

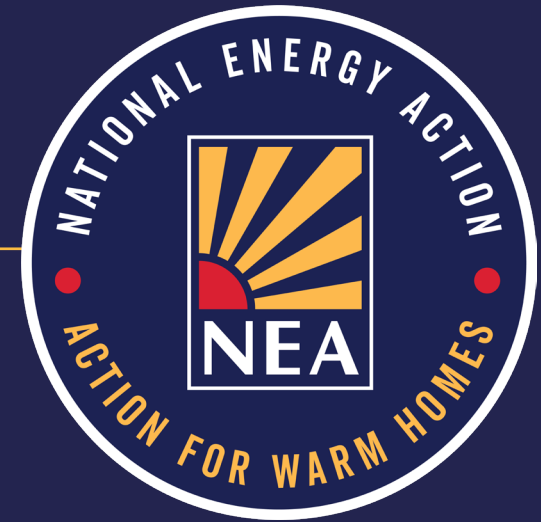
Dr Paul Rogers

29 September 2024

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An introduction to heat pumps

361 Energy Fair



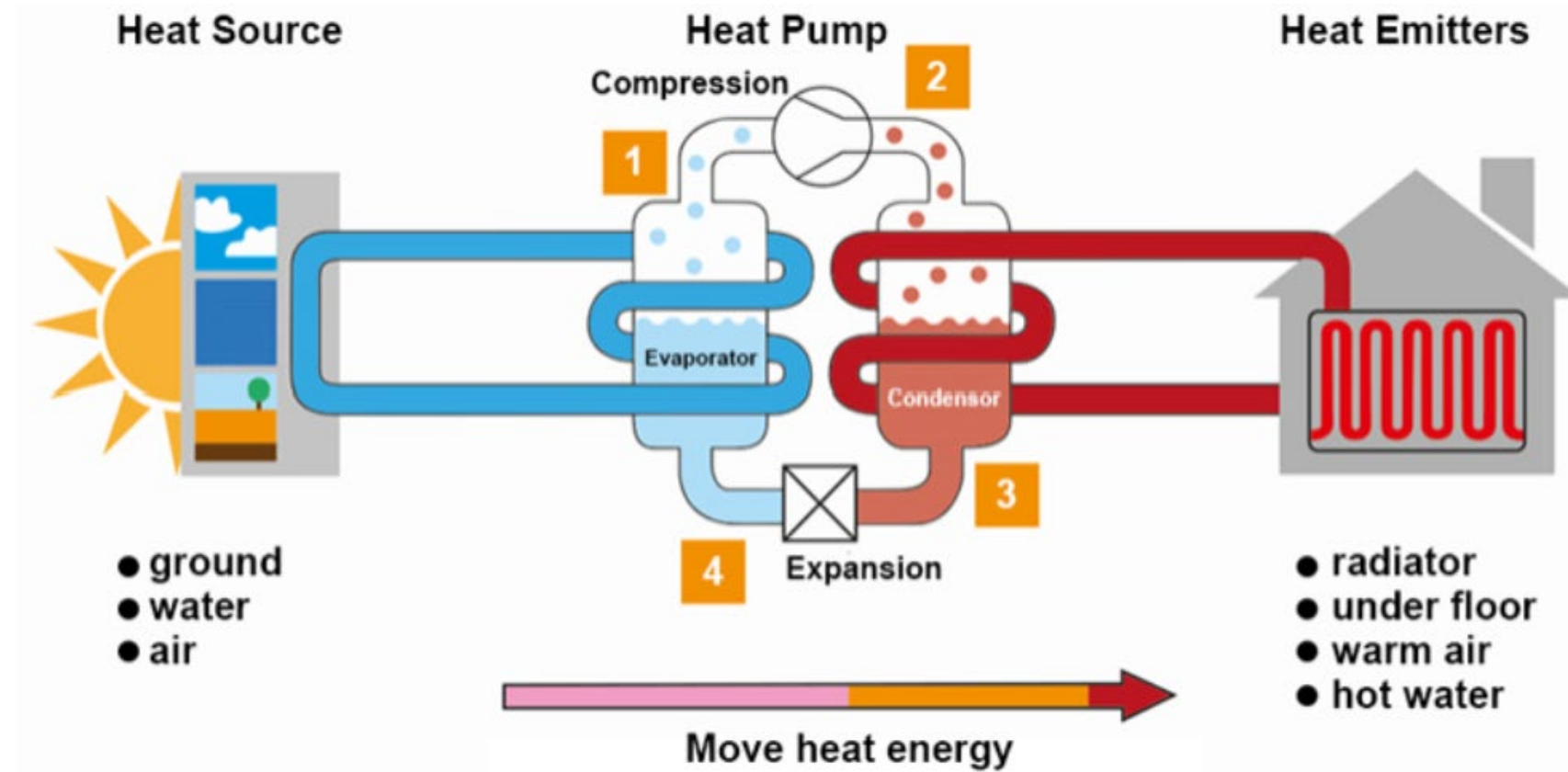
# Presentation overview

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- Heat pumps
  - How they work
  - Types of heat pumps
- Examples from project with North Devon Homes
  - Heat pumps with battery storage and solar PV
