Adaptácia budov na zmenu klímy— predstavenie technického usmernenia na úrovni EÚ

Seminár: Zvyšovanie odolnosti budov na zmenu klímy

Zmeny klímy

- Dopady sú už tu...
- Dokonca aj v najlepšom prípade (+ 1,5 °C)...
- Riziká sa výrazne zvýšia...

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Prečo?

- Zmena klímy už postihuje ľudí... **a zastavané prostredie zohráva úlohu** pri ich ochrane.
- Dochádza kzmene klímy a **EÚ v tejto oblasti podniká kroky**: cieľom EÚ je stať sa do roku **2050** klimaticky neutrálnou a odolnou voči zmene klímy
- EÚ prijala **ambiciózny politický rámec,** ktorý si vyžaduje **odolnosť budov voči zmene klímy...**

...cieľom nášho projektu je poskytnúť niekoľko **usmernení o tom, ako to uskutočniť**.

- Európsky právny predpis v oblasti klímy
- Balík Fit for 55
- Vlna obnovy
- Stratégia EÚ pre adaptáciu na zmenu klímy
- Revízia s energetickej hospodárnosti budov a nariadenia o stavebných výrobkoch
- Taxonómia udržateľného financovania
- Rámec Level(s)
- Európske normalizačné organizácie zrevidovali stavebné normy pre budúcu klímu
- Digitálny lodný denník budov
- Nový európsky Bauhaus
- Európska zelená dohoda
- ZVO pre verejné budovy

V tejto súvislosti sa štúdia zameraná na vypracovanie **technických usmernení na úrovni EÚ týkajúcich sa prispôsobenia budov zmene klímy** zameriavala na:

zhromažďovať a syntetizovať existujúce metódy, špecifikácie, najlepšie postupy a usmernenia pre budovy odolné voči zmene klímy do správy, ktorá môže poskytnúť praktické rady.

Ako sa vypracovali technické usmernenia?

Technické usmernenie vypracovali spoločnosti Ramboll a CE Delft v kontexte štúdie, ktorá trvala jeden rok, od januára 2022 do januára 2023.

Prehľad literatúry
(700+ dokumentov)

→

Návrh technického usmernenia

→

Konzultácie so zainteresovanými stranami (podujatia, semináre, prieskum, rozhovory)

→

Záverečné technické usmernenia

Konzultačné činnosti so zainteresovanými stranami boli kľúčom k vypracovaniu technických usmernení

Konzultácie so zainteresovanými stranami (podujatia, semináre, prieskum, rozhovory)

- 2 podujatia zainteresovaných strán s cieľom predstaviť projekt a návrh technického usmernenia
- 2 odborné semináre s špecializovanou skupinou odborníkov zloženou zo zástupcov stavebného a stavebného ekosystému
- 1 online prieskum o návrhu technického usmernenia
- 6 následných rozhovorov s kľúčovými zainteresovanými stranami

Čo možno nájsť v technickom usmernení?

Politika a revízia štandardov

Prehľad o adaptácii a normalizácii v oblasti životného prostredia

Preskúmanie vnútroštátnych politík a predpisov EÚ a členských štátov týkajúcich sa adaptácie budov na zmenu klímy.

Odolnosť voči zmene klímy v štrukturálnom dizajne budov

Preskúmanie konštrukčného dizajnu budov podľa eurokódov a vnútroštátnych predpisov relevantných pre navrhovanie odolnosti budov na zmenu klímy.

Posúdenie rizika a revízia hodnotenia

Klimatická zraniteľnosť a metodika posudzovania rizík

Preskúmanie metodiky posudzovania zraniteľnosti klímy a rizík pre budovy a bloky budov z existujúcich metodík.

Prístup založený na hodnotení odolnosti voči zmene klímy

Preskúmanie ratingových prístupov pre odolnosť budov, preskúmanie kritérií, typu prístupu a odkazu na metodiku CVRA.

USMERNENIA TÝKAJÚCE SA NAJLEPŠÍCH POSTUPOV

Najlepšie postupy na zlepšenie odolnosti voči zmene klímy

Zhromaždenie najlepších postupov pri odolnosti proti zmene klímy pre budovy a integrované do miestneho životného prostredia. Prípadové štúdie najlepších postupov sa kategorizujú podľa klimatických rizík s podpornými usmerneniami poskytnutými v súvislosti s rôznymi procesmi alebo prioritami podľa klimatickej zóny, fázy projektu a aktéra stavebného sektora.

Stiahnuť technické usmernenia

Stiahnite si technické usmernenie a usmernenie o najlepších prístupoch z Úradu pre publikácie EÚ.

Viac o nich a odolnosti proti zmene klímy v budovách vo všeobecnosti nájdete na platforme Climate-ADAPT.

