## Feedback from the 44th AIVC-12th TightVent & 10th venticool Conference: Summary of the airtightness & ventilation systems' inspection presentations

On 9-10 October 2024, the AIVC – TightVent - venticool 2024 joint Conference "Retrofitting the Building Stock: Challenges and Opportunities for Indoor Environmental Quality", was organised by the International Network on Ventilation and Energy Performance (INIVE) on behalf of the Air Infiltration and Ventilation Centre (AIVC), the Building and Ductwork Airtightness Platform (TightVent Europe) and the international platform for ventilative cooling (venticool). The University of Galway, the Maynooth University and the Sustainable Energy Authority Of Ireland (SEAI) were also key organisers. This successful event brought together over 180 participants, including researchers, engineers, architects, policymakers, manufacturers, stakeholders, and international organizations from 26 countries.

The conference programme featured three parallel tracks with approximately 150 presentations across the key themes of Smart Ventilation, Indoor Air Quality (IAQ) and Health, Building & Ductwork Airtightness, and Ventilative and Resilient Cooling. A special session of "90-Second Industry Presentations", was organised to disseminate exclusive information from the event's sponsors to the conference participants, in addition to the conference exhibition.

Additionally, the conference provided a vital forum for discussions on current projects, including the IEA EBC Annex 87, Energy and Indoor Environmental Quality Performance of Personalized Environmental Control Systems. This article offers an overview of the main trends, ideas, and insights shared over the two-day conference, focusing particularly on building and ductwork airtightness as well as ventilation systems' inspection. The article is structured into four main themes.

### *Building & ductwork airtightness impact and guidelines*

Roberts, Allinson, & Lomas (2024) examined the relationship between airtightness and infiltration, focusing on summertime conditions. Their study involved 34 blower door tests via depressurization (between January and March 2017) and 15 infiltration measurements taken throughout the summer using the $CO_2$ tracer gas decay method. The study revealed notable discrepancies between predicted infiltration rates (calculated using 11 different infiltration estimation methods) and actual summer infiltration rates (Figure 1). On average, the methods overpredicted measured infiltration rates by 64-208%. These findings highlight critical implications for the accuracy of overheating risk assessments, underscoring the need to account for these uncertainties in building design and modelling for summertime overheating resilience.

Using CONTAM simulations, Roh, Lee, Lee, Lee, & Yeo (2024) evaluated the impact of airtightness improvements—up to 80%—on pressure differentials and contaminant dispersion in temporary negative pressure isolation rooms (TNPI). The study found that elements like inter-room penetrations and ward doors significantly impacted pressure differentials, while exterior walls and inter-room penetrations were key factors in infection risk (Figure 2, Figure 3). Enhancing airtightness in critical areas, including inter-room penetrations, exterior walls, sliding doors, and ward ceilings, is recommended to improve performance in these temporary setups. The findings highlight the need for customized, project-specific interventions.

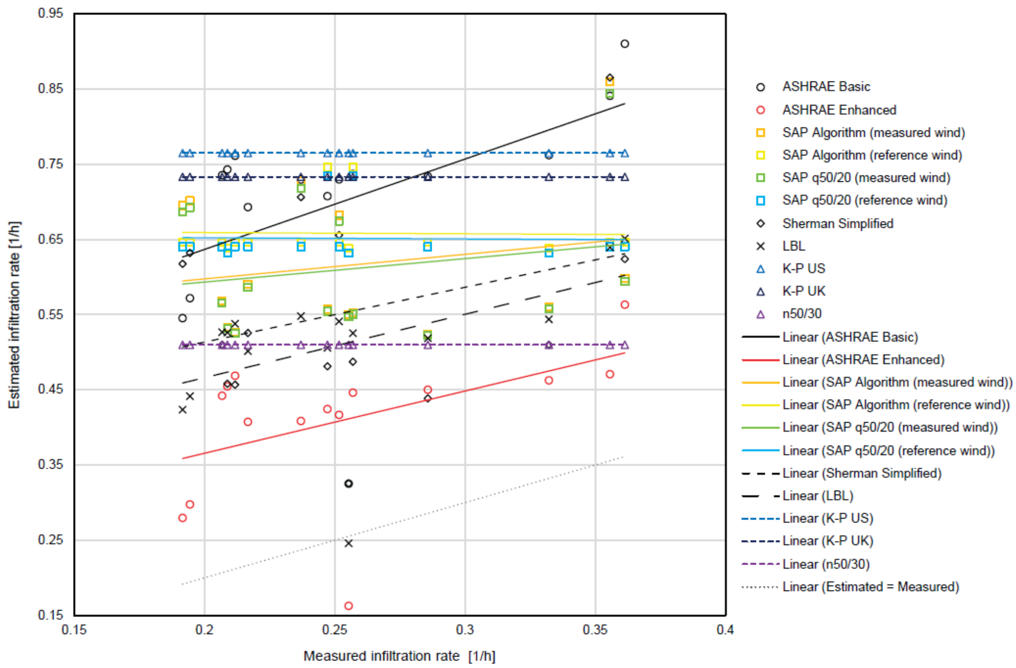


Figure 1: Measured infiltration rate plotted against estimated infiltration rate. Each data point represents one of the 15 tracer gas tests and the corresponding infiltration estimation method prediction (Roberts, Allinson, & Lomas, 2024)

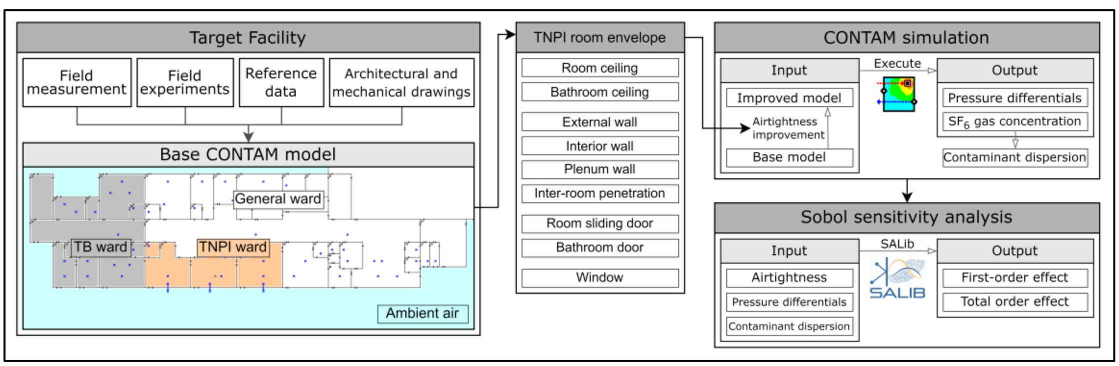


Figure 2: Schematic diagram depicting the methodology of the study (Roh, Lee, Lee, Lee, & Yeo, 2024)

