

# POLO ECOLOGICO

Energy for the  
future of the  
environment





aceea

PINEROLESE

L'INNOVAZIONE È IL NOSTRO TERRITORIO

# THE BEGINNING OF THE PROJECT

The project idea of Polo Ecologico, Acea Pinerolese Organic waste Treatment Plant and especially the Anaerobic Digestion line starts in the '90s, a moment when the rules were changing towards a much more innovative concept of wastes considering them as a resource more than something to eliminate. The organic parts, for long time not considered, were acquiring a primary role. At the same time the need for advanced and adequate treatment technologies was emerging. Beyond technical, economical and environmental aspects, the importance of creating plants which could be accepted in the context of the territory was one of the main focus.

Aware of these assumptions, the planning process of the plant was entirely realised by internal resources thanks to the many decades of experience in the treatment of urban waste waters and management of gas networks. Starting with the analysis of the different treatment technology solutions in Europe, it seemed there were not adequate ones for the needs. For this reason the models imported from Northern Europe were improved and adapted to the characteristics of the territory and to the already existing technologies.

The area chosen for the construction of the anaerobic digestion line was already the place where a composting plant and waste water treatment plant were operating.

The works started in August 2000 and were ended by 2002. In the year 2003 it was completely operative.

The anaerobic digestion plant started with the aim of treating the organic wastes of the city of Pinerolo and surroundings but soon the true potential came out. Thanks to further optimisation works the plant is today the core center at provincial level for the organic fraction treatment and an internationally renowned case-study.



# POLO ECOLOGICO INTEGRATO ORGANIC WASTE TREATMENT PLANT

Polo Ecologico Integrato tells already with its name its special characteristics: it is an area integrating different plants all located in a unique area and characterized by a special environmental attention, in terms of rational use of resources and reduction of impacts.

It is enough to follow the flow line in order to understand the potential of the plant.

## WATERS

The water resources necessary to the bio digestion process are mostly obtained by the water treatment plant and recirculated. Waste waters are then treated in the dedicated plant.

✓ *The use of natural resources is limited at minimum amount. The process wastes are managed inside the organic waste treatment plant increasing the reuse and reducing the transportation of materials.*

## DIGESTATE

The first product of anaerobic digestion is a dehydrated material, called digestate, which is taken to composting plant and transformed in compost.

✓ *The product of the first process becomes "raw material" for the following plant which enables the highest waste reduction.*

## BIOGAS

Anaerobic Digestion produces biogas, rich in methane. This gas mixture, together with gas from waste water treatment and the one recovered from the landfill (3 km away and connected to the plant through a pipeline) is transformed by the cogeneration plant in electric and thermic energy, entirely from renewable sources.

✓ *The energetic potential of wastes is totally used, recovering biogas produced by all plants. There is therefore no release of biogas in atmosphere with clear benefit against green house gases effect.*