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Prehľad o adaptácii a normalizácii v oblasti životného prostredia

Obsah

- **Stratégie EÚ** pre adaptáciu na zmenu klímy a ich vzťah k budovám
- Identifikácia nástrojov vo **vnútroštátnych politikách**
- Prehľad **regulačných nástrojov a noriem EÚ**
- Zhrnutie **vplyvov, synergií a kompromisov** s inými cieľmi politiky EÚ

Prehľad politických nástrojov EÚ na adaptáciu na zmenu klímy

Všeobecné
Taxonómia EÚ, rámec Level(s), Digitálne denníky budov

Dizajnéri
- Taxonómia EÚ
- Level(s) Ciele 4, 5 a 2

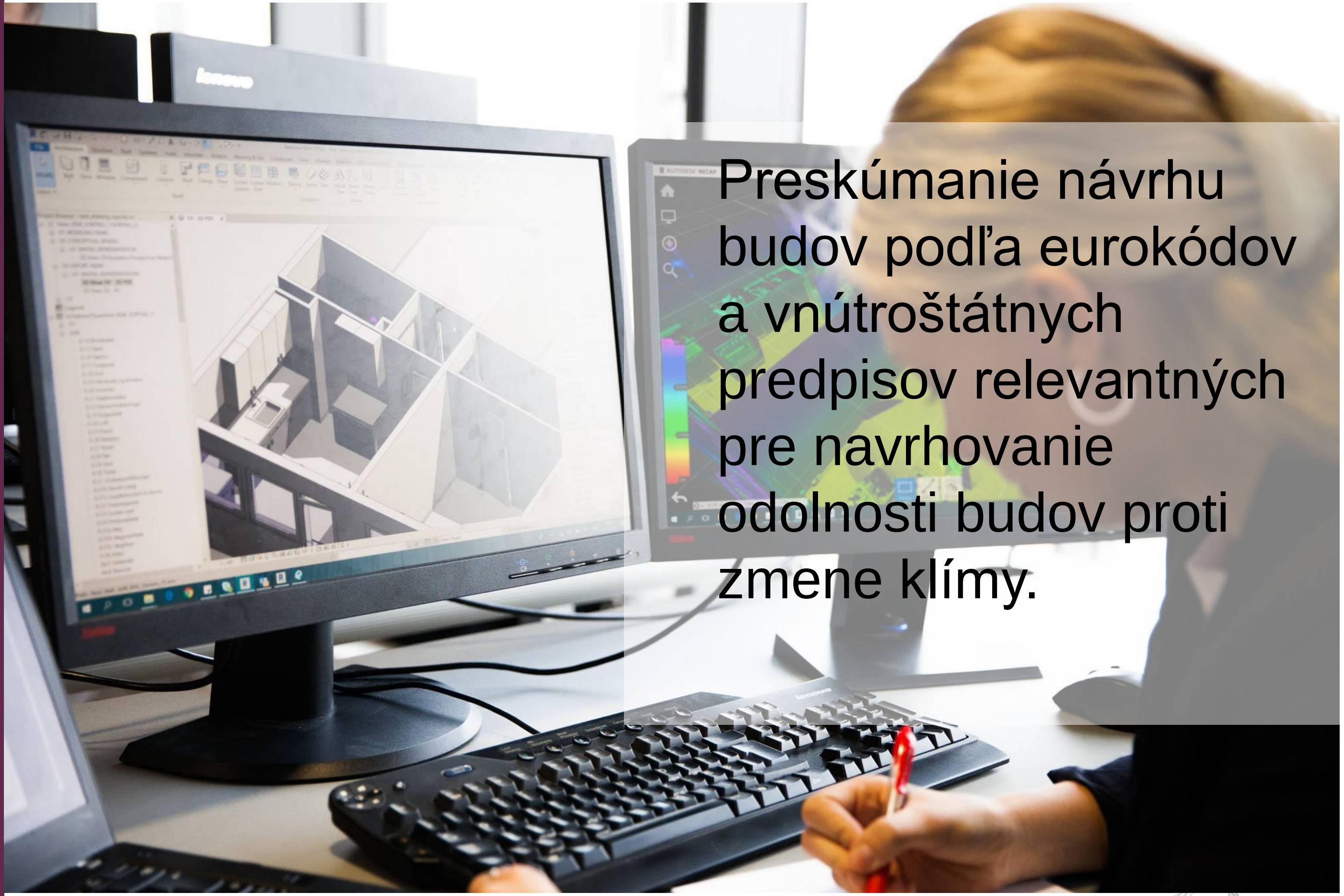
Investori, developeri, poisťovatelia
- Taxonómia EÚ
- Nariadenia o podávaní správ (NFRD, SFDR)*
- Úroveň (úrovne) Cieľ 6

