An brief overview of international ventilation research priorities

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Overview

- Method
- Research priorities by country
- Summary of key themes

Method

- Survey of AIVC board members (47% response rate)
- Use of national networks
- Industry connections

Belgium

- **Upgrade of the Belgian standard for residential ventilation** to make it performance based (government funded)
- **Monitoring performance of carbon neutral social housing** district. Some houses use demand control exhaust ventilation whereas others used MVHR. Report due this summer (EU demonstration project)
- Living Labs: **deep renovation of residential buildings**. Included are elements of the building that are pre-fabricated , and all require the integration and investigation of ventilation systems (Flemish authority funded)

France

- **Energy performance and eco-design:** heat recovery, energy consumption of fans, airtight ductwork, environmental footprint of components and systems
- **indoor air quality:** assessment, improvement
- **quality of the installed systems:** guidelines for installation and maintenance, training of workers
- **commissioning and audit of installed systems:** relevant methods
- **innovative systems:** control strategies, sensors, coupling with heating, cooling and domestic hot water systems
- **acoustics:** avoiding noise issues

Netherlands

- Themes the Dutch ventilation industry are **currently working** on:
  - **Quality assurance of integral performance of ventilation system** both IAQ and Energy, this concerns methodology and instruments.
  - **Cost effective methods to measure IAQ**. Which parameters should be measured and how?
  - **Methods of determining IAQ**
- Questions the Dutch ventilation industry **would like** answered:
  - How can user behavior be guided or changed by means of ventilation system design or new products?
  - Effect of ventilation and indoor air quality on sleep quality.
  - Particulate matter in dwellings and the influence of ventilation and airtightness on exposure

New Zealand

- **IAQ Knowledge.** A short project to determine what knowledge exists on IAQ in New Zealand homes. It will guide future research if knowledge gaps are identified.
- **Energy Efficient Ventilation.** Recommend ventilation options that will work in the NZ context for different housing types. Highlight necessary upgrades required for certain types of homes so that some particular ventilation systems function more effectively.
- **Occupant Ventilation Behaviour and Indoor climate.** Study the behaviour of the occupants of 100 homes in terms of window opening and the states of internal doors. Measure house temperature and relative humidity. The homes are a subset of our recently conducted house condition survey which will provide a rich meta data set.

New Zealand

- **Interstitial Moisture in Roof Cavities.** Investigate moisture problems in roofs. In particular so called Skillion or cathedral roofs with small air cavity volumes have shown moisture problems in our very high humidity climate.
- **Ventilation Performance in large span roofs.** Investigate long running institutional roofs with very small cavities where we encounter corrosion.
- **Airtightness trends, Impacts and energy savings opportunities.** Continue air tightness survey stopped about 5 years ago.

Spain

- Characterization of **air infiltration of the Spanish housing stock.** Applying for funding from Ministry of Development. There is some research that has already been developed by the Vasc and the Andalusian Energy Agencies.
- Characterization of **air infiltration and its influence on IAQ and energy** demand of working-class housing built between 1950-1980 and of social housing from the beginning of the 21st century in Andalusia. (Founded by MINECO, Ministry of Economy).
- On going research on proposal of **new IAQ regulatory requirements** based on the use of innovative ventilation systems that save energy and reduce condensation risks. (Funded by Ministry of Development)
- Influence **of ventilation on radon** concentration in a house in La Navata (Madrid). (Funded by MINECO)

Sweden

- Use of **technological advancements**, sensors, information and communication technology (internet of things) for control of indoor air quality
  - How to measure emissions from building materials
  - Demand controlled ventilation using alternative to CO_2 such as VOCs
- **Interaction between occupants, buildings and indoor climate**: the occupants understanding of a building's systems and functionality (e.g. demand controlled ventilation)
- **Bio-psycho-social aspects of health**, particularly particulate matter (PM)
  - Levels of everyday exposure to airborne particles in our homes
  - Outdoor sources and filtration technologies
  - Costs of, and barriers to, improving indoor air quality in terms of PMs

Sweden

- **Energy efficiency** (including airtight low energy buildings), climate change **and consequences for health and thermal comfort** (in particular) for **vulnerable groups** of the population
- **Buildings' sustainability and heat-air-moisture** – dilemmas and challenges due to climate change
- **Performance gap** between estimated performance of a proposed design and operational performance. Example of problematic area is MVHR due to contractors and occupants lack of awareness and experience.
- **How to deal with overheating?** - Increasing energy demands lead to more insulation and more airtight buildings. In combination with large glazed areas, lack of shading and increased outdoor temperatures overheating will increase.