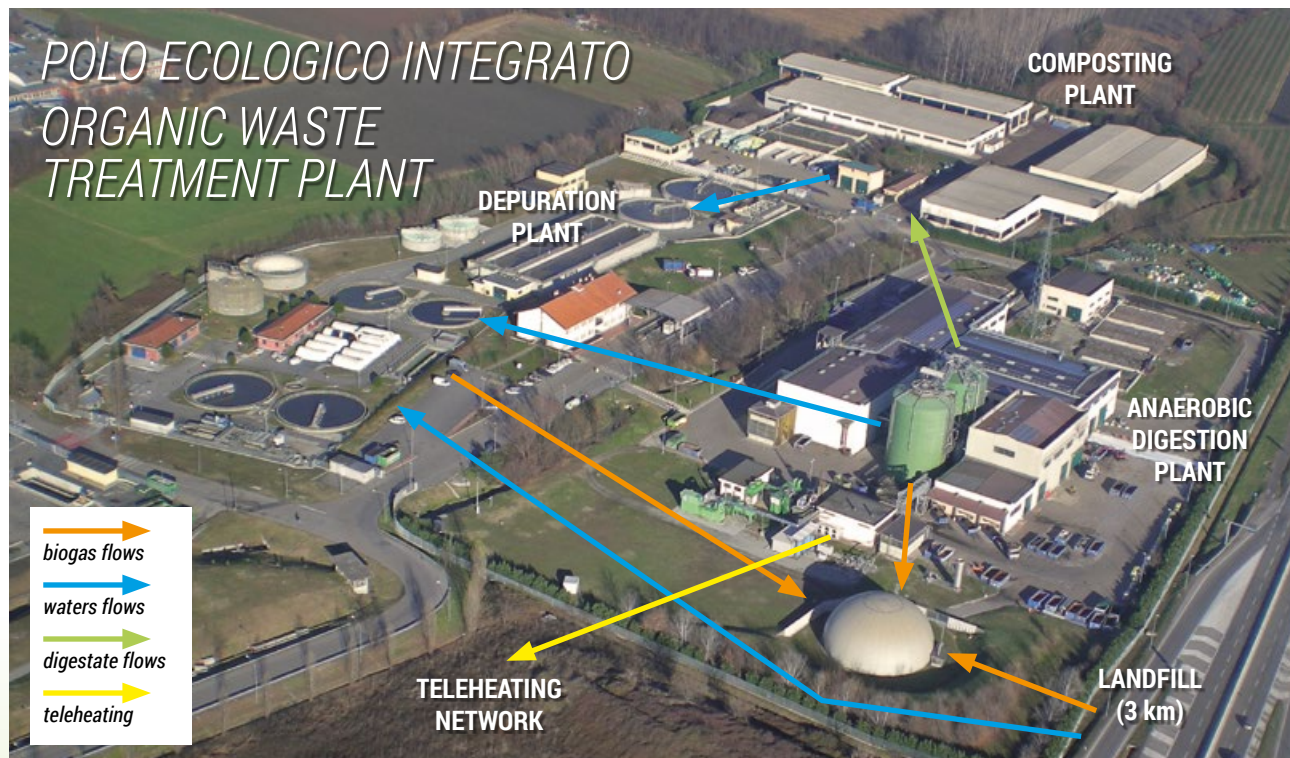
At the organic waste treatment plant there is also an undifferentiated urban waste treatment line which transforms it into Solid Secondary Fuel, used by external plants for energy production.

## The benefits of the system

The organic treatment Plant is a highly innovative system with includes three patents and the following strengths:

- Possibility to produce renewable energy;
- Less need to use natural resources, outplaced by the products of waste treatment: biogas to produce energy and digestate to produce compost;
- Minor impact due to odors, that thanks to a “closed” process are strongly limited;

- Minor quantity of surface occupied per unit of tons treated compared to the only aerobic treatment, with equal amount of entering material;
- Higher efficacy of recovery of materials (production of compost from digestate) and energy (biogas produced) compared to the aerobic treatment alone;
- Reduction of organic fraction sent to landfill, according to EU regulations;
- Reduction of CO<sub>2</sub> emissions compared to the aerobic treatment alone;
- Minor environmental impact of the system compared to composting alone.





# THE TIME LINE

2003

**In 1997**

## **BEGINNING OF AN IDEA**

We started to think to a different plant system that overcomes the landfill concept. Here begins the concept of the Organic Waste treatment plant.

**March 2001**

## **THE FIRST TEST**

The composting plant is operational.

## **September 2003 THE ADVENTURE BEGINS**

Start of the Anaerobic digestion line.

2004

## **April 2004 ENERGY PRODUCTION**

The first cogeneration plant is started.

## **October 2004 JOINED ENERGIES**

The 3 km far landfill is connected to the Organic waste treatment plant to collect and valorise biogas there produced.

2005

## **February 2005 ENERGIES DOUBLED!**

Second cogeneration plant is started.

## **March 2005 FLORAWIVA BIRTH**

The Acea Pinerolese Compost is registered under the commercial name "Florawiva" and enters the market with its own brand identity.

## **5 May 2005 THE FIRST RECOGNITION**

The Quality mark of Consorzio Italiano Compostatori (Italian Composting industry Federation) is awarded.

2006

## **Summer 2006 A GROWING PLANT**

The plant becomes reference point at provincial level.

2007

## **Summer 2007 IT'S TRIGENERATION**

The cooling system of the plant offices is started using co-generators heat.

## **3 August 2007 THE IMPORTANCE OF KNOW HOW**

Two European patent requests are submitted for the mixing systems of the digesters.

## **November 2007 RESEARCH TIME**

The pre-treatment line improvement studies are started.

