

PART 10 – Indoor Environmental Quality (EQ)



Introduction

This credit category is about the strategies related to indoor air quality and thermal, visual, and acoustic comfort. A good standard of indoor environmental quality is essential in green buildings to protect health and increasing occupants' comfort level and productivity.

The EQ credit category will be discussed under two major sections:

- Indoor air quality
- Increased occupant comfort

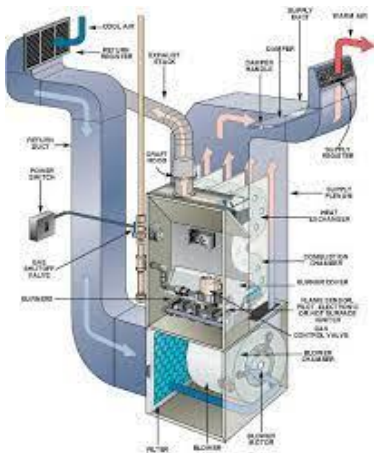
Studies show that poor indoor air quality can result in respiratory disease, allergies, asthma, and sick building syndrome (SBS) or other building-related illnesses (BRI).



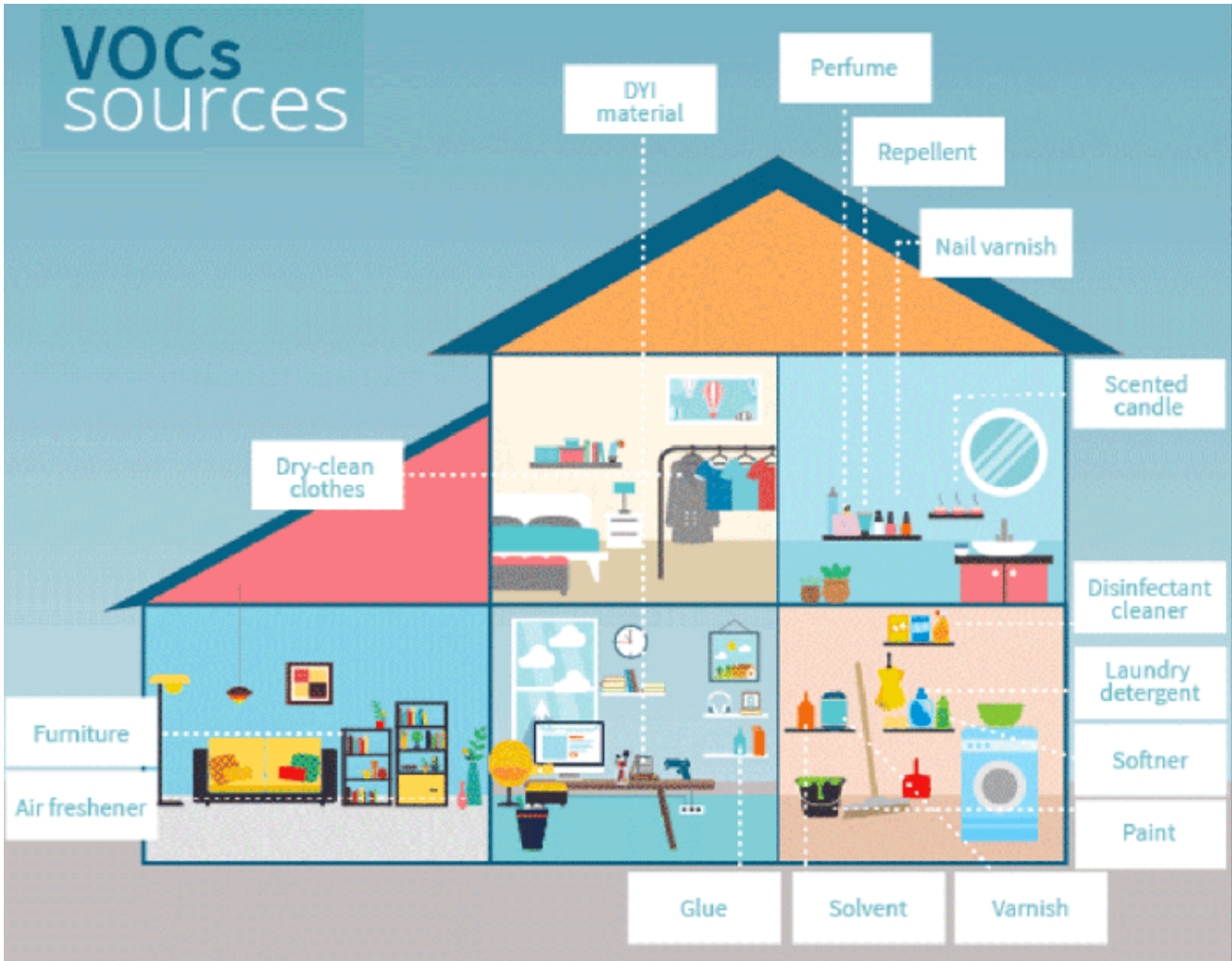
Indoor air quality

In order to increase the indoor air quality of a building, first, the sources of contaminants should be identified, and necessary measures should be taken to prevent them from reaching the indoors, which is also called **source control**.

