



# Cooling demand and its status in the UK Energy Policy

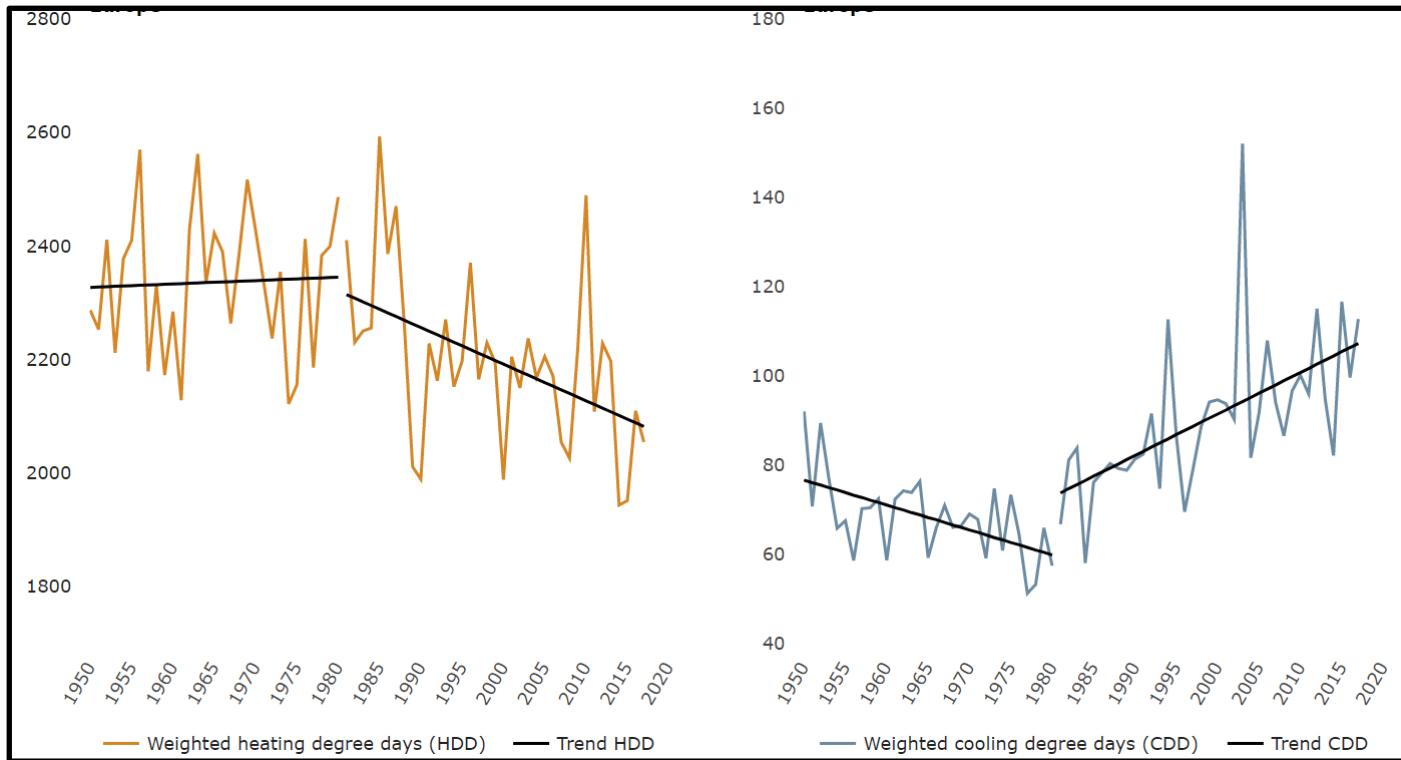
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## Cooling demand across the globe is increasing

- The cooling of buildings accounts for about 20% of the total electricity use worldwide.
- It is estimated that the use will triple by 2050 due to increase of cooling degree days.

