

**Ground Source Energy Expo 2015**  
**The Ricoh Arena, Coventry**  
**10 September 2015**

**John Cantor Heat Pumps Ltd**

**[www.heatpumps.co.uk](http://www.heatpumps.co.uk)**

**Author**  
**Heat Pumps for the Home**

**(Crowood press)**



# Monitoring

Introduce performance monitoring / energy monitoring

Why?

Who benefits?

Examples

# What is Monitoring

Collect operational data

- Operating temperatures
- Power consumption
- Heat output

Display on a website



# Why Monitor Heat Pumps?

Heat pumps are fundamentally different from any other heating technology

Heat pumps transfer heat from one place to another

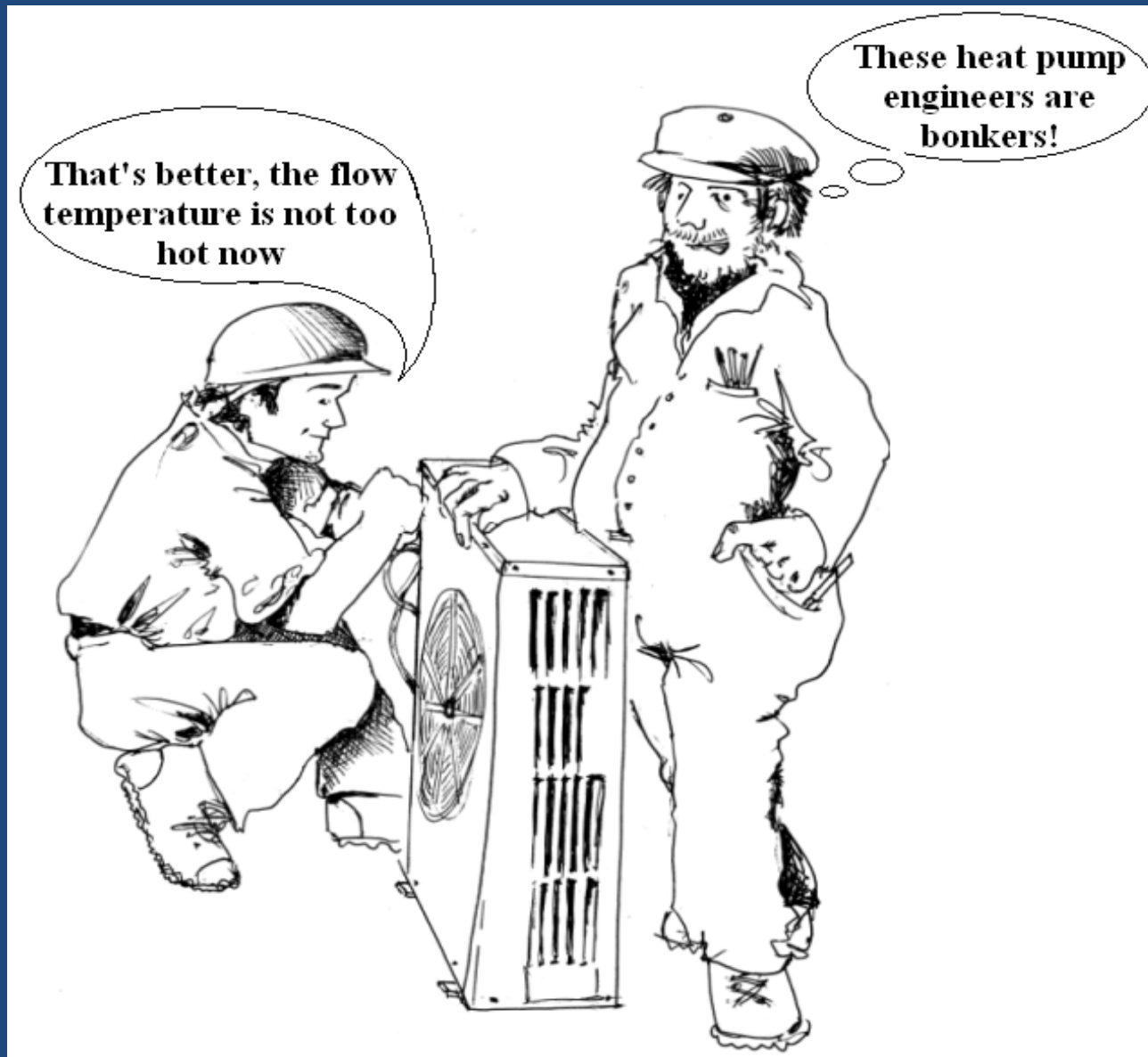
The entire heat pump system is complicated

# Why Monitor Heat Pumps?

- Ground source size, depth and fluid circulation
  - The heat pump unit
  - Distribution of heated water
  - Emitter system (underfloor or radiators)
  - Domestic hot water
- 
- The type of house and way it is used
  - User controls



