During COP27, who can address “Sustainable Recycling of Plant Nutrients” and “Sustainable Utilization of Bioenergy”?

To brave people at COP27

As a retiree who had the opportunity to research the recycling of plant nutrients, I am concerned about development throughout the world. There is a lot of talk about greenhouse gases, but not a word about how much pollution and costly losses occur when renewable organic material is managed in waste and wastewater using unsustainable methods. Soil degradation continues.

To avoid world starvation, the chemical elements that plants need during photosynthesis must be managed in a sustainable way. Everyone knows that plants get carbon (C), oxygen (O) and hydrogen (H) from carbon dioxide (CO_2) and water (H_2O). Less known is that at least 14 chemical elements (N, P, K, Ca, Mg, S, Cl, Fe, B, Mn, Zn, Cu, Mo, Ni) must be present near plant roots.

All chemical elements essential for life are stored during photosynthesis in plant biomass with the help of the sun's radiant energy, which is converted into bioenergy, and which is also stored in plant biomass.

How much bioenergy is stored annually in vegetation on land and in water?

Can bioenergy be used in an ecologically, economically, and socially sustainable way when there is a lack of a scientifically supported definition?

Humans and most living organisms are made up of the mentioned chemical elements and need bioenergy from plant biomass to live. The plants are called Primary Producers without which human life is impossible.

Who invests in securing food by reorganizing the handling of renewable organic material in waste and sewage, i.e. all material that comes from the plant and animal kingdom?

Worldwide, less than 2% of plant nutrients are returned to cultivated land, according to the Ellen MacArthur Foundation. That the 98% pollute air and water and thus everything around us rarely comes up. Likewise, it is silent about energy-intensive, polluting and for citizens costly methods used to waste plant nutrients and bioenergy contained in renewable organic material.

Many in the EU are now paying attention to the problem of lack of nitrogen because nitrogen-containing mineral fertilizers are either imported or produced from the nitrogen in the air with the help of fossil gas and with an energy-intensive method. It is estimated that between 1-2% of all energy in the world is used for this process.

Can we afford to waste nitrogen?

The problem that is not talked about is that during the treatment of wastewater, more than 50% of nitrogen is expelled into the air during so-called nitrogen reduction with an energy-consuming method. When burning waste and in cogeneration plants, all nitrogen is released into the air as nitrogen oxides (NO, N_2O).

In the US, nitrogen reduction in wastewater treatment plants costs an average of $140 per pound of nitrogen, which is about 300 euros per kilogram of nitrogen. Is this sustainable?

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Just as toilet waste, 1,000 people leave 4.5 tons of nitrogen per year in wastewater. Some nitrogen already leaves wastewater on the way to the wastewater treatment plant, more than half is expelled into the air during nitrogen reduction when a few percent become nitrous oxide (N2O), around 15% is released into the water system with the so-called "purified water" and only about 25% is left in the sewage sludge. If the sludge is burned, nitrogen is released into the air in the form of nitrogen oxides (NO, N2O) and this impairs our breathing, just like when garbage, wood or straw is burned.

Why produce mineral fertilizers in unsustainable way when we can recycle all plant nutrients in local high-tech biogas plants in all villages, urban districts, on agricultural and food enterprises, etc. using ecologically, economically, and socially sustainable biological methods?

Residents of many municipalities in Sweden collect food waste to produce biogas and biofertilizer. It is estimated that household food waste is approximately 97 kg per person per year. The Swedish Environmental Protection Agency writes that approximately one third of food waste is flushed down the drain.

According to available analyses, the food waste from 1,000 inhabitants per year, which weighs 97 tons, contains 29 tons of dry matter with approx. 145 MWh of bioenergy, 990 kg of nitrogen (N), 80 kg of phosphorus (P), 300 kg of potassium (K), 70 kg of sulfur (S) 14.6 tons of organically bound carbon (C org) and 67.9 tons of water (H2O).

If you were to incinerate the food waste, nitrogen oxides (NO, NO2), sulfur dioxide (SO2) and 53.5 tons of carbon dioxide would be formed, and all the water would become water vapor. Carbon dioxide and water vapor are greenhouse gases that are released also during collection and transport and when processing food waste.

What percentage of the food waste's bioenergy and plant nutrient content is really utilized in the inefficient central biogas plants that use water-borne systems instead of optimal water content to maximize yield?

The food eaten results in an average of 1.2 kg (litres) of toilet waste (urine and faeces) per person per day. Available analyzes show that from 1,000 inhabitants there is 438 tons of urine and feces per year, which contains 35 tons of dry matter with about 175 MWh of bioenergy, 4.5 tons of nitrogen (N), 550 kg of phosphorus (P), 1.3 tons of potassium (K), 310 kg of sulfur (S) and 7.4 tons of organically bound carbon (C org).

How much of all the essential elements and bioenergy is in the sewage sludge?

Losses that pollute the air already occur during the transport of toilet waste, which is done with the help of drinking water. Then in sewage treatment plants, a lot is lost to the air and with outgoing water. The sewage sludge is enriched with several synthetic chemicals that come from industrial water and all those that are added during treatment in sewage treatment plants.

Is sewage sludge a sustainable raw material for biogas plants?

Renewable organic material that is burned in garbage incineration or in cogeneration plants for the biomass should instead be mixed with the aqueous food and toilet waste to create the

right balance for microorganisms that carry out the biochemical transformation in the biogas plant.

Example of current pollutions and losses during combustion: A cogeneration plant burns 310,000 tons of wood material per year. Roughly 500 tons of nitrogen that form nitrogen oxides (NO, NO2), 16 tons of sulfur that forms sulfur dioxide (SO2) are released into the air each year. 10 tons of phosphorus remains in the fly and bottom ash. At the same time, roughly 500,000 tons of carbon dioxide (CO2) and a few tons of water vapor are formed, which depends on the material's water content.

All plant nutrients can be recycled and the bioenergy in the biogas can be transformed to electricity and heat/or cooling.

Example: Malmö can build approx. 100 local high-tech biogas plants and 100 local gray water biological treatment plants instead of building a sewer tunnel for an unsustainable system for 2.1 billion over 7 years according to the SBRS concept which stands for "Sustainable Biological Recycling System". The toilet of the future may be called CC-BAS, but many more variants and similar equipment for collecting food waste are needed.

Description of SBRS concept and estimates of possible sustainable recirculation of plant nutrients and sustainable utilization of bioenergy (and my CV) can be read on www.biotransform.eu.

Which economists can present a cost-benefit analysis to be able to compare the current management of renewable organic material in waste and sewage systems with the SBRS concept?

When will politicians ensure that residents can hygienically collect food and toilet waste at the source and use it as raw material for local high-tech biogas plants?

Call to COP27

Declare that the transformation of current unsustainable methods of handling all types of renewable organic material, including food and toilet waste, in waste and sewage systems must be accelerated to radically reduce

- ***air and water pollution that contaminates everything and thus negatively affects the environment, health, and climate***
- ***losses of plant nutrients and bioenergy causing unnecessary costs to citizens and many societal functions***

No public funds, such as project money, may be used to renovate or build facilities that are demonstrably unsustainable.

Appoint an international organization to announce an innovation competition where all citizens are invited to present different models of (i) "hygienic and easy-to-use waterless collection toilets" and (ii) similar devices for food waste, (iii) local high-tech biogas plants and (iv) local biological treatment plants for greywater.