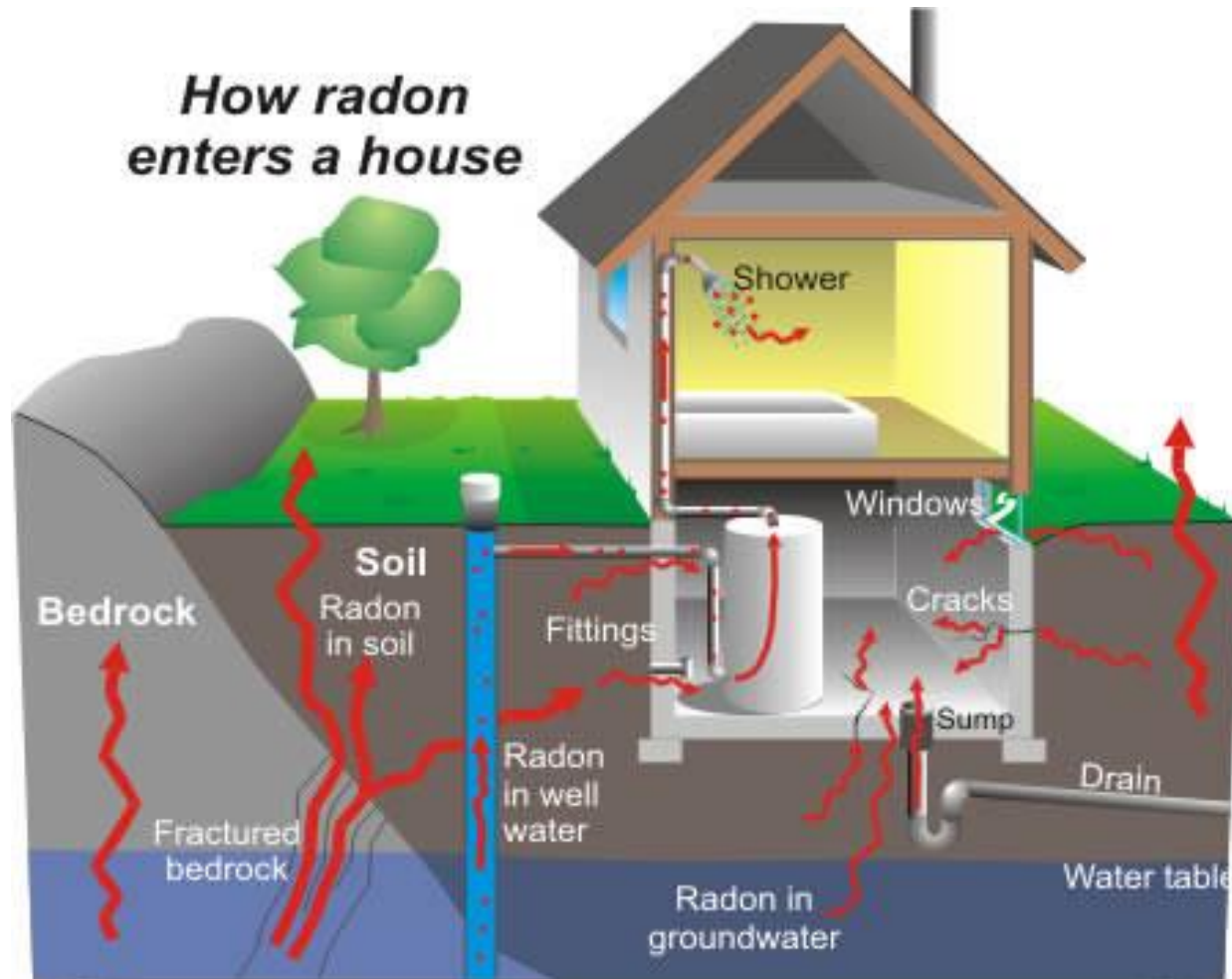
Below are some of the contaminants that will negatively affect the indoor air quality of a building.



Indoor air quality



Indoor air quality



Indoor air quality

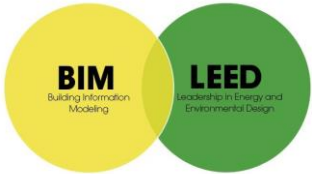
Set minimum air quality standards

All LEED projects must comply with certain aspects of the ASHRAE 62.1 standard (which is a ventilation standard used to achieve acceptable indoor air quality).

After the minimum air quality standards have been set, monitoring the indoor air quality is essential since, in some cases, providing enough fresh air to the building may not be enough.

Compound		Concentration Limit	
Carbon Dioxide	CO ₂	3500	Ppm
Carbon Monoxide	CO	11	ppm (8 h)
		25	ppm (1 h)
Nitrogen Dioxide	NO ₂	0.05	Ppm
		0.25	ppm (1 h)
Particulate		40	µg/m ³ (8 h)
		100	µg/m ³ (1 h)
Sulphur Dioxide	SO ₂	0.019	Ppm
VOC ^a		1 - 5	mg/m ³
Acrolein	C ₃ H ₄ O	0.02	Ppm
Acetaldehyde	C ₂ H ₄ O	5.0	Ppm
Formaldehyde	CH ₂ O	0.1	Ppm

^a: Limits for VOCs are usually presented per individual compound. The presented value for VOCs concentration limit is a suggested target from Health Canada (Health Canada, 2007) while limits for C₃H₄O, C₂H₄O, and CH₂O are from ASHRAE (2009).



Indoor air quality

Stop secondhand smoke

Exposure to secondhand smoke can cause lung cancer in nonsmokers and increase the risk of heart disease.

LEED prohibits smoking indoors and does not allow smoking within 8 meters of the building entrance. For residential projects, LEED requires partitioning of the rooms and prohibits smoking in the common spaces. Additionally, it requires a blower door test to ensure that air cannot leak from smoking units to others.

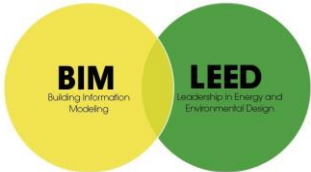


Indoor air quality
Use low-emitting materials

Material off-gassing can seriously affect indoor air quality and human health. The amount of **volatile organic compounds (VOCs)**, such as **formaldehyde**, contained in construction materials will affect the health of both construction workers and the building occupants.

