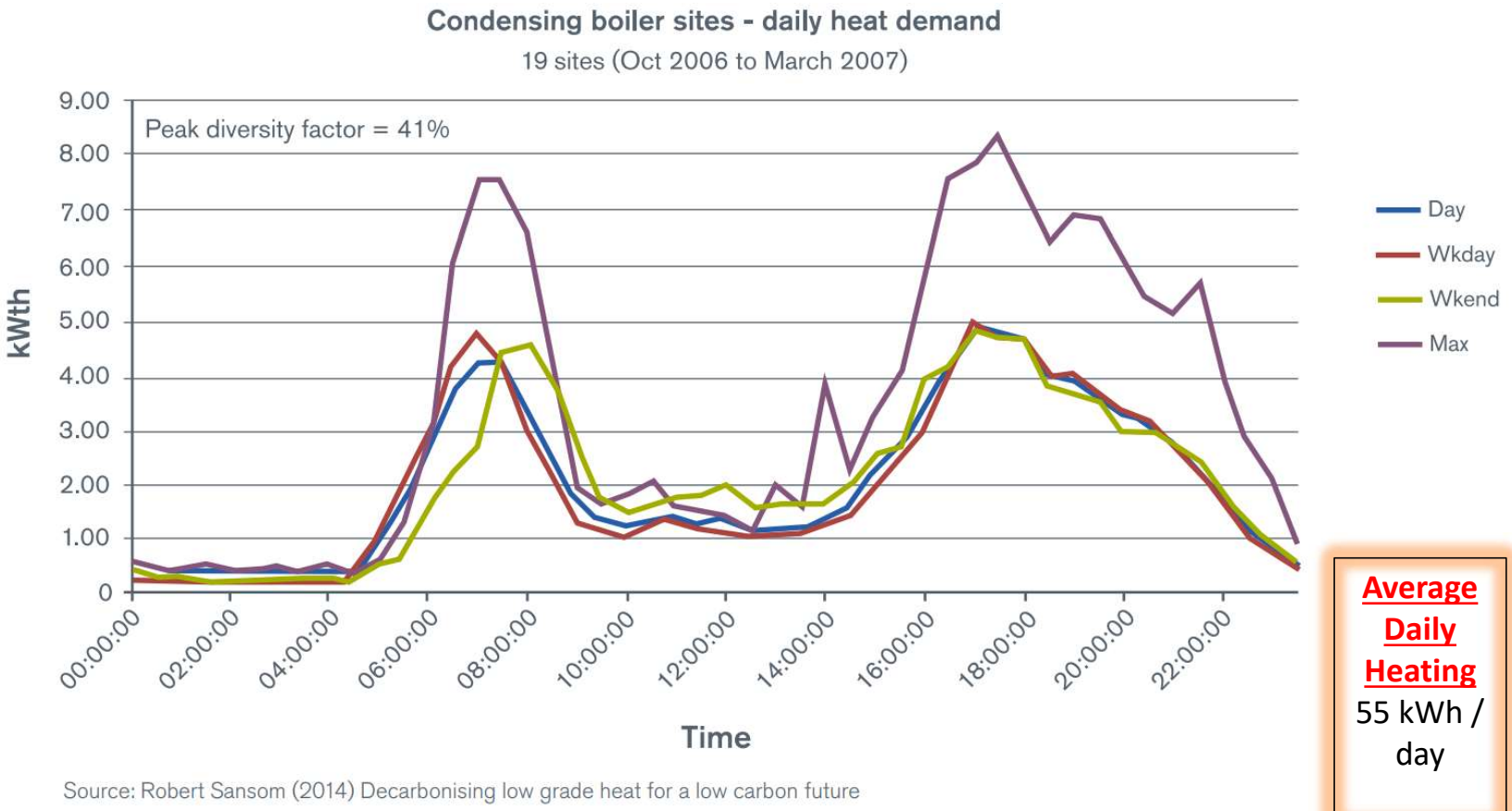
2 Existing Radiator = K2 – 500 mm (506*1.57 W) designed for Oil Boiler $90/70^0C$ conditions

