

# Ventilation system types in some EU countries



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## Introduction

Ventilation system is a combination of appliances designed to supply interior spaces with outdoor air and to extract polluted indoor air. The system can consist of mechanical components (e.g. combination of air handling unit, ducts and terminal units). Ventilation system can also refer to natural ventilation systems making use of temperature differences and wind with facade grills in combination with mechanical exhaust (e.g. in corridors,

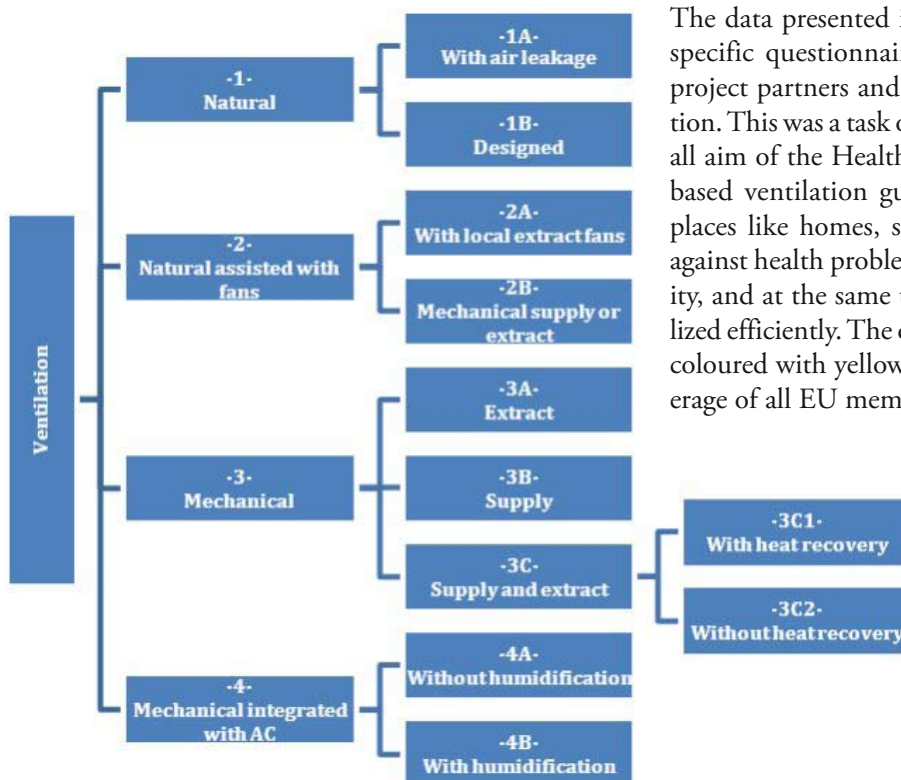
toilets etc.). Both mechanical and natural ventilation can be combined with operable windows. A combination of mechanical and non-mechanical components is possible (hybrid systems).

Across EU countries, ventilation does not follow the same practices. This discrepancy can be due to the climate and building tradition. For the future development of energy efficient ventilation for good indoor environment it is important to know the ventilation systems in current building stock in Europe. In this summary commonly used ventilation systems in Europe in dwellings, schools, kindergartens and office buildings. The ventilation systems are either natural or mechanical ventilation. These main categories are further subdivided into several subsystems (**Figure 1**).

## Data collection

The data presented in this article was collected with a specific questionnaire in the HealtVent project from project partners and other national experts on ventilation. This was a task of REHVA in the project. The overall aim of the HealthVent project is to develop health-based ventilation guidelines for protecting people in places like homes, schools, kindergartens, and offices against health problems caused by poor indoor air quality, and at the same time will ensure that energy is utilized efficiently. The questionnaire covered the countries coloured with yellow in the **Figure 2**, giving good coverage of all EU member states.

The responses were based either on national regulations, national knowledge in construction practises, national related studies or national statistics. With only a few respondents from each country may be a source of error. However, as the data was collected just to provide an overview of the European situation, minor errors are not significant.



**Figure 1.** Classification of ventilation systems in this article.

For each of 15 systems in **Figure 1** colour was designated (**Table 1**). The results are presented in the diagrams (**figures 3-13**). The colours were chosen based on accurate visual distinction and on system and adjacent subsystems identification (i.e. different shades of the same colour).

### Ventilation systems in buildings stock

The responses from the participating countries showed that national official statistics of ventilation systems is not available from any country. The results shown below are based on the estimations delivered by experts from participating countries. Some subjective judgement has been use in grouping the some ventilation system types in the results. Collected information was also incomplete, particularly regarding the ventilation systems in the building stock.

