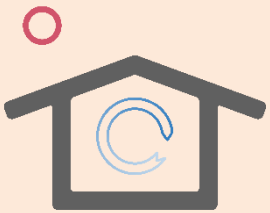
ENERGY EFFICIENT BUILDING DESIGN

High impact measures for hot climate zones

PEEB
PROGRAMME FOR ENERGY EFFICIENCY IN BUILDINGS

Hot arid climate (semi-arid)

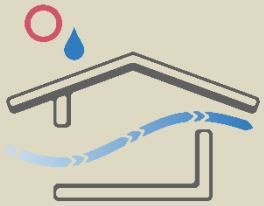
Cairo, Dakar, Doha, Dubai, Hermosillo, Kuwait, Lima, Marrakech, Monterrey, Riyadh



Massive or highly insulated building, airtight, blocking heat, with natural ventilation at night and mechanical cooling.

Tropical wet and dry climate (savannah)

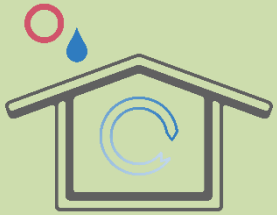
Abuja, Bangkok, Brasília, Cancún, Dhaka, Ho Chi Minh City, Mumbai, Rio de Janeiro



Light or mid-weight building, with natural ventilation all year around.

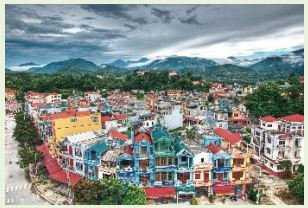
Tropical wet climate (rainforest)

Jakarta, Kampala, Kuala Lumpur, Recife, Singapore



Massive or highly insulated building, airtight, with natural ventilation and mechanical cooling during hot periods.

Humid subtropical climate

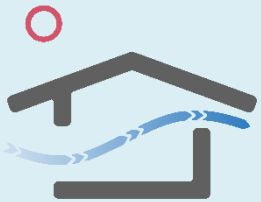


Delhi, Durban, Guangzhou, Hanoi, São Paulo, Porto Alegre, Shanghai, Sydney, Tokyo

Light or medium-weight building, well insulated, with natural ventilation in summer and comfortable in short cool winters.

Mediterranean climate

Algiers, Beirut, Casablanca, Rabat, Tel Aviv, Tashkent, Tunis



Massive building, blocking heat during the day and naturally cooling down at night.

HOT ARID CLIMATE

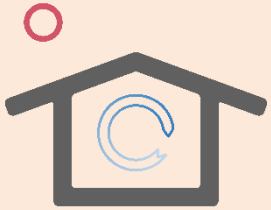
High impact measures for hot climate zones

PEEB PROGRAMME FOR ENERGY EFFICIENCY IN BUILDINGS

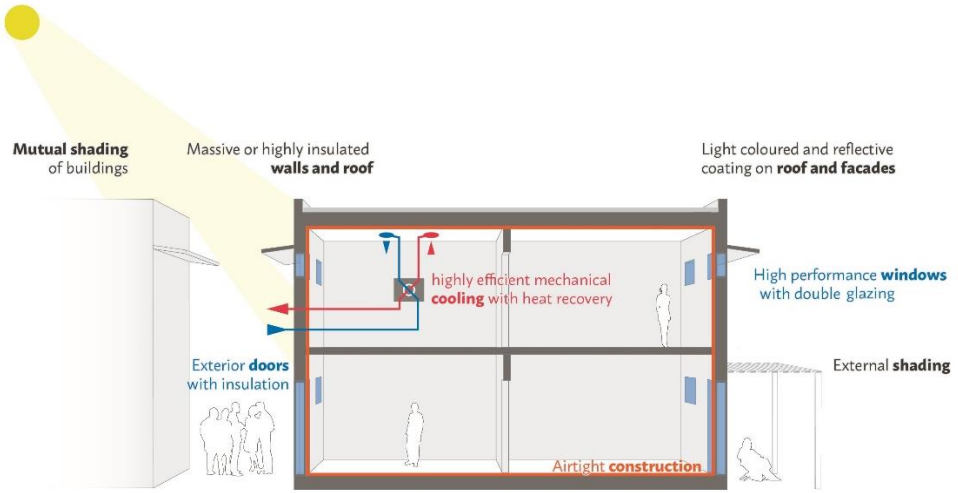
Hot arid climate (semi-arid)

Very hot daytime temperatures and, depending on the altitude and latitude, huge temperature differences between day and night.