Many buildings materials, such as adhesives, sealants, composite wood, paints, coatings, floorings, furniture, wall coverings, and other products such as photocopy machines can contain harmful levels of VOCs.

Architectural Applications	VOC Limit (g/L less water)	Specialty Applications	VOC Limit (g/L less water)
Indoor carpet adhesives	50	PVC welding	510
Carpet pad adhesives	50	CPVC welding	490
Wood flooring adhesives	100	ABS welding	325
Rubber floor adhesives	60	Plastic cement welding	250
Subfloor adhesives	50	Adhesive primer for plastic	550
Ceramic tile adhesives	65	Contact adhesive	80
VCT and asphalt adhesives	50	Special purpose contact adhesive	250
Drywall and panel adhesives	50	Structural wood member adhesive	140
Cove base adhesives	50	Sheet applied rubber lining operations	850
Multipurpose construction adhesives	70	Top and trim adhesive	250
Structural glazing adhesives	100		



Indoor air quality

Protect the site during construction

The project team should develop and implement an indoor air quality (IAQ) plan in order to protect the health of both the construction workers and the building occupants.

While developing the IAQ plan, the project team can refer to the **Sheet Metal and Air Conditioning National Contractors Association (SMACNA)** guidelines, which describe the necessary control measures to be taken during the construction phase to maintain sufficient indoor air quality.

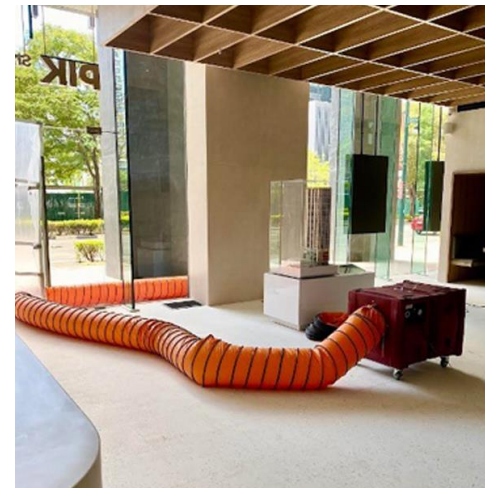


Indoor air quality

Schedule construction activities to minimize occupant exposure

After the completion of construction, the project team should make sure that any contaminants and dust are cleared before the building occupants arrive. To ensure sufficient air quality after the completion of construction, an **air quality test** can be conducted.

Or the project team can choose to conduct a **flush-out**, which is a process of supplying ample amounts of fresh air to the building before or during occupancy; this process will take place away the contaminated air and establish the desired level of indoor air quality.

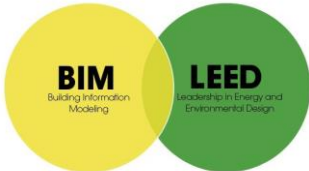


Indoor air quality
Increase ventilation rate

Fresh air is by far the most important element of indoor air quality. This can be established by increasing the ventilation rates of the HVAC system. Otherwise, if the climate in the project location is appropriate, **natural ventilation** can be established by the opening of windows and doors, which would also reduce the building operation costs.

In an appropriate climate, projects can use **mixed-mode ventilation**, which employs both HVAC and natural ventilation.

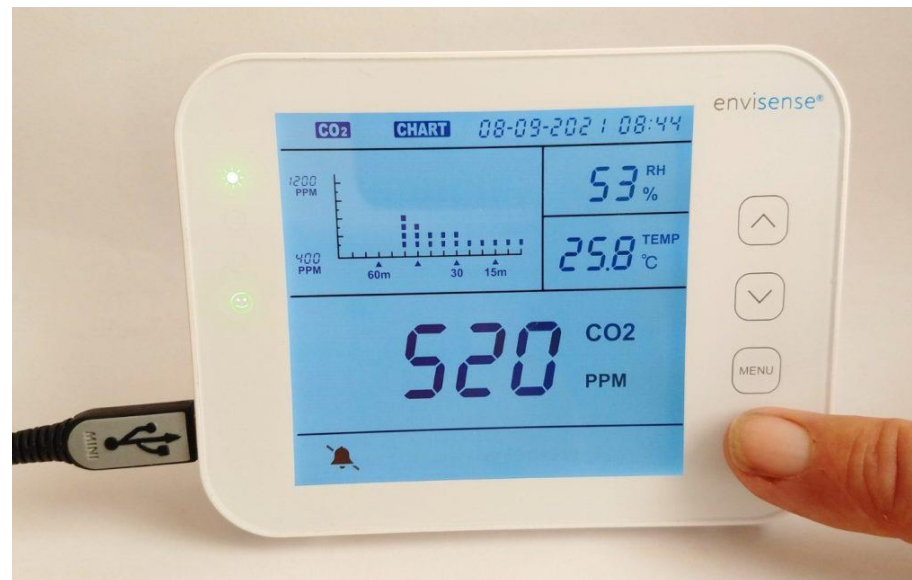
Occupancy Category		People Outdoor Air Rate m ³ /h Person	Area Outdoor Air Rate m ³ /h m ²	Default Values	
				Occupant Density	Combined Outdoor Air Rate
				#/100 m ²	m ³ /h Person
Office Building	Break rooms	2.5	0.6	50	3.5
	Office space	2.5	0.3	5	8.5
	Reception areas	2.5	0.3	30	3.5
	Main lobbies	2.5	0.3	10	5.5



Indoor air quality

Monitor carbon dioxide (CO₂)

By installing carbon dioxide monitoring equipment, the thresholds for CO₂ levels can be determined, and once CO₂ levels increase above the threshold, necessary actions can be taken to increase the amount of fresh air inside the building.



