

A close-up photograph of a human hand holding a dark, irregularly shaped piece of biochar. The hand is positioned in the lower half of the frame, with fingers slightly curled around the biochar. The background is a solid, deep purple color. The text is overlaid on the left side of the image.

# BRINGING BIOCHAR TO YOUR CITY LESSONS FROM THE STOCKHOLM BIOCHAR PROJECT

Bloomberg  
Philanthropies

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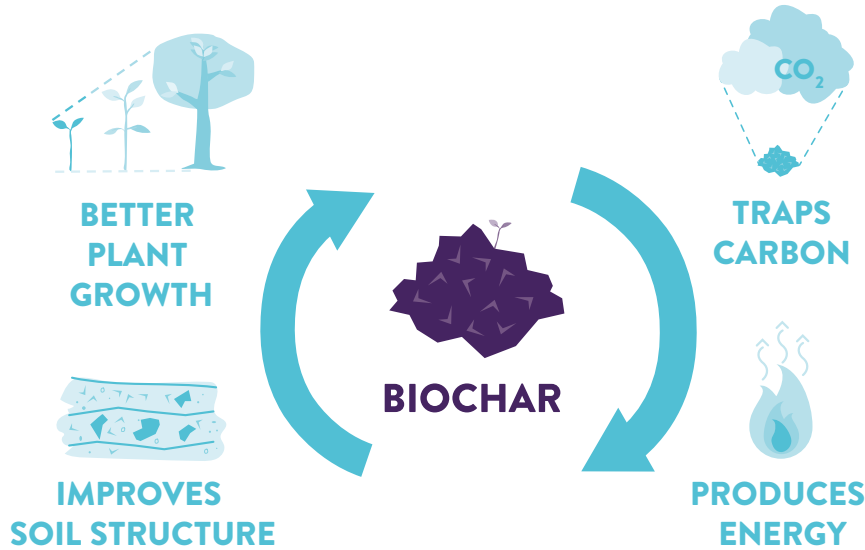
# INTRODUCTION

The Mayors Challenge encourages cities to generate bold new ideas that solve urban challenges and improve city life, as well as have the potential to spread. The competition invited hundreds of cities to define a serious problem and develop a bold, new idea to solve it.

In 2014 the city of Stockholm was one of five winners of the European Mayors Challenge, with their ambitious plan to engage citizens in the fight against climate change through converting plant waste in biochar. Stockholm is one of the few global cities that has made the ambitious commitment to become fossil fuel free by 2040 and carbon neutral by 2045. The biochar project will be the first city initiative to directly involve citizens in meeting this target.

Over the last three years the city has been developing the idea and preparing for implementation. The plant was delivered in October of 2016, and has been producing biochar since late February 2017.