The estimation of ventilation system in the building stock can be give only in residential buildings, schools and kindergartens, and only for a few countries (**figures 3, 4, 5 and 6**).

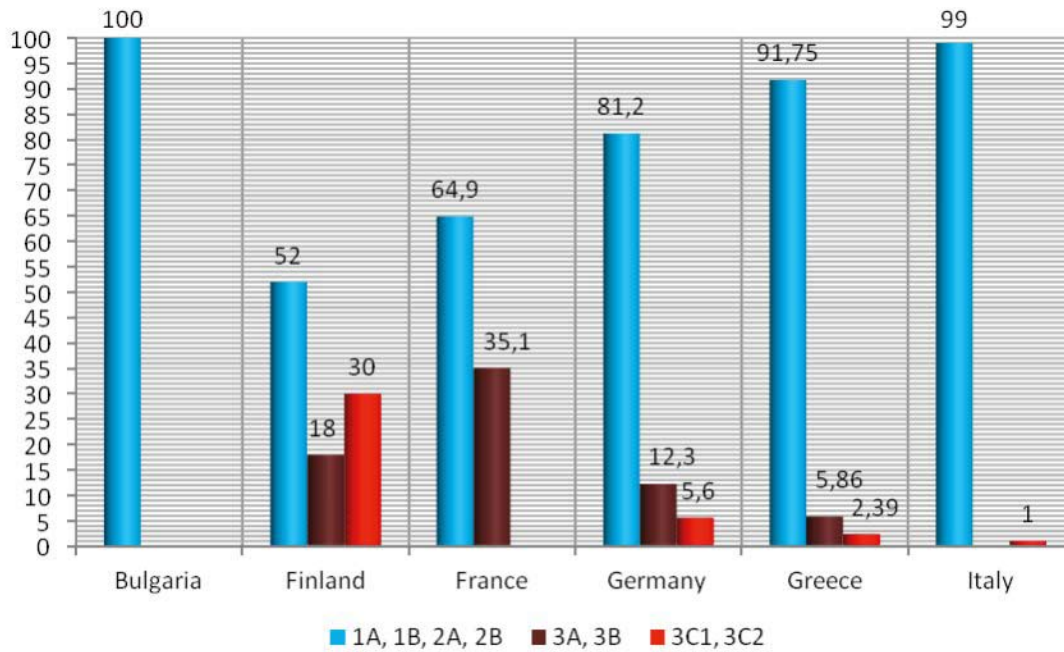


**Figure 2.** The countries for which are included in the survey coloured with yellow.

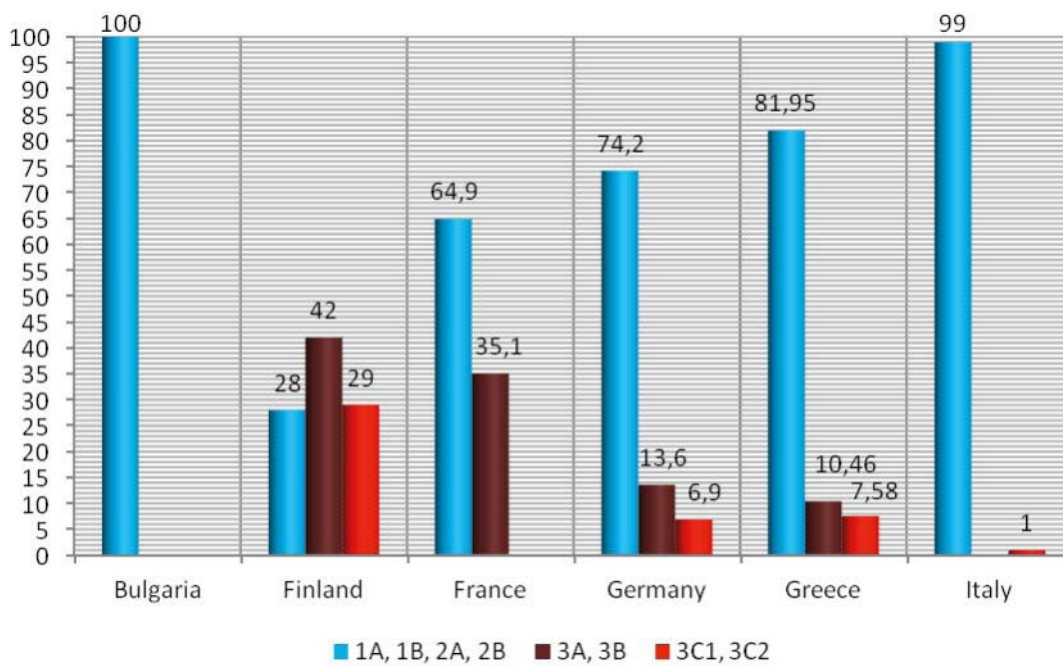
For houses the distribution of ventilation systems, presented in **Figure 3**, clearly shows that natural ventilation and fan assisted natural ventilation account for more than 50% of existing systems. The values vary