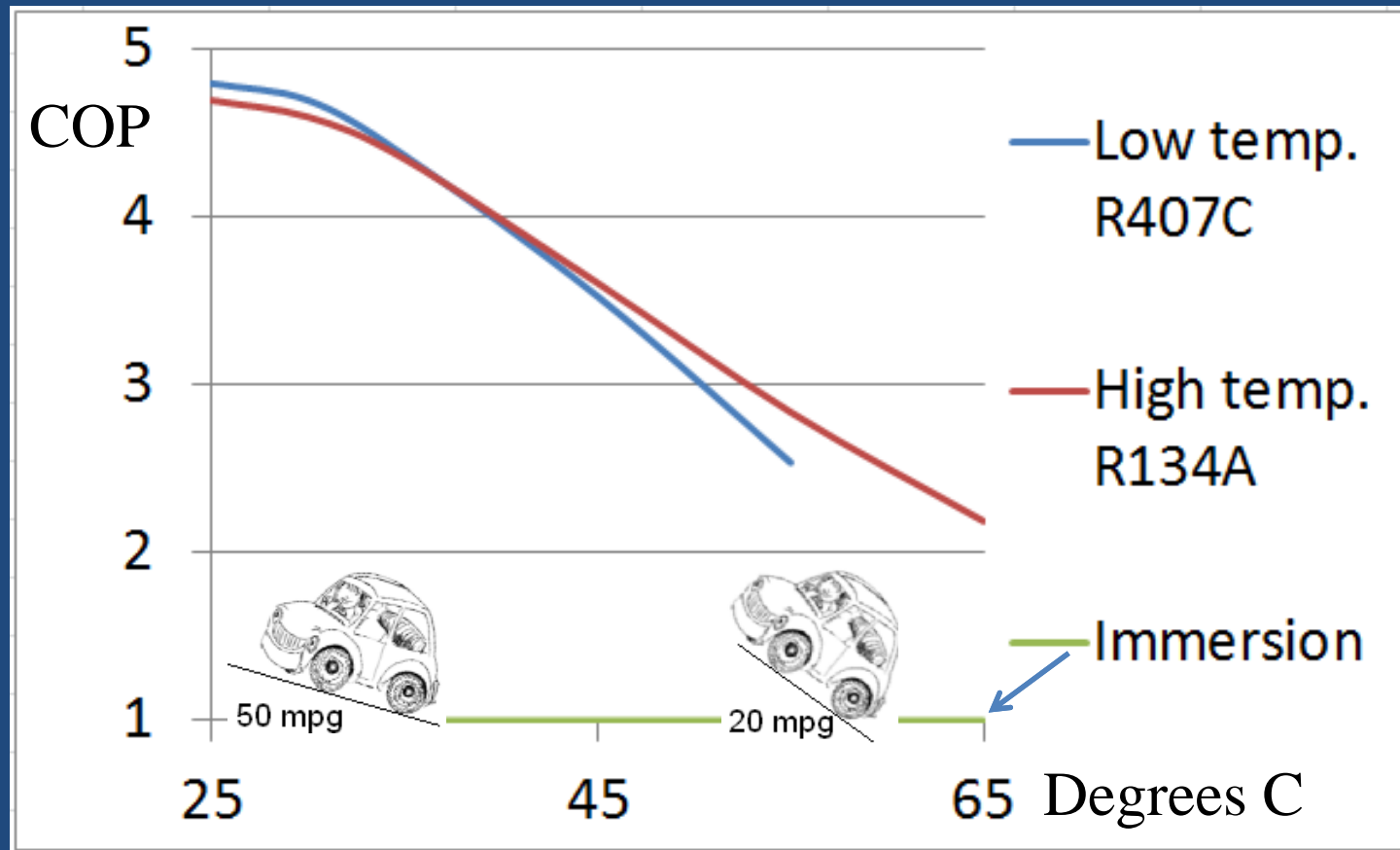
**DON'T PANIC!**



Lower water temperatures improve energy efficiency

# Operating the system at its best efficiency

Energy efficiency v Output temperature



# Who Benefits?

## **Installer/ designer**

Ensure the system is operating correctly

Can learn what designs work best

Can alert potential issues as they develop

## **Home owner**

Learn how to set the system for best effect

Check running costs and operation



# Metering and Monitoring Service Package

Contract between MCS installer and the customer

Pays the home owner £230/year (for 7 years)

<https://www.ofgem.gov.uk>. (Search MMSP)

<https://www.recc.org.uk/rhi/mmsp>



Capped at 10,000 applicants this year

<https://www.ofgem.gov.uk>. (Search MMSP)

**ofgem e-serve** Making a positive difference  
for energy consumers

## Domestic Renewable Heat Incentive (RHI)

Version 1.0 April 2014



### Essential Guide to Optional Monitoring Metering and Monitoring Service Package

A way to check how well a renewable heating system is performing - **information for applicants and installers**

# MMSP compliant monitoring systems

Hardware

<http://www.melcloud.com/>

The diagram illustrates the hardware components and data flow of the MELCloud monitoring system. It features the Mitsubishi Electric logo (Living Environmental Systems) and the Ecodan logo (Renewable Heating Technology). A central thermostat unit is connected via a 'Data Feed' to an external sensor unit. Below the thermostat, two 'Electric Meters' are shown, connected to an outdoor air conditioning unit and a heat pump. A red heat pump component is also depicted. Dotted arrows indicate the flow of data from the sensors and meters to the thermostat, and from the thermostat to the MELCloud cloud service.

**MELCloud**

In order to be MMSP compliant, data from the system must be stored at minute intervals each year.