Výrobcovia materiálu, dodávatelia
- Nariadenie o stavebných výrobkoch

Verejné orgány
- Kritériá zeleného verejného obstarávania
- Level(s), najmä cieľ 5

* SMERNICA O ZVEREJŇOVANÍ NEFINANČNÝCH INFORMÁCIÍ: Smernica o zverejňovaní nefinančných informácií
SFRD: Nariadenie o zverejňovaní informácií o udržateľnom financovaní

Odolnosť voči zmene klímy v štrukturálnom dizajne



Preskúmanie návrhu budov podľa eurokódov a vnútroštátnych predpisov relevantných pre navrhovanie odolnosti budov proti zmene klímy.

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Odolnosť voči zmene klímy v štrukturálnom dizajne

Obsah

- V správe sa sumarizuje súčasný stav **stavebných noriem na európskej a vnútroštátnej úrovni**.
- Primárna štruktúra sa posudzuje vo vzťahu k prioritným rizikám identifikovaným v rámci klasifikácie taxonómie EÚ.
- Diskutuje o prístupe **eurokódov** (súčasných aj budúcich)
- Predkladajú sa zistenia **týkajúce sa vnútroštátnych právnych predpisov**, ktoré zahŕňajú Európu a iné krajiny na celom svete.
- **Súčasné usmernenia sú zvyčajne založené na historických súboroch údajov** namiesto prediktívnych údajov a žiadne krajiny v plnej miere nezaviedli budúce klimatické riziká.

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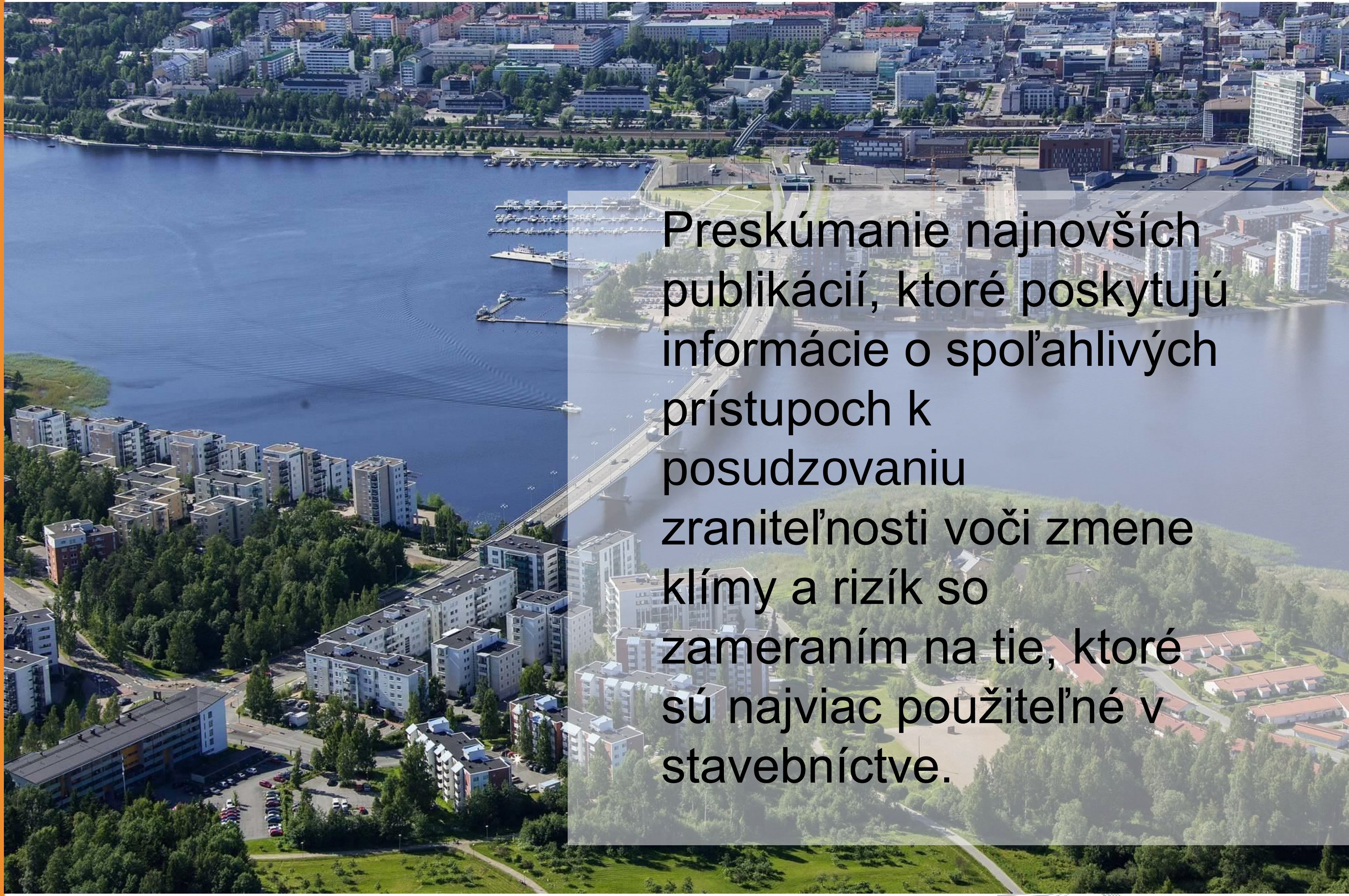
Zraniteľnosť a metodika posudzovania rizík