2008

## **2 April 2008 FLORAWIVA IS GREENER AND GREENER**

Florawiva compost enters the Recycling Repertoire. It's the first one in Italy.

## **October 2008 TELEHEATING NETWORK**

The teleheating network of Pinerolo is opened. It uses the heat derived from the cooling process of the biogas engines.

2009

**May 2009  
TWIN LINES**

It is started the second pre-treatment line of the organic fraction, which prepares wastes to anaerobic digestion.

**June 2009  
THIRD ENGINE**

The third cogeneration plant is started. Now the installed power is 3 Mwe.

2010

**2010  
WORKS OF  
ENGINEERING**

The Florawiva MORE internal project begins in order to improve the entire process.

**September 2010  
COMPOST  
FLORAWIVA:  
NEW  
RECOGNITIONS**

Compost Florawiva arrives in Agadir (Morocco) for UNO coordinated experimental project.

**27 September 2010  
THE  
IMPORTANCE  
OF KNOW-HOW**

The international patent request for Florawiva MORE machine is submitted.

2011

**2011  
FLORAWIVA  
MORE**

This machine which enables the improvement of the pre-treatment process of wastes thanks to selection and mixing operations, is now completed and operational.

**2011  
GOODBYE TO  
PLASTICS**

New grids are introduced to further separate the thin plastics in the treatment phase of liquid digested material.

**30 September 2011  
THE  
FOTOVOLTAIC  
PLANT**

installed on the top of the treatment facility is opened. Some further 112 KW are added to the energetic potential of Acea. All from renewable sources.

2012

**23 May 2012  
THE PLANT  
DOUBLES**

The province authorization for the increase of the anaerobic digestion line from 50.000 to 90.000 tons/year is released.

**October 2012  
FLORAWIVA  
MORE DOUBLES**

It is ended the construction of the second pool where the operations of mixing and selection take place.

2013

**22 April 2013  
10 YEARS OF  
INNOVATION  
FOR  
ENVIRONMENT**

It is the ten year anniversary of Polo Ecologico Integrato, the Organic waste treatment plant.

**November 2013  
MORE RECYCLE  
LESS WASTES**

A plant for the reduction of plastic wastes is created.

2014

**July 2014  
RIUSO...  
NETWORK IS  
FOUNDED**

A network of public and private companies, leaders in organic wastes treatment. Acea is one of the main promoters.

**October 2014  
FILL-UP OF  
ENERGY WITH  
BIOMETHANE!**

The Biogas upgrading plant for Biomethane production is opened.

2015

**September 2015  
BACK TO THE  
FUTURE IS NOW  
REALITY**

The first FIAT PANDA fuelled with biomethane and mixtures of biomethane and biohydrogen produced at the facility, is officially presented.

FUTURE

**ENERGIES FOR  
THE FUTURE OF  
ENVIRONMENT**

Acea Pinerolese will further proceed with valorization of the organic wastes. Bioplastics, tensioactives, fitostimulants are the future products whose production process from compost is being studied.

# THE PROCESS OF VALORIZATION

## The anaerobic digestion

The entering material is organic waste coming from the differentiated collection of citizens and non-domestic users such as: restaurants, canteens and markets.

### 1 ENTRANCE - THE DROP OFF AREA

The organic waste is dropped off in a pool with a walking floor which enables the following treatment steps.



### 2 BAG CUTTER

The machine cuts bag and the material inside falls in the riddle.



### 3 RIDDLE

In this step there is the separation of lighter and larger materials which make up the impurities to discard from the heavier ones. The first flow, composed mainly of plastics, is squeezed in such a way to reduce the discarded parts. The second one goes on with its flow.

