



koberg

Our quality guarantees your success.

Contents

Reason of presentation: Increase the possibilities for interior- and indoor planters

- Photosynthesis
- **what is light?**
- **Normal light vs plant light**
- **Human eye vs plants**
- **Plant light or just light?**
- Color of light on plants
- Even distribution
- Why plant light
- **When is plant light needed**
- **Too little or wrong light**
- **BREEAM**
- **Different types of projects**
- Custom made
- **Various lamps with example projects**
- **Frequently Asked Questions**
- **Questions / Ideas / findings from practice**



Plants need light for photosynthesis

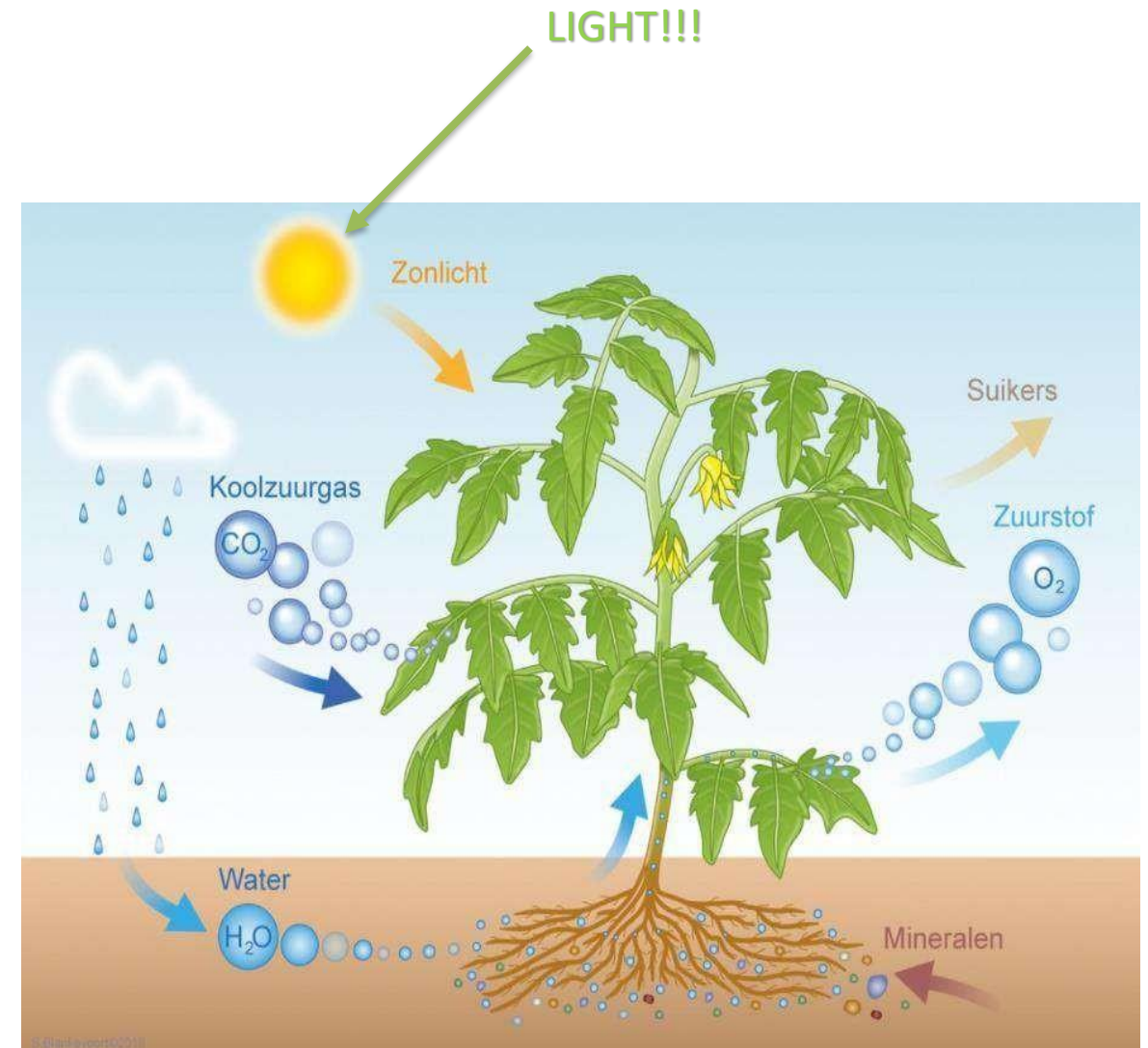
What is photosynthesis?

The process of plants in which they make glucose through CO₂ and convert light into oxygen.

What's so important about photosynthesis?

- without photosynthesis the plant cannot survive
- without photosynthesis there is no growth
- without photosynthesis there is no clean air
- without photosynthesis there would be no life on earth at all!

To carry out the processes, the plant needs energy, which the plant gets from light. Light is therefore crucial for the photosynthesis process



What is light?

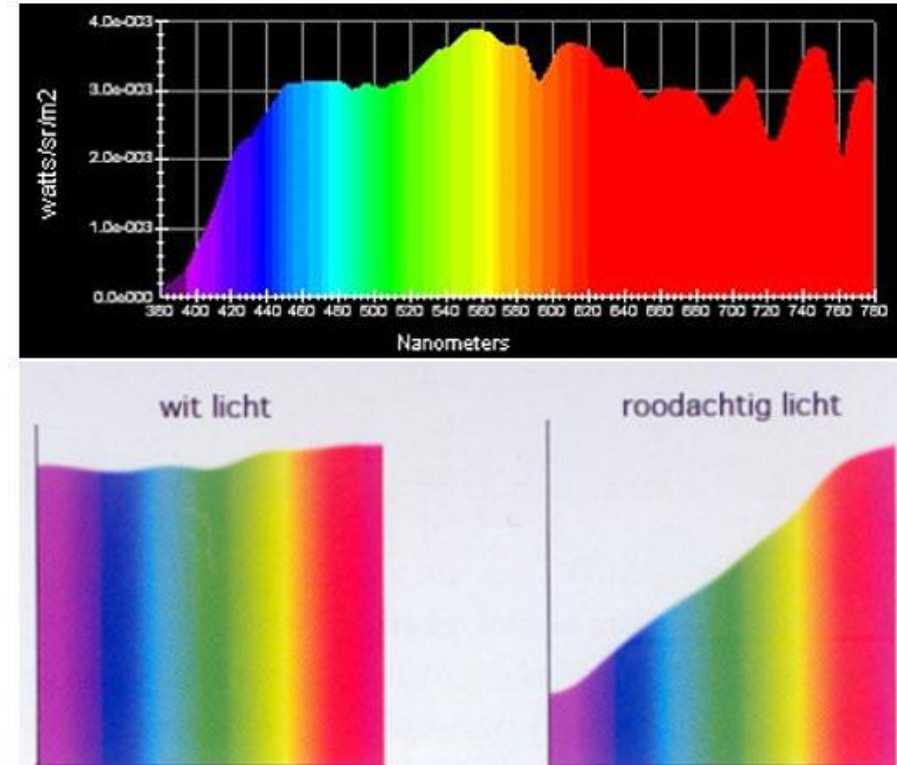
What is light?

