

## Introduction

The purpose of realizing the SBRS concept is to offer people all over the world a good life / wellbeing in clean air, as well as access to clean water, healthy food and locally produced electricity and heating / cooling by using in a sustainable way Renewable Organic Material (ROM) in residues and waste since its value is currently neglected.

**ROM** is anything that is based on photosynthesis, i.e., all material derived from plants, animals, and microorganisms. ROM contains the sun's radiant energy which is converted and stored during photosynthesis as **bioenergy** and at least the following **chemical elements** are essential for most higher plants: carbon (C), oxygen (O), hydrogen (H) nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), sulfur (S), magnesium (Mg), manganese (Mn), boron (B), iron (Fe), copper (Cu), chlorine (Cl), zinc (Zn) and molybdenum (Mo).

The bioenergy of plants and essential chemical elements are used by organisms - including humans - in food chains and thus **photosynthesis is the basis for circular bioeconomy**.

With SBRS concept, bioenergy and the essential chemical elements will be by methane fermentation/anaerobic digestion transformed to biogas and biofertilizer as well as grey water will be purified by biological method. With advanced technology, biological transformation will be carried out in decentralized systems, which enables a transition to a sustainable management of ROM in residual products and waste.

**SBRS concepts is flexible and will be able to be adapted to the requirements in all city districts, in all villages, on agricultural companies and other companies that produce ROM in residual products and / or in waste.**

## Background

According to the three dimensions of sustainability, treatment of ROM in residues and waste with current methods in waste management and sewage systems is unsustainable and can be assessed as follows:

### *Ecological dimension*

Under methods that use thermal and chemical conversion processes - such as combustion, thermal gasification, pyrolysis, esterification, etc. - and in sewage treatment plants

- all organisms that live on and in ROM are killed, which has a negative effect on biodiversity
- emissions are created that cause air and water pollution and polluted air with the rain pollutes the soil and crops
- toxic ash and sludge containing environmentally hazardous substances contaminate the soil and groundwater where they are deposited.

### *Economic dimension*

Pollutants are at the same time costly losses of bioenergy and the chemical elements important for photosynthesis that should be returned to cultivated land to ensure sustainable harvests.

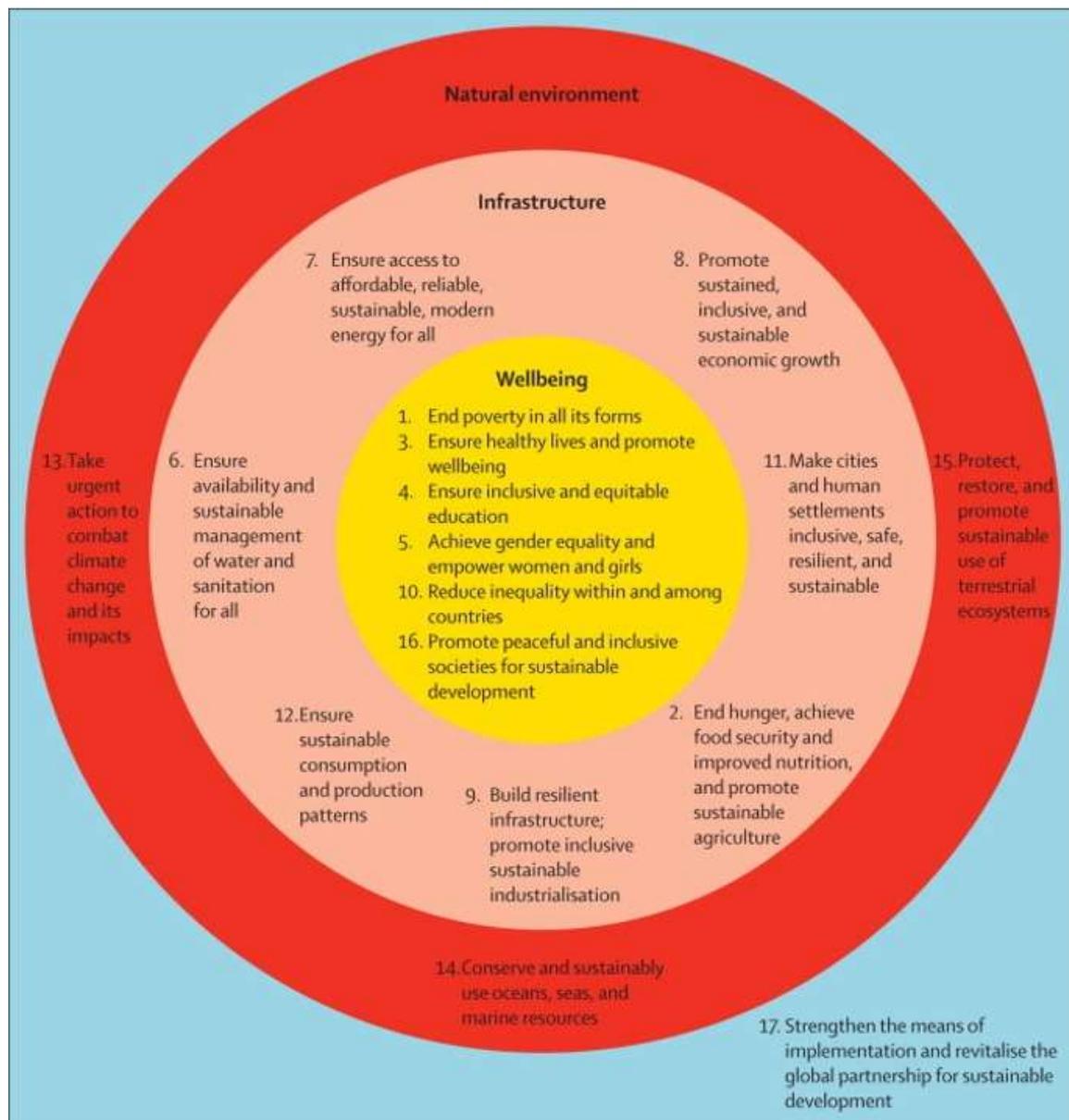
Unfortunately, soil degradation continues as recycling is lacking and growers must use

