

Building Energy Code Working Group

Building Code Considerations for Overheating Management - Global Overview

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Background

- Overheating protection in residential buildings has been adopted in some countries
 - European Union directive
 - Other countries are also developing/ considering overheating protection
- Previous effort summarized regulation being applied
 - **IEA Annex 80 (2023)** – survey of 26 European countries
 - **IEA Annex 5 (2026)** - survey of 19 countries
 - **IEA EBC Building Energy Code Working Group (2026)** – presentations from 9 countries
 - Other review papers
- **Purpose:** highlight commonalities, differences, and challenges

Countries with regulation to manage overheating (not exhaustive):

- France
- UK (England, Scotland, Wales)
- Finland
- Austria
- Denmark
- Germany
- Ireland
- Netherlands
- Sweden

Countries developing regulations to manage overheating (not exhaustive) :

- Australia
- New Zealand
- US* (model code)

General Code Structure

Different levels of complexity for different buildings/projects

- *Simple method*
 - For simpler projects and buildings, buildings in low-risk regions etc.
 - Prescriptive based requirements (UK, Finland)
 - Calculations with simple inputs (Ireland, Germany, Denmark)
- *Detailed/Comprehensive method*
 - Some European countries require dynamic simulation (with various levels of complexity) for all buildings or buildings that can't comply through simple methods
 - Occupant adaptive behaviour considered
 - Different metrics used (thermal comfort vs health impact based)



House or MURB ?



***SHGC,
WWR,
Opening
Area/Ratio***



***Low risk or high
risk?***



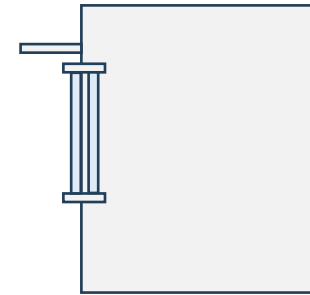
***Active vs
Passive
Occupants***



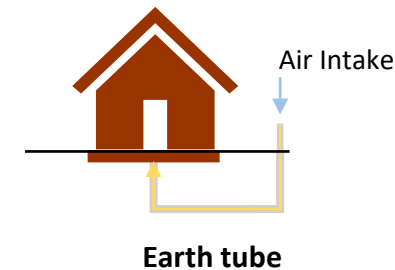
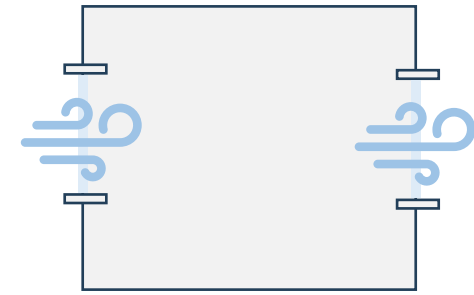
Acceptable Measures

- Operable internal shading not accepted by England
- Examples of accepted measures
 - Earth tube
 - Cross ventilation
 - Internal thermal mass
 - Shading devices (internal, external)
 - Window to wall ratio
 - Orientation and tilt of window
 - Insulation
 - Cool roofs
 - Mechanical ventilation
 - Mechanical cooling
 - Ventilation louvres