3 Existing Radiator = K2 – 500 mm (506*2.45 W) designed for Oil Boiler $90/70^0C$ conditions

EPS
ENVIRONMENTAL PROCESS SYSTEMS LTD

AVERAGE UK DOMESTIC HEATING DESIGN DATA

According to Ofgem, the average household in the UK has 2.4 people living in it, and uses 8 kWh of electricity and 33 kWh of gas respectively, per day. This works out as an average of 242 kWh or electricity and 1,000 kWh of gas per month, or 2,900 kWh of electricity and 12,000 kWh of gas each year.



Source: Robert Sansom (2014) Decarbonising low grade heat for a low carbon future

Boiler sizes are measured in kilowatts (kW) and range from 24-27 kW, 28-34 kW and 35-42 kW. A house with one bathroom and 10 radiators would need a 24-27 kW boiler, whereas a large house with over 20 radiators and three bathrooms or more would need a 35-42 kW boiler.

GAS BOILERS;

A 24 kW boiler will use 24 kWh of energy per hour

Average Daily Heating

55 kWh / day

OIL BOILERS;

Most oil boiler systems use kerosene and one liter of kerosene equals around 10 kWh heating output.

PIPE SIZING

Boiler Water Flow Rate

Heating Load = 30 kW

30 = m x 4.186 x (75-55)

m = 0.358 kg/s (Lt/s)

1.28 m3/h

Heat Pump Water Flow Rate

Heating Load = 30 kW

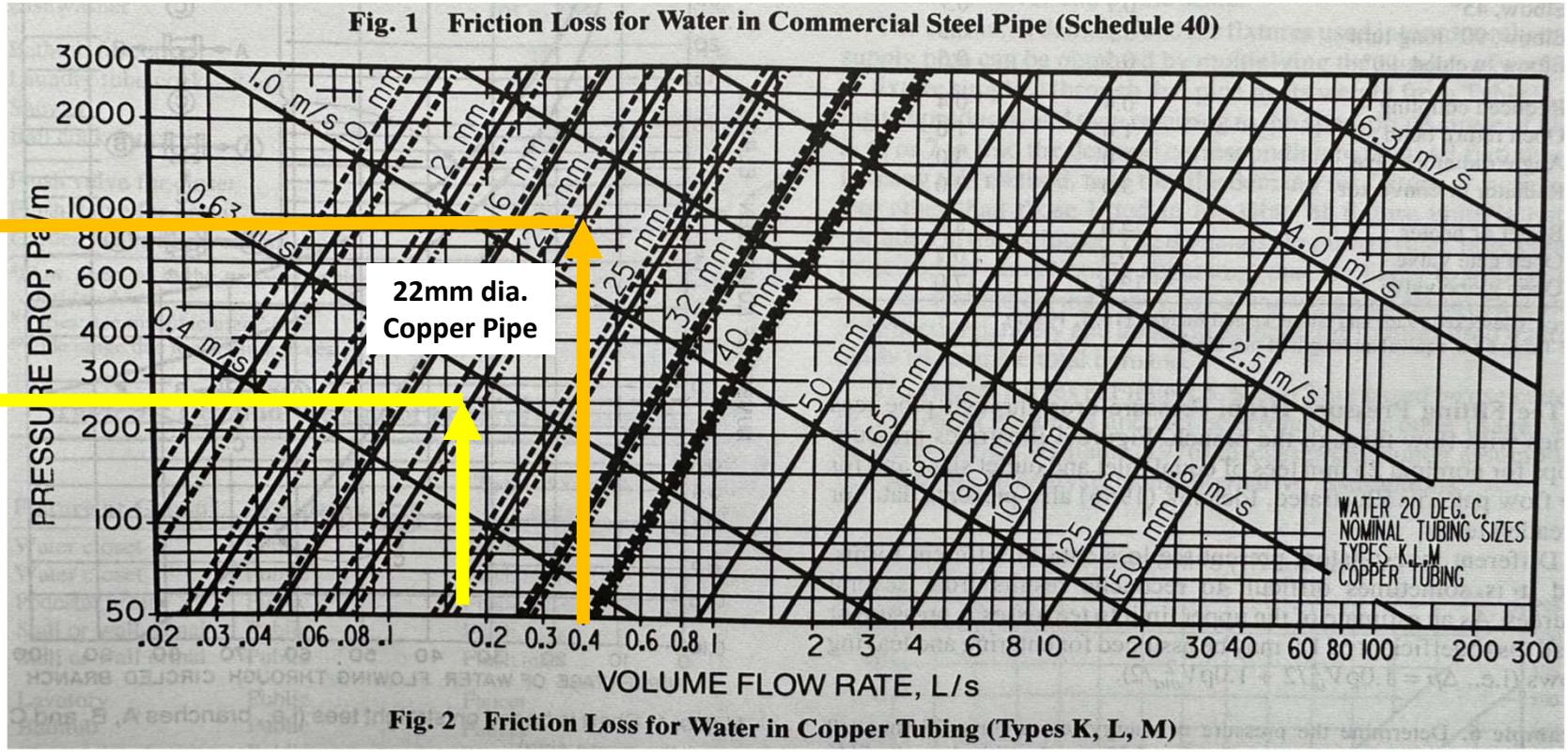
30 = m x 4.186 x (55-45)