**Table 1.** Colour code for the ventilation systems in the figures below.

	1A	Natural ventilation with air leakage
	1B	Designed natural ventilation
	1A, 1B	Natural ventilation
	2A	Natural ventilation with local extract fans
	2B	Hybrid ventilation (1A or 1B + intermittent 3A or 3B)
	2A, 2B	Natural assisted with fans
	1A, 1B, 2A, 2B	Natural ventilation with or without assisting fans
	3A	Mechanical extract ventilation
	3B	Mechanical supply ventilation
	3A, 3B	Mechanical ventilation
	3C1	Mechanical extract and supply ventilation with heat recovery
	3C2	Mechanical extract and supply ventilation without heat recovery
	3C1, 3C2	Mechanical with or without heat recovery
	4A	Ventilation integrated with AC without humidification
	4B	Ventilation integrated with AC with humidification



**Figure 3.** Distribution of ventilation systems in percentage from total number of houses in existing building stock.



**Figure 4.** Distribution of ventilation systems in percentage from total number of apartment buildings in existing building stock.

from Bulgaria with 100% natural to Finland with 52% natural and 48% mechanical.

For apartment buildings, presented in **Figure 4**, the situation is almost the same with slight differences for Greece and Germany but with obvious domination of mechanical ventilation in Finland.

It is interesting to observe that France has only extract or supply mechanical ventilation whereas Greece and Germany have one third of the mechanical ventilation systems with extract and supply (with or without heat recovery) and Finland has more than half of the houses and almost half of the apartments equipped with supply and extract mechanical ventilation.

### Evolution of residential ventilation systems in some countries

Types of the ventilation systems used in a specific country differ with construction year due to changes in regulations and construction practise. In the responses to the questionnaire each country selected its range of construction year. The breakdown of the ventilation systems based on the selected construction year of buildings are presented in percentage from specific building constructed during the time period indicated above each pie chart.

The European residential building stock (in m<sup>2</sup>) accounts for 75% of the whole building stock, from which 64% is taken by houses. The figures 7-13 show the distribution of ventilation systems in the building constructed during each indicated time period.

Looking at the development of ventilation systems is evident that in all countries the use of natural ventilation systems is decreasing in favour of mechanical ventilation systems. The evolution is different in all counties but the trend is the similar

- before 1980 all countries used mainly natural ventilation;
- Finland was within the first countries to make a change i.e. before 1959, by introducing mechanical supply and/or extract ventilation systems; gradually the situation evolved reaching the point that all after 2004 constructed buildings have only mechanical ventilation systems;
- in the United Kingdom the changes took place between 1980 and 2010, during which the constructed buildings assured ventilation mostly through more and more fan assisted natural ventilation but also mechanical supply and/or extract ventilation; only lately, i.e. 2011 mechanical ventilation systems account for half of systems in constructed houses;

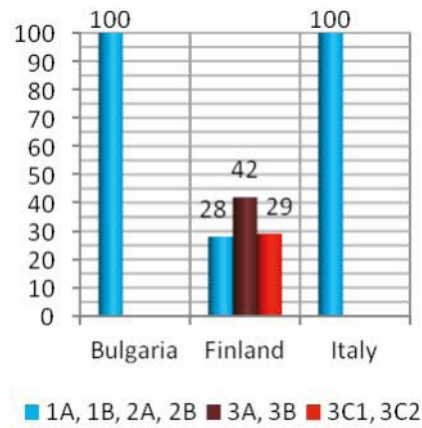


Figure 5. Distribution of ventilation systems in percentage from total number of school buildings in existing building stock.