Preskúmanie najnovších publikácií, ktoré poskytujú informácie o spoľahlivých prístupoch k posudzovaniu zraniteľnosti voči zmene klímy a rizík so zameraním na tie, ktoré sú najviac použiteľné v stavebníctve.

European Commission

Klimatická zraniteľnosť a metodika posudzovania rizík

Obsah

- V správe sú zhrnuté **existujúce prístupy k CVRA**, ktoré sú potenciálne relevantné pre budovy.
- Identifikované **základné prvky** požadované a **úpravy** potrebné na dokončenie CVRA pre budovu
- Navrhnúť **praktický, fázový prístup**, ako sa uvádza ďalej.

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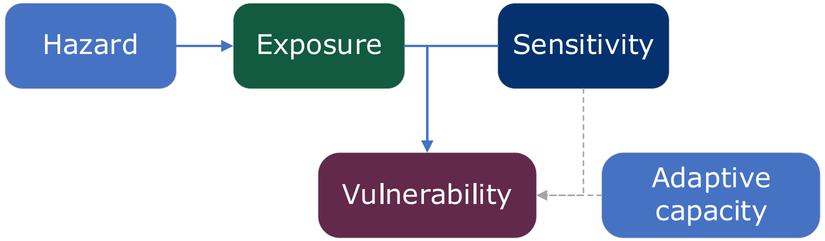
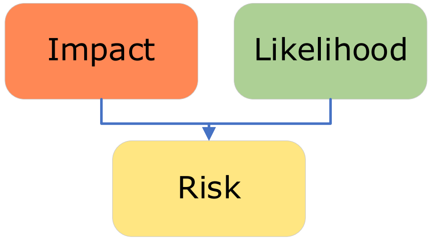


Fáza 2:



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Prístup založený na ratingu

Preskúmanie ratingových prístupov pre odolnosť budov proti zmene klímy, preskúmanie kritérií, typu prístupu a odkazu na metodiku CVRA.

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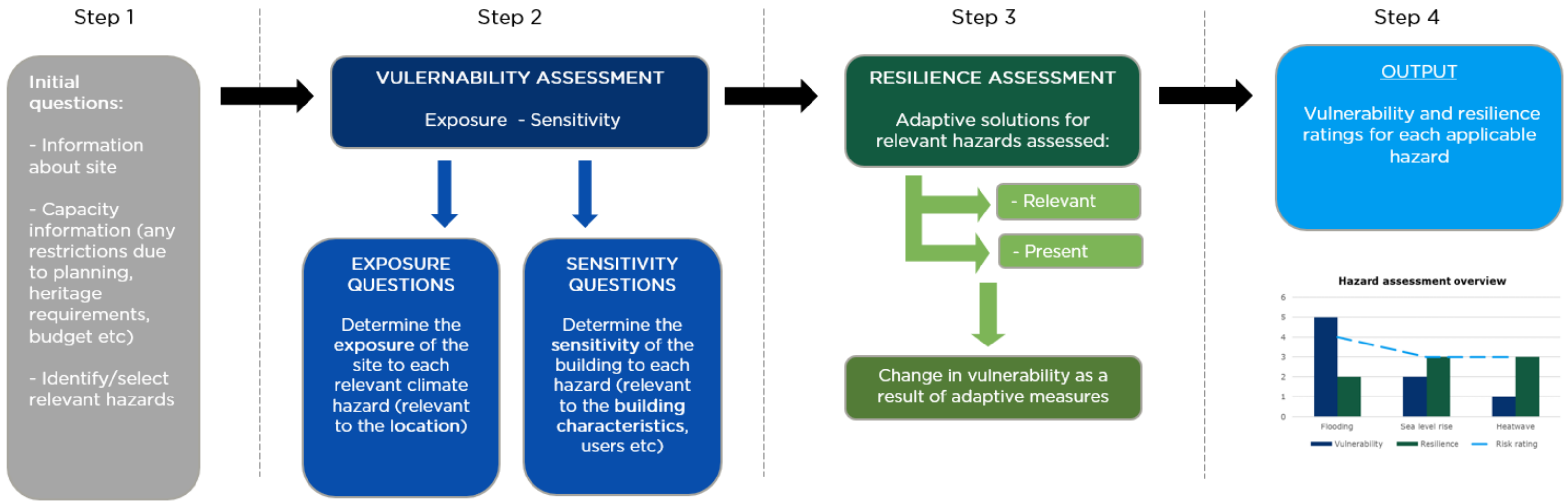
Prístup založený na ratingu