expensive synthetic agricultural chemicals instead of recycled biofertilizers. Both waste and sewage systems use synthetic chemicals and energy-intensive methods that are very costly for individuals and for society when pollutants and synthetic chemicals negatively affect the environment, health, and climate.

### *Social dimension*

The working environment for people in systems that handle ROM in residues and waste is unhygienic and leads to an increase in diseases, which is harmful to both individuals and society.

### Sustainable holistic approach



Source: Governing the UN Sustainable Development Goals: interactions, infrastructures, and institutions. Waage, Jeff et al. *The Lancet Global Health*, Volume 3, Issue 5, e251 - e252.

**This figure illustrates an analysis of the intersections between the SDGs.**

A proposal for the project for collaboration on the SBRS concept that promotes circular bioeconomy - the economy of life. <http://biotransform.eu/wp-content/uploads/2021/10/A-proposal-for-the-project-for-collaboration-on-the-SBRS-concept-RS-2021-10-03.pdf>.

SBRS concept is also described on <http://biotransform.eu/wp-content/uploads/2021/05/SBRS-Copy-of-application-2021-RS.pdf>.

Some simple pictures that show how the SBRS concept will work are shown on <http://biotransform.eu/wp-content/uploads/2021/10/From-Photosynthesis-to-Photosynthesis-according-to-SBRS-concept-2021-05-RS.pdf>

Methane fermentation in biogas plants is a known process but needs **radical upgrading to minimize losses, improve the working environment and increase yield / profitability**. Biological purification of greywater is a method that is already used in greenhouse companies and in crayfish farming but needs to be further developed.

Completely new in the SBRS concept is the collection of food and toilet waste as well as digitized logistics. Prototype of collection toilet - which encapsulates material after each toilet visit in foil of biomaterial - is available. It is called Collecting Closet BAS (CC BAS) and will be further developed. Food waste can be collected in a similar way as toilet waste in Collecting Food Waste BAS (CFW BAS).

SBRS concept is a proposal for conversion to a sustainable management of ROM in residual products and waste in decentralized systems that can be adapted to the needs in all parts of cities, in all villages and can be built at agricultural companies and other companies that produce ROM in residual products and / or waste.

According to the three dimensions of sustainability, treatment of ROM in residues and waste with the SBRS concept gives the following results:

### *Ecological dimension*

In SBRS concept the biological conversion process "methane fermentation" requires

- hygienic and easy-to-use devices for collecting food and toilet waste to avoid polluting emissions
- precision for pre-treatment and for the design of substrates for methane fermentation using the Optimum Solids Anaerobic Digestion (OSAD) method will be carried out in advanced bioreactors to avoid polluting losses
- digitized logistics for ROM to avoid losses of bioenergy and for life essential chemical elements during collection and transport.

