Everything you want to know about Heat Pumps…. But don’t know who to ask.

Martin Paterson – Cosmos Energy
Graham Miles – SCMiles, Heating Engineer
John Downe - HEAT

An Introduction to Heat Pumps

Martin Paterson

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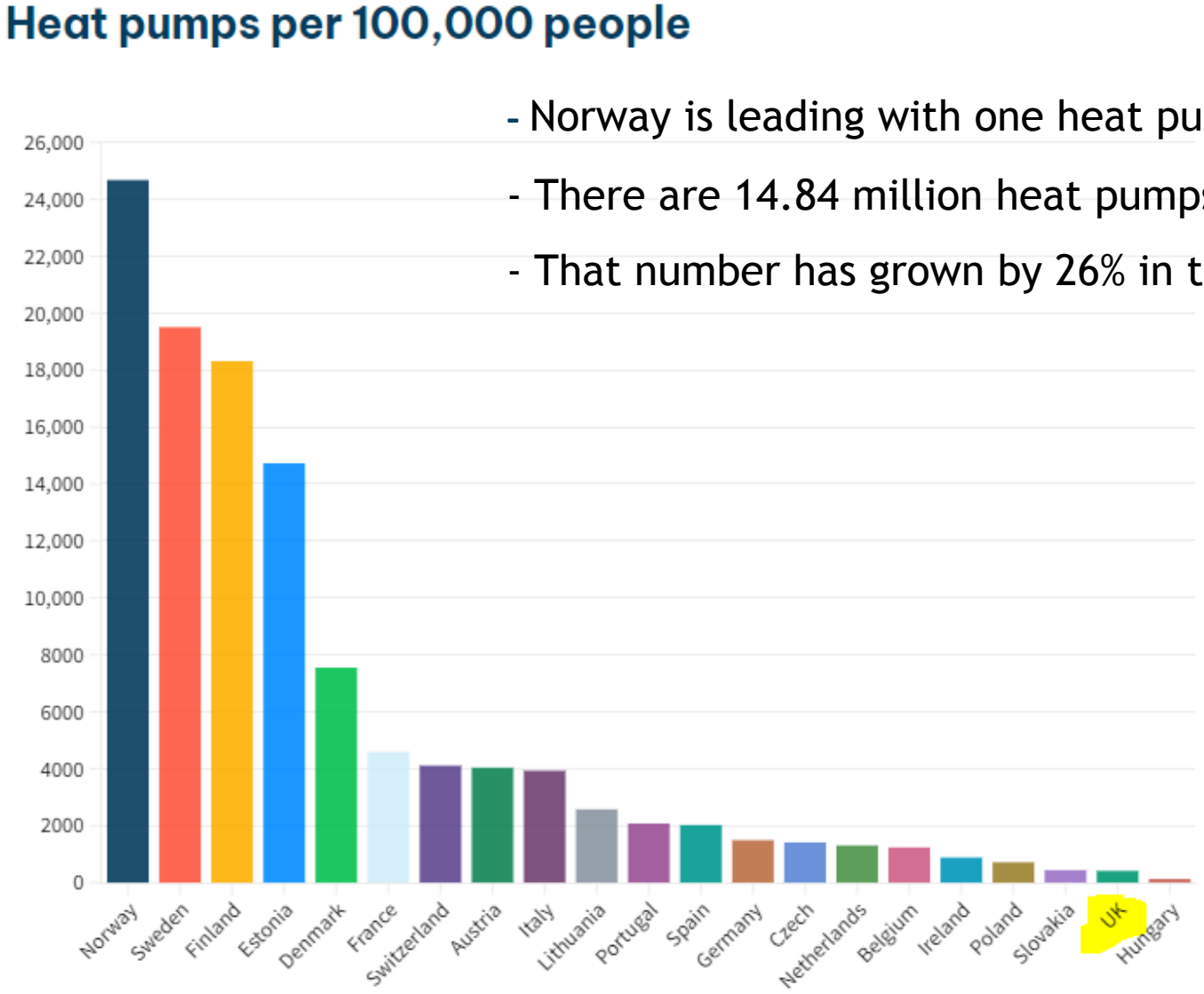
MCS
APPROVED INSTALLER
MCS accreditation no:
NAP 13425

