PRESENTATION OF IEA EBC ANNEX 62 VENTILATIVE COOLING

PER HEISELBERG
DEPARTMENT OF CIVIL ENGINEERING

OPERATING AGENT
IEA EBC ANNEX 62

AALBORG UNIVERSITY
DENMARK

BACKGROUND

THE CURRENT DEVELOPMENT TOWARDS NEARLY-ZERO ENERGY BUILDINGS HAVE LEAD TO AN INCREASED NEED FOR COOLING – NOT ONLY IN SUMMER BUT ALL YEAR.

ELEVATED TEMPERATURE LEVELS ARE ONE OF THE MOST REPORTED PROBLEM IN POST OCCUPANCY STUDIES, EVEN IN RESIDENCES IN THE "HEATING SEASON"

THERE HAS BEEN A LARGE FOCUS ON REDUCING THE HEATING NEED IN BUILDINGS. THERE IS ALSO A NEED TO ADDRESS THE COOLING NEED AND TO DEVELOP MORE ENERGY-EFFICIENT COOLING SOLUTIONS

WHY DO WE EXPERIENCE AN OVERHEATING PROBLEM?

EBC Energy in Buildings and Communities Programme

OVERHEATING IS A ”NEW AND INCREASING PROBLEM” FOR LOW ENERGY BUILDINGS

- More focus on energy than indoor environment (less requirements for documentation)
- Is underestimated and is not given enough focus in the design process
- Old rules of thumb still used

TOO SIMPLIFIED DESIGN METHODS USED

- Averaging heat loads in time and space
- Uncertain correlation between cooling need and overheating risk

NO (VERY FEW) STANDARD TECHNICAL SOLUTIONS AVAILABLE, ESPECIALLY FOR DWELLINGS

NO (VERY LIMITED) USER EXPERIENCE ON HANDLING OF OVERHEATING PROBLEMS - “ONE-OF-A-KIND” SOLUTIONS ARE OFTEN NOT WELL-ADAPTED TO “PRACTICAL USE”

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WHY DO WE EXPERIENCE AN OVERHEATING PROBLEM?

EBC Energy in Buildings and Communities Programme

IT IS NOT POSSIBLE TO REACH GOALS THROUGH MORE:

- Envelope insulation, Building airtightness, Ventilation heat recovery,

WHICH ARE ROBUST TECHNOLOGIES WITHOUT USER INTERACTION

NEW MEASURES NEEDS TO BE INCLUDED:

- Demand controlled ventilation, Shading for solar energy or daylighting control, Lighting control, Window opening

ALL TECHNOLOGIES:

- Where performance is very sensitive to **control**
- Which involve different degree of user interaction
- Whose function and performance are difficult for users to understand

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VENTILATIVE COOLING IS A SOLUTION

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VENTILATIVE COOLING IS AN ATTRACTIVE AND ENERGY EFFICIENT PASSIVE SOLUTION TO COOL BUILDINGS AND AVOID OVERHEATING.

- Ventilation is already present in most buildings through mechanical and/or natural systems
- Ventilative cooling can both remove excess heat gains as well as increase air velocities and thereby widen the thermal comfort range.
- The possibilities of utilizing the free cooling potential of low temperature outdoor air increases considerably as cooling becomes a need not only in the summer period.

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DEFINITION OF VENTILATIVE COOLING

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VENTILATIVE COOLING IS APPLICATION OF VENTILATION FLOW RATES TO REDUCE THE COOLING LOADS IN BUILDINGS.

*VENTILATIVE COOLING UTILIZES THE **COOLING POTENTIAL** AND **THERMAL PERCEPTION POTENTIAL** OF OUTDOOR AIR.*

THE AIR DRIVING FORCE CAN BE NATURAL, MECHANICAL OR A COMBINATION

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POTENTIAL AND LIMITATIONS

OUTDOOR CLIMATE POTENTIAL

- Outdoor temperature lower than the thermal comfort limit in most part of the year in many locations
- Especially night temperatures are below comfort limits
- Natural systems can provide “zero” energy cooling in many buildings

LIMITATIONS

- Temperature increase due to climate change might reduce potential
- Peak summer conditions and periods with high humidity reduce the applicability
- An urban location might reduce the cooling potential (heat island) as well as natural driving forces (higher temperature and lower wind speed). Elevated noise and pollutions levels are also present in urban environments
- High energy use for air transport limit the potential for use of mechanical systems
- Building design, fire regulations, security are issues that might decrease the potential use of natural systems

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IEA EBC Annex 62 Overview

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ANNEX OBJECTIVES

TO ANALYSE, DEVELOP AND EVALUATE SUITABLE METHODS AND TOOLS FOR PREDICTION OF COOLING NEED, VENTILATIVE COOLING PERFORMANCE AND RISK OF OVERHEATING IN BUILDINGS THAT ARE SUITABLE FOR DESIGN PURPOSES.

TO GIVE GUIDELINES FOR INTEGRATION OF VENTILATIVE COOLING IN ENERGY PERFORMANCE CALCULATION METHODS AND REGULATIONS INCLUDING SPECIFICATION AND VERIFICATION OF KEY PERFORMANCE INDICATORS.