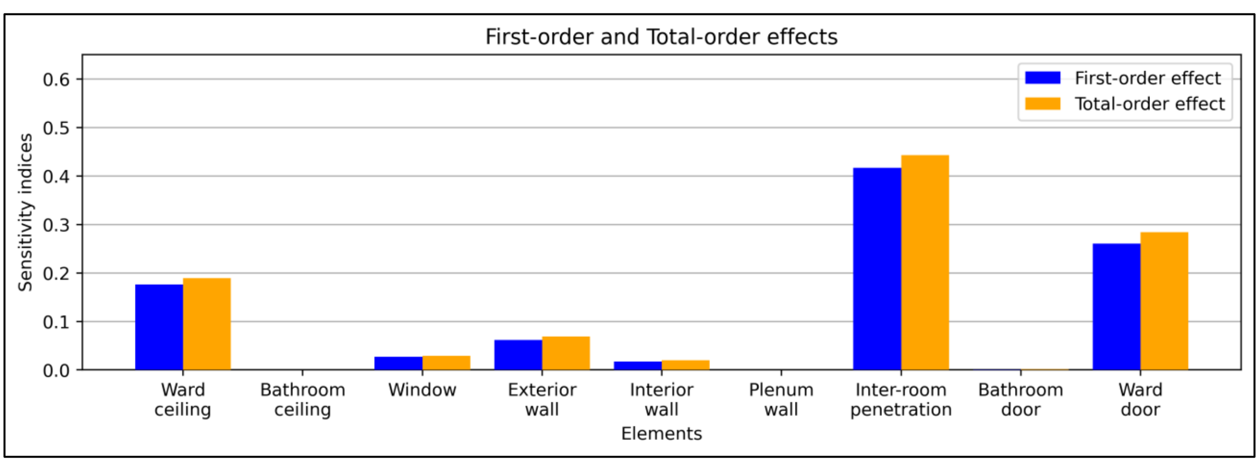


Figure 3: First-order and total-order effects of each element on the average pressure differentials of TNPI rooms (Roh, Lee, Lee, Lee, & Yeo, 2024)

Modera & Gord (2024) analysed energy and peak demand saving mechanisms across different types of duct systems, including exhaust, Constant Air Volume, and Variable Air Volume systems with different outdoor air (OA) controls (Figure 4)(Table 1. They examined savings mechanisms like fan power, OA conditioning, and peak power reduction, noting that savings from duct sealing vary significantly by application, with the largest factors being the operating hours of the system, the relief air fraction. Notably, substantial thermal conditioning savings (roughly 1/5 to 1/3 of savings) —independent of climate—are associated with the relief air fraction, especially beneficial in hospitals, where savings occur even when outdoor and relief airflows remain unchanged post-sealing.

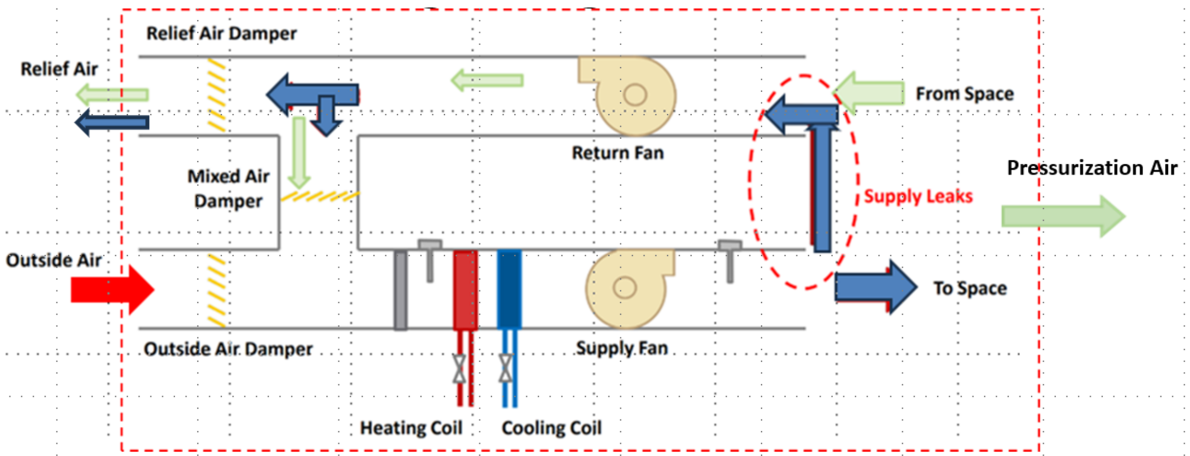


Figure 4: Schematic of Air Flow Pathways for CAV Supply System (Modera & Gord, 2024)

Table 1: Duct Sealing Impacts for Sealing 20% Supply Leakage for 23,600 l/s, 500 Pa system in NYC (Modera & Gord, 2024)

| Application | Fan Power [kWh] | Fan-Heat Cooling [kWh] | Extra OA Cooling [kWh] | Total OA Cooling [kWh] | OA Heating [kWh] | Total Savings [kWh] |
|---|---|---|---|---|---|---|
| Office CAV Supply (fixed %OA) | 33,638 | 10,659 | 1,702 | 3,938 | 47 | 49,984 |
| Office CAV Supply (fixed OA, $\Delta P_{building}$) | 33,638 | 10,659 | 0 | 2,236 | 0 | 46,533 |
| Hospital CAV Supply (fixed OA, $\Delta P_{building}$) | 133,942 | 31,273 | 0 | 53,426 | 0 | 218,641 |

The WTA (International Association for Science and Technology of Building Maintenance and Monuments Preservation) leaflet series, as presented by Rolfsmeier (2024) and scheduled for release by 2025, offers recommendations for achieving a defined quality of building airtightness when renovating existing buildings in Germany. These guidelines support planners, builders, and quality inspectors by (a) defining required airtightness levels for renovated buildings and building elements while establishing basic planning principles, (b) addressing planning details, sources of errors, construction options, and quality-check methods, and (c) focusing on suitable airtightness testing and leak detection methods, including guidance on building preparation and optimal testing timing.

