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CIBSE AM17

21/06/2022

Today's Webinar

CIBSE AM17

- Introduction to AM17 – Purpose and contents
- Application and design considerations for different building types
- Case studies
- Q&A

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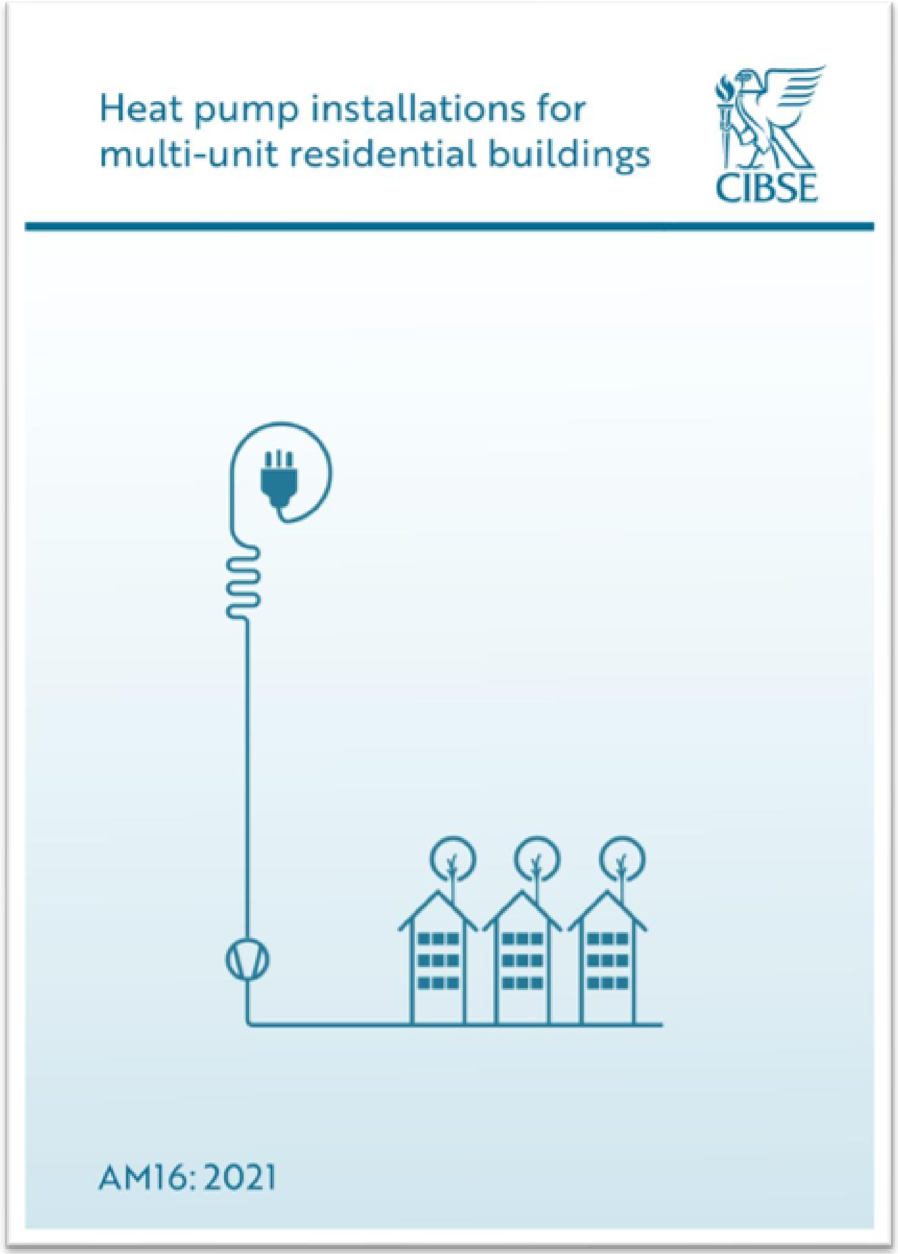
Heat pump installations for
multi-unit residential buildings
CIBSE
AM16: 2021


Heat pump installations for
large non-domestic buildings
CIBSE
AM17: 2022
Department for
Business, Energy
& Industrial Strategy

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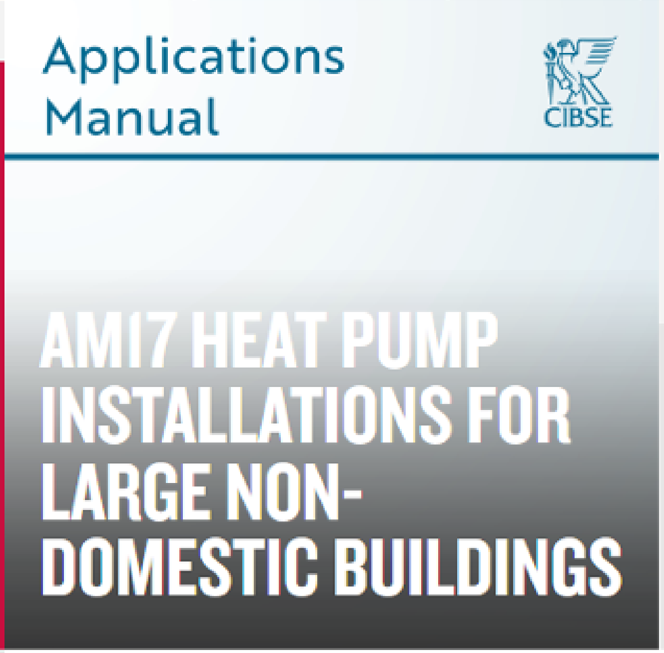

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AM17 Heat pump installations for large non-domestic buildings

The PDF version of this publication is free to all - simply use the voucher code 'AM17' at checkout.