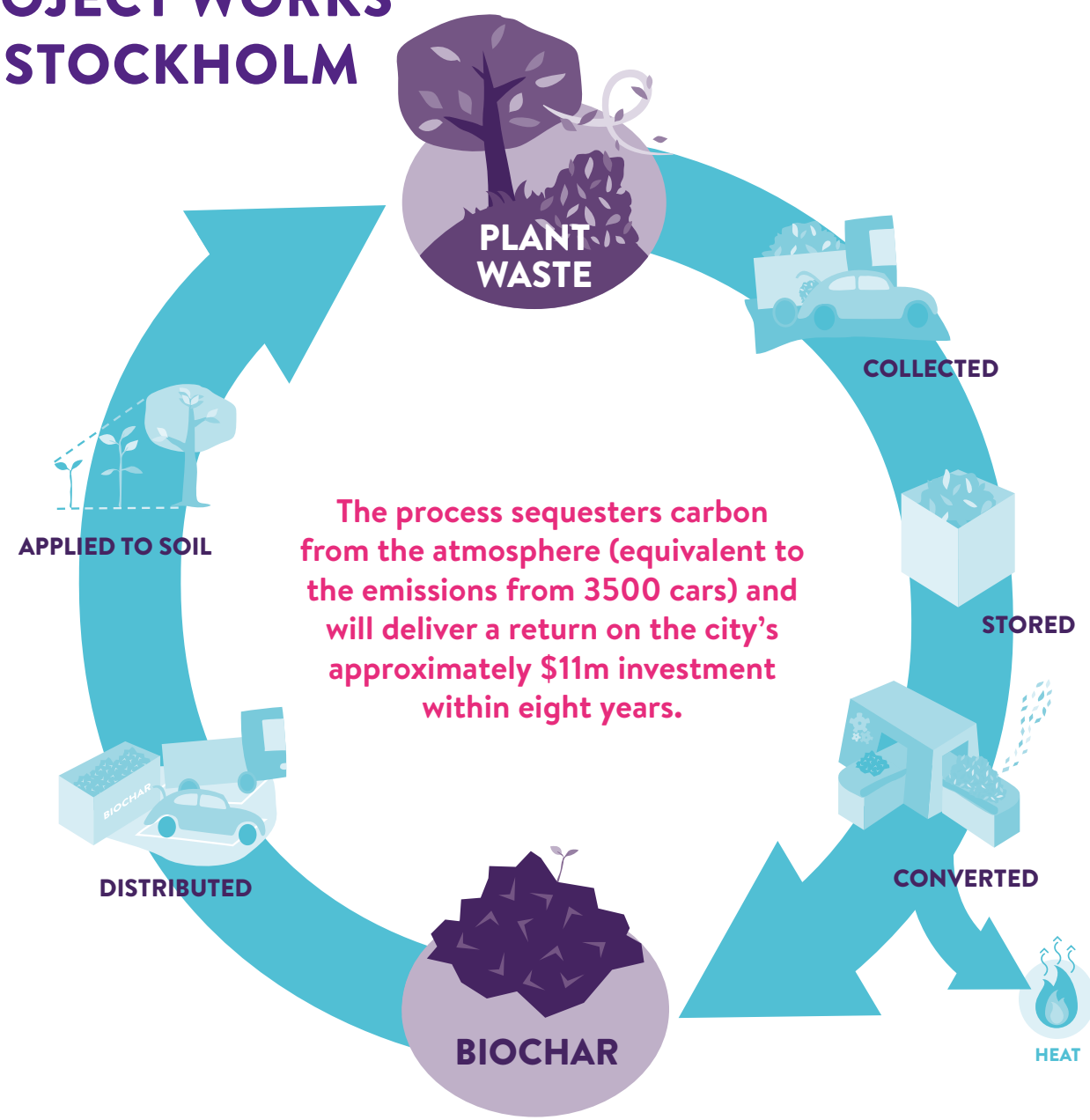
This booklet provides a resource for other cities who are interested in adopting their own biochar project. Drawing on Stockholm’s experience, it sets out the keys to the successful implementation of a biochar project in a city context.



Biochar is a charcoal-like substance that has multiple benefits:

- The biochar production process traps carbon that would otherwise be released into the atmosphere as carbon dioxide and produces heat that can be used as energy.
- When used in plant beds and fields, it improves the soil structure and stores nutrients that lead to better plant growth.

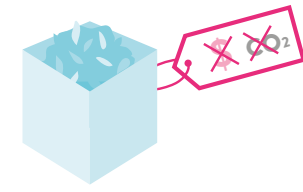
# HOW THE PROJECT WORKS IN STOCKHOLM



## COLLECTED

**NO ADDITIONAL FINANCIAL OR CARBON COST**

Both citizens and the city already deliver park and garden waste at a network of waste management centers across Stockholm.



## STORED

**NO ADDITIONAL FINANCIAL OR CARBON COST**

These waste management centers already have plant waste storage facilities.



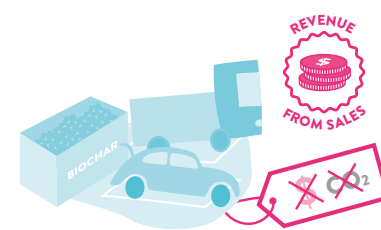
## CONVERTED

**HIGH ADDITIONAL FINANCIAL COST**

The project requires an upfront capital investment, both to purchase the plant and prepare the site. Plant waste also needs to be chipped before it can be used in the plant.