Overhang Shading



Cross Ventilation

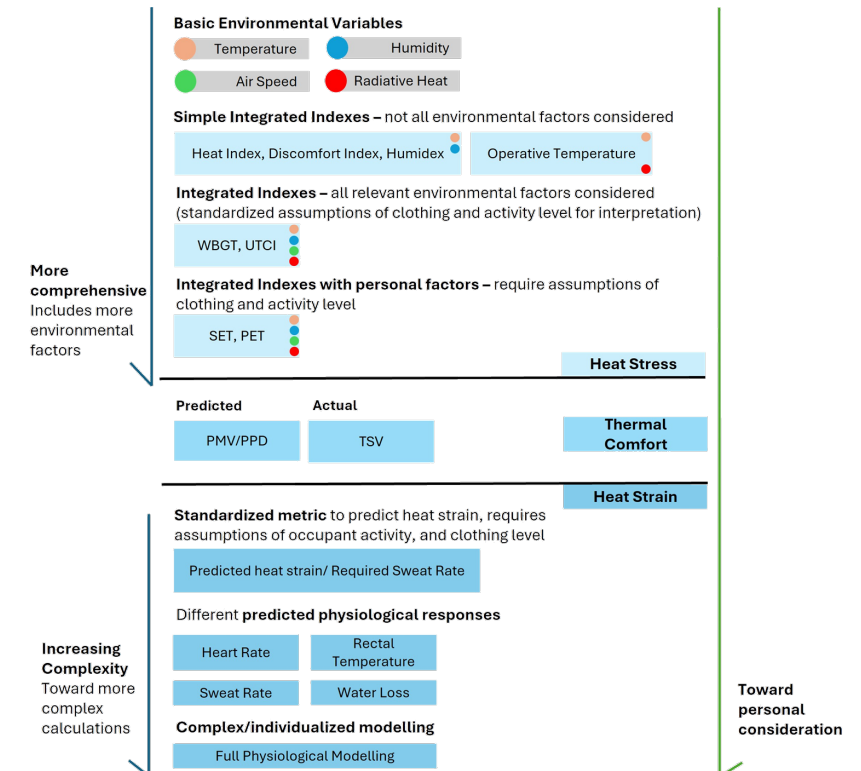


Cool roof



Metrics and Thresholds

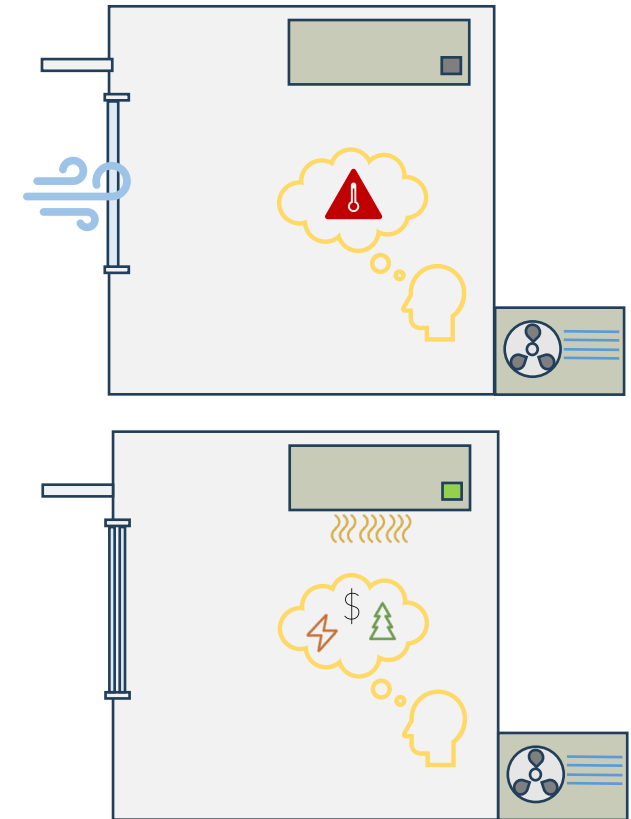
- Metrics to indicate overheating conditions are mainly based on environmental indicators
 - Room(dry-bulb) temperature (Finland)
 - Operative temperature (France, UK, Ireland, Denmark, Austria)
 - Thermal comfort criteria is also being used
 - Standard Effective Temperature is considered by New Zealand, Australia and used for impact analysis of future US model code (in draft)
- Pass/fail criteria for overheating evaluation is rarely determined at the first exceedance
 - Overheating degree hours – France, Finland, Flanders(Belgium), Netherlands
 - # or % of hour exceedance – UK, Denmark, Ireland



Summary of indoor overheating metrics (from “Exploring the role of building codes in protecting occupants from overheating—A Canadian perspective” (Siu, Brown, Brideau et al. 2025))