### *Durability of building airtightness*

During the topical session on “Building Airtightness Durability”, Leprince (2024) gave a brief introduction and presented key factors affecting the durability of building airtightness. According to the presenter, airtightness durability is influenced by several key factors, including product quality, where the resilience of sealants, tapes, and membranes is essential but can degrade over time due to aging, UV exposure, and moisture. Installation quality also plays a role, as e.g. inadequate use of sealing products can compromise durability. Environmental conditions during installation, such as temperature, humidity, and dust, may further impact airtightness durability. Additionally, occupancy effects, like regular use, the opening and closing of doors and windows, furniture installation, and retrofit activities, can affect airtightness over time. Finally, building/airtightness layer movement due to settlement or wind can reduce its long-term effectiveness.

As part of the Durabilitair2 Project, Litvak, Handschoewercker, Berthault, & Mathieu (2024) explored the impact of dust on adhesion surfaces which can degrade the performance of air sealing over time (Figure 5, Figure 6, Figure 7). Their research assessed the feasibility of an experimental weight measurement method to quantify dust levels on surfaces used for air sealing applications. While the method is suitable for quantifying floor dust, it is less effective for vertical surfaces due to higher uncertainties. Further investigation is needed to enhance reliability, with careful consideration of factors like adhesive properties and environmental conditions to address various uncertainties.

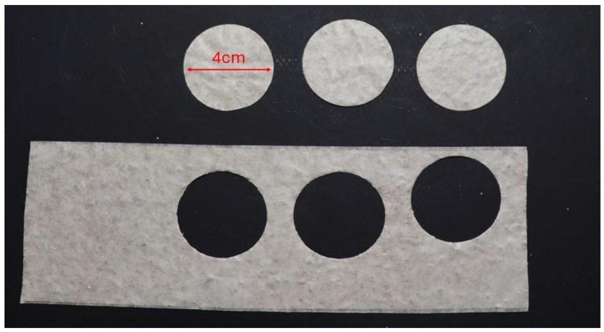


Figure 5: Preparation of samples taken on site (Litvak, Handschoewercker, Berthault, & Mathieu, 2024)

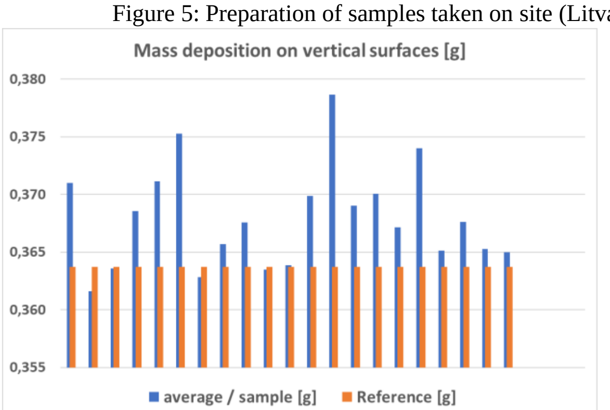


Figure 6: Mass deposition by samples on vertical surfaces (Litvak, Handschoewercker, Berthault, & Mathieu, 2024)

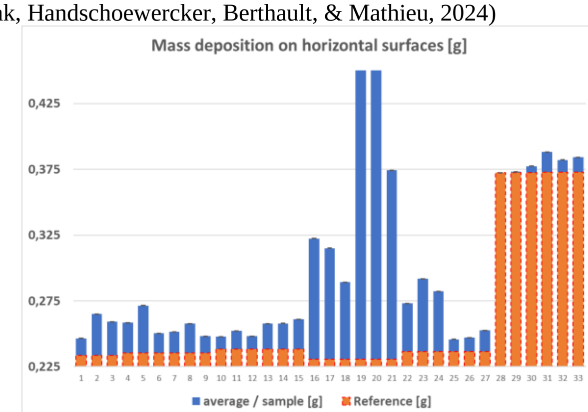


Figure 7: Mass deposition by samples on horizontal surfaces (Litvak, Handschoewercker, Berthault, & Mathieu, 2024)

Another presentation by Prignon (2024), focused on the HAMSTER bi-climatic chamber, installed in Brussels in 2022 and designed to assess the airtightness of building components in various conditions including, but not limited to, its durability (Figure 8). The HAMSTER chamber's dual climate zones-hot (simulates interior conditions) and cold (reproduces exterior climate)-enable precise replication of external and internal building environments, including also features to reproduce rain, pressure difference or infrared radiations. This setup allows measuring airtightness performances in specific climatic conditions and assessing the durability of building components through accelerated ageing.

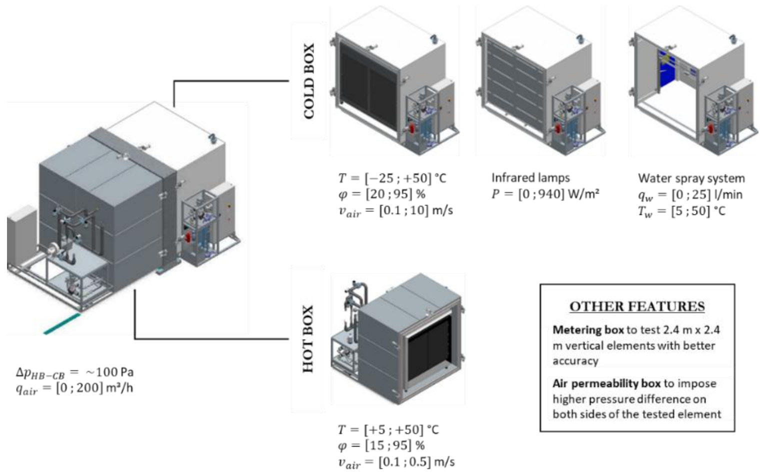


Figure 8: Features for HAMSTER equipment (Prignon, 2024)

The TightEN project carried out in the years 2019-2022, aimed to highlight and strengthen the research on adhesive tapes and develop test methods adequate in the cold climate conditions to ensure a proper durability of sealing solutions over time so that energy efficiency is maintained throughout buildings' lifetime (Kolstad Linløkken & Dorota Hrynyszy, 2024). A new testing methodology, addressing local Norwegian conditions, was proposed to evaluate the long-term performance of tape products and systems for air-sealing application in buildings with sufficient accuracy, reproducibility, and repeatability. This method measures air permeability using a Test Stand and assesses durability by comparing permeability rates before and after artificial aging (Figure 9). Unlike existing methods, it directly measures permeability, though results vary with the quality of specimen application. The approach effectively verifies whether tapes meet specific permeability thresholds.

