

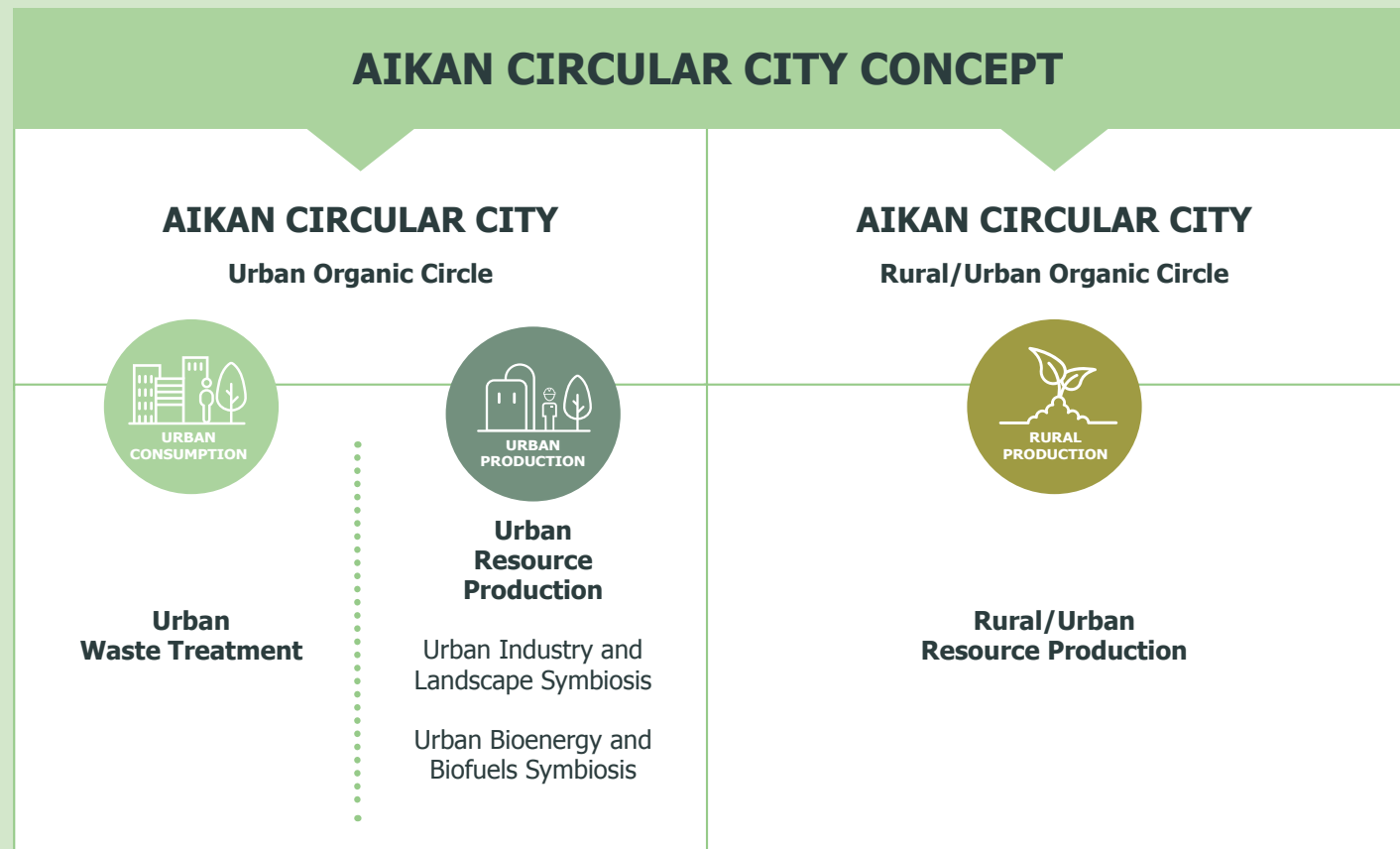
# **AIKAN** **CIRCULAR** **CITY CONCEPT**

**City-integrated biogas and  
composting plant of tomorrow**

**IMAGINE** LIVING IN A CITY IN WHICH YOU CAN SEE **DAY BY DAY** THAT YOU CONTRIBUTE TO PRESERVING **NATURE, CLIMATE, AND ENVIRONMENT**.  
 ... THAT CITY IS REAL. WITH THE AIKAN CIRCULAR CITY CONCEPT.