The part of the electromagnetic radiation that is visible to people. This wavelength range runs from 400 to 700 nanometers.

Simply put: light is the radiation from the sun or light source that is visible to the human eye.

What color is light?

When we look at the rainbow or shine light through a Prisma we see many colors. Light is a combination of these colors and does not have 1 color. The color we see depends on the combination of all those colors together. For the human eye, we often want a combination of colors that together give a soft white or yellowish color. The choice of light color is therefore visual for humans. The color spectrum is not important as long as the end result has the desired color.



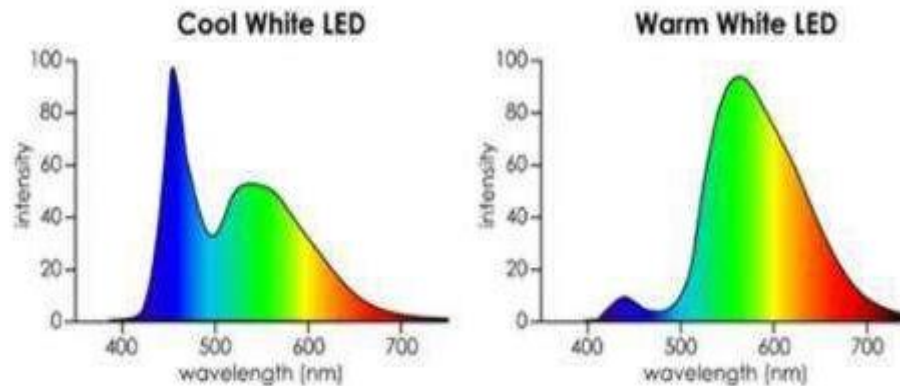
“Normal light” vs plant light

For plants this is totally different. This white or yellowish light mainly consists of green and yellow and is of little to no use to plants.

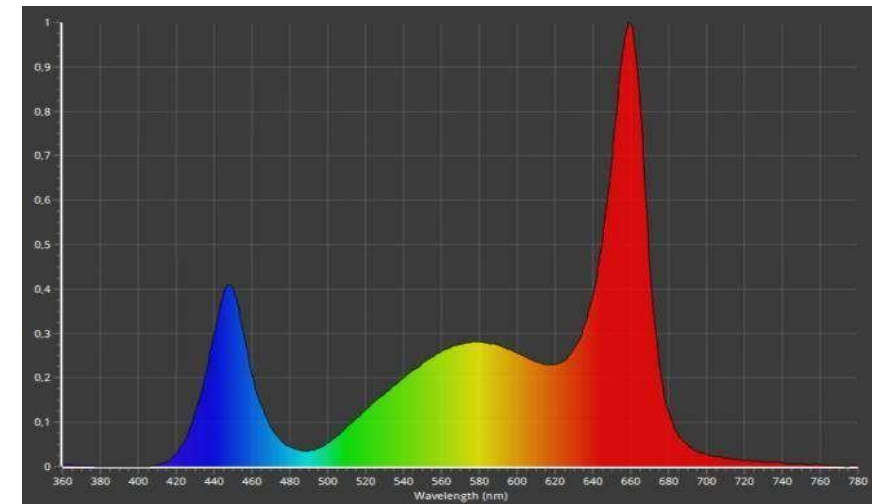
In many years of research it has been discovered that the build-up of light, especially the colors blue, red, a little green and far-red, is important for plants. The combination of these colors and the amount present determines how the plant will grow. Red is the most important color and is therefore the most present in our spectrum.

Red is not a color that is chosen for the human eye and is therefore normally rarely present in office lighting.

Office lighting (white)



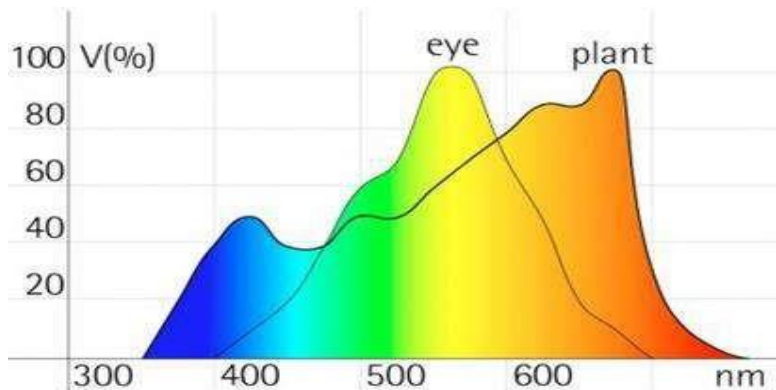
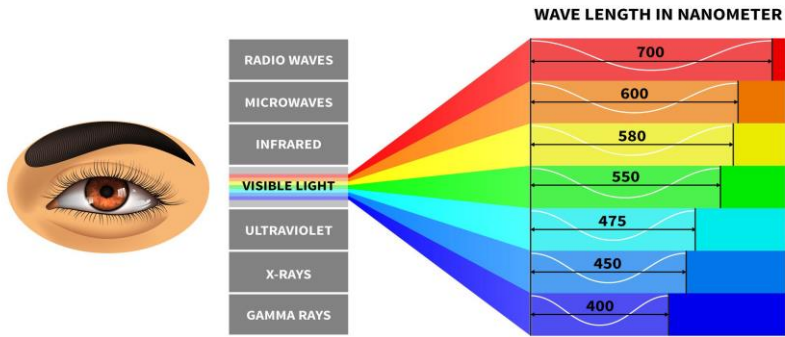
Plant lighting