Indoor air quality

Implement green cleaning practices

Using green cleaning products will have a lower detrimental impact than regular cleaning product. **A green cleaning program** can be developed.

For the cleanliness of the building, custodial effectiveness assessments should also be conducted to obtain the occupants' opinion of the green cleaning program and to see whether they are ever exposed to contaminants.



Green Cleaning

Mold & Mildew

To rid your home of pesky mold and mildew, use solely vinegar when cleaning. The vinegar will remove any mold and mildew and sterilize the surface. Your home will be safe and naturally clean.

Toilet

All you need to clean your toilet is baking soda and vinegar. Sprinkle baking soda around the inside of your toilet, away from the water and scrub away! Use the vinegar to clean the outside surfaces of your toilet.

Counters and tile flooring

Simply use vinegar, baking soda and water! The baking soda acts as little scrubbers and the vinegar will disinfect your counters and tile flooring. Add a splash of lemon juice for a refreshing and natural after smell.

Naturally clean air

Instead of using store bough air fresheners, try burning cloves or other herbs for a more natural fresh scent. Create your own fresh scent by cutting up fruit and mixing it with spices, herbs and water and allow it to boil. Once boiling point is reached allow the mixture to simmer and enjoy the fresh scent in your home.

Carpets

Carpets can get a little musty smelling. Baking soda will treat these odors and leave your carpet smelling fresh. Lightly sprinkle the baking soda and sweep it around. Let it sit for a while and then vacuum it up!

Wood

Using lemon juice and olive oil you can clean your wood furniture. With a small amount on a rag, wiping in long clean strokes you'll clean your furniture and have a nice smell in your home.

 **Gillece Services**
Plumbing | Heating | Cooling | Electrical



Indoor air quality

Periodically maintain and replace air filters

Without quality air filtration media, no building can establish good indoor air quality. The **minimum efficiency reporting value (MERV)** rates the air filters according to their success in removing particles from the air.

Air filters with higher MERV values will remove more particles from the air, but more energy will be consumed in passing the air through them. To avoid clogged filters, frequent maintenance and replacement of air filters is necessary.

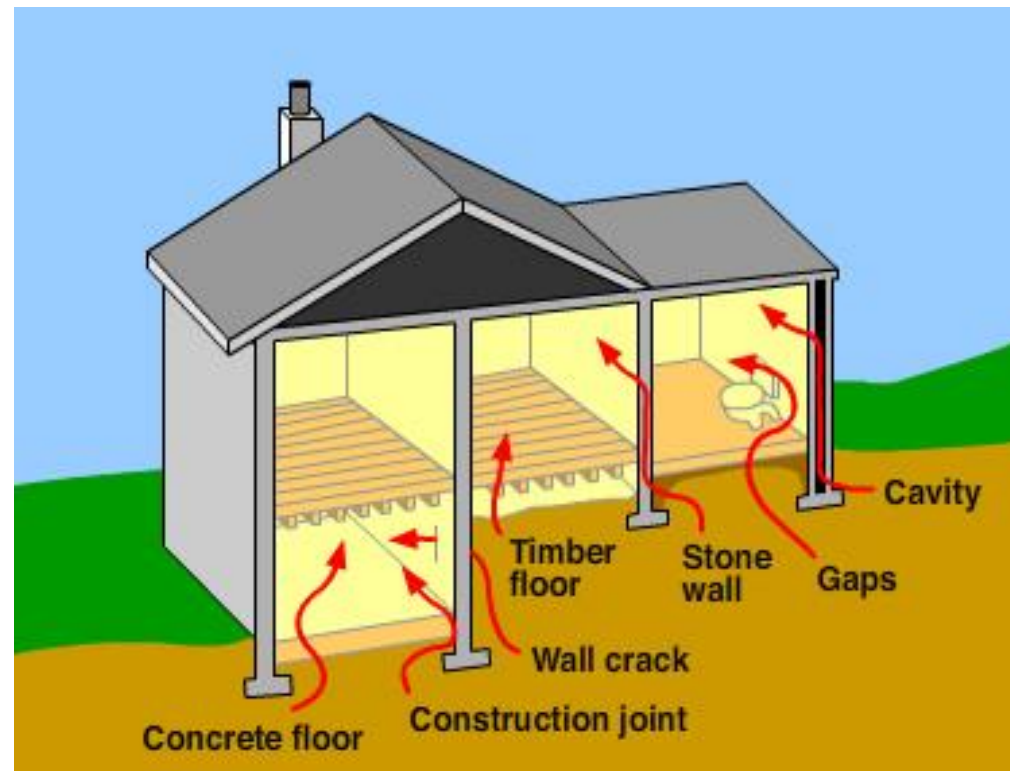


Indoor air quality

Reduce radon levels

Radon is a radioactive gas that is naturally found in soils, rocks, and water bodies. The presence of radon inside a building can create serious health effects such as lung cancer.

LEED implements strategies to reduce radon infiltration into a residence.



Increase occupant comfort

Building occupants need to feel comfortable and in control of their environment in order to be healthy, happy, and productive in their buildings. There are several factors that will affect the comfort of an occupant.