  - Heat pumps with time of use tariffs



# How a heat pump works



# Jargon Buster

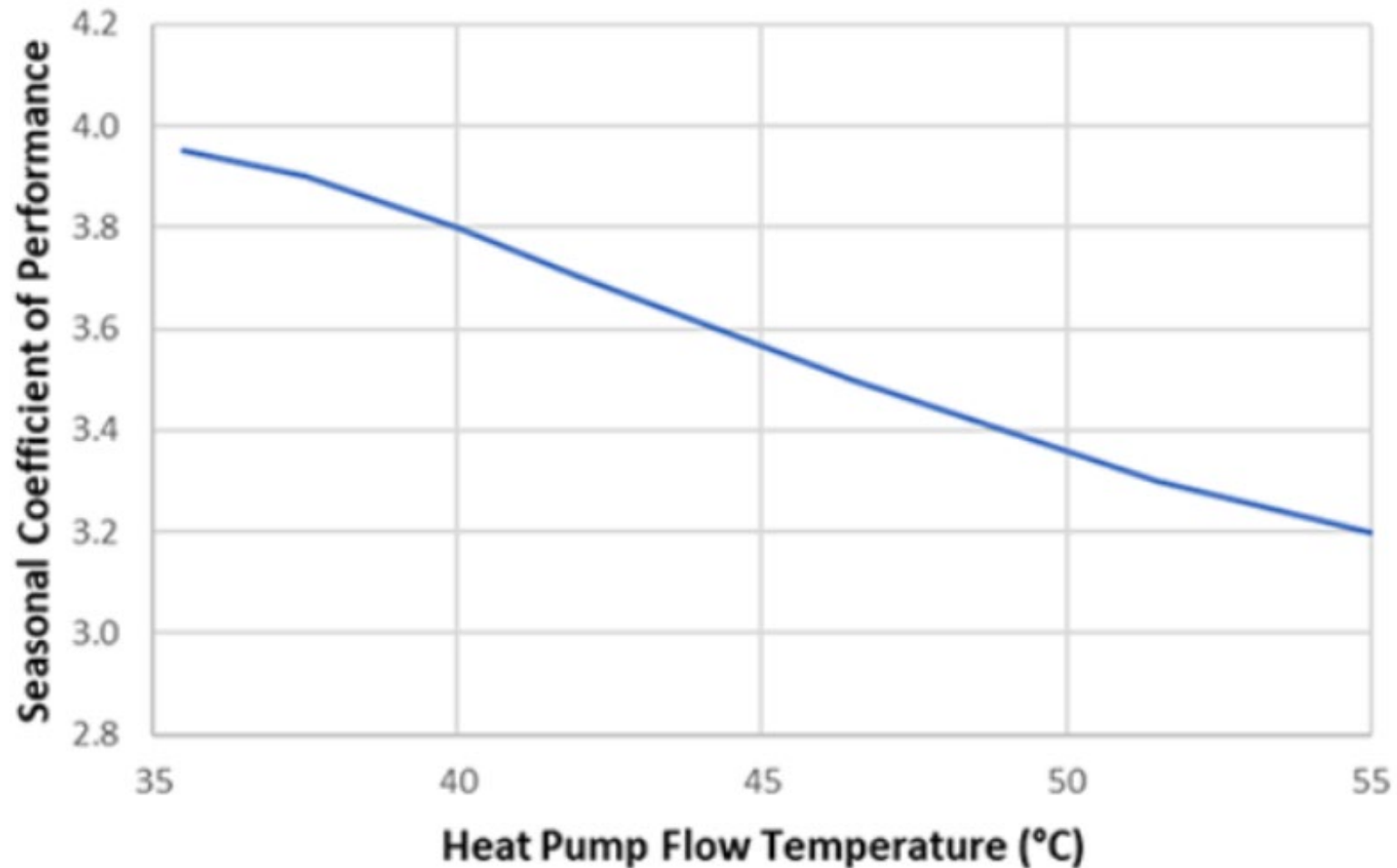
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- Coefficient of Performance
  - A measure of the efficiency of the heat pump
  - = Heat output / electrical input
  - ASHP: 1kW of electricity provides about 3kW of heat
- Flow temperature
  - Temperature of the heating fluid in the supply (flow) pipe going into the heat emitters



