Resilient Cooling Guidelines from the IEA EBC Annex 80

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SUMMARY

The world is seeing a rapid increase of cooling of buildings[1]. This is driven by multiple factors, such as urbanization and densification, climate change and elevated comfort expectations together with economic growth in hot and densely populated regions of the world. Additionally, disruptive events, such as extreme heat and heat waves are occurring more often and are expected to become a common phenomenon by mid-century. The trend towards cooling seems inexorable. It is therefore mandatory to steer this development towards sustainable solutions.

Against this background, it is the motivation of this guidebook to support practitioners to implement highly efficient, low-carbon, resilient cooling solutions, technologies, and strategies and contributing to a sustainable built environment. Resilient cooling aims to avoid heat stress to people and to maintain safe and operable conditions in buildings in the event of externally induced disruptions. It therefore goes beyond the upkeep of thermal comfort. This guidebook focuses on the design of resilient cooling against such disruptions.

The Resilient Cooling Guideline is based on findings of the international research project of the Energy in Buildings and Communities (EBC) programme Annex 80 Resilient Cooling of Buildings provided by a group of scientists from numerous institutions in various fields such as architecture, engineering, building science and building physics.

The Resilient Cooling Guideline addresses both free-running and mechanically cooled buildings and aims to answer the following question: How can I/we design a “resilient cooling” building?

For such, it is important to understand the underlying concepts of resilience regarding buildings, the available technological solutions, and the methods and tools used to evaluate options. Several chapters are sequenced to assist practitioners in these areas, as shown in Table 1.2. Two chapters provide practical examples of application of the guidelines for case-study buildings.

KEYWORDS

resilient cooling, guideline, framework, implementation

Table 1: Chapter overview

Chapter	Overview	Topics addressed
2	Provides a definition of disruptions and resilient cooling and explanations of the disruptive events identified in the context of resilient cooling design	✓ How can resilience be conceptualized? ✓ What is the definition of resilient cooling?
3	Provides concise information of resilient cooling solutions	✓ Which resilient cooling solutions exist to improve the building resilience (technology specific KPIs)? ✓ Which strategies and technologies to implement in building design process to be prepared for future disruptions? ✓ How to size these strategies considering future climate uncertainties? ✓ How to assess the performance of resilient cooling strategies prospectively?

[1] Birol, D. F. (2018). The Future of Cooling. 92.

4	Provides a selection of key performance indicators (KPI) that can be used for the evaluation of resilient cooling in buildings	✓ How can the resilience of a building/cooling system be quantified in the case of power outages and/or heat wave events?
5	Gives an overview of performance assessment methods and tools for the evaluation of operational and energy efficiency of buildings to identify potential improvements	✓ How to select input and output parameters for simulation and technology assessment? ✓ How to evaluate the resilience of a building against different disruptions? ✓ How to model specific resilient cooling technologies? ✓ How to calibrate a building simulation model?
6	Introduces climate data necessary for resilient cooling design	✓ How to account for future or extreme events? ✓ How to select future or extreme weather data sets for building simulation? ✓ How should future weather files be prepared for building simulations?
7	Discusses parameters related to people and their use of spaces, and incorporation of these issues in building performance simulation and analysis	✓ How do occupancy patterns impact building performance assessment? ✓ How does metabolic rate impact building performance assessment? ✓ What about internal gains?
8	Addresses performance influencing factors such as the setting of a building and its form, envelope characteristics or orientation.	✓ How does microclimate, location, landscape, and orientation affect building performance? ✓ What influence do fenestration design, shading systems and opaque envelope characteristics have on resilient cooling?

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