Ground Source Now 2011:
What did the Energy Saving Trust Field Trials really say?

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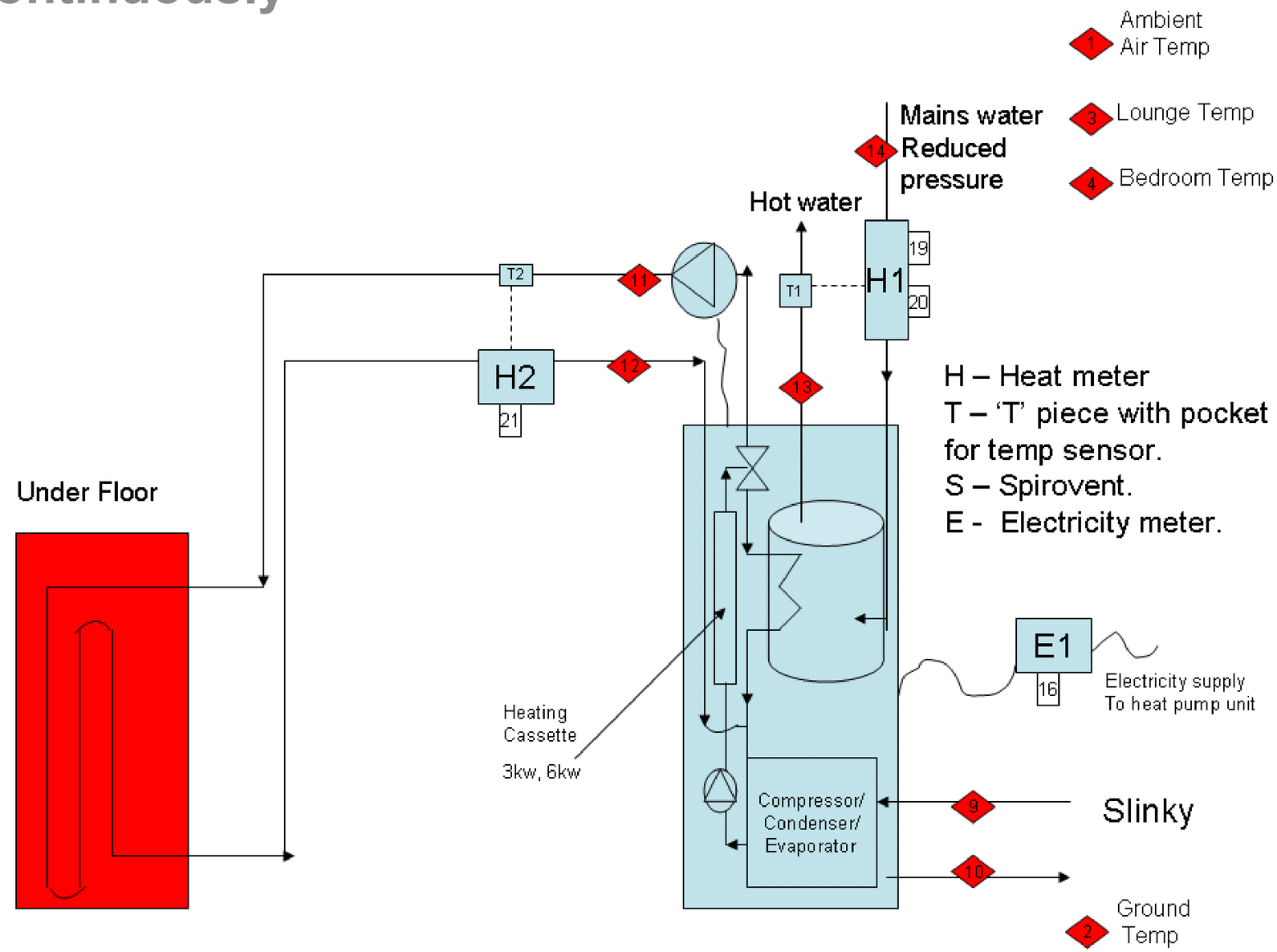
27th June 2011

Case study 1: A barn conversion, heated continuously

- 4-bed detached house
- 11kW GSHP
- 3 no. 50m slinkies
- Supplies DHW and underfloor heating
- Wood-burning stove

Case study 1: A barn conversion, heated continuously



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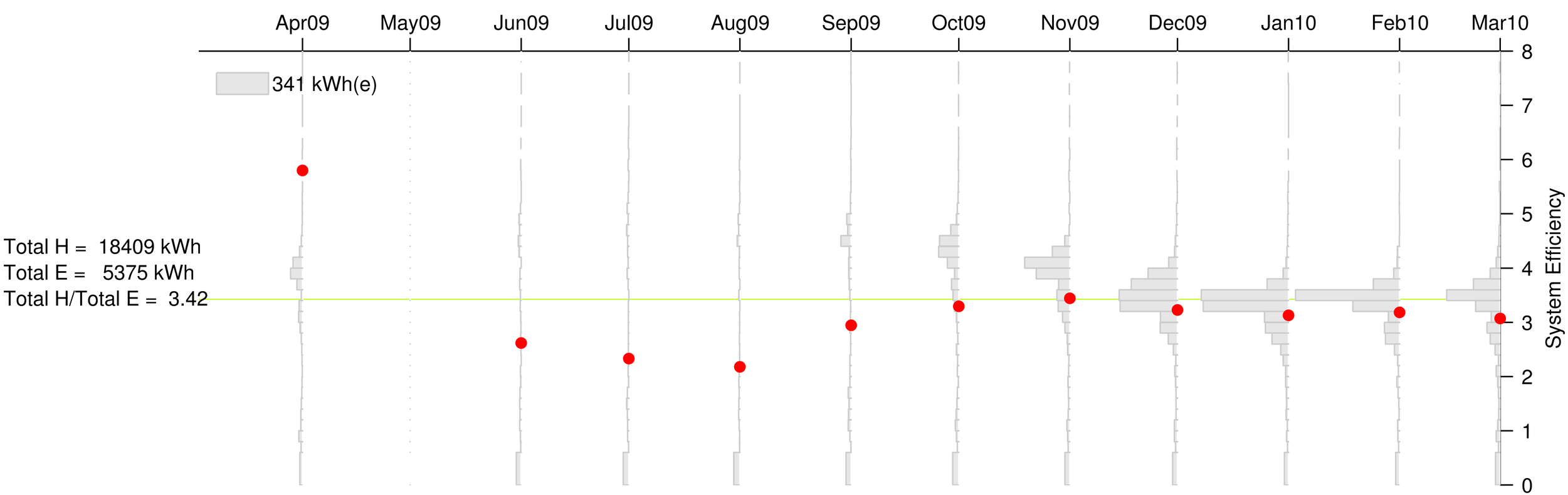

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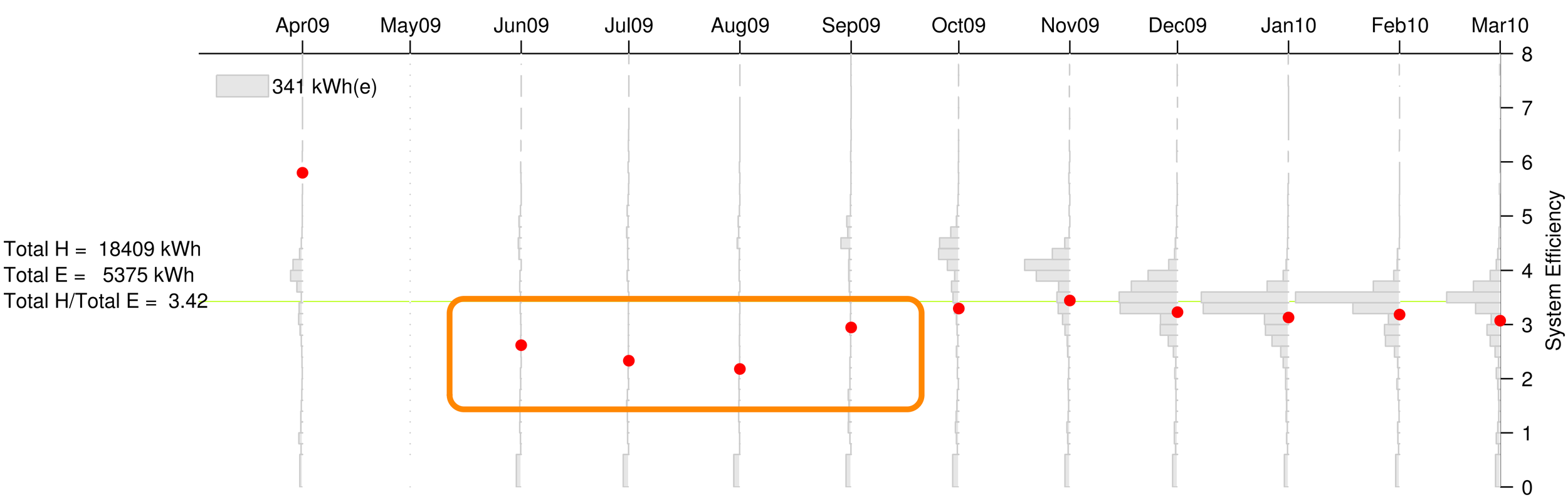

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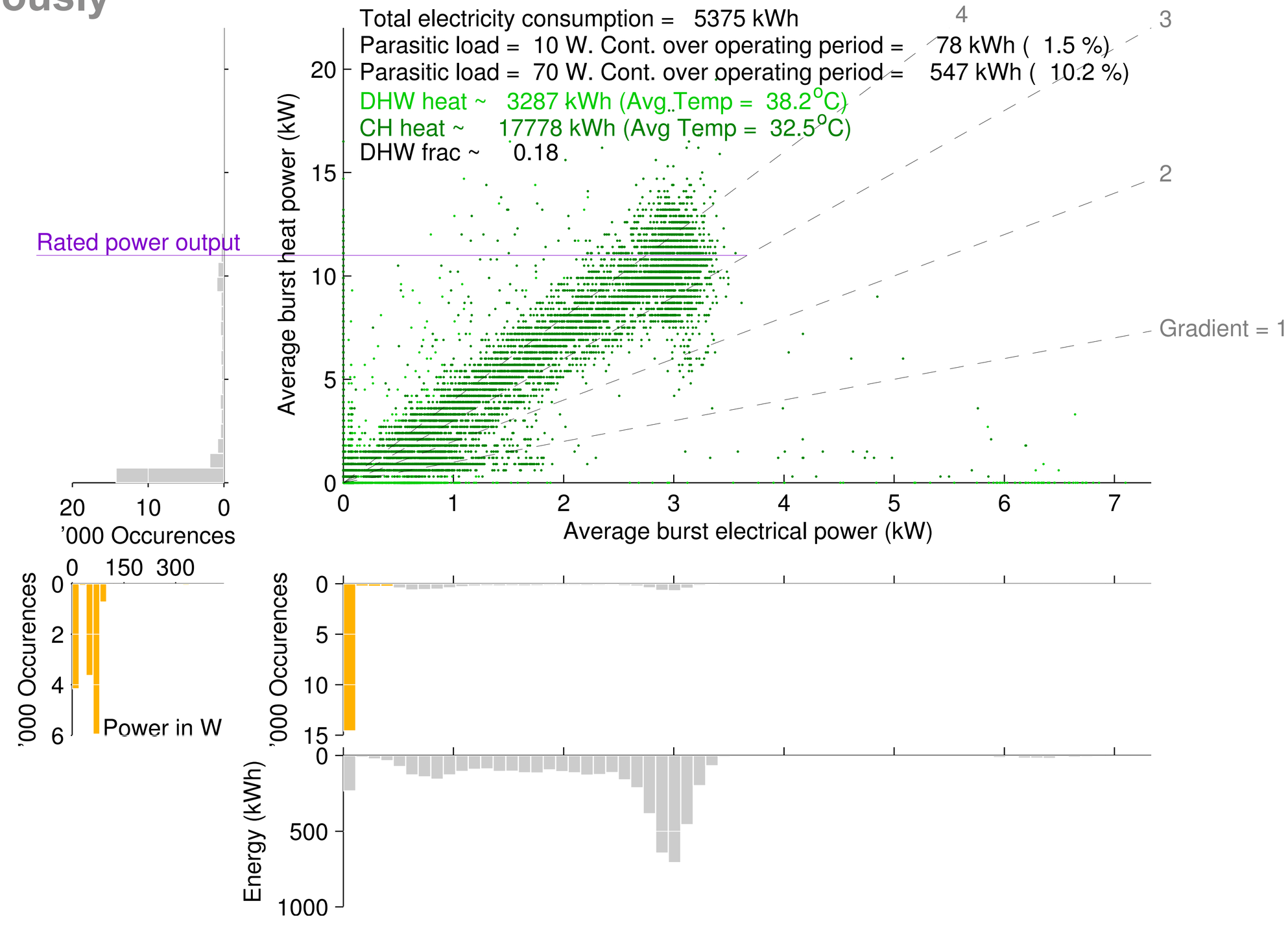