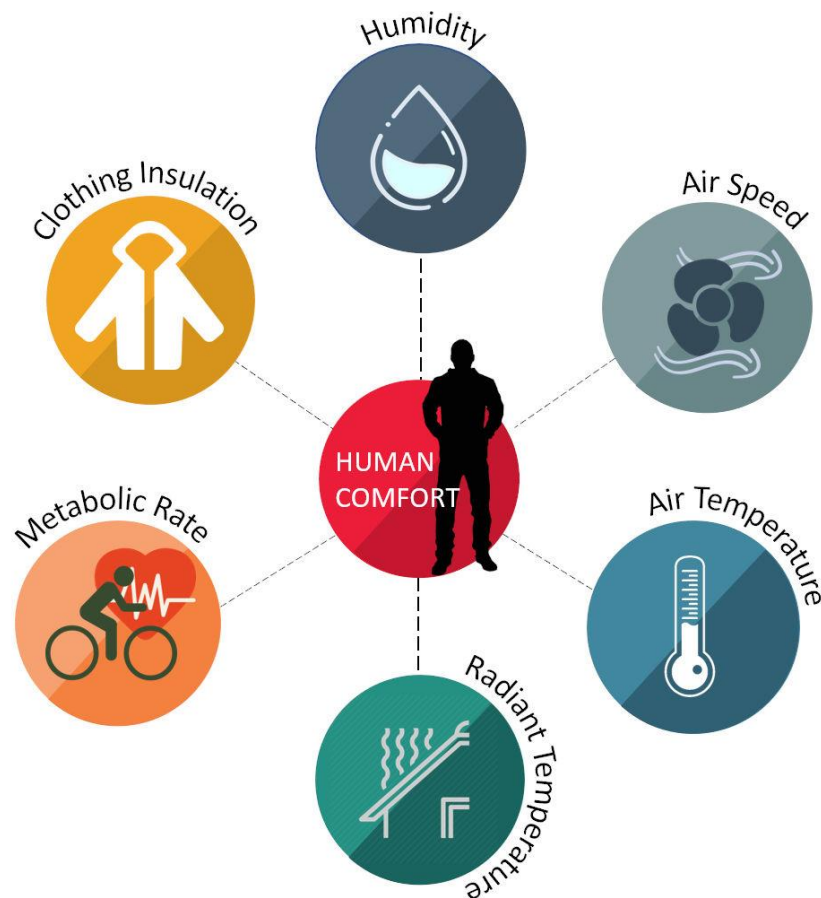
Occupant surveys are also essential to ensure occupant comfort.



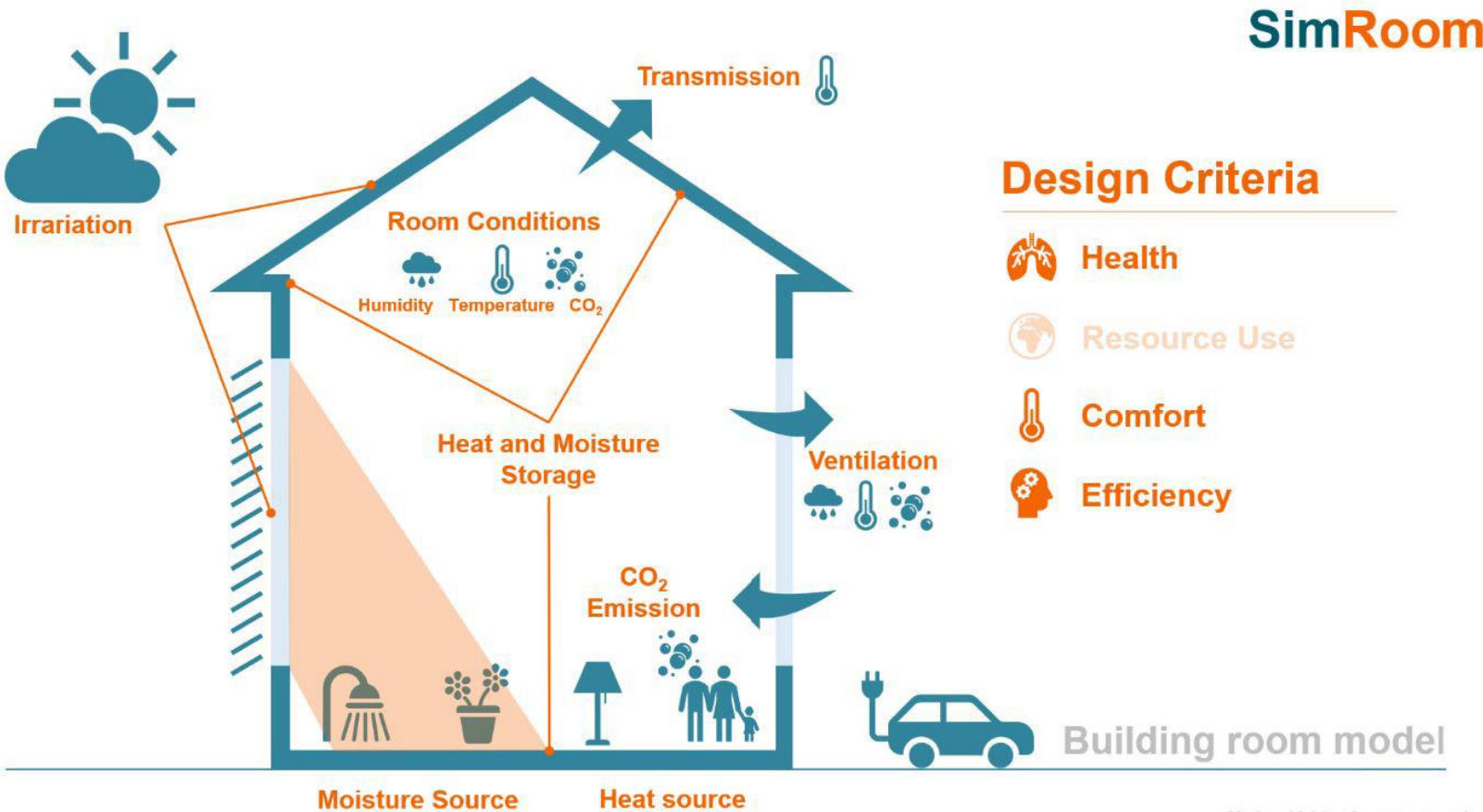
Increase occupant comfort

Thermal comfort

Thermal comfort is much more than merely adjusting the room temperature. It includes air movement and humidity as well.