Human eye versus plant lighting

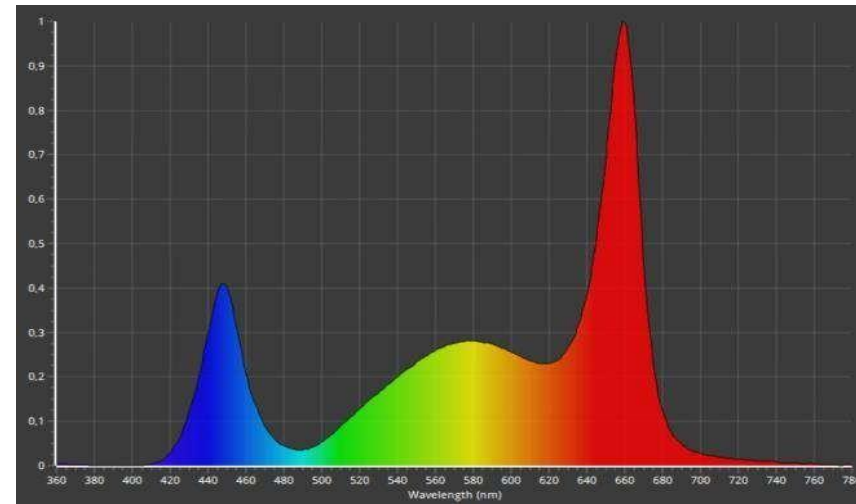
Human eye

- Sees colors between 400 nm – nm700 (nanometers)
- Sees most yellow and green



Plants

- See colors between 400 nm (nanometers) – nm700
- Only grow with the colors red and blue.
The other colors are to control processes. Plants don't need these colors to grow, but only to shine and breathe.



The correct ratio between these colors is very important!!

Plant light or just light?

These days there is a lot lighting available. Many “normal” lighting companies pretend to have plant lighting.

PLEASE NOTE!.....this is no correct plant lighting.

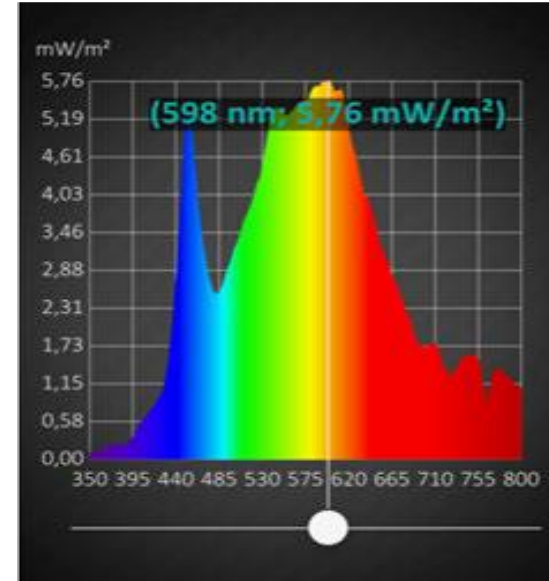
Some do work, but they are less effective and plants don't get as beautiful as possible.

What should you pay attention to?

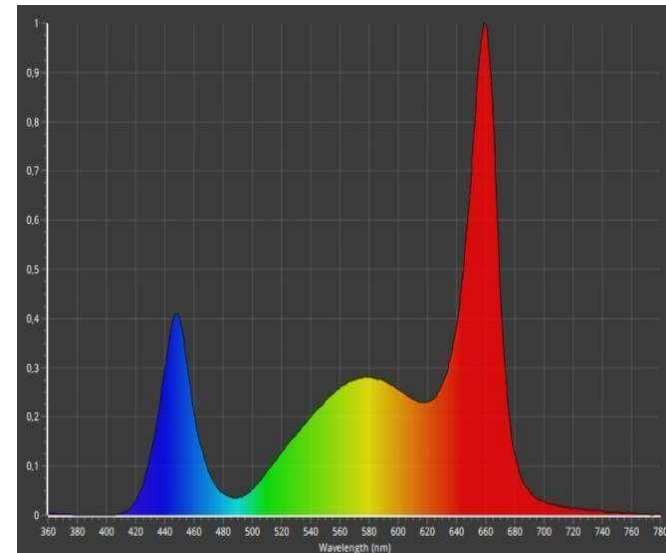
- Plant light is expressed in micromole.
What is the number of Micromol, PPF or PPFD?
Other values, such as Lux and Lumen have to do with visual lighting.
- What does the spectrum look like
If it contains a lot of green and yellow it is not effective and wastes a lot of energy

Correct color spectrum:

- Big peak of Red
- Smaller peak blue
- Even smaller peak of green
- No far red due to stretching



Common used “plant light”



Correct color spectrum

LUX

A Lux measurement is still done too often. This doesn't really mean anything. This indicates a value for the human eye.

- Too little Lux: Obviously there is also too little light for plants.
- Sufficient Lux: Still not clear whether there is enough light for plants.
1000-1500 Lux maybe sounds good, but with only yellow and green this is still not good for plants.

Lux measures the amount of light, but does not measure colors. This is, for example, a problem with a heat resistant coating on windows. This leaves out the heat...heat is the color red..... THE most important color for plants!

With our spectrum, because it is so effective we can work with only 500 Lux!!

Correct effective plant light is expressed in Micromol, PAR, PPF or PPFd and mainly consists of colors red, blue and a small part green.

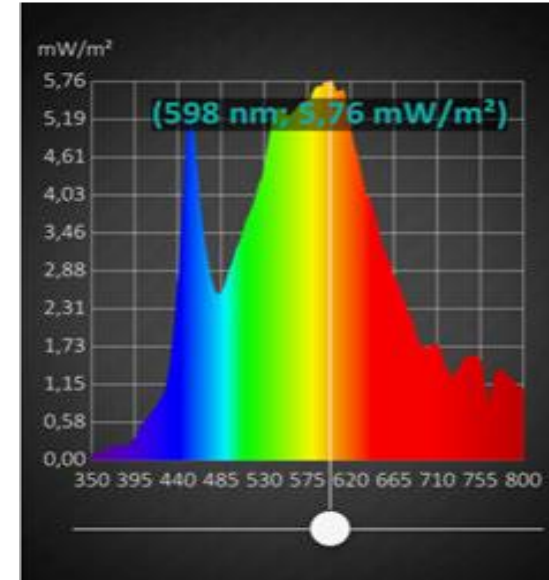
We measure this with a spectrometer.

