

Subtask 4 - Strategies for design and control of buildings

**TOPICAL SESSION: "Ventilation design and control in residences - current challenges, innovative solutions and case studies gathered by IEA-EBC Annex 68"**

**"Introduction: How IEA EBC Annex 68 identified challenges and potential solutions in design and control of ventilation system in residences"**

40th AIVC conference, Ghent, Belgium

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## Introduction – IEA EBC Annex 68



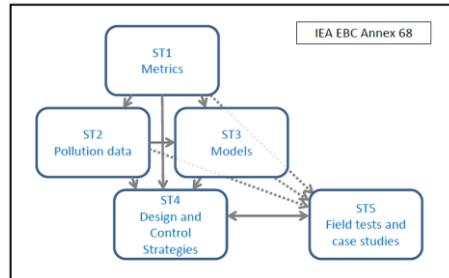
- Highly energy efficient residential buildings are airtight, and their need for ventilation should be optimized
- Inappropriate ventilation leads to risk of high levels of pollutants indoors
- Annex 68 shall focus on design and operation of buildings towards highest energy efficiency while ensuring good & healthy indoor conditions
- Annex 68 should consider latest scientific data regarding indoor air pollution as well as available modelling tools
- Annex 68 shall provide guidance regarding design and operation with a specific target of new and refurbished residential buildings

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# Subtasks

- ST1 - Defining the metrics
- ST2 - Pollutant loads in residential buildings
- ST3 - Modeling
- ST4 - Strategies for design and operation
- ST5 - Field measurements and case studies



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# Subtask 4 - Objectives

- Gather results and approaches of the other subtasks of the Annex 68 and annex participants
- Address optimal and practically applicable design and control strategies for high IAQ in residential buildings
- Present results in context with existing knowledge



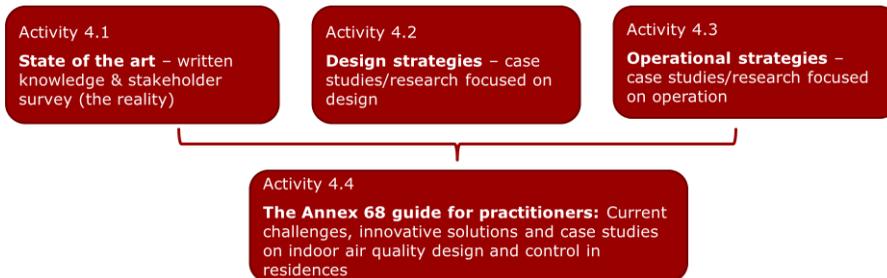
Figure: Sustain Solutions A/S

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# Approach and structure

Focus of the subtask is on energy efficient and comfortable mechanical ventilation in tight, low energy residences

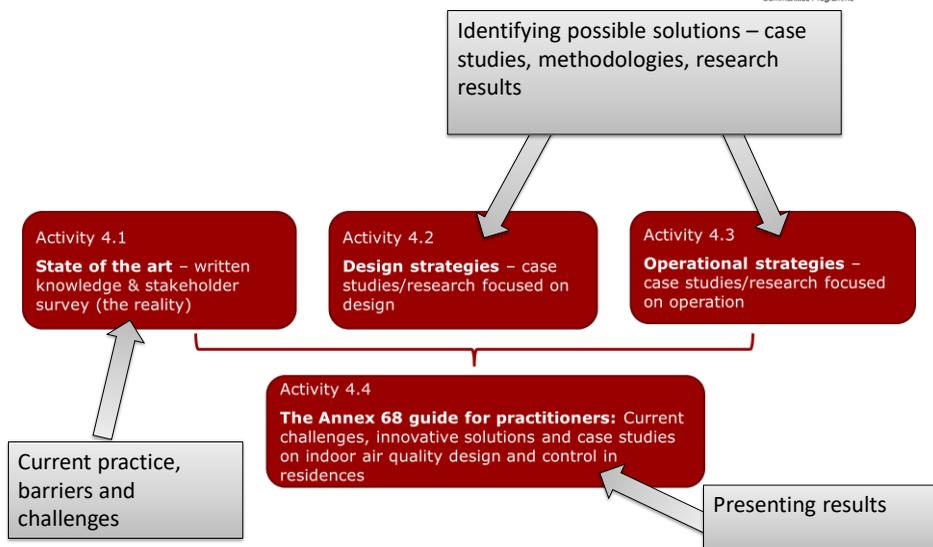
## Structure:



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# Approach and structure



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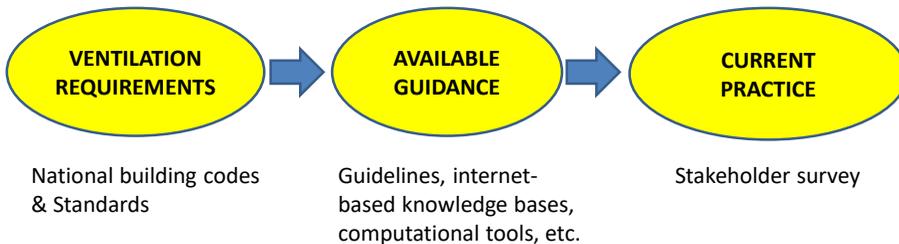
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## Activity 4.1 State of the art, challenges & barriers

### Objective:

To identify improvement opportunities for the design and operation of mechanical ventilation in residential buildings

### “Transition from requirements to practice”



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## Methods

### Review of ventilation requirements

- Recommended ventilation systems
- Background and nominal ventilation rates
- Supply and extract airflows
- Requirements for heat recovery efficiency
- Requirements for specific power input (SPI)
- Requirements for demand-controlled ventilation (DCV)

### Stakeholder survey

*Overview about today's practice in design, operation and commissioning of ventilation systems in residential buildings in different countries*

#### **Stakeholder groups:**

- A – Ventilation designers and Consultants
- B – Facility management and Building administration
- C – Public authorities
- D – Housing developers
- E – Producers of ventilation systems

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## Survey results – Conducted interviews

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>Total</b>
	Designers	Admin.	Authorities	Developers	Producers	
<b>Austria</b>	2		1	2	1	<b>6</b>
<b>Belgium</b>	4	2	2		2	<b>10</b>
<b>Denmark</b>	4				1	<b>5</b>
<b>Estonia</b>	1	1	1		1	<b>4</b>
<b>France</b>	2		2		1	<b>5</b>
<b>Norway</b>	2		2	3		<b>7</b>
<b>UK</b>	2		1	3	1	<b>7</b>