Increase occupant comfort
Thermal comfort



Markus Lichtmeß – www.enec.de

Increase occupant comfort

Daylighting

Daylighting will increase the occupants' health, comfort, and productivity while also reducing building operating costs by using less artificial lighting inside the building.

The orientation of the building, configuration, the glass types for the windows, the layout of the rooms, the types of furnishings, and the colors of surfaces should all be considered during the design to maximize the use of daylighting without creating any discomfort.

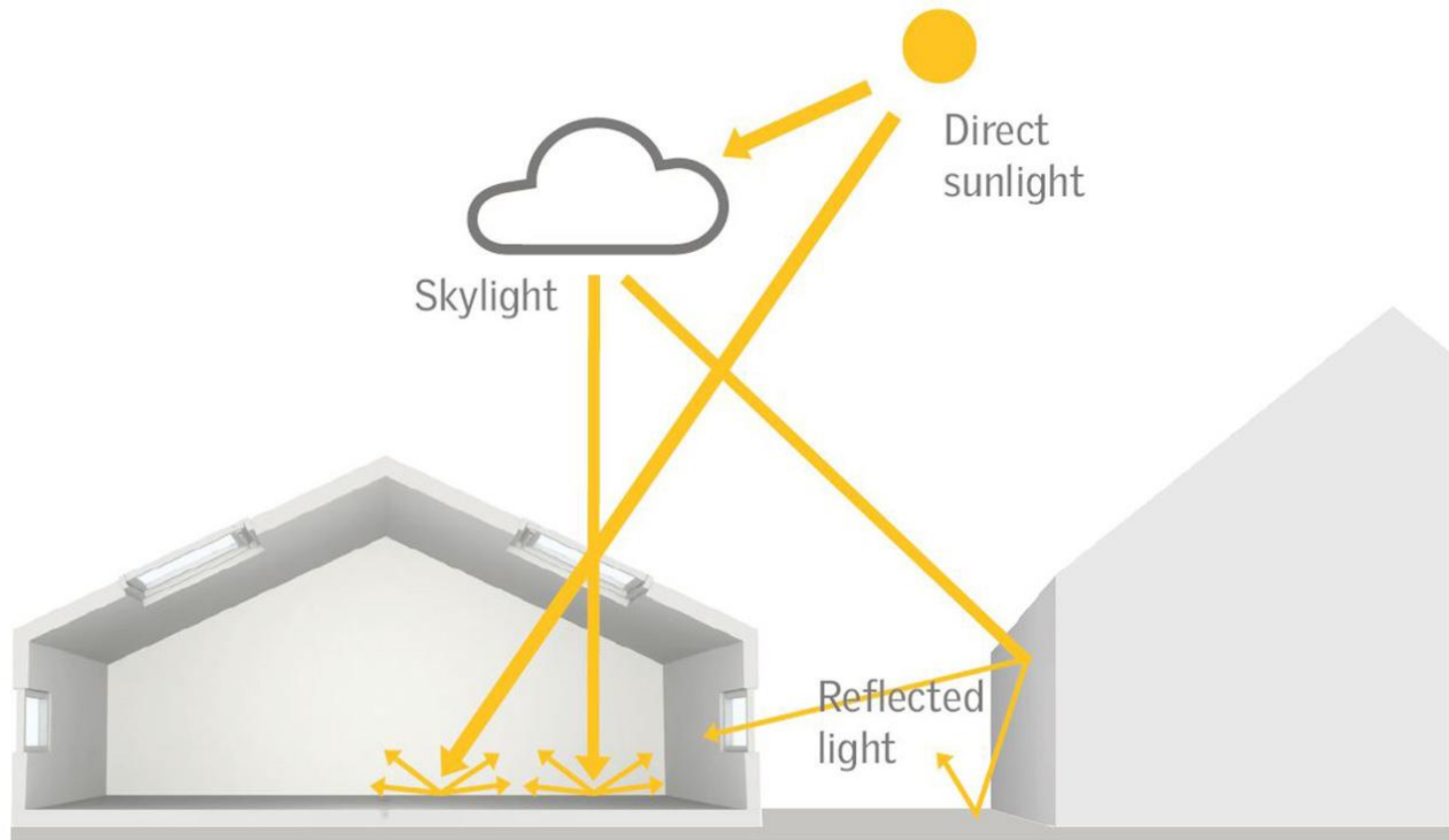
Below are some benefits of daylighting:

- Positive mental and physical effects on the building occupants
- Increased occupant productivity and comfort
- Cost savings due to the decreased usage of artificial lighting
- Cost savings due to increased occupant productivity



Increase occupant comfort

Daylighting



Increase occupant comfort

Daylighting

Daylighting systems can be categorized as either passive or active. **Active daylighting** is a system that tracks and collects the sunlight using mechanical devices. **Passive daylighting** is a system that collects the sunlight using static and nonmoving items such as windows, glass doors, skylights, light tubes, and light shelves.

Appropriately sizing and locating all of the windows are important for increasing the daylight.



Increase occupant comfort *Daylighting*



Increase occupant comfort

Daylighting

To control glare and avoid direct sunlight reaching a building occupant, adjustable window shades can give occupants control over excessive brightness and glare. The project team should also evaluate the ground surfaces, adjacent buildings, pavement, and objects, as they all can cause glare.