This allows us to measure exactly how much light there is and very important: the ratio between the colors!

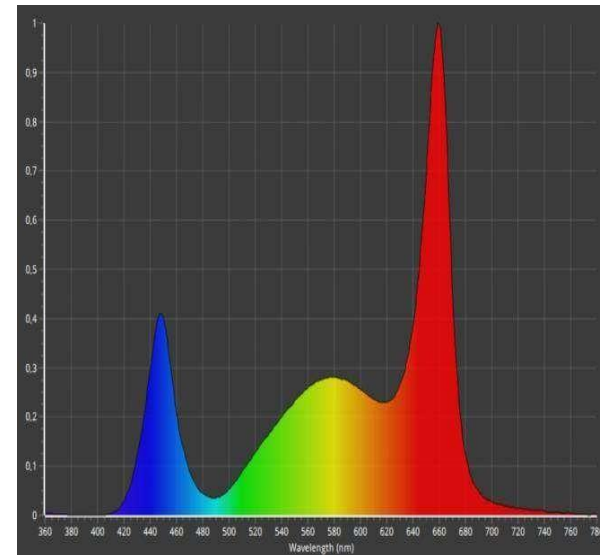
Ideal Umol values:

- Plants: 10-20 Umol/s/m² with a Minimum of 5 Umol and a maximum of 30 Umol
- Trees around 40 Umol/s/m²

Note: these values are enough with the correct ratio between the colors



Een veel gebruikt fout "plantlicht"

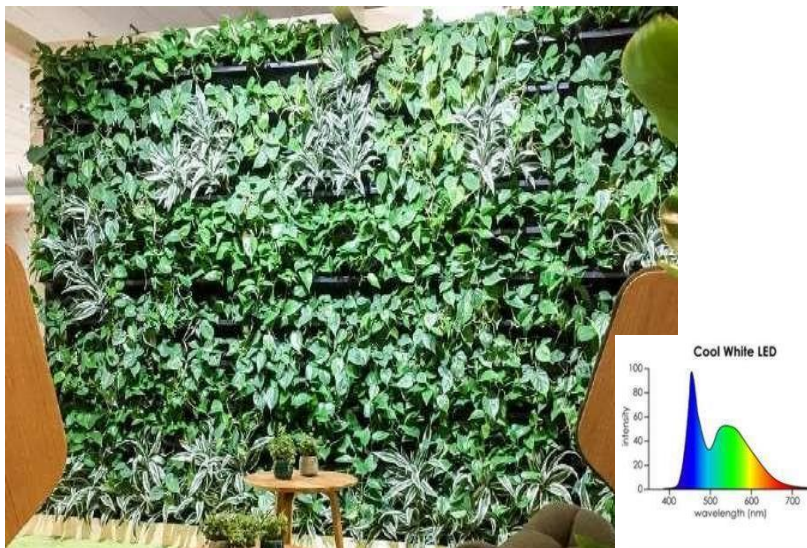


Juiste kleurenspectrum

Color light on plants

Light with a lot of blue in the spectrum gives a cold white glow to the leaves. With the right spectrum, the color green is extra accentuated so the plants keep their natural color.

A lot of blue

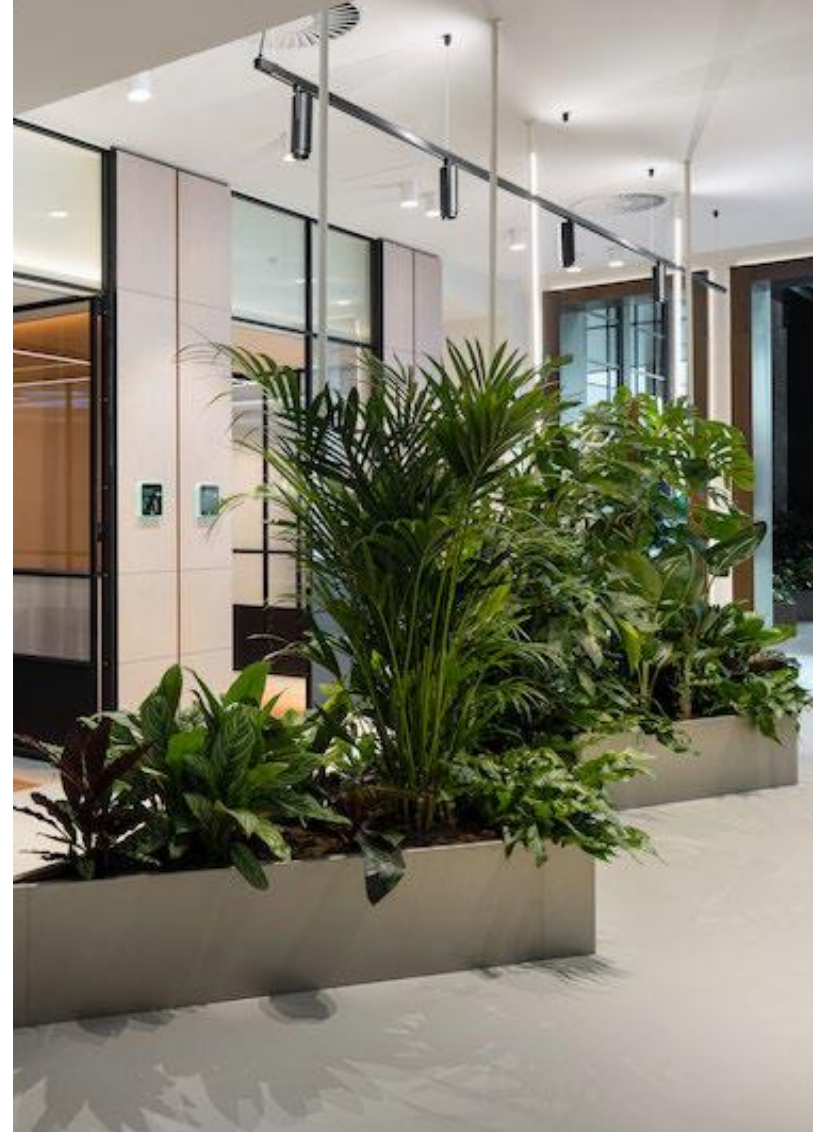


Correct plant light



Why plant light

- Stimulates flowering and growth of all types of trees and plants
- Makes (tropical) indoor jungles possible
- **Plants color more beautiful and healthier**
- **less control required**
- Similar to daylight but composed more efficiently
- **No more high replacement costs**
- **Nicer business card for your company**



How do we determine whether extra plant light is needed?