# How flow temperature affects the COP

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# Flow temperatures for different heat emitters



Single or double panel  
60 – 80°C



Oversized or triple panel  
35 – 55°C

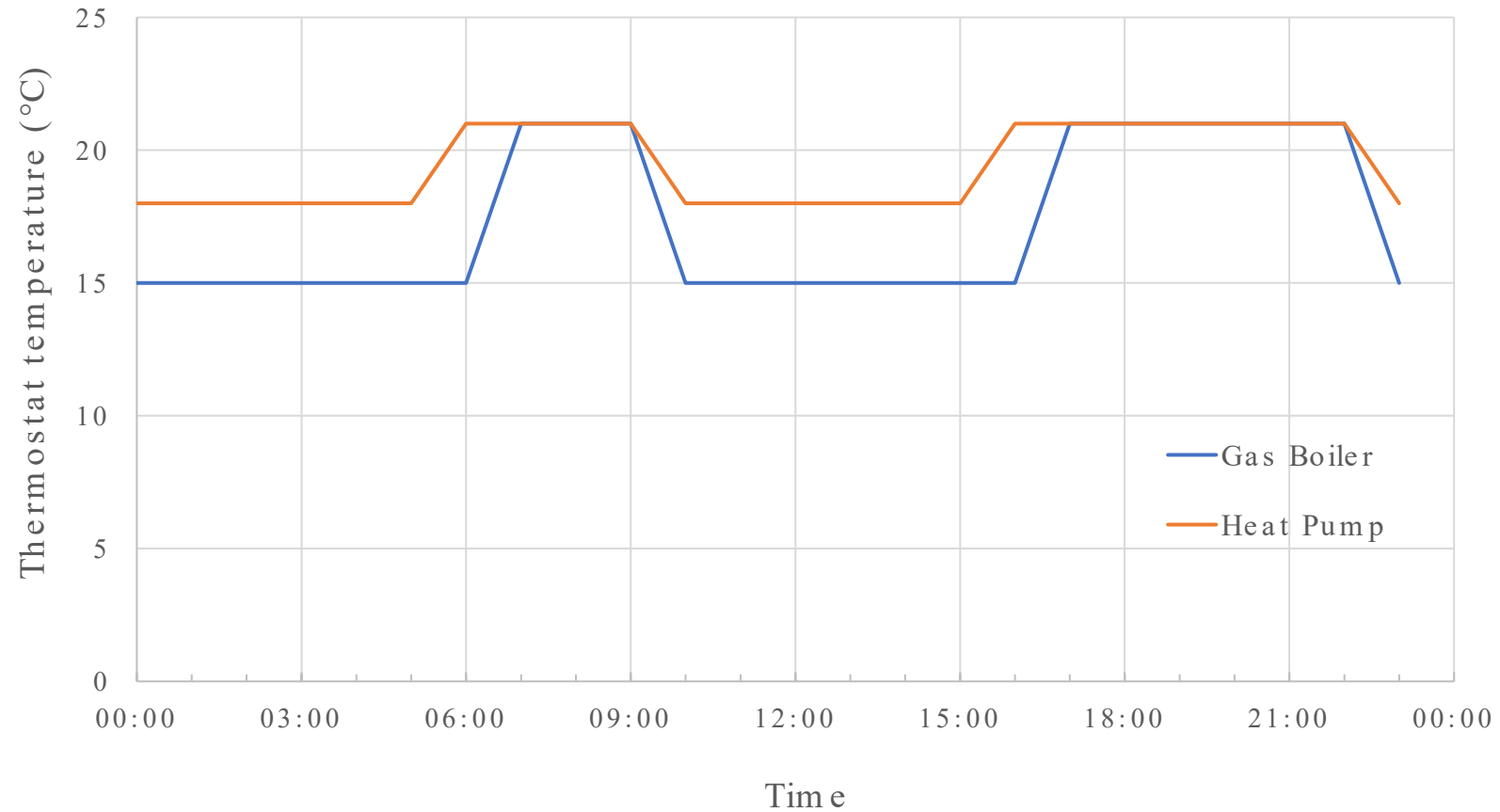


Underfloor heating  
30 - 35°C



# Heating schedules

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# Types of heat pumps

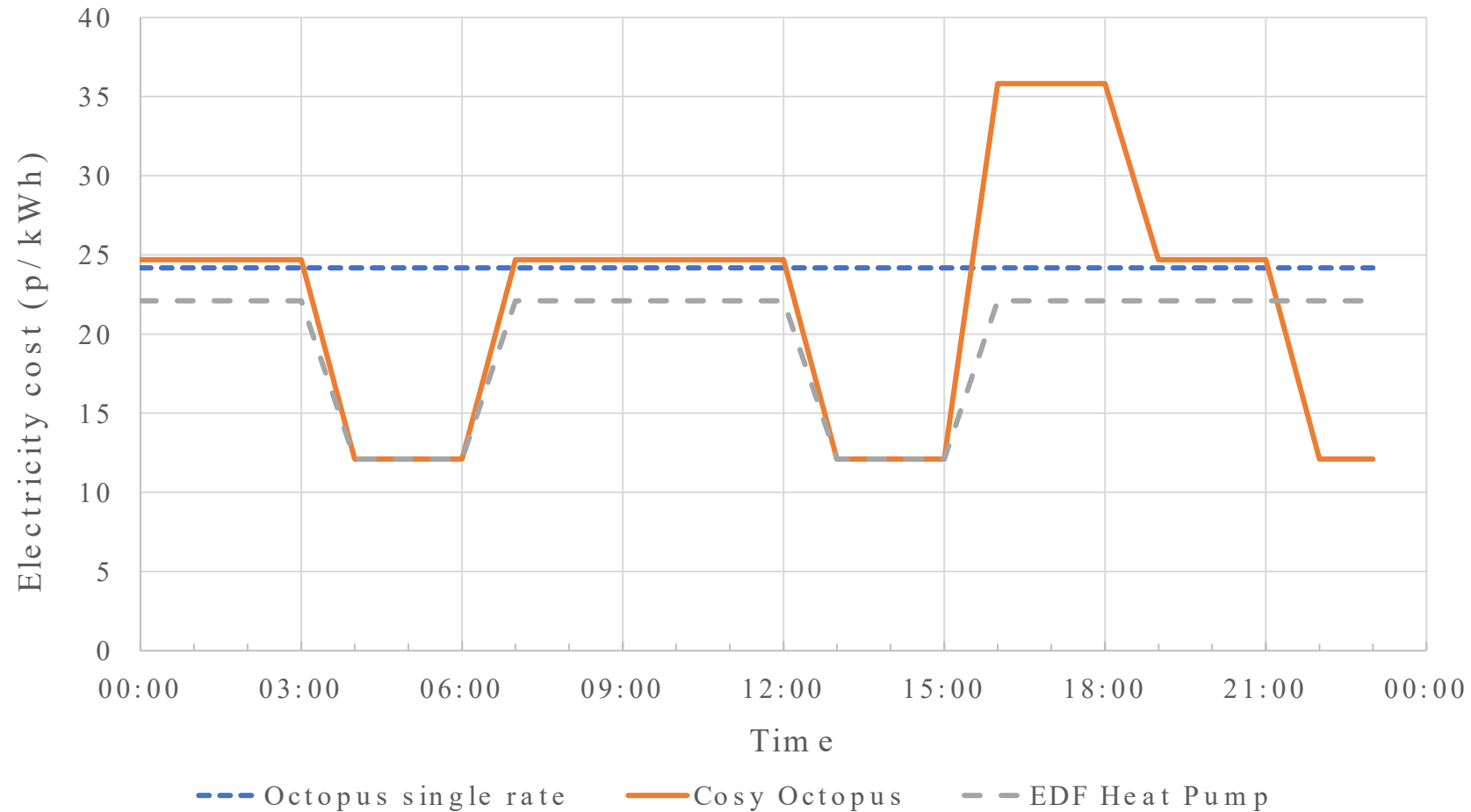
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- Air to water source heat pump (ASHP)
  - Has outdoor unit with fan and heat transferred to radiators
  - High temperature heat pumps can operate with higher flow temperatures
- Air to air source heat pump
  - Has outdoor unit with fan and heat provided through hot air
- Hybrid heat pump
  - Has outdoor unit for ASHP and combines with a gas boiler
- Ground source heat pump
  - Heat collected from ground via a borehole or coils of pipe in a long trench





