DGENTR LOT 6: Task 2 AC & Ventilation systems

ARMINES, BRE, VHK

Roger Hitchin, Christine Pout,
Building Research Establishment, UK
hitchinr@bre.co.uk poutc@bre.co.uk

Contents

- OVERVIEW and SCOPE
    - Energy, Cost, End-use, Production, Modellling
- COLD GENERATION
  - Chillers,
    - Sales, technology, characteristics, stock, future stock
  - Non-chiller systems
    - Single-splits, rooftops, multisplits, VRF
- AIR HANDLING UNITS
    - Sales, services, energy metrics, stock, future stock
- OTHER PRODUCTS
    - Terminal units, cooling towers, filters

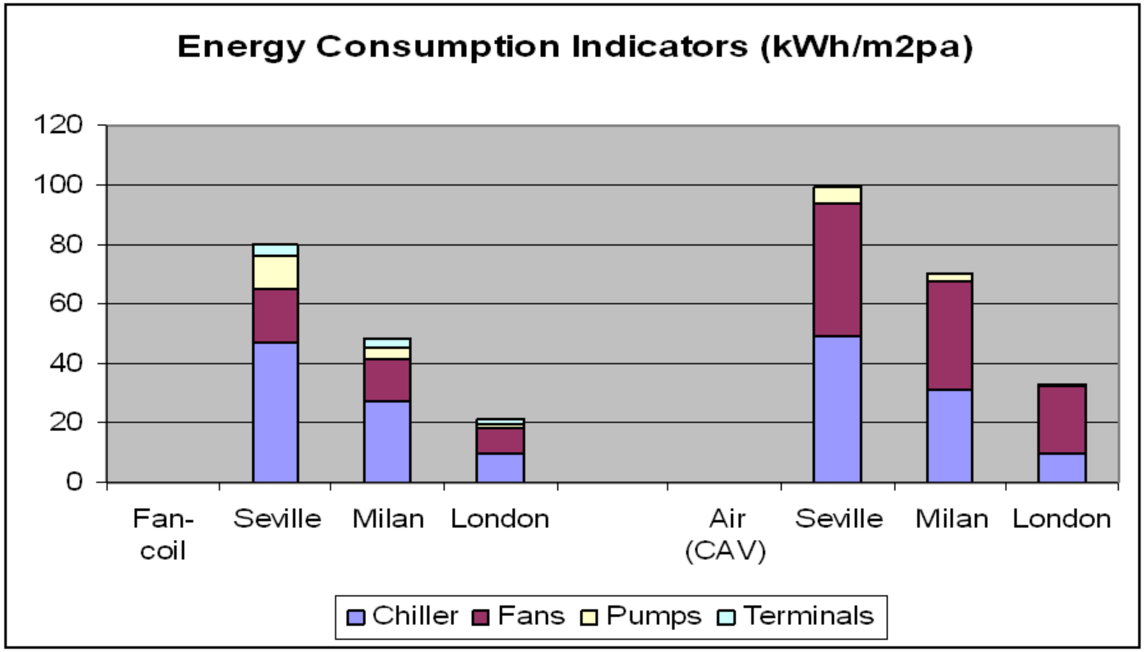
Overview and Scope

- « Centralised AC Systems »

  (Systems which are not room units < 12kW)

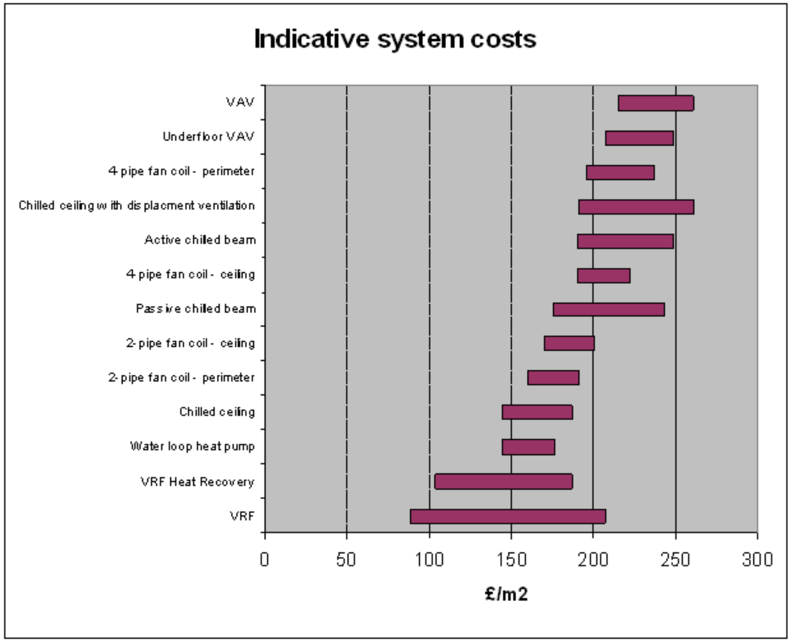
  - Includes many possible system configurations
  - Containing a wide range of possible products
  - We focus on the principal energy-using products
    - Cold Generators and Air Handling Units
  - Noting that other component products
    - Have impact on the energy demand (ductwork, filters…)
    - Use smaller amounts of energy directly (pumps, terminals…)