Launch webinar - 21 June 2022, 11:00-12:00 (BST) | Register now

Purpose of AM17

- Heat pumps key to decarbonisation
- Delivery at scale
- Support delivery of high quality installations
- Principally aimed at building services engineers

Scope of AM17

Large installations >45kW

Assumes heat pump is chosen technology

Non-domestic buildings

Existing and new buildings

Other resources

- BSRIA BG7: *A guidance document for designers* (2009)
- BESA TR30: *Guide to good practice — Heat pumps* (2021)

- LETI *Climate Energy Design Guide* (2020)
- Best practice sustainable building accreditation schemes (BREEAM)

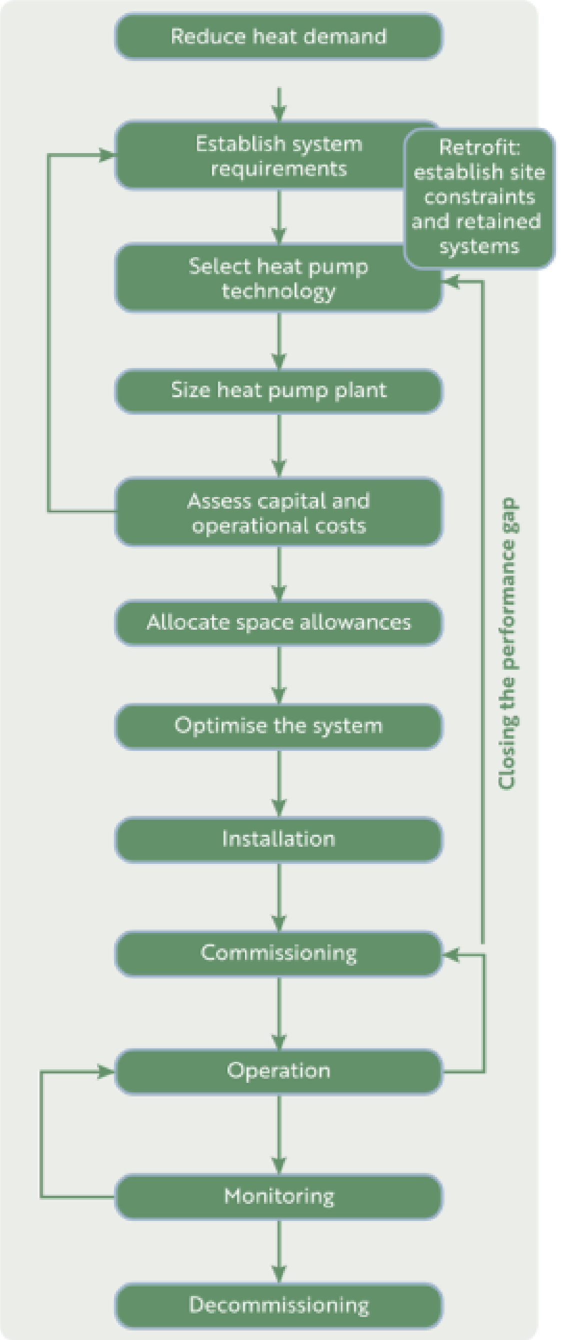
GSHP reading
- CIBSE TM51: *Ground source heat pumps* (2013)
- BSRIA TN18/99: *Ground source heat pumps* (1999)

WSHP reading
- CIBSE CP2: *Surface water source heat pumps: Code of Practice for the UK* (2016)
- CIBSE CP3: *Open-loop groundwater source heat pumps: Code of Practice for the UK* (2016)

- BSRIA *Heat pump installer manual* (2010)
- BS EN 15450:2007: *Design of heat pump heating systems*
- BS EN 378:2020 for design requirements relating to refrigerant management
- CIBSE Commissioning Code R: *Refrigerating systems*
- *Soft Landings*, for handover

- CIBSE Guide M: *Maintenance engineering and management* (2014)

- CIBSE TM65: *Embodied carbon in building services: A calculation method* (2021)
- CIBSE TM56: *Resource efficiency of building services* (2014)



Using this Applications Manual

- **Chapter 2** highlights the importance of reducing energy demand (particularly in existing buildings) to enable effective heat pump operation
- The next step is to characterise the heating and cooling demand (temperature, capacity, requirements relating to resilience)

- **Chapter 3** sets out the different types of heat pump on the market: ground source, air source, exhaust air source and water source

- **Chapter 4** explains how to size a heat pump system — including when working with a bivalent system

- **Chapter 7** provides high-level guidance on capital, energy and maintenance costs of heat pumps

- **Chapter 5** covers the impact on architectural and building design; including concept space allowances for different types of building

- **Chapter 6** is 'System performance optimisation', which focuses on closing the performance gap through efficient controls and effective metering

- **Chapter 9** provides guidance on installation and workmanship; particularly for ground source systems

- **Chapter 8** gives guidance on initial commissioning and seasonal commissioning

- **Chapter 10** outlines the subjects which should be included within user guidance for heat pump systems

- **Chapter 8** also gives guidance on metering and monitoring

- **Chapter 11** covers whole life carbon and responsible decommissioning options

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Define load types

What loads does the building need to satisfy?

Space heating / Space cooling / DHW / Process heating/cooling

↓

Reduce demand

What energy efficiency or passive measures can be used to minimise these loads?

↓

Define building requirements

Calculate peak loads (point of use)

- What is the peak load for each load type seen at the point of use? **[kW]**

Calculate peak loads (diversified)

- What is the peak load for each load type considering diversity (at floor level, building level, whole development level)? **[kW]**

Calculate load profiles

- What is the daily and annual profile for each load?
- What is the typical range of part loads?
- When are heating and cooling loads coincident, and what is the magnitude of these coincident loads? **[kW]**
- What is the annual heating and cooling demand? **[kWh]**

Choose emitters

FCU/AHU/Radiator/Chilled beam/ UFH etc.