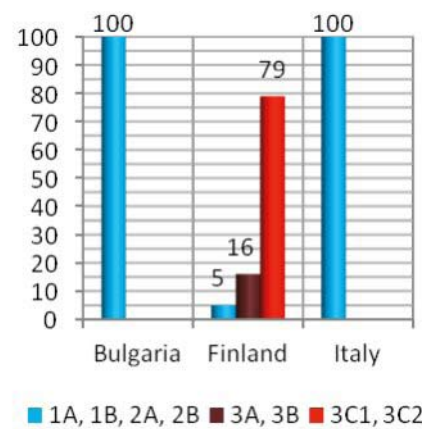


Figure 6. Distribution of ventilation systems in percentage from total number of kindergartens buildings in existing building stock.

- for Greece 1978 was the turning point after which more fan assisted natural ventilation and mechanical extract and/or supply systems were used; the situation has been slowly evolving but still natural ventilation accounts for half of the currently constructed houses;

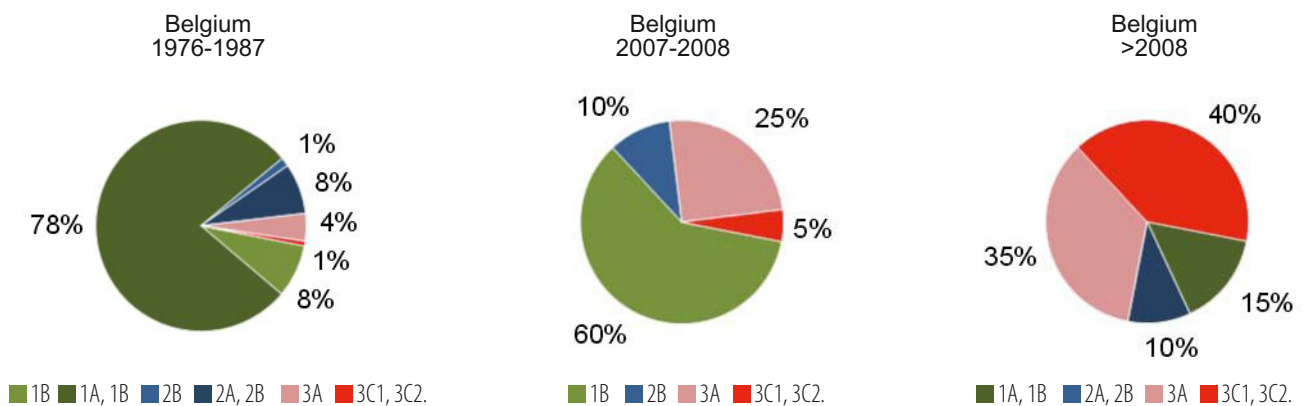
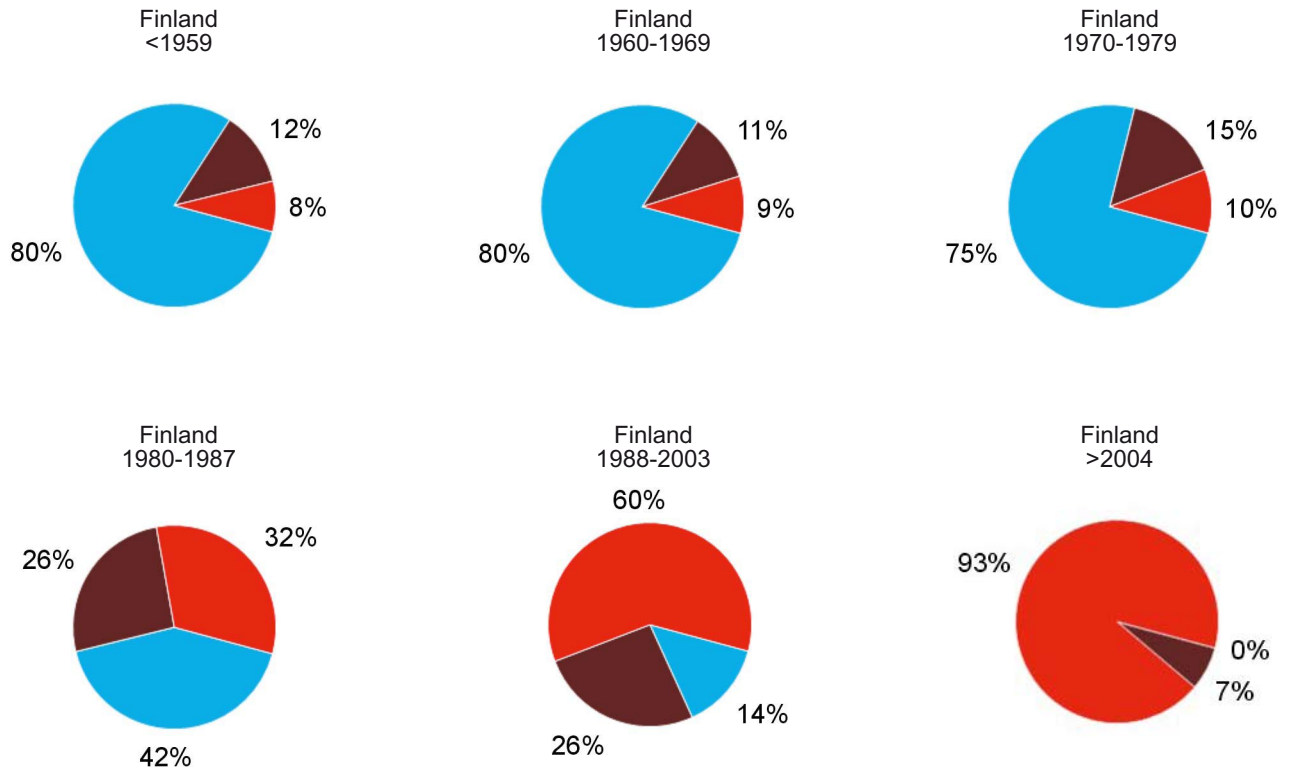
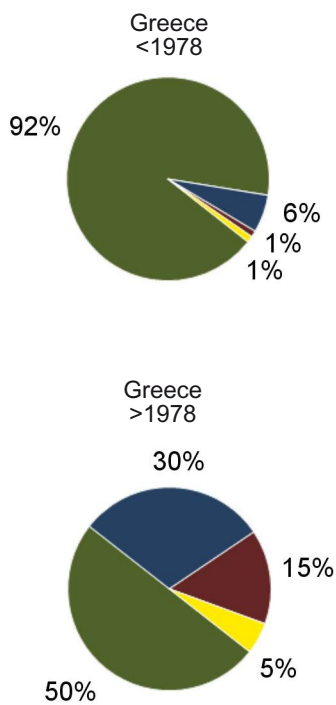