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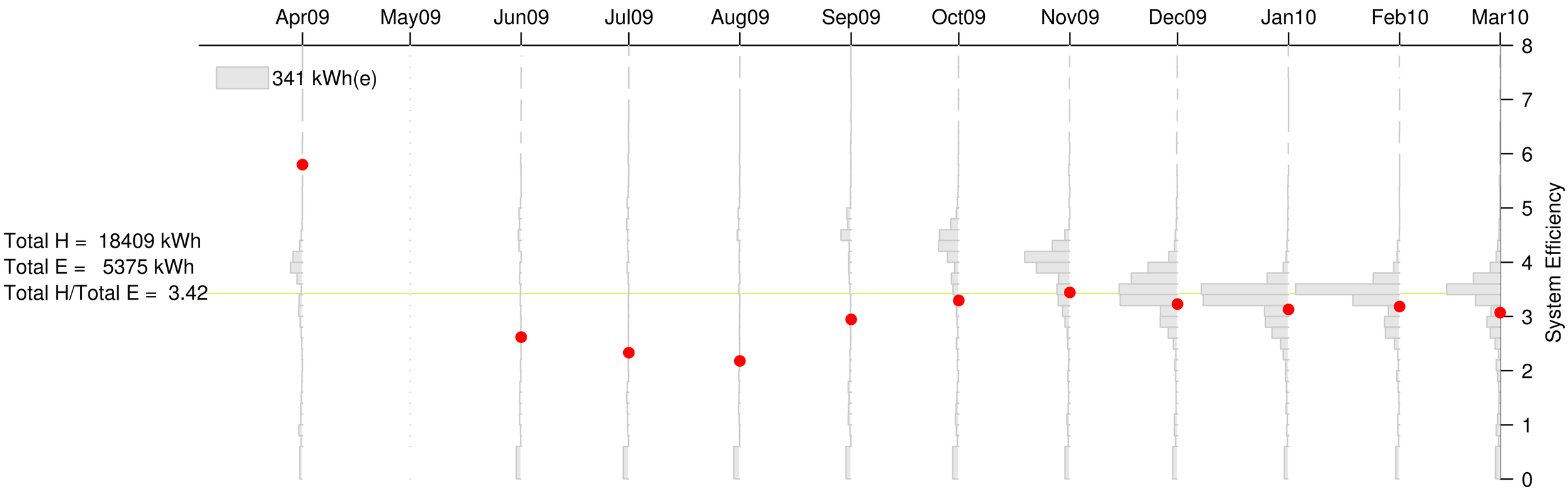
What happens to the system efficiency of this system on the coldest day?



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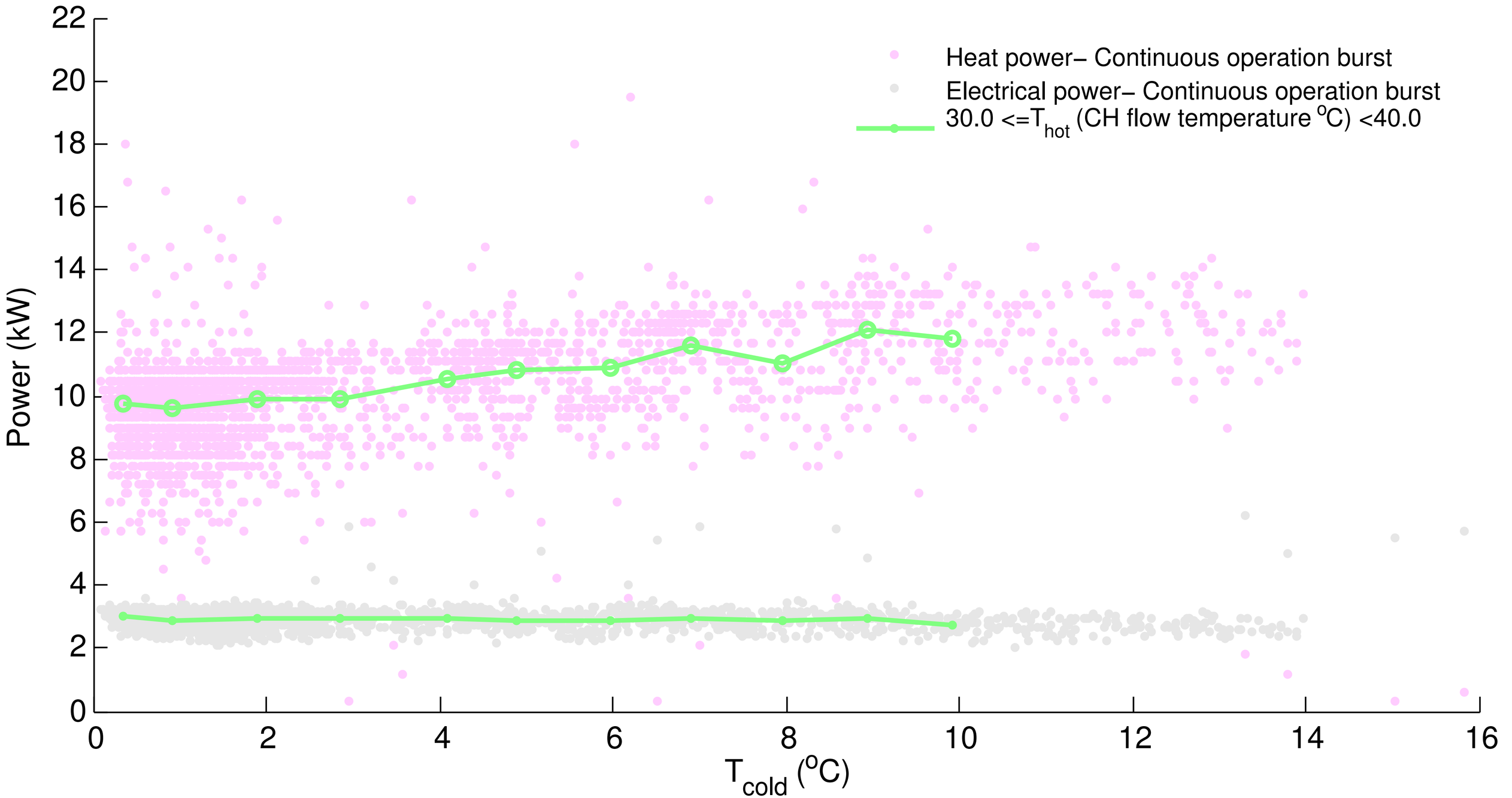

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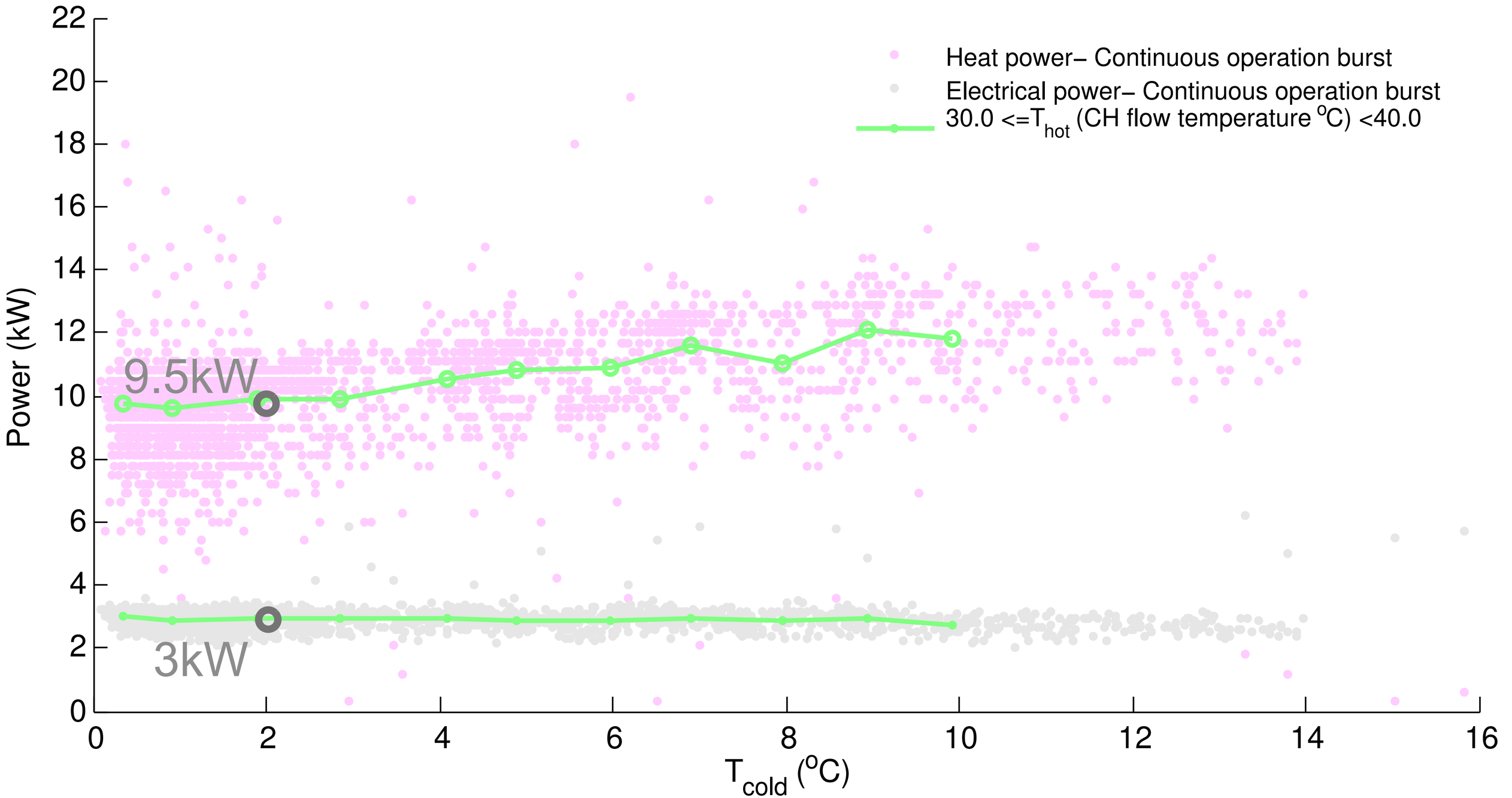
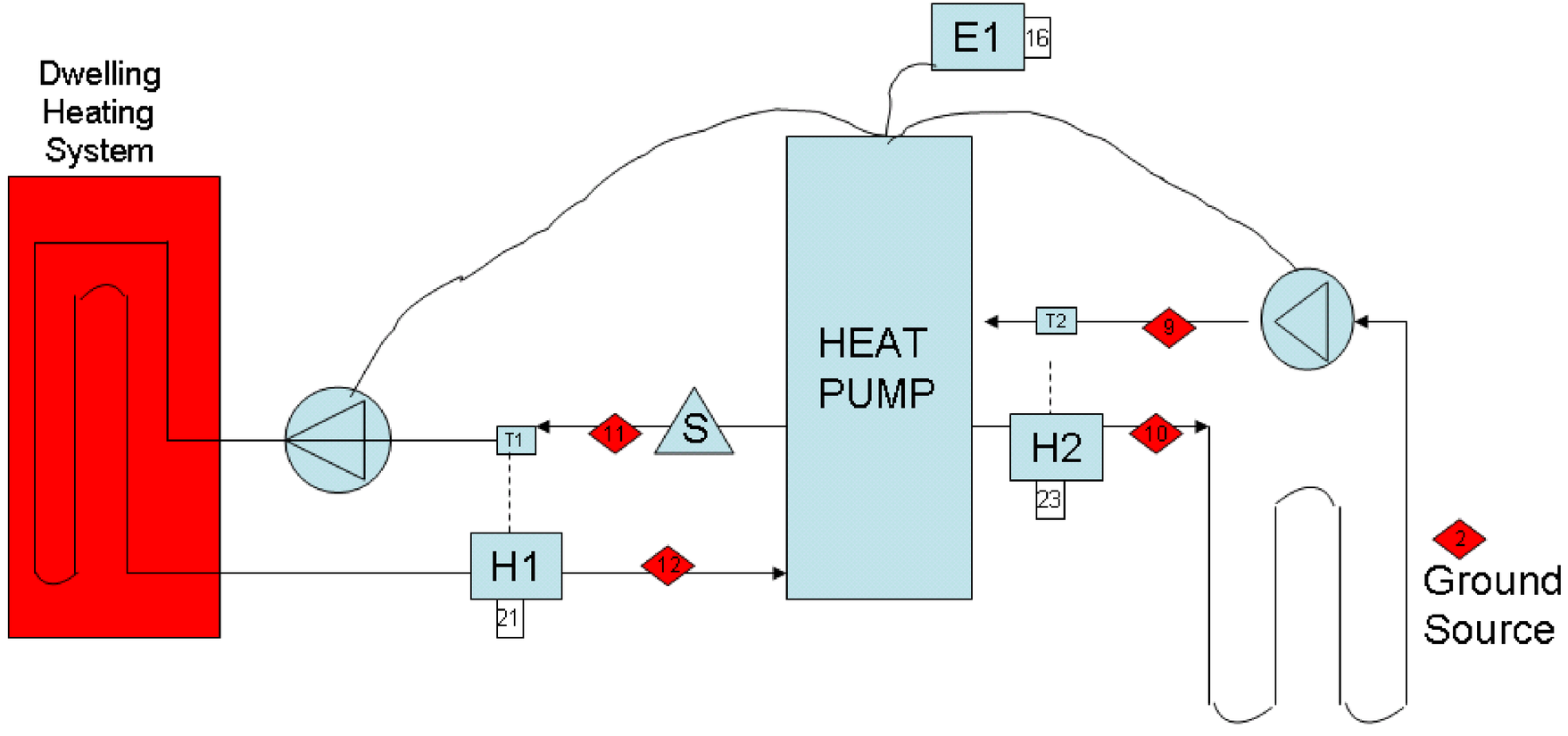