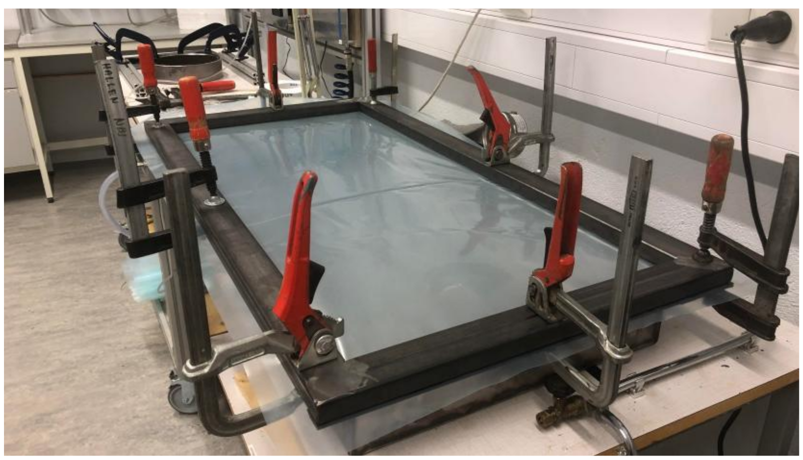

Figure 9: Test Stand leakage evaluation setup (Kolstad Linløkken & Dorota Hrynyszy, 2024)

A paper by O'Brien & Artigas (2024) reviewed research on the long-term durability of air barrier systems, with a focus on wall membranes and fenestration systems (Figure 10, Figure 11). Their study used energy modelling of a typical large building at various air leakage rates to assess potential impacts on energy use. Their results showed that current code requirements for air barrier systems performance are practical and achievable with today's materials and industry knowledge. Exceeding air leakage beyond these requirements appears to have a minimal impact on energy use; however, air barrier durability is crucial for condensation control and overall building enclosure performance. The authors recommend further research into accelerated material weathering, field studies, and over time comparisons of actual air leakage.

Figure 10: Breach in fluid-applied air barrier (O'Brien & Artigas, 2024)

Figure 11: Mold growth on interior wall and damaged carpet due to air and water leakage (O'Brien & Artigas, 2024)

### *Building airtightness measuring methods*

Ordinary Least Squares (OLS) regression, the standard method recommended by ISO 9972 for building airtightness tests, faces reliability issues under fluctuating wind conditions. To address these challenges, Kölsch & Leprince (2024) proposed improvements to the regression method and uncertainty calculation. Their study evaluated three methods-OLS, Weighted Least Squares (WLS), and Weighted Line of Organic Correlation (WLOC)-using data from over 6,000 blower door tests across various house configurations (Figure 12, Figure 13, Figure 14, Figure 15). While all methods showed similar accuracy in predicting the airflow at 50 Pa, WLS and WLOC_2 outperformed OLS at 4 Pa under high wind speeds, with WLS offering the most reliable uncertainty estimates. These findings support incorporating weighted regression methods into airtightness testing standards.

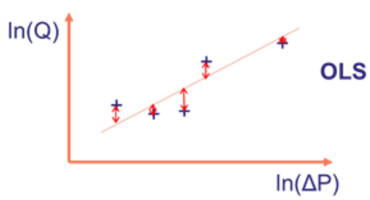


Figure 12: Schematic representation of regression techniques methodology for OLS (Kölsch & Leprince, 2024)

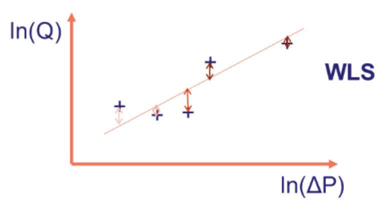


Figure 13: Schematic representation of regression techniques methodology for WLS (Kölsch & Leprince, 2024)

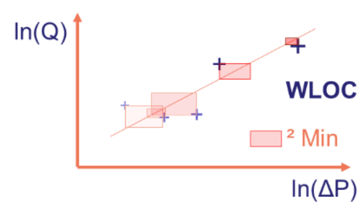


Figure 14: Schematic representation of regression techniques methodology for WLOC (Kölsch & Leprince, 2024)

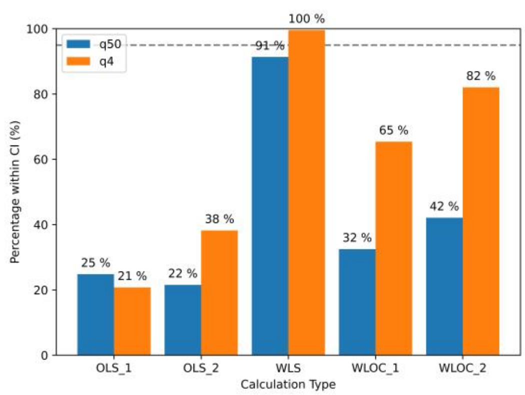


Figure 15: Total percentage per type of regression where mean values of calculated airflows at 50 Pa and 4 Pa fall into the 95% confidence interval (Kölsch & Leprince, 2024)

Prignon, Delmotte, & Kölsch (2024) investigated the uncertainty associated with estimating the zero-flow pressure difference in the fan pressurization method, a technique used to measure building airtightness according to the ISO 9972:2015 standard. This method assumes a constant zero-flow pressure difference throughout the test, with the value calculated as the average of pre- and post-test measurements; however, this assumption introduces some uncertainty. The authors used two different datasets to assess the reliability of an existing formula proposed in the literature for calculating this uncertainty, explored variations in the measurement protocol to reduce it, and evaluated the impact of this uncertainty source on the final result of the fan pressurization test. Their findings indicated that uncertainty, which can affect overall test accuracy, can be minimized by increasing the number of measurements or employing a multiple-estimator approach. Future research should aim to incorporate additional datasets to address certain limitations of this study and to develop alternative procedures that could further reduce this source of uncertainty.