Without expensive measuring equipment it is more difficult to say whether additional light is needed.

To start, we have to make assumptions:

What is the source?

- Normal light 3000-5000K
This contains usable light for plants, but very little. That's why a lot of these lights have to be used to get a “good” result.
- Plant light (is this the right one?)
- Sunlight



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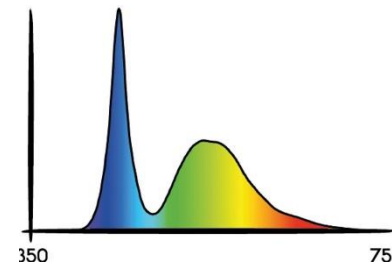
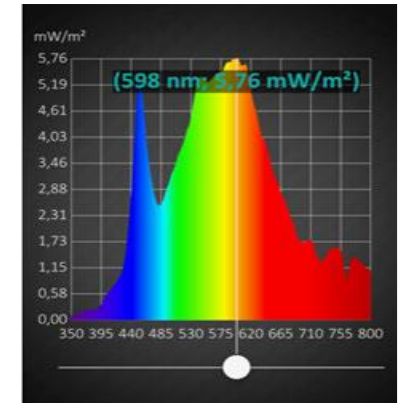
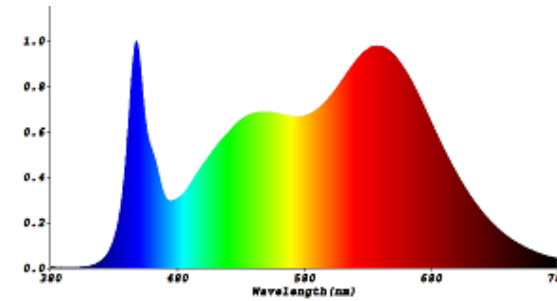
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Sunlight

- Sunlight is perfect, but unfortunately not available all the time
- Seasons.... Winter is different than summer
- Which side is the window?
In case of the north side, there probably will be problems during winter
- Are buildings or trees blocking the light?
- A green wall usually needs extra light around the top edges, because windows usually do not reach the top.
- With normal windows without coating you have sufficient light at the south side at 3 - 5 m.
Disadvantage: Leaves all turn towards the window.
- Heat-resistant coating?
Usable plant light is blocked by 50-80%. Almost only yellow/green is getting through. Heat is blocked. This is the color red.



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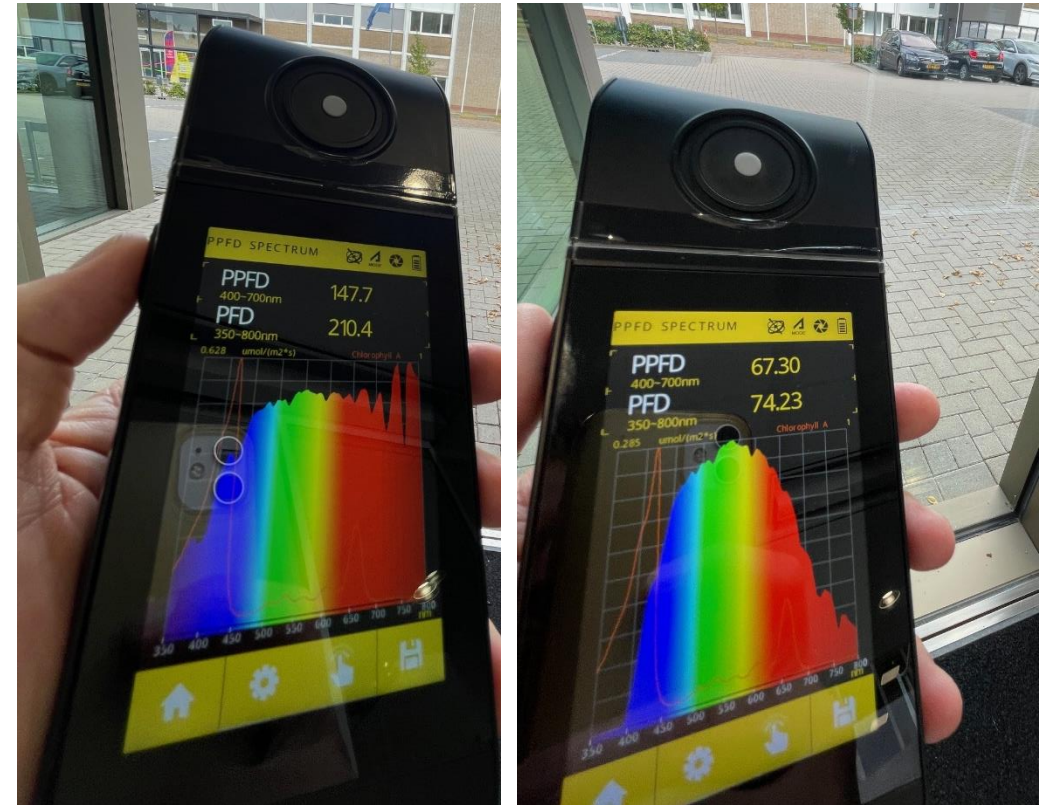
Most visibel side (Bottom leaves)



Wondow side (Top of leaves)

Sunlight

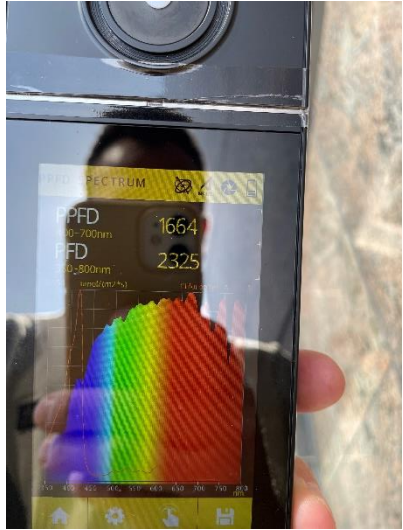
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Example heat resistant coating



Example mirror glas coating



PPFD: 1664



PPFD: 38,28

-98% !!