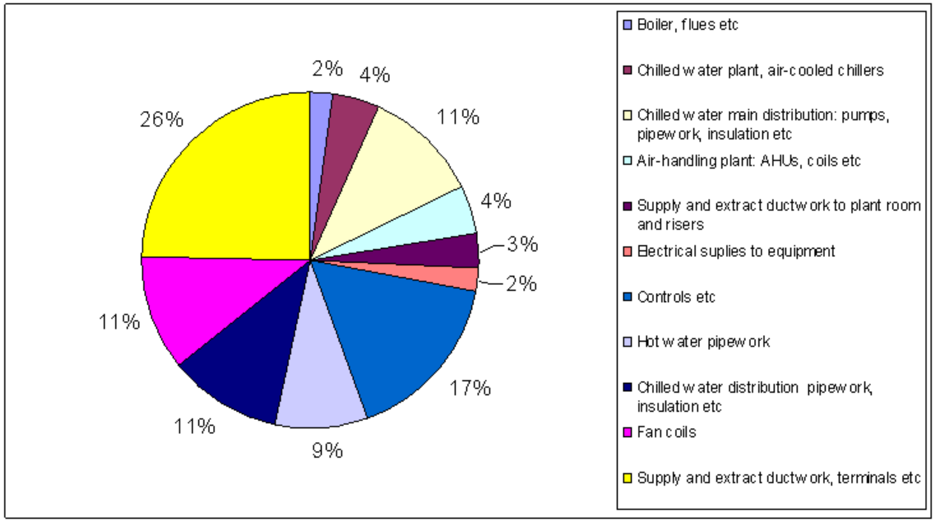
Energy Consumption



- For a given building and weather, energy consumption depends on system type (and detailed design)
- Major energy use is by cold generators and fans

Costs

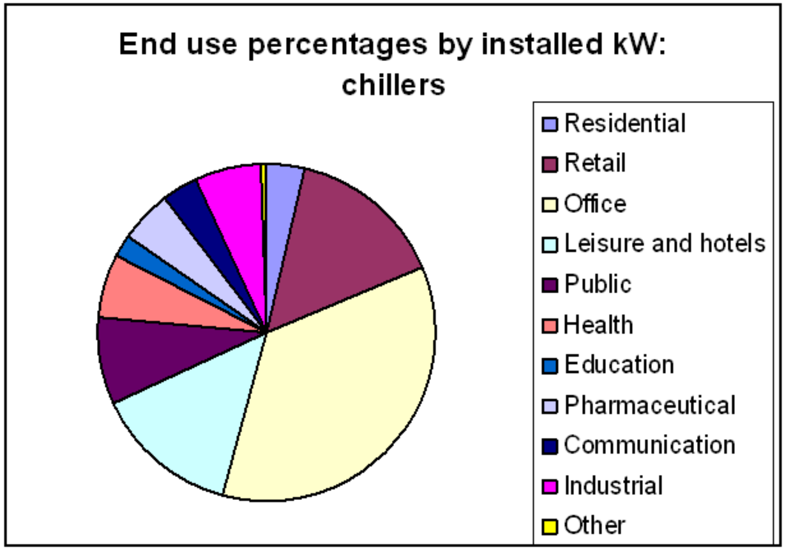




• Energy-using products typically account for only 20% of system cost

• System costs vary significantly between system types
- and between buildings

End-use Sectors

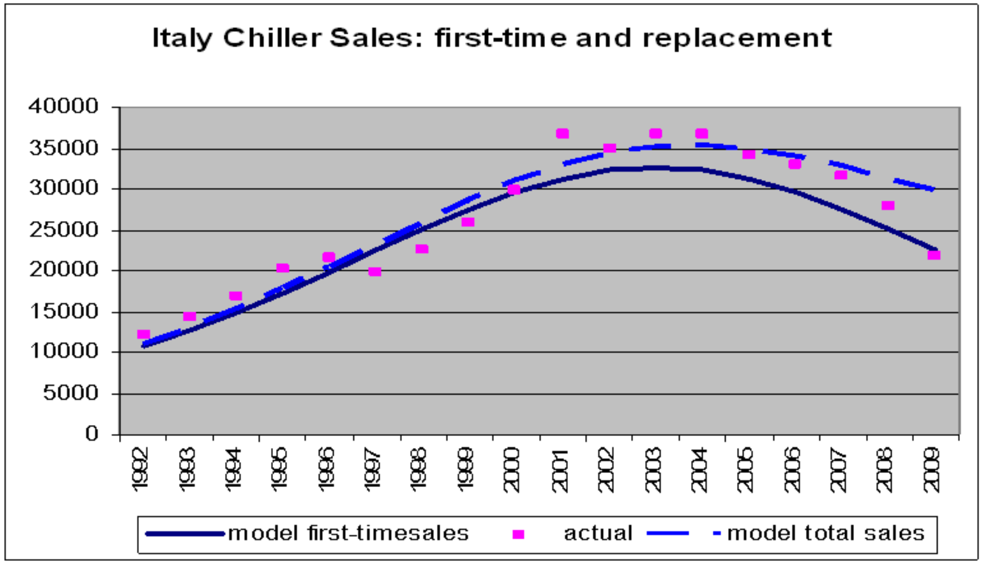


	Newbuild	Refurbishment	Replacement
Chillers	39%	32%	29%
AHU	34%	30%	35%
Fan coil	27%	28%	45%
VAV	36%	39%	25%
Other terminal units	41%	28%	31%

