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TRENDS IN BUILDING VENTILATION REQUIREMENTS AND INSPECTION IN FRANCE

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October 2025 AIVC-Tightvent Webinar

Background Information

Non Res. Res.

- France Overview
  - 68 million inhabitants (2023)
  - 37.2 million dwellings (2022), with 50% built before 1974
  - New construction in 2023: 16,059 single-family homes, 205 multi-family buildings, and various offices and educational buildings
- Building Types
  - Houses (79%, avg. 100 m²)
  - Apartments (21%, avg. 64 m²)

Regulatory Framework for Ventilation

Res.

- Residential Ventilation Regulations:
  - Began with the “Arrêté du 24 mars 1982”
  - Main requirements:
    - Continuous air renewal
    - Air inlets in main rooms and exhausts in humid rooms
    - Specific air flow rates per room type
    - Reduced flow rates, notably for kitchens (2 stages airflows)
  - 1983: Introduction of demand-controlled ventilation (DCV) systems

Number of main rooms	Achievable exhaust air flow rate (m^3/h)				
	Kitchen	Bathroom with toilet	Other bathroom	Toilet	
				First one	Others
1	75	15	15	15	15
2	90	15	15	15	15
3	105	30	15	15	15
4	120	30	15	30	15
5 and more	135	30	15	30	15

Number of main rooms	Minimum values of reduced exhaust air flow rates (m^3/h)		
	Without demand controlled ventilation		With demand controlled ventilation
	Total Exhaust	Kitchen	Total exhaust
1	35	20	10
2	60	30	10
3	75	45	15
4	90	45	20
5	105	45	25
6	120	45	30
7	135	45	35

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Regulatory Framework for Ventilation

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    - Specific air flow rates per room type
    - Reduced flow rates, notably for kitchens (2 stages airflows)
  - In 1983, Introduction of demand-controlled ventilation (DCV) systems
  - NF DTU 68.3: National standard for the design of ventilation systems
  - Cooker-hood are not mandatory, they are assumed not to be needed thanks to this two-stages flowrate, usually only recirculation cooker-hood are installed in order to comply with EP-requirements on airtightness.

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Regulatory Framework for Ventilation

Res.

- Residential Ventilation Regulations: Example
  - A house of 90 m² (2.5 m height), 1 main room, 3 bedrooms (1 master (2 adults) , 2 kids), 1 kitchen, 1 bathroom and 1 toilet.
  - Flowrate to extract permanently are:
    - 30 m^3/h in the bathroom
    - 30 m^3/h in the toilet
    - 45 m^3/h in the kitchen and it must be possible to reach 120m^3/h during cooking events (1 hour per day in average)
  - In case of DCV the minimum flowrate can be reduced, according the values given in the “Avis techniques” agreements for each size of dwelling. This induces a reduction of 30 to 50% of the average flowrate with most of the systems.

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Regulatory Framework for Ventilation

Non Res.

- Non-Residential Regulations:
  - Based on 2 regulations :
    - Work Code (1979)
    - “Reglement Sanitaire Départemental Type” (RSDT)
  - Requirements for both general rooms and rooms with specific pollution sources (toilets, etc.)
  - Ventilation can be stopped; the modulation of flowrate is allowed and recommended by the EP Regulation
  - No standard to describe the design and installation of non-residential ventilation systems. EN standards apply but not mandatory

Kind of enclosure	Q_{min} (m^3/h) per occupant	
	Smoking not allowed	Smoking allowed
School	15	-
High-school and university	18	25
Sleeping spaces (dormitory, etc.)	18	25
Office rooms	18	25
Meeting rooms	18	30
Shops	22	30
Bar and restaurant	22	30
Gymnasium (per athlete)	25	30
Swimming pool	22	30
Gymnasium (per onlooker)	18	30

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Regulatory Framework for Ventilation

Non Res.

