ECOFRIENDLY MULTIPURPOSE BIOBASED PRODUCTS FROM MUNICIPAL WASTE

LIFE19 ENV/IT/000004

> "Before burning everything up, consider saving what is valuable: municipal biowaste contains valuable organic matter and the real waste is dismissing to landfills or burning it"

BIOWASTE

The estimated European production of **municipal biowaste** ranges around **100 million tons** per year. The two major streams of this waste are:
- park & garden
- kitchen waste

WATER

Municipal organic waste contains **50-80% of water**. This water, due to the destination of this type of waste and the treatments currently in use, is mostly dissipated.

LANDFILL

The most common destination for municipal biowaste is **landfilling** or, alternatively, **incineration**, tue to the limitations of current treatment technologies.

SUSTAINABLE

With the **LIFE EBP** process it is possible to **reduce** the production of **ammoniaca** (-100%) and **CO2** (-20%), **recover water**, **eliminate** the **inceneration** or **landfill** of **municipal biowaste**.

BUSINESS

Municipal organic waste can be used to produce **new bio-products** capable of stimulating the development of a **green economy**, in accordance with the paradigm of the **circular economy**.

POLICY

LIFE EBP aims to stimulate communities, municipalities and private investors to **implement** specific **environmental EU policies** and to **update legislation** in this field.

CURRENT CONTEXT

LIFE EBP

LIFE EBP is realised by Hysytech, Acea Pinerolese industriale, Allegrini, Agricultural University of Athens, Societe D'extrusion Du Polyethylene A.Barbier, Biomasa Peninsular, Castellón City Council, Cyprus University of Technology, POOL.ITI, Sewerage Board of Limassol – Amathus, Técnicas y Tratamientos Medioambientales, Università degli Studi di Catania, Università degli Studi di Roma Unitelma Sapienza, Università degli Studi di Torino and Municipality of Vrilissia, with the contribution of the LIFE Programme of the European Union.

LIFE EBP Project

Ecofriendly multipurpose Biobased Products from Municipal Waste

Summary

Introduction

The aim of this document is to present an innovative project for the treatment of municipal bio-waste that reduces environmental impact and creates added value in the perspective of sustainable development.
This document is addressed to ***political stakeholders*** *at local, regional, national and European level.*

The increasing in the production of **municipal bio-wastes** increased the need to find solution for their recycling.
Previous researches made by ACEA Pinerolese Industriale and University of Torino were finalized to upgrade biomasses as source for different kind of bio-based products.
These researches validated the initial idea of **converting municipal bio-wastes to products with added value** for different uses, both at laboratory and plant scale, with an increased monetary value (1-100 $/kg) considering a processing costs averagely of 0.1-0.5 $/kg, depending on the purity.
According to these researches, an **increase in the biogas and methane production** can be achieved by adding, to the feed of the biogas production reactor, soluble bio-organics, moreover, the ammonia content digestate can also be reduced with a process called controlled ammonia biogas production technology.
Such new technologies generate products which are still not known in the market requiring, then, both market assessment and legislative acceptance.
This solution presents advantages not only from the environmental point of view but also regarding costs since both operation and capital costs of the new controlled ammonia biogas technology are lower than traditional technologies for the same purpose justifying the

integration of the proposed technology to facilities producing soluble bio-organics from compost for in-house as additive in anaerobic digestion reactor making the process independent to the allocation of soluble bio-organics external market.
The excess of soluble bio-organics, due to the new facility, represent the first step in the mutation of a waste treatment plant to produce bio-based products with added value with a minimum financial risk.
The validation of the presented controlled-ammonia biogas production technology is one of the main aims of **LIFE EBP** project, at the ACEA waste treatment plant and in the partner countries located in Greece and Cyprus, intended to sensitize both private investors and administrations to this new and environmental-friendly approach in urban waste recycling.
The **partnership composition** is a **large-scale cooperation among public institutions and private companies** demonstrating innovative process and products in the field of municipal bio-waste and can be a proper solution for the pilot activity in validating the technology proposed both in Italy and in other European countries. LIFE EBP is also aimed to encourage investors at European level to make a municipal bio-waste treatment plant a real option disseminating worldwide and validating the ideas proposed in the project thanks to the participant of a pool made up thanks to the European approach. In this way, the institutional activities and the industrial participants will impact many other countries demonstrating the feasibility to recycle bio-based waste into chemical and consumer's market with consequent advantages for environment, society and industry such as lower CO_2 emission, lower fossils consumption and lower concern for disposal practices of industrial wastes, low production cost, high product added value and lower consumption of synthetic chemicals