↓

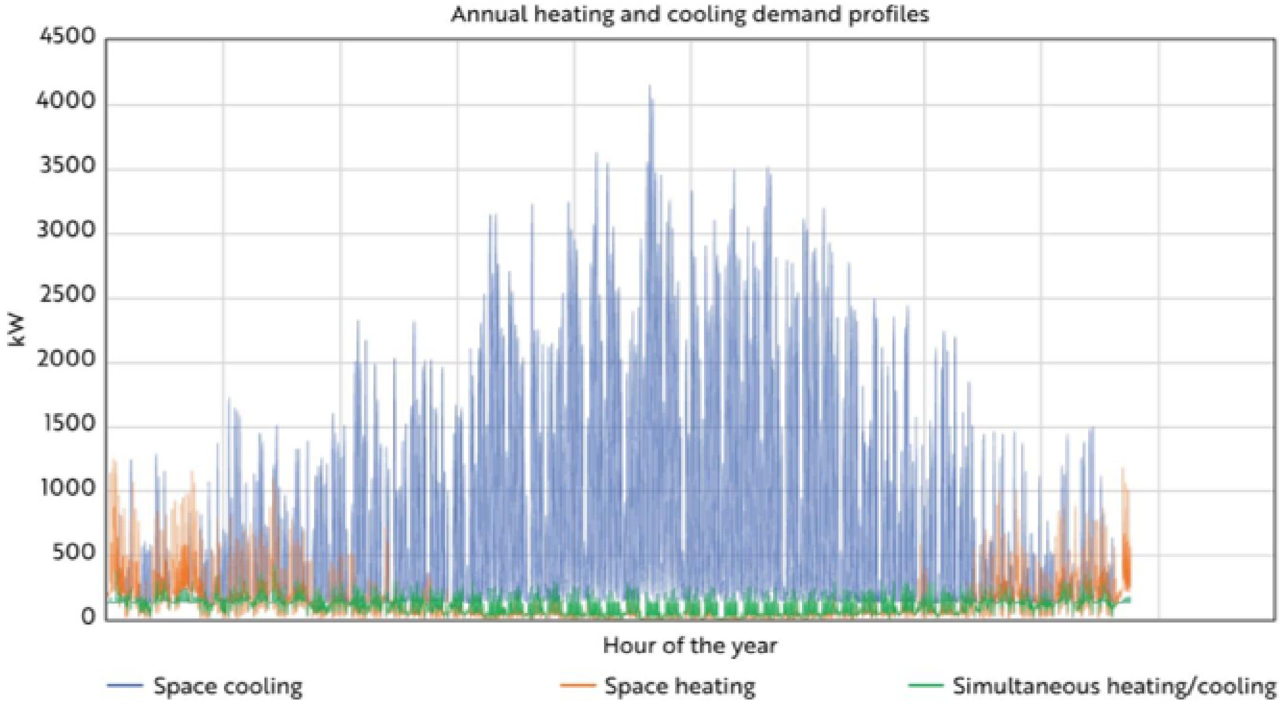
Define temperatures

- What temperature is required at point of use for each load type? [°C]

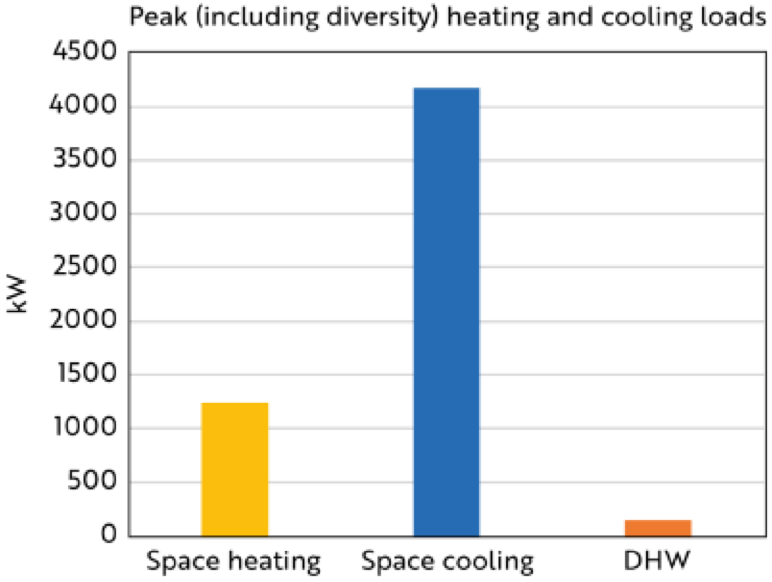
Define additional requirements

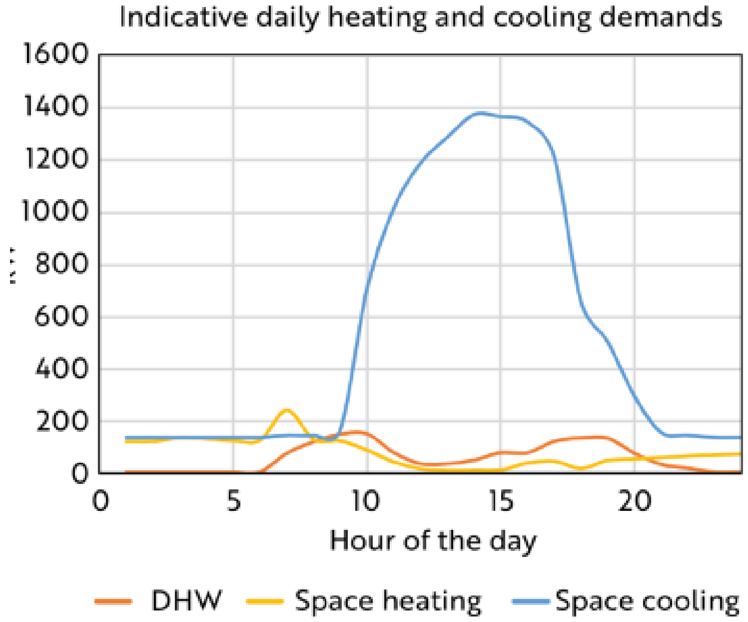
- What level of resilience is required for each load type?
- Are there likely to be any changes to requirements during the lifetime of the heat pump system?