Building Design



Massive or highly insulated building, airtight, to hold temperature longer and to create a natural barrier between interior and exterior temperatures.



Building design and high impact measures

Orientation:

- Buildings are **oriented from east to west** along the sun path, exposing only small façades to the sun.

Shape:

- Buildings are **compact and close to each other** to expose few façades to the sun and to **provide shade**.

Openings:

- **Openings** (doors, windows, vents) **face north or south** to reduce solar radiation.

Highly efficient building envelope without thermal bridges, superior windows, mechanical ventilation with heat recovery, highly efficient thermal insulation and airtight construction.

Walls

- **Walls are thick** and made of massive construction materials or of composite materials with high thermal insulation.
- **Bright and reflective coating** on all exterior façades to reflect high solar radiation.
- Exterior **doors with thermal insulation** and airtight seals.

Roofs

- **Thick roofs** made of massive construction materials or of composite materials with high thermal insulation.
- **Bright and reflective coating** to reflect solar radiation.
- **Roof overhangs** to shade building façades and windows.

Windows

- High performance and **airtight windows**.
- **Double glazing** and low emissivity glass.
- Window frames with **thermal insulation and airtight seals**.
- Exterior **movable shading** on windows blocking solar radiation in summer.

Natural ventilation

- Should be used at night during the dry season to reduce cooling needs during the day

Mechanical cooling

- **Highly efficient mechanical cooling system** or devices for active cooling.
- Ventilation with heat recovery.
- If possible, installation of **photovoltaic system** on roofs or façades to generate electricity for mechanical cooling.
- Cooling systems **without harmful refrigerants**, such as CFCs and HCFCs.

TROPICAL WET AND DRY CLIMATE

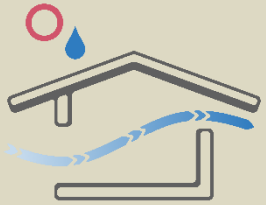
High impact measures for hot climate zones

PEEB PROGRAMME FOR ENERGY EFFICIENCY IN BUILDINGS

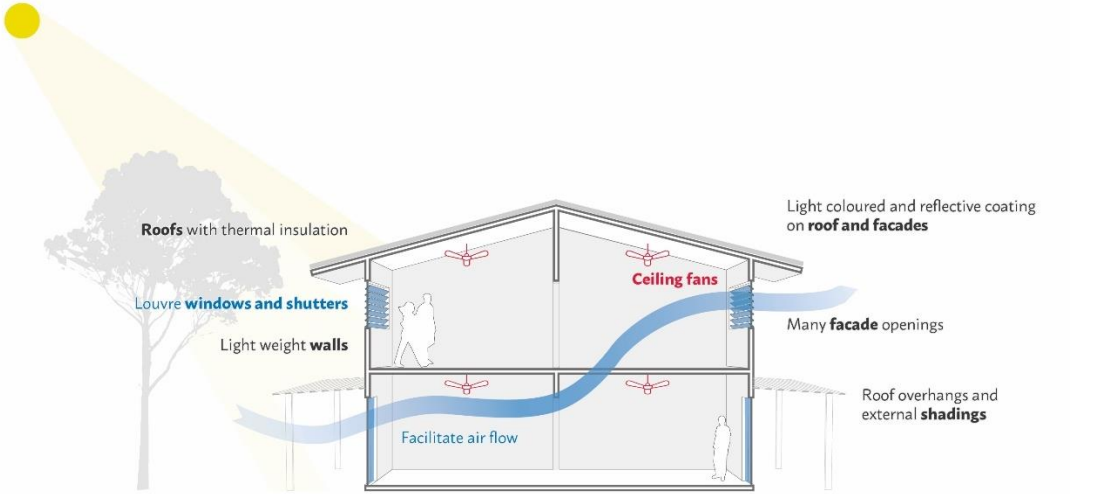
Tropical wet and dry climate (savannah)

Warm with less rainfall than tropical wet climate or with more pronounced dry season.

Building Design



Light or mid-weight building with openings for natural ventilation, improving thermal comfort and avoiding the need for mechanical cooling.