Project objectives

Objective of LIFE EBP project is to demonstrate that the environmental, economic and social benefits of bioproducts in the sectors of municipal biowaste management, agriculture, and chemical industry in 5 European countries (Cyprus, France, Greece, Italy and Spain) taken as case studies, by:

1. replicating **Biobased Products** production process in real operational condition **using municipal biowaste** as feedstock
2. validating the performance of Biobased Products as **soil fertilizers, plant biostimulants/anti-pathogen agents, biopolymers** to make plastics, **surfactants** to make detergents
3. confirming Biobased Products **compliance with European regulation**
4. assessing Biobased Products **marketability**
5. after the end of the project, **establish joint ventures** among stakeholders in the sectors of **waste management, agriculture and chemical industry** and
6. promote **industrialisation and use** of Biobased Products

Climate relations

Even though LIFE EBP is related to waste treatment, **the environmental benefits** brought by the innovations proposed **will impact on the climate too**.

Starting from the first step of the project, the **municipal bio-waste will be recycled reducing the environmental impact** (gas emission into the atmosphere and leachate released into soils) with positive consequences also on the greenhouse effect. Moreover, the more ecofriendly digestate produced, characterized by reduced ammonia content, can be used as soil natural fertilizer instead of using traditional chemical products

Allowing, at reduced entrepreneurial risk, the market assessment related soluble bio-organic products in several sectors such as chemical industry and agriculture, the construction of bio-waste production plant, the project will achieve higher climate related values.

A further climate advantage is represented by **replacing traditional fossil sourced commercial products with bio-products** currently used for the manufacture of chemical and agricultural finished formulations.

To quantify the environmental benefits, LCA will be assessed in order to compare, in a quantitative and measurable way, the innovative protocol with the conventional treatment technologies for municipal bio-waste treatment.

Environmental problems targeted

Three sectors of human activities will be impacted by LIFE EBP project: municipal bio-waste management (from collection to landfilling), agriculture and chemical industry. **Municipal bio-waste is biodegradable and the estimated production ranges around 100 Mt**.

The environmental and economic impacts of the treatments depend on local conditions such as population density, infrastructure and climate, as well as on markets for associated products.

LIFE EBP proposes an innovative approach based on a virtuous material cycle involving anaerobic digestion and composting, coupled to chemical hydrolysis.

Agronomic benefits (improvement of soil structure, moisture infiltration, water-holding capacity, soil microorganisms and nutrients) can be obtained by the use of compost and digestate as fertilizer.

The environmental impact of composting is mainly due to limited greenhouse gas emissions and volatile organic compounds, moreover it is influenced by the quantity of NH_3 produced due to organic N mineralization (Ammonia inhibits methanogenic bacteria, especially sensitive to this compound).

Nitrate Directive (91/676/EEC) restricts, in Europe, the input of mineral N on farmland, to protect the ground and surface water from pollution.

Benefits are expected at two stages:

- in the short term, from the application in real operational environment of the new municipal bio-waste anaerobic digestion process;
- in the longer term, from promoting treatment plant construction for bio-products production at reduced entrepreneurial risk.

The economic benefits may encourage communities to dismiss landfills and reduce incineration practices in the perspective of more economically rewarding and ecofriendly technology.

The proposed LIFE EBP technology is very simple and can be applied in bioreactors of any size. Small farms can purchase the soluble bio-organics, once it becomes a marketed product, and add it in small amounts to the local biogas reactor. This would allow producing locally an environmentally friendly digestate with controlled amount of ammonia, without purchasing and operating secondary treatments facilities.

Considering that, the total EU manure production is one order of magnitude higher the food loss and waste, that manure is spread over a myriad of small farms, whereas food wastes are concentrated in urban areas collection facilities, and the impossibility of adapting current conventional technologies at small farm scale, the proposed LIFE EBP technology applied to manure has potential to achieve additional high beneficial environmental impact throughout EU countries.