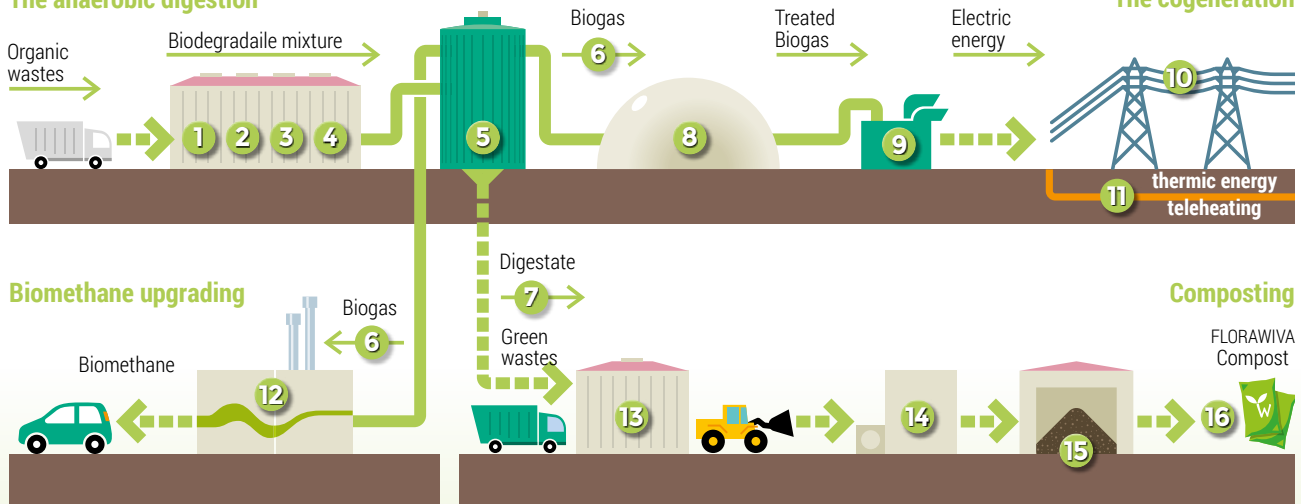


### 4 FLORAWIVA MORE

Mixer of Organic elements: this machine, protected by a patent, enables to separate some few plastics remained after the riddle, nonferrous materials and inerts generally. Adding water the correct dilution is obtained. The ferrous metals are detected and eliminated thanks to proper machines.



## The anaerobic digestion





## 5 BIODIGESTER

It's the core of the system. The pure organic waste undergoes a process of degradation thanks to bacteria.

The fermentation takes place in absence of oxygen.



## 6 BIOGAS

The first result of the degradation work.

The amount of methane ranges at about 60%.

## 7 DIGESTATE

It's the second result of fermentation.

It's a very liquid material. This material is then dehydrated. This digestate is transferred to the composting plant.



## The cogeneration

## 8 GASOMETER

The Biogas extracted by the biodigesters is temporarily deposited in a 3,300 m<sup>3</sup> gasometer. Here also biogas coming from landfill and the water treatment plant is stocked.



## 9 ENGINES

After a cooling and compression phase, biogas is sent to three engines, for an installed power of over 3 MW.



## 10 ELECTRIC ENERGY

The **electric energy** produced is used by the plant itself and the rest in excess is conveyed to the national network.

## 11 THERMIC ENERGY

The **thermic energy** is used by the process itself and

it's also used for the teleheating/cooling system of the operation areas and the offices. The exceeding part is conveyed to the teleheating network.

## Biomethane upgrading

## 12 BIOMETHANE

Biogas deriving from digestion is compressed, cooled, washed and filtered. These operations are necessary in order to eliminate undesired gases and reach the necessary pressure to use it. At the end of these operations the result is **biomethane**.



## Composting

The entering material is made up of digested matters (digestate) and green wastes from separate collection.

## 13 MIXING

The digestate is mixed to green wastes previously grinded.



## 14 ACCELERATED MATURATION

The mixture is stored in different piles, turned weekly. From the floor flows the air. The mixture remains here for maturation for about one month.



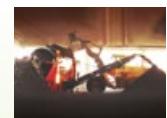
## 15 SLOW MATURATION

This stage takes place in open sheds, where the material ends the maturation.



## 16 REFINING

The material is checked and filtered to eliminate impurities. The result is the **high quality compost Florawiva**.



# THE PRODUCTS OF RECYCLE

## Biogas

The availability of renewable energetic sources, alternative to fossil sources and with low environmental impact, is fundamental today more than in the past, in order to face climate changes due to greenhouse effect. The Organic Waste Treatment Plant is able to answer to this request thanks to biogas coming from organic matrix. The main source is the anaerobic digestion, which produces an excellent quality biogas with a high amount of methane, over 60%. Aiming at optimising all wastes treated, the Plant receives also the biogas conveyed by the landfill. This one is lower in quality compared to the one from anaerobic digestion, that means 35%-40%, but it represents anyhow a potential to valorise.