# Electricity tariffs for heat pumps



# Making heat cheaper, smarter and greener project

- North Devon Homes project
  - Trial funded by Energy Industry Voluntary Redress Scheme
  - Installations in Witheridge
  - Off gas with storage heaters
  - Economy 7 tariffs
- Installations
  - Wet central heating system
  - Air source heat pump
  - Electrical battery & heat battery



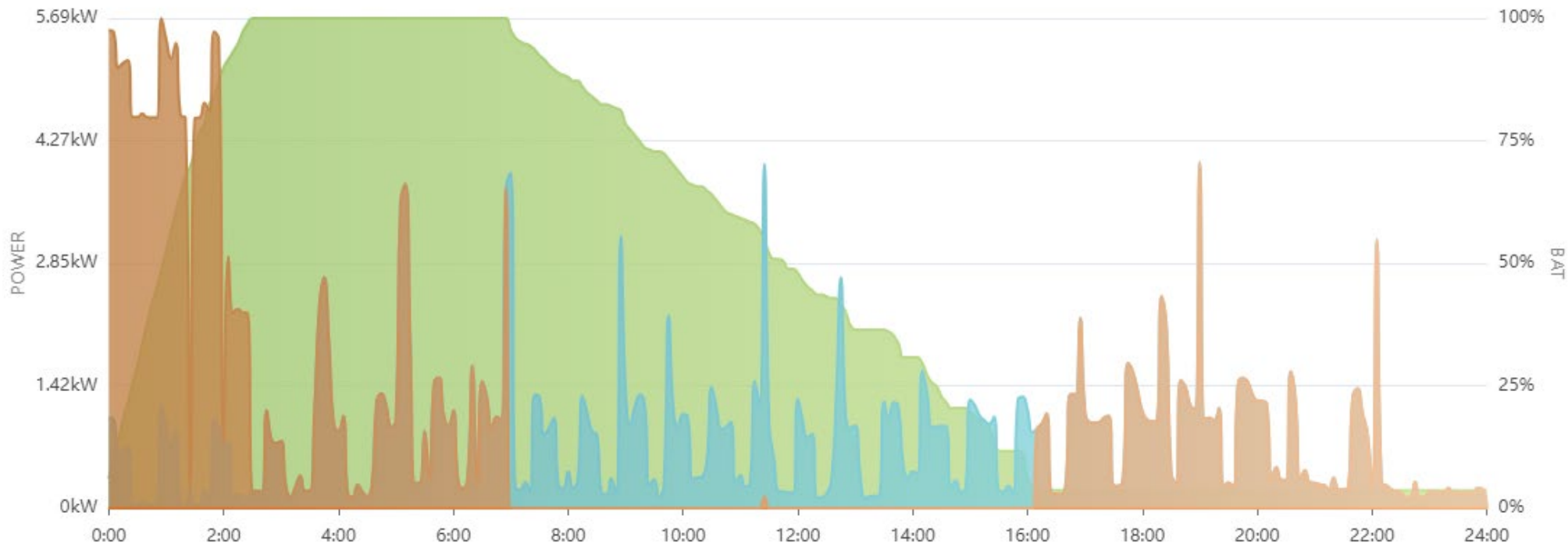
# Making heat cheaper, smarter and greener project