• New-build, refurbishment and product replacement are all important
- *Relative importance varies with product*

• The main market sectors (65%) for central air conditioning are offices, retail, and hotels and leisure

Modelling

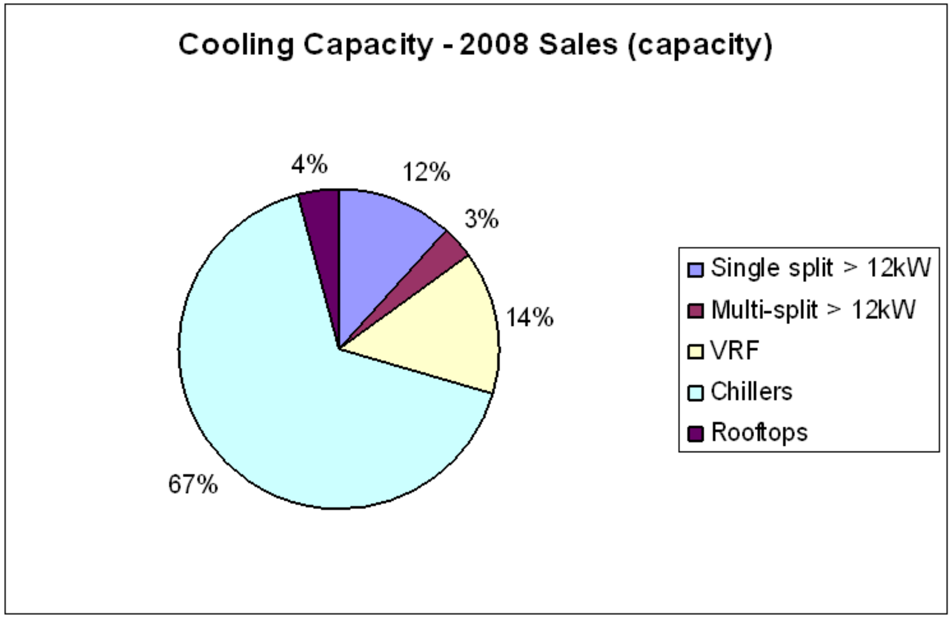


- We are working from sales data, usually from 1992 onwards
- We use modelling, calibrated to these sales data, to estimate
  - pre-1992 sales and thus to separate replacements from first-time sales (to estimate current installed stock)
  - future stock, and stock turn-over

Production, Imports and Exports

- PRODCOM data not very informative
- From other sources:
  - Chillers
    - Italy and France significant exporters
    - Other countries largely importers
  - Air Handling Units
    - Mainly domestic production
    - Except Germany, which is also a major exporter
  - Fan Coil Units
    - Mainly domestic production
    - Except Italy, which is also an exporter
    - And Germany (and, to a degree, Spain) which are also significant importers

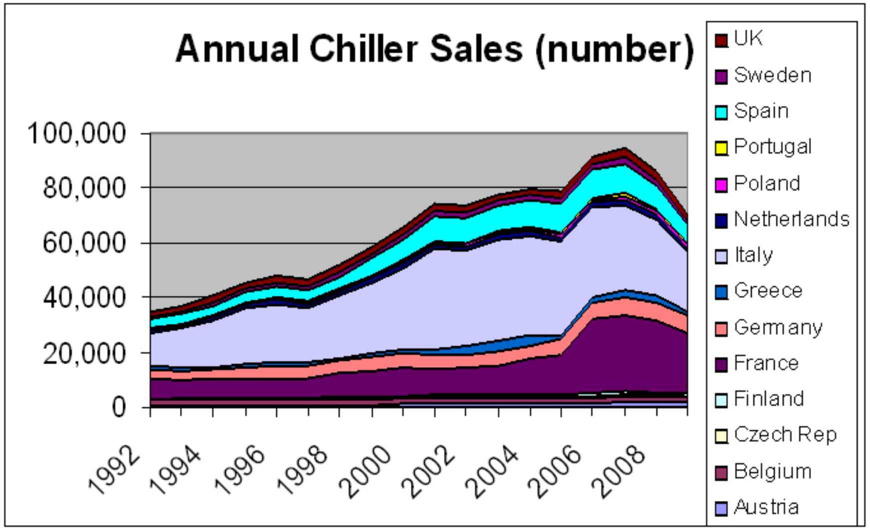
Cold Generators

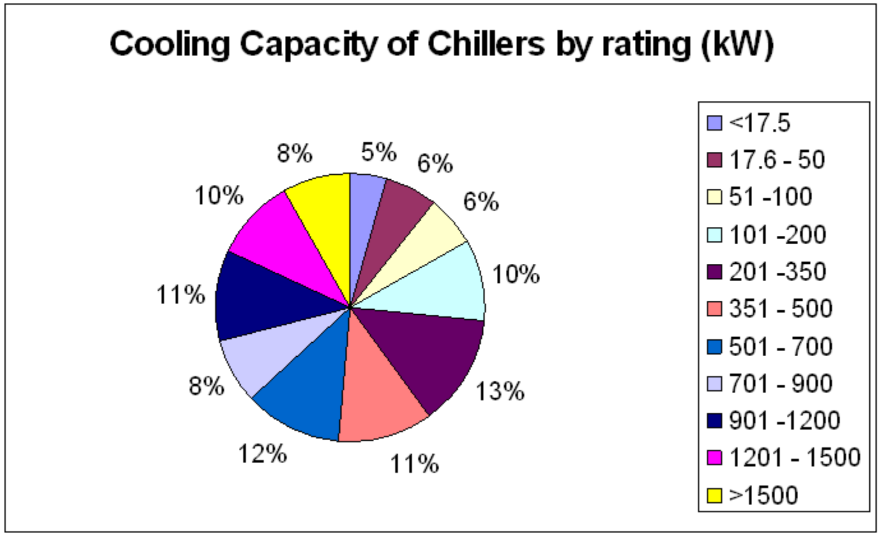


- Chillers account for 2/3 of cooling capacity sold
- VRF and single-splits > 12kW are also significant