Use the answers to these questions to select the heat pump technology, and size the system
(Proceed to Sections 3 and 4)



Building requirements





Building heating/ cooling demand	Resilience requirement	Emitters	Temperatures
Space heating	Central plant to be able to provide 60% peak load in the event of one heat pump failure	AHU/FCU LTHW coil	50 °C/30 °C
		UFH	
DHW	Storage of 30% of morning peak		70 °C flow
Space cooling	*N* + 1 for central plant	FCU/CHW coil	7 °C/13 °C

Figure 11 Heating and cooling characteristics for an example building

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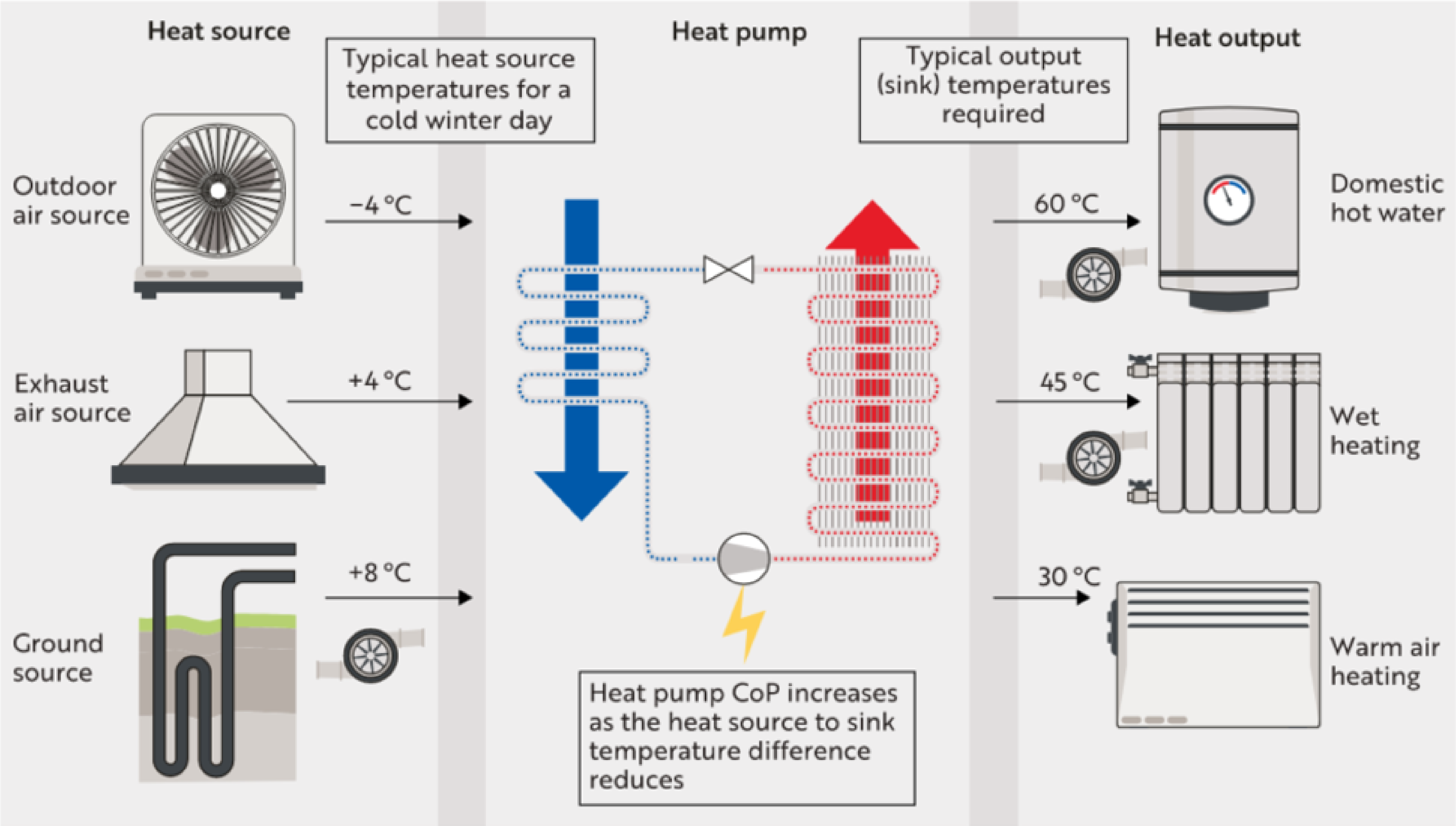