Obsah

- Zameranie na **dostupné prístupy a nástroje** na hodnotenie odolnosti budovy proti zmene klímy
- **Na** uspokojenie potrieb všetkých potenciálnych používateľov sú potrebné rôzne prístupy;
- **Načrtnúť prístup navrhnutý tak, aby drobným developerom/správcom aktív/majiteľom aktív poskytoval základný rating odolnosti voči zmene klímy**

Prehľad procesu



Najlepšie postupy na zlepšenie odolnosť voči zmene klímy

Zhromaždenie najlepších postupov usmernenia o odolnosti proti zmene klímy pre budovy a integrované do miestneho životného prostredia.

Najlepšie postupy na zlepšenie odolnosť voči zmene klímy

Obsah

V dokumente sa uvádzajú usmernenia týkajúce sa:

- Klimatických rizík, ktoré sú rozdelené na **prioritné riziká** a riziká podľa **klasifikácie taxonómie EÚ**
- **Klimatické zóny** Európy
- Rôzne **skupiny zainteresovaných strán/subjekty v oblasti budov**
- Vymedzené **fázy projektu**
- Zahŕňa **prípadové štúdie** najlepších postupov pre prioritné nebezpečenstvá.

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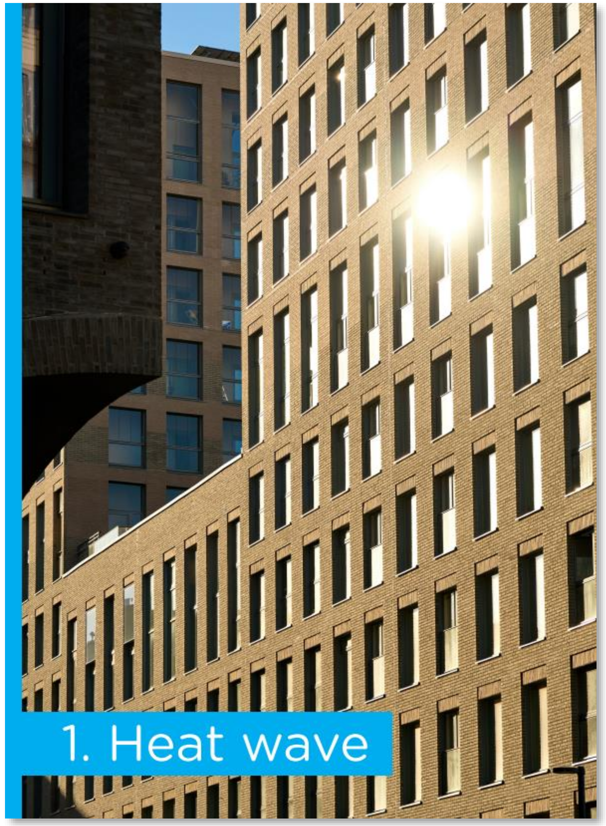
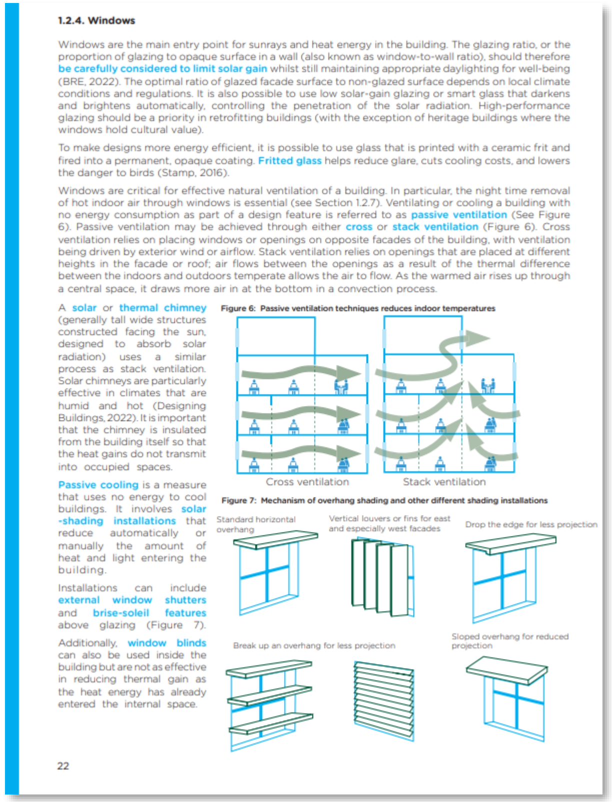
Vzorka