  - *Note: the chart shown been updated since the report*

Chiller Sales

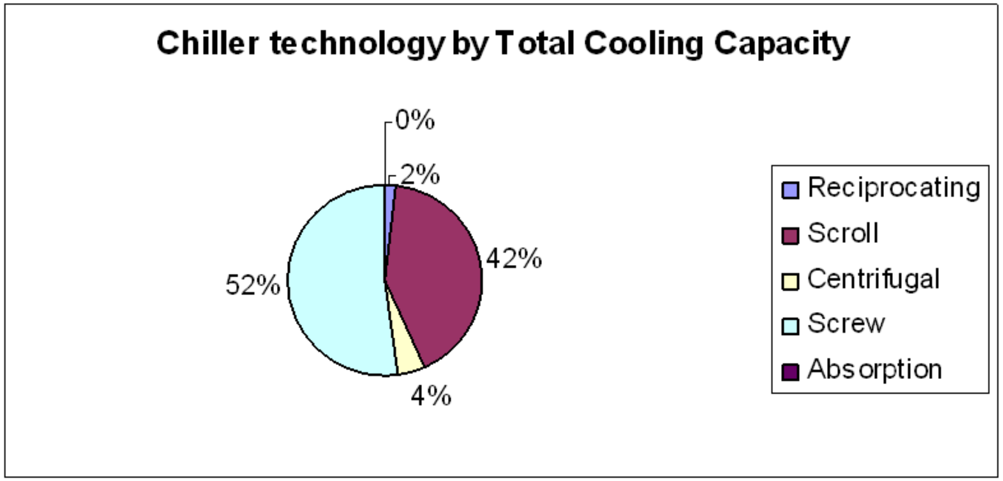




- Half sales (by number) in three countries: Italy, France, Germany
- Two-thirds in these three plus Spain and UK
- *Significant downturn*

- Half sales (by number) < 17.5 kW, two-thirds < 50 kW
- By **total capacity,** these sizes only represent 11% and 5% respectively
- **All size ranges are important**