Case study 2: Screed underfloor system (CH only) on Economy 10 tariff

- 2-bed semi-detached barn conversion
- 8kW GSHP
- 2 no. 40m slinkies
- Supplies underfloor heating only
- Wood-burning stove



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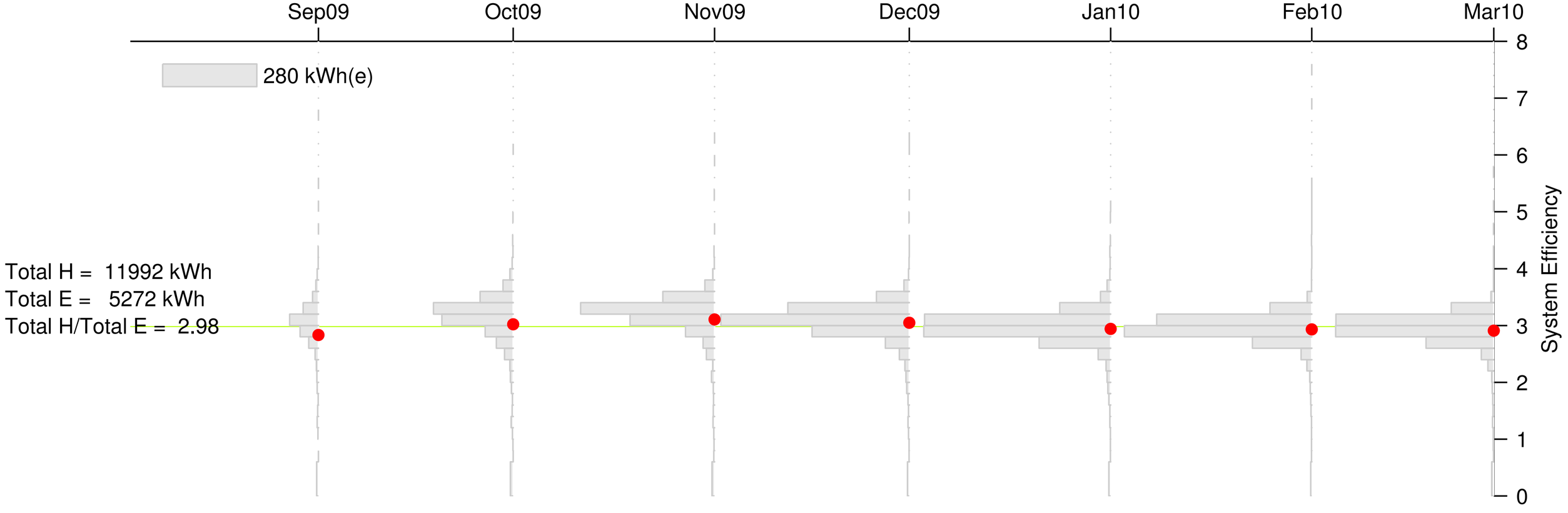
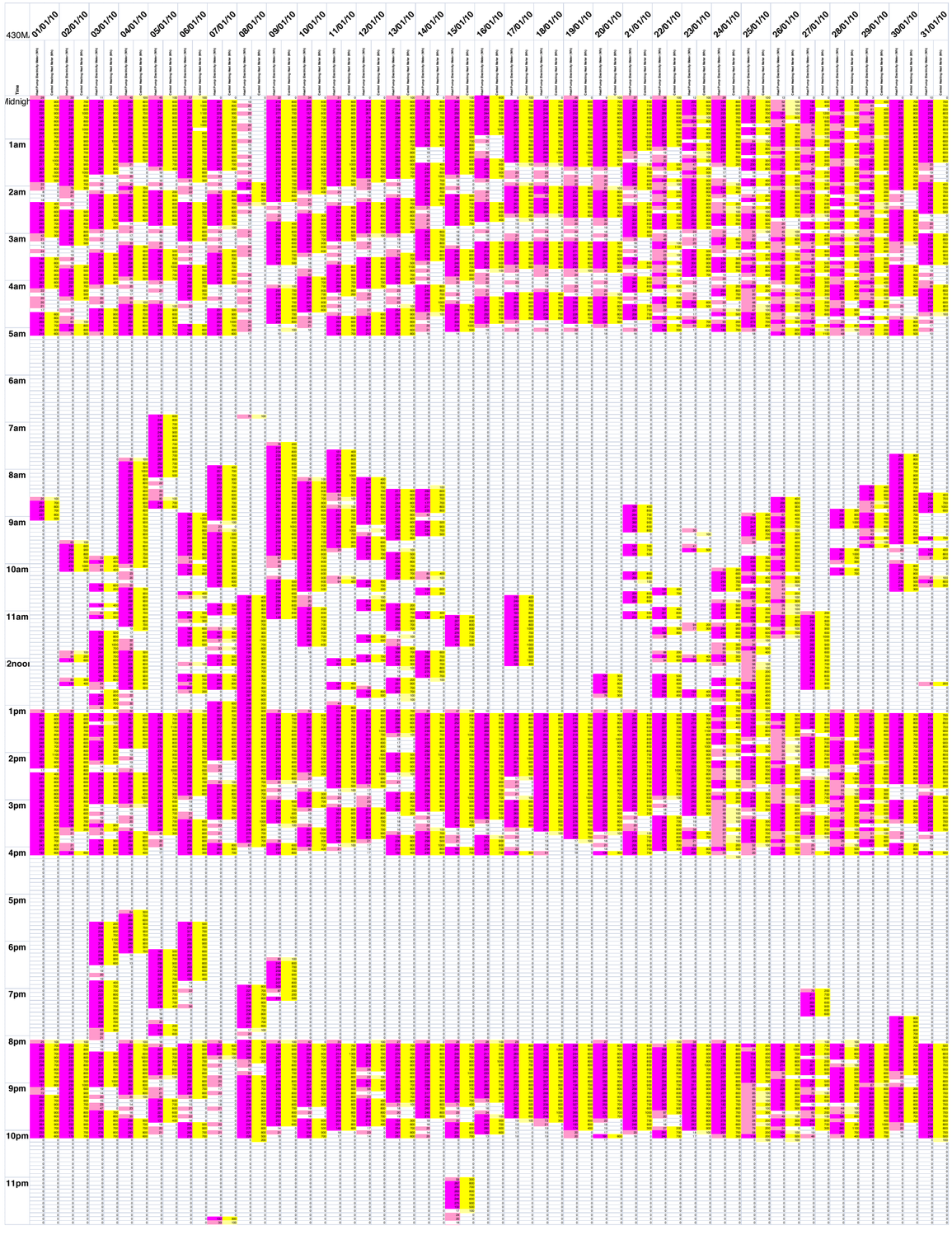


Case study 2: Screed underfloor system (CH only) on Economy 10 tariff

- Economy 10 tariff
- 35°C underfloor heating temperature on 1st Jan 2010
- 1°C minimum ground return temperature on 1st Jan 2010
- BUT 250W parasitic load



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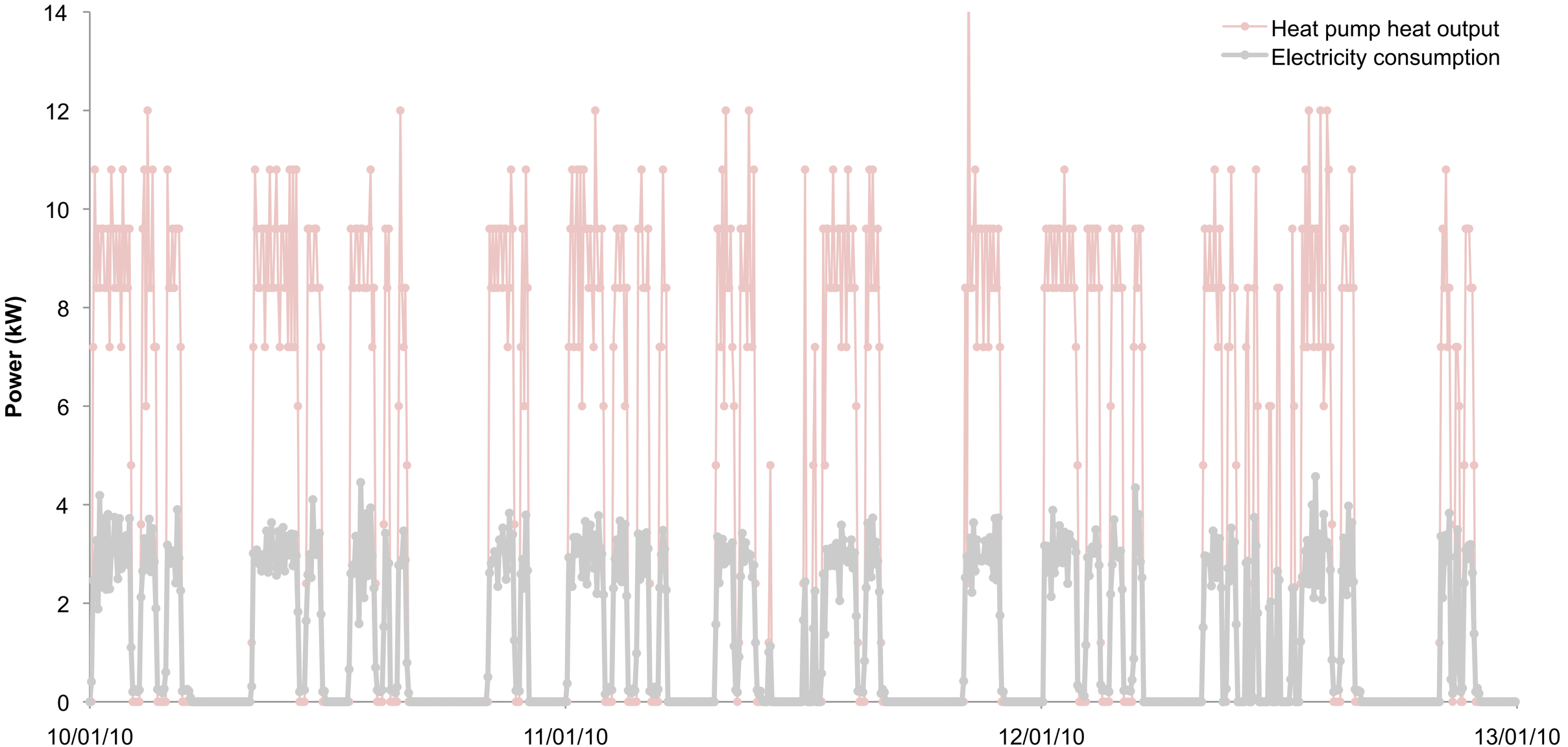