TO EXTEND THE BOUNDARIES OF EXISTING VENTILATION SOLUTIONS AND THEIR CONTROL STRATEGIES AND TO DEVELOP RECOMMENDATIONS FOR FLEXIBLE AND RELIABLE VENTILATIVE COOLING SOLUTIONS THAT CAN CREATE COMFORTABLE CONDITIONS UNDER A WIDE RANGE OF CLIMATIC CONDITIONS.

TO DEMONSTRATE THE PERFORMANCE OF VENTILATIVE COOLING SOLUTIONS THROUGH ANALYSIS AND EVALUATION OF WELL-DOCUMENTED CASE STUDIES.

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ANNEX LEADERSHIP

PARTICIPATING COUNTRIES
Australia, Austria, Belgium, China, Denmark, Finland, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Switzerland, UK, USA

OPERATING AGENT:
Denmark, represented by Per Heiselberg, Aalborg University
SUBTASK A:
Leader: Switzerland, represented by Fourentzos Flourentzou, ESTIA
Co-leader: Italy, represented by Annamaria Belleri, EURAC
SUBTASK B:
Leader: Austria, represented by Peter Holzer, IBRI
Co-leader: Denmark, represented by Theofanis Psomas, AAU
SUBTASK C:
Leader: China, represented by Guoqiang Zhang, Hunan University
Co-leader: Ireland, represented by Paul O’Sullivan, CIT

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ANNEX ORGANIZATION

SUBTASK A: METHODS AND TOOLS

- Analyse, develop and evaluate methods and tools for prediction of cooling need, ventilative cooling performance and risk of overheating in buildings that is suitable for design purposes

SUBTASK B: SOLUTIONS

- Investigate the cooling performance of existing mechanical, natural and hybrid ventilation systems and technologies and typical comfort control solutions Develop flexible and reliable ventilative cooling solutions that can create comfort under a wide range of climatic conditions.

SUBTASK C: CASE STUDIES

- Demonstrate the performance of ventilative cooling through analysis and evaluation of well-documented case studies

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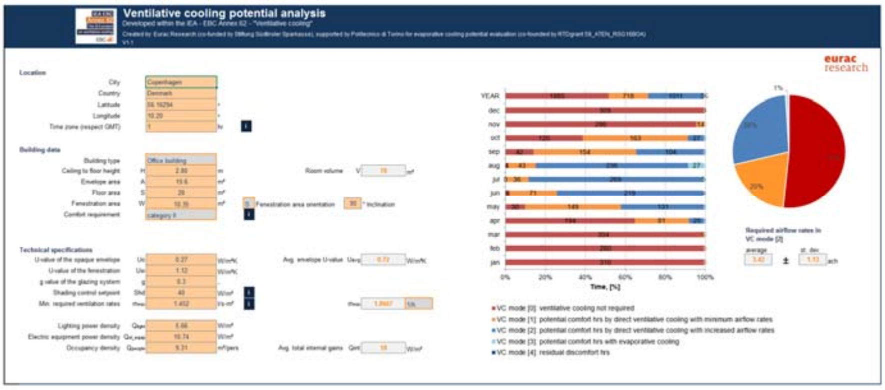
ANNEX DELIVERABLES

ID	Official Deliverable	Target Group
D1	Overview and state-of-the art of Ventilative Cooling	Research community and associates. Policy makers
D2	Ventilative Cooling Source Book	Building component and ventilation system developers and manufacturers. Architects, and design companies, engineering offices and consultants
D3	Ventilative Cooling case studies	Architects, consulting engineers
D4	Guidelines for Ventilative Cooling Design and Operation	Architects and design companies, engineering offices and consultants
D5	Recommendations for legislation and standards	Policy makers and experts involved in building energy performance standards and regulation
D6	Project Summary Report	Research community and associates + ECBCS Programme

VC TOOL

CHARACTERISTICS

- Can estimate climate potential
- Suggest potential relevant strategies
- Estimate necessary air flow rates



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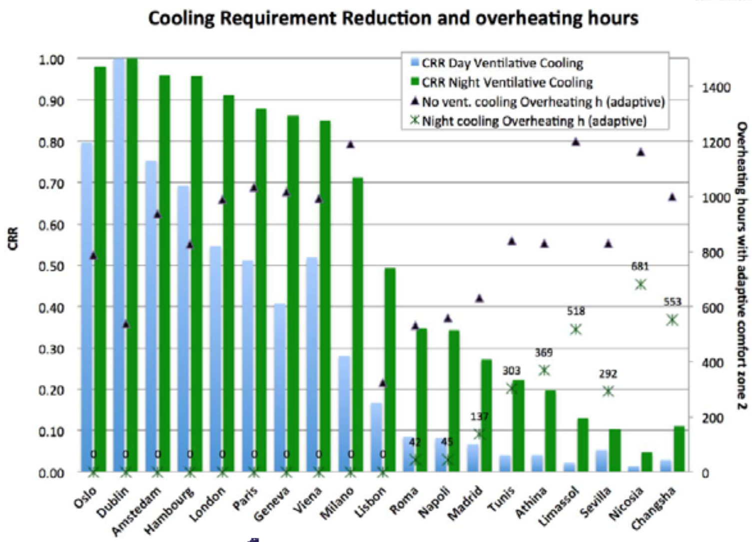