Figure 12 Sources and sinks of heating and cooling for heat pumps

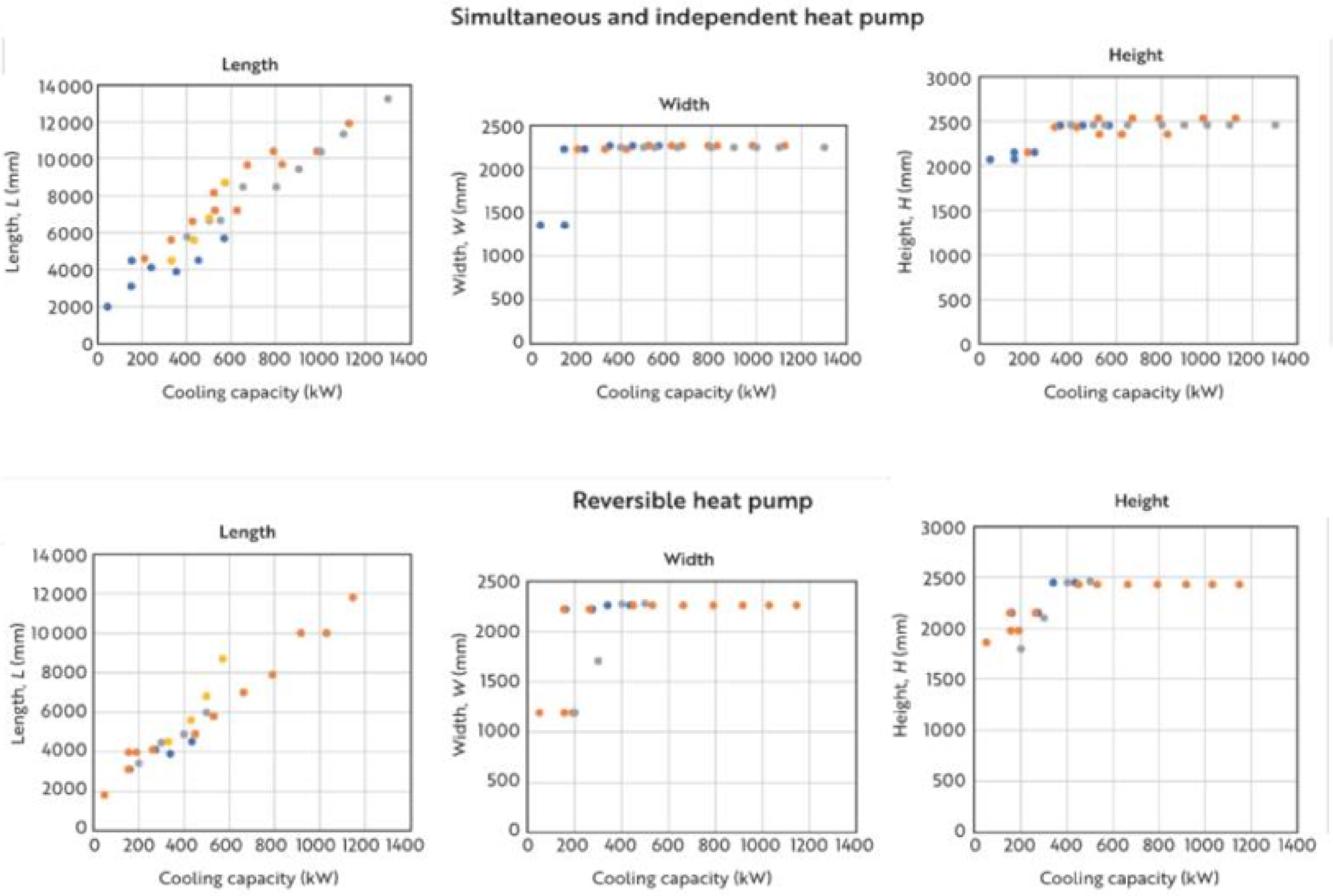

Figure 44 Typical ASHP equipment lengths (*L*), widths (*W*) and heights (*H*) for four manufacturers' products, based on heat pump rated cooling capacity (kW)

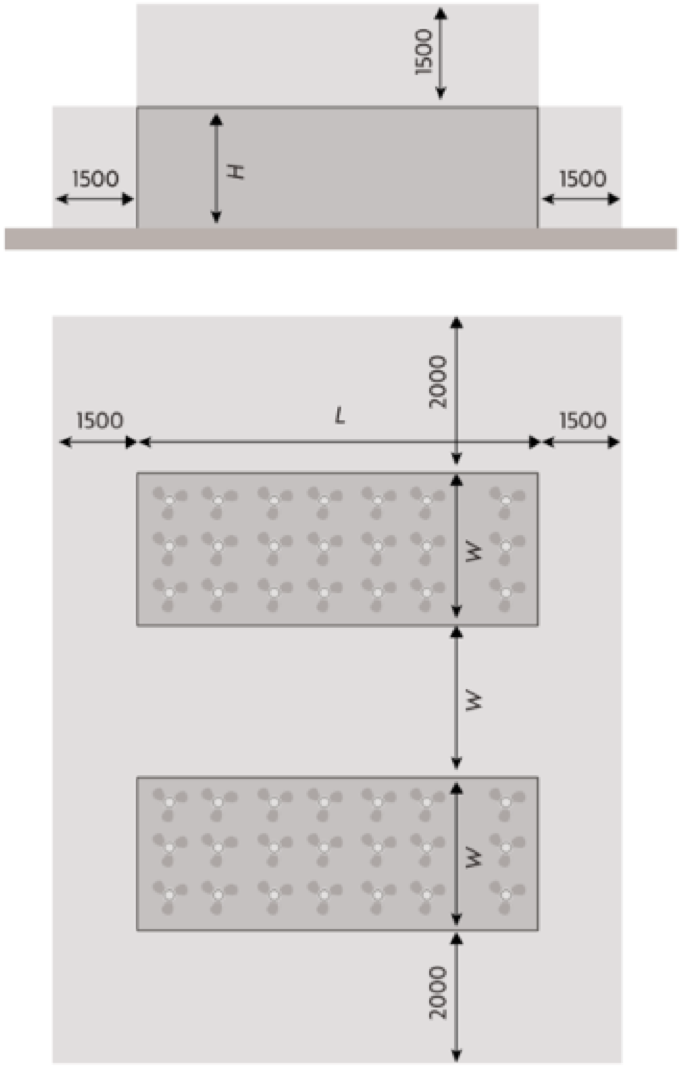

Figure 42 ASHP typical clearances; elevation (top) and plan (bottom)