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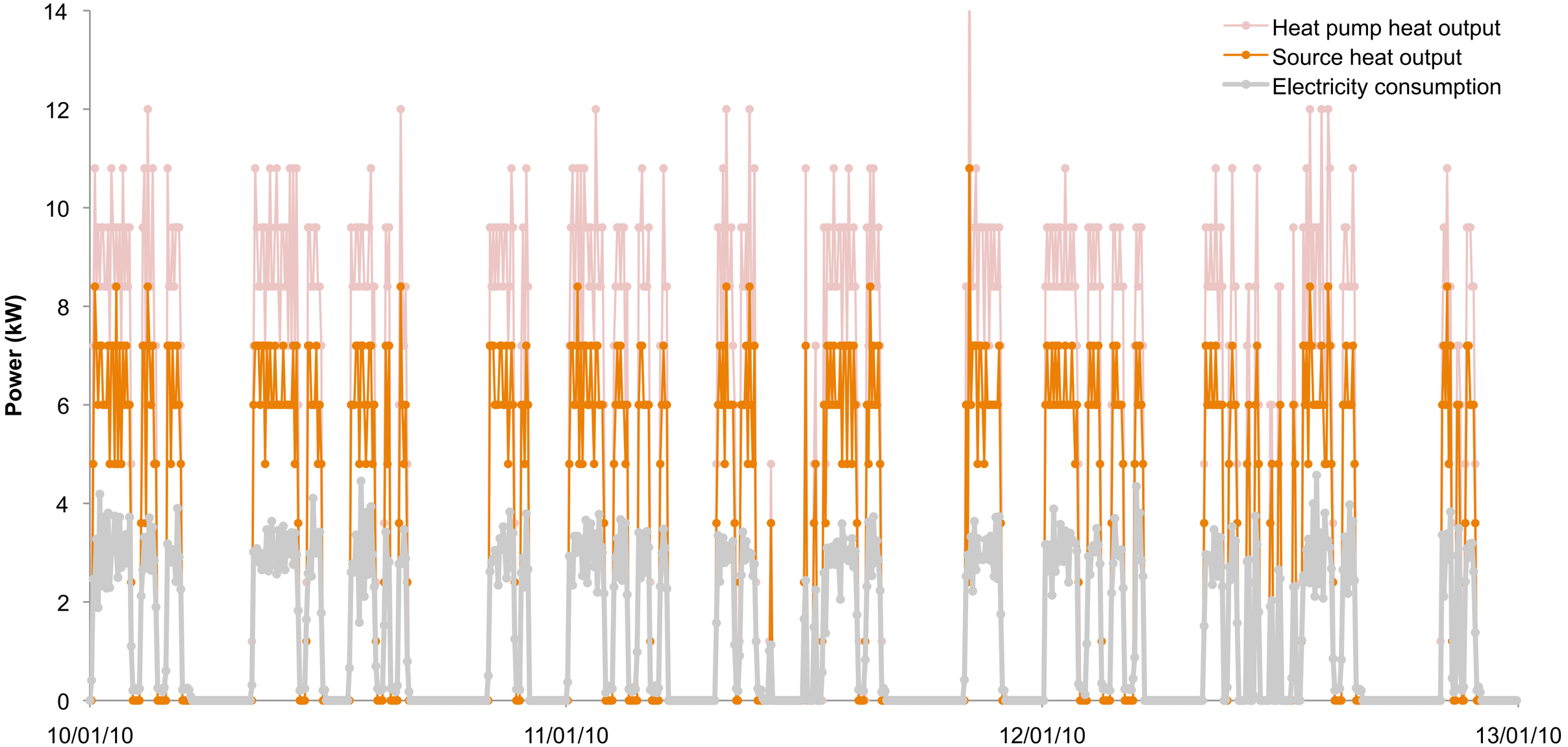

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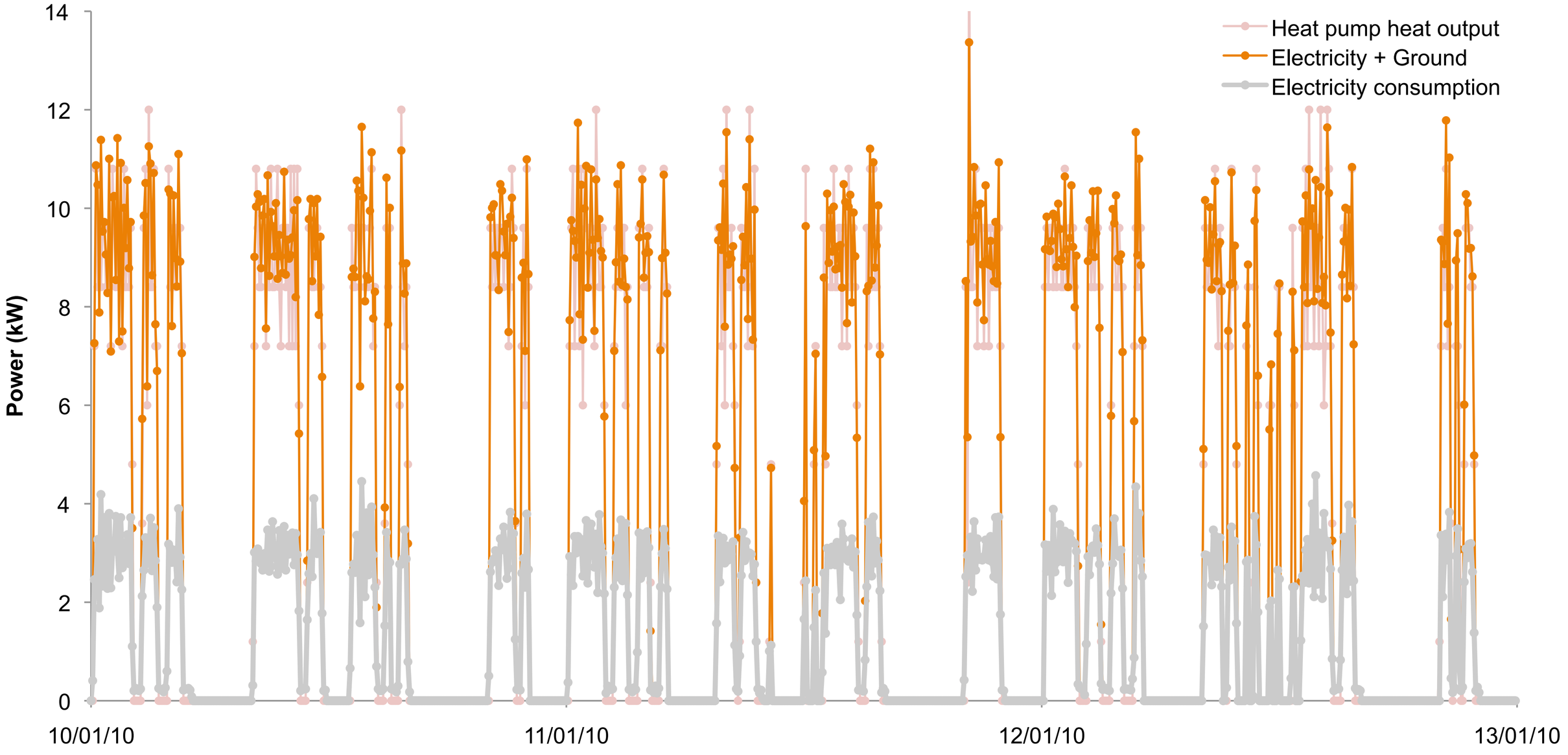
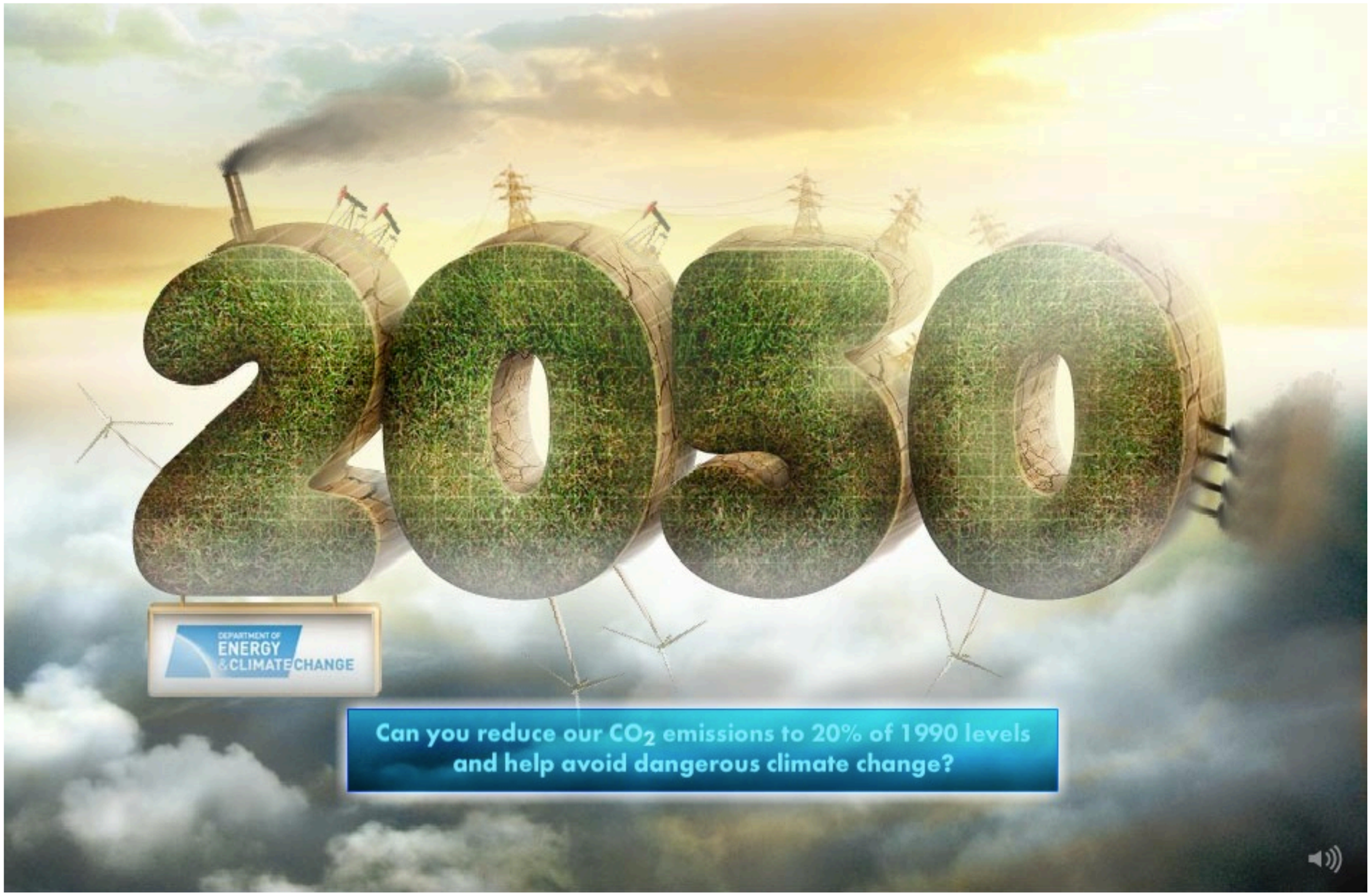


Overview

- Some examples of GSHPs performing well
- Why does DECC care so much?
- What causes poor performance?
    - Incorrectly design/installed ground loops
    - Insufficient HP capacity
    - High emitter temperatures
- What are we doing about it?
    - Major MCS installer standard revision (MIS 3005)
    - Closely monitoring the Renewable Heat Premium Payment
-

Why does DECC care so much?