Maturity of the Technology

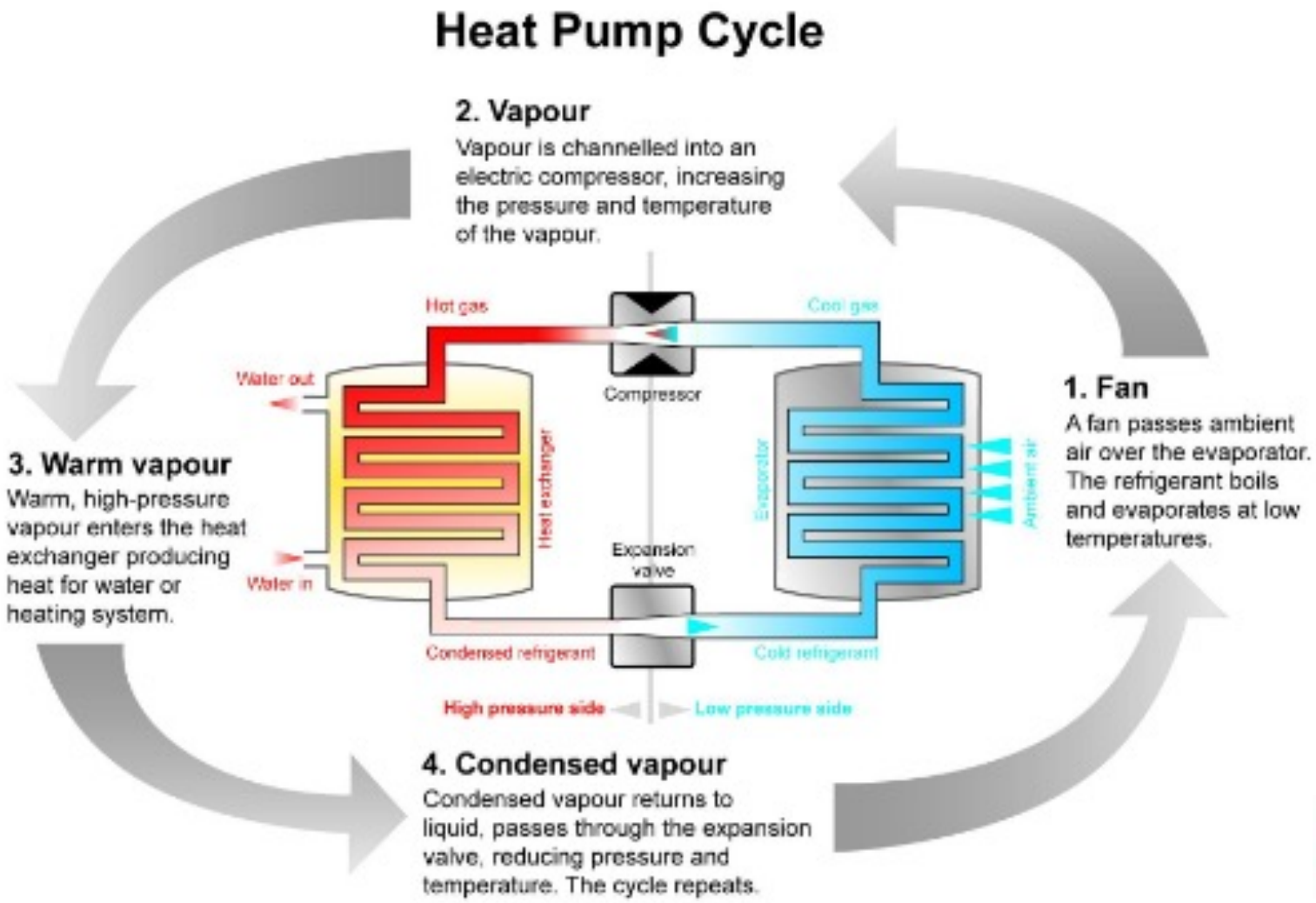
- First Large scale Heat pump was developed in Norwich in 1948
- Adoption rose because of the OPEC oil crisis in the 1970's
- By 2008 its estimated that Sweden had over 50,000 units and USA had 750,000
- Heat pumps are the future of domestic heating systems, which the UK govt has acknowledged with a target of 600,000 annual installations by 2028, and a ban on new gas boiler sales from 2035
- Heat pumps are the default choice for new Swedish homes, and they have consistently reached 100,000 installations per year for the past decade.
- Governments all over Europe have long been committed to heat pumps, paving the way for 40% of all residential buildings to be heated by electricity by 2030

Heat Pump Deployment in Europe



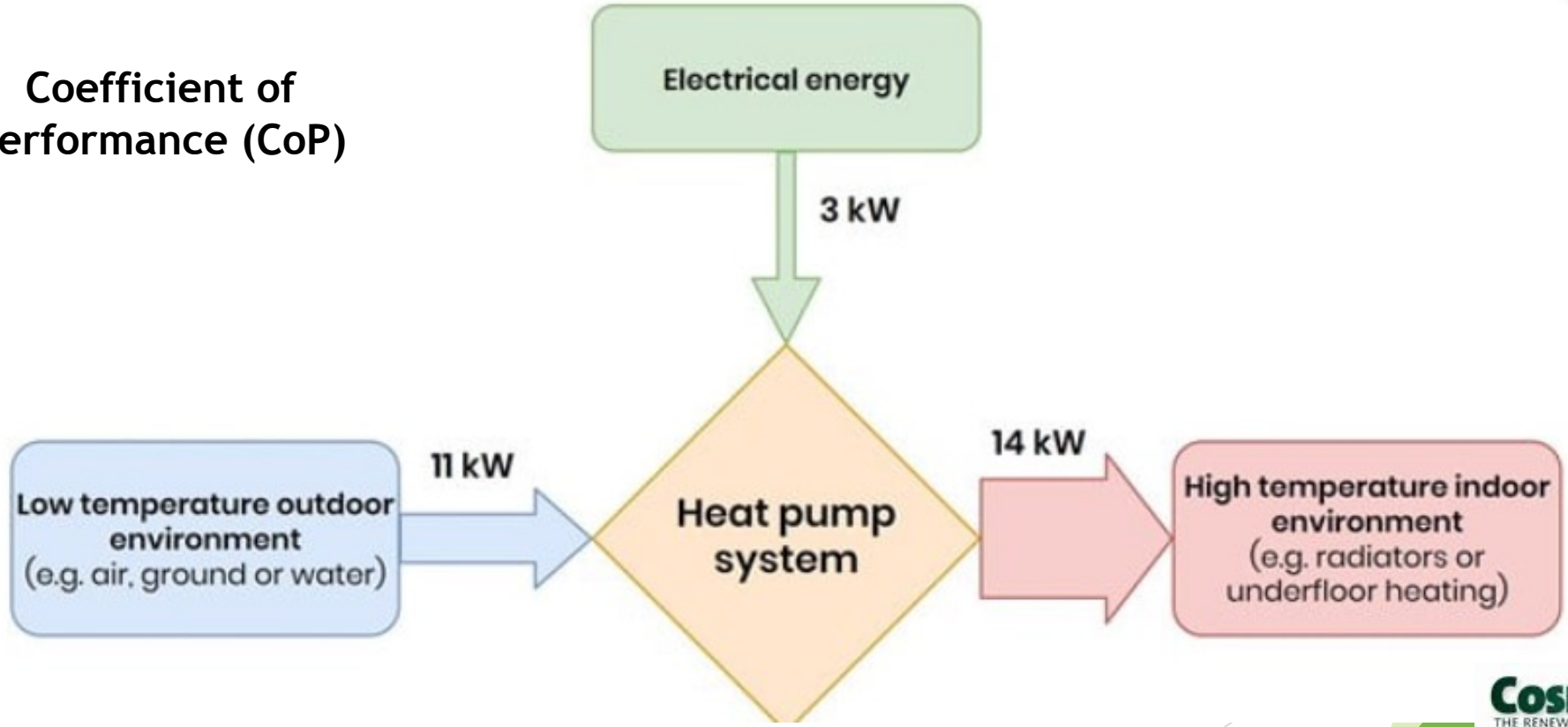
- Norway is leading with one heat pump for every four people
- There are 14.84 million heat pumps in Europe
- That number has grown by 26% in the past two years