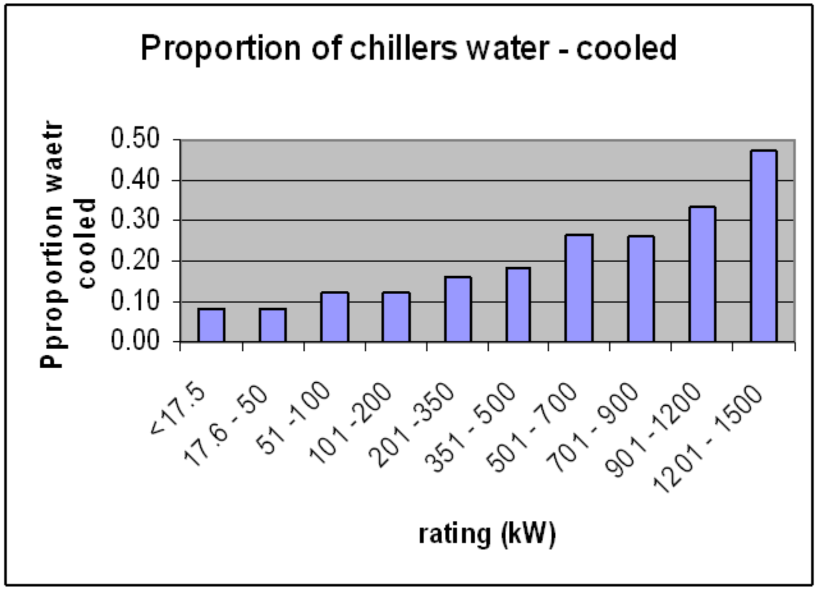
Compressor Technology

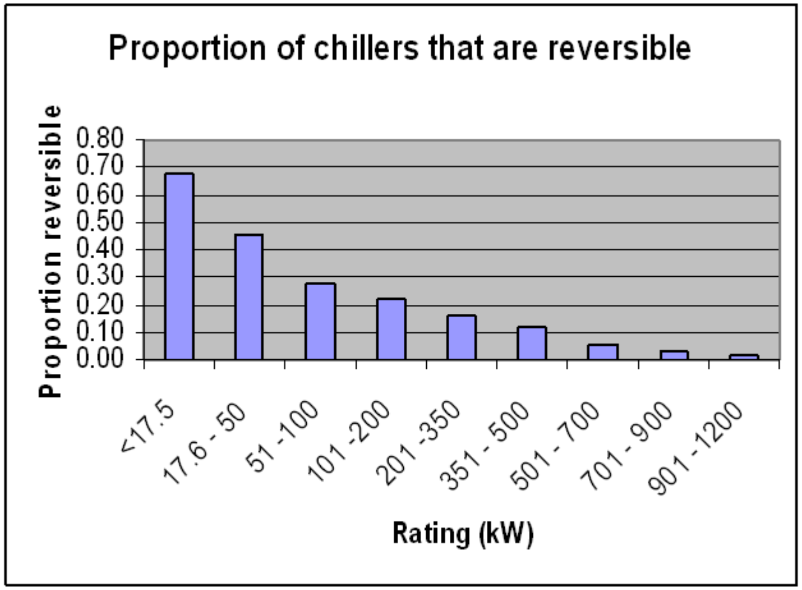


- Scroll and screw compressors account for most sales
  - Scroll mostly below 300 to 400 kW
  - Screw above 300 kW
  - Centrifugal mostly very large sizes
  - Hardly any reciprocating

- *But the installed stock may well be different*

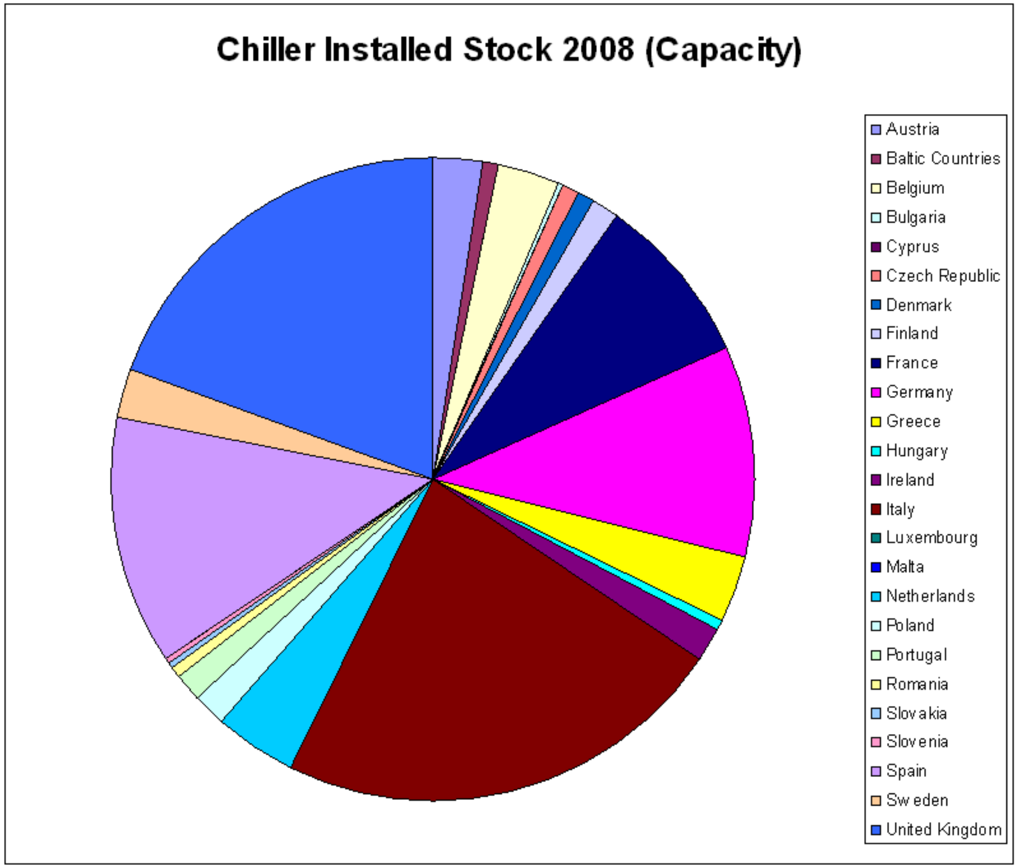
Chiller Characteristics





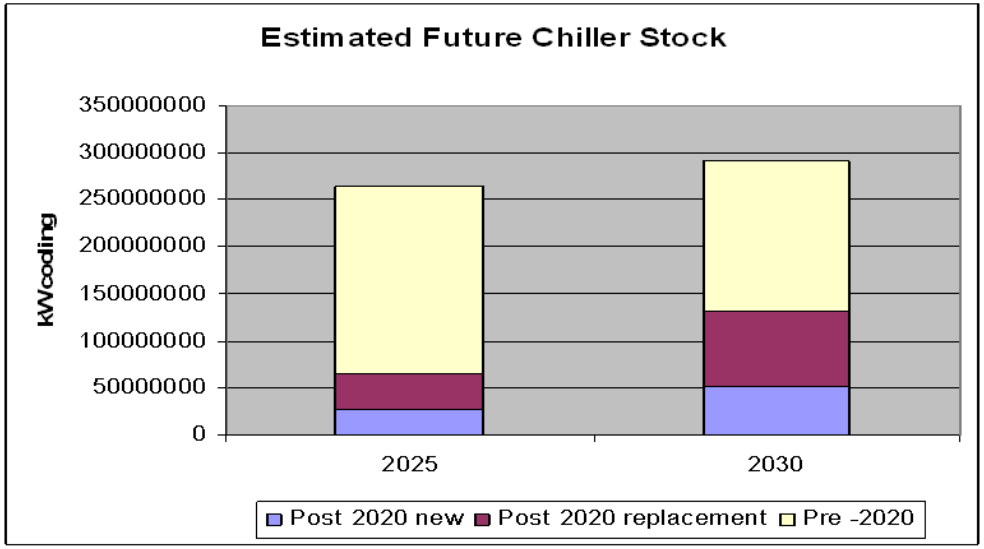
- Three-quarters of chillers are air-cooled
  - fewer at large sizes
- 16% are reversible
  - More at small sizes