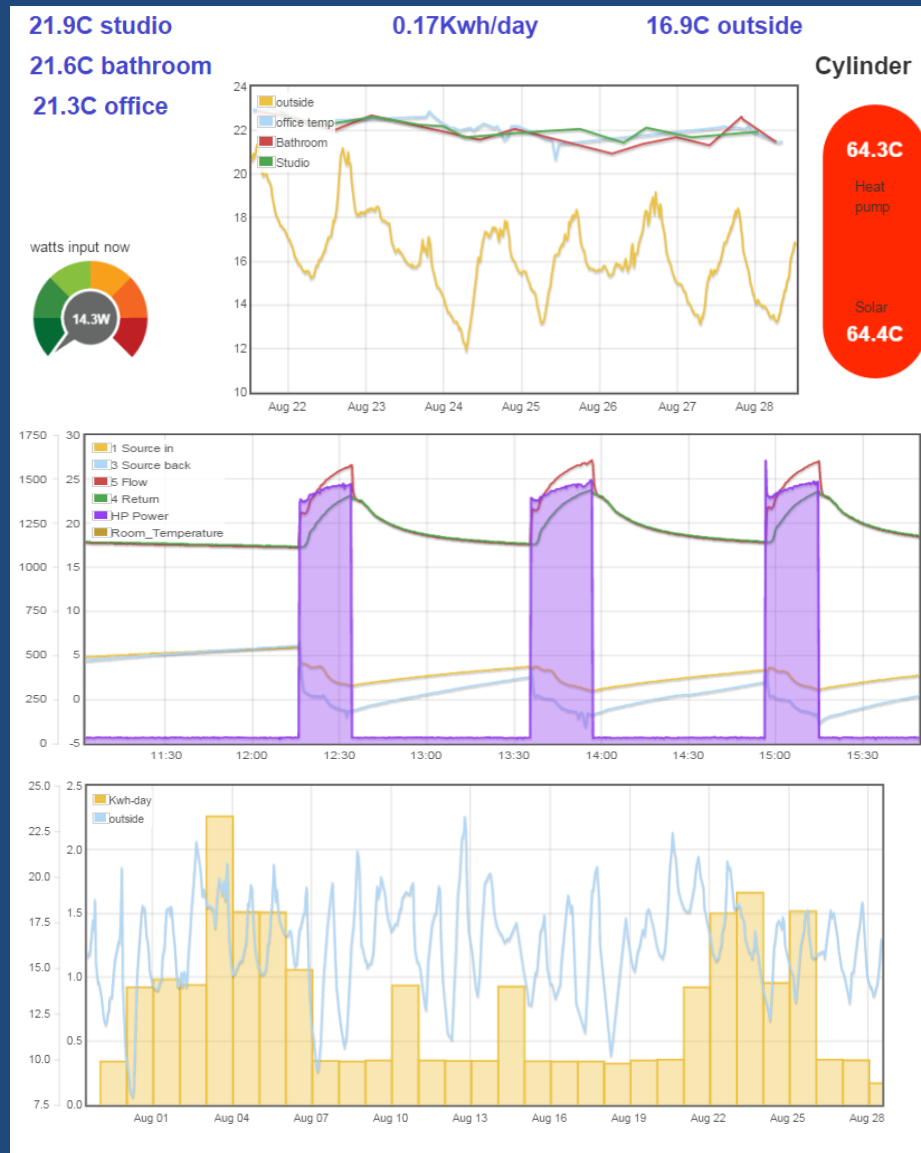
The reports are generated within the MELCloud app environment and can be exported to PDF. Sample MMSP report:

The sample MMSP report consists of two charts. The first is a pie chart showing energy usage: Heating (773.2kWh, 71%) and Hot Water (292kWh, 29%). The second is a bar chart showing Energy Production (kWh) from September to January. The y-axis ranges from 0 to 2000 kWh. The x-axis shows months: Sep, Oct, Nov, Dec, Jan. The bars are stacked, with orange at the bottom and red on top. A blue line graph is overlaid on the bars, showing a sharp increase in production in December and January.