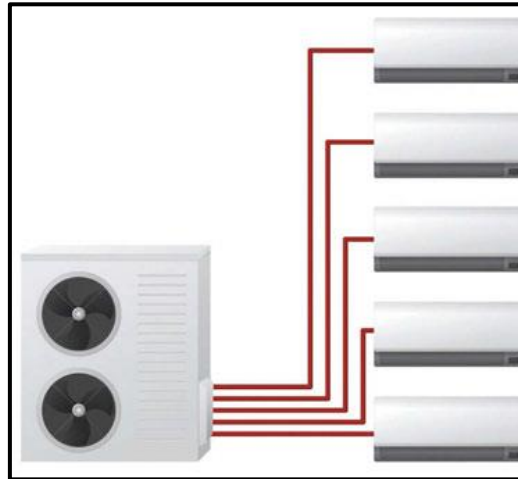


Time series of heating degree days (left) and cooling degree days (right) averaged over Europe over the period 1950–2017 (European Environment Agency)

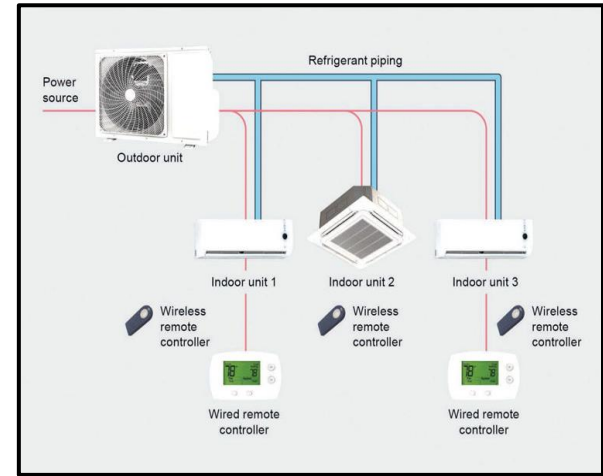
# Active Cooling Strategies:



**Single split**



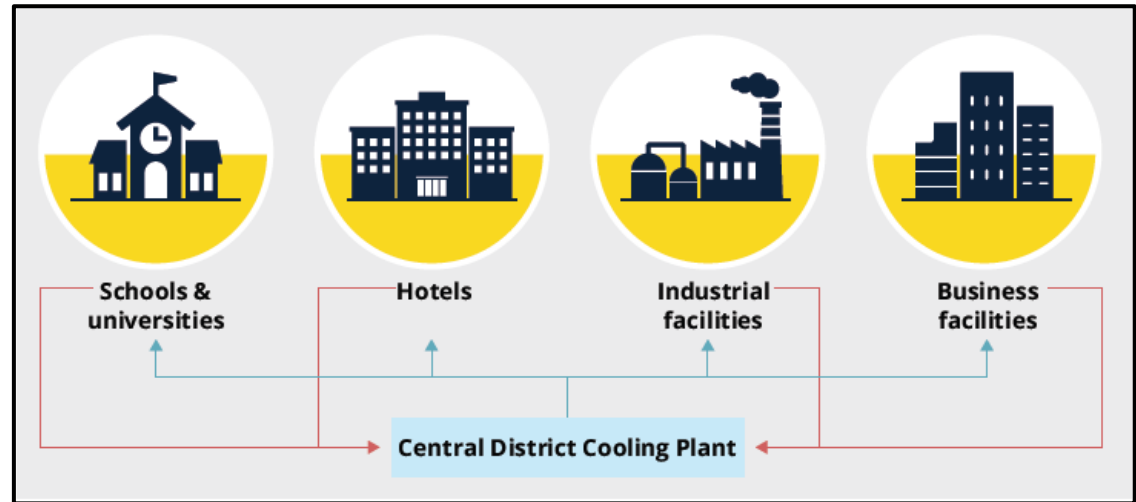
**Multi split**



**Variable Refrigerant Flow (VRF)**



**Air-cooled chiller system**



**District cooling system**

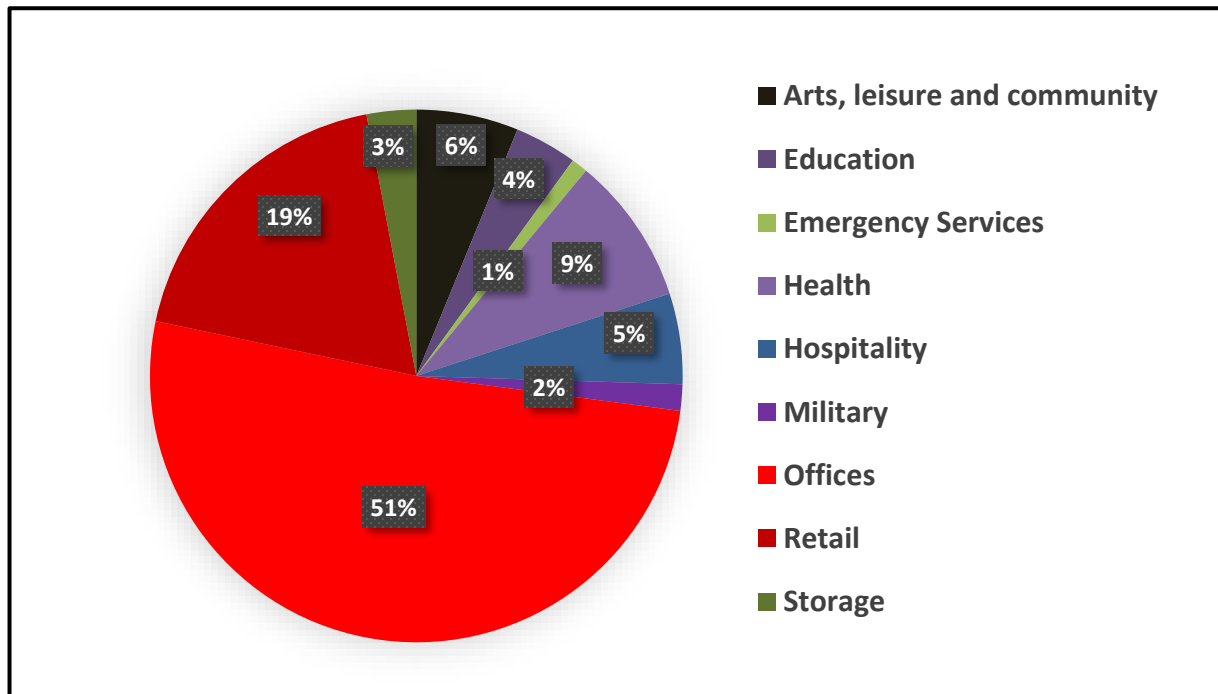


## Cooling is 'hotting up' in the UK

- The current active cooling demand in the UK's buildings is small, only accounting for 3% of the total fuel consumption. But, It's likely to increase due to rising temperatures (CCC, 2019).
- The current cooling demand is dominated by non-domestic buildings.
- Approximately 6,187 GWh of UK energy was consumed for cooling in 2019, mostly for non-domestic buildings (BEIS, 2021).
- Research suggesting that up to 20 % of homes currently experience overheating problems during an average UK summer.

## The current cooling demand in the UK

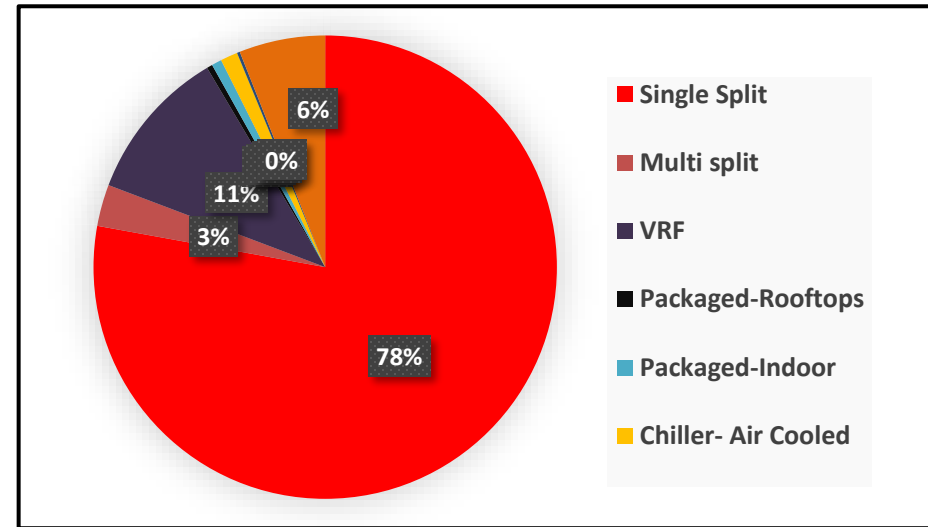
- The office sector has the largest cooling demand which accounts for around half of non-domestic energy consumption in the UK.