m = 0.716 kg/s (Lt/s

2.57 m3/h

HEAT PUMP

BOILER

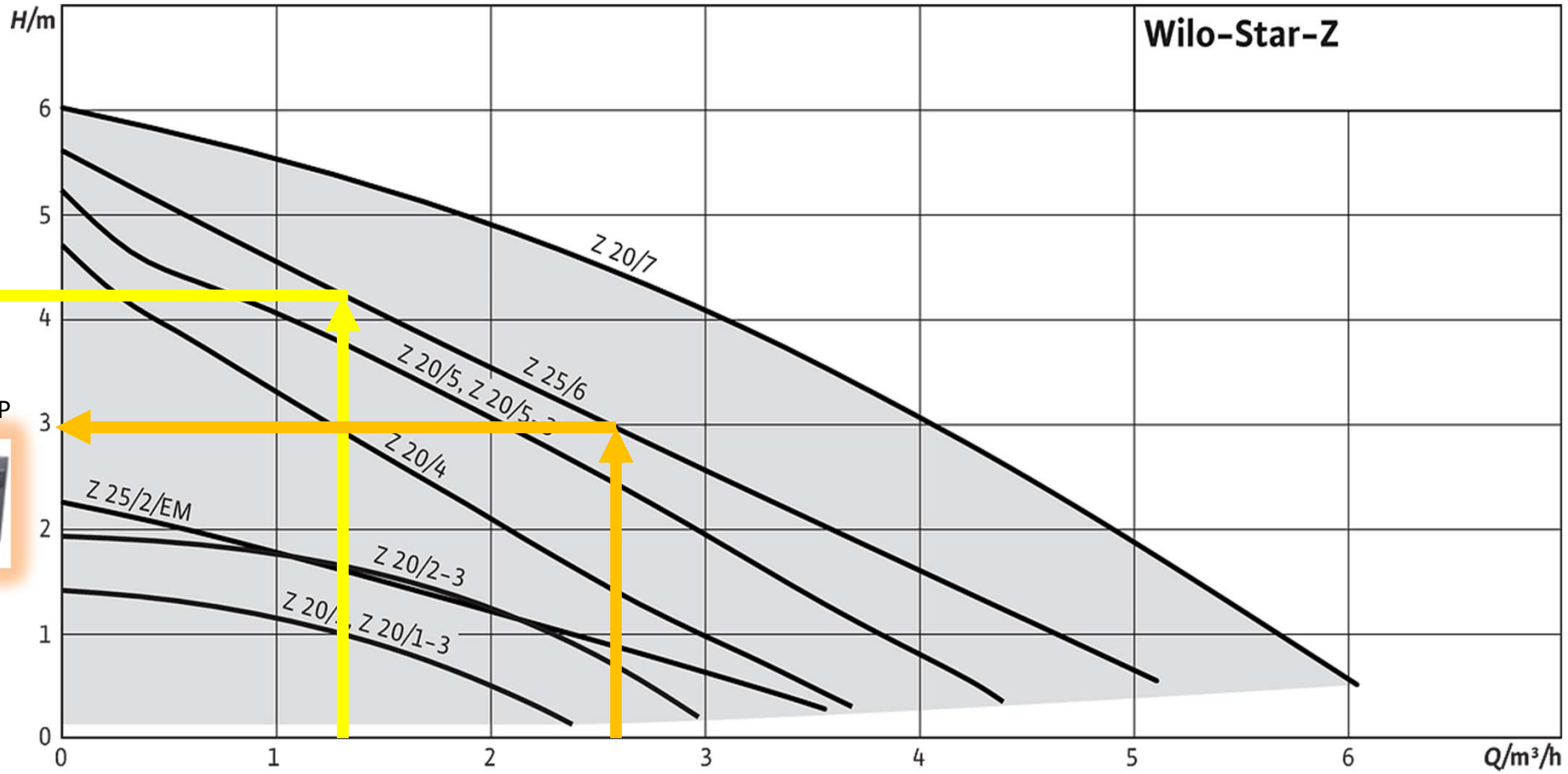


PUMPS

29% Reduction on head

BOILER

HEAT PUMP



THERMAL ENERGY STORAGE

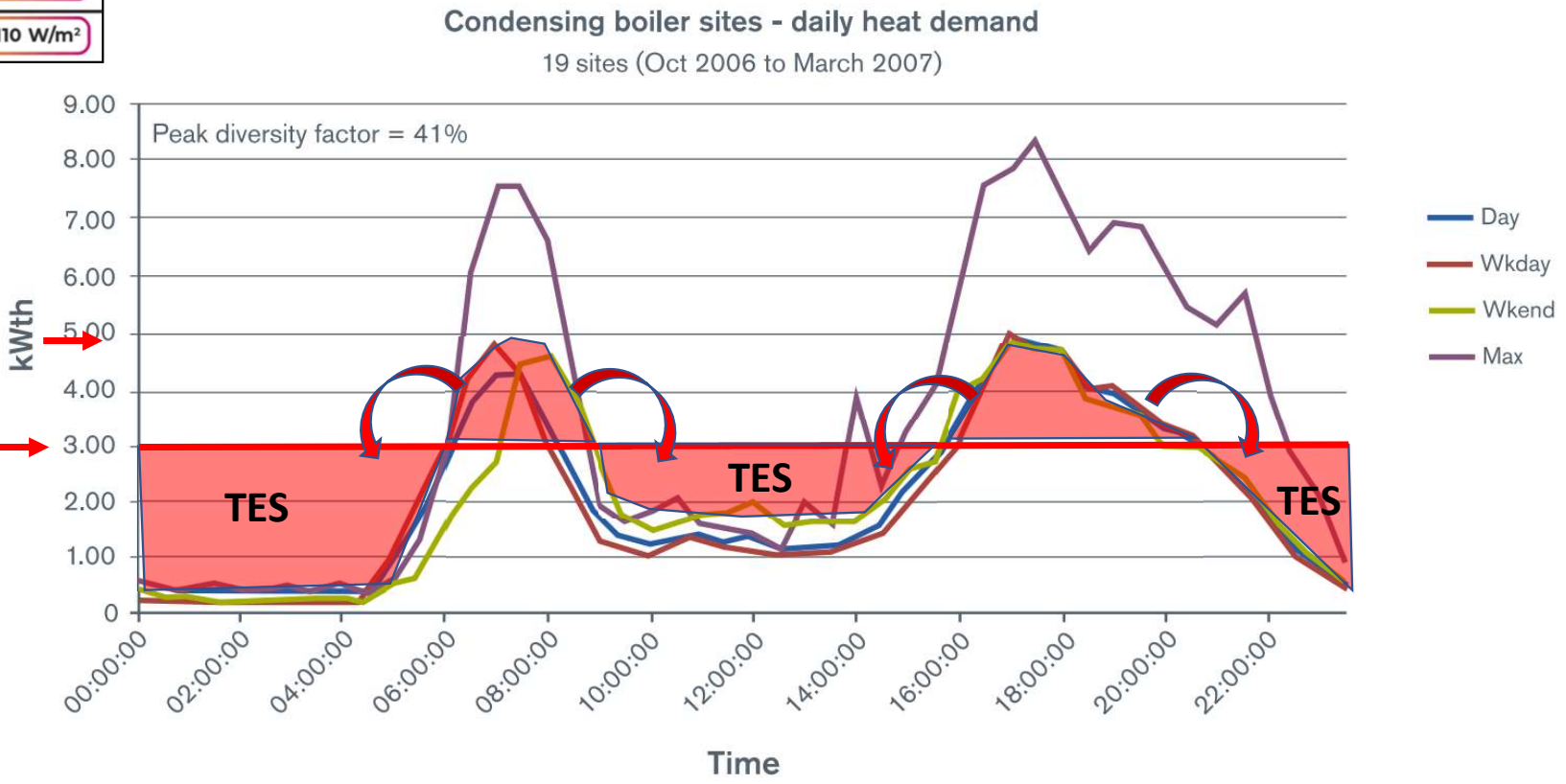
HEAT LOAD LEVELS

Passive haus	2-10 W/m²
Eco/low carbon homes	10-20 W/m²
Recent new build (post 2006)	20-40 W/m²
Pre 2006 new build or recent renovation	30-50 W/m²
Renovated properties with cavity wall insulation and over 75mm loft insulation	40-65 W/m²
Victorian houses, perhaps a mix of single/double glazing with 55-75mm loft insulation	65-85 W/m²
Victorian or older, single glazed, no loft insulation	95-110 W/m²