- Non-Residential Regulations: Examples
  - In a class room of 50 m² with 25 students and 1 teacher
    - the flowrate depends from the age of the kids
      - from 15 m^3/h for the youngest to 18m^3/h in high schools and universities,
    - as a worker the teacher shall have 25 m^3/h
    - **So the total for a class with young children is 15*25+25*1=400 m^3/h.**
    - The installation of a ventilation system is not mandatory if the area of the windows in the room is sufficient.
    - => few existing schools are equipped with mechanical ventilation
  - In an office of 12 m² with 1 occupant : 25 m^3/h

Energy Requirements (RE2020)

Non Res. Res.

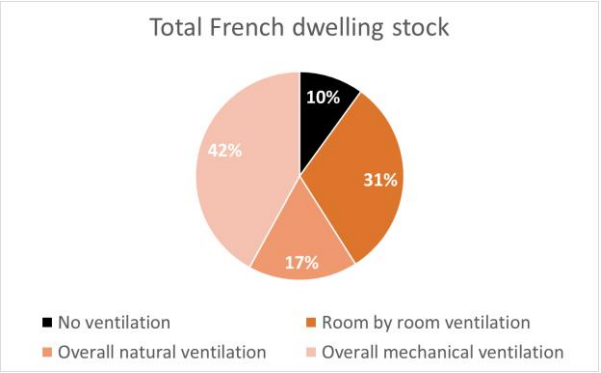
- Energy Performance Regulation – new buildings
  - RE2020 sets guidelines for low-energy buildings, replacing RT2012
  - Focuses on air flow rates, energy use, heat recovery, and airtightness
  - DCV Systems are promoted
    - Assessment of energy saving through Avis Techniques
- Energy Efficiency Measures – existing buildings
  - "MaPrimeRenov'" subsidizes if MVHR systems
  - EP certificates now include ventilation system (general) information

Ventilation Systems in the French existing stock for residential buildings

Res.

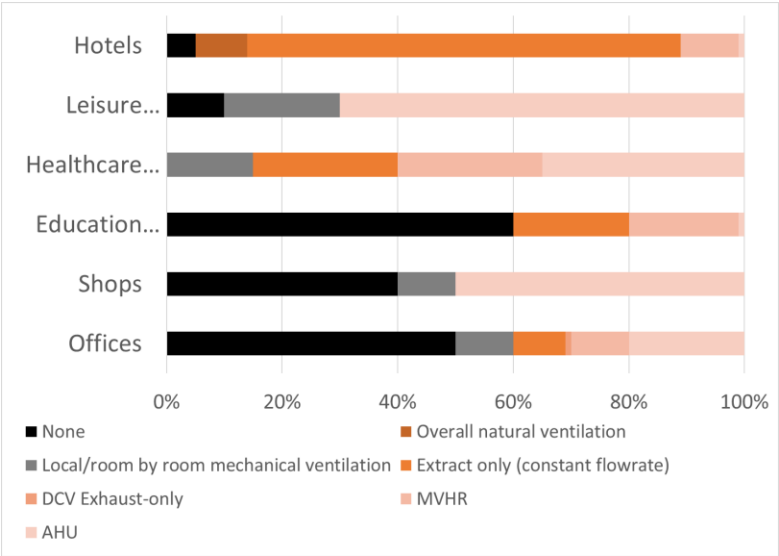
- Common Systems for new residential systems
  - Centralized mechanical exhaust systems dominate
  - Humidity-based DCV systems are prevalent in new residential buildings (>90%)
  - MVHR in only 3-4% of new dwellings

- Existing Stock (Insee 2017)



Ventilation Systems in the French existing stock for non-residential buildings

Non Res.



AIR.H, Installation de ventilation dans lexistant : enjeux et propositions d'amélioration à travers les diagnostics-Report for ADEME, (2007).

Ventilation Inspection Trends

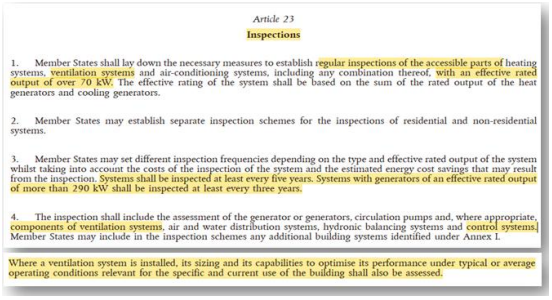
Res.