DECC's latest 2050 publication: My2050



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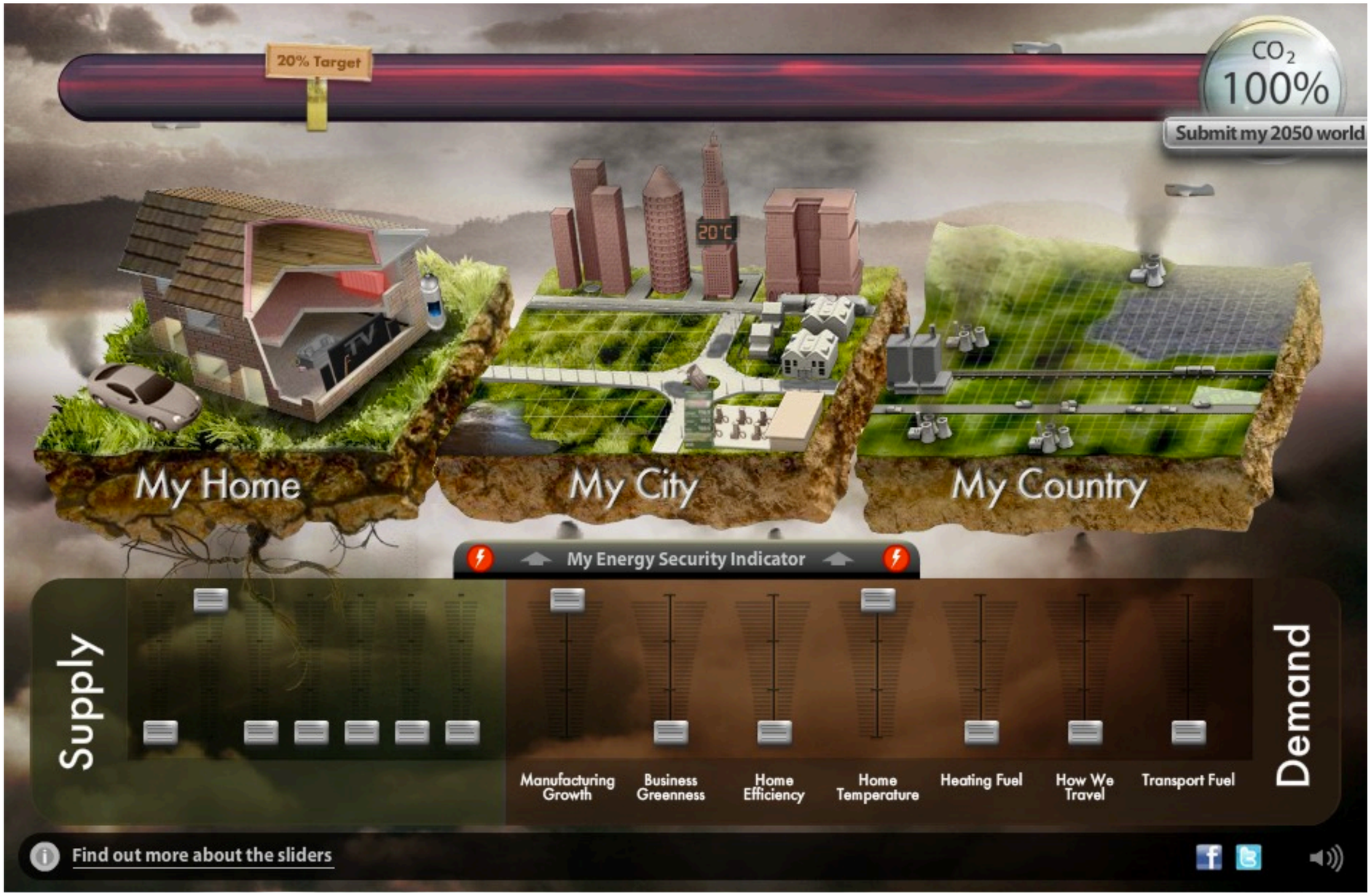

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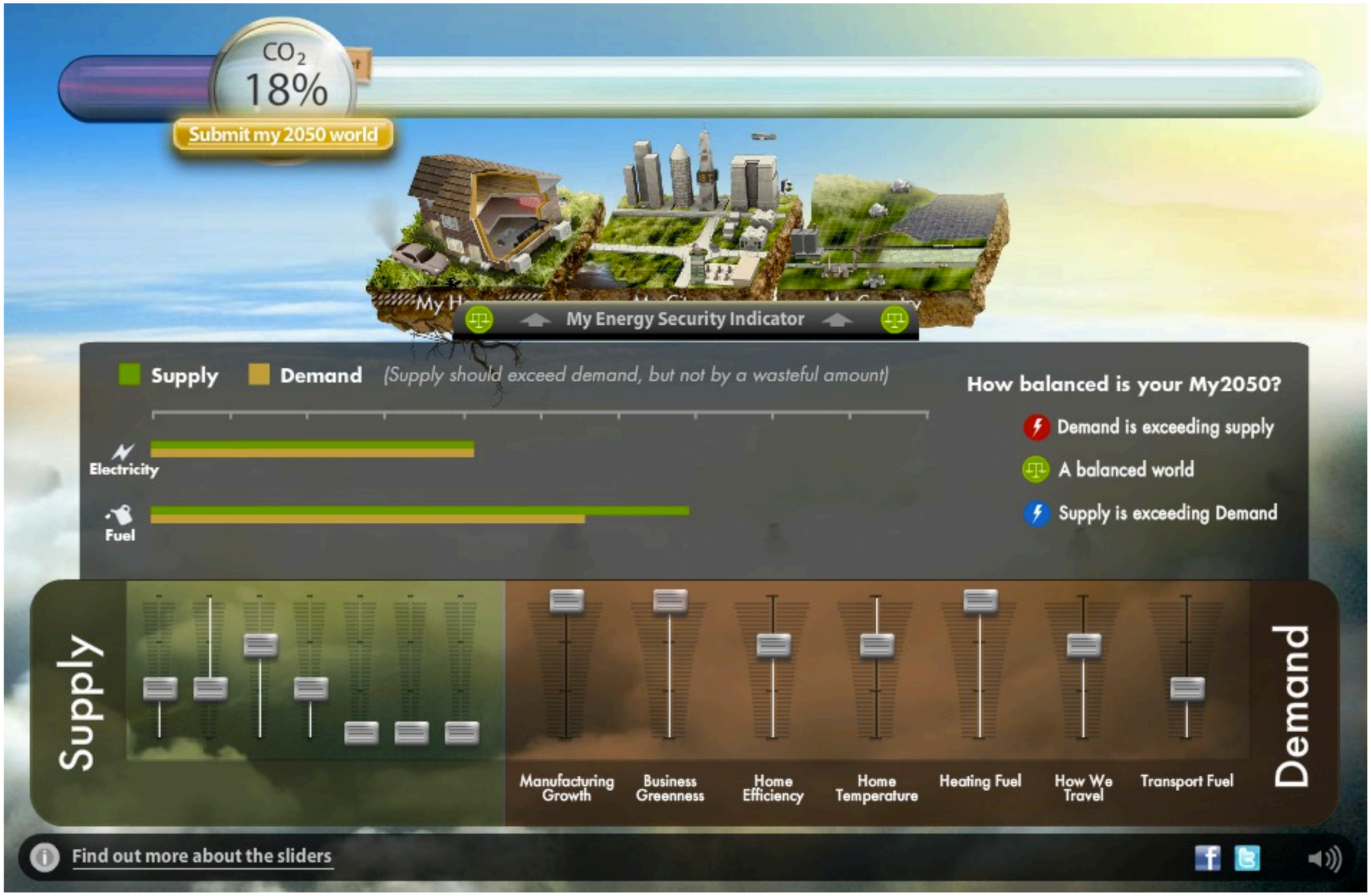
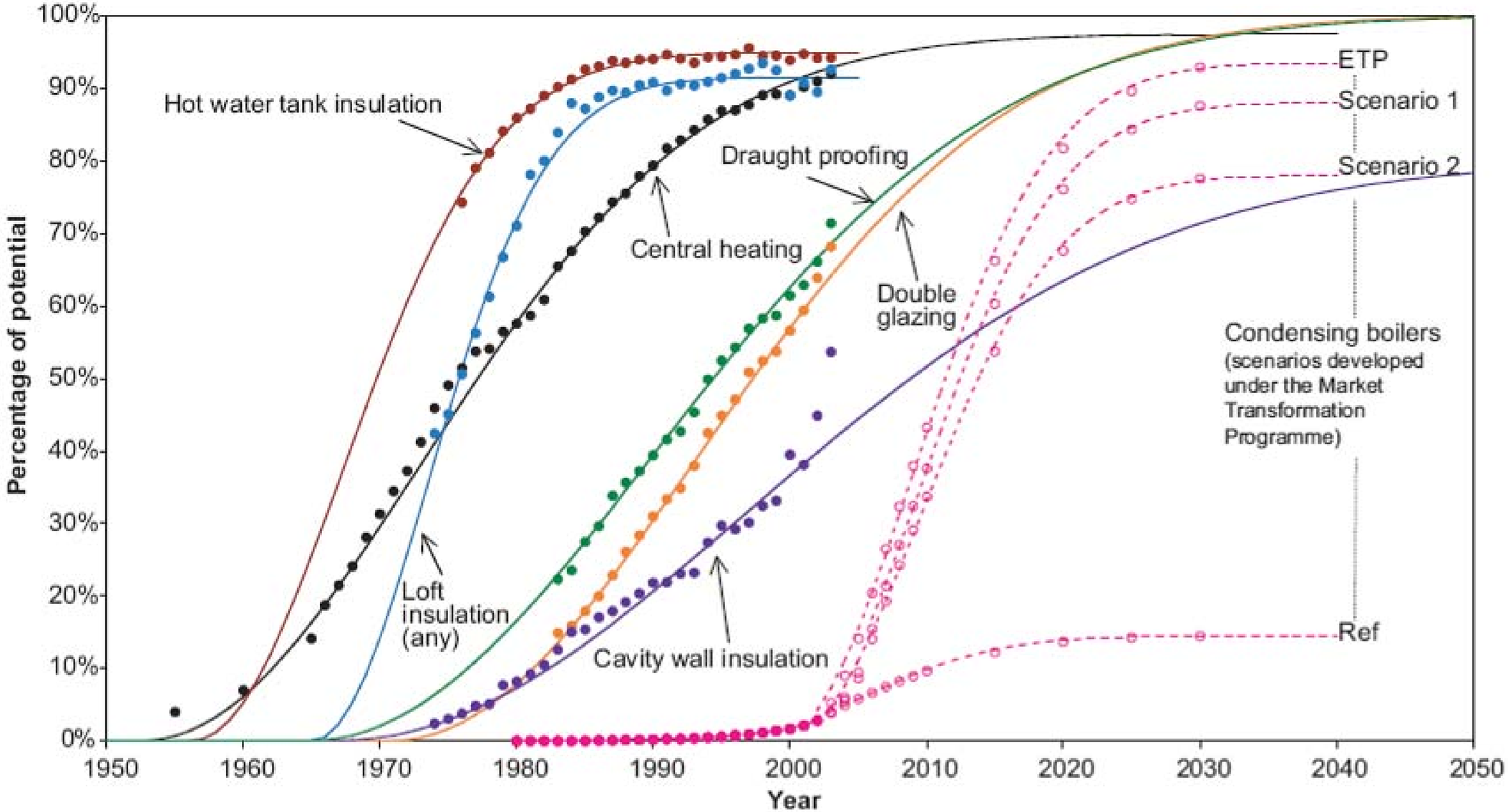


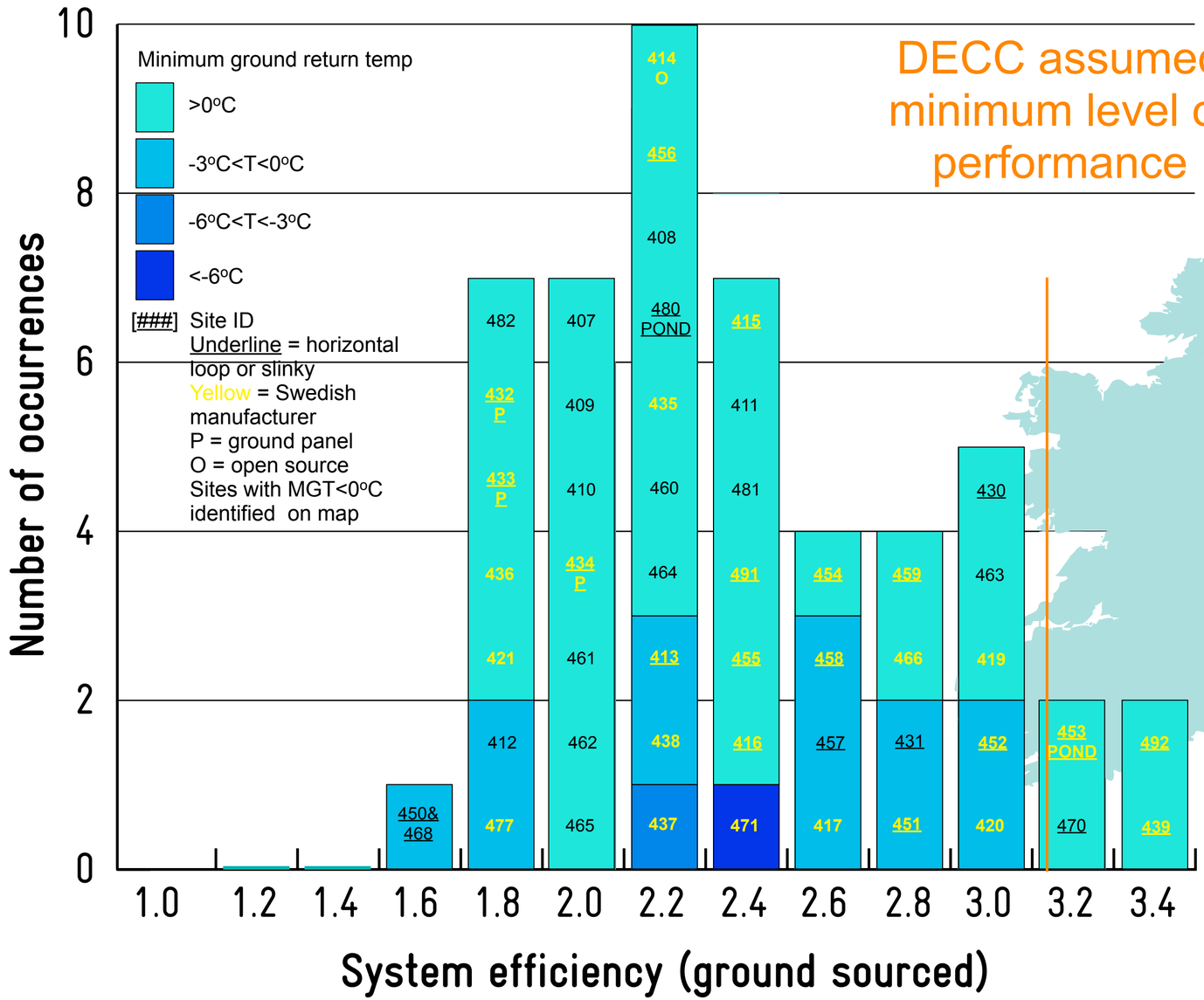
How long will 60-80% penetration of heat pumps take?