Figure 7. Distribution of ventilation systems in houses by construction year in Belgium: before 2007, 2007-2008 and after 2008.





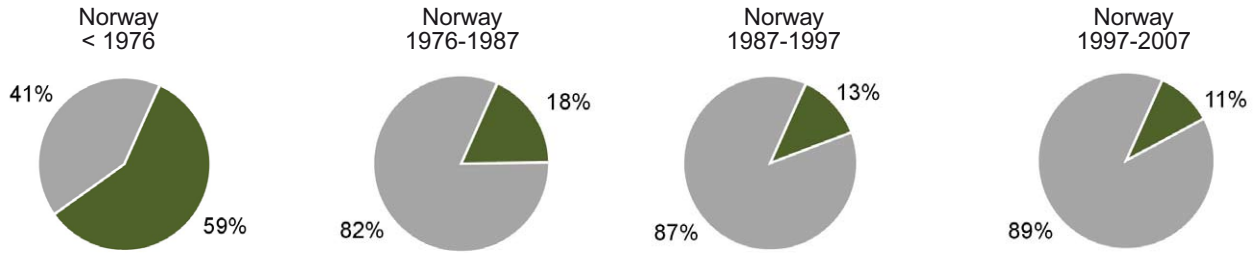
**Figure 8.** Distribution of ventilation systems in houses by construction year in Finland: before 1959, 1960- 1969, 1970-1979, 1980-1987, 1988- 2003 and after 2004. ■ 1A, 1B, 2A, 2B ■ 3A, 3B ■ 3C1, 3C2.



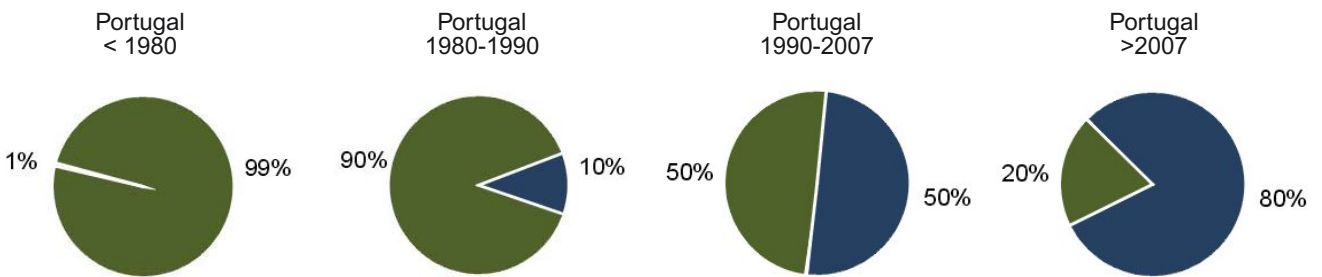
**Figure 9.** Distribution of ventilation systems in houses by construction year in Greece: before 1978 and after 1978. ■ 1A, 1B ■ 2A, 2B ■ 3A, 3B ■ 3C1.