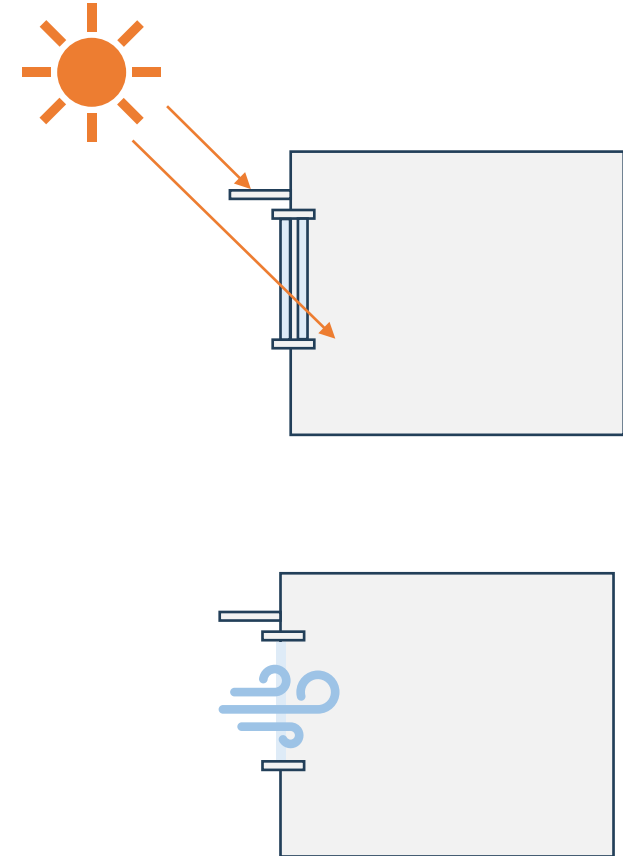
Passive First

- Generally, European countries (such as France and UK) favor a passive measure first strategy
- Passive measures are implemented first, then mechanical cooling is added when passive measures are not sufficient
- Relevance for **reducing cooling load** (energy consumption)
- Beneficial for **passive survivability**



Prescriptive Requirements

- Focuses on **solar gains control** and **utilization of natural ventilation**
- For solar gains, maximum heat gain values
 - France prescribes different maximum solar heat gain values based on orientation of surface
 - England also has similar prescription, but limits max glazing area and require additional shading devices in the most glazed room
- For natural ventilation, minimum window opening sizes for buildings with cross ventilating (window guards are used to prevent falling)
 - Sizes prescribed as % of window area or % of floor area



Weather Data

- Mainly based on historical weather data
 - Historical extreme event (France 2003 heat wave)
 - Design summer year (UK, Ireland)
 - Typical weather year (Finland, Germany, Denmark)
- Some countries considering the inclusion of future weather data or encourages additional analysis
 - Germany (midterm conditions 2041 to 2060)
 - Denmark (TMY 2050s and 2090s are encouraged)
 - UK encourages the use of extreme summer years and future weather data
 - New CIBSE TM59 2026 requires the use of 2050 weather data
- Choosing appropriate weather data for compliance analysis requires careful consideration of applicability of local context

Type of conditions	Typical	Extreme
Seasons	Summer	Winter
Representative periods / scenario	Historical	Future • Near term • Midterm • Long term
Techniques	Statistical	Morphing
	Climate Simulation	

Challenges

- Simple vs comprehensive evaluation
 - Risk of **mis-characterization** (need to determine acceptable rate)
- Demonstrating **code compliance** is not replacement of comprehensive **design analysis**
 - Generalization vs individual circumstances
 - How to define minimum standard vs best practices vs state of the art?
- Solutions **beyond building design**
 - Education of adaptive practices
 - Community level resources
 - Shelters, cooling centers (not preferred by occupants in North America)

	Fail determined by simulation	Pass determined by simulation
Fail determined by simple evaluation	True Fail	False Pass
Pass determined by simple evaluation	False Fail	True Pass

Conclusions

- Different countries have different approaches and they are evolving
- Context are different, **no one size fits all**
 - Climate
 - Preferred heat management strategies
 - Harmonized vs decentralized code
 - Enforcement



Additional information

Reviews on overheating regulations

[Overheating calculation methods, criteria, and indicators in European regulation for residential buildings \(Attia et al. 2023\)](#)

[AIVC Technical Note 76 - Overheating assessment & ventilative cooling in national building codes regarding indoor environmental quality and energy performance \(Breesch and Kapsalaki, 2026\)](#)

[Working Group on Building Energy Codes – Exploring Overheating and the codes \(I to IV\)](#)

[A Critical Review of Overheating Risk Assessment Criteria in International and National Regulations—Gaps and Suggestions for Improvements \(Sadeghi, Chen and Wright 2024\)](#)

[Review on Overheating Evaluation Methods in National Building Codes in Western Europe \(Rahif, Amaripadath and Attia, 2022\)](#)

Canada

- A lot of seasonal and geographical variation in Canada's climate
 - Cold winters and short but hot summer
- Building code focuses on reducing heating energy consumption
- Overheating-related measures in existing regulation
 - Maximum SHGC based on FDWR (fenestration and door to wall ratio) and climate zone (based on heating degree days)
 - Cooling load-based evaluation to determine if air conditioning is needed
- Development of updates to future codes is underway
 - Work is being done to determine thresholds, methods and requirements

Resources:

[Overheating in the National Building Code of Canada](#)

France

- Comprehensive regulations on overheating
- Prioritizes passive measures, but requires mechanical cooling when passive measures are not sufficient in reducing overheating during occupied hours
- Air-conditioned buildings must meet 1250 degree hour threshold with AC off
- There is no prescriptive pathway to meet the summer comfort requirements
- Prescriptive requirements on solar gain control and window opening sizes
- Access doors to cooled areas need to close automatically after people pass through
- Occupied hours are mainly in nighttime
- Recognizes occupant adaptive behaviour, different methods to modulate operable shading and window operation
- Different temperature threshold for awake (26°C) vs asleep (28°C)