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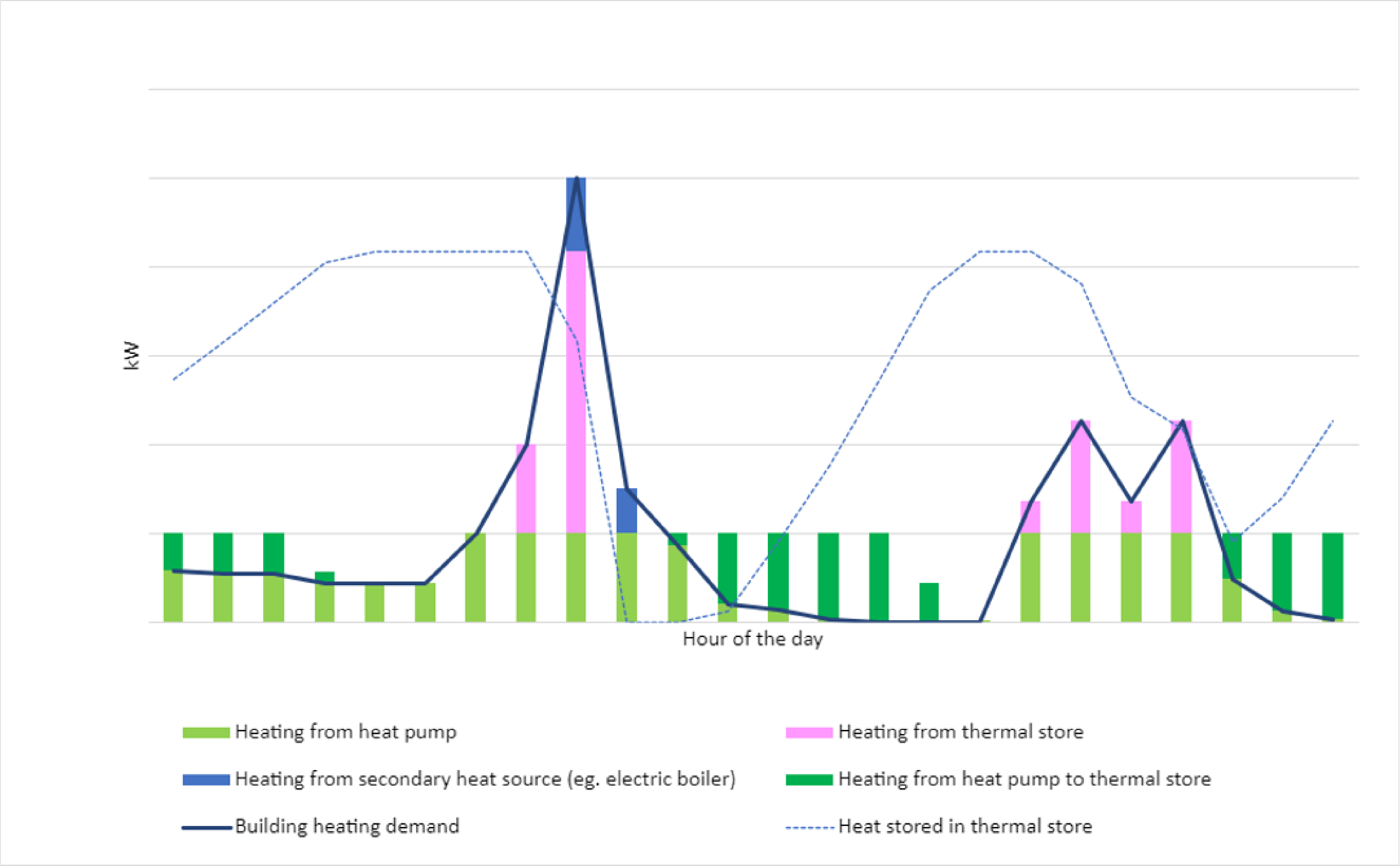
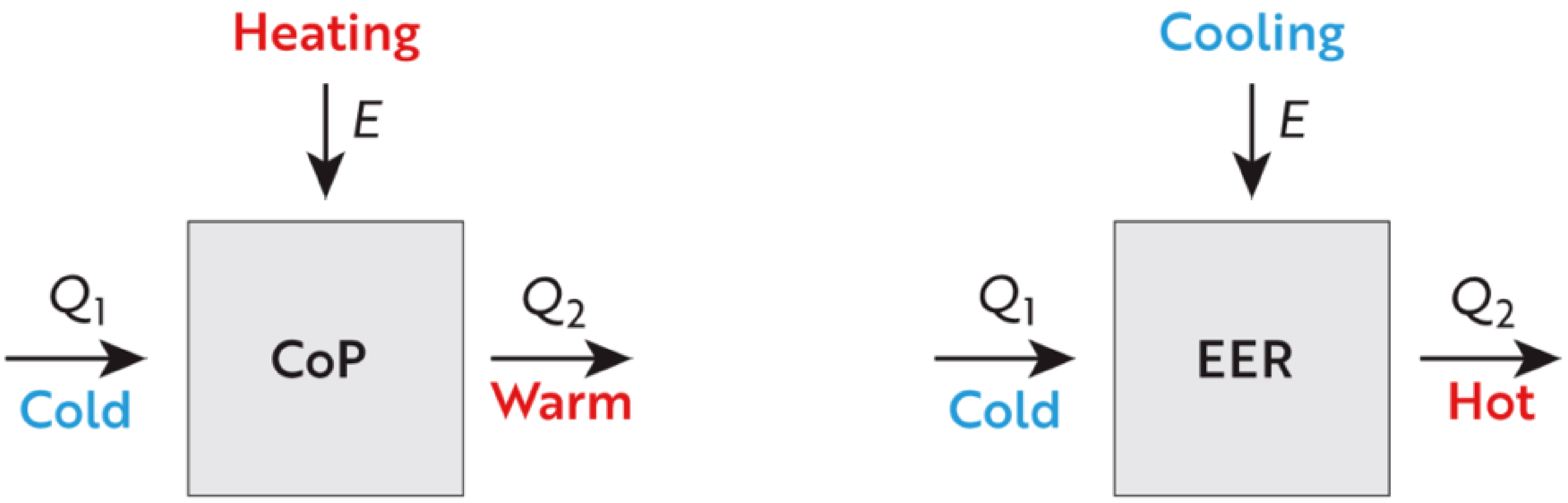


kW
Hour of the day
Heating from heat pump
Heating from thermal store
Heating from secondary heat source (eg. electric boiler)
Heating from heat pump to thermal store
Building heating demand
Heat stored in thermal store



