



**greencity
solutions**



we grow fresh air

MEDIA INFORMATION

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FACTSHEET GREEN CITY SOLUTIONS

Green City Solutions is a green tech pioneer from Brandenburg. Living moss serves as an alternative to conventional urban greenery: it possesses the ability to absorb and metabolize pollutants, cooling the surroundings through water evaporation. These natural properties are maximized through state-of-the-art IoT technology, as well as innovative ventilation and irrigation techniques. In a confined space, approximately 50 watts of electrical power can generate up to 6,500 watts of cooling capacity – equivalent to the impact of 80-100 newly planted street trees. The particle filtration efficiency from the air is about 10 times higher than that of traditional greenery.

These specialized mosses are high-performance plants that allow for targeted use indoors and outdoors as an effective and measurable measure against heat and pollutants. They are enveloped in city-friendly, multifunctional designs that ensure automatic and on-demand supply.

Moss modules are used in various multifunctional fresh air concepts. The integration of traditional green elements for biodiversity promotion, analog and digital information carriers, seating, water tanks, and even network technology or charging infrastructure allows for versatile applications. Due to their high evaporation capacity, they can also be used in rainwater management strategies, leading to the development of various business models based on fresh air.

Green City Solutions has combined its vision of bringing fresh air to cities with Digital-Out-Of-Home, creating the first truly sustainable advertising network called „climAD.“ This network not only broadcasts digital messages but also emits cool and clean air. With every 10-second spot aired, over 4,000 liters of fresh air are produced. Advertising gains a valuable additional benefit, capturing the attention of viewers and making the advertising medium stand out. Currently, the fresh air network reaches over 2.7 million contact opportunities per week and continues to grow.

Whether it's product launches, recruitment campaigns, or awareness campaigns, climAD is the perfect medium for impactful communication.

Therefore, moss filters make an important contribution to sustainability and a healthy, livable city – both visibly and measurably, locally and immediately. They also have environmental product declarations that assess the CO₂ footprint throughout their lifecycle and are eligible for various forms of support and funding.

QUICK FACTS

- The active moss filters can **remove up to 82%** of fine dust from the air and cool the air **by up 4 Kelvin (°C)** via evaporation
- The performance and impact parameters were **evaluated** in extensive scientific measurements
- Environmental performance can be determined, evaluated and controlled through the **use of sensors**
- The filter mats are never „full“, as the fine dust is **being metabolized** by the moss to a large extent and converted into natural biomass
- The mosses grow under controlled conditions in the company's own moss farm up to **16x faster** than in nature
- The moss filters reduce CO₂ and filter gases and particles that are harmful to the climate and health, such as soot.

FOUNDATION

March 2014

FOUNDERS

Peter Sanger, Zhengliang Wu

MANAGING DIRECTOR SHAREHOLDER

Peter Sanger

WEB

greencitysolutions.de/en/

SOCIAL MEDIA

Instagram

YouTube

Facebook

LinkedIn

CONTACT

media@mygcs.de

ADDRESS

Green City Solutions GmbH

Fernstrae 27

15741 Bestensee

Germany



PROBLEM & SOLUTION

PROBLEM AIR POLLUTION

Air pollution is one of the world's biggest environmental problems and is responsible for 1 in 7 deaths. 85% of all citizens in Europe are exposed to levels of fine dust that are considered harmful to humans¹. Fine dust is also linked to cardiovascular and respiratory diseases such as asthma, cancer and COPD, as well as neurological diseases such as dementia.

Successful measures against air pollution often require long planning and deployment phases, which is why implementation is a lengthy process for cities and companies. Measures that can be realized in the short term therefore play an important role in the fight for better air.

¹ Source: World Health Organization

CLEAN AIR FOR ALL

Green City Solutions was founded by a young team of experts from different fields in Dresden. The individual expertise was combined and led to the basic idea of combining nature with state-of-the-art technology to specifically improve air quality. The core product is a moss filter that combines the natural filtering ability of moss with intelligent technology, making it measurable and controllable. The products can also be used wherever other urban greenery cannot thrive.

With its rapidly implemented solutions, Green City Solutions helps people in particularly polluted urban areas to breathe cleaner air and thus to improve their health and quality of life.

PROBLEM CLIMATE CHANGE

The cause of climate change is the increased emission of CO₂ into the atmosphere due to the combustion of fossil fuels such as coal, gas and oil. Combating climate change with various measures to reduce emissions and existing CO₂ is probably the greatest challenge of our time.