Lighting controls can dim or turn off the electrical lights completely when daylighting is sufficient.



Increase occupant comfort

Views

Having quality views in building is another factor that will increase an occupant's comfort and productivity.

Following are some design strategies to maximize the views

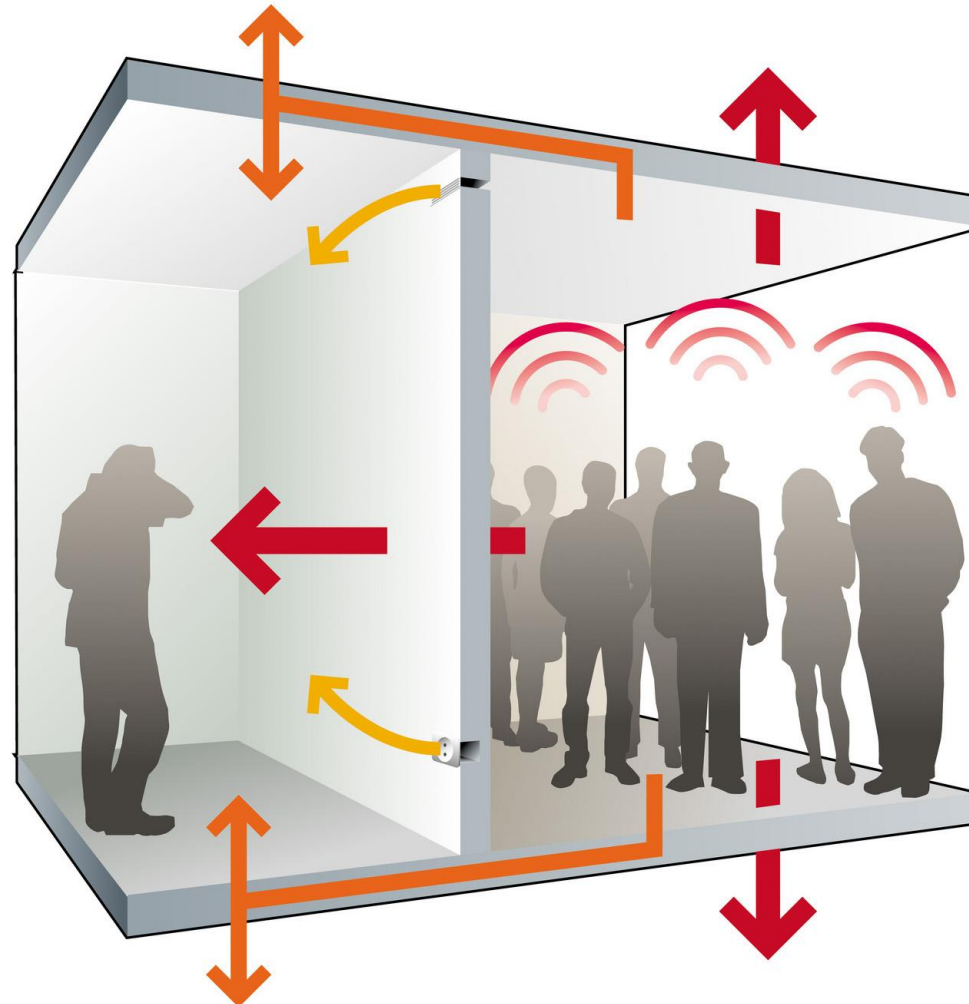
- Using vision glazing
- Using glazing without frits, patterns, colors, fibers, or tints
- Using low cubicle partitions or no partitions in open offices
- Adjusting building orientation, site design, façade, and interior layout to maximize views
- Locate the private offices closer to the core of the building
- Removal of objects that obstruct views



Increase occupant comfort

Acoustics

Building acoustics will affect an occupant's health, comfort, communication, and productivity.



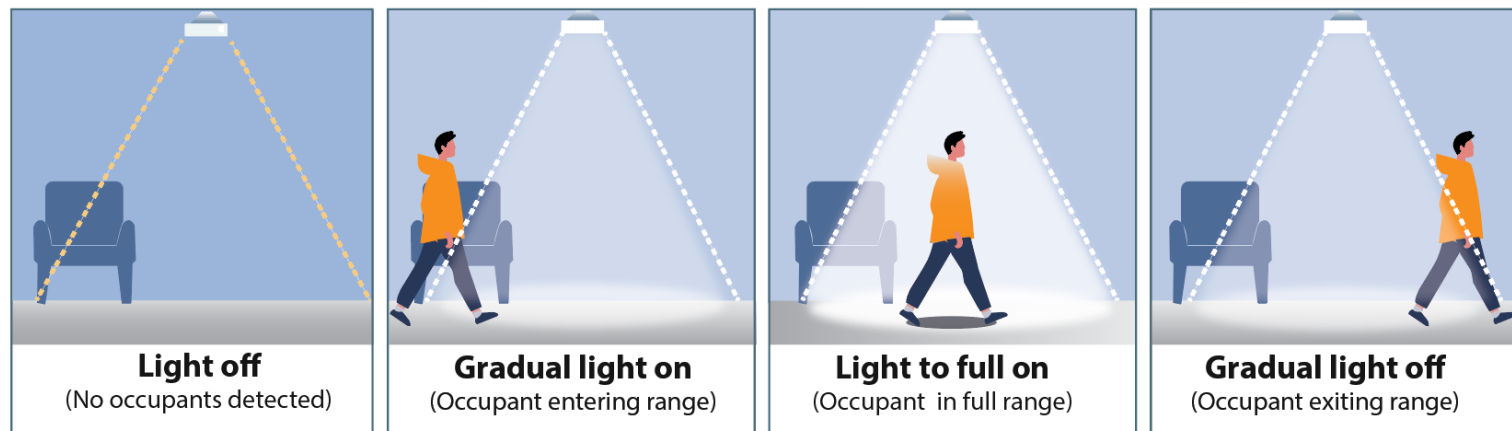
Increase occupant comfort

Lighting controls

Providing individual lighting controls with adjustable lighting levels will increase occupant comfort and reduce lighting costs. Additionally, installing **occupancy sensors** will shut off light when an occupant is away.