- Boxergy installations
  - 5 x semi-detached bungalows
  - 2 x mid-terraced houses
  - Electrical battery
    - 2 x 5.7kWh or 1 x 10.4kWh
  - Heat battery
    - Either 9.5kWh or 12.6kWh
  - Battery charged overnight on Economy 7 to help power home during the peak rate period



# Making heat cheaper, smarter and greener project

- Household B-02 on Economy 7 on 12 Jan 2023 – used 21.6kWh

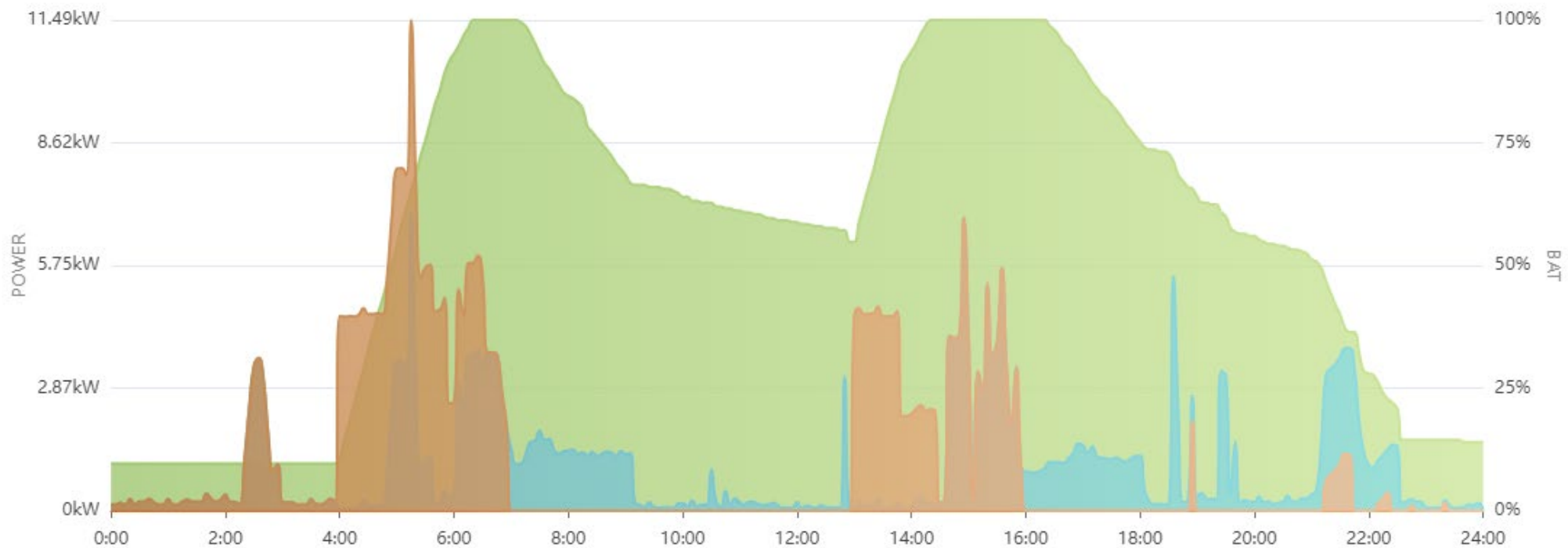


Used peak rate electricity from 16:00



# Making heat cheaper, smarter and greener project

- Household B-02 on Cosy Octopus on 1 Mar 2023 – used 27.6kWh



Majority of grid consumption off-peak



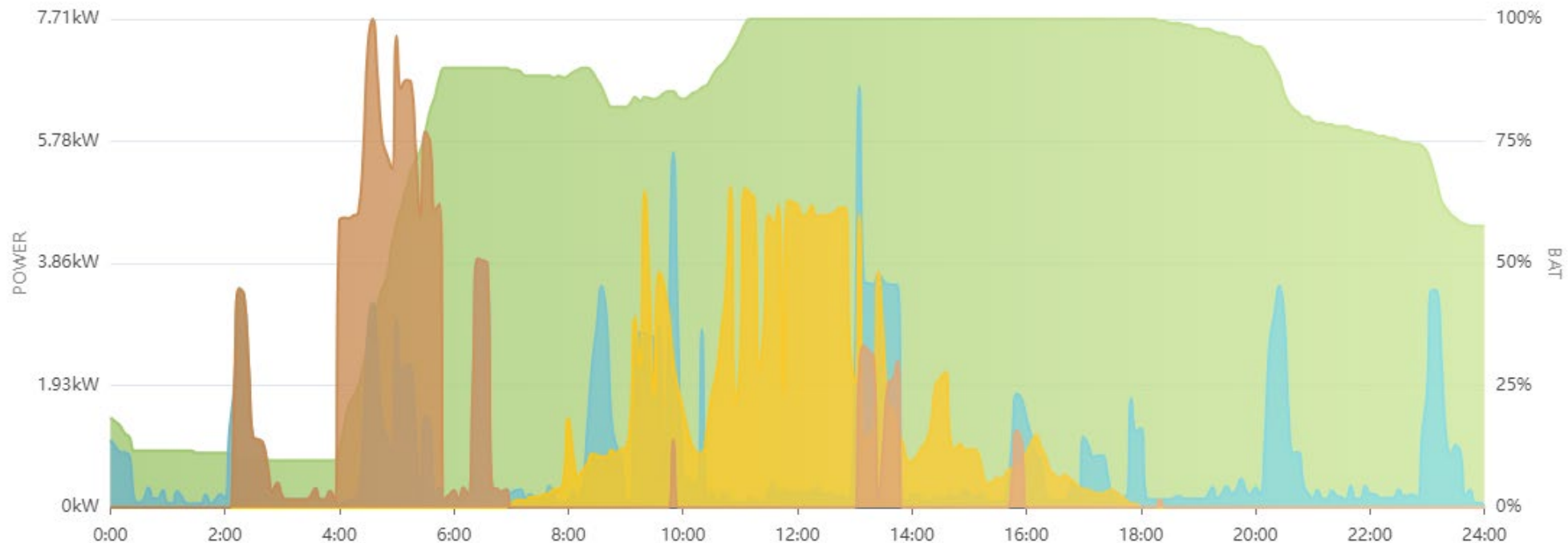
## Phase 2 project – Solar PV with Electric Heating

- Solar PV installed on 18 properties with electric heating
- Included 7 properties with Boxergy
- Boxergy PV systems
  - 5.8kW or 5.67kW
  - Orientation – south or east/west



# Solar PV with Electric Heating

- Household B-02 on Cosy Octopus on 10 Mar 2024 – used 15.6kWh



PV generation = 19kWh

Household consumption = 21.1kWh



## Solar PV with Electric Heating

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- Household B-02 on Cosy Octopus from 13 Feb 2023
- Solar PV system fitted on 22 Aug 2023

Start date	End date	Cosy rate consumption (kWh)	Standard rate consumption (kWh)	Peak rate consumption (kWh)
22 Feb 23	21 Feb 24	5373.1	590	40.9
		89.5%	9.8%	0.7%