Building design and high impact measures

Orientation:

- Buildings are **oriented from east to west** along the sun path, exposing only small façades to the sun.

Shape:

- Greater **distances between buildings** and a more spacious arrangement for **good air circulation**.

Openings:

- **Openings** (doors, windows, vents) **face north or south** to reduce solar radiation.

Open building envelope with well insulated roof, many façade openings for natural ventilation. Building is compact and has an open layout and often an adjacent or inner courtyard combining open and closed spaces.

Walls

- **Walls are light or mid-weight** with plenty of openings and vents for ventilation.
- **Bright and reflective coating** on all exterior façades to reflect high solar radiation.

Roofs

- **Roofs have high thermal insulation**.
- **Bright and reflective coating** to reflect solar radiation.
- **Roof overhangs** to shade building façades and windows.

Windows

- **Louvre windows** or shutter windows for **continuous air flow**.
- **Exterior shading** on windows blocking solar radiation.
- **Minimise glazing** area to east and west façades.

Natural ventilation

- Open building design ensures **constant** natural ventilation.
- This design is usually applied in regions with frequent **local air currents** making high temperatures and humidity bearable.

Mechanical cooling

- **Ceiling fans** can be used to increase comfort during temperature peaks.

TROPICAL WET CLIMATE

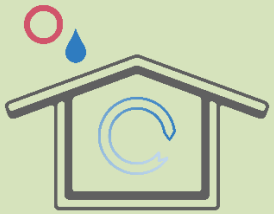
High impact measures for hot climate zones

PEEB PROGRAMME FOR ENERGY EFFICIENCY IN BUILDINGS

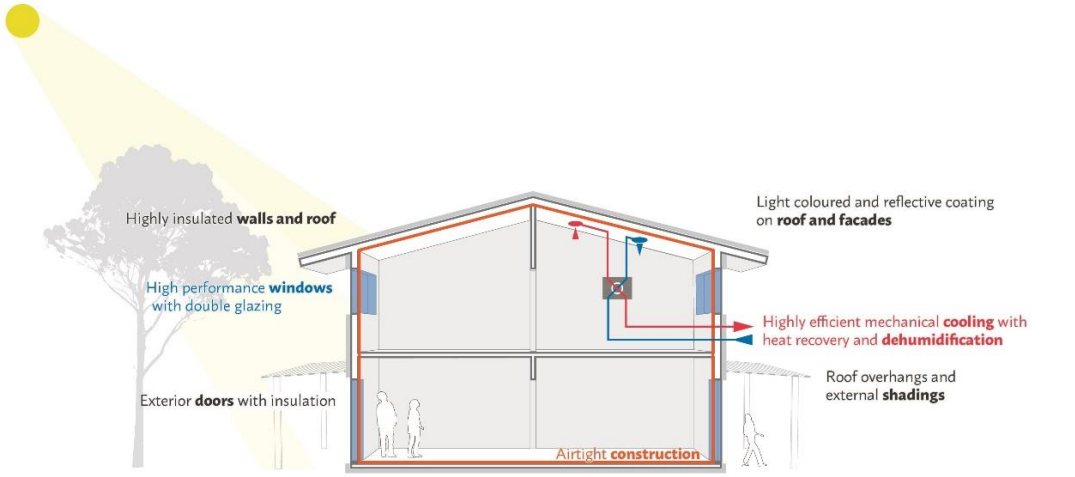
Tropical wet climate (rainforest)

Constant hot temperature throughout the year, calm winds, short dry season and wet season with frequent and heavy rainfall.

Building Design



Massive or highly insulated building, airtight to mechanically cool the interior in the most efficient way.



Building design and high impact measures

Orientation:

- Buildings are **oriented from east to west** along the sun path, exposing only small façades to the sun.

Shape:

- Greater **distances between buildings** for **good air circulation**. For a closed building design, buildings are compact to reduce external façade surfaces.

Openings:

- **Openings** (doors, windows, vents) **face north or south** to reduce solar radiation.

Highly efficient building envelope without thermal bridges, superior windows, mechanical ventilation with heat and energy recovery, highly efficient thermal insulation and airtight construction.

Walls

- **Thick walls** made of massive construction materials or of composite materials with high thermal insulation.
- **Bright and reflective coating** on all exterior façades to reflect high solar radiation.
- Exterior **doors** with **thermal insulation** and **airtight seals**.