What is a Heat Pump



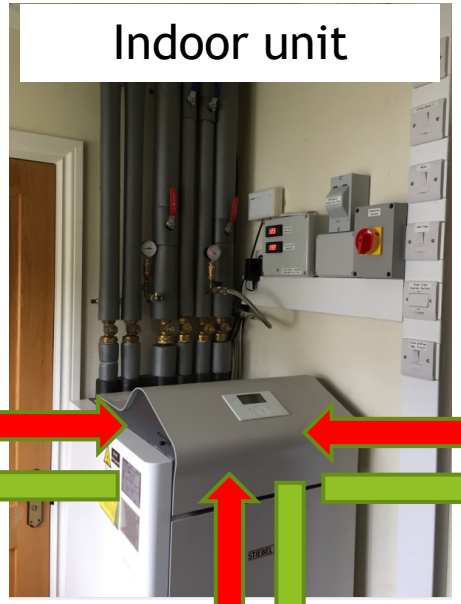
Characteristics to be exploited

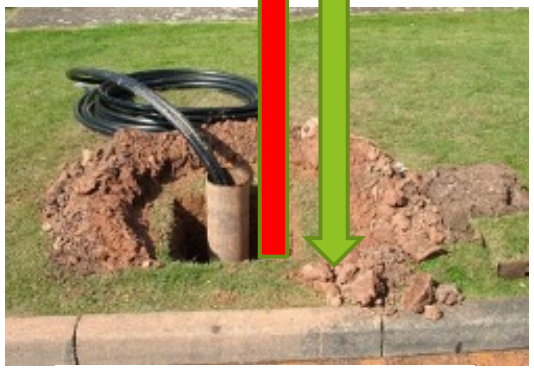
Coefficient of Performance (CoP)