**NEW REVENUE**

As well as turning plant waste into biochar, the carbonization process produces heat which is sold into the grid in order to heat local homes.



## DISTRIBUTED

**NO ADDITIONAL FINANCIAL OR CARBON COST**

Citizens and city gardeners pick up biochar from waste management centers when they are dropping off their plant waste.

**NEW REVENUE**

Biochar is sold to the open market and to the city's traffic administration team (the department that manages the city's trees). It will be gifted to citizens.



## APPLIED TO SOIL

**NO ADDITIONAL FINANCIAL OR CARBON COST**

City gardeners and citizens apply biochar to their parks and gardens in the course of their regular activity.

**NEW CARBON SAVING**

When planted with trees or plants biochar increases growth while sequestering carbon dioxide from the atmosphere.



# KEYS TO SUCCESS WHEN REPLICATING THE BIOCHAR PROJECT

1. BEFORE YOU BEGIN
2. GETTING GOING
3. OPERATING THE PLANT
4. ENGAGING THE PUBLIC

## 1. BEFORE YOU BEGIN

### THINGS TO CONSIDER

A biochar plant is only worth investing in if there is a market for biochar in your city.

Do those people or organizations who stand to benefit from biochar (citizen gardeners, relevant city teams, farmers) know anything about it?

If they don't, then start by helping them to understand the potential benefits of biochar before committing to investing in a plant.

If there is demand, start by trying to understand how much they want and what it is going to be used for.

### In Stockholm...

The traffic administration takes care of all trees in the city and has been involved in the project from the start. Having used biochar with great success for a number of years, they had previously been purchasing biochar from elsewhere in Europe.

While over time the project team are keen to build demand among different groups, in particular citizen gardeners, the demand from traffic administration has helped to get the project off the ground.

## Your existing waste management infrastructure will dictate the kind of biochar project you invest in.

Does your city already collect and organize park and garden waste separate to other waste streams?

If it does not, then start by thinking about how you will collect and organize sufficient quantities of biomass to make investment in a plant worthwhile. Alternatively, you might choose to adopt a much more informal approach to biochar production at a smaller scale, using analog technology (The Page Trust in Mysore, India, is an interesting example).

## The development of a biochar project requires consistent, committed leadership.

Do you have someone with the passion and experience necessary to drive the development of a biochar project?

Do you have a wider group of senior stakeholders who can provide this person with the support and sponsorship they will need?

The passion and energy of your project manager will be crucial to overcoming the numerous barriers a biochar project will likely come up against. But no matter how fantastic your project manager, there will be moments when the intervention of supportive senior stakeholders will be key.

### In Stockholm...

The City of Stockholm has well established waste management facilities and processes. Biomass is stored in a network of waste management centers across the city, after being collected by the city, and dropped off by citizens. The city also has a district heating system which means that excess heat produced by the plant can easily be used to heat people's homes.

### In Stockholm...

The tireless commitment of Stockholm's project manager, Mattias Gustafsson, combined with his links into the international biochar community has been central to the development of the biochar project. Throughout, Mattias has been supported by a small group of senior stakeholders from across the city, who were first drawn together by their passion for biochar. The team has also drawn heavily on the sponsorship of Katarina Luhr, the City's Vice Mayor for the Environment.

The Stockholm team:



Kåre  
Gustaffson  
Stockholm  
Energy

Mattias  
Gustaffson  
Biochar Project  
Manager

Jonas Dahlöf  
Stockholm  
Waste and  
Water

Björn  
Embren  
Stockholm  
Traffic office

## 2. GETTING GOING

### THINGS TO CONSIDER

#### Choose your biochar plant based on what you already have and what you need.

Can you find a plant that is capable of processing the kind of biomass you collect, while producing the kind of biochar you need in order to satisfy your demand?

Different biomass will produce biochar with different properties. Choosing the right plant means finding the sweet spot between the kind of biomass you have available, and the kind of biochar you want to produce.