Month	Energy Production (kWh)
Sep	0
Oct	0
Nov	~400
Dec	~1700
Jan	~300

Dashboard

# Dashboard example



## OpenEnergyMonitor

Open source

Data stored on a website

Viewable from any computer

Very adaptable

Steep learning curve

<http://www.openenergymonitor.org/emon/>

# 1) Electrical power input



Pulse  
measurement



CT clamps  
With  
Voltage  
sensing

## 2) Temperatures



Heat meter sensor  
In pocket



Room temperature transmitter

### 3) Heat output

## Heat Meters

Water (glycol) flow rate  
& temperature difference



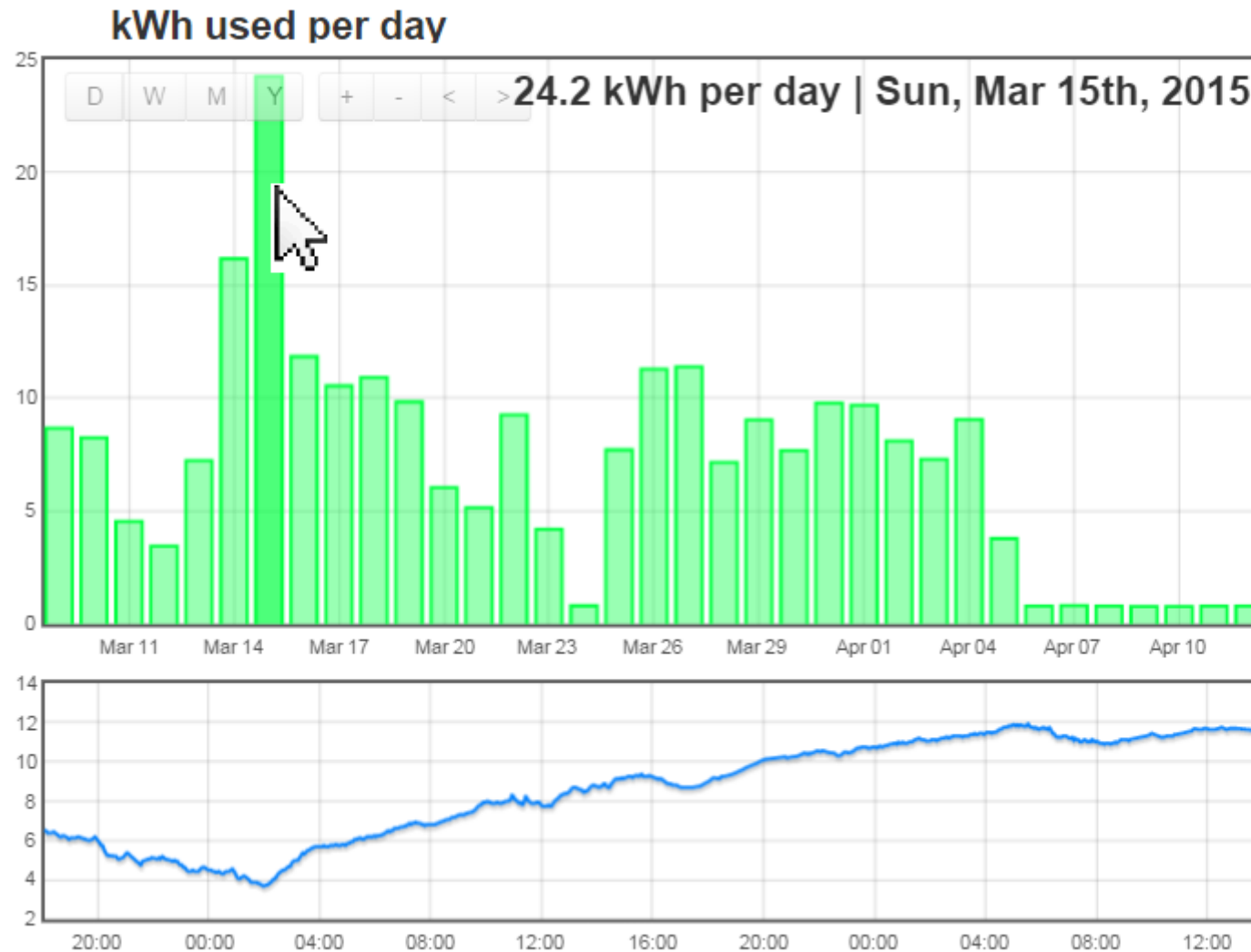
Kamstrup



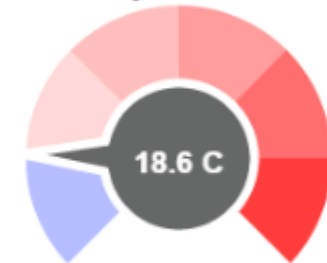
Sontex

# Simple dashboard for home owner

## Heat Pump Dashboard



Cylinder temperature



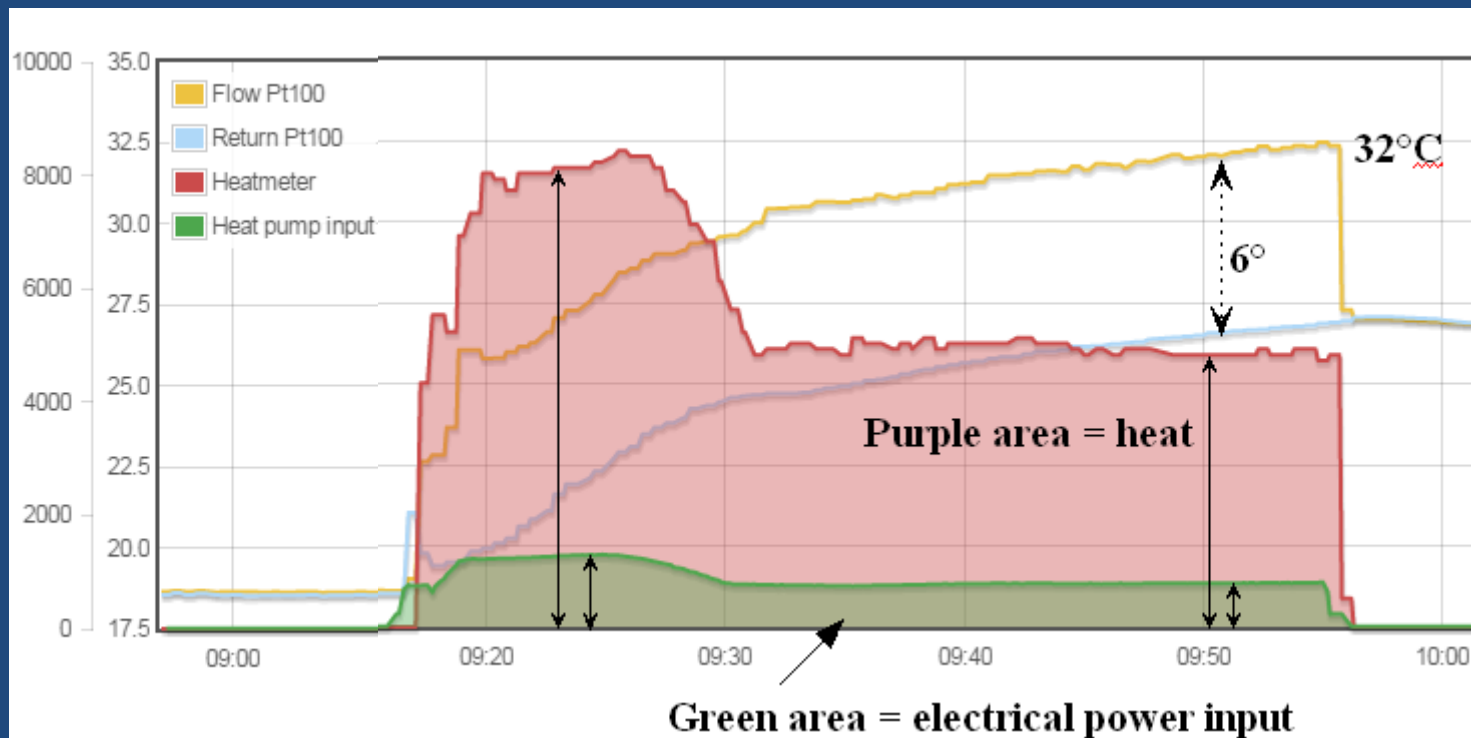