Types of Heat Pump – Ground & Water

Water Source





Vertical /Bore Hole

Horizontal array

Types of Heat Pump – Air Source

Indoor System including DHW tank

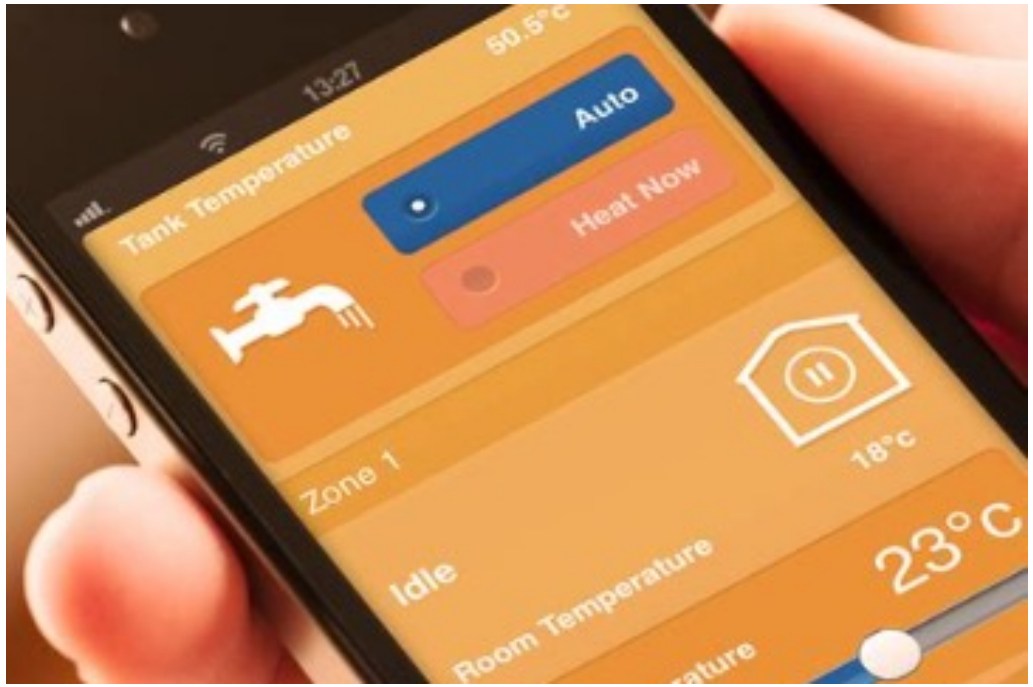
Outdoor Unit

Considerations for installation

- Space for a heat pump – Inside and Outside
- Lower Water temperatures require;
  - Larger DHW Tank
  - Potentially larger Radiators
  - Good flow rates so potential pipe modifications
  - Buffer tank or low loss header for improved efficiency
  - Pipe Insulation
- Combining with other refurbishment projects
- Water Softeners are recommended

Monitoring and Maintenance

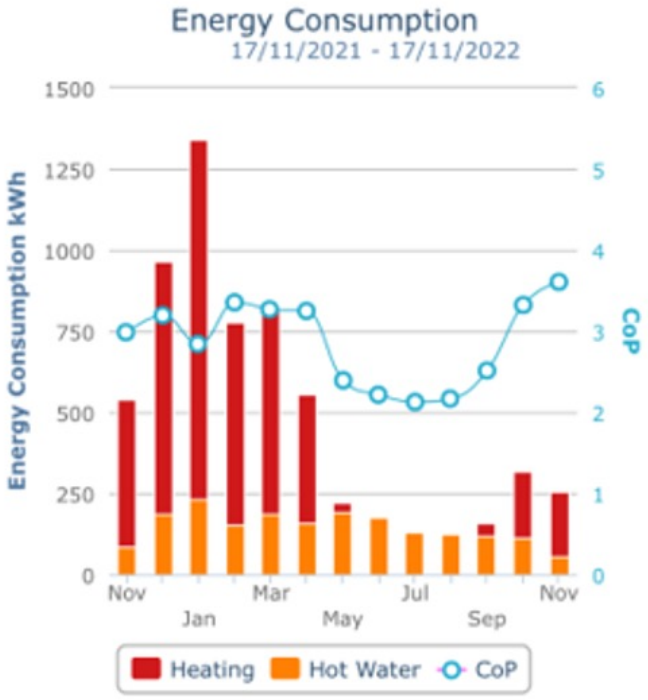
Many systems now have remote access capability



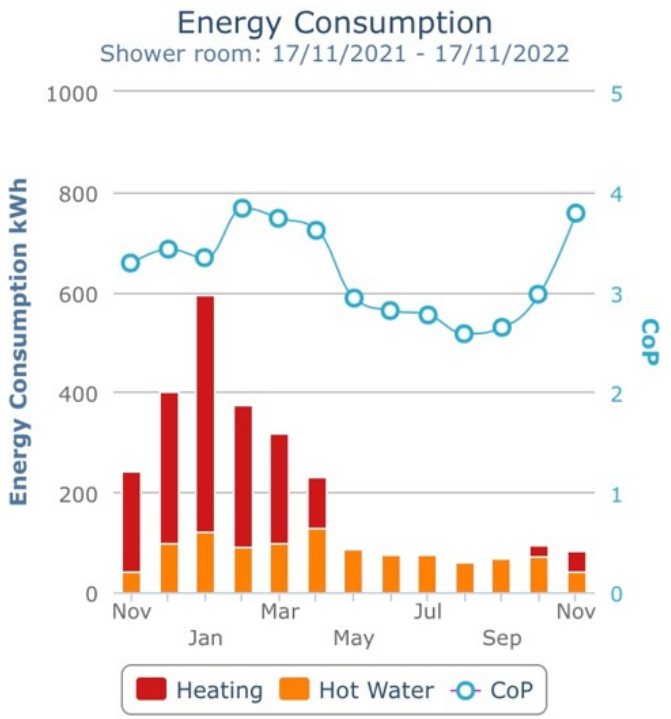
Performance Monitoring

Performance Monitoring

Large house, two people with occasional children and secondary DHW



Two adults and three grown up children at home



End of Presentation

Heat Pump Installations

Graham Miles
S C Miles, Wantage

Sam's House....

Before.....

After....