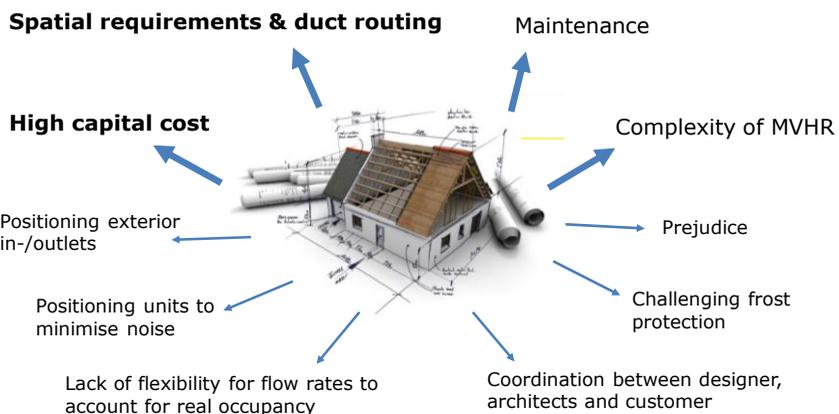
Total: 44 interviews

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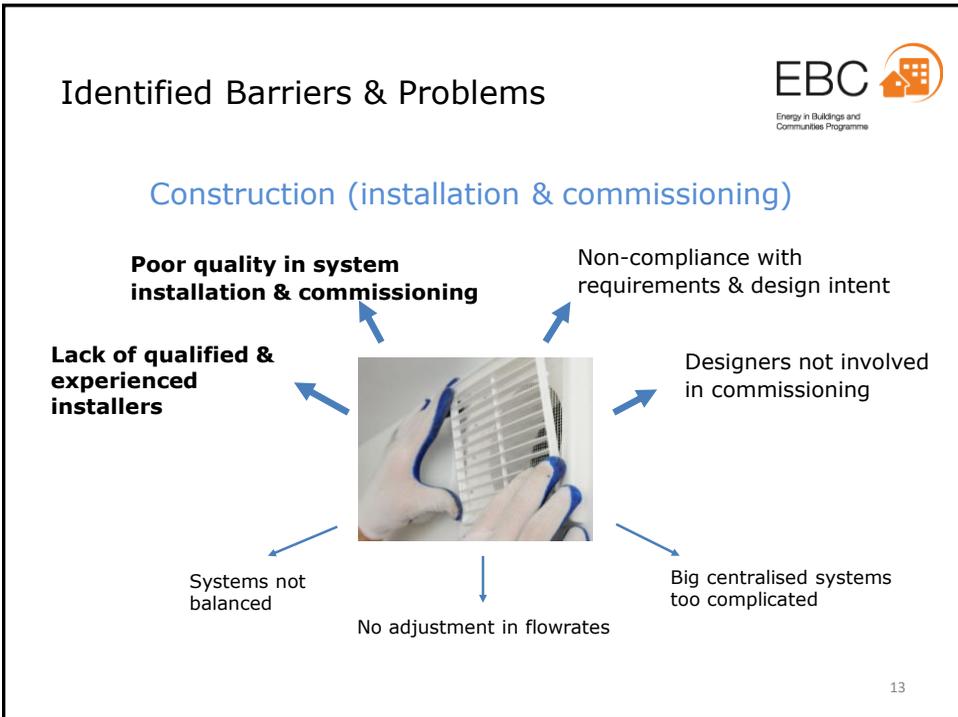
## Identified Barriers & Problems

Design (decision making, concept design, detail design)

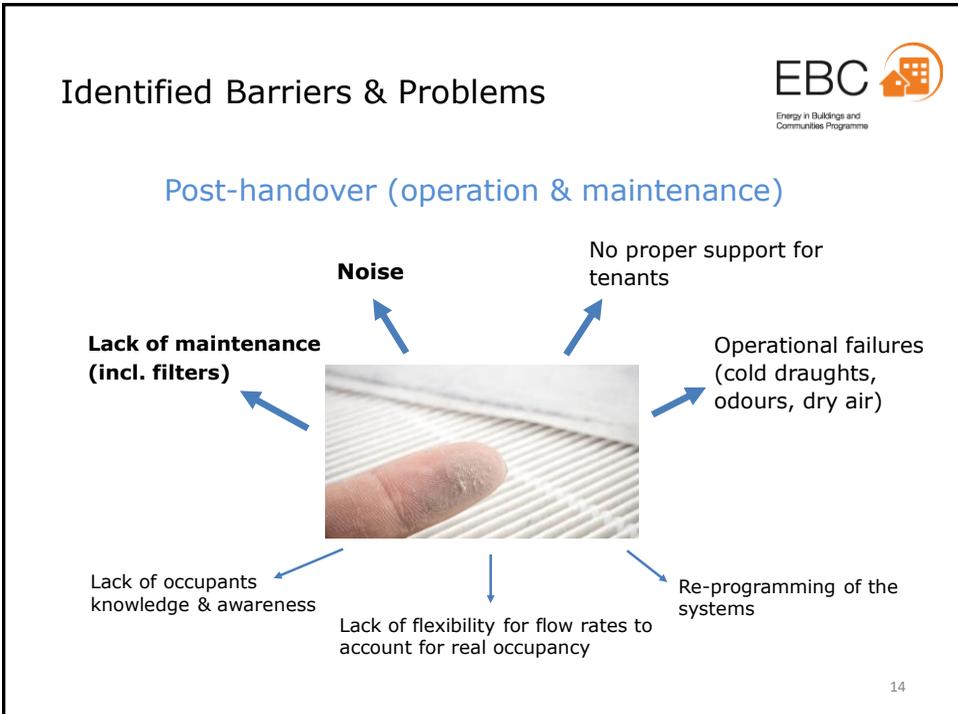


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## Suggestions for improvements by survey participants



### Legislative pushes:

- More flexibility in legislation including a more holistic approach allowing for trade-offs
- Coordinated approach to energy and IAQ
- Strengthen requirements to installation, commissioning and maintenance

### Technical pushes:

- Training and accreditation of installers
- Simple design and user control flexibility / Zonal control and more sensors
- Identification of risk factors and failure modes of a design strategy
- Specify appropriate mitigation measures throughout the building procurement process

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## Suggestions for improvements by survey participants



### Financial incentives pulls:

- Government subsidy or grants for systems
- Insurance incentives for system maintenance