16.1 C  
Room temperature

14.3 C  
Outside temperature



# Ground source inverter heat pump

## 40 minute run period to underfloor heating

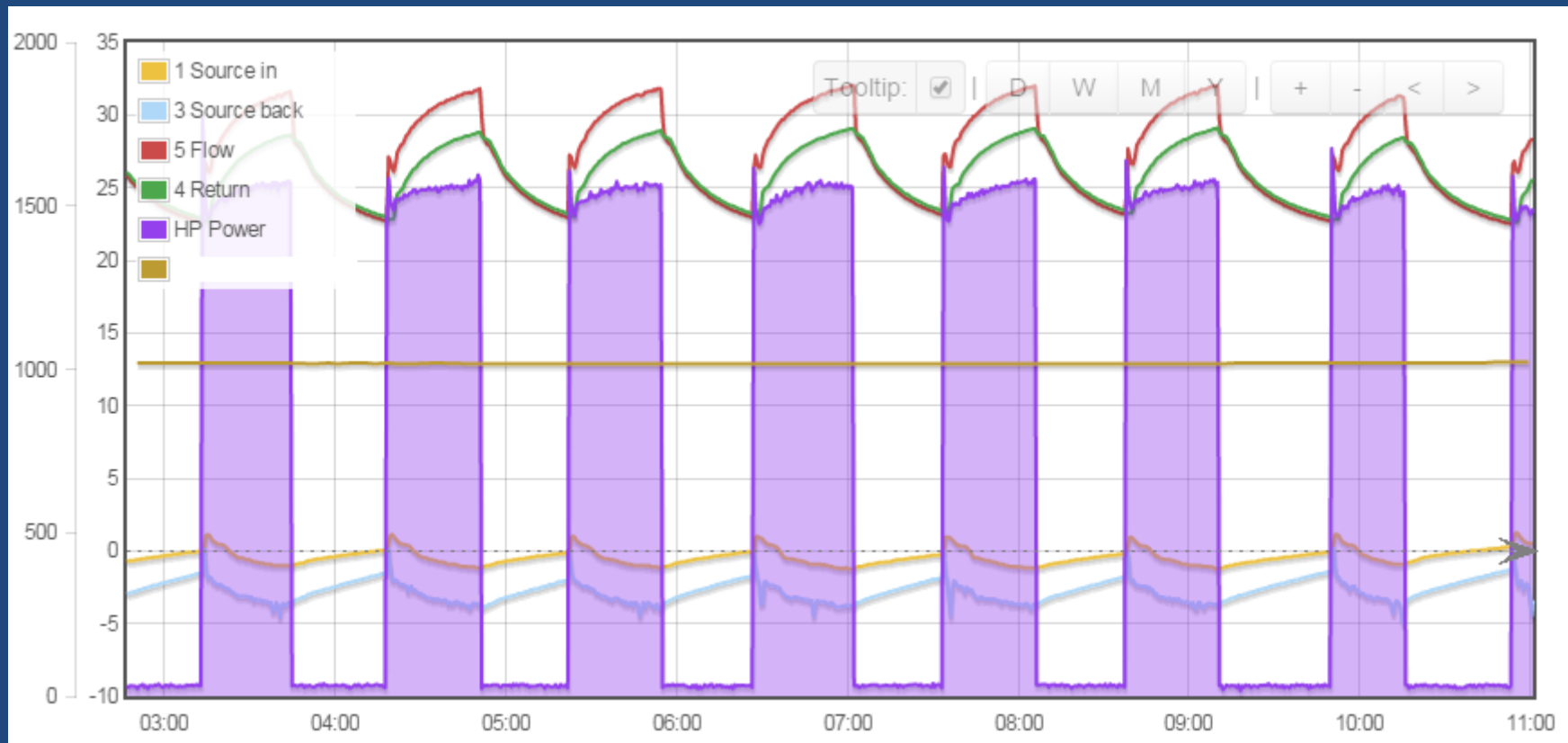


# Ground source heat pump

30 minute run periods to underfloor heating

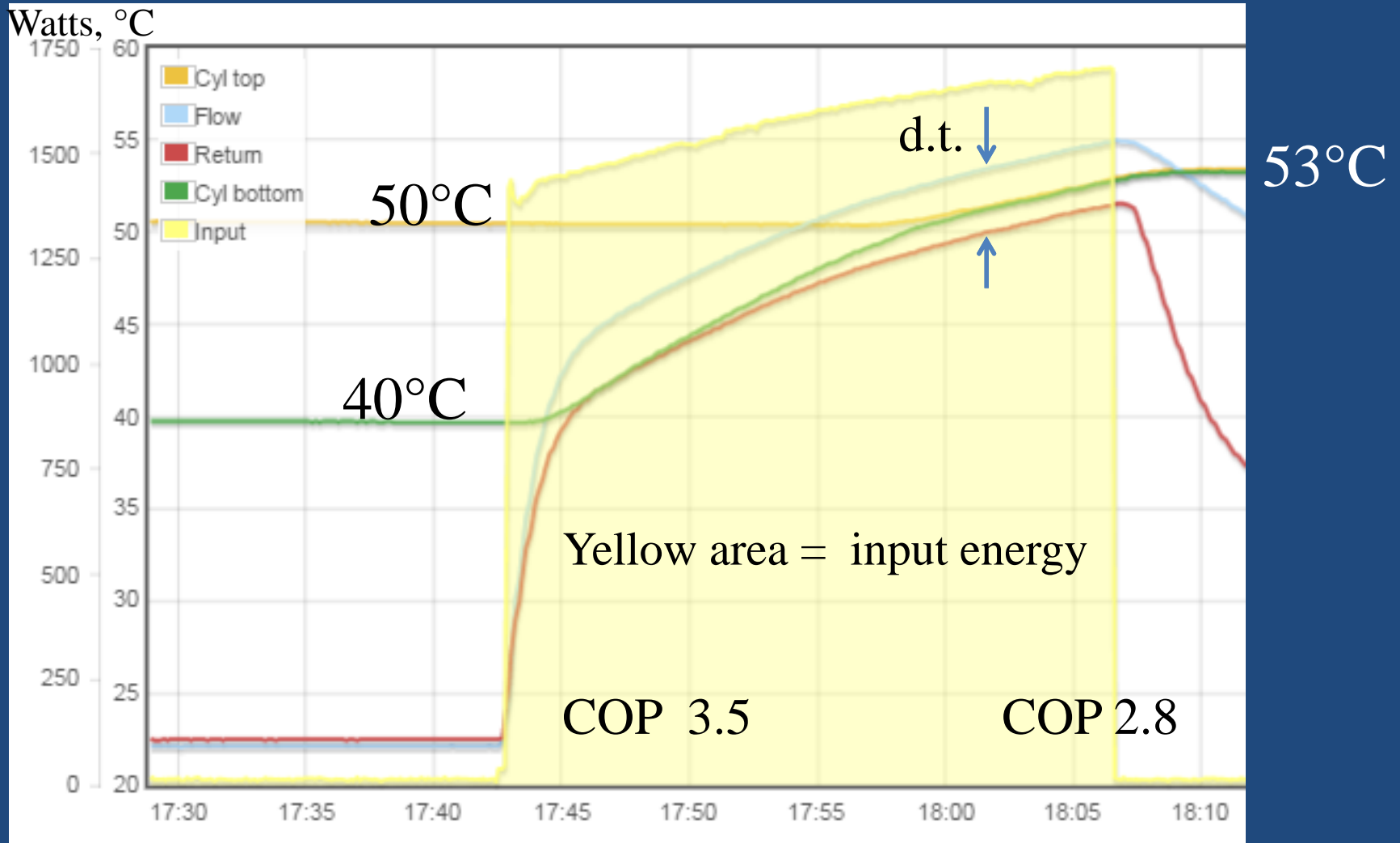
Flow-return dt's good, flow rates good

Ground coil below zero!