Prof. Dennis Loveday. Market penetration of home energy-efficiency related measures

Does measured performance build consumer confidence?

DEPARTMENT OF ENERGY & CLIMATE CHANGE



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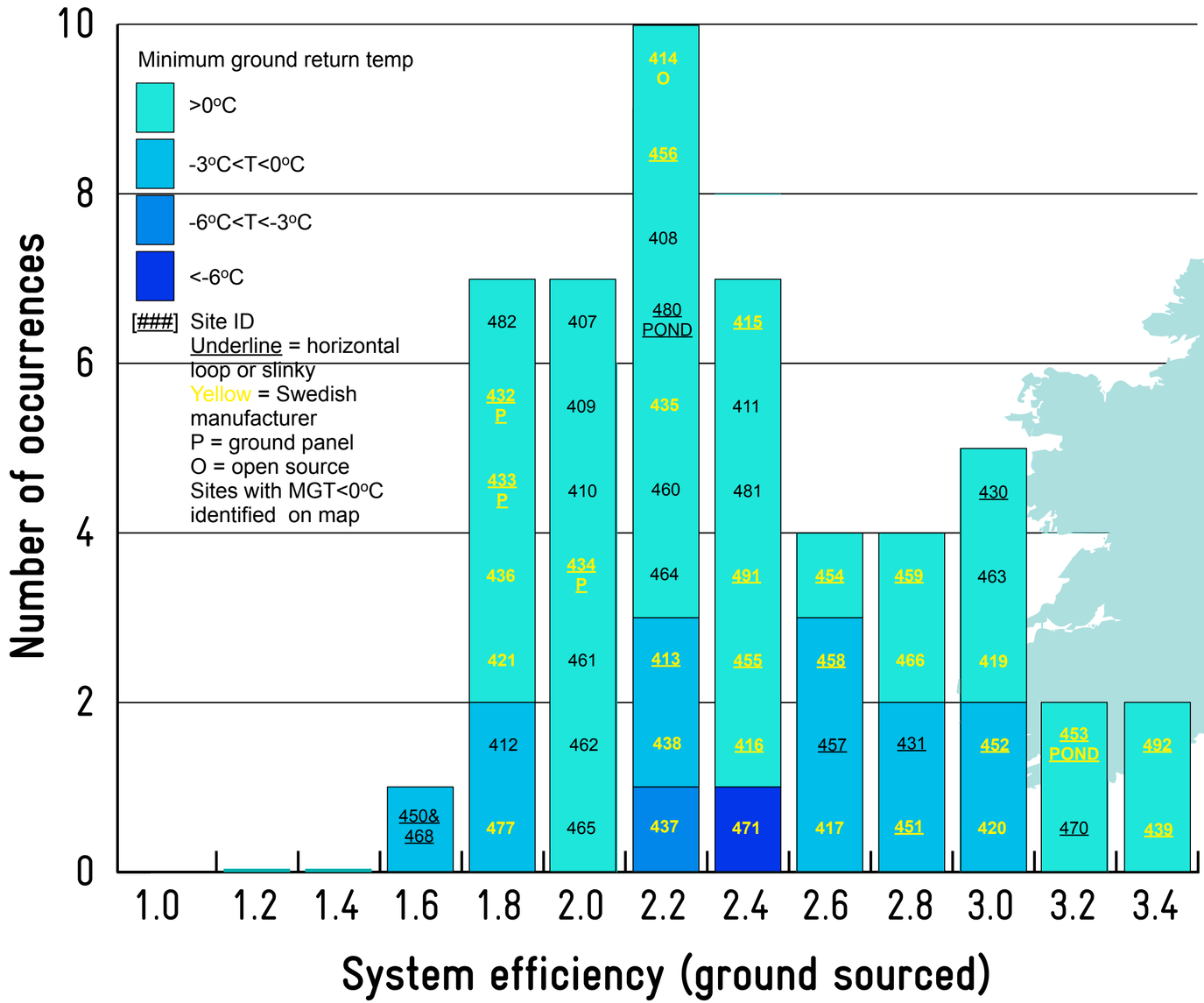
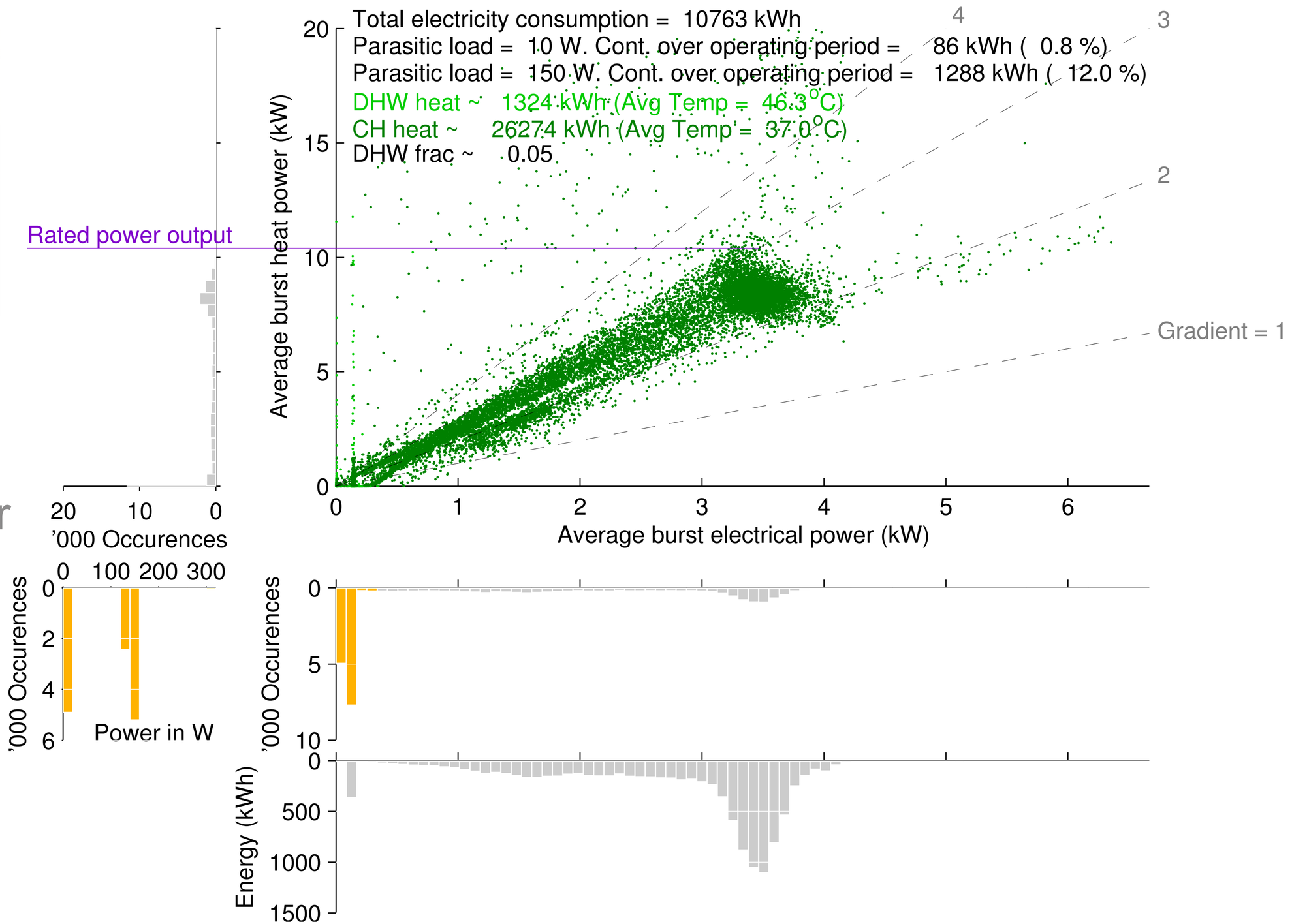


Case study 3: Poor ground loop design

- GSHP
- Semi-detached
- Integrated solar hot water
- DHW + underfloor + rads
- Coaxial borehole?



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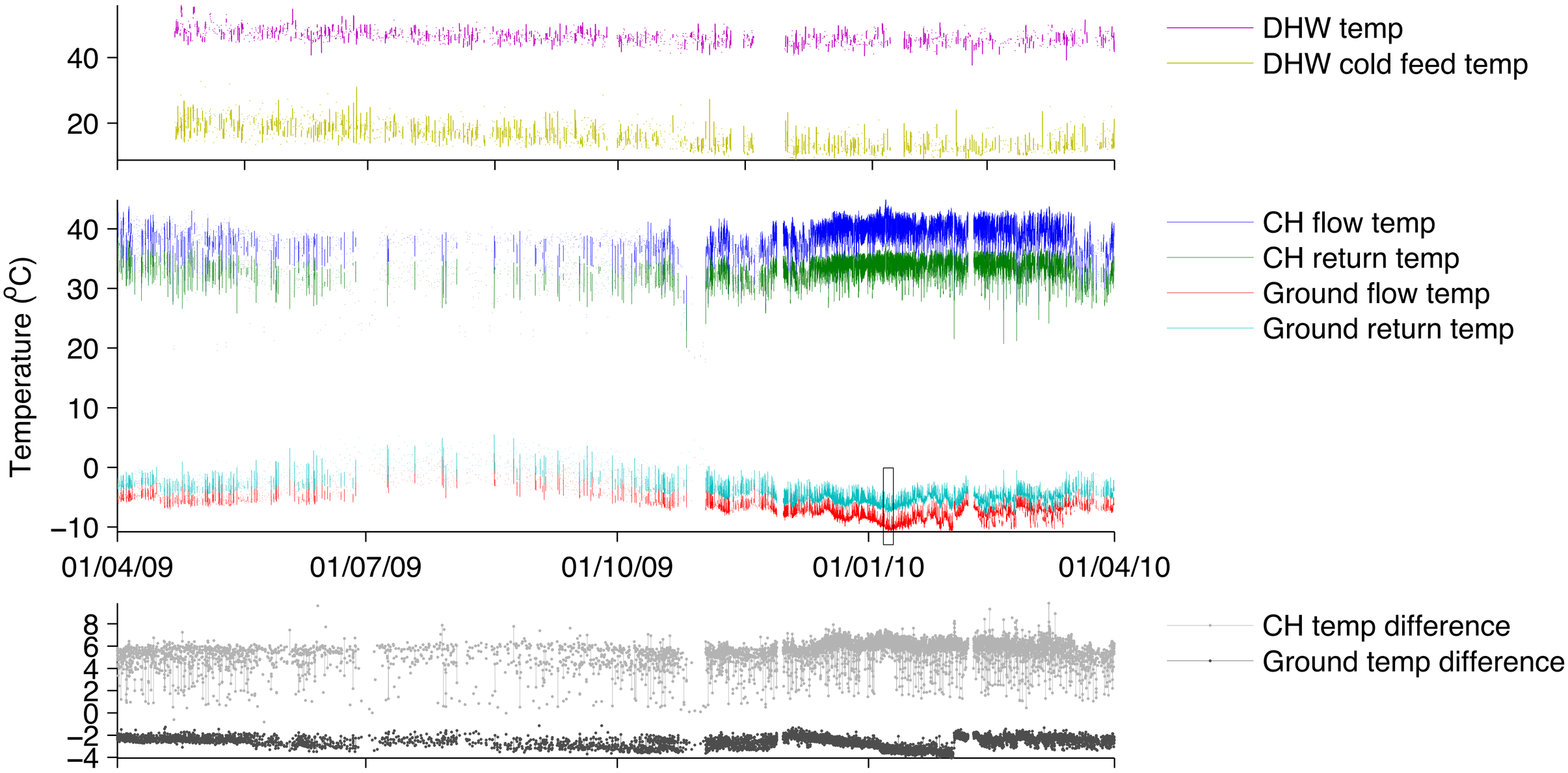