A study by Tountas (2024) investigated the air permeability of windows and doors installed in buildings in Athens, Greece, highlighting discrepancies between the manufacturers' declared air permeability classifications and the classification measured on-site (Figure 16). Through testing 40 windows and doors across both new and retrofit projects, the study found that nearly 95% of installations performed below the manufacturer-stated airtightness classifications, primarily due to installation practices that fail to maintain factory standards. Results showed that the airtightness of frames often decreases by more than 50% once installed, significantly impacting energy efficiency and leading to energy losses contrary to the consumer's investment in high-performance products. The findings emphasize the need for updated regulations mandating airtightness checks during installation to ensure consistent energy savings and $CO_2$ reduction goals.

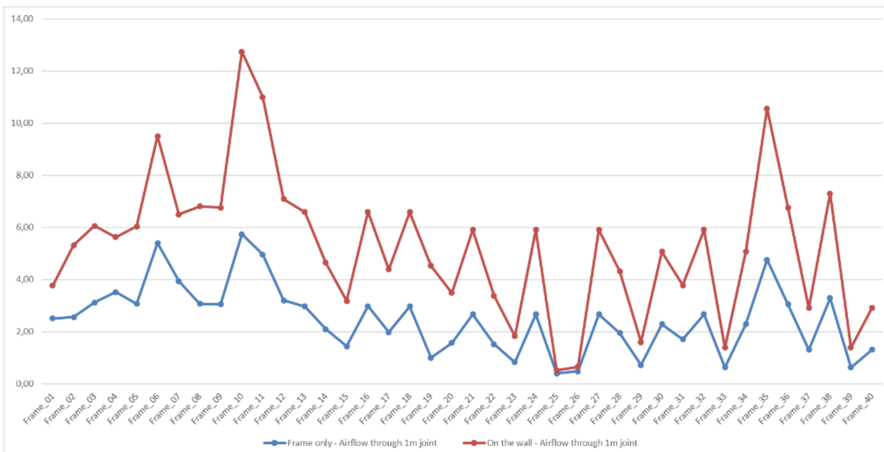

Figure 16: Airflow through 1m joint (Tountas, 2024)

A literature review by Prignon (2024) examined 43 studies -published between 1930 and the present- on window airtightness measurements to identify trends and gaps in current knowledge. The findings highlight the lack of standardized reporting, the limited number of reported results and the bad repartition among studies which make it difficult to draw solid conclusions, especially for in-situ measurements. Despite these limitations the review found that existing windows generally exhibit significant air leakage, with performance declining over time compared to newly installed windows. The study revealed that in-situ tests yield poorer airtightness results than laboratory tests, largely due to factors like the window-wall interface, the deterioration over time and the deterioration during installation. Additionally, sliding windows perform worse than other types of windows while windows with steel or aluminium frames exhibit poorer airtightness compared to wood-framed windows. Since the arrival of weather-stripped windows, there is no clear improvement of the windows airtightness over time, in either laboratory or in-situ settings. The study suggests acquiring data from further in-situ measurements on existing windows, with standardized measurements that account at least for variables such as window frame materials, opening mechanisms, the period of construction of windows and the year of testing.

Pedranzini (2024) proposed a revised model for estimating air leakage in HVAC systems, addressing limitations in current standards, which are based on one-point measurement with a fixed leakage exponent. The study highlighted issues with the Duct Air Leakage Test (DALT) model (widely used since the 80s), which inaccurately assumes a leakage exponent of 0.65, causing substantial errors in leakage and energy loss estimations among others (Figure 17). The author proposes an advanced model that uses multi-point measurements to better capture leakage behaviour. The findings highlight the need for updated standards that align with the capabilities of current technology and building requirements.

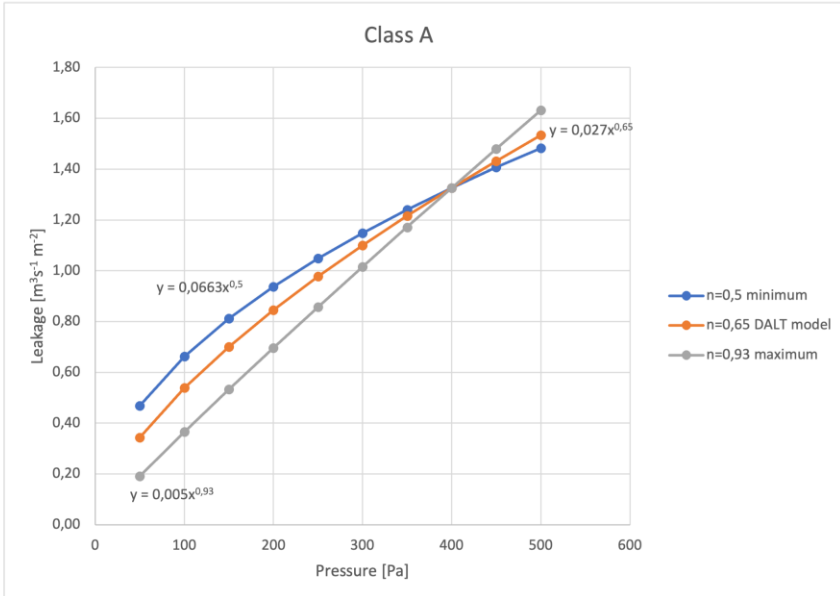


Figure 17: Comparison of systems with exponents other than n=0,65 (Pedranzini, 2024)

Diel, Schiricke, & Pernpeintner (2024) introduced a new test facility developed to improve the accuracy of acoustic and thermographic methods for detecting air leaks in building envelopes (Figure 18). Initial experiments showed that an acoustic camera could reliably locate leaks of varying hole sizes and measurement distances demonstrating a correlation between the maximum sound pressure level and the hole size. Meanwhile, thermographic imaging identified leaks smaller than the camera's pixel resolution, even at greater distances and shallower incidence angles. These findings support the feasibility of using both methods in detecting and quantifying leaks, with future work aimed at refining detection in more complex leak scenarios.