Too little or wrong light

- Plants start to stretch
 - Leaves become smaller
 - Leaves become paler, duller and weaker
 - Resistance decreases
- More sensitive to pests and diseases



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BREEAM Building Research Establishment's Environmental Assessment Method

You have probably all heard of, or had to deal with BREEAM.

This is a certification for the well-being of people and the environment. Many large projects these days work with BREEAM.

Of course the well-being of the world is important and we are happy to contribute to this.

BREEAM works with a points system where you can earn and lose points.

By having a good Biophilia plan which means bringing people and nature back together, points can be earned back.

Placing a lot of plants is good for humans and so points can be earned back.

But of course plants need light. Normally this would cost a lot of energy and does not fit into BREEAM.

Due to the amount of extra electricity needed for plant lighting green projects are being rejected.

This is a big shame.

But this is where it becomes very interesting!

With our lights this is absolutely not the case.

Our lights are very efficient because we leave out all unnecessary colors. The power consumption is very limited. We can illuminate with only 3 to 8 watts per m².

This means no rejections of green projects due to power consumption anymore!

An example of how efficient our lights are.

A customer asked me to make a calculation for a wall of 6 x 20 m

We needed 21 lamps to do it good. 27 to do it perfectly.

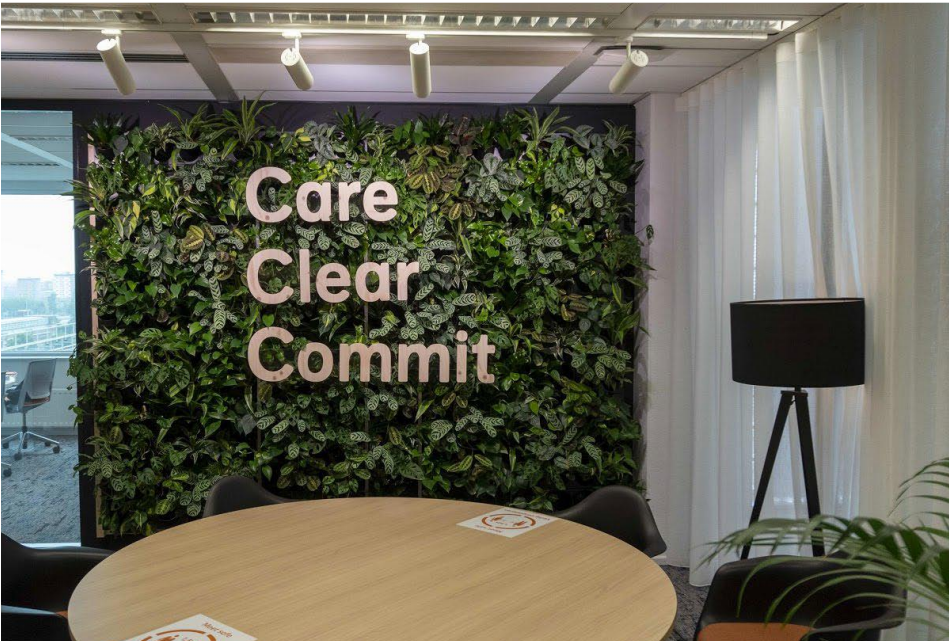
Another party needed at least 70!!

This really shows how effective we are and how we fit into BREEAM perfectly.



Many different projects

Green walls



Other walls



Offices



Furniture



Catering industry



Special projects



Swimming pools



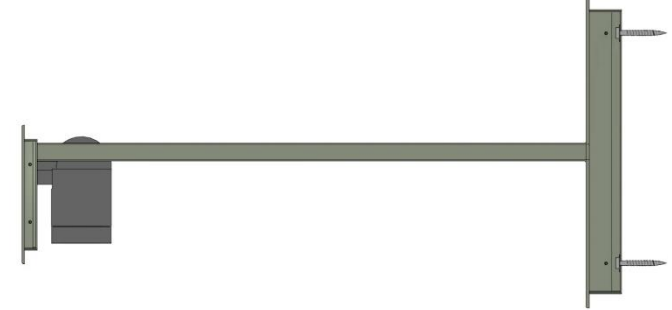
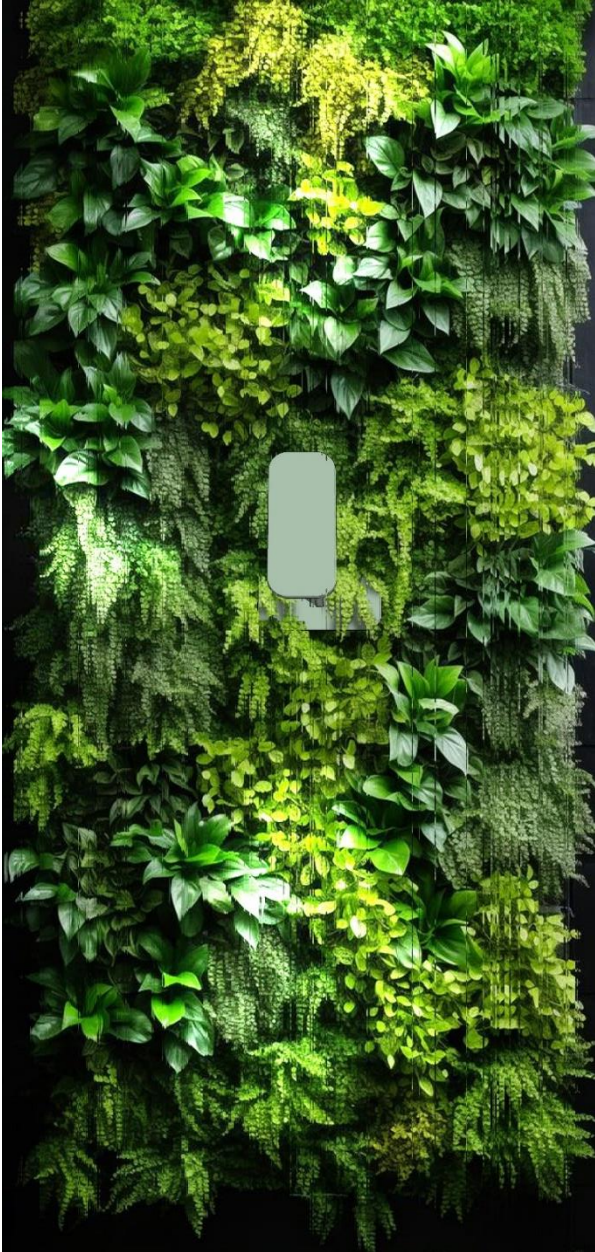
Indoor farming