Due to climate change, the number of annual heat days is already rising steadily, also in Europe. Urban areas are particularly affected by this development, as the temperature here is up to 10 °C higher than in the surrounding suburbs. The plethora of asphalt, concrete or glass surfaces store the heat instead of reflecting it and cause hardly any cooling, even at night. Furthermore, heatwaves globally raise the likelihood of droughts and wildfires.

MOSS AGAINST GLOBAL WARMING AND ITS CONSEQUENCES

Mosses bind CO₂ and convert it into oxygen via photosynthesis. Each of the moss mats (60 x 80 cm) from Green City Solutions processes one kilogram of CO₂ per year. In addition to CO₂, however, there are numerous other gases and substances that have a negative impact on the climate. A major driver of global warming is soot („black carbon“), which has an effect on global warming that is up to 1,500 times stronger than that of CO₂. The mosses in the biofilters capture soot particles that are present in the air as a component of fine dust. For example, one CityTree offsets up to 342 kg of CO₂ and CO₂ equivalents annually, making it a climate protection and climate impact mitigation measure at the same time.

The moss filters also actively humidify the environment and cool the air by up to 4 Kelvin (°C). The secret is the enormous water absorption capacity. Mosses act like sponges, storing water whose evaporation provides the pleasant cooling effect. Hence, the mosses can also be selectively deployed during heavy rainfall events, which often impact paved areas in cities that have limited capacity for rapid water absorption. Intermediate storage solutions, such as cisterns and artificial basins, can contribute to capturing and storing water, and can additionally be utilized for cooling urban spaces on hot days.

NATURE MEETS TECHNOLOGY



CENTREPIECE MOSS MODULE

SUPERPLANT MOSS

About 4 m² of moss grow in every moss module. According to the Leaf Area Index, this corresponds to an active moss surface of 100 m².

ACTIVE VENTILATION

Warm, impure city air is passed through the mosses and released as a fresh and clean breeze regardless of external conditions.

SMART SENSORS

Built-in sensors detect the vitality of the mosses. A unique bio-algorithm controls the ideal supply and saves resources.

INTERNET-OF-THINGS AND SENSORS

Mosses are capable of amazing things and are also highly adaptable. But in the middle of the city, on a crowded square or next to a busy street, the little plants need our support to remain vital and efficient in the long term. A specially developed bio-algorithm ensures that the mosses are supplied as needed, depending on weather conditions and other factors such as local air quality. With the help of more than 30 installed sensors and a connected analysis database, factors such as ventilation and irrigation are controlled in such a way that the mosses are

optimally supplied at all times and can concentrate fully on filtering and refreshing the urban air.



SCIENTIFIC EVIDENCE

In recurring measurements, we were able to prove and validate the performance values of the biofilter. Our research partners were the Leibniz Institute for Tropospheric Research in Leipzig (effective radius) and the Dresden Institute for Air and Refrigeration Technology (separation rate).

**REDUCES
FINE DUST**
in the air

up to
4°C

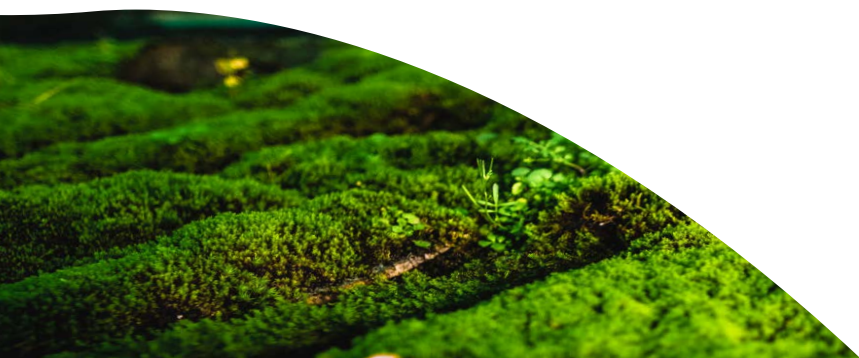
**COOLS &
HUMIDIFIES**
the ambient air

up to
82%

**COMPENSA-
TES CO₂ & CO₂
EQUIVALENTS**

up to
342 kg
each year

*Examination CityTree



MOSS

THE SUPERPLANT

Mosses are the oldest land plants on earth and are capable of amazing things. They bind fine dust, some are antiseptic, antiviral and fungicidal; real all-rounders for air pollution control and health.



WATER STORAGE WITH COOLING POTENTIAL

Mosses are small sponges and can store enormous amounts of moisture, making them an ideal component in rainwater management. The water not only serves the vitality of the moss, but also cools the surrounding air noticeably through natural evaporation.