#### Finding a site for the biochar plant is more complicated than finding the plant itself.

Can you find a site that has plenty of potential biomass storage space, and good connections into the necessary utilities (electricity, water, gas)?

Can you find a site with easygoing neighbors who won't mind significant construction next to their land?

The more work you have to do to the site to get it ready, the more time it will take and the more money it will cost. Risk-averse neighbors (such as energy companies or airports) are likely to require significant reassurance that the work will not disrupt their own activities.

#### In Stockholm...

The city currently collects lots of different types of biomass from a wide variety of trees and plants. As a result they decided to go for a plant that was flexible enough to work with diverse material.

The traffic administration team is also happy to use the biochar that this slightly more generic process will produce.

#### In Stockholm...

Stockholm found a site on an existing waste storage facility, making it straightforward to transport and collect the biomass.

But the site needed a great deal of work in order to connect it into the necessary utilities and the local district heating system. It is also located directly under a power line that supplies much of the south of the city. The team managed the risk of potential damage to the power cable through the build by doing rigorous due diligence in advance, and conducting regular face-to-face meetings with the power company, which created delays in getting the construction work signed off and underway.





Don't underestimate the bureaucracy surrounding construction.

Are you clear about the permits you will need in order to begin the construction work or the operation of the plant?

You will likely need a series of permits that demonstrate compliance with city regulations, concerned with everything from business to environment (i.e. water and wastewater). The more neighbors you have the more permits you are likely to need.

New technologies require flexibility in procurement and contracting.

Can you find anyone in your organization with experience of procuring new technologies at this scale?

Can you work with all parties at the outset (including the manufacturer and the city's procurement team) to set expectations and brainstorm solutions to standard procurement questions?

City government procurement processes are ill-equipped to deal with new and innovative technologies that are often untested at scale. While you can't circumvent the process altogether, working alongside procurement teams to problem solve will help accelerate the process.

Preparing the site is complex, so prepare for the unexpected.

Do you have someone on the team who has experience of leading and managing complex construction projects?

Have you allowed flexibility and contingency in your timeframes and your budgets for when things slip?

While preparing the site is not a significant construction job in terms of scale, it is complex. It is impossible to predict all the things that might go wrong, but experience and good instincts can help to manage the risk and minimize additional cost.

In Stockholm...

The team in Stockholm had to apply for both environmental and building permits. This process didn't hold them up too much because they invested time in getting to know people in the relevant departments.

In Stockholm...

Companies that make biochar plants tend to be small startups or university spin-outs and can't necessarily guarantee that their technology will work at specific efficiency levels nor can they provide precedents for how the technology has worked in other cities. The city found it was difficult to find the time to negotiate a middle ground with the manufacturer.

In Stockholm...

The team commissioned an external consultant to support with the construction work at the site, but they were unable to give the project the time and attention it required. Because the consultant spent very little time at the site, or with the team, the construction took longer and put extra pressure on the project lead, who had little experience of managing complex builds.



### 3. OPERATING THE PLANT

#### THINGS TO CONSIDER

#### The time you to take to find and prepare your operational team will be time well spent.

Who will be responsible for the day to day operations of the plant? What do they need to know in order to operate the plant successfully?

Can you find an operational manager with experience of running innovative technology projects?

There will always be challenges when starting up an innovative piece of technology. The more experienced your operational manager, and the better prepared your operational team, the less likely these challenges will lead to significant delays.

#### In Stockholm...

The team managed to find an operational manager who combined relevant experience with a practical and pragmatic approach. This person was given two days of intensive training by the manufacturer, and then supported to share these lessons with the wider operational team, which was made up of existing staff at the waste management facility.

#### Routines are important, but are likely to change over time.

Can you work out a routine for the operational team to follow on a daily basis?

Is the team sufficiently well informed to be able modify this routine if needed?

The kinds of operational tasks you need to consider and plan around are: getting the biomass machine ready; loading the machine; cleaning the machine; processing and storing the biochar when it is ready; and disposing of any waste material.

#### In Stockholm...

Developed in partnership with the operational manager, the Stockholm routine is based on a seven day operating cycle - with six and a half days on, and half a day off for cleaning. This routine is being tested and iterated regularly through the first few months of operation.