1.2.4. Windows

Windows are the main entry point for sunrays and heat energy in the building. The glazing ratio, or the proportion of glazing to opaque surface in a wall (also known as window-to-wall ratio), should therefore be carefully considered to limit solar gain whilst still maintaining appropriate daylighting for well-being (BRE, 2022). The optimal ratio of glazed facade surface to non-glazed surface depends on local climate conditions and regulations. It is also possible to use low solar-gain glazing or smart glass that darkens and brightens automatically, controlling the penetration of the solar radiation. High-performance glazing should be a priority in retrofitting buildings (with the exception of heritage buildings where the windows hold cultural value).

To make designs more energy efficient, it is possible to use glass that is printed with a ceramic frit and fired into a permanent, opaque coating. Fritted glass helps reduce glare, cuts cooling costs, and lowers the danger to birds (Stamp, 2016).

Windows are critical for effective natural ventilation of a building. In particular, the night time removal of hot indoor air through windows is essential (see Section 1.2.7). Ventilating or cooling a building with no energy consumption as part of a design feature is referred to as passive ventilation (See Figure 6). Passive ventilation may be achieved through either cross or stack ventilation (Figure 6). Cross ventilation relies on placing windows or openings on opposite facades of the building, with ventilation being driven by exterior wind or airflow. Stack ventilation relies on openings that are placed at different heights in the facade or roof; air flows between the openings as a result of the thermal difference between the indoors and outdoors temperate allows the air to flow. As the warmed air rises up through a central space, it draws more air in at the bottom in a convection process.

A solar or thermal chimney (generally tall wide structures constructed facing the sun, designed to absorb solar radiation) uses a similar process as stack ventilation. Solar chimneys are particularly effective in climates that are humid and hot (Designing Buildings, 2022). It is important that the chimney is insulated from the building itself so that the heat gains do not transmit into occupied spaces.

Passive cooling is a measure that uses no energy to cool buildings. It involves solar -shading installations that reduce automatically or manually the amount of heat and light entering the building.

Installations can include external window shutters and brise-soleil features above glazing (Figure 7).

Additionally, window blinds can also be used inside the building but are not as effective in reducing thermal gain as the heat energy has already entered the internal space.

Figure 6: Passive ventilation techniques reduces indoor temperatures

Cross ventilation | Stack ventilation

Figure 7: Mechanism of overhang shading and other different shading installations

Standard horizontal overhang | Vertical louvers or fins for east and especially west facades | Drop the edge for less projection | Break up an overhang for less projection | Sloped overhang for reduced projection

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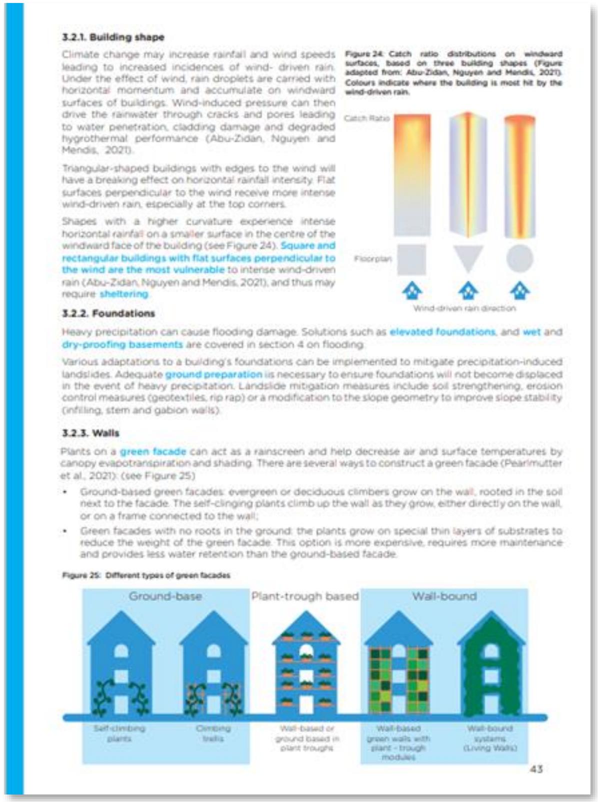

3.2.1. Building shape

Climate change may increase rainfall and wind speeds leading to increased incidences of wind- driven rain. Under the effect of wind, rain droplets are carried with horizontal momentum and accumulate on windward surfaces of buildings. Wind-induced pressure can then drive the rainwater through cracks and pores leading to water penetration, cladding damage and degraded hygrothermal performance (Abu-Zidan, Nguyen and Mendis, 2021).

