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?

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"

WHY DO WE EXPERIENCE AN OVERHEATING PROBLEM?

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
VENTILATIVE COOLING IS A SOLUTION

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.

DEFINITION OF VENTILATIVE COOLING

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
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
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.

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
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

ANNEX DELIVERABLES

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

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

![Diagram showing VC Tool characteristics]

Cooling Requirement Reduction and overheating hours

![Bar chart showing cooling requirement reduction]

DEPARTMENT OF CIVIL ENGINEERING
AALBORG UNIVERSITY
## LESSONS LEARNED

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>zero2020 (IE)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bruna Primary school (NO)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solstad barnhage (NO)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wanguo MOMA (CN)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNI Innsbruck (AT)</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wk Simonsfeld (AT)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renson (BE)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KU Leuven Ghent (BE)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maison Air et Lumiere (FR)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mascalucia ZEB (IT)</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nexus Hayama (JP)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CML Kindergarten (PT)</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bristol University (UK)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Living Lab (NO)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## CASE EXAMPLES

- **University, United Kingdom**
  - Kindergarten, Portugal

Energy in Buildings and Comfortable Environments

DEPARTMENT OF CIVIL ENGINEERING
AALBORG UNIVERSITY
BUILDING COMPONENTS

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, ...

Dear visitor,

Welcome to this new and combined website of the ventiCool platform and of IEA EBC annex 62 ‘ventilative cooling’.

The ventiCool platform was launched in October 2012 and aims to increase communication, networking and awareness raising about ventilative cooling to mobilize the untapped potential in terms of energy savings and improved comfort. Information can be found in the left part of the menu.

The Annex 62 ‘ventilative cooling’ of the ‘Energy in Buildings and Communities Programme (EBC) of the International Energy Agency (IEA) was approved in November 2012 for a 1 year preparation phase. Information can be found in the right part of the menu.

As the ventiCool platform will act as a key partner for dissemination of annex 62 and in order to optimize the communication, it was decided to have one single website for both actions.
Thanks for your attention

More information on IEA EBC Annex 62 on www.venticool.eu