UK Cooling energy consumption by sector for non-domestic buildings ,2019

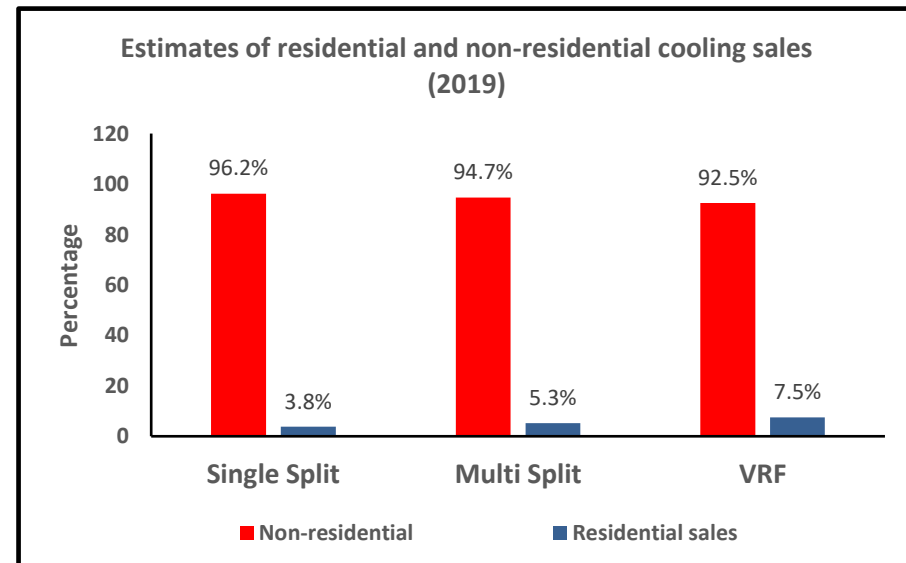
## Current active cooling technologies in the UK:

The split systems have been the preferred type of ACs use in the UK with almost 80% of total sale which is mostly used in commercial buildings (BEIS, 2021).



Various types of active cooling strategies currently used in the UK

More than 90% of cooling sales goes into non-domestic buildings in the UK.

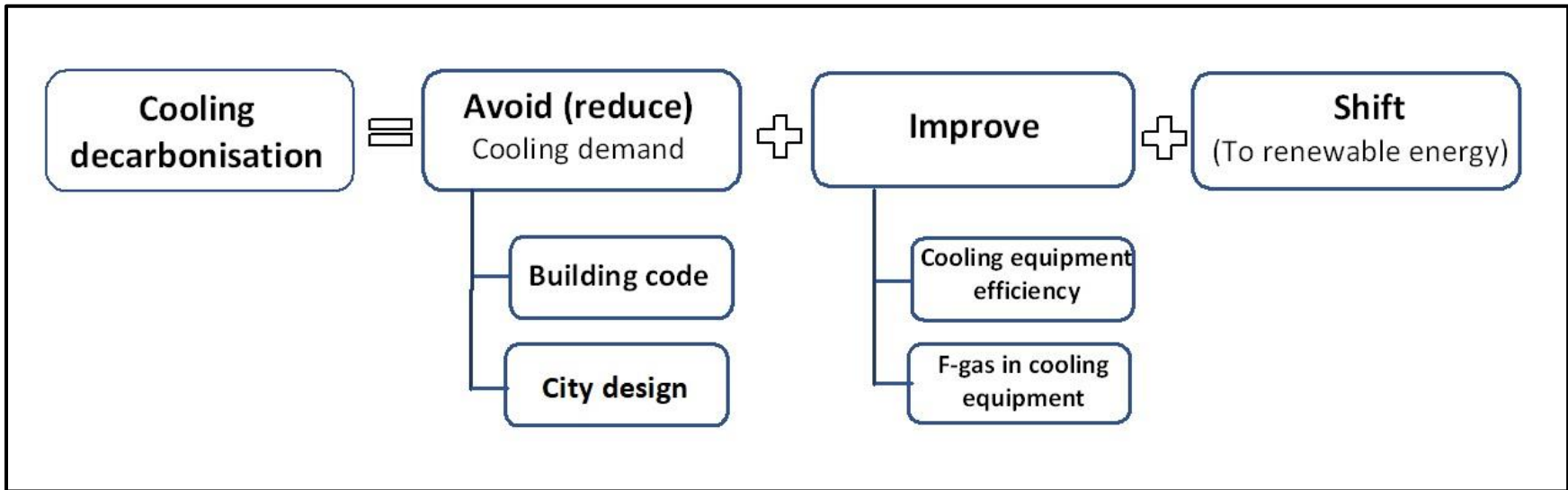


Estimates of residential and non-residential cooling sales (2019)





# To what extent has this cooling demand been considered in the UK energy policy?



**Adapted framework (Reduce/Improve/Shift) to reach cooling decarbonisation**

## 1- Reducing the cooling demand through passive approach:

- The CCC's Report on making UK housing fit for future (2019) recommended passive cooling measures in existing and new homes to reduce overheating risks by the review of Building Standards by MHCLG (The Committee on Climate Change, 2019).
- The Heat and Building Strategy was published by the government in Oct 2021, considered passive strategies (BEIS, 2018).
- The government has recently published revisions to the existing Building Regulations that set some passive cooling measures (Part O) to tackle overheating in all new residential buildings which came into force from June 2022 in England (HM Government, 2021).