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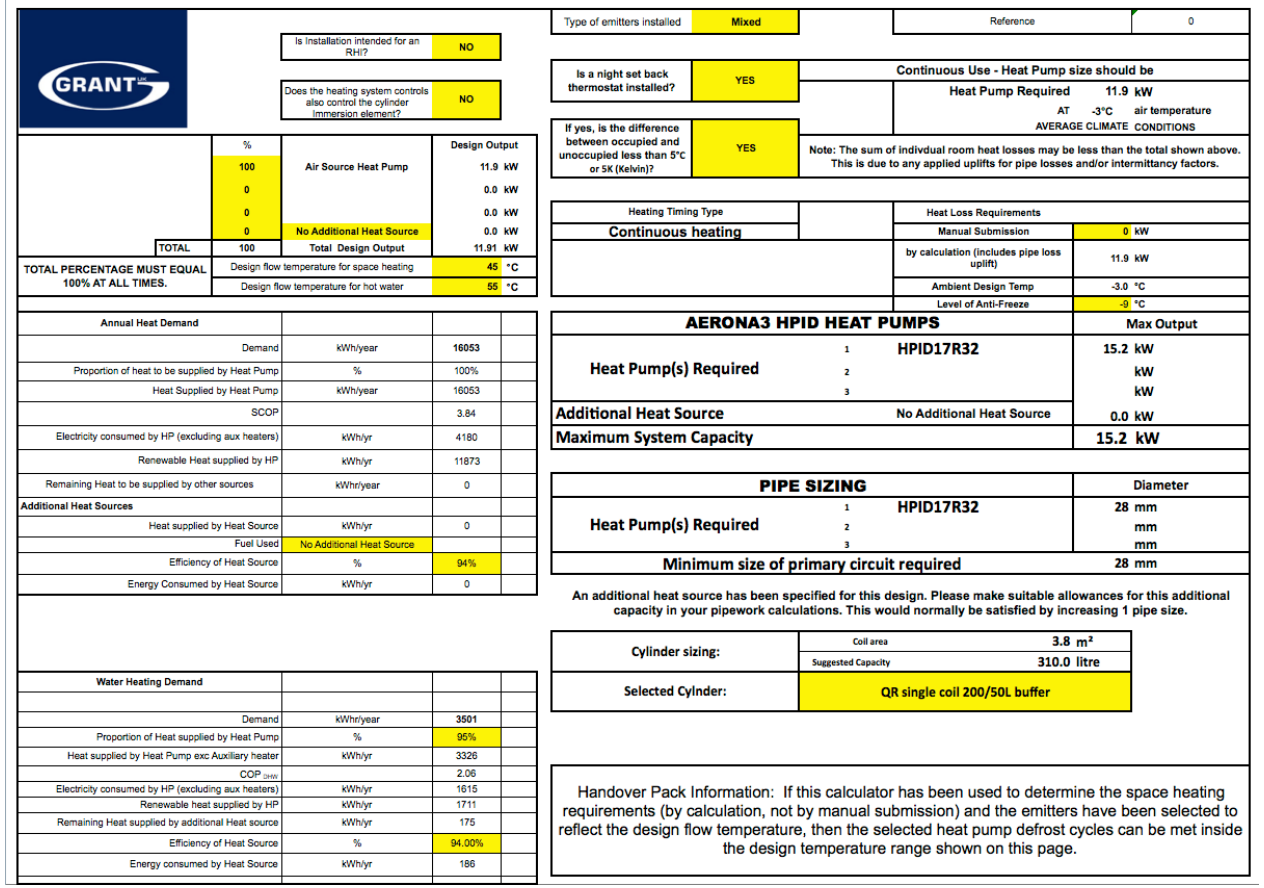


Is Installation intended for an RHI?	NO
Does the heating system controls also control the cylinder immersion element?	NO
Type of emitters installed	Mixed
Reference	0
Is a night set back thermostat installed?	YES
If yes, is the difference between occupied and unoccupied less than 5°C or 5K (Kelvin)?	YES

Continuous Use - Heat Pump size should be

Heat Pump Required 11.9 kW

AT -3°C air temperature

AVERAGE CLIMATE CONDITIONS

Note: The sum of indivdual room heat losses may be less than the total shown above. This is due to any applied uplifts for pipe losses and/or intermittancy factors.

%		Design Output
100	Air Source Heat Pump	11.9 kW
0		0.0 kW
0		0.0 kW
0	No Additional Heat Source	0.0 kW
TOTAL 100	Total Design Output	11.91 kW

TOTAL PERCENTAGE MUST EQUAL 100% AT ALL TIMES.

Design flow temperature for space heating	45 °C
Design flow temperature for hot water	55 °C

Heating Timing Type	Heat Loss Requirements	
Continuous heating	Manual Submission	0 kW
	by calculation (includes pipe loss uplift)	11.9 kW
	Ambient Design Temp	-3.0 °C
	Level of Anti-Freeze	-9 °C

Annual Heat Demand		
Demand	kWh/year	16053
Proportion of heat to be supplied by Heat Pump	%	100%
Heat Supplied by Heat Pump	kWh/year	16053
SCOP		3.84
Electricity consumed by HP (excluding aux heaters)	kWh/yr	4180
Renewable Heat supplied by HP	kWh/yr	11873
Remaining Heat to be supplied by other sources	kWhr/year	0
Additional Heat Sources		
Heat supplied by Heat Source	kWh/yr	0
Fuel Used	No Additional Heat Source	
Efficiency of Heat Source	%	94%
Energy Consumed by Heat Source	kWh/yr	0

AERONA3 HPID HEAT PUMPS			Max Output
Heat Pump(s) Required	1	HPID17R32	15.2 kW
	2		kW
	3		kW
Additional Heat Source		No Additional Heat Source	0.0 kW
Maximum System Capacity			15.2 kW