Triangular-shaped buildings with edges to the wind will have a breaking effect on horizontal rainfall intensity. Flat surfaces perpendicular to the wind receive more intense wind-driven rain, especially at the top corners.

Shapes with a higher curvature experience intense horizontal rainfall on a smaller surface in the centre of the windward face of the building (see Figure 24). Square and rectangular buildings with flat surfaces perpendicular to the wind are the most vulnerable to intense wind-driven rain (Abu-Zidan, Nguyen and Mendis, 2021), and thus may require sheltering.

Figure 24: Catch ratio distributions on windward surfaces, based on three building shapes (Figure adapted from: Abu-Zidan, Nguyen and Mendis, 2021). Colours indicate where the building is most hit by the wind-driven rain.

Catch Ratio | Floorplan | Wind-driven rain direction

3.2.2. Foundations

Heavy precipitation can cause flooding damage. Solutions such as elevated foundations, and wet and dry-proofing basements are covered in section 4 on flooding.

Various adaptations to a building's foundations can be implemented to mitigate precipitation-induced landslides. Adequate ground preparation is necessary to ensure foundations will not become displaced in the event of heavy precipitation. Landslide mitigation measures include soil strengthening, erosion control measures (geotextiles, rip rap) or a modification to the slope geometry to improve slope stability (infilling, stem and gabion walls).

3.2.3. Walls

Plants on a green facade can act as a rainscreen and help decrease air and surface temperatures by canopy evapotranspiration and shading. There are several ways to construct a green facade (Pearlmutter et al., 2021): (see Figure 25)

- Ground-based green facades: evergreen or deciduous climbers grow on the wall, rooted in the soil next to the facade. The self-clinging plants climb up the wall as they grow, either directly on the wall, or on a frame connected to the wall;
- Green facades with no roots in the ground: the plants grow on special thin layers of substrates to reduce the weight of the green facade. This option is more expensive, requires more maintenance and provides less water retention than the ground-based facade.

Figure 25: Different types of green facades

Ground-base | Plant-trough based | Wall-bound

Self-climbing plants | Climbing trellis | Wall-based or ground based in plant troughs | Wall-based green walls with plant - trough modules | Wall-bound systems (Living Walls)

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Stručné referenčné zhrnutia

Budovanie adaptačných riešení pre každé prioritné riziko je uvedené podľa **nákladov** (nízke až vysoké) a **náročnosti vykonávania** (jednoduchá až komplexná)

Prehľad riešení sa poskytuje aktérom v odvetví zastavaného prostredia, od miestnych orgánov, investorov, developerov, inžinierov a architektov až po používateľov a vlastníkov budov. Pri **renovácii budov** sú zahrnuté aj kľúčové aspekty.