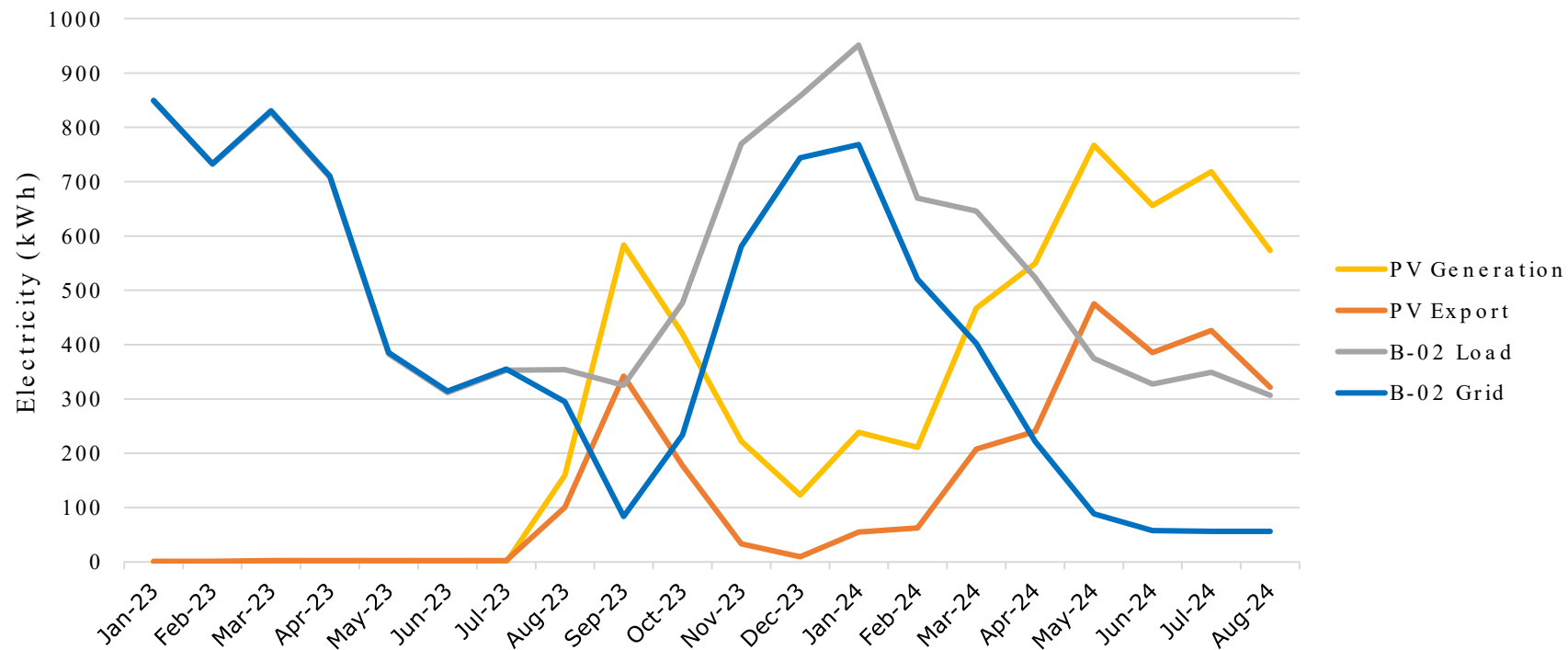
\* Note missing data from 11 Oct 23 to 17 Oct 23





# Solar PV with Electric Heating

## ■ Household B-02 – impact of solar PV



- Saving from solar PV from 1 Sep 23 to 31 Aug 24 = 2763kWh
- 42% reduction in grid consumption



# NEA report on ASHPs with battery storage

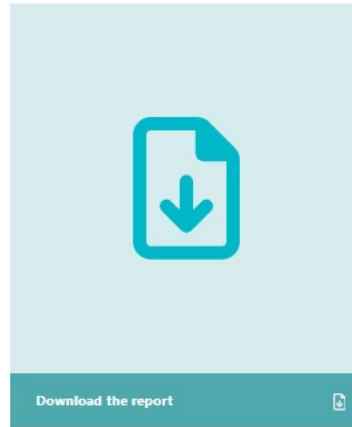
## Making heat cheaper, smarter and greener

Date: 09th Jun 2023



## Resources

Making heat cheaper, smarter and greener



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Innovation and Technical Evaluation, Homes

<https://www.nea.org.uk/publications/making-heat-cheaper-smarter-and-greener/>

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# Thank you for listening

*Any questions?*

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