Roofs

- **Thick roofs** made of massive or composite materials with high thermal insulation.
- **Bright and reflective coating** to reflect solar radiation.
- **Roof overhangs** to shade façades and windows.
- **Separate ceiling**, forming a ventilated attic space.

Windows

- **High performance** and **airtight windows**.
- **Double glazing** and low emissivity glass.
- Window frames with **thermal insulation and airtight seals**.
- **Exterior shading** on windows blocking solar radiation.

Natural or mechanical ventilation

- **Fans** help reducing cooling needs by improving thermal comfort.

Mechanical cooling

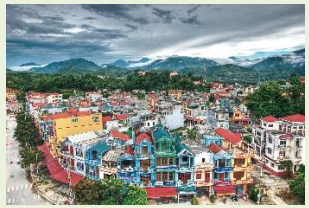
- **Highly efficient mechanical cooling system** or devices for active cooling with dehumidification.
- Ventilation with **heat recovery**.
- If possible, installation of **photovoltaic system** on roofs or façades to generate electricity for mechanical cooling.
- Cooling systems **without harmful refrigerants** such as CFCs and HCFCs.

HUMID SUBTROPICAL CLIMATE

High impact measures for hot climate zones

PEEB PROGRAMME FOR ENERGY EFFICIENCY IN BUILDINGS

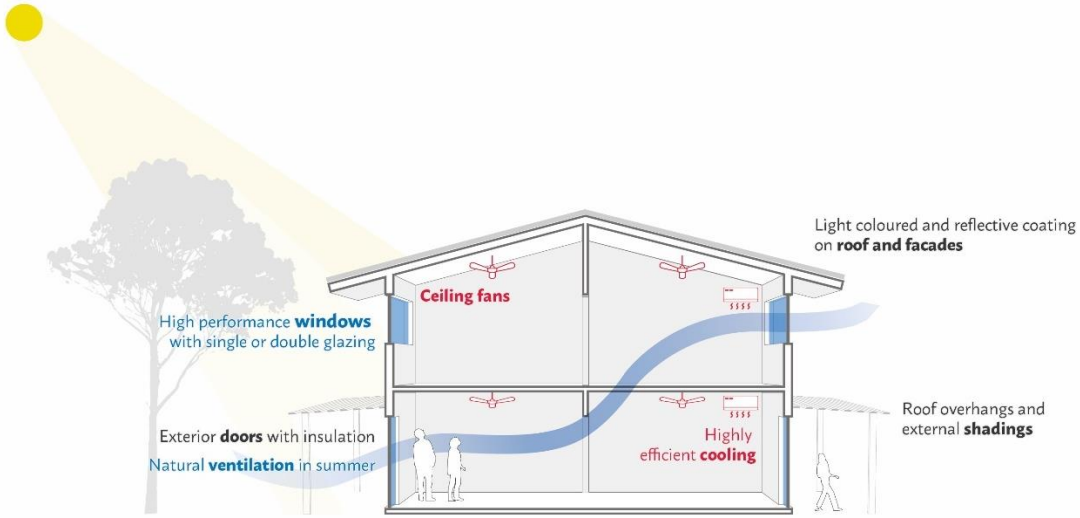
Humid subtropical climate



Long hot and humid summers, and short but cool to mild winters.

Building Design

Light or medium-weight building with openings for natural ventilation in summer, and well insulated to keep interior temperatures during short but cool winters.



Building design and high impact measures

Orientation:

- Buildings are **oriented from east to west** along the sun path, exposing only small façades to the sun.

Shape:

- Greater **distances between buildings** and a more spacious arrangement for **good air circulation**.

Openings:

- **Openings** (doors, windows, vents) **face north or south** to reduce solar radiation.

Efficient building envelope with well insulated roof, walls with thermal qualities or thermal insulation and high-quality windows for natural ventilation in summer. Building has an open layout, is little, compact and often with an adjacent or inner courtyard, combining open and closed spaces.

Walls

- **Light or mid-weight walls** with thermal insulation.
- **Bright and reflective coating** on all exterior façades to reflect high solar radiation.

Roofs

- **Roofs have high thermal insulation**.
- **Bright and reflective coating** to reflect solar radiation.
- **Roof overhangs** to shade building façades and windows.

Windows

- **High-quality windows** with single or double glazing and low emissivity glass.
- **Exterior moveable shading** on windows blocking solar radiation in summer.

