

>> WELCOME TO THE GREEN TECHNOLOGY REVOLUTION

The Entsorga alternative for sustainable development

Since 1997 we develop clean and efficient technologies to transform waste into resources, bringing to new life materials that were discarded.

This paradigm change has been our response to the problem of economic and environmental sustainability.

This has become **our revolution**.

ENTSORGA'S NUMBERS

9 TRADEMARKS AND 11 PATENTS
14 PROVEN AND BANKABLE TECHNOLOGIES
2½ MILLION T/Y OF WASTE CAPACITY TREATED
102 PLANTS BUILT IN 27 COUNTRIES
5 PLANTS SUPERVISED/MANAGED BY
O&M BUSINESS UNIT
ABOUT 1 M€ INVESTED IN R&D
ANNUALY
70% OF EMPLOYEES WITH
UNIVERSITY DEGREE

A SOLUTION PROVIDER TO MITIGATE HUMAN IMPACT ON THE ENVIROMENT

To date, Entsorga has developed 14
proprietary technologies and 11 patents, and has built over 100 plants in more than 27
countries, acting both as a provider of proprietary technologies and as an EPC contractor, supporting clients from design to plant commissioning.

support services using AI systems to remotely monitor plants and ensure maximum performance at all times.

Since 2024, Entsorga is a Benefit

Corporation.

The company also offers cloud-based

BIOGAS, BIOMETHANE, COMPOST AND ALTERNATIVE FUELS. FROM WASTE SOIL NUTRIENTS AND CLEAN ENERGY FOR THE FUTURE.

Over the years, the company's accumulated experience and continuous investment in Research and Development have enabled it to grow and offer increasingly comprehensive and integrated solutions in the fields of:

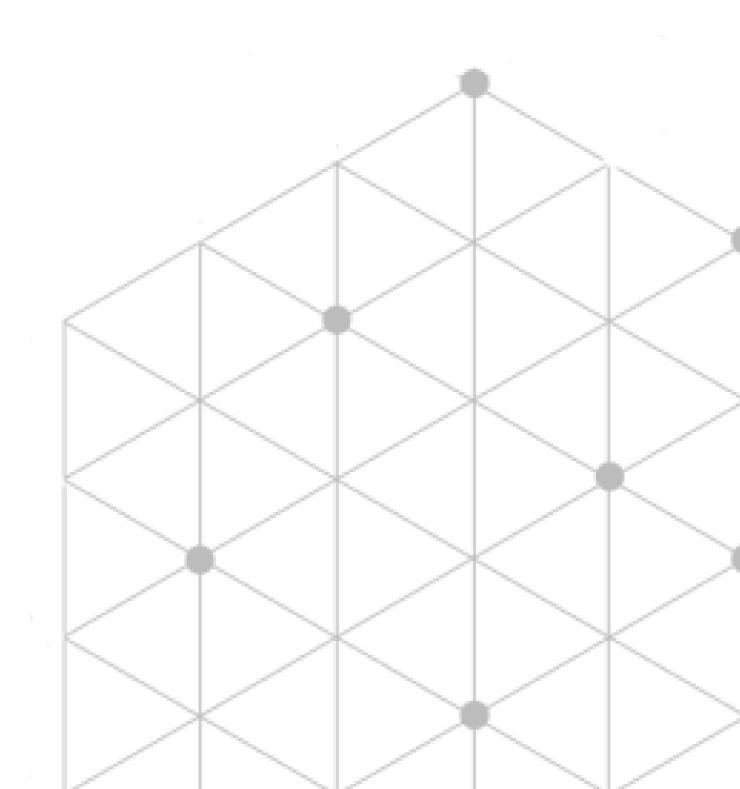
- Mechanical and Biological Treatment (for compost production)
- Anaerobic Digestion (for Biogas and Biomethane production)
- management of Solid Recovered Fuels (SRF) for cement plants