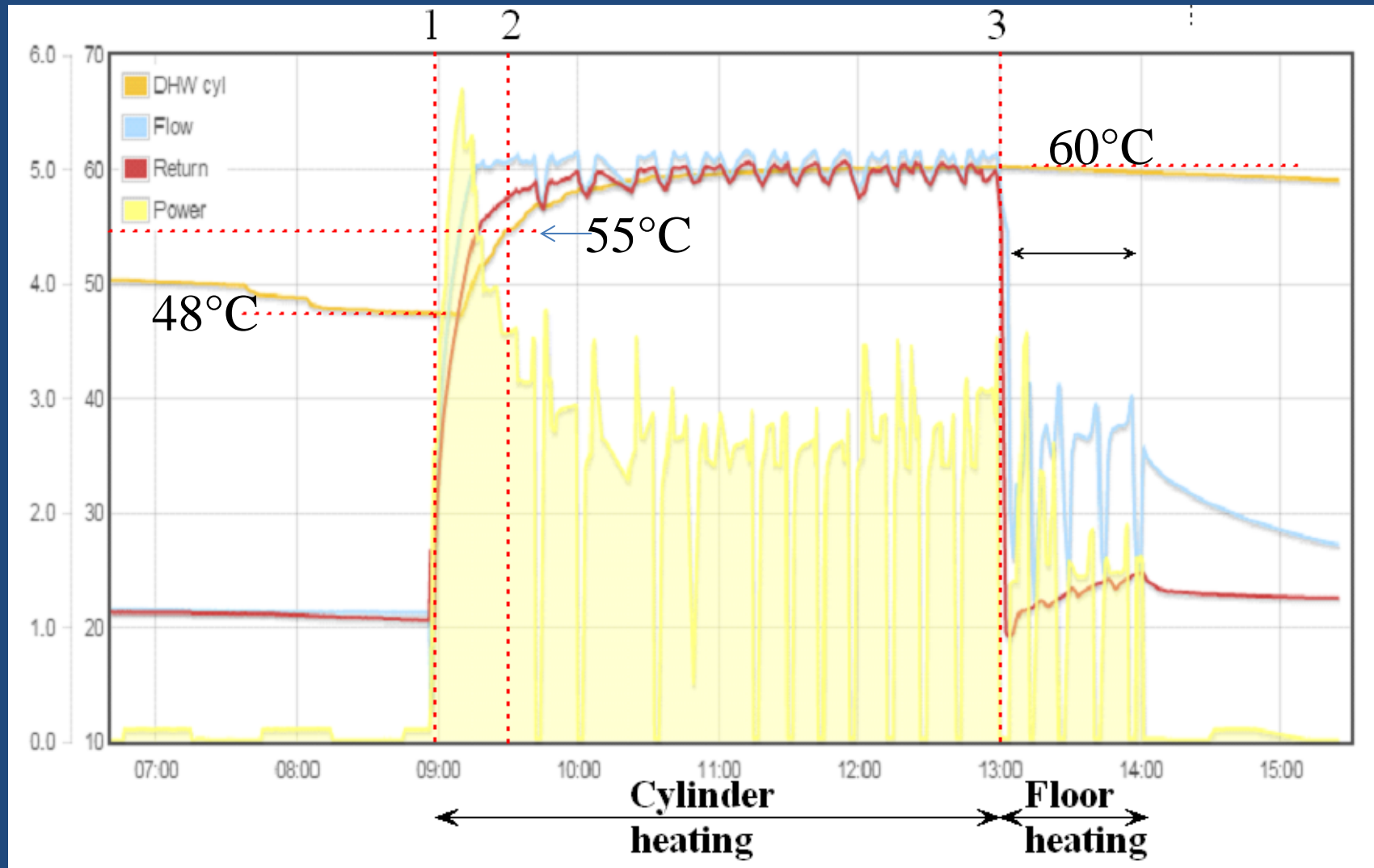
# Domestic hot water

## Analysis for engineer



Indicating an average COP over heating period of over 3

# Domestic hot water



# What can we glean?

Is the compressor cycling reasonably?

Can the heating curve be lowered?

Are there unnecessary DHW charge periods?

Is standby power reasonable?

Temperature difference (flow-return) tells us what the liquid flow-rate is.

Is pipework sized correctly?

Is there a blocked filter?

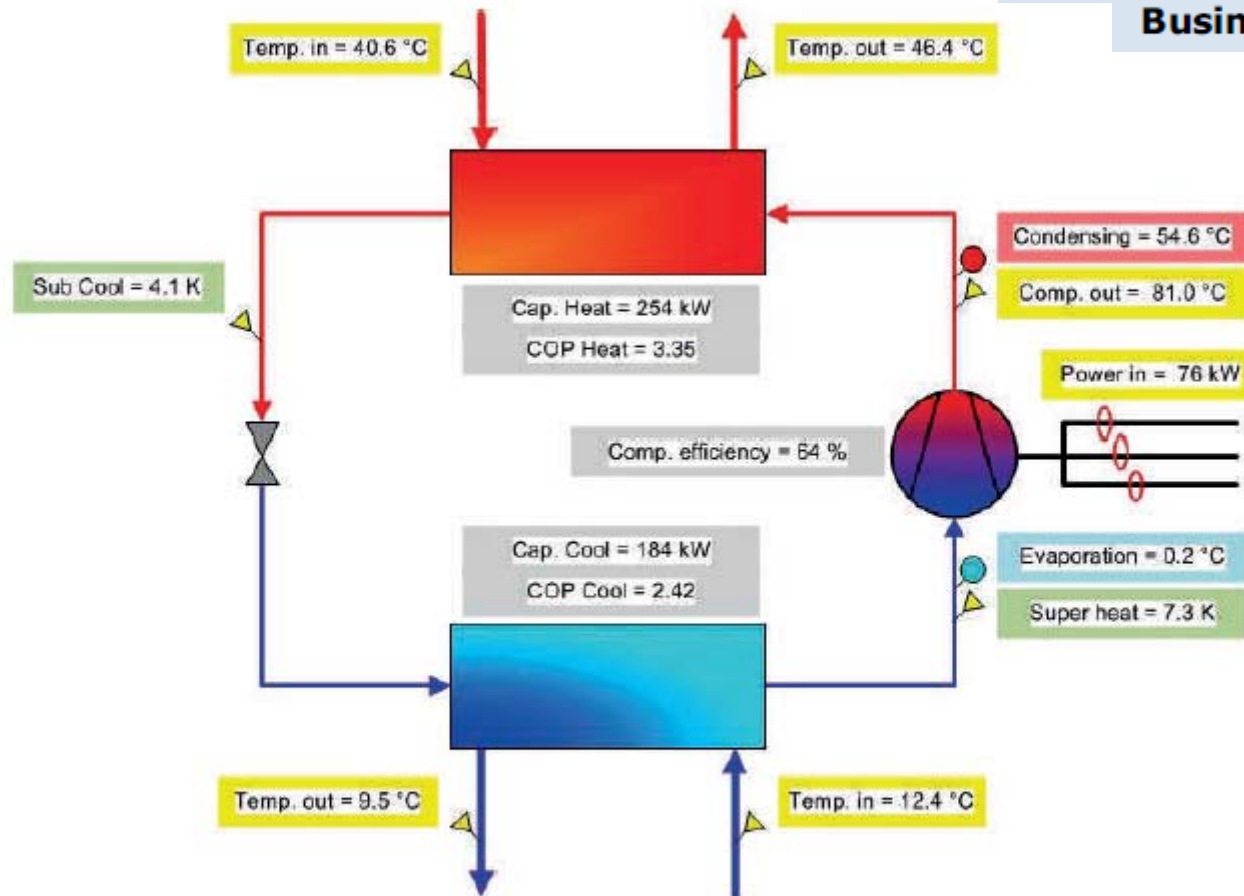
Is the pump speed set correctly?