United Kingdom

- What is the indoor **air quality** like **in existing traditional homes that have not been modernised**. How do CO_2 levels vary in these homes? 1000 ppm is used as a proxy for good indoor air quality in new homes, but is it practical or necessary with a natural ventilation system?
- What is the **indoor air quality** like **in traditional homes that have been draught-proofed, insulated and double glazed**, etc. We worry a lot about IAQ in new homes but what about existing homes?
- What are the true **causes of dampness and mould growth in new homes?** Is it really because they are too airtight or is it more down to occupant behaviour?
- In new homes, how important is ventilation in the first heating season while homes are still drying out?

United Kingdom

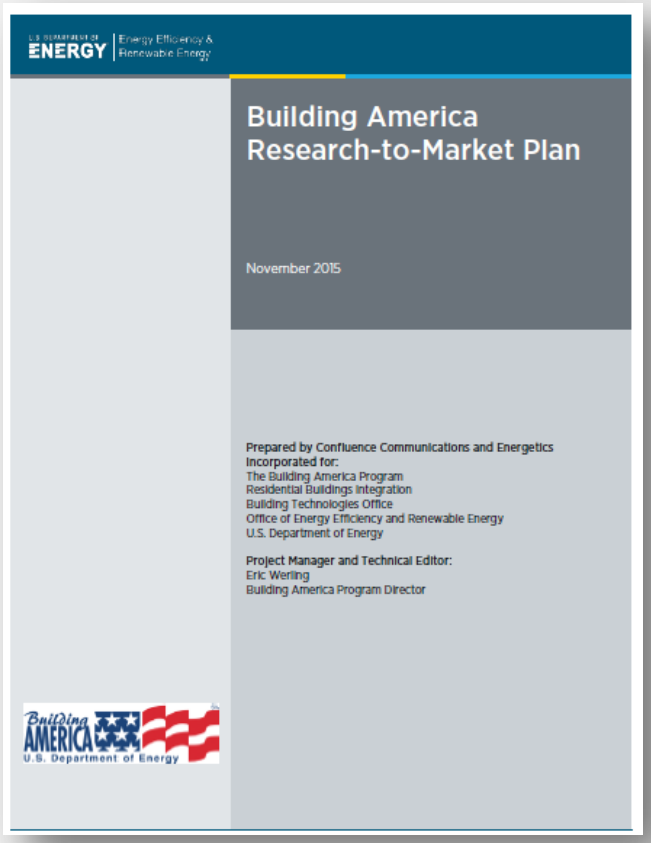
- **Brunel:** RCUK Centre for Sustainable Energy Use in Food Chains
- **Cambridge:** Managing Air for Clean Inner Cities (MAGIC)
- **Nottingham:** Relationships between Energy, Cooking, and Health, in Houses (REACHH)
- **CIBSE:** AM10 Natural Ventilation in Non-Domestic Buildings revision (CIBSE funded)
- **UK Government:** Revision of BB101 Ventilation and IAQ in Schools (Department of Education)

United State of America

Ongoing research

- ASTM Range Hood Capture Efficiency Standard
- Smart ventilation
- Targeted Pollutant Solutions: Filtration and Air Cleaning
  - Provide the technical support for changes to codes, standards and guidelines using the population impact assessment modeling framework that includes gaseous and PM2.5 exposures.
- IAQ Valuation
  - Develop existing LBNL tools to value the health benefits of reduced indoor pollutant exposures with the target of developing comprehensive IAQ rating systems and scores for new homes and retrofits
- Healthy Efficient Homes
  - Reduce the IEQ risks that are a barrier to industry adoption of high performance homes.

United State of America



United State of America

Future Work (DoE funded)

1. **Targeted pollutant solutions** that better control known indoor contaminants of concern, near their emission source(s), to allow for improved IAQ without increasing dilution ventilation requirements.
2. **Smart ventilation technology solutions** that optimize the balance between IAQ and energy and account for other variables that affect IAQ, such as occupancy, exhaust fan (e.g., dryer and range hood) operation, indoor and outdoor temperature, RH, and outdoor pollutant levels (e.g., ozone and particles).
3. **IAQ valuation** that facilitates standardized, quantified assessments of home IAQ to encourage more informed and objective design decisions regarding IAQ measures.

Other Stakeholders

- ATLANTIC, AERECO, VELUX
  - IAQ metrics
  - Demand Control Ventilation
- MEZ-TECHNIC
  - Energy use attributed to ductwork leakage
  - Schemes for controlling building airtightness and ventilation performance
  - Ventilation in existing buildings
- Venticool (Annex 62)
  - practices to maintain acceptable IAQ while minimizing energy demand.
- Tightvent
  - practices to reduce energy demand by reducing adventitious and duct leakage

Summary of Key Themes

- Indoor air quality (particulates, radon) and ventilation systems design to maintain adequate levels (Annex 68)
- Moisture and mould
- Smart and innovative ventilation systems
- In-situ assessment of ventilation system performance
- Effect of occupant behaviour on ventilation system performance (Annex 66)
- Distribution of air permeability and infiltration rates in housing stocks