(1) $\text{CoP} = \dfrac{Q_2}{E}$

(2) $Q_1 + E = Q_2$

(1) $\text{EER} = \dfrac{Q_1}{E}$

(2) $Q_1 + E = Q_2$

Figure 14 Energy flows for a heat pump in heating and cooling mode

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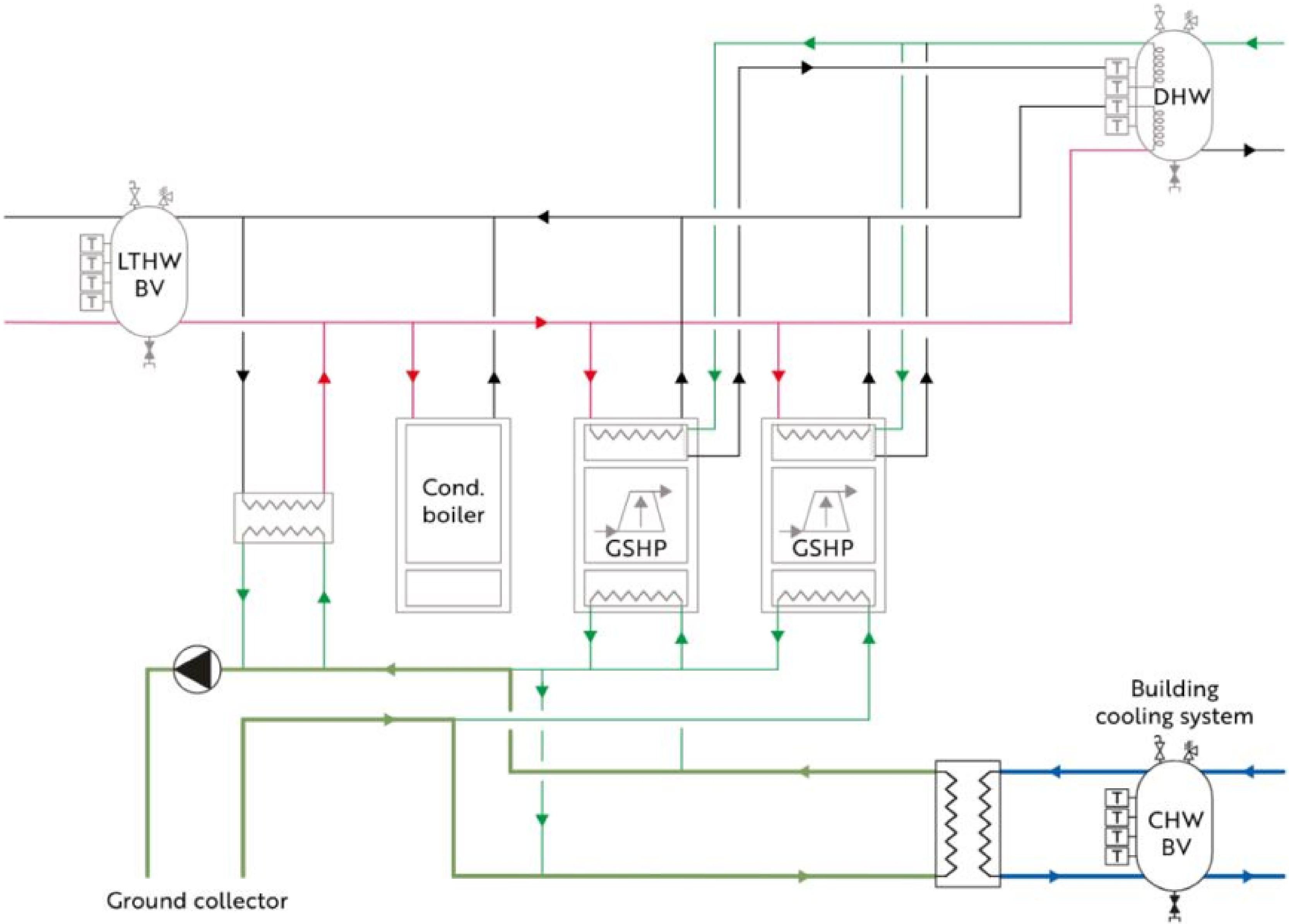

Figure 24 Example pipework and heat exchanger arrangement to facilitate passive cooling; in this arrangement the ground loop can exchange heat directly with the building CHW circuit without operation of the heat pump(s)

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Measures of success

- A comfortable environment for building occupants
- Reliability of heating/cooling supply
- Ease of use and ease of maintenance
- Low energy use in operation
- Safe operation
- Future proofed and resilient
- As cost-effective as possible in terms of capital and life-cycle costs

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Case studies included within AM17

AM17 includes 5 case studies:

- Case study 1 – Heat pump sizing based on annual building loads analysis - 350 Room hotel in Scotland
- Case study 2 – GSHP system operation varying from design – College building in Oxford
- Case study 3 – Sizing cascade systems – Chapel building retrofit in Gloucester
- Case study 4 – Buffer vessel as a thermal store to stabilise the system return temperature – University building in Edinburgh
- Case study 5 – ASHP sizing, system volume and minimum turndown – Public food hall in Cambridge

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Case Study 5: ASHP sizing, system volume and minimum turndown