LOAD SHIFTING

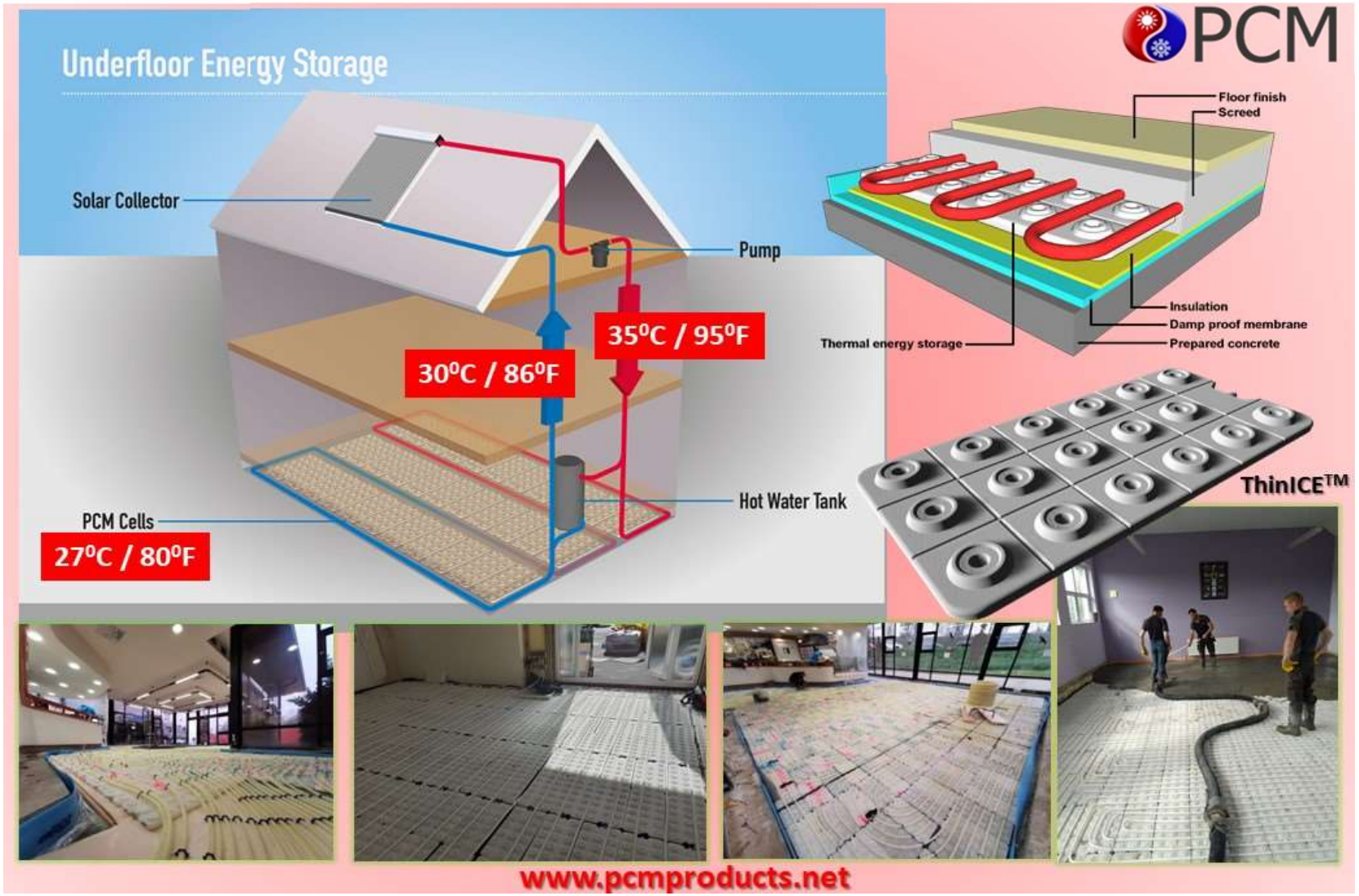
STANDARD

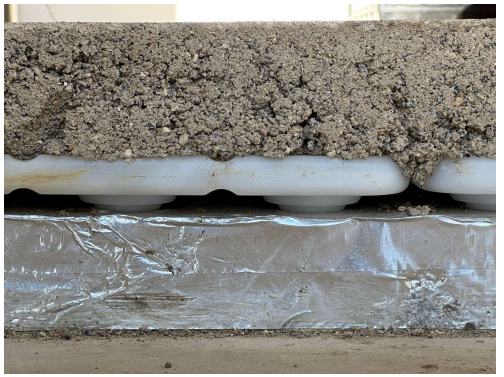
TES



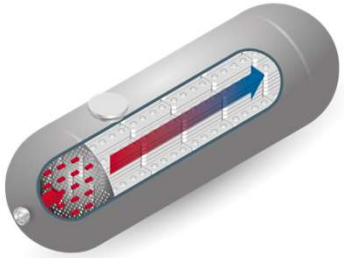