Chiller Stock 2008



- Three-quarters of capacity in five countries:
  - Italy, UK, Spain, Germany, France
- By numbers, Italy and France are more important
- 156 GW of installed cooling power

Chillers: Future Stock



Year	2025	2030
Installed cooling	265 GW	291 GW
Installed before 2020	75%	55%
Replacements since 2020	15%	27%
First-time installations since 2020	10%	18%

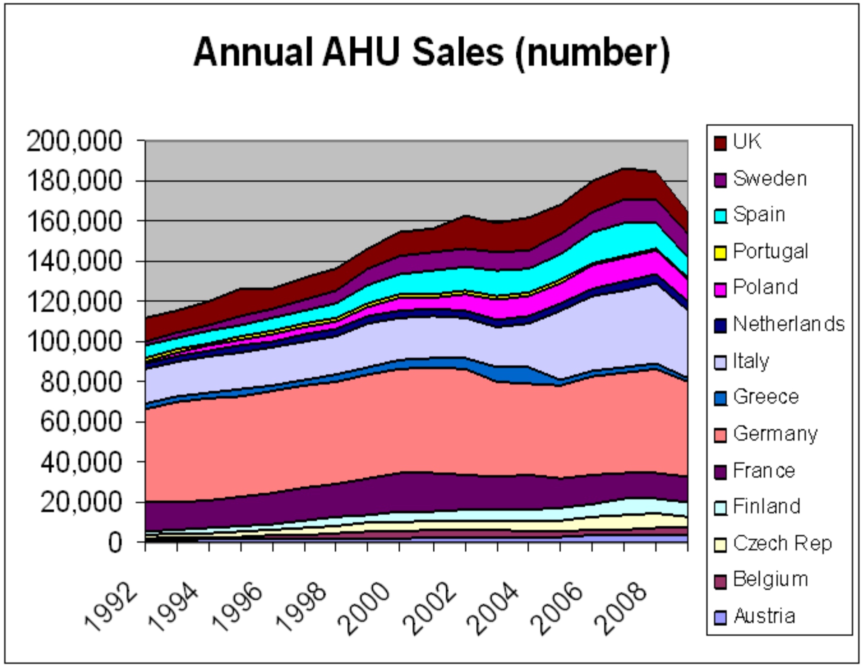
From analysis of market data, typical replacement age is around 18 years

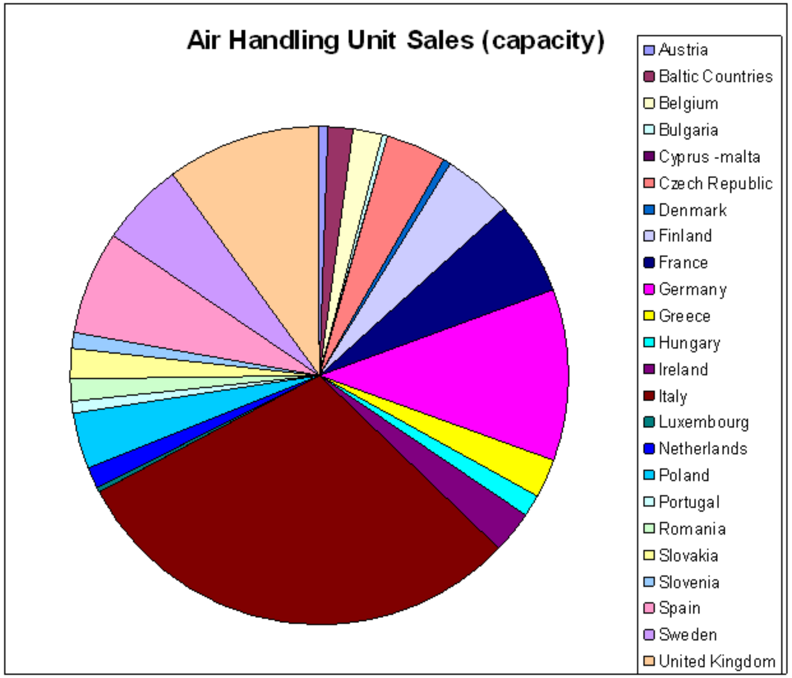
Non-chiller systems

One-third of sales by cooling capacity

- Single splits > 12kW and rooftops
  - Single-splits > 12 kW
    - 12% of sales by cooling capacity
    - Limited data in this sub-category
  - Rooftops
    - 4% of sales by cooling capacity
- Multi-splits > 12 kW and VRF
  - VRF
    - 14% of sales by cooling capacity
    - Most sales in Italy, France, Spain, UK, Germany
    - 60% with heat pump capability
    - 28% with heat recovery capability
    - 12% cooling only
  - Multi-splits > 12 kW
    - 3% of sales by cooling capacity
    - Limited data in this sub-category