A major aspect of lighting that will affect occupant comfort is lighting quality. Excess brightness and glare are factors that will cause discomfort to building users.

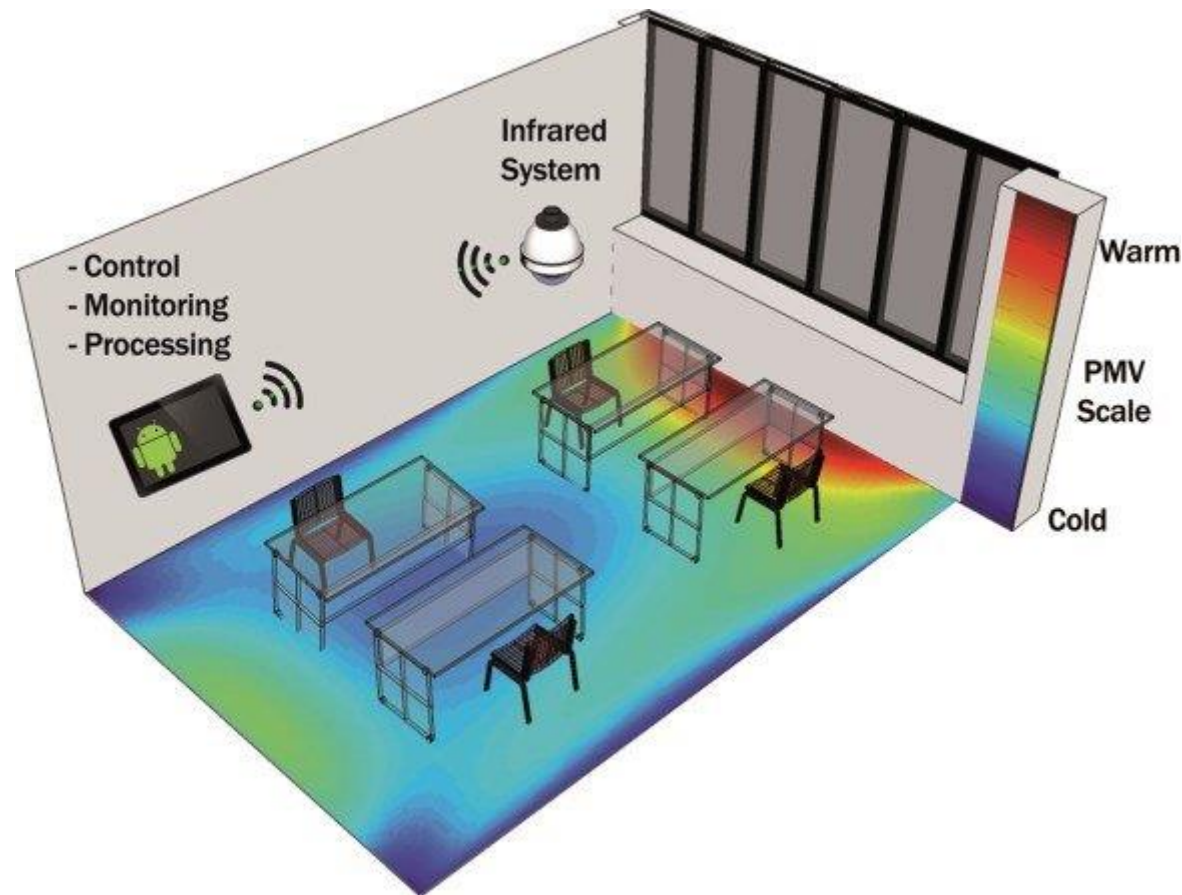
Install **task lighting** is another important tool that will allow a user to illuminate an area for a specific task.



Increase occupant comfort

Temperature controls

Every individual has different temperature preferences. Providing thermal comfort controls for individual spaces can allow building users to set their desired space temperature.



Increase occupant comfort

Ergonomics

Office layouts, individual workstation design, furnishings, and equipment all contribute to the ergonomics of a building. Since every individual has different needs, the project team should consult and analyze occupant needs.

Key ergonomic principles to be implemented should include flexibility, versatility, fit, and postural change.



Strategies to address indoor environmental quality

- Set minimum air quality standards
- Increase ventilation rates
- Protect the air that comes into the building
- Prohibit smoking
- Specify low-emitting materials
- Develop and follow a construction indoor air quality management plan
- Test of radon or other contaminants
- Use air filters with high MERV ratings
- Protect the site and buildings elements during construction
- Protect the air during construction
- Conduct a flush-out
- Conduct air testing after the construction to ensure good air quality
- Install entryway systems like grates, grilles, or mats to stop contaminants entering the building
- Monitor outdoor airflow and carbon dioxide
- Calibrate sensors as routine preventive maintenance
- Develop and implement a green cleaning policy
- Conduct custodial effectiveness assessment
- Use integrated pest management
- Use daylighting
- Maximize occupant views
- Install operable windows



Strategies to address indoor environmental quality

- Provide temperature and ventilation controls to the occupants
- Provide lighting controls to the occupants
- Conduct occupant surveys
- Provide ergonomic features
- Address acoustics