**AIKAN CIRCULAR CITY CONCEPT**

is the fully circular city-integrated biowaste solution. Here, the city's biological resource is utilised to the optimum in a closed circle.



## 1

## GREEN FRONTRUNNER CITIES

Cities and urban communities of tomorrow increasingly demand green waste and resource solutions for organic waste treatment and resource utilisation.

Six megatrends are accelerating this development.



### 1. Growing world population and consumption

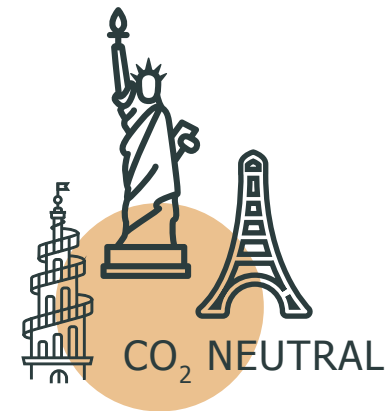
Already as it is, the Earth's resources are consumed at a rate at which neither climate nor ecosystems can cope. Developments are enhanced by expectations that world population will increase from 7 to 10 billion up to 2050 – along with the positive trend that more people move away from poverty and up into the middle classes.

These developments increase the pressure for a significantly higher and more sustainable resource utilisation in all spheres of our production and consumption, including better cohesion between rural production and urban consumption of food.

### 2. Exploding urbanisation

The world's cities and conurbations are seeing rapid growth, and this trend will continue in the coming years – both when it comes to population and economic growth. According to the International Organization for Migration (IOM), the number of people living in an urban area is expected to increase from 3.9 billion in 2016 to 6.4 billion in 2050. This means that two of three people in 2050 will live in an urban area. The definition of an urban area differs from one country to another, but according to IOM the minimum limit in most countries is between 1,000 and 5,000 inhabitants.

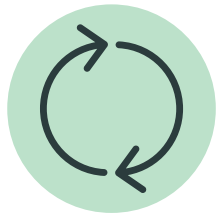
This urbanisation creates more megacities – cities with more than 10 million inhabitants. In 1990 there were ten megacities in the world – today we have 29. The UN expects this figure in 2030 to be as high as 41.



### 3. Smarter, greener, and CO<sub>2</sub> neutral metropolises

Cities are frontrunners in the transition from black to green transition to the benefit of the citizens and users of the city – and of environment and nature. Today, metropolises across the world, have set higher and earlier climate and environment targets than what is requested by states and supranational agreements. For example, Copenhagen has a target of being CO<sub>2</sub> neutral already by 2025. New York wishes to reduce its CO<sub>2</sub> emissions by 80 % in 2050, while cities like Paris and London have set up similar ambitious targets. All major cities (+100,000 inhabitants) in principle need to integrate green waste solutions in the city's waste management, operation, and production in order to attain the agreed green targets.

# 1



#### 4. Circular cities of tomorrow

Circular economy is a way of ensuring better management of the Earth's resources, and along with it businesses get new economic opportunities by developing, for instance, new business models.

Quite simply, circular economy is about keeping materials and products in the economic circle with the highest possible value as long as possible. Circular economy disrupts the concept where we have a linear value chain beginning with the extraction of resources and ending with waste generation.

Cities play a pivotal role in the circular economy, when it comes to realising the vision in practice and to creating green growth in the form of new industries and workplaces, better quality of life, sustainable urban development, climate adaptation, etc.



#### 5. Better cohesion between country and city

In the future organic circle, nutrients and biomass will return to the biological system and primary production. Here, the cities play a decisive role, since the major part of consumption of food – and thereby also the major part of waste generation – takes place here.

At the same time, vital resources are recycled back to the country from the city, including phosphorus. Phosphorus is on the EU list of critical raw materials: it is a scarce resource, and only few occurrences are known.



#### 6. Sorting of food waste all over EU

As part of the EU action plan for circular economy the EU Council of Ministers and the EU Parliament entered in December 2017 a political agreement on a number of binding, enhanced targets and initiatives in the field of waste and resources. The agreement commits, among other things, EU Member States to ensuring separate collection of food waste no later than in 2023.