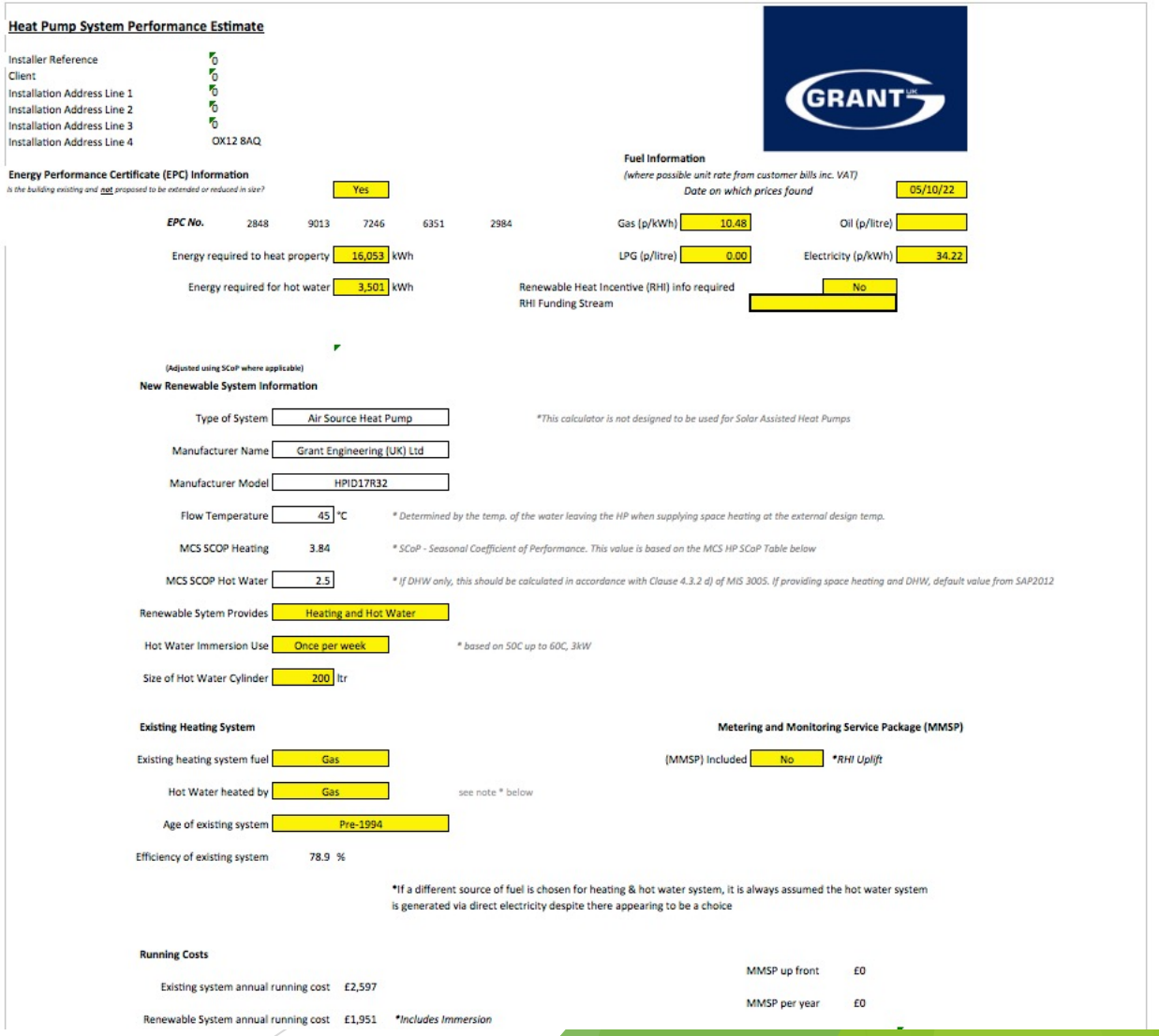
PIPE SIZING			Diameter
Heat Pump(s) Required	1	HPID17R32	28 mm
	2		mm
	3		mm
Minimum size of primary circuit required			28 mm

An additional heat source has been specified for this design. Please make suitable allowances for this additional capacity in your pipework calculations. This would normally be satisfied by increasing 1 pipe size.

Cylinder sizing:	Coil area	3.8 m²
	Suggested Capacity	310.0 litre
Selected Cylinder:	QR single coil 200/50L buffer	

Water Heating Demand		
Demand	kWhr/year	3501
Proportion of Heat supplied by Heat Pump	%	95%
Heat supplied by Heat Pump exc Auxiliary heater	kWh/yr	3326
COP SHW		2.06
Electricity consumed by HP (excluding aux heaters)	kWh/yr	1615
Renewable heat supplied by HP	kWh/yr	1711
Remaining Heat supplied by additional Heat source	kWh/yr	175
Efficiency of Heat Source	%	94.00%
Energy consumed by Heat Source	kWh/yr	186

Handover Pack Information: If this calculator has been used to determine the space heating requirements (by calculation, not by manual submission) and the emitters have been selected to reflect the design flow temperature, then the selected heat pump defrost cycles can be met inside the design temperature range shown on this page.



Heat Pump System Performance Estimate

Installer Reference 0
Client 0
Installation Address Line 1 0
Installation Address Line 2 0
Installation Address Line 3 0
Installation Address Line 4 OX12 8AQ

Energy Performance Certificate (EPC) Information

Is the building existing and not proposed to be extended or reduced in size? Yes

EPC No. 2848 9013 7246 6351 2984

Energy required to heat property 16,053 kWh

Energy required for hot water 3,501 kWh

(Adjusted using SCoP where applicable)

Fuel Information

(where possible unit rate from customer bills inc. VAT)

Date on which prices found 05/10/22

Gas (p/kWh) 10.48 Oil (p/litre)

LPG (p/litre) 0.00 Electricity (p/kWh) 34.22

Renewable Heat Incentive (RHI) info required No

RHI Funding Stream

New Renewable System Information

Type of System: Air Source Heat Pump **This calculator is not designed to be used for Solar Assisted Heat Pumps*