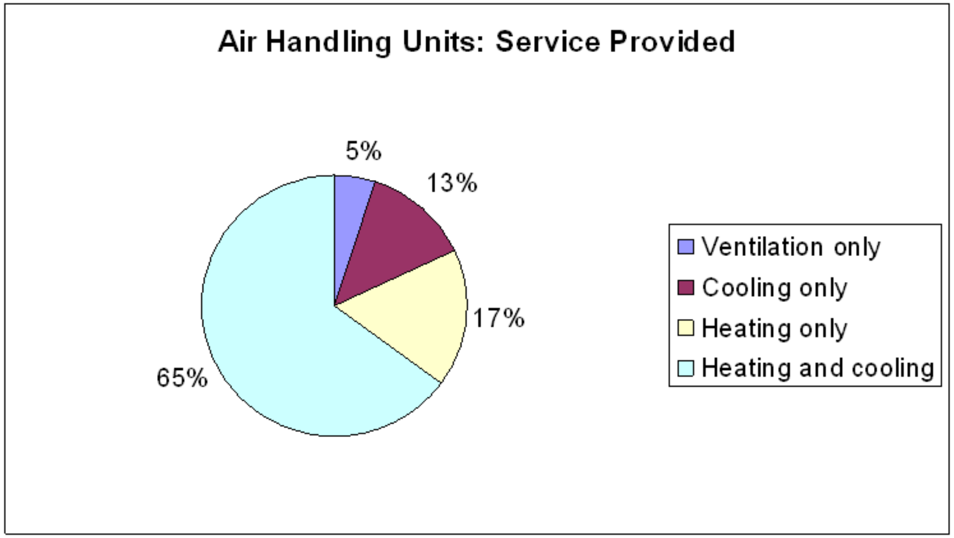
Air Handling Unit Sales





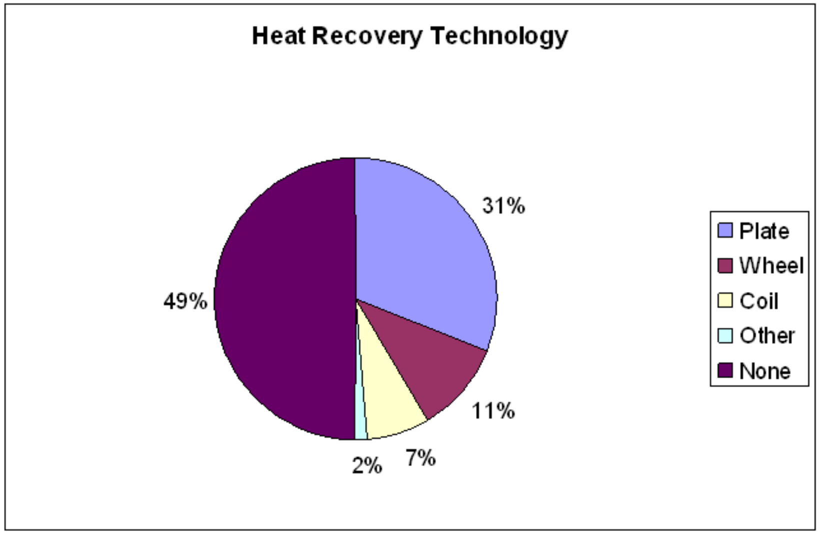
- Italy and Germany together account for about half of sales by number or capacity

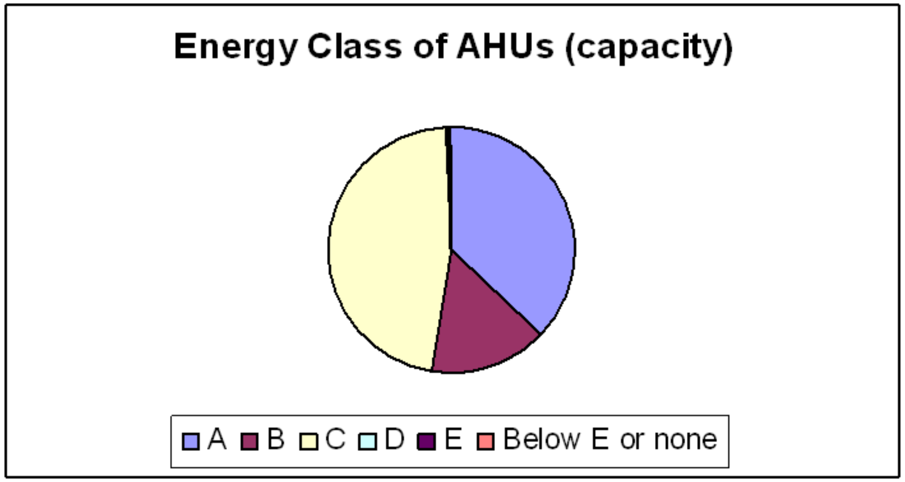
Air Handling Units: Service Provided



- Most AHUs (65%) provide both heating and cooling
  - Proportions vary by country
  - Very few ventilation-only
  - Three-quarters are single-zone