## 2

# AIKAN IS THE SOLUTION FOR CITIES' INCREASING DEMANDS

With the AIKAN technology Solum Gruppen / Biovækst meet the cities' increasing demand for green waste solutions and the megatrends accelerating them - thanks to the AIKAN CIRCULAR CITY CONCEPT.

The AIKAN technology is unique; it is a plant platform that is designed to optimising utilisation of resources contained in organic waste and producing biobased products in the form of methane and nutrient-rich compost products for use in metropolises and conurbations all over the world.

**AIKAN CIRCULAR CITY CONCEPT** is the connecting link between urban consumption and urban production AND the connecting link between country and city. The AIKAN technology, in a essence, is closing the organic circle.

We call the connecting link between urban consumption and urban production AIKAN CIRCULAR CITY Urban Organic Circle, and the connecting link between country and city we call AIKAN CIRCULAR CITY Rural/Urban Organic Circle.

**AIKAN CIRCULAR CITY CONCEPT** is the fully circular city-integrated solution in which the biological resource is utilised to the optimum in a closed circle.



# 2.1

## CIRCULAR ECONOMY IN THE CITY

### AIKAN CIRCULAR CITY Urban Organic Circle

AIKAN CIRCULAR CITY Urban Organic Circle integrates waste management in the city with the production in and around the city.

We call waste treatment in the city Urban Waste Treatment. On the basis of food waste and garden/park waste in the city AIKAN produces methane and nutrient-rich compost for use directly in urban production: we call it Urban Resource Production.

In the AIKAN Urban Resource Production the two resource components of methane and nutrient-rich compost can each enter different symbioses:

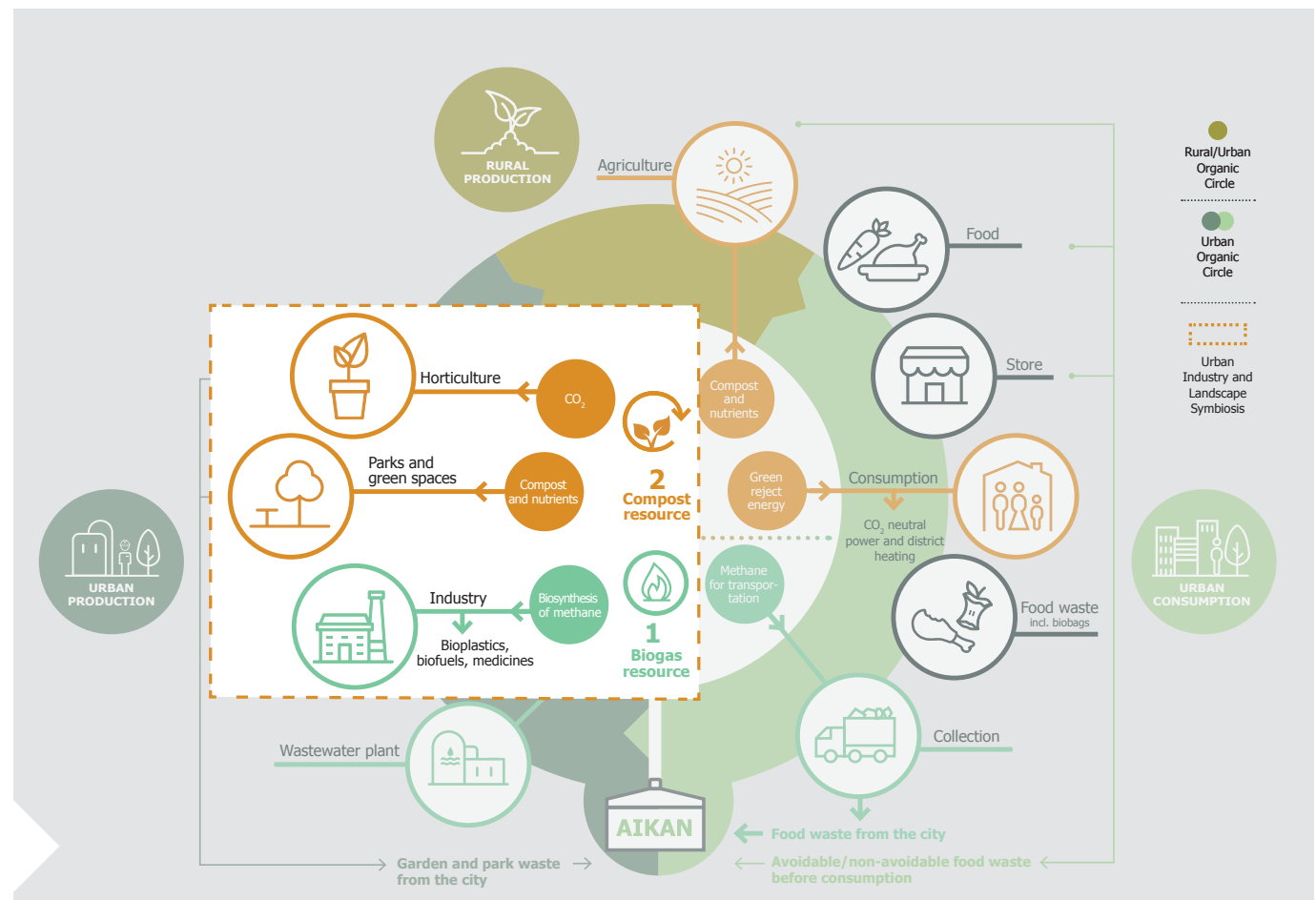
- Symbioses relating to the creation of new products and foods in and around the city: we call it Urban Industry and Landscape Symbiosis.
- Symbioses relating to the contribution to sustainable supply to the city's residents, businesses, and transportation: we call it Urban Bioenergy and Biofuels Symbiosis.