The biogas coming from the treatment plant (Polo ecologico) is transformed in electric and thermic energy, both derived from renewable sources. Furthermore, since 2014 from biogas upgrading is possible to obtain biomethane that can be used on the network and for cars.

## ENVIRONMENTAL BENEFITS OF BIOGAS

- 🌿 CO<sub>2</sub> produced by burning biogas derived from wastes takes to a breakeven of carbon dioxide released in atmosphere: the carbon present in it was previously fixed by green plants.
- 🌿 The biogas captation prevents spreading methane naturally released by degrading of organic matrix. Methane is one of the most powerful greenhouse gases: the emission of 1 kg of CH<sub>4</sub> in a time span of 100 years is equal to a 25 kg CO<sub>2</sub> emission.<sup>1</sup> Through a controlled captation and following combustion, it is degraded to CO<sub>2</sub> and water, reducing strongly the environmental impact.

<sup>1</sup> Source: IPCC (Intergovernmental Panel on Climate Change) - [www.ipcc.ch](http://www.ipcc.ch)

The **biogas** is a mixture composed mainly of methane (CH<sub>4</sub>) produced by anaerobic fermentation of organic wastes. The energy produced is totally renewable.



## Compost

The further desertification of terrains and the strong reduction in soil fertility, widened by present climate changes, is a trend regarding also Europe, and especially Southern Countries, including highly relevant areas of Italy. To return organic matter to soil is then fundamental in order to preserve the productive yields, but also to avoid environmental risks such as erosion.

Recovering biodegradable wastes and transforming them in an organic fertilizer such as compost represent an efficient system to contribute to the sustainable use of resources. Using compost prevents from using mineral fertilizers, generally derived from chemical synthesis and therefore a non-renewable resource.<sup>2</sup>

<sup>2</sup> Abstract and adaptation of : "Composting in Italy since 20 years now" by Consorzio Italiano Compostatori.

## COMPOST PROPERTIES

- It is very much suggested to be used for ornamental plants, garden, fruit grooves, flowers, large terrains and environmental revitalisation plans.
- It improves the chemical-physical structure of the ground, adding organic substance.
- It prevents the use of substances to eliminate pathogens of the terrains.

## ENVIRONMENTAL BENEFITS FROM THE USE OF COMPOST

- Compost, deriving from organic wastes, avoids using further natural resources and reduces the amount of wastes sent to less virtuous treatment operations.
- Further increase of carbon in the soil. Compost stores carbon (carbon sink) contributing to the fight of green house effects.
- It improves fertility of the soil, increasing the water absorption capacity.
- It can be used to integrate or replace chemical fertilizing.



# THE ORGANIC WASTE TREATMENT PLANT IN FIGURES

## PROJECT DATA

Start year	2003
Treatment tipology	Umid single stage
Tipology of fermentation	Thermofil (about 55°)
Average time of stay in digesters	14 days
Total time compost production (average)	100 days
Inhabitants served	1,000,000
Organic wastes treatment capacity	60,000 tons/year
Treatment Capacity with further development under construction	90,000 tons/year
Green wastes treatment capacity	20,000 tons/year
Compost produced	6,000 tons/year

## ECONOMIC FIGURES (2015)


Initial investment anaerobic digestion line and composting	€ 16,600,000
Annual turnover of the anaerobic digestion line and composting	€ 6,300,000
Direct employees for anaerobic line digestion and composting	23
Annual turnover Acea	€ 61,200,000
Total employees ACEA	353

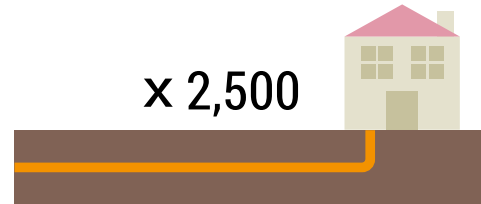
## ENERGETIC RESULTS (2015)

Biogas produced by Polo Ecologico	10,241,500 Nm <sup>3</sup> /year
Equal in energy to	46.5 GWh/year
Electric energy produces	17.1 GWh/year
Electric energy used by Polo Ecologico	10.4 GWh/year
Thermic energy available for teleheating and internal uses	18.8 GWh/year
Thermic Energy used at Polo Ecologico	6.3 GWh/year

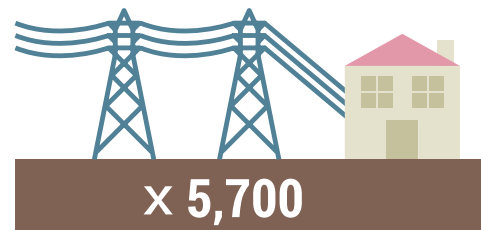
*(Data are referred to the entire production of the Organic Waste Treatment plant)*

With biogas produced in one year by the Organic Waste Treatment plant is possible...