Air Handling Units: Energy Metrics

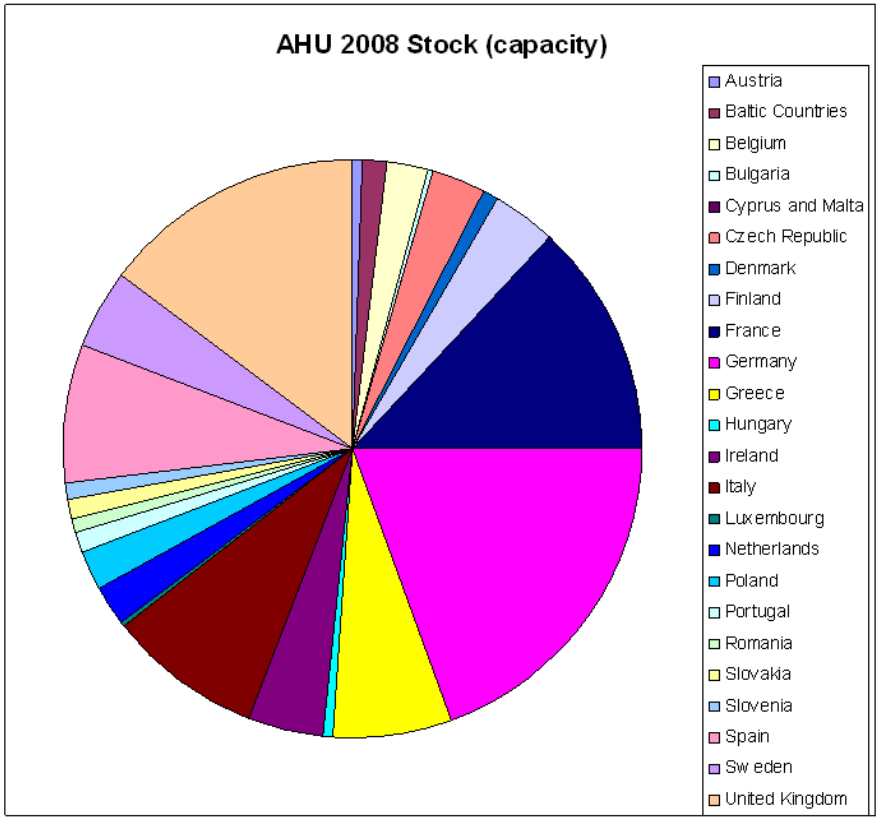




- Half of AHUs sold include heat recovery
  - Proportion appears to be increasing
  - Mostly plate exchangers

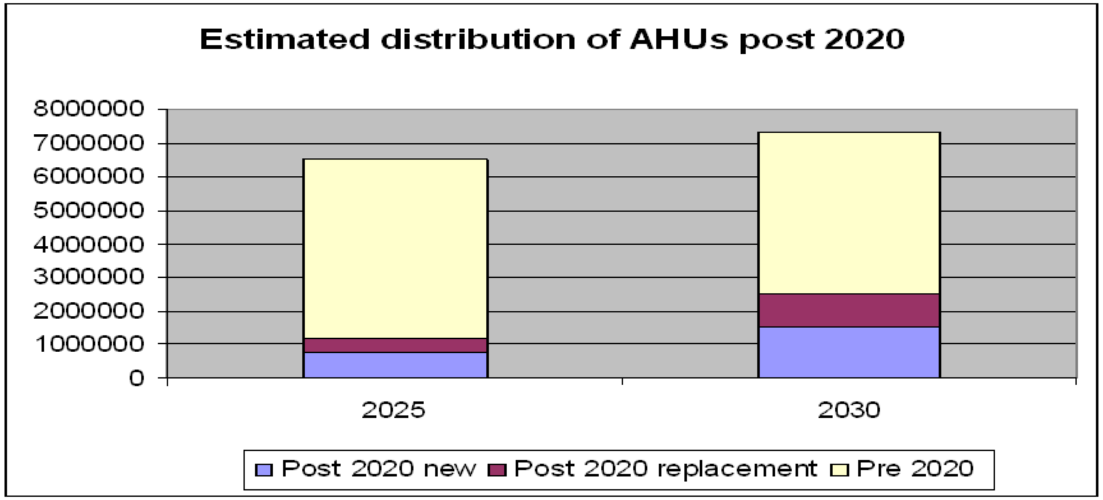
- Most are rated either A or C
  - Appears to be geographical split
  - North and West higher

Air Handling Units: 2008 Stock



- Nearly half of **capacity** is in Germany, France and UK
- By number
  - 40% in Germany
  - Another 20% in France and UK
- Total capacity 39000 M m3/h
  - *Note: data sources for AHU capacity are not consistent*
- *Note: not all air handled is for hygiene ventilation – some is to transfer heat*

Air Handling Units: Future Stock



Year	2025	2030
Installed Stock	6.5M	7.3M
Installed before 2020	82%	66%
Replaced since 2020	6%	13%
First-time installation since 2020	12%	21%

From analysis of market data, typical replacement age is 30 to 35 years

Other Products

- Terminal Units
  - Fan Coil Units
    - Cooling only: 12%
    - 2-pipe with electric heater 7%
    - 2-pipe change-over 53%
    - 4-pipe 26%
    - Heating only 2%
  - *60% of sales are in Italy and France*
  - Other terminal units
    - Limited information
- Other products
  - Cooling Towers
    - Limited information
  - Filters
    - Very limited information
  - Other component products
    - Limited information

What we would like from you

- Your comments: does the picture seem realistic?
  - Any local information on AHU sizes?

- Market information (*if possible broken down by category*): especially
  - Cooling towers
  - Filters
  - Other system component products
  - Large single-splits
  - Terminal units

- Typical product and system prices
  - Is there a premium for energy efficiency?