Figure 18: Test facility ATLAS equipped with its requisite measurement technology: Minneapolis DuctBlaster with Micro Leakage Meter (left), loudspeaker (inside), microphone array (right) and infrared camera (right) (Diel, Schiricke, & Pernpeintner, 2024)

An optimized methodology has been introduced for characterizing infiltration airflow in buildings through controlled air inlets using infrared (IR) thermography. Developed by Tamayo-Alonso, Poza-Casado, Padilla-Marcos, Mercado, & Meiss (2024), the method employs a three-dimensional matrix setup to capture a single IR thermal image, creating a 3D visualization of airflow and significantly reducing test time compared to traditional multi-image techniques (Figure 19, Figure 20, Figure 21, Figure 22). Conducted in a controlled environment, this approach minimizes potential errors from temperature or pressure fluctuations during measurements, as well as from camera location variation due to limited battery life. Results demonstrate the method's effectiveness for real-time applications, paving the way for further research in areas such as leakage quantification, in-situ evaluation of operating regime of ventilation grids, and validation of CFD systems.

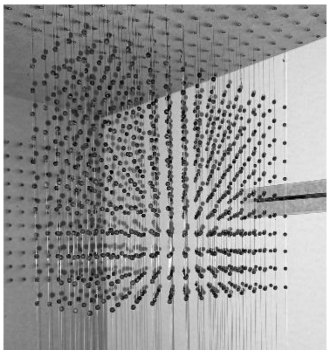

Figure 19: 3D Matrix (Tamayo-Alonso, Poza-Casado, Padilla-Marcos, Mercado, & Meiss, 2024)

Figure 20: Set-up of the experiment (Tamayo-Alonso, Poza-Casado, Padilla-Marcos, Mercado, & Meiss, 2024)

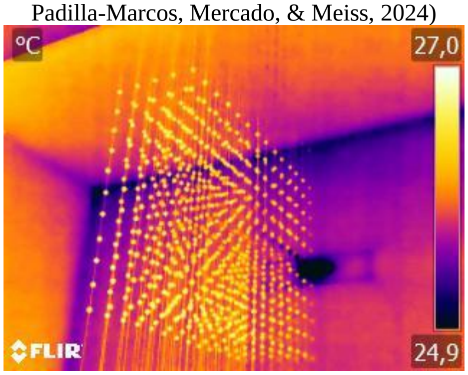


Figure 21: Thermal image of the airflow (Tamayo-Alonso, Poza-Casado, Padilla-Marcos, Mercado, & Meiss, 2024)

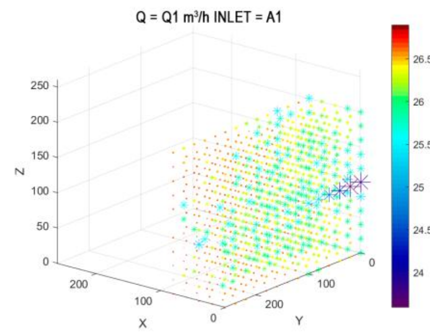


Figure 22: 3D representation of half the airflow (Tamayo-Alonso, Poza-Casado, Padilla-Marcos, Mercado, & Meiss, 2024)

Deprez, Verniers, Pollet, Bink, & Laverge (2024) investigated the variability of reference air pressure differences used to assess airtightness in 2 case studies in Belgium. Their study focused on a two-storey single-family home and a 14-storey student high-rise, applying various test methods to measure airtightness and differential pressure. The single-family home was tested using Blowerdoor, ACIN Air Tightness Tester, and Pulse methods, revealing greater variations in results at 50 Pa compared to 4 Pa, especially for the Pulse test. Additionally, simultaneous air pressure difference and wind measurements were conducted on both building façades. The study found that even with a mechanical extract only ventilation system the air may go out though inlets at 90% of the time (Figure 23, Table 2). Overall, the findings highlighted significant wind and stack effects on pressure distribution and demonstrated the need for pressure-regulated vents due to pressure variability.

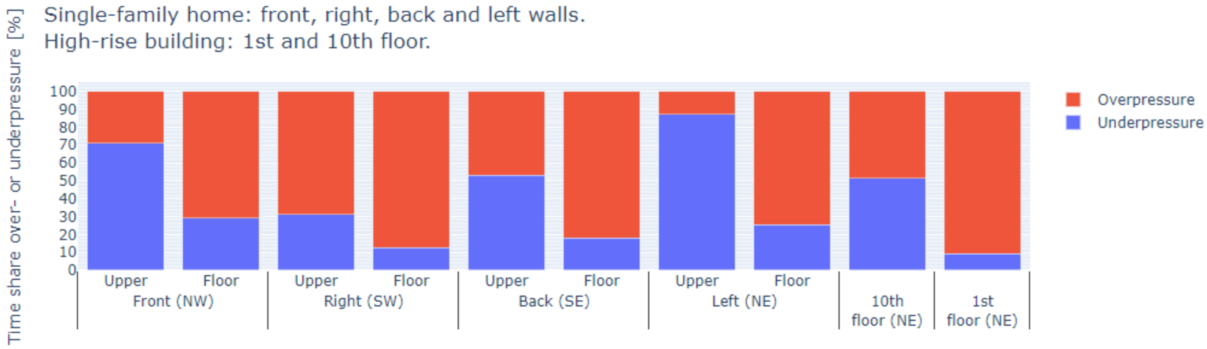


Figure 23: Time distribution between over- and under pressure conditions at each measurement point (Deprez, Verniers, Pollet, Bink, & Laverge, 2024)