AIR AND CLIMATE PROTECTION

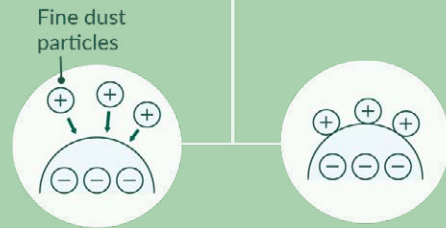
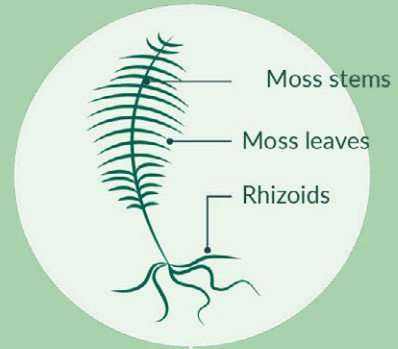
Mosses bind and metabolise particles and gases that are harmful to the climate and health, such as soot, CO₂ or VOCs. Most of the „prey“ is directly metabolised or indirectly biodegraded by microorganisms and then converted into harmless biomass.

MOSS FARM & MOSS LAB

As pioneers in the use of moss, everything has always revolved around these inconspicuous plants. In the moss laboratory, mosses are researched and qualified for cultivation. Under controlled conditions the super plants grow in the moss farm about 16 times faster than in nature.

Sustainability is also a top priority in the fully digitalised moss farm. The use of water, heat and electricity is monitored by sensors and optimally controlled.

The mosses are robust and reusable - they return to the moss farm by post about once or twice a year for a cure and are then used again in our products.

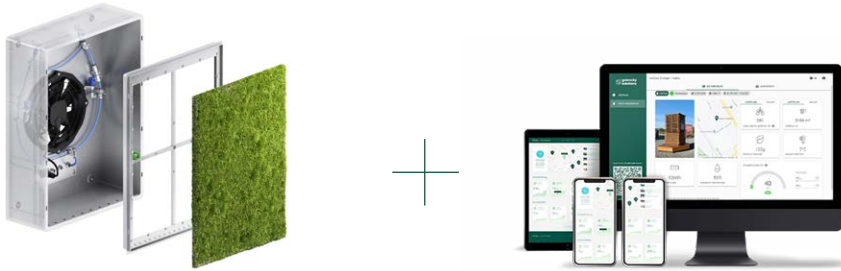


- ≈ 50% of the particulate matter are **metabolized** and thus used as food
- ≈ 25% of the fine dust are **biodegraded** by microorganisms
- ≈ 25% of the fine dust are **stored** in the sediment of the moss



THE SOLUTIONS

Three biofilters that significantly enhance the natural capabilities of moss through active ventilation and make them usable and measurable for specific indoor and outdoor use.



CityBreeze 4 MOSS MODULES

The CityBreeze combines active air filtration by moss with digital presentation technology. On one side is a green, vitalizing moss wall with active filter technology and on the other a 75 inch LCD screen. This combination makes sense: both information and advertising as well as the selective improvement of air quality is placed where as many people as possible react and benefit.



Equivalent to cooling capacity of 21 trees!

CityTree 8 MOSS MODULES

The CityTree is a combination of street furniture and biofilter - a bench below, a moss-covered surface above and complex technology with IoT interface inside. In busy squares, along busy streets or or even as an indoor solution in atriums and industrial halls: The CityTree offers a relaxation zone in fresh & clean air. The 43 inch screen can also display the air quality and cleaning performance in real time.



Equivalent to cooling capacity of 81 trees!

WallBreeze 4 MOSS MODULES

The WallBreeze allows the biofilters to be connected over a wide area. The slim modules can be used quickly and without retrofitting on building facades (ground-based) or even indoors. Due to an active air circulation and the special surface structure of the mosses, the WallBreeze is the most powerful facade green.



Equivalent to cooling capacity of 21 trees!



INTERVIEW

with Peter Sanger, CEO & Co-Founder
Green City Solutions

What drives you at Green City Solutions?

Cities are undoubtedly the living space of the future. By 2030, two-thirds of all people are expected to live in cities. So for the majority of humanity to have a healthy and livable living and working environment, a lot has to happen in cities. On the one hand, cities are the main driver of global warming - more than 70 percent of all CO₂ emissions occur in cities. At the same time, urban areas are particularly vulnerable to the consequences of climate change. Bad air and heat accumulate here.