Manufacturer Name: Grant Engineering (UK) Ltd

Manufacturer Model: HPID17R32

Flow Temperature: 45 °C ** Determined by the temp. of the water leaving the HP when supplying space heating at the external design temp.*

MCS SCOP Heating: 3.84 ** SCoP - Seasonal Coefficient of Performance. This value is based on the MCS HP SCoP Table below*

MCS SCOP Hot Water: 2.5 ** If DHW only, this should be calculated in accordance with Clause 4.3.2 d) of MIS 3005. If providing space heating and DHW, default value from SAP2012*

Renewable Sytem Provides: Heating and Hot Water

Hot Water Immersion Use: Once per week ** based on 50C up to 60C, 3kW*

Size of Hot Water Cylinder: 200 ltr

Existing Heating System

Existing heating system fuel: Gas

Hot Water heated by: Gas see note * below

Age of existing system: Pre-1994

Efficiency of existing system: 78.9 %

Metering and Monitoring Service Package (MMSP)

(MMSP) Included: No **RHI Uplift*

**If a different source of fuel is chosen for heating & hot water system, it is always assumed the hot water system is generated via direct electricity despite there appearing to be a choice*

Running Costs

Existing system annual running cost £2,597

Renewable System annual running cost £1,951 **Includes Immersion*

MMSP up front £0

MMSP per year £0

Sam's House Sizing and Running Costs Calcs

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Janne's House.....

Heat Pump System Performance Estimate

Installer Reference	JRCR1
Client	0
Installation Address Line 1	0
Installation Address Line 2	0
Installation Address Line 3	0
Installation Address Line 4	OX12 8HJ

Energy Performance Certificate (EPC) Information

Is the building existing and not proposed to be extended or reduced in size? Yes

Fuel Information

(where possible unit rate from customer bills inc. VAT)

Date on which prices found 05/10/22

EPC No. 9320 2231 1190 2109 4101

Energy required to heat property	5,987 kWh	Gas (p/kWh)	10.46
Energy required for hot water	2,391 kWh	LPG (p/litre)	
Potential RHI energy	8,378 kWh	Oil (p/litre)	
Energy potentially eligible for RHI (Adjusted using SCoP where applicable)	6,407 kWh	Electricity (p/kWh)	34.22

Renewable Heat Incentive (RHI) info required: Yes

RHI Funding Stream: Domestic

New Renewable System Information

Type of System	Air Source Heat Pump	*This calculator is not designed to be used for Solar Assisted Heat Pumps
Manufacturer Name	Grant Engineering (UK) Ltd	
Manufacturer Model	HPID10R32	
Flow Temperature	45 °C	* Determined by the temp. of the water leaving the HP when supplying space heating at the external design temp.
MCS SCOP Heating	4.25	* SCoP - Seasonal Coefficient of Performance. This value is based on the MCS HP SCoP Table below
MCS SCOP Hot Water	2.5	* If DHW only, this should be calculated in accordance with Clause 4.3.2 d) of MIS 3005. If providing space heating and DHW, default value from SAP2012
Renewable Sytem Provides	Heating and Hot Water	
Hot Water Immersion Use	Once per week	* based on 50C up to 60C, 3kW
Size of Hot Water Cylinder	125 ltr	

Existing Heating System

Existing heating system fuel	Gas	
Hot Water heated by	Gas	see note * below
Age of existing system	12	
Efficiency of existing system	90 %	

Metering and Monitoring Service Package (MMSP)

(MMSP) Included: No *RHI Uplift

Renewable Heat Incentive (RHI)

RHI Tariff 10.71 p/kWh — *RHI Tariffs can be viewed here*

*If a different source of fuel is chosen for heating & hot water system, it is always assumed the hot water system is generated via direct electricity despite there appearing to be a choice

Running Costs

Existing system annual running cost	£974	MMSP up front	£0
Renewable System annual running cost	£835 *Includes Immersion	MMSP per year	£0

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Hungerford Installations…..

Hungerford Hub

Swimming Pool House

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Hungerford Hub Calculations

Design Details

Project Reference:		**MCS Designer:**	*Graham Miles*
Date:		**Company Name:**	*S. C. Miles & son*
Customer Name:		**MCS No:**	*26000*
Site Address:		**Address:**	
			13, Paddock Close
			Charlton Heights
			Wantage
Post Code:	*RG17 0JG*	**Post Code:**	*OX12 7EQ*
Contact Nos.		**Contact Nos.**	07973827450
Email Address:		**Email Address:**	graham@scmiles.co.uk