### Market pulls:

- Quality labels for ventilation systems
- Low emission building products
- Market interventions to balance energy efficiency and cost of installation
- Level playing field in the market
- Stricter regulatory requirements

### Outreach programmes:

- Clear government guidance on IAQ
- Feedback to designers on actual performance of systems
- Enhanced training for practitioners
- Outreach campaign on benefits of mechanical ventilation systems

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## Activity 4.4 – Presenting results

**A guide through innovative solutions, current challenges, and selected case studies on indoor air quality, ventilation design and control in residences**

TABLE OF CONTENTS	EDITORS
<b>1/INTRODUCTION</b>	Jakub Kolarik & Carsten Rode
<b>2/STATE OF THE ART AND CURRENT CHALLENGES</b> How do we design residential ventilation today?	Daria Zukowska Esfand Burman
<b>3/DESIGN</b> Ways to design residential ventilation in the future/How to overcome nowadays challenges?	Gabriel Rojas Guangyu Chao
<b>4/OPERATION</b> Towards better performance, user satisfaction and easier maintenance	Jakub Kolarik Kevin Smith
<b>5/CONCLUSIONS and OUTLOOK</b>	Jakub Kolarik, Gabriel Rojas

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## Annex 68 guide - overview

Chapter	Case study	Design			Construction, Commissioning & Operation	
		Assessment methods	Assessing ventilation concepts	Novel ventilation solutions	Quality assurance	Assessing in-use performance
3.1	Alternative ducting options for balanced mechanical ventilation systems in multifamily housing					
3.2	Ambient air filtration in highly energy efficient dwellings with mechanical ventilation					
3.3	Development of a compact ventilation system for facade integration					
3.4	VOC exposure due to Floor heating systems versus Radiator heating					
3.5	Control strategies for mechanical ventilation in Danish low-energy apartment buildings					
3.6	Response of commercially available Metal Oxide Semiconductor Sensors under air polluting activities typical for residences					
3.7	Impact of multi zone air leakage modelling on ventilation performance and indoor air quality assessment in low-energy houses					
3.8	Towards a better integration of indoor air quality and health issues in low-energy dwellings					
3.9	List of key pollutants for design and operation of ventilation in low-energy housing					
3.10	Definition of a Reference Residential Building Prototype for Evaluating IAQ and Energy Efficiency Strategies					
3.11	Temperature dependent emissions of Volatile Organic Compounds from building materials					
3.12	Detailed modelling of IAQ to improve ventilation design in low energy houses					
3.13	Mechanical ventilation system in deep energy renovation of a multi-story building with prefabricated modular panels					
3.14	Simplifying MVHR systems: Assessing the extended cascade ventilation and active overflow concept					
3.15	Design of room-based ventilation systems in renovated apartments					
4.1	House owners' experience and satisfaction with Danish Low-energy houses - focus on ventilation					
4.2	Development and test of quality management approach for ventilation and indoor air quality in single-family buildings					
4.3	Applications of the Provevent protocol for ventilation systems inspection in French regulation and certification programs					
4.4	Long-term durability of humidity-based demand-controlled ventilation: results of a ten years monitoring in residential buildings					
4.5	Practical use of the Annex68 IAQ Dashboard					
4.6	Performance evaluation of Mechanical Extract Ventilation (MEV) systems in three 'low-energy' dwellings in the UK					
4.7	Indoor air quality in low energy dwellings: performance evaluation of two apartment blocks in East London, UK					

**Addressed topics:**

- Health & Comfort
- Spatial requirements
- Cost & Energy consumption
- Refurbishment
- Commissioning
- Quality of installation
- Maintenance
- User satisfaction

- 40 contributors
- 22 case studies
- Available in spring 2020

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## Annex 68 guide - overview

Each case study is presented using a fixed structure comprising of:

- **Objectives, description and methods** – briefly presents background, aim and main methodology used in the case.
- **Main results and findings** – this section documents how the objectives were fulfilled.
- **Conclusions and lessons learned** – represents a direct connection between the case study and practice.
- **Further reading** – a simplified reference section. Presents one, most important source for further reading providing additional information regarding the case study.

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## Annex 68 guide – an appetizer

Following presentations in this session represent examples of individual “chapters” in the guide

Thank you for your attention

<http://www.iea-ebc-annex68.org/>

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