Building regulations currently support a '**passive first**' approach, which should be followed in new residential buildings.

## 1- Reducing the cooling demand through active approach:

- UK does not have any policy for considering active cooling approach.
- However a recent CCC's Report (July 2022) 'Risks to health, wellbeing and productivity from overheating in buildings' says:

**A clear policy is needed to understand when ACs and other active cooling systems should be prioritised for use on buildings at high risk from overheating.**

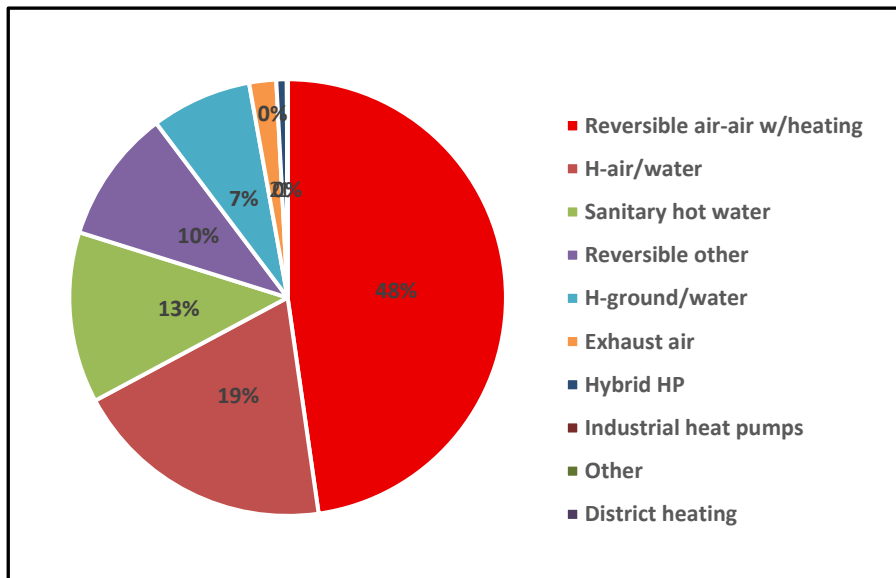
**Thus, the cooling demand in existing UK buildings is still absent from energy policy.**

## 2- Improving the efficiency of cooling equipment and reducing F- gas of air conditioning and refrigerants

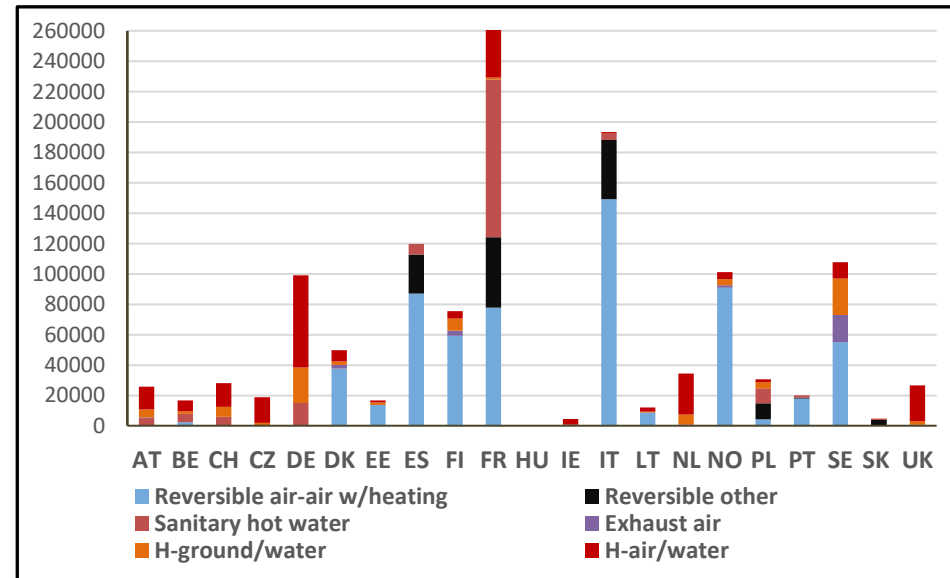
- The 2014 EU F-Gas regulation came into force in the UK in January 2015 which requires a 79% reduction in the use of hydrofluorocarbons (HFCs) between 2015 and 2030 (CCC, 2020).
- Under f-gas bans, UK has already phased out more than 40% of HFCs consumption.
- However, most ACs and heat pumps still rely on F-gases as their refrigerant in the UK (Post Note 642, 2021), as there is no bans on ACs and heat pumps,
- Some more bans are needed to phase out the F-gases over the next UK F-gas regulation revision.