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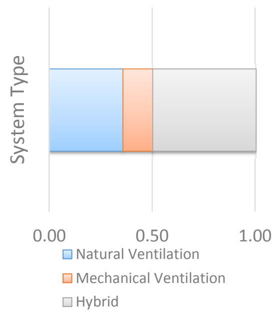
LESSONS LEARNED

Ventilative cooling Concepts	Natural driven	Mech. Supply Driven	Mech. exhaust driven	Natural night ventilation	Mech. night ventilation	Air conditioning	Indirect Evap. Cooling	Earth to Air Heat Exch.	Phase Chang eMaterials
zero2020 (IE)	X			X					
Brunla Primary school (NO)	X			X					
Solstad barnehage (NO)	X		X	X	X				
Wanguo MOMA (CN)		X	X		X	X			
UNI Innsbruck (AT)	X		X	X					
wk Simonsfeld (AT)	X		X						
Renson (BE)	X			X					
KU Leuven Ghent (BE)	X		X				X		
Maison Air et Lumiere (FR)	X								
Mascalucia ZEB (IT)	X			X				X	
Nexus Hayama (JP)	X					X			
CML Kindergarden (PT)	X			X					
Bristol University (UK)					X	X			X
Living Lab (NO)	X								



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CASE EXAMPLES

Kindergarten, Portugal

University, United Kingdom

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BUILDING COMPONENTS

EBC
Energy in Buildings and Communities Programme

AIRFLOW GUIDING VENTILATION COMPONENTS
- WINDOWS, ROOFLIGHTS, DOORS, DAMPERS, FLAPS, LOUVRES, GRILLES, VENTS

AIRFLOW ENHANCING VENTILATION COMPONENTS
- CHIMNEYS, ATRIA, VENTURI AND ROTATING EXHAUST VENTILATORS,
- WIND TOWERS, -CATCHERS, -SCOOPS, DOUBLE FACADES

PASSIVE COOLING VENTILATION COMPONENTS
- CONVECTIVE, EVAPORATIVE, PHASE CHANGE MATERIAL

ACTUATORS
- CHAIN, SPINDLE, ROTARY

SENSORS
- TEMPERATURE, HUMIDITY, CO2, OCCUPANCY, ...

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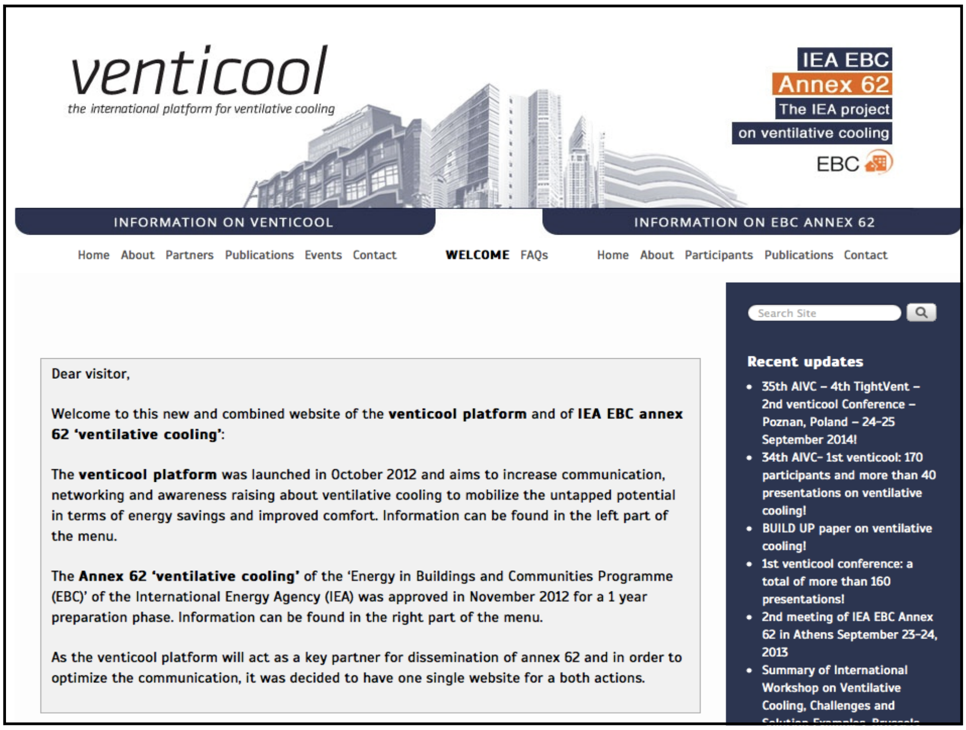


Thanks for your attention
More information on IEA EBC Annex 62 on
www.venticool.eu