In **agriculture**, in the long-term period, the use of soluble bio-organics at lower dosed than compost is expected to enhance plant growth and productivity, while reducing the environmental problems connected to the use of compost. The use of soluble bio-organics as feed supplement for animal husbandry is expected to reduce GHC emission, and ammonia and nitrate leachates from manure, moreover, in place of synthetic chemical products for diversified uses would contribute to decrease the depletion of fossil sources and the consequent CO_2 emission.

The ultimate benefits from recycling are a more sustainable economy and the possibility of reducing chemical fertilizers. The more ecofriendly LIFE EBP digestate and/or soluble bio-organics are expected to generate the same benefits, while reducing the environmental impact of the traditional current composts and digestates outlined above.

Based on chemical composition the soluble bio-organics fall well into the category of fertilizers.

Finally, EU **chemical industry** produces 330 Mt/yr synthetic organic chemicals from fossil sources to cover consumers' need for plastics and other finished products. Major concern is depletion of fossil source to produce fuels and chemicals and the increasing GHG emissions. Estimated CO_2 emission from conventional EU chemical industry is 1037 Mt/yr. As core action addressing the chemical industry sector, LIFE EBP will prove Bioproducts as eco-friendly bio-surfactants and bio-polymers for the manufacture of cleaning products and plastics, respectively, in comparison with commercial fossil based products for the same uses.

Surfactants are used massively day-to-day such as detergents: surfactants' world production is over 13 Mt/yr, 3 Mt/yr produced in EU to cover consumption of over 4.2 Mt/yr detergents and 1.2 Mt/yr softener products. Elevated concentrations of surfactants and their degradation products may affect organisms in the environment.

In the case of plastics, a recent survey estimates that in 2019 plastics' production and incineration will add more than 850 Mt GHG to the atmosphere. With ongoing rapid expansion of plastic and petrochemical industries, plastics' climate impacts will accelerate dramatically in the coming decade, threatening the ability of the global community to keep global temperature rise below 1.5°C degrees.

Socio Economic effect

"Before burning everything up, consider saving what is valuable; municipal bio-waste contains valuable organic matter and the real waste is dismissing to landfills or burning it" can be consider the best socio-economic message of LIFE EBP.

The appealing economic benefits of the integrated municipal bio-waste plant producing bio-products might be an important socio-economic driver for diverting waste from landfill or from incinerating valuable organic matter. In densely populated areas the integrated municipal bio-waste plant might become a real viable option to reduce landfills and incineration.

Thus, LIFE EBP will allow achieving to integrate environmental sustainability with economic growth and welfare by decoupling environmental degradation from economic growth and doing more with less, a key EU objective stated in the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan.

Contribution to European policies

LIFE EBP can contribute to achieve the objectives and to update and integrate **EU policies:**

- Decision 2010/707, 2013/208, 2014/322, COM/2009/0257 on **policies for employment**;
- **Europe 2020 strategy** for developing economy based on knowledge and innovation;
- EC new legislative proposal on strategy to transform Europe into a more competitive resource efficient economy, addressing a range of economic sectors, waste and circular efficient economy compatible with jobs and growth;
- **Circular Economy Action Plan** for sustainable growth;
- **"Towards a circular economy: A zero waste program for Europe"** aiming to increase the durability of products and create markets for recyclable materials;
- Employment policies, as **Green Employment Initiative**, on coordination of economic policy to play a more active role in supporting job creation in the transition to the green and resource efficient economy;
- The **European Green Deal**, the action plan to overcome the challenges related to climate change and environmental degradation.

The Partnership

- Hysytech S.r.l., Italy
- ACEA Pinerolese Industriale S.p.A., Italy
- Agricultural University ofAthens, Greece
- Allegrini S.p.A., Italy
- Societe D'extrusion Du Polyethylene A.Barbier Et Cie, France
- Biomasa Peninsular S.A., Spain
- Castellón City Council, Spain

- Cyprus University of Technology, Republic of Cyprus
- POOL.ITI S.r.l., Italy
- Sewerage Board of Limassol – Amathus, Greece
- Técnicas y Tratamientos Medioambientales, S.A.U., Spain
- University of Catania, Italy
- University of Roma Unitelma Sapienza, Italy
- University of Torino, Italy
- Municipality of Vrilissia, Greece

For more info, visit the project website: www.lifeebp.eu