## Efficient active cooling technologies: Reversible heat pumps

- Reversible heat pumps can provide both heating and cooling as a single system.
- Reversible air to air heat pumps are the dominant type of heat pumps in the global market including Europe.
- Almost all heat pumps sold in the UK are hydronic air to water.



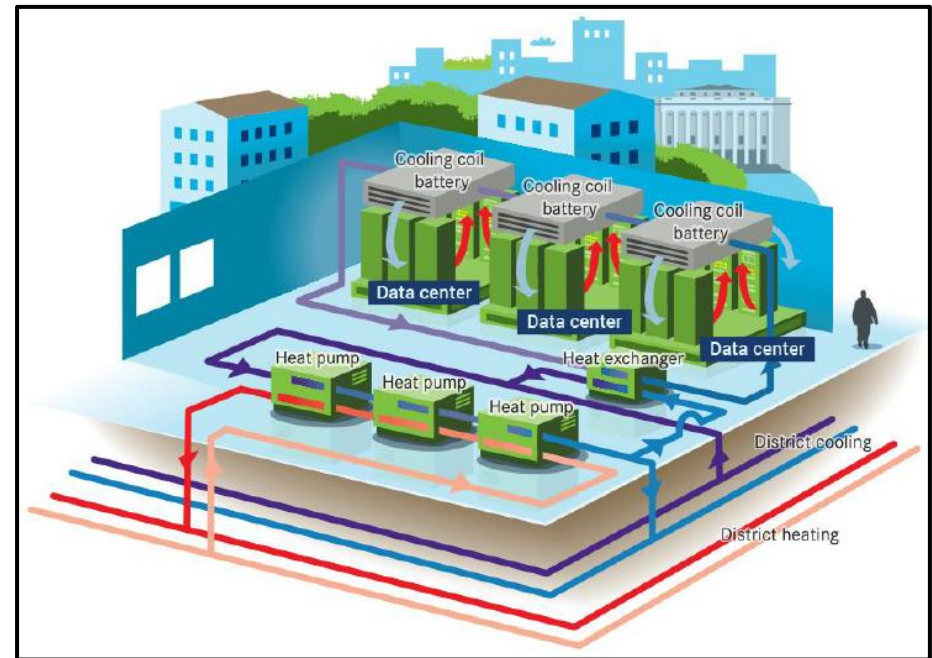
Percentage of the heat pumps sold in 2018 by type across Europe



Heat pump sales in 2018 by type and by country across Europe

### 3- Shifting cooling to renewable, thermal storage and district cooling

- District cooling system is more energy efficient compared to conventional systems being operated at individual buildings.
- The system is common in the Middle East, Scandinavia, Germany, and France.



**District cooling and heating system in Stockholm**

Based on the Clean Growth Strategy (2019), heat networks in the UK are projected to meet:

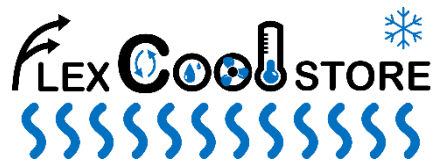
- 17% of heat demand in homes
- 24% of heat demand in industrial buildings to meet 2050 decarbonisation targets,
- Heat networks currently supply around 2% of buildings heat demand (BEIS, 2021).

**The UK current progress on district cooling and heating is still in emerging step compared to elsewhere in Europe.**



## Initial Conclusions:

- 1. Considering cooling in the UK energy policy:** Review of cooling demand in UK energy policy shows that cooling has been ignored in the UK energy policy despite the potential health implication associated with overheating in the UK.
- 2. Scaling up home retrofit plans:** Include consideration of overheating risks and passive cooling strategies for existing homes,
- 3. Combining heating and cooling strategies is necessary:**
  - **Increase energy efficiency:** The simplest common area between heating and cooling strategies must be first explored with an **'efficiency first'** approach such as building codes,
  - **Switch to low carbon technologies:** The government should consider some interventions encouraging the uptake of reversible heat pumps to decarbonise heating which will also accelerate the uptake of cooling.



This part of the research is currently under reviewed by Journal of

*' Communications Earth & Environment '*

# Thank you