#### URBAN INDUSTRY AND LANDSCAPE SYMBIOSIS

Compost and nutrients for use in the city's parks, in green spaces, and sports facilities.

Methane for use in biosynthesis for industrial production of bioplastics, biofuels, medicines, etc.

Byproducts in the form of CO<sub>2</sub> from the composting process as a growth agent in urban horticulture near the AIKAN plant.



# 2.1

Products from the AIKAN process can be used in the city's industry and food production, in the green spaces and facilities of the city, and they can be used in the utility system of the city in the form of methane-based biofuels for use in heavy transportation as well as a CO<sub>2</sub> neutral biofuel in the form of rejects from the compost production.

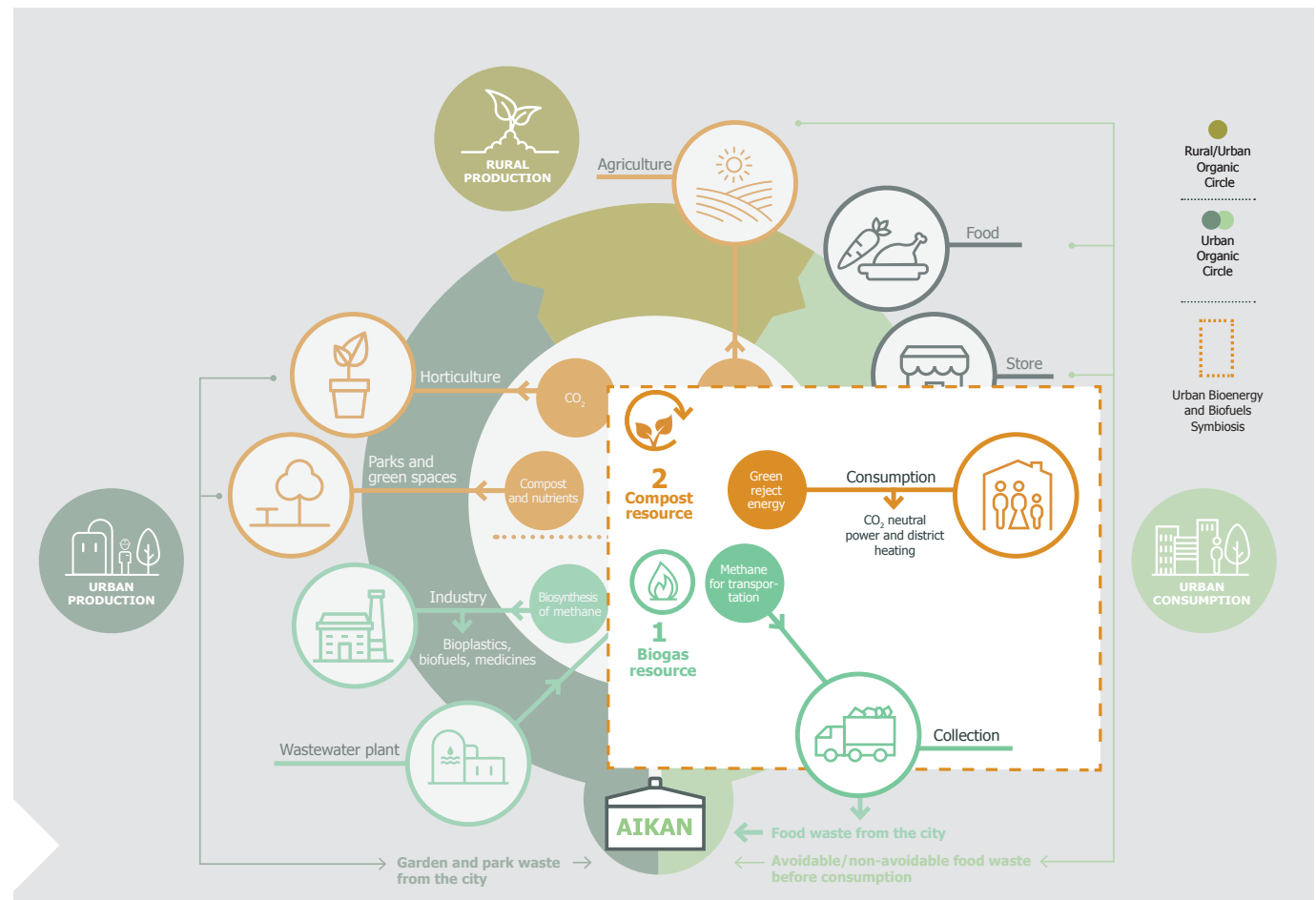
Citizens can thus first-hand see and feel that their efforts in segregation of food waste are of direct benefit. By using resources in local production such as horticulture, biorefining, the pharmaceutical and bioplastics industries, those resources from the city add value both in terms of the environment and economy.

By using a two-string symbiosis strategy neither product nor byproduct from the AIKAN process is wasted: all resources contained in the waste are used locally.

## URBAN BIOENERGY AND BIOFUELS SYMBIOSIS

Biogas for heavy transportation, such as food waste collection vehicles.

Green reject from compost production for energy in the form of CO<sub>2</sub> neutral power and district heating.



# 2.2

## CIRCULAR ECONOMY BETWEEN COUNTRY AND CITY

### AIKAN CIRCULAR CITY Rural/Urban Organic Circle

Just as the compost and nutrient resource can enter the city's production in the form of operation, maintenance, and development of green facilities and spaces, this component can also be used as a fertilizer and for area development in agriculture and food production outside the city.

We call this symbiosis Rural/Urban Resource Production. With the contribution from nutrient-rich compost for new food production a circle is formed between food produced for and consumed in the city, before ending its life with collection and waste treatment in the city at the AIKAN plant.

The methane produced can be used in the form of methane-based biofuel in heavy transportation outside the city, for instance in agriculture and in food production.

AIKAN Rural/Urban Resource Production thus initiates a symbiosis between consumption and waste generation in the city and food production outside the city; this results in the country and the city having better cohesion in a resource-preserving circular bioeconomy. In brief: from farm to fork and back to farm.

#### RURAL/URBAN RESOURCE PRODUCTION SYMBIOSIS

Compost and nutrients for use in agriculture.