Biological transformation processes in the settlements' "microgrids" avoid pollution when

- methane fermentation of substrates consisting of food and toilet waste mixed with plant material and ROM in household waste takes place in local high-tech biogas plants **without polluting air and water**
- biological treatment of gray water from settlements replaces purification processes in central wastewater treatment plants that use large amounts of chemicals, pollute air and create problems with sewage sludge.

Biological conversion process "biological purification of gray water" requires local plant to

- avoid losses of water
- cooperation with residents to avoid synthetic chemicals and other substances disrupting biological processes in gray water thus less harmful chemical will be used.

Wastewater from industries and companies with special pollutants must be taken care of by the companies.

### *Economic dimension*

Adaptation to the SBRS concept will be costly during construction, but both residents and society will receive long-term benefits in the form of

- the biogas energy which in microgrids replaces some of the electricity and energy for heating / cooling
- digestate that is processed into different types of biofertilizer to suit the needs of different crops and thus there is no need to import most of the synthetic fertilizers and pesticides.
- cultivated land increases fertility and thus cultivations become more sustainable
- land degradation is slowed down with recycled biofertilizer
- fewer synthetic chemicals in society reduce costs for imports and costs for environmental problems, human health and for negative climate effects.

### *Social dimension*

The working environment for all people will be hygienic and everyone will get a decent job that contributes to increased cohesion that leads to increased focus on avoiding environmental degradation and negative climate impact.

## **To compare two methods of biological conversion of ROM**

Method that uses anaerobic conversion is **methane fermentation** / anaerobic digestion. Two valuable products and minimization of polluting losses can be obtained with a radical improvement of equipment for

- methane fermentation in substrates adapted to microorganisms
- handling of ROM before methane fermentation
- energy efficient use of biogas
- proper treatment of digestate for biofertilizer adapted to the crops and the cultivated lands to minimize losses and maximize harvests.

What results can be achieved with improvements and with some innovations are described in two examples:

1. Biogas and biofertilizer from a ton of raw material. <http://biotransform.eu/wp-content/uploads/2015/03/Biogas-and-biofertilizer-from-a-ton-of-raw-material.pdf>.

2. Scenario for a city. <http://biotransform.eu/wp-content/uploads/2015/03/Scenario-for-a-city.pdf>.

The most used method is still **composting** under aerobic conditions.

Unfortunately, composting is an unsustainable method. Most composting strategies result in about 30% compost "of uncertain quality" of the raw material used. This means that 70% are losses that pollute. During composting, bioenergy is released in the form of carbon dioxide and water. Nitrogen and sulfur compounds etc. are released into the air. With leachate, several plant nutrients disappear, which when composting food waste in different drums are diluted to manure water.

In experiments performed with composting in bioreactors in the laboratory, the result was 85% product in less than two weeks. It sounds fantastic but the method is very expensive, and the fertilization effect is small because most of the product are energy-rich compounds of biologically bound carbon.

It is logical when dry matter in mixed plant material consists of 96% by weight of carbon, oxygen and hydrogen which represent bioenergy. The 13 essential plant nutrients represent only 4% according to the table published by Professor Sune Petersson (available on page 4 in a document on <http://biotransform.eu/wp-content/uploads/2017/10/L%C3%B6nsamhet-p%C3%A5-r%C3%A4tt-s%C3%A4tt-H%C3%A5llbar-hantering-av-F%C3%B6rnybart-Organiskt-Material-i-avfall-och-avlopp-RS-2020.pdf>).

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## Estimation of CAPEX and OPEX

### Capital expenditures

Material cost for the upgrading/development of all parts of the SBRS concept to present a complete demonstration facility built on a farm is estimated at 2 million euros.

**Operating expenses** include rent, equipment, inventory costs, marketing, payroll, insurance, step costs, and funds allocated for research and development.

Work must be completed in 3 years and the annual cost is estimated at 1 million euro per year.

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Everyone is welcome to comment on a vision for 2040.

By 2040, the air and water are clean, food is healthy, and weapons are banned.

<http://biotransform.eu/wp-content/uploads/2021/10/By-2040-the-air-and-water-are-clean-food-is-healthy-and-weapons-are-banned-RS-2021.pdf>.