- Buildings:
  - High non-compliance rate: 50% of ventilation systems do not meet regulatory standards, 70% for houses
- Residential Buildings:
  - New Inspection Requirement in the new RE2020 (EP) Regulation
    - Mandatory inspection by certified inspectors for residential buildings
    - Focus on visual inspection, system performance, and airflow/pressures measurement
    - A new database

Ventilation Inspection Trends

Non Res.

- Non-Residential Buildings:
  - No mandatory inspection, but protocols exist
- New EPBD requirements
  - Mandatory inspection of systems when heating and cooling power exceed 70kW (every 5 years) or 290kW (every 3 years)
  - States have 2 years to implement this requirement!.. By March 2026



Article 23

Inspections

1. Member States shall lay down the necessary measures to establish regular inspections of the accessible parts of heating systems, ventilation systems and air-conditioning systems, including any combination thereof, with an effective rated output of over 70 kW. The effective rating of the system shall be based on the sum of the rated output of the heat generators and cooling generators.

2. Member States may establish separate inspection schemes for the inspections of residential and non-residential systems.

3. Member States may set different inspection frequencies depending on the type and effective rated output of the system whilst taking into account the costs of the inspection of the system and the estimated energy cost savings that may result from the inspection. Systems shall be inspected at least every five years. Systems with generators of an effective rated output of more than 290 kW shall be inspected at least every three years.

4. The inspection shall include the assessment of the generator or generators, circulation pumps and, where appropriate, components of ventilation systems, air and water distribution systems, hydronic balancing systems and control systems. Member States may include in the inspection schemes any additional building systems identified under Annex I.

Where a ventilation system is installed, its sizing and its capabilities to optimise its performance under typical or average operating conditions relevant for the specific and current use of the building shall also be assessed.

Challenges and Innovations

- Performance-Based Regulation (coming soon…)
  - Moving from prescriptive to performance-based systems
  - Targets for CO_2 levels, humidity, and proxi pollutants
  - Promotes innovative systems beyond humidity-based DCV
  - (See our presentation in dedicated topical session)
- COVID-19 Impact
  - Increased interest in air quality monitoring (e.g., CO_2 sensors in schools)
  - The ministry asked HCSP (high council for public health) for guidance on how the regulation shall change following lessons learned with COVID (published in 2024): HCSP recommends:
    - Modify codes air flow rates to match the "average" of 16798-1 (a big ×2 on schools)
    - Bring existing buildings with or without ventilation systems up to these levels, and do more airing by then
    - implement demand-controlled systems
    - implement monitoring and therefore establish IAQ criteria for this monitoring....

  => We hope this will at last bring a new regulation for Non-residential!


Haut Conseil de la santé publique

AVIS

Relatif aux adaptations envisageables en matière d'aération et de ventilation des locaux, autres que ceux d'habitation ou d'hébergement, dans un contexte de sobriété énergétique

1 Périmètre de la saisine

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Conclusion

- Key Takeaways:
  - France has a strong regulatory framework for ventilation in residential buildings but faces challenges with non-compliance and outdated non-residential regulations
  - In non residential buildings like existing schools, air renewal is still mainly based on the opening of windows
  - RE2020 emphasizes energy efficiency in ventilation systems, with mandatory inspections newly introduced for residential buildings
  - Innovation is expected with the shift towards performance-based regulations
- Future Outlook:
  - Expected review of non-residential regulations and continued innovation in ventilation technologies

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    - V. Leprince, B. Poirier, G. Guyot, How to create a performance-based regulation on ventilation – the French Experience, in: Copenhagen, Denmark, 2023.
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Thank you for your attention !

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Requirements on IAQ in buildings with sensitive populations or those exposed over long periods

- Day-care centers, schools, high schools, facilities for the disabled and juvenile detention centers (2010 updated the 1st of January 2023)
- Imposes the monitoring of IAQ at some specific point of the building life.
- Pollutants measured are CO_2, benzene and formaldehyde
- In case of non-conformity an action plan shall be set.