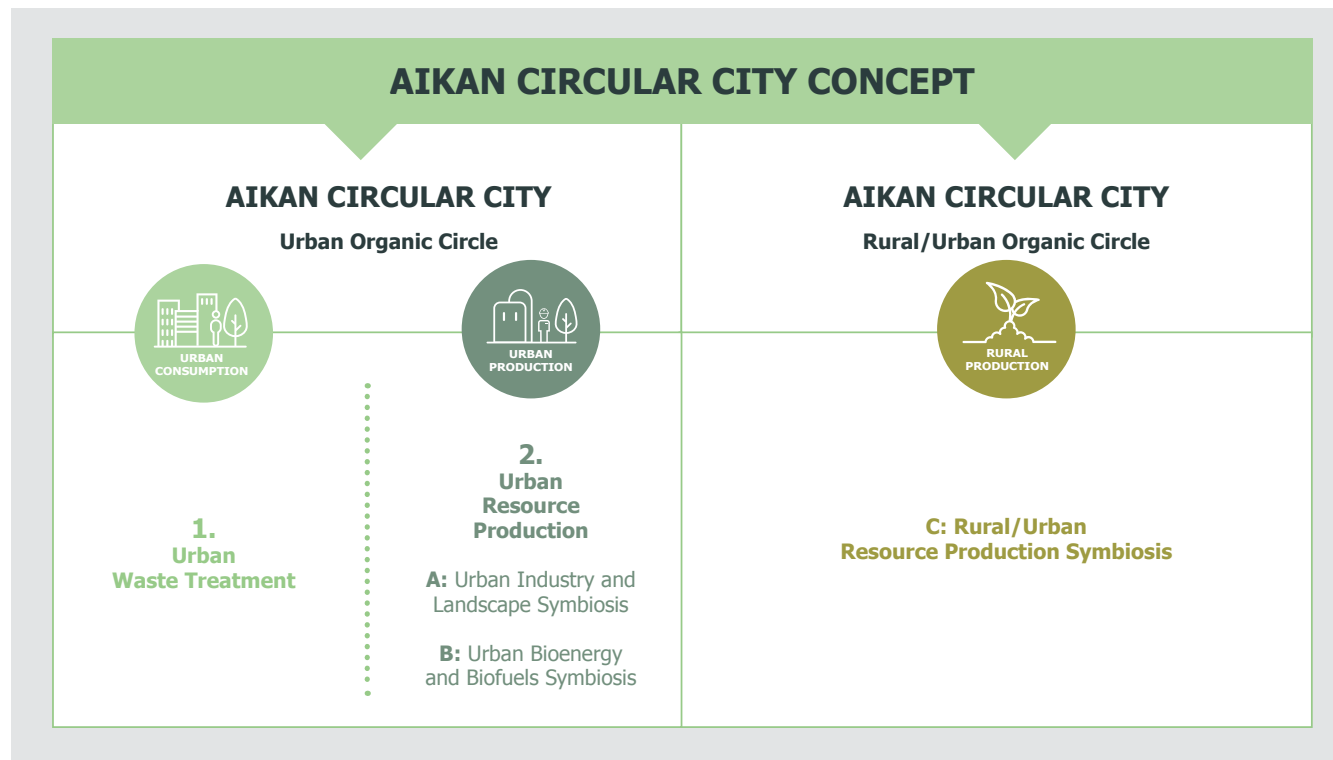
Biogas for heavy transportation, such as agricultural machinery or trucks for the transportation of food from country to city.





## 3

## OVERVIEW



## 2. AIKAN CIRCULAR CITY Resource Production

*A: Urban Industry and Landscape Symbiosis*

- Compost and nutrients for use in the city's parks, in green spaces, and sports facilities.
- Methane for use in biosynthesis for industrial production of bioplastics, biofuels, medicines, etc.
- Byproducts in the form of CO<sub>2</sub> from the composting process as a growth agent in urban horticulture near the AIKAN plant.

*B: Urban Bioenergy and Biofuels Symbiosis*

- Biogas for heavy transportation, such as food waste collection vehicles.
- Green reject from compost production for energy in the form of CO<sub>2</sub> neutral power and district heating.

**AIKAN CIRCULAR CITY RURAL/URBAN ORGANIC CIRCLE**

## AIKAN CIRCULAR CITY Rural/Urban Resource Production

*C: Rural/Urban Resource Production Symbiosis:*

- Compost and nutrients for use in agriculture.
- Biogas for heavy transportation, such as agricultural machinery or trucks for the transportation of food from country to city.

**URBAN & RURAL/URBAN ORGANIC CIRCLE****1. AIKAN CIRCULAR CITY Urban Waste treatment**

- Food waste from citizens, shops and supermarkets, restaurants, canteens, and cafés - incl. biobags that decompose entirely in the AIKAN plant waste treatment.
- Garden and park waste from the city's public and private green spaces.
- Food waste from the city's food producing industries, large-scale kitchens, slaughterhouses, etc.