#### Protecting the safety of staff is paramount, and takes work.

Have you met best practice health and safety standards?

Do you have sufficient safety equipment to protect all staff?

Health and safety best practices are complex and are likely to look different in every city. Make sure you take advice from someone who is familiar with your city's requirements.

#### In Stockholm...

In Stockholm, baseline health and safety practices include: a documented health and safety plan and standard operating procedures; worker safety training and follow up training; regular safety meetings for all staff; frequent audits and drills; regular checks to ensure all applicable building and fire codes are adhered to; keeping safety equipment well-maintained and in good working order.

#### Demand for biochar will change over time, so be prepared to adapt.

Are your routines and processes set up to flex as demand increases and/or drops over time?

For example, do you have enough safe biochar storage?

Biochar must be handled and stored properly to prevent the quality from diminishing, and to ensure safety (biochar is capable of self-ignition and to prevent this must be stored at a moisture content of at least 20%). You can also cool biochar with long conveyors to prevent this from happening. Your storage facilities need to be able to cope with an increase in production.

#### In Stockholm...

Stockholm's peak demand is in spring and fall, the point at which both citizen and city gardeners are most active. The team is developing routines that allow them to increase production during these times, while reducing it during quieter months.

#### How you package and distribute your biochar will affect its appeal.

Do you need to find different ways to package your biochar in order to satisfy the differing demands of your key audiences?

Can you find ways to distribute biochar to those that might not otherwise use it?

While city teams are likely to need large quantities of biochar, citizens will need much less. While keen gardeners are likely to go out of their way to collect biochar, others might need more encouragement. Finding ways to distribute biochar directly to citizens can help to encourage participation in the scheme.

#### In Stockholm...

The City's traffic administration uses large quantities of biochar (packaged in big bags) and will collect this directly from the waste management facility. Keen gardeners who already drop off their garden waste will be able to pick up smaller bags at the same time. Over time, the team hope to find ways to distribute the biochar directly to less enthusiastic gardeners.



# 4. ENGAGING THE PUBLIC

## THINGS TO CONSIDER

### Biochar has many benefits for many people.

Are you clear on your audiences?

Have you refined your messages about biochar and its benefits to appeal to these audiences?

Certain stakeholder groups are likely to be attracted to biochar - gardeners (good and bad!) who care about improving their gardens or allotments, and with people who care about rates of CO<sub>2</sub> in the atmosphere or the sustainability of our energy system. Each of these groups will be attracted to a different set of benefits and your messages need to highlight these.

### In Stockholm...

The urban gardening movement in Stockholm is well established; from people living in city center apartments who keep well tended plant boxes, to keen gardeners who rent one of the large number of allotment spaces across the city. This is where the city has chosen to focus its activity.

### Early adopters make excellent biochar champions.

Do you know who your early users or adopters of biochar are likely to be?

Can you use their enthusiasm to help bring others on board?

While the benefits of biochar are significant, they are not widely known. Early adopters are those who are likely to be immediately interested in using biochar, for example enthusiastic citizen gardeners. Their enthusiasm can be powerful in making the case for biochar with other audiences.

### In Stockholm...

The team decided to start by targeting allotment owners, who are enthusiastic gardeners who will try anything if it promises to improve their gardens. They ran a competition in a small number of allotments, asking gardeners to use biochar for a period of time and measure the impact.

## There are lots of ways for people to engage with biochar.

- Are there any institutions or events in your city that are likely to be interested in biochar that you might partner with?
- Can you identify moments in your implementation journey during which your key audiences can engage with the project?
- While it is important to target your early adopters, your project will also present lots of opportunities to engage a broader cross section of the public.

### In Stockholm...

The team has partnered with one of the largest museums in Stockholm, hosting a show over two consecutive weekends focused on introducing visitors to biochar and the project as a whole. As well as a public launch focused primarily on politicians and journalists, study visits and lectures, the team is also hosting 'open days' during which citizens dropping off their garden waste can come and see the plant in action and ask questions.

# IF YOU WANT TO FIND OUT MORE



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