Table 2: n50 and air leakage rates at 50 and 4 Pa for three airtightness test methods. Converted values in italics (Deprez, Verniers, Pollet, Bink, & Laverge, 2024)

| Air tightness test method | Flow exponent n | Air leakage rate [m³/h] 50 Pa | 4 Pa | $n_{50}$ [1/h] |
|---|---|---|---|---|
| **Blowerdoor (under- & overpressure)** | | | | |
| 2019: underpressure | 0.690 | 965 | *169* | 1.6 |
| 2019: overpressure | 0.780 | 978 | *136* | 1.7 |
| 2019: average | 0.735 | 972 | *153* | 1.7 |
| 2023: underpressure | 0.615 | 1314 | *278* | 2.2 |
| 2023: overpressure | 0.671 | 1333 | *245* | 2.3 |
| 2023: average | 0.643 | 1324 | *262* | 2.3 |
| **ATT (underpressure): 2023** | | | | |
| Test 1 downstairs: $q_{extract}$ = 326 m$^3$/h; Δp=5.1 Pa | 0.660 | *1471* | *278* | 2.5 |
| | 0.615 | *1327* | *281* | 2.3 |
| Test 2 downstairs: $q_{extract}$ = 326 m$^3$/h; Δp=5.2 Pa | 0.660 | *1452* | *274* | 2.5 |
| | 0.615 | *1311* | *277* | 2.2 |
| Test 3 upstairs: $q_{extract}$ = 326 m$^3$/h; Δp=6.1 Pa | 0.660 | *1307* | *247* | 2.2 |
| | 0.615 | *1189* | *252* | 2.0 |
| Test 4 upstairs: $q_{extract}$ = 326 m$^3$/h; Δp=6.0 Pa | 0.660 | *1321* | *249* | 2.3 |
| | 0.615 | *1201* | *254* | 2.0 |
| **Pulse (overpressure): 2024** | | | | |
| Test 1: downstairs | | *1450* | 265 | 2.5 |
| Test 2: downstairs | | *1712* | 317 | 2.9 |
| Test 3: downstairs | | *1676* | 310 | 2.9 |

### *Inspection of ventilation systems*

The topical session on "Ventilation regulations in various countries" introduced the new series of Ventilation Information Papers by the AIVC focusing on trends in building ventilation requirements and inspection in Spain, Ireland, Belgium & France.

Linares-Alemparte, García-Ortega, & Feldman, (2024) highlighted the evolution of Spain's ventilation regulations over the past two decades, driven by greater focus on indoor air quality (IAQ), energy efficiency, and environmental policies. The main regulatory frameworks, CTE (Código Técnico de la Edificación) and RITE (Reglamento de Instalaciones Térmicas de los Edificios), mandate IAQ and ventilation standards for residential and non-residential buildings. While older dwellings predominantly used natural ventilation, all new constructions since 2006 require mechanical or hybrid systems, with hybrid systems being the most common, followed by single-flow mechanical systems, and, in advanced cases, double-flow systems with heat recovery. For non-residential buildings RITE sets mandatory requirements on ventilation establishing 5 different methods for the calculation of the needed outdoor rate: airflow per occupant indirect method, airflow per net floor area indirect method, perceived air quality direct method, $CO_2$ concentration direct method, and dilution method. According to a market analysis carried out by AFEC (Air Conditioning Equipment Manufacturers Association), from 2021 to 2022, the market for air distribution and diffusion rose by 19.7% and Air Handling Units and Ventilation Units by 10%. As regards the inspection of ventilation systems, RITE regulates initial and periodic assessments of ventilation systems covering all buildings with thermal installations to be carried out by authorised companies or inspection entities. HVAC systems should undergo inspections every four years, and thoroughly checked every fifteen years.

In Ireland, ventilation requirements for new constructions and major renovations are governed by the Building Regulations, Part F, last updated in 2019, to enhance energy performance and indoor air quality (Coggins, McIntyre, Jones, & McGrath, 2024). Section 1.2 of Technical Guidance Document (TGD) F deals with ventilation methods for new dwellings and extensions including continuous mechanical extract ventilation, mechanical ventilation with heat recovery and natural ventilation (no longer common). Section 1.3 of TGD F deals with ventilation methods for buildings other than dwellings, in particular, offices and car parks. Requirements for inspection of ventilation systems are mandatory (for residential dwellings) and are covered in the National Standards Authority of Ireland Ventilation Validation Registration Scheme.

Belgium's ventilation requirements for buildings are found in national ventilation standards & health regulations, as well as regional environmental & EPB regulations. Since 2006, it has been mandatory for all new and renovated residential and non-residential buildings needing a permit, to install a natural or mechanical ventilation system for acceptable indoor air quality. (Janssens, De Jonge, De Strycker, & Van Gelder, (2024) reviewed the present ventilation requirements, market trends, energy and inspection requirements, innovations, and COVID-19's impact (Figure 24, Figure 25, Figure 26). While national guidelines and standards exist, regional differences exist in building energy performance regulation, including ventilation requirements, i.e. Flanders, Brussels Capital, and Wallonia which have unique aspects, especially in inspections. The Regional decrees on EPB refer to Annexes which specify the residential & non-residential ventilation requirements according to the Belgian standard NBN D50-001 (1991) and NBN EN 13779 respectively. A mandatory quality framework with on-site performance checks has been implemented in Flanders since 2016 featuring ventilation pre-design before the start of construction, ventilation performance report after installation, measurements of mechanical ventilation flow rates, and, if possible, measurement of fan power. These tasks must be conducted by a qualified individual using appropriate measurement equipment and may be performed by someone involved in the project or an independent party. Additionally, a control body audits 10% of inspections during or soon after they are completed to ensure compliance.

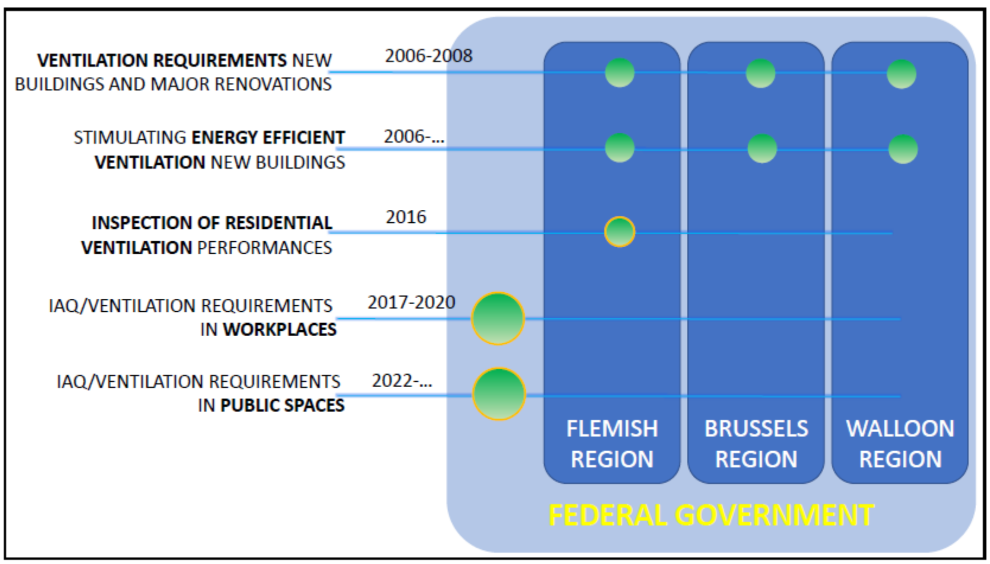


Figure 24: (Janssens, De Jonge, De Strycker, & Van Gelder, 2024)