# Refrigerant circuit analysis

 **ClimaCheck**

**Business Edge Ltd**

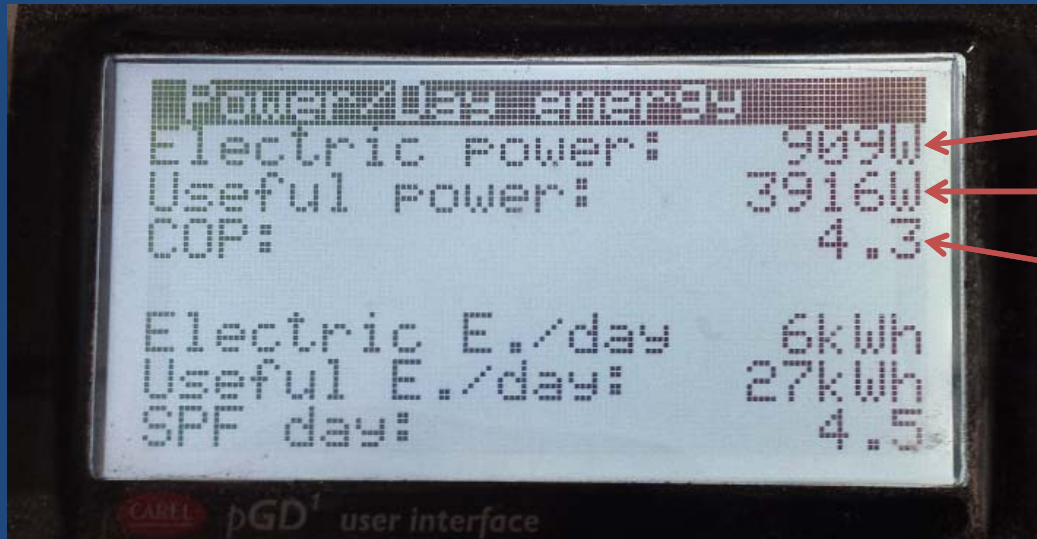
To heating circuits



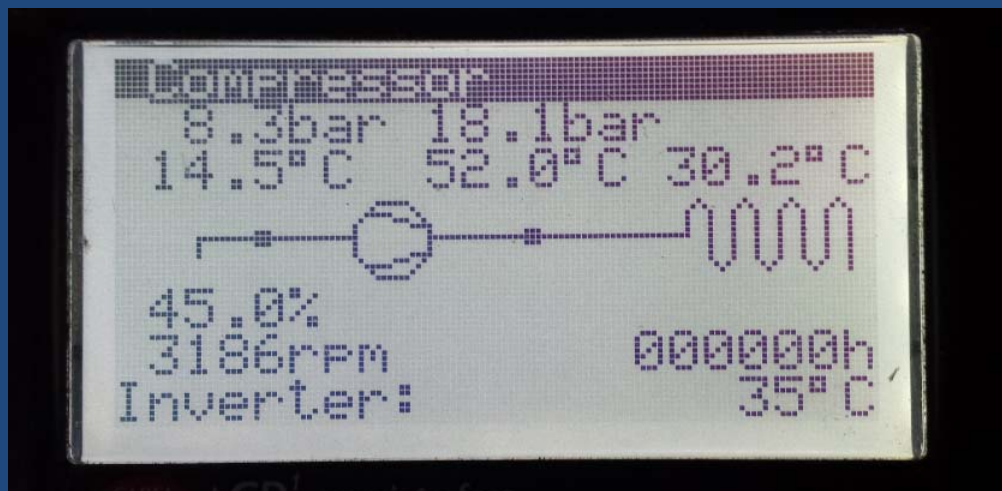
From ground loops

**System Flow Chart with dynamic sensor readings**

# Heat pump controller's COP/SPF calculator



Input power  
Heat output  
COP



Refrigerant data

# Thank You

[www.ofgem.gov.uk](http://www.ofgem.gov.uk). (Search MMSP)

[www.recc.org.uk/rhi/mmsp](http://www.recc.org.uk/rhi/mmsp)

[www.openenergymonitor.org/emon/](http://www.openenergymonitor.org/emon/)

<http://johncantorheatpumps.blogspot.co.uk/>