## 4

## DANISH TECHNOLOGY – FIFTEEN YEARS OF EXPERIENCE

The Danish developed AIKAN system combines biogasification and composting of organic waste. This means that it is possible - in one and the same system - to recover methane from the waste and to produce a compost.

In the AIKAN system, waste is treated in separate modules. Therefore, the plant can treat different waste type concurrently and independently. In addition, the treatment can be adjusted to needs for more methane yield (biogasification) or shortest possible processing time (composting).

### Protection of immediate surroundings

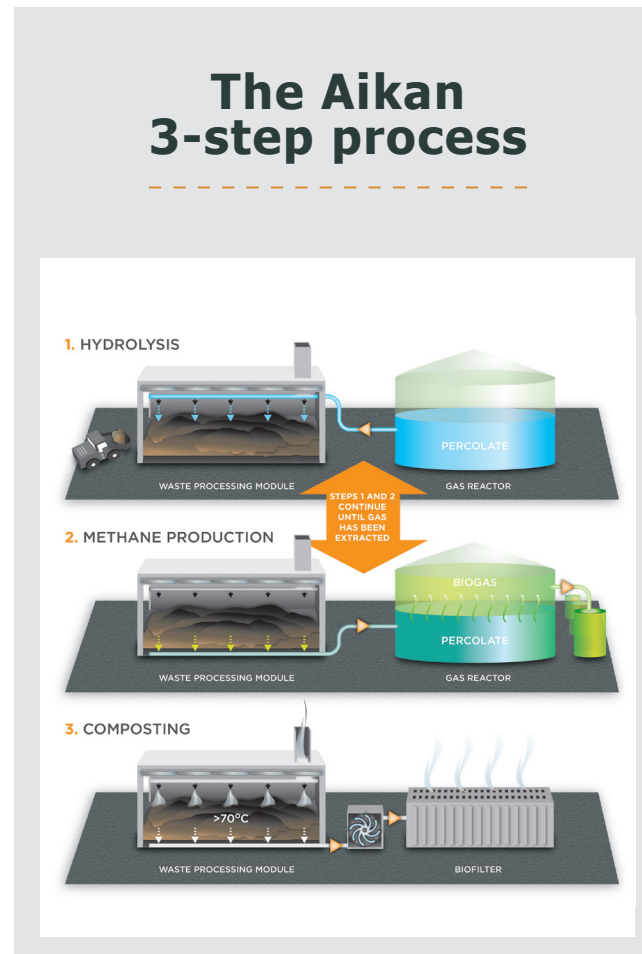
Since most of the process takes place in a closed system, contact with the surroundings is limited, mitigating thereby also any potential odour nuisance.

Waste is not moved about during treatment. Only liquids, so-called leachate, are conveyed in robust pumps. Thanks to this concept, the AIKAN system is very reliable.

### Proven and flexible technology

In Denmark, an AIKAN plant is in operation near the city of Holbæk; for the past 15 years it has treated biowaste in the form of food waste and garden/park waste from several municipalities on the island of Zealand.

Furthermore, the AIKAN technology has been chosen for treatment of biowaste at an AIKAN plant in Connecticut, USA, and in Iceland: in Reykjavik an AIKAN plant is being established for the management of urban organic waste.



The AIKAN plant can recycle all organic food waste

Including:



**BIOPLASTIC BAGS,** WHICH ARE SEGREGATED IN OTHER PLANTS

**PIZZA BOXES,** WHICH WOULD OTHERWISE BE INCINERATED



**WASTE PAPER FROM THE KITCHEN,** SUCH AS COFFEE FILTERS, TEA BAGS, AND TISSUE PAPER



**POTTED PLANTS AND MULCH**



## PARTNER TO ELLEN MACARTHUR FOUNDATION

AIKAN has been admitted to the Ellen MacArthur Foundations Emerging Innovators programme C100. Thereby, the AIKAN technology is part of a global community and cooperation forum for circular economy that counts cutting-edge businesses, metropolises, and states taking together the lead in the transition from a linear to a circular economy.



### AIKAN CIRCULAR CITY CONCEPT is a part of:

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