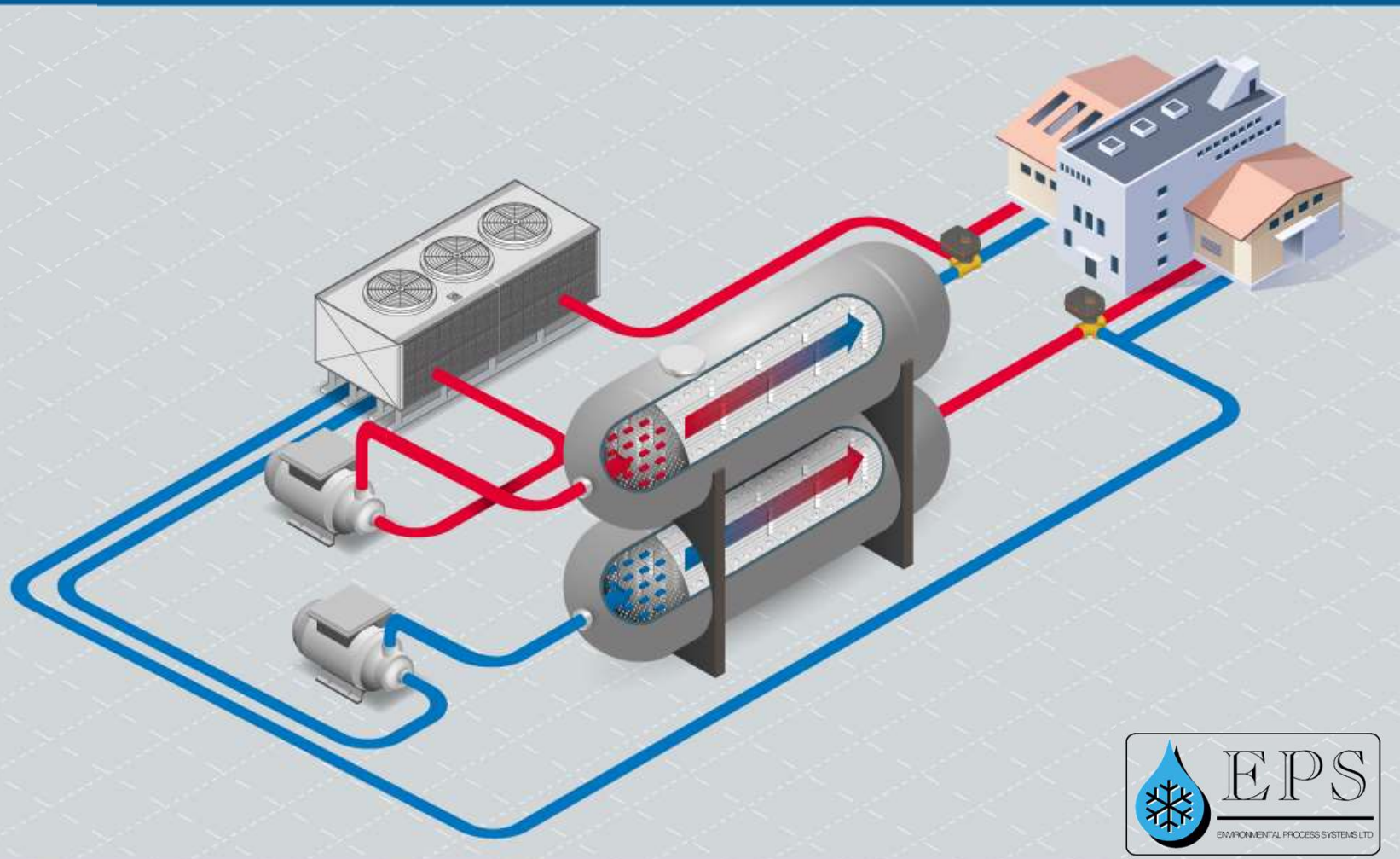
Source: Robert Sansom (2014) Decarbonising low grade heat for a low carbon future

UNDERFLOOR HEATING TES





TES TANKS



Heat Pump - Load Shifting