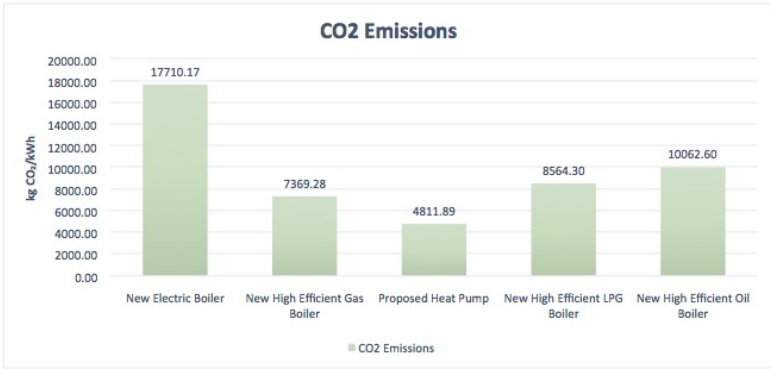
Property Details			
House Type	*Light Commercial*	Amount of Bedrooms	*2*
Built (year)	*Post 2006*	Occupants per Bedroom	*1*
Electrical Supply	*Single Phase*	Total Floor Area (m²)	*228.14*
		Total Volume (m³)	*1008.33*
Design Data			
Outside Design Temp - ODT (°C)	*-2.8*	Altitude (m)	*100*
Degree Days (DD)	*2033*	Min Hot Water Cylinder (litres)	*135*
Mean air temp - MAT (°C)	*11.3*	Hot water per occupant (l/day)	*45*
MAT Location	*Thames Valley (Heathrow)*	Legionnaires' protection (days)	*7*
Building Requirements			
Space Heating load (kW)	*11.46*	Annual Hot water heating	*2534*
Heat loss W/m²	*50.23*	Immersion Energy (kWh)	*82*
Space Heating (kWh/yr)	*33317*	Total Energy Usage (kWh/yr)	*35851*
Selection			
Type of Heat Pump	*Air Source*	Buffer Vessel (litres)	*30*
Manufacturer	*Grant Uk*	Hot Water Cylinder (litres)	*200*
Model	*Aerona HPID17R32*	Type of Emitters	*UFH*
Output @ ODT/DFT (kW)	*14.90*	Design Flow Temp - DFT (°C)	*50.00*
Output @ 0°C/HW (kW)	*15.30*	CH pump power (W)	*50*
Manufacturers htg SCOP	*3.69*	Hot Water storage temp (°C)	*50*
Manufacturers HW SCOP	*3.56*	Hot Water system efficiency	*80.00%*

Estimated Running Costs			
Space Heating	*£3,089.68*	Ground Pump	*£0.00*
Hot Water from Heat Pump	*£275.44*	Electric (p/kWh)	*£0.34*
Hot Water from Immersion	*£27.94*	Gas (p/kWh)	*£0.10*
Total Running Costs	*£3,393.06*	LPG (p/kWh)	*£0.75*
Central Heating Pump	*£40.82*	Oil (p/kWh)	*£0.82*

Property assumed U Values	Ground Floor	Mid-floor	Upper Floor	Single Storey
Upper-Floor	***U' Value***	***Construction***		
Floor	*0.35*			
Windows	*2.80*			
Door	*2.80*			
External Wall	*0.60*			
Flat Roof	*0.12*			
Pitched Roof	*0.12*	*Pitched roof - Slates or tiles, , ventilated air space, 100mm insulation between joists, 9.5 mm plasterboard*		
Internal Wall	*0.50*			
Party Wall	*0.50*			
Roof Glazing	*2.80*			

Estimated Fuel Price Comparison Calculations

Energy Requirement (heating)		33317	kWhr/yr
Energy Requirement (hot water)		2534	
OIL			
Price of oil per litre		£0.82	
kWhr per litre		10.27	kWhr
Boiler Efficiency of existing Oil Boiler		88.00%	% SEDBUK
Efficiency of new Oil boiler		88.00%	% SEDBUK
	existing	9.04	kW hrs per litre oil
	new	9.04	kW hrs per litre oil
	existing	£0.09	£ per kWhr
	new	£0.09	£ per kWhr
ELECTRICITY / HEAT PUMP			
Price of Unit of electricity		£0.34	
SPF SH		369.00%	
COP HW @ flow temp		356.00%	
Energy Requirement (SH)		9028.87	kWhrs annual demand (Inc hot water)
Energy Requirement (HW)		711.80	
Cost Htg Pump (£)		£40.82	
Cost Ground Pump (£)		£0.00	
Cost Immersion (£)		£27.94	
GAS (natural)			
Efficiency of proposed boiler (New)		90.00%	% SEDBUK
Price of Gas per kWhr		£0.10	
Energy Requirement		39833.94	kWhrs annual demand (Inc hot water)
GAS LPG			
Price of LPG per litre		0.75	Bulk purchase
kWhr per litre		6.60	Std Conversion
Boiler Efficiency		90.00%	Assumed if very new
		5.94	kW hrs per litre lpg
		0.13	Pence per kWhr
ELECTRIC BOILER			
Price of Unit of electricity		£0.34	
Energy Requirement		35851	kWhrs annual demand (Inc hot water)
ANNUAL COSTS			
New Electric Boiler		£12,308.88	Electric
New High Efficient Gas Boiler		£4,215.42	Gas
Proposed Heat Pump		£3,393.06	Heat Pump
New High Efficient LPG Boiler		£4,567.41	LPG Gas
New High Efficient Oil Boiler		£3,293.62	Oil
CO2 EMISSIONS			
Electric		0.494	kg CO2/kWh 35850.54 kWhrs
Gas		0.185	kg CO2/kWh 39833.94 kWhrs
Heat Pump		0.494	kg CO2/kWh 9740.67 kWhrs
LPG Gas		0.215	kg CO2/kWh 39833.94 kWhrs
Oil		0.247	kg CO2/kWh 40739.25 kWhrs
New Electric Boiler		17710.17	CO_2 New Electric Boiler
New High Efficient Gas Boiler		7369.28	CO_2 New High Efficient Gas Boiler
Proposed Heat Pump		4811.89	CO_2 Proposed Heat Pump
New High Efficient LPG Boiler		8564.30	CO_2 New High Efficient LPG Boiler
New High Efficient Oil Boiler		10062.60	CO_2 New High Efficient Oil Boiler



End of Presentation

Hungerford Hub Heating System Visit….

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