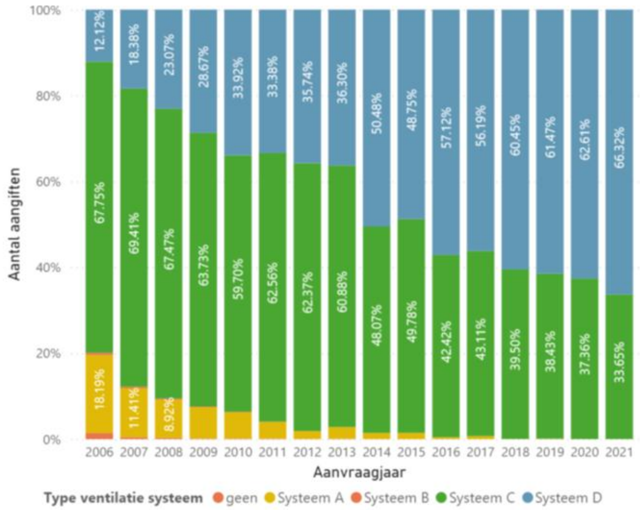


Figure 25: Evolution of the distribution of the type of ventilation systems in new dwellings in Flanders, Belgium between 2006 and 2021 (year of building permit), all dwellings combined (Janssens, De Jonge, De Strycker, & Van Gelder, 2024)

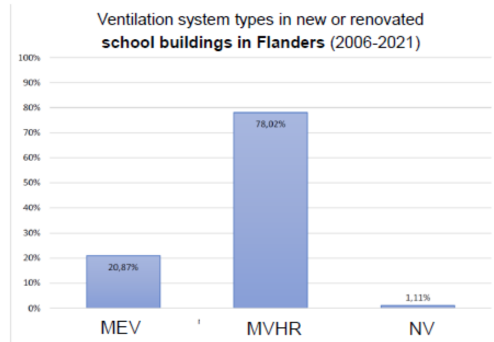


Figure 26: Ventilation system types in new or renovated school buildings in Flanders (Janssens, De Jonge, De Strycker, & Van Gelder, 2024)

French regulations for residential building ventilation have been in place since 1982, mandating mechanical ventilation systems to ensure continuous air renewal, adjustable air inlets, and air exhausts in key rooms among others (Leprince, Guyot, & Mouradian, 2024). Currently, around 95% of new residential buildings with exhaust-only ventilation are equipped with a humidity-based demand control system (Figure 27). Since January 2023, the RE2020 regulation requires mandatory inspections of the ventilation systems at commissioning for all new residential buildings, conducted by qualified testers and documented on an online platform. In contrast, regulations for non-residential buildings, dating back to 1979, do not impose the installation of ventilation systems as a prescriptive requirement; compliance is achieved if adequate air renewal is provided, which may involve a significant window area proportional to the floor area. However, inspections for non-residential buildings remain optional, even though more than half include some form of ventilation system.

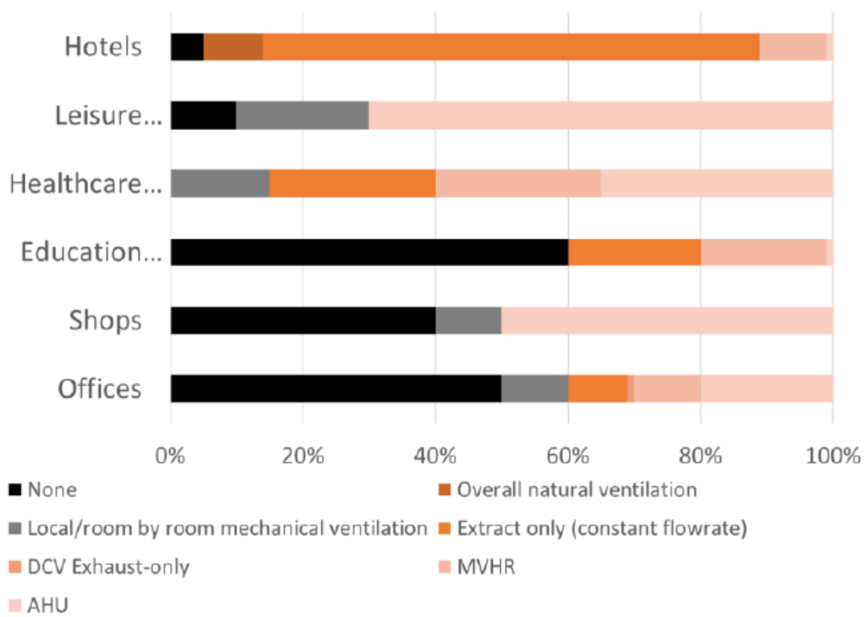


Figure 27:Ventilation Systems in the French Market for non-residential buildings (Leprince, Guyot, & Mouradian, 2024)

During the topical session: "What is new in the EPBD recast 2024 with respect to indoor environmental quality and ventilation?" (Leprince, 2024) presented the revised EPBD's new requirements on the inspection of ventilation systems and highlighted existing gaps. Regarding the commissioning of smart systems, the presenter pointed out the need for a system-specific reception protocol to be designed concurrently with the system, as well as the importance of establishing maintenance protocols that take advantage of connected systems to trigger maintenance operations. For IAQ inspection they recommended a standardized commissioning measurement protocol, with clear specifications for the type of measurement, sensor position & specification, and measurement duration. Furthermore, they emphasized the value of continuous monitoring to assess the robustness and resilience of ventilation systems.

The discussions and research showcased at the conference highlighted significant advancements and ongoing challenges in building and ductwork airtightness, ventilation system inspections and more. We encourage participants to join our future conferences to stay informed and engaged with the latest developments in the field.

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