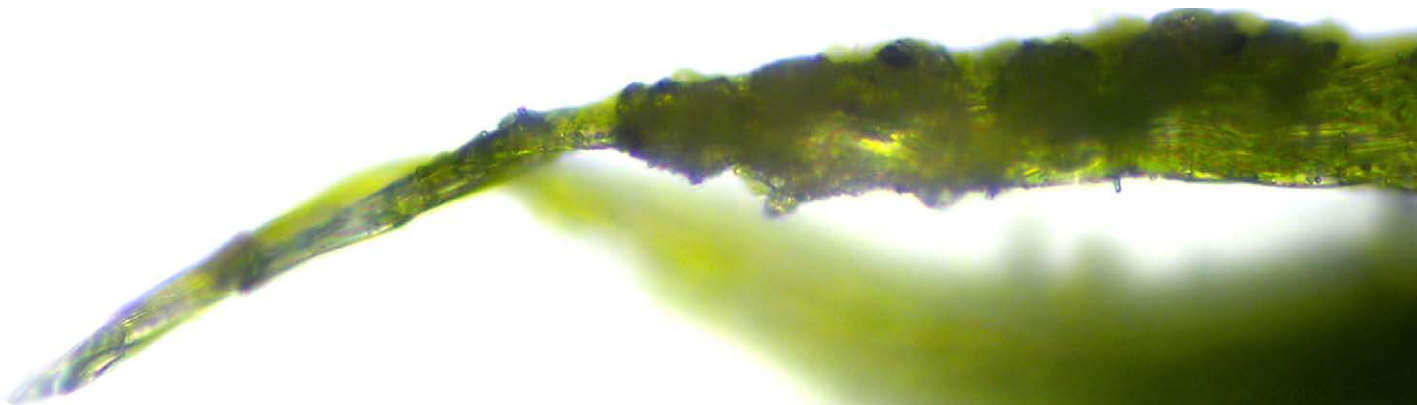
The predominant sealing of the ground makes it extremely difficult to use more greenery to capture emissions at the source. But it is not only new planting that is difficult in many places. Existing urban trees are also suffering enormously from the effects of climate change and are dying in rows. We want to be an alternative where classic greenery has a hard time. There, the very area-efficient moss in combination with our biofilters can ensure that air pollution in living and working spaces is specifically reduced and the damage to people and the climate is limited.

Moss in the city?

How is that supposed to work?

We find: Moss must go to town! Our core product is a moss filter. It is based on the idea of combining nature with digital technology to improve air quality. There is so much more to the natural plant moss than meets the eye! Mosses bind fine dust, some are antiseptic, antiviral and fungicidal; real all-rounders for air pollution control and health. With the interplay of sensors, intelligent ventilation, irrigation and software, we can enhance this natural cleaning performance and make it usable and measurable.

All our products are based on the idea of actively channeling warm and polluted urban air through purifying moss mats to cool and purify it. Smart Internet-of-Things technology controls the moss' water supply and measures environmental and air quality data. The mosses are able to bind and even metabolize fine dust, so our biofilters are sustainable and completely free of filter waste.





What solutions does Green City Solutions have to offer?

By 2030, we want to have brought 100,000 square meters of moss into the world's urban spaces, protecting 500 million people from air pollution and heat accumulation. To help achieve this ambitious goal, we're building a variety of urban pathways.

Starting with the CityTree. The largest and most powerful of our biofilters is also the one that started it all. Back in 2016, we installed a first version across Europe, but it has undergone enormous development in the meantime. The latest version of the CityTree can no longer be compared with its predecessor - both on the outside and in terms of what's inside.

The CityTree circulates 5,000 cubic meters of air per hour, the equivalent of 10,000 people breathing in the same amount of time. It is used on busy streets, market squares, schoolyards, but also in industrial halls. In combination with the bench, it creates a meeting zone in a forest atmosphere.

The second solution is the CityBreeze, an outdoor screen with a moss filter in the back. Since it sometimes takes a long time to get all the permits for installation in public spaces, we thought: It would be good to have a fast-track solution, as well. In cities, many locations are already set

Where does the moss used in the moss filters come from and how long does it last?

There are about 20,000 moss species all over the world, from the polar regions to the desert. Since we do not want to take the mosses out of nature, of course, and we are constantly striving to find better moss species and combinations for our purposes, we have set up the world's first vertical moss farm in Bestensee near Berlin. Here, mosses grow on roughly 1,200 square meters in the form of vertical moss mats.

In nature, mosses need about 4 years to grow to a dense surface, through special care we were able to shorten the time in our moss farm to 12 weeks. Once inserted into the moss filters, our special bio-algorithm ensures that the mosses are well taken care of. We work with natural and

aside for digital stelae. These are usually replaced after seven years. We think that's when an upgrade makes sense. Why not add value to the screen? The great thing is that out-of-home screens are used in places where a lot of people spend time. That's exactly where we want to clean the air.