Resources:

[Summer Comfort Regulations For New Buildings](#)

[Consolidated Texts | Energy And Environmental Regulations For Buildings Portal](#)

England

- Introduced in 2021, with discussion on updates
- Provides prescriptive and performance-based pathways
- Prioritizes passive measures (mechanical cooling is used when passive measures are not sufficient)
- Need to demonstrate passive means have been reasonably implemented before mechanical cooling is installed (this may change to encourage more AC usage)
- Certain zones are occupied all day
- Recognizes noise and security as constraints of window operation at night
- Occupants decide on window opening state before bedtime
- Thresholds and compliance criteria based on CIBSE TM59 with some modification

Resources:

[Code considerations on overheating - England](#)

[Overheating: Approved Document O](#)

[CIBSE - TM59 - 2017](#)

US (Connecticut)

- Different organizations are working on model code
- New model energy code for climate resilience in development for Connecticut
 - Mainly prescriptive based, but quite comprehensive
 - Requirements on backup critical systems (power – especially renewables, controls etc.) and energy storage; improved envelope; urban heat island mitigation; and emergency management procedures
 - Preliminary simulation-based impact analysis showed significant improvement for passive survivability of extreme cold event, but slightly worse results under extreme heat event

Resources:

[Overheating and Extreme Heat in the U.S.](#)

[Extreme Heat and Resilience](#)

Brazil

- No direct regulation on overheating
- Energy efficiency strategy has mainly been on regulating efficiencies of equipment
- New energy labeling would be rolled out for public, commercial, residential and low-income buildings
- Natural ventilation is the primary cooling strategy, historically low average residential electricity consumption (partly related to energy poverty)
- Occupants prefer naturally ventilated environments, air conditioning is usually used at night
- Consumer protection legislation has encouraged the adoption of building performance standards within the formal construction sector
- Adaptive indoor operative temperature limits are used for thermal performance analysis

Resources:

[Code Considerations On Overheating - Brasil](#)

Australia

- There is no specific overheating requirements for residential buildings, air conditioning is assumed to be present
 - Currently, energy efficiency is used as proxy for preventing overheating
- Energy code provides two pathways for compliance – elemental (prescriptive) and energy model (performance)
 - Performance based pathway more common for new standalone and attached housing
- Research is underway to develop ROMA (Residential Overheating Model Australia)
 - Review existing standards and building code
 - Identify gaps and limitations in current guidelines
 - Develop ROMA to be included in code
 - ET* has been used as overheating metric in research projects

Resources:

[Code Considerations On Overheating – Australia](#)

[Development Of A Comfort Rating Method For Australia's Nationwide House Energy Rating Scheme \(Nathers\) – Darwin Houses Case Study](#)

[Investigation Of The Occupant Thermal Behavioural Settings And Overheating In A Hot-dry Climate In Australia](#)

[Room-level Overheating Disparities And The Limits Of Passive-design Attribution In Humid Subtropical Australian Homes: A Year-long Field Study](#)

New Zealand

- Minimum temperatures in early childhood centers and retirement homes, but no requirements for overheating
- Future changes will include performance requirements for overheating, research is currently underway
 - Definition of heat wave → determine which weather file to use for assessment
 - TM 59 would be basis of modelling assumptions – but will be updated to reflect New Zealand's energy loads and profiles
 - SET* is considered to be used to define thresholds for heat stress and heat strain

Resources:

[Developing An Overheating Risk Assessment Methodology For New Zealand's Building Regulations](#)

Japan

- Wide variety of climate conditions, severely cold to hot humid
- Main focus of presentation is on energy efficiency
 - Natural ventilation analysis
 - Discharge coefficient differs depending on angle of wind flow
 - Cooling load analysis
 - Partial load of heat pumps
 - Oversizing is common practice, but right sizing can reduce cooling energy usage.