- in Belgium only lately, i.e. after 2008, more mechanical ventilation systems were installed than natural ;
- Portugal, although has favoured fan assisted natural ventilation over natural ventilation, introduced mechanical ventilation systems as hybrid ventilation;
- Romania adopted new regulation in 2010, after which 20% of constructed houses have mechanical ventilation systems; still until 2008 more than 99% of buildings had natural ventilation systems;
- the data from Norway, provides only evidence of the decrease of natural ventilation share in favour of other ventilation systems.

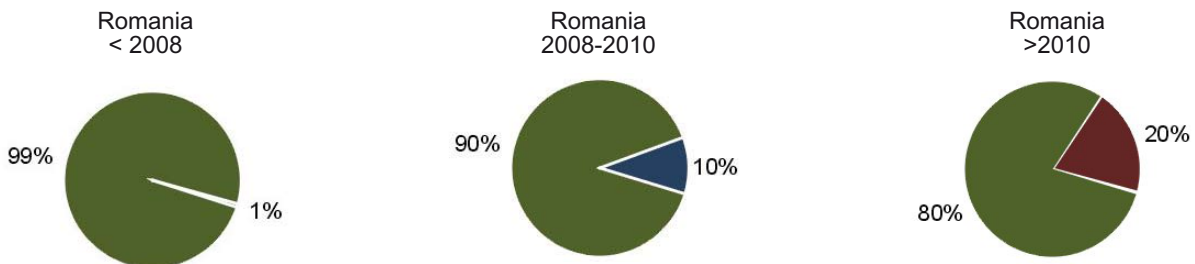
As a conclusion, the distribution of ventilation systems has had a similar evolution from natural ventilation systems towards mechanical ventilation systems. The evolution occurred sooner for some countries than others but it is clear that lately mechanical ventilation practises are forced by emerging regulations regarding energy efficiency and performance. But still, as most houses from the building stock are old houses the overall distribution of ventilation systems allocates the greatest share to natural ventilation systems.



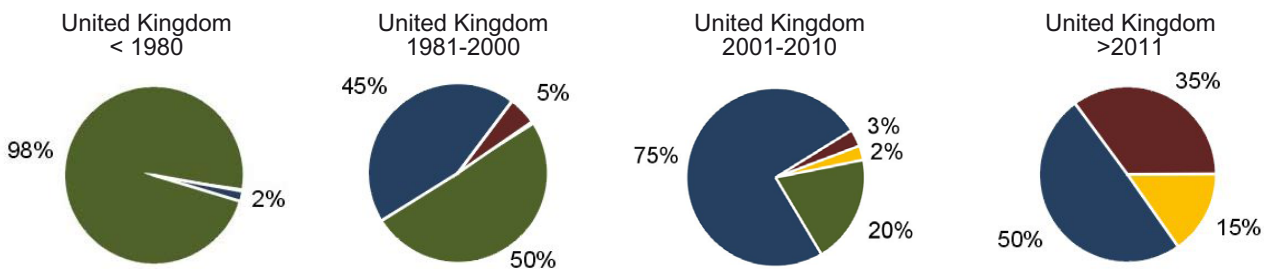
**Figure 10.** Distribution of ventilation systems in houses by construction year in Norway: before 1976, 1976 – 1987, 1987 - 1997, and 1997-2007. ■ 1A, 1B ■ OTHER.



**Figure 11.** Distribution of ventilation systems in houses by construction year in Portugal: before 1980, 1980- 1990, 1990-2007, and after 2007. ■ 1A, 1B ■ 2A, 2B.



**Figure 12.** Distribution of ventilation systems in houses by construction year in Romania: before 2008, 2008-2010 and after 2010. ■ 1A, 1B ■ 2A, 2B ■ 3A, 3B.



**Figure 13.** Distribution of ventilation systems in houses by construction year in United Kingdom: before 1980, 1981-2000, 2001-2010 and after 2010. ■ 1A, 1B ■ 2A, 2B ■ 3A, 3B ■ 3C2.

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