VENTILATIVE AND RESILIENT COOLING
IEA EBC ANNEXES 62 AND 80

PER HEISELBERG, DENMARK
PETER HOLZER, AUSTRIA
VENTILATIVE COOLING POTENTIAL

CHARACTERISTICS

• Can estimate climate potential
• Take into account building characteristics and loads
• Suggest potential relevant strategies
• Estimate necessary air flow rates

COOLING REQUIREMENTS REDUCTION (CRR)

\[
CRR = \frac{Q_{ref}^{\text{C}} - Q_{\text{C}}^{\text{C}}}{Q_{ref}^{\text{C}}}
\]
VENTILATIVE COOLING STRATEGIES

LIMITATIONS

- Climate
  - Peak summer conditions and periods with high humidity reduce the applicability
  - Temperature increase due to climate change might reduce potential

- Urban location
  - Might reduce the cooling potential (heat island)
  - Reduced driving forces for natural systems (higher temperature and lower wind speed).
  - Elevated noise and pollutions levels might also be present

- Other
  - 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
## DESIGN INFLUENCES

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### DESIGN CONSIDERATIONS

**Look for when searching for solutions**
- Possibility to use outdoor air without filtering
- Possibility to use direct airflow from outside without a noise problem, a control problem, a burgling/mix and/or rain problem
- Use exposed thermal mass in the building structure
- Use heat recovery in cold climates and in buildings with relatively low heat loads
- Use a large height difference between ventilation intake and exhaust to maximise stack effect and vertical temperature differences
- Use overflow between rooms either for supply or extract side of ventilation
- Minimise need for ducting of ventilation air
- Minimise airflow rate by air distribution design that can provide low supply air temperatures with risk of draught

**Avoid when searching for solutions**
- Direct solar-exposure of occupants
- Solar heating of intake air
- Negative effects from wind on buoyancy driven air flow
- Building design with little thermal mass exposed in intake air flow paths and in rooms
- Noise transfer from outside and from other rooms of building
- Insufficient room air distribution
- Air flow paths which do not allow easy inspection and cleaning

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<td>Temperature (≥ 10°C from comfort zone)</td>
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<td>Hot and dry (&gt;20°C from comfort zone)</td>
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<td>Hot and humid</td>
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<td>Outdoor noise from low wind speeds (&lt; 2 m/s)</td>
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<td>Outdoor noise from high wind speeds (&gt; 10 m/s)</td>
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**Building heat load level:**
- Low heat load: D = 20
  - Cold (≤ 10°C from comfort zone) (heat recovery needed)
  - Temperature (≥ 10°C from comfort zone)
  - Hot and dry (>20°C from comfort zone)
  - Hot and humid
  - Medium heat load: D = 30
    - Cold (≤ 10°C from comfort zone) (heat recovery needed)
    - Temperature (≥ 10°C from comfort zone)
    - Hot and dry (>20°C from comfort zone)
    - Hot and humid
  - High heat load: D = 50
    - Cold (≤ 10°C from comfort zone) (heat recovery needed)
    - Temperature (≥ 10°C from comfort zone)
    - Hot and dry (>20°C from comfort zone)
    - Hot and humid

**Thermal comfort:**
- Cold (≤ 10°C from comfort zone) (heat recovery needed)
- Normal requirements (50% of occupancy hours)
- High requirements (30% of occupancy hours)
- Requirements adaptive to outdoor conditions

**Burglary Prevention:**
- Low level of exposed building thermal mass
- Medium level of exposed building thermal mass
- High level of exposed building thermal mass
- High level of insulation and weather-tightness
Dear visitor,

Welcome to the combination of Ventilative Cooling.

**AIVC 2019 Conference: Call for Abstracts & Topical Sessions**

We are pleased to announce that the 2019 Conference "From Energy crisis to sustainable indoor climate – 40 years AIVC" is now accepting abstracts & proposals for topical sessions. The Conference will be held during 15-16 October, 2019 at "Het Pand", the congress centre of Ghent University in Ghent, Belgium.

The conference programme will include well-prepared and structured sessions focused on the conference topics, invited speakers, long and short oral presentations arising from the call, as well as 90 seconds industry presentations.

This year, there are **2 new features**:

- 2 separate calls for abstracts & papers depending on whether the authors are interested in the peer review of their papers.

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RESILIENT COOLING
IEA EBC ANNEX 80

DR. PETER HOLZER
INSTITUTE OF BUILDING RESEARCH & INNOVATION
AUSTRIA
Australia heatwave: overnight minimum of 35.9°C in Noona sets new record

On fifth day of record-breaking extreme weather, temperatures in parts of Victoria, ACT and NSW forecast to soar above 40°C, including in Sydney’s west

- 25 January - Australia extreme heatwave: Victoria and Tasmania face bushfire threat - live updates
- Extreme heat Melbourne: city expecting 44°C as Victoria faces hottest day since Black Saturday

July 2012 Heatwave in Ohio, West Virginia, Virginia and Maryland
Temperatures above 38°C being accompanied by violent storms
THE SURGE OF AIR CONDITIONING

25Y DEVELOPMENT OF STOCK AND CAPACITY OF AC WORLDWIDE

![Graph showing the tripling of AC stock and cooling capacity within 25 years.](Image)

Installed stock and cooling capacity of AC
Source: IEA Report Future of Cooling, 2018

THREATS OF THE “AC SURGE”

- MAKING HOUSES EVEN MORE VULNERABLE
- MAKING OUTDOOR SPACES EVEN HOTTER AND LESS LIVEABLE
- CHALLENGING THE GOALS OF DECARBONISATION & CLIMATE PROTECTION
- RAISING THE DANGER OF GRID BLACKOUTS

Source: IEA Report Future of Cooling, 2018
RESILIENT COOLING REQUIREMENTS

- RELIABILITY & FAILURE SAFETY
- AFFORDABILITY & ACCESSIBILITY
- ENERGY EFFICIENCY & CARBON NEUTRALITY
- SOCIAL INCLUSIVENESS

AFTER DECADES OF COMFORT RESEARCH AND EFFICIENCY RESEARCH:

IT IS NOT ONLY ABOUT COMFORT. IT IS ABOUT SURVIVAL.

IT IS NOT ONLY ABOUT EFFICIENCY. IT IS ABOUT SUFFICIENCY AND RESILIENCE.
ANNEX 80 OBJECTIVES

A **IDENTIFY AND DOCUMENT** POTENTIALS, LIMITATIONS AND BOTTLENECKS OF COOLING SYSTEMS. PROVIDE GUIDANCE ON DESIGN, PERFORMANCE CALCULATION AND SYSTEM INTEGRATION OF RESILIENT COOLING.

→ SUBTASK A – IMPACT ASSESSMENT

B **DEVELOP AND IMPROVE** SYSTEMS AND TECHNOLOGIES. DEVELOP NEW SOLUTIONS. RESEARCH TOWARDS IMPLEMENTATION OF EMERGING TECHNOLOGIES. EXTEND BOUNDARIES OF EXISTING SOLUTIONS, INCLUDING USER INTERACTION AND CONTROL STRATEGIES.

→ SUBTASK B – SOLUTIONS

C **EVALUATE** THE REAL PERFORMANCE OF COOLING SOLUTIONS. IDENTIFY PERFORMANCE GAPS AS WELL AS SUPPORTING CONDITIONS.

→ SUBTASK C – FIELD STUDIES

D **IDENTIFY AND SPREAD** BEST PRACTICE IN POLICY ACTIONS.

→ SUBTASK D – POLICY ACTIONS

A WARM WELCOME TO STILL JOIN ANNEX 80


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