Natural ventilation and mechanical heating

- **Summer:** Open building envelope for **natural ventilation**; mechanical ventilation can be an additional option during temperature peaks.
- **Winter:** Closed building and **mechanical** or **passive solar heating**.

Mechanical cooling

- **Ceiling fans** can be an option to increase comfort during temperature peaks.

MEDITERRANEAN CLIMATE

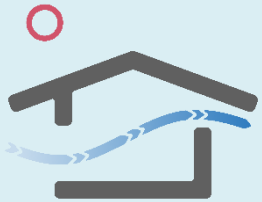
High impact measures for hot climate zones

PEEB PROGRAMME FOR ENERGY EFFICIENCY IN BUILDINGS

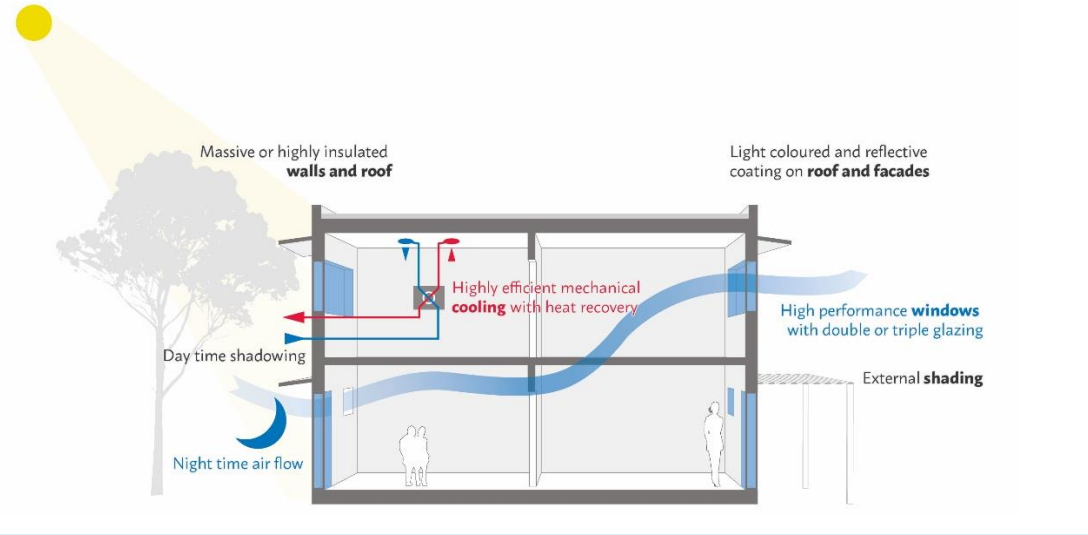
Mediterranean climate

Hot daytime temperatures and, depending on the altitude and latitude, huge temperature differences between day and night.

Building Design



Massive or highly insulated building to block the heat during the day and slowly release it during the night, thus compensating high temperature variations.



Building design and high impact measures

Orientation:

- Buildings are **oriented from east to west** along the sun path, exposing only small façades to the sun.

Shape:

- Buildings are **compact and close to each other** to expose few façades to the sun and to **provide shade**.

Openings:

- **Openings** (doors, windows, vents) **face north or south** to reduce solar radiation.

Highly efficient building envelope without thermal bridges, superior windows, highly efficient thermal insulation and airtight construction.

Walls

- **Thick walls** made of massive construction materials or of composite materials with high thermal insulation.
- **Bright and reflective coating** on all exterior façades to reflect high solar radiation.
- **Exterior doors with thermal insulation** and airtight seals.

Roofs

- **Thick roofs** made of massive or composite materials with high thermal insulation.
- **Bright and reflective coating** to reflect solar radiation.
- **Roof overhangs** to shade building façades and windows.

Windows

- **High performance** and **airtight windows**.
- Double glazing and low emissivity glass.
- Window frames with **thermal insulation and airtight seals**.
- **Exterior shading** on windows blocking solar radiation.

Natural ventilation

- Building envelope (windows, shading) **closed during at day** to block heat.
- Windows **open during the night** to cool building down naturally.

Mechanical cooling

- **Mechanical ventilation** can be an additional option only during hot summer months.
- If so, **highly efficient** mechanical cooling system or devices for active cooling.