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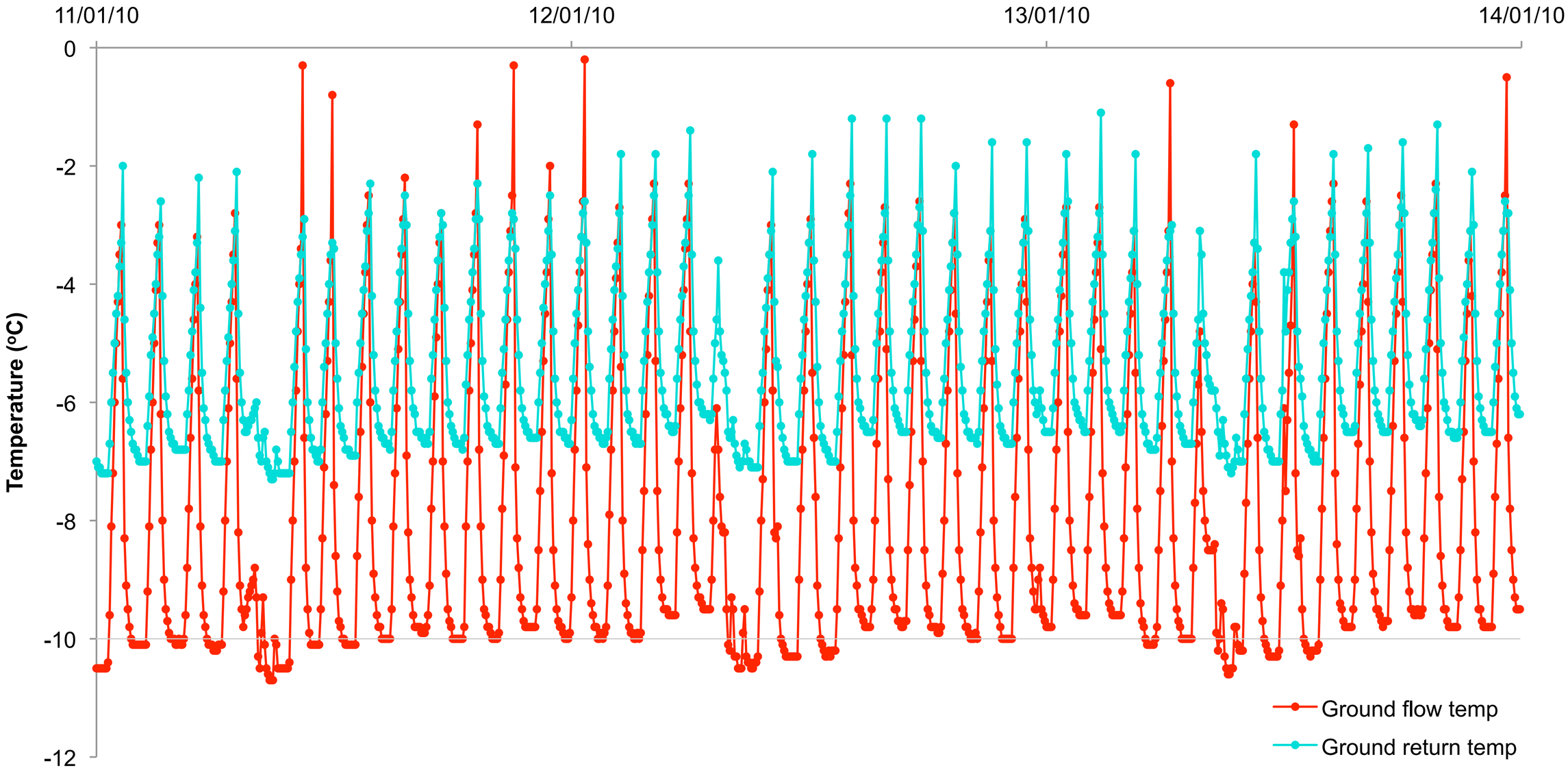
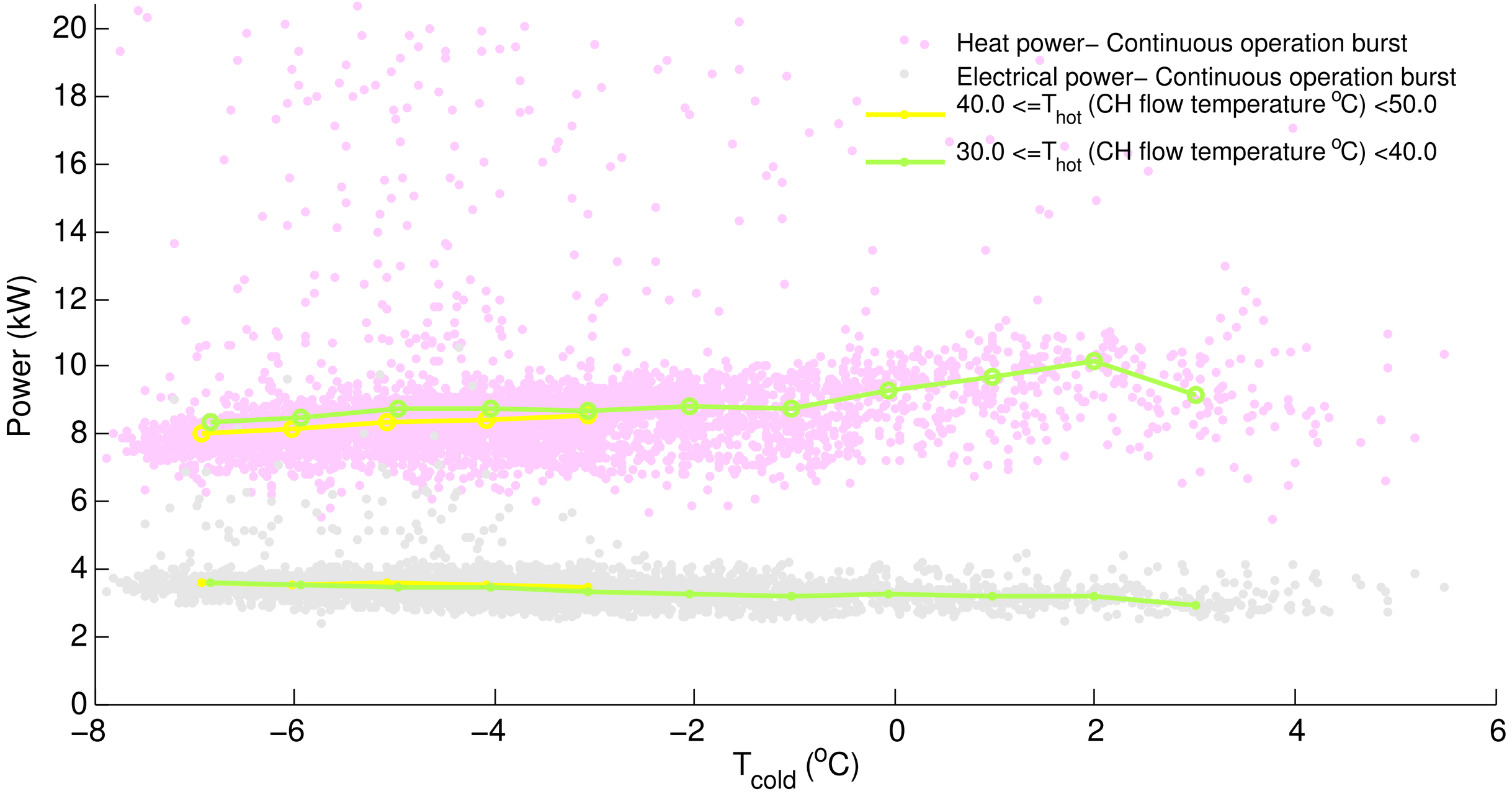


Case study 3: Poor ground loop design: what happens on the coldest day?



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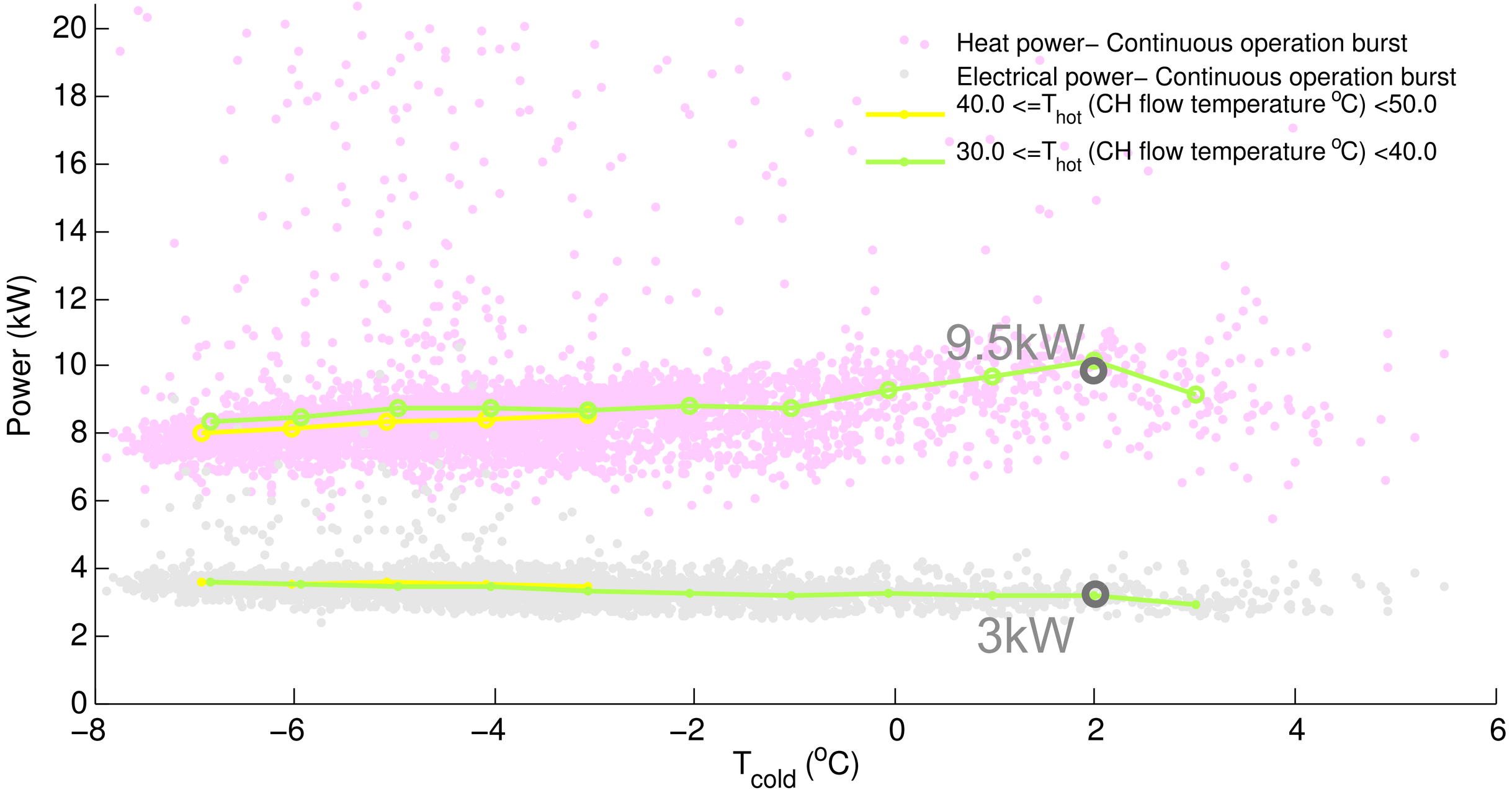

Case study 3: Ground loops: borehole design

- This heat pump requires frequent manual reseting
- System efficiency could increase from ~2.5 to ~3.2 if the ground collector was fixed.
- Several other systems with sub-zero ground return temperatures for large fractions of the year.
- Horizontal ground collectors are also poorly sized.