The third solution is our facade module called WallBreeze. Without the need for costly retrofitting, it fits on any wall and is independent of wind conditions thanks to its ventilation system. This makes it more powerful and effective, in contrast to climbing plants, which are increasingly used on facades.

The same performance data applies to all three solutions: Up to 82% of the fine dust is cleaned by the moss while at the same time the ambient air is cooled down by about 4 Kelvin (°C).

sustainable filters that can regenerate themselves. However, as living organisms, mosses can lose their vitality due to stress or disease. In order to ensure high and consistent performance, we take care of their health and potential replacement. Rather than being destroyed, the moss mats are revitalized in the company's own moss farm and then put back to work.

With every day that the bio-algorithm learns, the endurance of the mosses increases. Once or twice a year, we check the biofilters on site to ensure smooth operation. If we are on site, then we have fresh moss in our luggage and give the inserted moss a breather.

IN USE ALL OVER EUROPE

In over 80 different projects throughout Europe, our biofilters cool and purify the air, providing relief to both humanity and nature on the spot. **Natural, sustainable & provable.**



Refratechnik Ceramics Melle | Germany



Berlin | Germany



Cork City | Ireland



Hampstead Hill School | England



Addinger München | Germany



City of Heiligenhaus | Germany



Das Marquardt Stuttgart | Germany



Allee-Center Leipzig | Germany

IMAGES

Under this [link](#) you will find a selection of images.

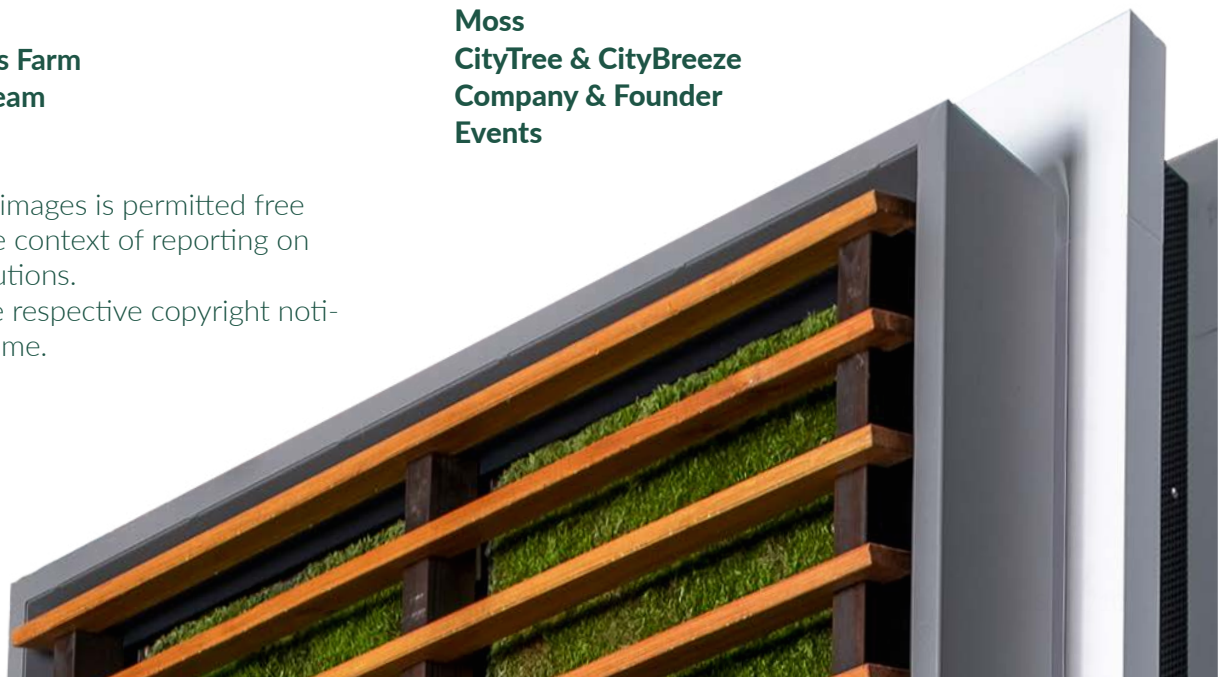
CityTree
CityBreeze
WallBreeze
Moss and Moss Farm
Founder and Team
Logo

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VIDEO FOOTAGE

In the [Green City Solutions YouTube channel](#) you will find numerous videos on different focus areas:

General
Moss
CityTree & CityBreeze
Company & Founder
Events



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**greencity
solutions**

Green City Solutions GmbH | Fernstrasse 27 | 15741 Bestensee | Germany
media@mygcs.de | +49 (0) 33763 222 144