Resources:

[Japan - Evaluation Of Building Performance Against Overheating](#)

- Minimum environmental criteria introduced in 2025, currently applicable to only public buildings. Has explicit method for overheating assessment.
 - Design oriented requirements includes solar heat gain limits, natural ventilation, thermal mass, operative temperature limits in summer, requirements for climate adaptation (heat waves and future climates)
 - Thermal comfort requirements for mechanically cooled and naturally ventilated buildings
 - Requirements for free cooling during shoulder season (heat recovery bypass of ventilation system)
 - Requirements on solar reflectance of building surfaces to reduce impact of urban heat island effect
- Other building types are subjected to energy efficiency requirements which indirectly addresses overheating

Resources:

[Italian Policies Concerning Overheating](#)

**based on 2015 regulation that seems to have been repealed, not sure about the current state of overheating regulation*

- Simulation for small residential buildings can be exempt if it meets prescriptive requirements
 - Solar control (either glass with g value ≤ 0.4 or shading devices that can achieve equivalent results)
 - WWR less than or equal to 30% on south and west facing walls
 - Openable window need to be at least 5% of floor area
- Simulation based compliance
 - Simulation using TRY weather data
 - Need to have less than 150 deg hour of overheating (over 27°C between Jun 1 and Aug 31)

Resources:

[Minimum Requirements For Energy Performance](#)

[Summertime Overheating Prevention Requirements And Results In Estonia](#)

[Summer Thermal Comfort: Compliance Assessment And Overheating Prevention In New Apartment Buildings In Estonia](#)

Finland

- For small residential buildings(category 1), prescriptive requirement on window opening – need to at least 1/10 of room area of workspace, living and accommodation space.
- Other building types, dynamic simulation is needed to prove overheating deg hour is less than 150 deg hour
 - For category 2 buildings temperature threshold is 27 °C
 - For category 3 to 8 temperature threshold is 25 °C

Resources:

[1010/2017 Decree of the Ministry of the Environment on the Energy Performance of New Buildings](#)

[1009/2017 Decree of the Ministry of the Environment on the Indoor Climate and Ventilation of New buildings](#)

[Ympäristöministeriön asetus asuin-, majoitus- ja työtiloista](#)

Denmark

- For large/commercial buildings, dynamic simulation is needed. For homes, simplified calculation can be used
- Simplified method is based on R-C (resistance capacitance) model
- Critical room approach, but not much guidance on how to determine which room is critical (bedroom vs living room)

Resources:

[Termisk indeklima og installationer til varme- og køleanlæg \(§ 385 - § 392\)](#)

Evaluation of simplified models for checking compliance with building regulations: Prediction of thermal comfort in dwellings (Homics and Kirkedal, 2013)

[Anvisning 213: Bygningers energibehov](#)

Norway

- Code requirements are relatively simple
- Only requires one window or door to be open to the outside for ventilative cooling (there are requirements for ventilation but not part of requirements for thermal condition)
- Suggested operative temperature range, but no evaluation method mentioned in the section
 - Dependent on level of work (light work: 19 °C to 26 °C; medium work: 16 °C to 26 °C; heavy work: 10 °C to 16 °C)
 - Only expected to meet these thresholds when systems are working
 - When outdoor air is high (not sure how this is defined), it is accepted to have 50 hours of overheating in a year

Resources:

[Byggteknisk forskrift \(TEK17\) med veiledning](#)

Ireland

- Simple calculation is used to identify overheating risks, dynamic calculation needed when overheating risk is identified using simplified method
- Critical room approach

Resources:

[Technical Guidance Document L
- Conservation of Fuel and
Energy – Dwellings](#)

[Technical Guidance Document F
- Ventilation](#)

[DEAP Manual](#)

[CIBSE - TM59 - 2017](#)

Germany

- Simple method focuses on reducing solar gains (threshold dependent on various factors such as location, type of building etc.)
- Detailed method requires dynamic simulation of critical room to meet degree hour limit (1200 deg hour for residential buildings; 500 deg hour for non-residential buildings)

Resources:

[Sommerlicher Wärmeschutz](#)

[EVALUATION OF THE VALIDATION
METHODS OF SUMMER HEAT
PROTECTION CALCULATIONS IN
GERMANY](#)

[A Critical Review of Overheating Risk
Assessment Criteria in International and
National Regulations—Gaps and
Suggestions for Improvements](#)

[Review on Overheating Evaluation
Methods in National Building Codes in
Western Europe](#)

Netherlands

3 Different ways to meet code

- 1) Solar gain limits
 - At least 95% of glass surface must block solar radiation using shades/solar control glass
- 2) Simple calculation: Tojuli
 - Indicator of overheating risk, needs to be calculated for each orientation/zone
 - $TO_{juli} < 1.2$
- 3) Dynamic simulation
 - Weighted Overheating Hours < 450

Resources:

[Change in TOjuli Rules: Risk of Overheating | SOCOTEC Netherlands](#)

[A Critical Review of Overheating Risk Assessment Criteria in International and National Regulations—Gaps and Suggestions for Improvements](#)

[Review on Overheating Evaluation Methods in National Building Codes in Western Europe](#)