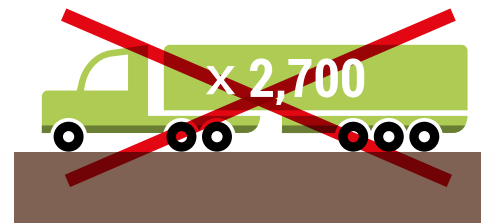
 to heat about 2,500 apartments.



 To produce electric energy for about 5,700 apartments.



Thanks to the treatment at the Organic Waste Treatment plant, each year 80,000 tons of wastes are not sent to landfill, equal to 2,700 trucks at full charge.



Thanks to the Organic Waste Treatment plant each year is avoided the emission of 76,000 tons of CO<sub>2</sub>equ<sup>1</sup>, a benefit equal to the one ensured by about **2 million plants** in the first ten years of life.<sup>2</sup>

<sup>1</sup> According to the evaluation made by "Composting in Italy since 20 years now" publication by Consorzio Italiano Compostatori, CIC, 2012: for each kg of organic waste not thrown in the landfill a 0.95 kg CO<sub>2</sub>equ emission is avoided.

<sup>2</sup> Source: [www.epa.gov/energy/greenhouse-gas-equivalencies-calculator](http://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator)





# ENERGIES FOR THE FUTURE...

The experience developed in the sector of organic wastes treatment has encouraged the research of new frontiers for valorisation of this wastes with particular attention to their energetic potential.

In a framework of continuous reduction of traditional production sources, it's crucial to have alternative resources. For this reason Acea has invested a lot in research, aiming at analysing further development opportunities of the treated materials.

In the last years many projects have been undertaken thanks to the availability of regional, national and European funds.

Thanks to synergy with relevant operators of the sector - from Politecnico di Torino up to University of Torino, Centro Ricerche Fiat and Environment Park - and the Torino based company Hysytech **biomethane** production has started.

A biological origin fuel which presents outstanding environmental benefits, among them:

- 🌿 The possibility to replace usual fossil origin fuels, with a lower environment impact, cause it's totally derived from renewable source without exploitation of natural resources;
- 🌿 The CO<sub>2</sub> released from combustion comes itself from renewable sources and does not produce greenhouse effects.

The research process undertaken does not end here.

Some studies are underway both in energetic and agronomic sector. The Biomethair Project has led to the creation of a study plant for the production of **biohydrogen**, exploiting fermentation of organic wastes in acid conditions. The further development we are working at is to unite in the same process the production of biohydrogen and biogas with the aim to valorise the whole energetic potential of organic wastes.

On the side of matter reuse, apart from the consolidated role of Florawiva in agriculture, it's being explored the possibility to obtain **humic substances** from compost (a soil feeder) that could replace the fossil origin ones.

The Organic Waste Treatment Plant, developed initially to respond to our territory needs, has progressively evolved into a more complex and advanced vision.

The organic wastes treatment line is today a **biorefinery**: a technical-scientific platform, where wastes, that is a biomass not used, is valorised in all its components, obtaining energy, fuels, products for agriculture, all from renewable sources. The development of biorefineries enables the general improvement of the environment quality, in terms of reduction of climate changing emissions, treatment of wastes and valorisation of the potential inside wastes.

If, in the future, all biogas produced in one year by the Organic Waste Treatment plant was transformed in biomethane, **a car could be propelled for over 55 million km!**



**over 55 million km!**

**Biomethane** is a mixture which is made at least for 96% of methane which has similar characteristics to Natural gas.

It is generated from renewable sources and it can be used for car fuelling as well as for the domestic gas network.

In the organic waste treatment plant of Acea, it comes from the purification of biogas that is produced through anaerobic digestion of organic wastes.





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