Building solutions, by priority hazard

Storms

Solution	Category	Cost	Ease of Implementation	Heat waves	Storms	Heavy Precipt.	Flooding	Subsidence	Drought	Commentary on co-benefits	Commentary on negative impacts
Changing the size and increasing the frequency of fastenings for roof tiles, slates, and ridges.	Roof	LOW	SIMPLE							• Prevents roofs from being wholly or partly uplifted from a building's structure during high winds. • Prevents roof damage due to heavy precipitation/load • Screws, rather than nails, and large washers are recommended.	• No negative climate adaptation impacts have been noted.
Effective roof drainage system	Roof	LOW	SIMPLE							• Prevents water pooling and leakage into building interior (and potential mould growth). • Prevents concentrated snow loads at the eaves.	• No negative climate adaptation impacts have been noted.
Hip-roof (with slopes of 30 degrees)	Roof	LOW	SIMPLE							• Hip-roofs with slopes of 30 ° have the best results in resisting strong winds and help shed snow most easily. • Gutters can easily be installed on hipped roofs. • This shape also improves ventilation.	• Sloped roof design limits opportunities for other adaptation solutions. Roof design may conflict with design aesthetic or cultural value of the building.
Hurricane straps and clips to fasten the roof to the walls	Roof	LOW	SIMPLE							• Under the roof, the linkage between the roof and the walls should be reinforced to prevent uplift.	• No negative climate adaptation impacts have been noted.
Lightning rods / air terminals	Roof	LOW	SIMPLE							• Lightning rods, or air terminals, can redirect electrical currents from lightning to the ground (reducing risk of fires and power surges).	• Lightning rods have a voltage limit and sometimes cannot divert all the energy
Physical non-continuity between the roof of the building and an extension (covered terrace, veranda, patio)	Roof	LOW	SIMPLE							• Prevents damage to the main roof if the extension is damaged or carried away by high winds.	• No negative climate adaptation impacts have been noted.
Short overhangs and protrusions	Roof	LOW	SIMPLE							• Long overhangs or any type of roof protrusion should be avoided to reduce wind loads.	• Reduces the extent of shading provided by the roof (and protection from overheating in high temperatures).
Favour hedges and shrubs over trees around the building	Vegetation	LOW	SIMPLE							• Vegetation can act as a windbreak offering some level of protection in the event of storms. • Trees should be placed at a safe distance from the building.	• Reduces the extent of shading provided by taller trees (and protection from overheating in high temperatures).
Surge protection device	Services	LOW	SIMPLE							• Can prevent power surges (caused by lightning) causing damage to electronic devices.	• No negative climate adaptation impacts have been noted.
Fix outdoor furniture and slabs to the ground	Space consideration	LOW	SIMPLE							• Prevents uplift and damage to furniture, slabs and terraces.	• Once anchored in place, outdoor furniture cannot be moved easily, reducing the flexible use of outdoor space around the building.
Sealant joint in windows	Windows	LOW	SIMPLE							• Careful design and sealing will prevent moisture and water from entering the building. Improves insulation of building and reduces likelihood of mould growth.	• No negative climate adaptation impacts have been noted.
Storm hooks to secure openings	Windows	LOW	SIMPLE							• Protects doors and windows from bending inwards in strong gusts of wind.	• Additional solutions are required to ensure protection from storms. Not the most effective as a standalone solution.
Impact resistant shingles	Roof & preferred material	LOW	MODERATE							• Minimises roof damage during severe weather events	• Shingles have a shorter design life than tiles. • Shingles may conflict with the aesthetic design and cultural value of the building.
Strong connections between exterior building elements (roof-walls, walls-foundations, foundations-ground)	Walls	LOW	MODERATE							• Improves structural strength of the building to resist wind forces.	• No negative climate adaptation impacts have been noted.
Favour aerodynamic shapes	Building shape	LOW	COMPLEX							• Reduces wind resistance on the building structure. • These shapes can also be earthquake resistant. • A round shape will also allow the inside to have constant natural light.	• Precise design and engineering required for curved walls and windows increases capital building costs significantly
Sub-roofing and sheathing to reinforce the roof	Roof	MEDIUM	SIMPLE							• Increases structural resilience of roof. • Sheathing also provides an additional barrier to prevent leaks.	• No negative climate adaptation impacts have been noted.

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Building users, facility managers and owners

Flooding	• Ensure electrical and building operation installations are elevated or raised out of areas that could be prone to flooding. • Establish emergency response plans. This could involve setting up a refuge zone to ensure the safety of buildings or emergency evacuation plans. Emergency supplies and bedrooms should be located above flood level. • Regular checks and the maintenance of gutters and pipes should ensure they are always clear and fixed securely. • Installation of temporary or permanent flood barriers can prevent damage in the case of (short duration) floods. • After a flooding event check that the adaptation solutions adopted are in good condition and continue to perform as expected. There will be a need to dry, clean and repair flood-affected buildings. **When renovating buildings:** • Consider installing water repellent or water-resistant materials or treatments to walls and insulation. • Dry or wet floodproofing may be implemented as part of a retrofit. • In traditional buildings, where flood-repellent materials or features may conflict with cultural heritage value, consider installing temporary flood barrier to entrances and openings. For further detailed information, refer to Section 4 and Section 4.5.4.
Subsidence	• Inspect buildings regularly throuhout their lifecycle for signs of subsidence. Notable signs include the appearance of cracks in a building's internal or external envelope. This is particularly important during and after a period of prolonged dry weather, or drought. • Regularly check the buildings plumbing, drainage, and stormwater systems to explore whether they have been affected by instances of subsidence. **When renovating buildings:** • If new services or alterations to the primary structure takes place during renovation, consideration should be paid to the effects this has on the foundations and stability of the building. For further detailed information, refer to Section 5 and Section 5.5.4.
Drought	• Install rainwater- harvesting solutions. • Install water-saving fixtures; also increase conservation and reuse to reduce household water consumption. All these measures are important for ensuring building users are prepared for periods of water scarcity. • Perform regular checks for leakages and pipe breaks to avoid water loss. • As droughts can lead to drought-induced subsidence, considerations described under subsidence may apply. **When renovating buildings:** • Assess the possibility of upgrading water systems so that water efficient systems and water-saving fixtures and fittings are part of retrofitting and renovating For further detailed information, refer to Section 6 and Section 6.5.4.

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Ďakujem