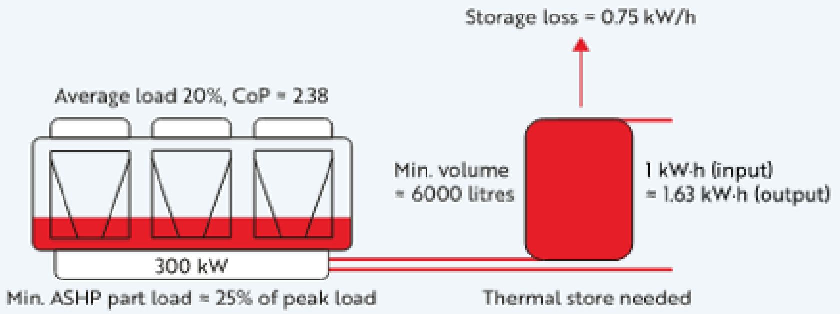

Figure 39 Single large size heat pump scenario

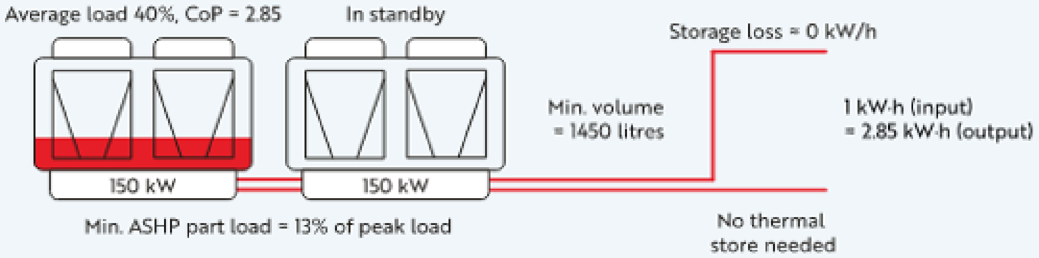

Figure 40 Multiple smaller size heat pumps scenario

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Case Study 3: Cascade systems for higher temperatures

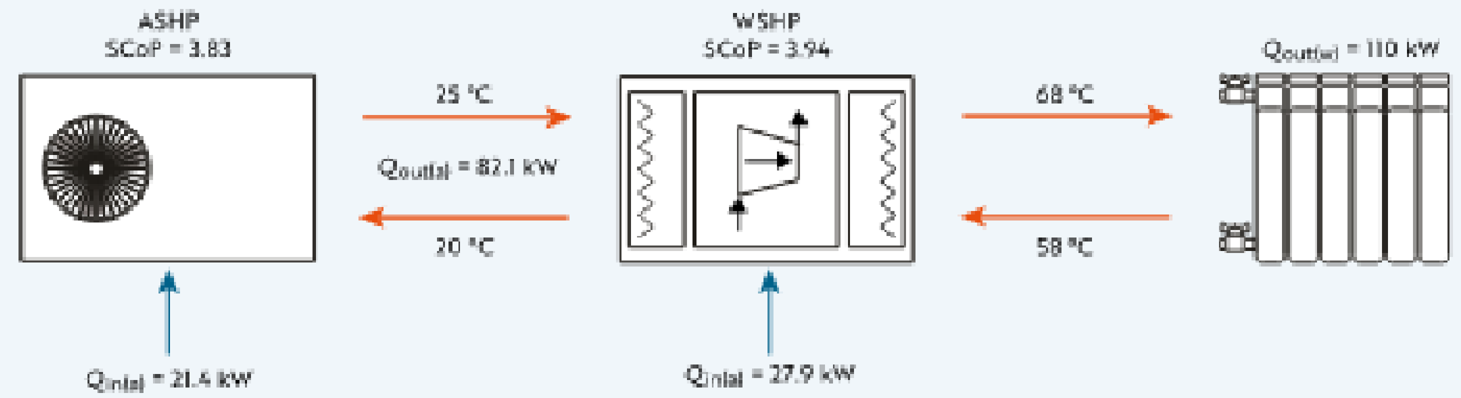

Figure 33 Temperatures, efficiencies and loads of the ASHP-WSHP cascade system

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Case study 2: GSHP System varying from design

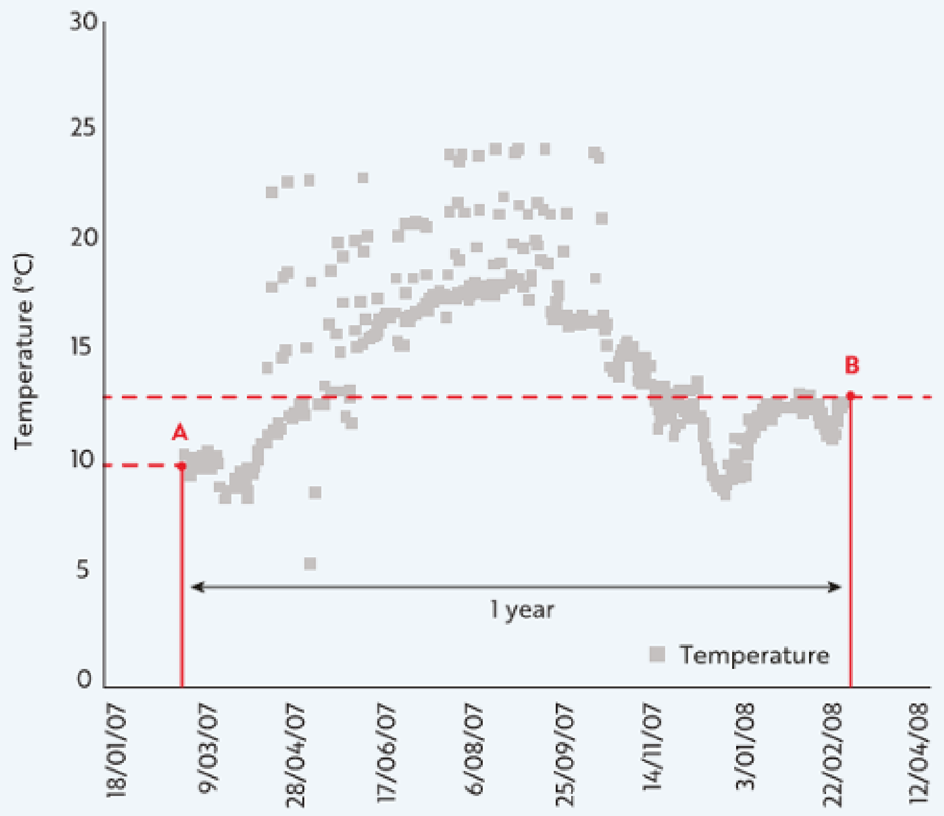

Figure 17 Ground temperature change over an annual cycle

Questions