Case study 4: Impact of direct electric top-up (undersizing)

- 5kW GSHP
- 3-bed detached house
- Supplies DHW and underfloor heating
- 300m horizontal ground loop
- Wood-burning stove
- RdSAP rating = C

Case study 4: Impact of direct electric top-up (undersizing)

- 5kW GSHP
- 3-bed detached house
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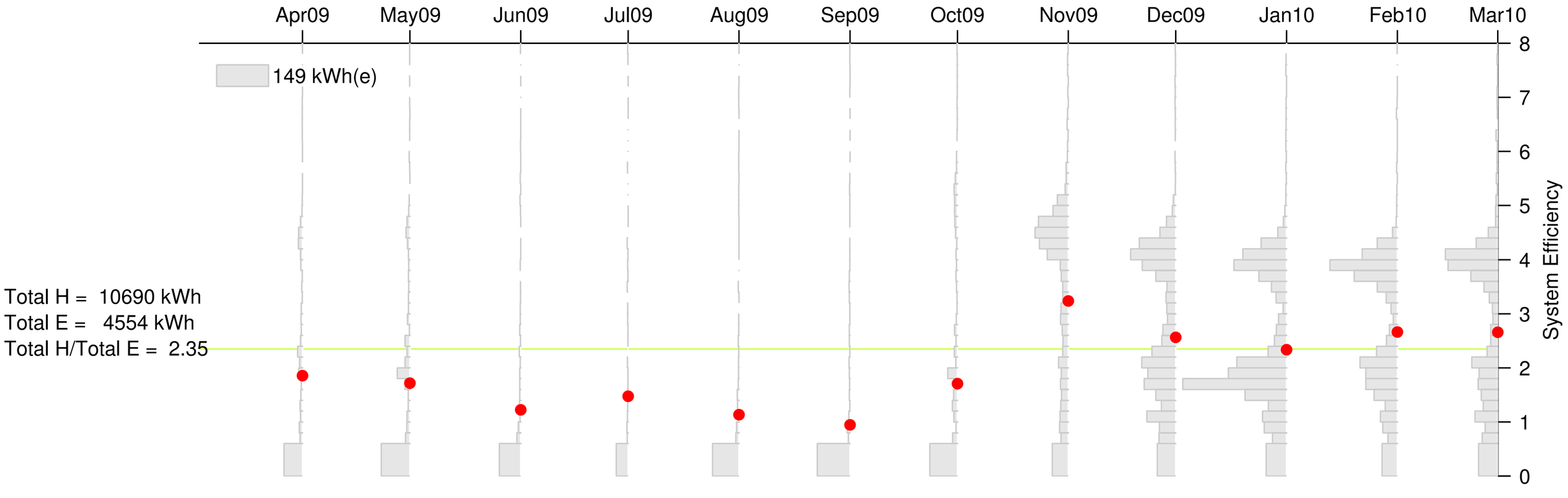
- RdSAP rating = C



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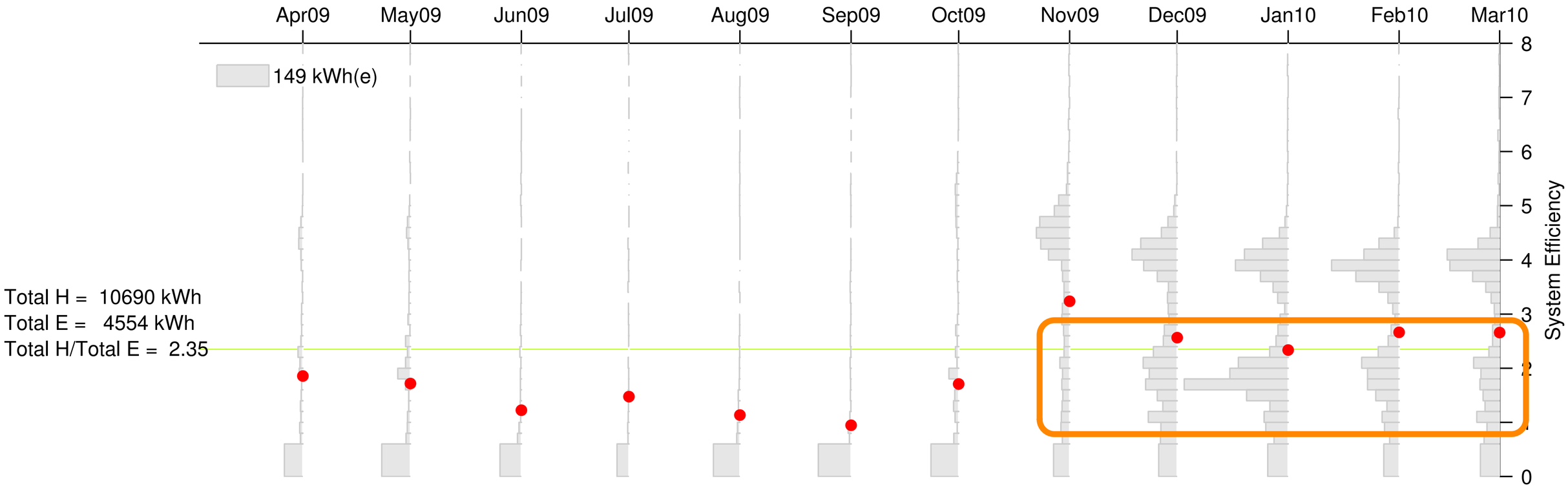

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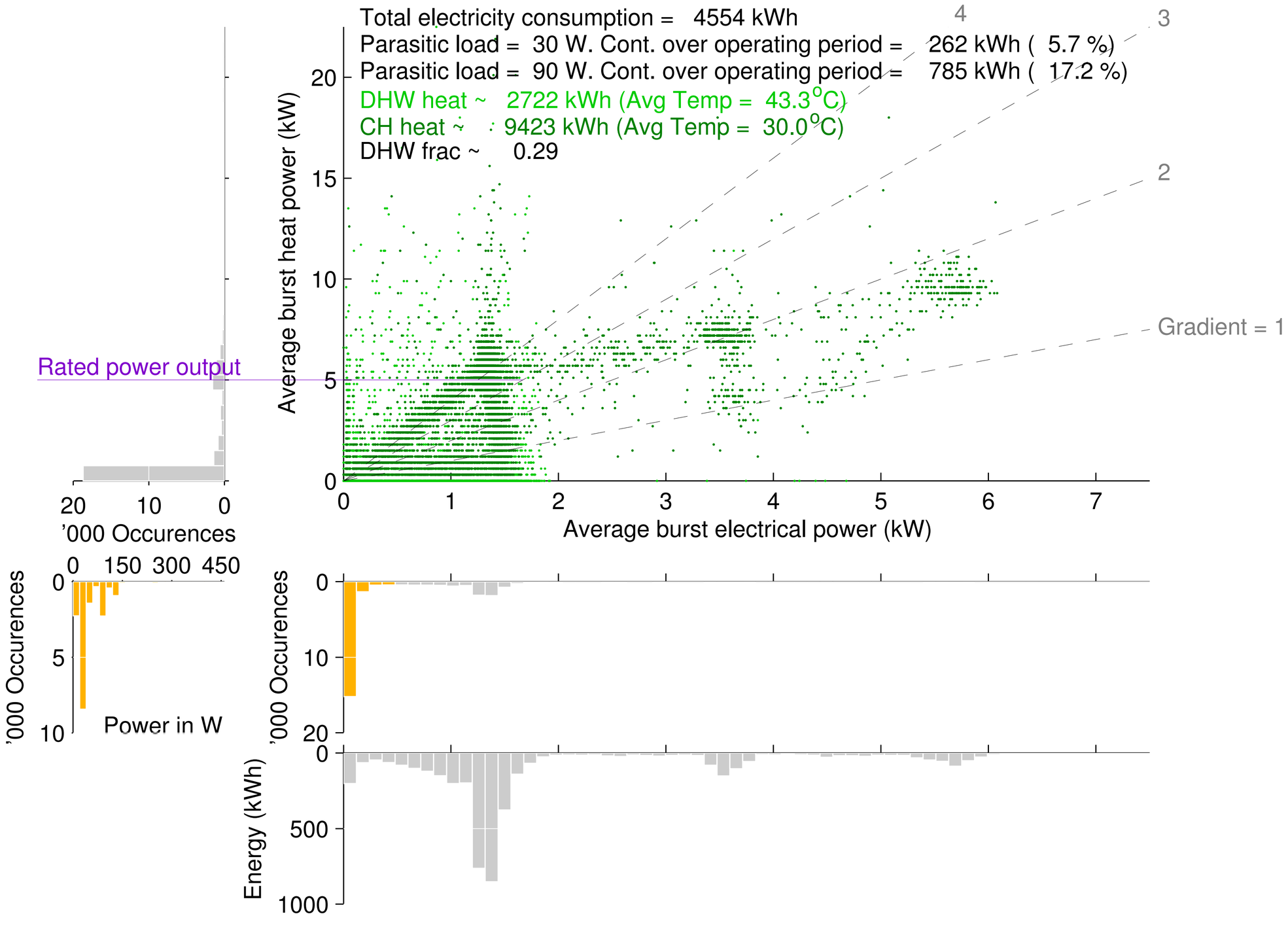

What are we doing about it?

Emitter guide- reduce room heat loss and design for a low emitter temperature

Shall determine room specific heat loss

Shall identify emitter

Should explain selection

Heat Loss of 50 watts per square metre as taken from heat loss calculations per BSEN12831

Efficiency Rating	GSHP Likely SPF	ASHP Likely SPF	Flow Temperature To Heating System °C	Return Water Temp °C
Highest efficiency ★★★★★★	4.3	3.6	35	30
★★★★★☆	4.1	3.4	40	35
★★★★☆☆	3.7	3	45	40
★★★☆☆☆	3.4	2.7	50	45
★★☆☆☆☆	3.1	2.4	55	50
Lowest Efficiency ★☆☆☆☆☆	2.8	2.1	60	55

UFH Screed Floor with TILE	UFH Screed Floor with WOOD	UFH Screed Floor with CARPET
PS≤300	PS≤100	
PS≤300	PS≤200	PS≤150
PS≤300	PS≤300	PS≤300
PS≤300	PS≤300	PS≤300
PS≤300	PS≤300	PS≤300
PS≤300	PS≤300	PS≤300

UFH Alu-panel with TILE	UFH Alu-panel with WOOD	UFH Alu-panel with CARPET
PS≤100		
PS≤200		
PS≤200	PS≤200	PS≤150
PS≤300	PS≤200	PS≤200
PS≤300	PS≤300	PS≤300
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Fan Coil Unit (correction factor)	Domestic Fan Convector/Fan Assisted Radiator (correction factor)	Standard Radiator (correction factor)
0.21	0.25	0.16
0.29	0.35	0.26
0.38	0.45	0.35
0.47	0.55	0.46
0.56	0.65	0.57
0.65	0.75	0.69

Shall communicate “temperature star rating”

Shall communicate Likely SPF

Should show the relevant table from the emitter guide

Should explain the emitter guide

Tabell 9.12. Riktlinjer för dimensionering av bergvärmesystem i zon II enligt KYS (1999) avseende maximalt värmeuttag per meter aktivt borrhål (W/m) under förutsättning att inkommande värmebärartemperatur till värmepumpen ej understiger -5 ºC och att maximalt uttagen energimängd under året ej överstiger 150 kWh/m.

Effekt-täckning (%)	Energi-täckning (%)	Drifttid VP (timmar)	Maximalt värmeuttag per meter borrhål		
			λ= 2,5 W/(m,K)	λ= 3,0 W/(m,K)	λ= 3,5 W/(m,K)
30	*68*	*5000*	*29*	*34*	*38,5*
40	*80*	*4450*	*29,5*	*34,5*	*39*
50	*88*	*3950*	*30*	*35*	*39,5*
60	*93*	*3500*	*32,5*	*37*	*42*
70	*96*	*3100*	*35,5*	*40,5*	*46*
80	*98*	*2800*	*38,5*	*44,5*	*50*
90	*99*	*2550*	*43*	*49*	*55*
100	*100*	*2400*	*47*	*54*	*60*

Korrigering av aktivt borrhålsdjup: Zon I –5 %, Zon II 0 %, Zon III +15 %, Zon IV +25%.

The ‘100% rule’

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- Because accurately determining building heat loss is difficult and the penalty of severe undersizing is much greater than the penalty of oversizing

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- Because in the future the electricity grid will require balancing

Closely monitoring the RHPP

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- The prize is a big one

Questions?