Custom made



Custom made



Custom made



Many different models

Spot lights



Track



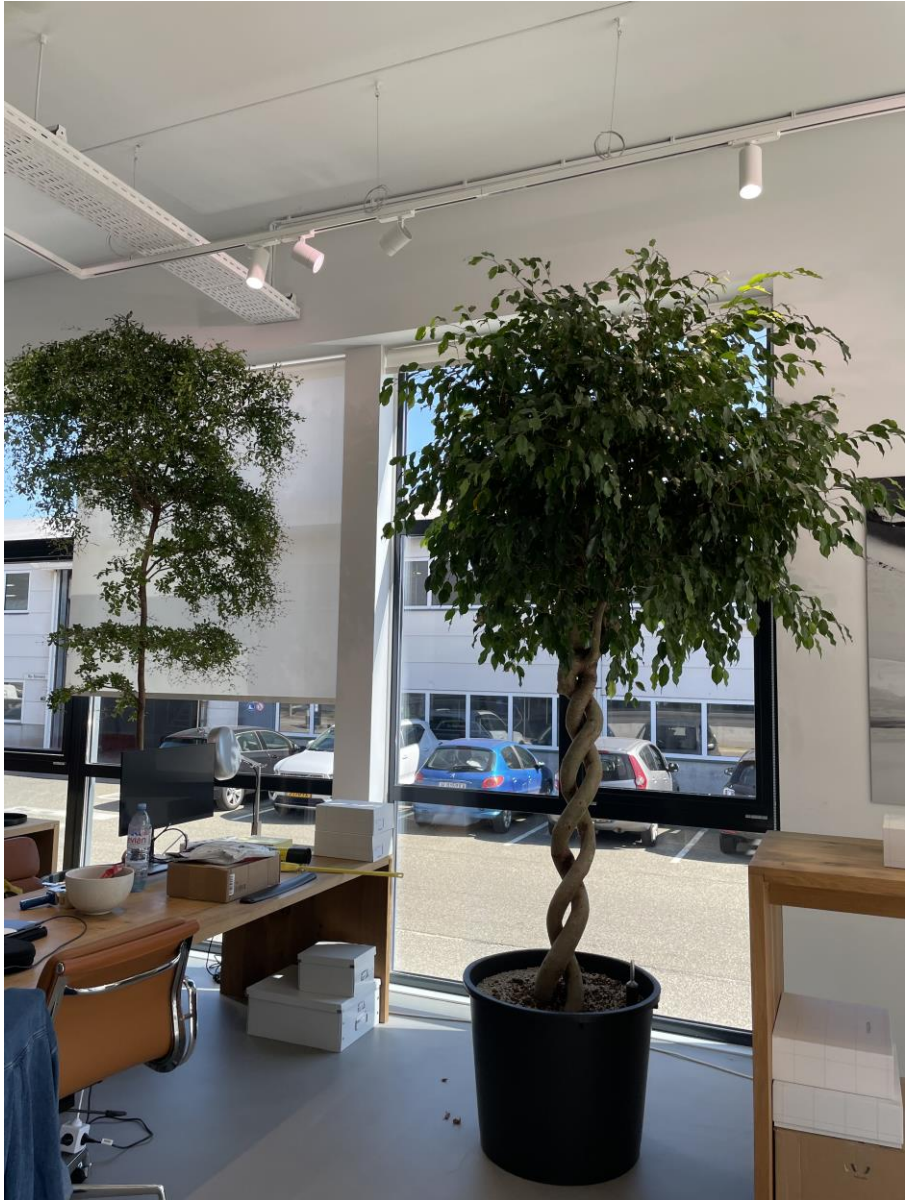
Foot



Recessed



ECCO SHOES



Floriworld



Recessed light



Very small lights



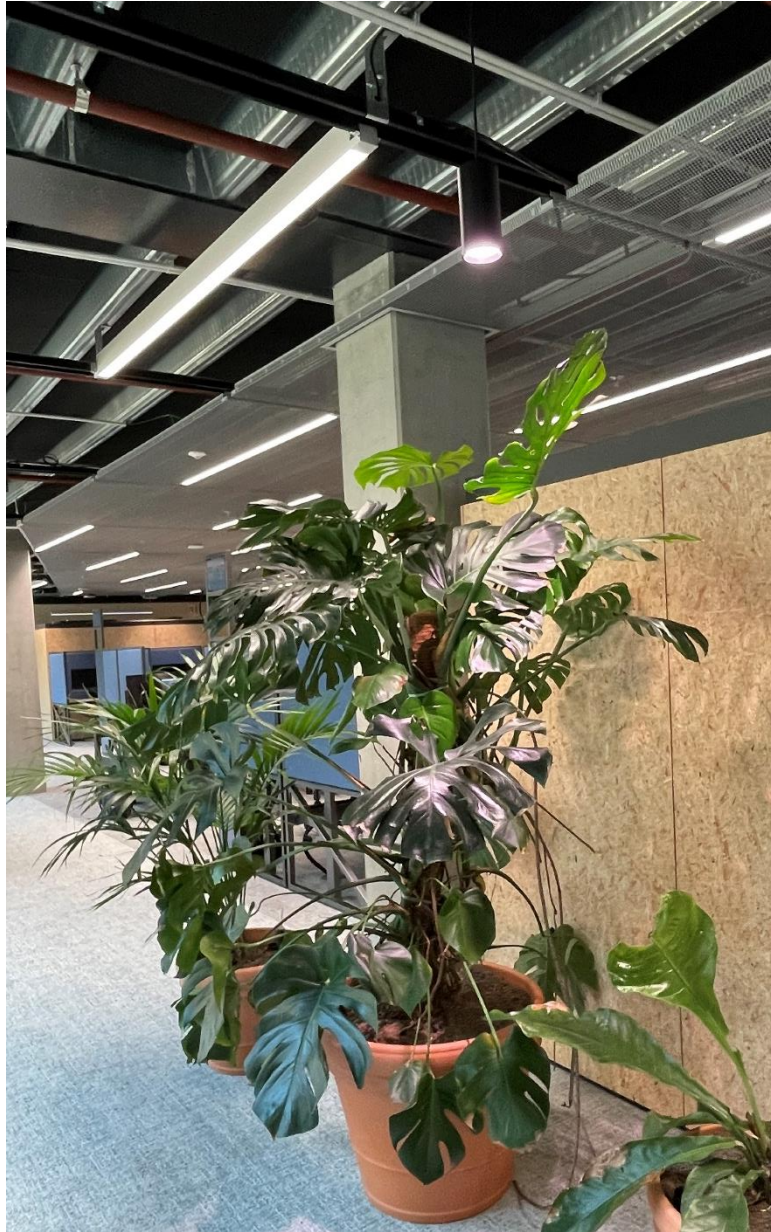
Center Parcs Eiffel



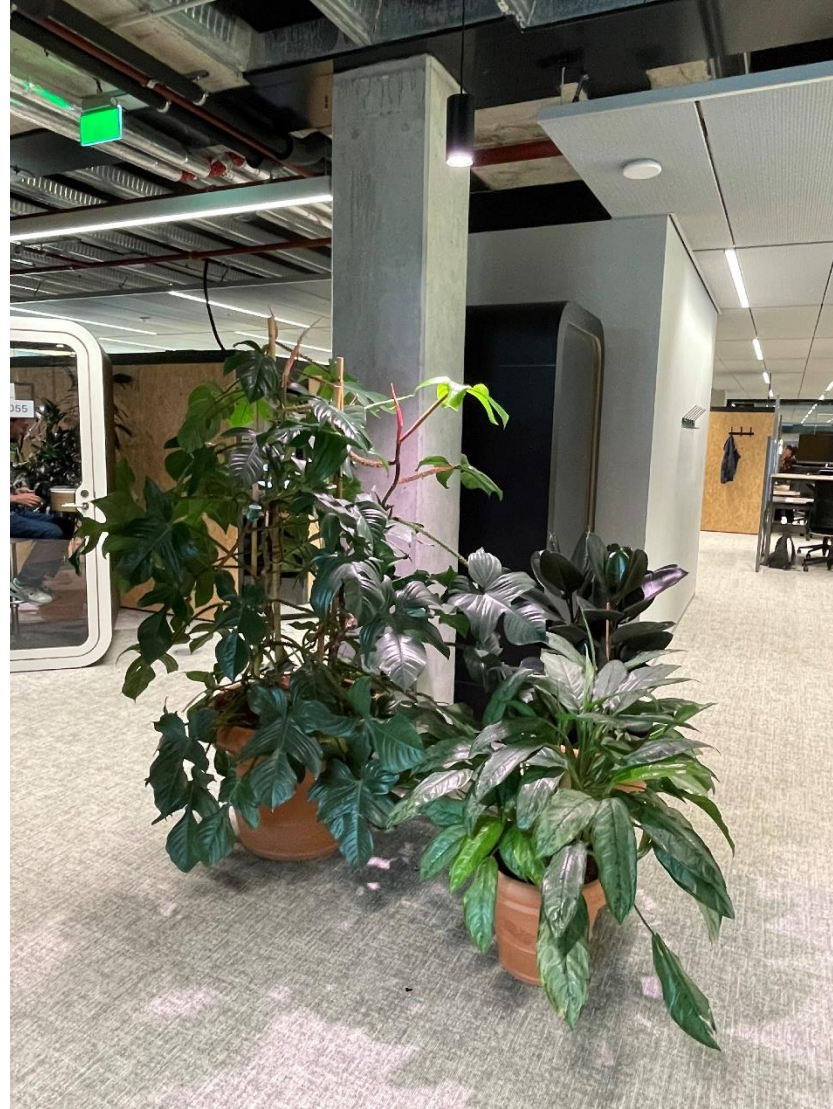
Private house



Pendant



Pendant



“Living wall” linear



Therme Boekarest



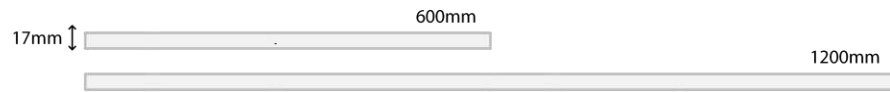
Center Parcs Limburse peel



“Medium” linear



“Small” linear



Large distance



ECCO SHOES



Unistone Realestate



Museum



Frequently Asked Questions



How much does lighting cost?

This must be calculated for every project, because every project is different. But a guideline is about €30-60 per m². This pales in comparison to the costs of purchasing a plant wall and continuously replacing the plants, these costs will be earned back in no time.



How long should the lights be on?

A plant needs 8-12 hours of light per day and at least 4 hours of rest. These hours can be divided according to the customer's wishes. Some customers, for whatever reason, do not want to leave the lights on during the day. This is no problem. The lamps can also be turned on at night. As long as 4 hours of darkness is taken into account.



Power consumption?

The lamps consume very little power. This is because the chips are very efficient and we left out all unnecessary light/colors. A track rail, for example, uses only 10-30 watts. About 3-8 watts per m².



How many lamps?

How many lamps are needed depends on the lamp and the distance to the plant. For example, a Track light, a recessed light and a pendant cover 4-6 m² at the ideal distance.

A linear reduces its own width to approximately 2,5 meters down.
Lamps with a wrong spectrum covers 1 to 1,5 m² so a lot are needed

10 x 3 m



So many lights draws attention



2,5 x 8 m