>> ENTSORGA TECHNOLOGIES



ENTSORGA PROPRIETARY TECHNOLOGIES

BASED ON SIMPLE PRINCIPLES LIKE

EASE-OF-USE, ENHANCED

AUTOMATION AND INCREASED

EFFICIENCY, ALL THE ENTSORGA

PROPRIETARY TECHNOLOGIES ARE

CONSTANTLY IMPROVED THANKS TO

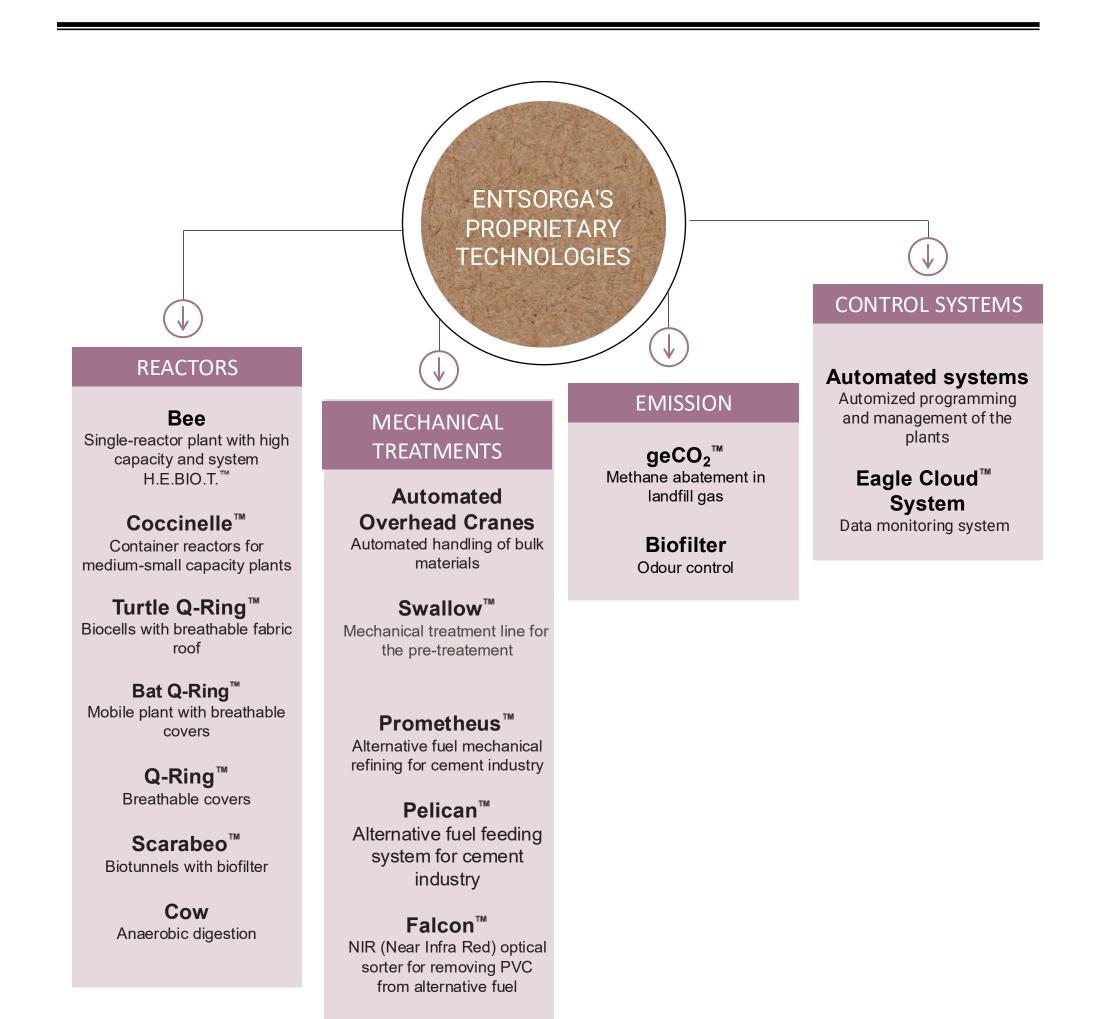
THE CONTINUOUS COMMITMENT TO

RESEARCH AND DEVELOPMENT.

FEATURES THAT MAKE TECHNOLOGY

PLATFORMS PARTICULARLY RELIABLE,

PROVEN AND BANKABLE.





BEETM SYSTEM

ADVANCED MECHANICAL BIOLOGICAL TREATMENT ENCLOSED BIOREACTOR FOR PROCESSING OF LARGE VOLUMES OF MSW



ENTSORGA'S PATENTED BEE SYSTEM IS THE STATE OF THE ART, EFFICIENT AND RELIABLE SOLUTION FOR MECHANICAL AND ORGANIC PROCESSING (BIODRYING) OF WASTE

HIGH RELIABILITY, MAXIMUM ENVIRONMENTAL COMPATIBILITY AND TOTAL AUTOMATION MAKE THIS TECHNOLOGY ONE OF THE MOST COMPETITIVE ON THE MARKET IN TERMS OF ECONOMIC EFFICIENCY AND SAFETY.



DEVELOPED AND IN OPERATIONS SINCE 2005, THE BEE™ SYSTEM IS THE HIGHER CAPACITY SINGLE REACTOR PATENTED BY ENTSORGA FOR MECHANICAL AND ORGANIC PROCESSING (MBT) OF WASTE. THANKS TO A CLEAN AND EFFICIENT PROCESS ALLOWS PROVIDING UP TO 90% LANDFILL DIVERSION, MAXIMIZING RECYCLING AND RECOVERY PROGRAMS AND EXTENDING CAPACITY OF LANDFILL ASSETS. A STATE OF THE ART INDUSTRY SOLUTION, TODAY THE BEE SYSTEM IS THE ENTSORGA'S MOST ADVANCED WASTE PROCESSING PLATFORM, WITH A NUMBER OF COMMERCIAL FACILITIES OPERATING IN EUROPE AND IN USA.

H.E.BIO.T.™

ENTSORGA'S ADVANCED MBT TREATMENT

The BEE™ systems uses the H.E.BIO.T.™

process (High Efficiency Biological
System), an highly efficient and highly
automated biological treatment system
that leverages on 20 years of successful
industrial operations and a continuous effort
in research and development.

The **winning principles** on which the process is based are:

- Accelerated aeration (1): the combined use of integrated air management, flow inversions and preheating of the material, substantially improve the efficiency of the bio-oxidation process, ensuring a more homogeneous and rapid treatment
- Automatic process control: proprietary software collects, analyzes and regulates data, optimizing process parameters
- Automation and optimized material handling (2) limited to transfers and not to process requirements.

ADVANTAGES

- Higher treatment's capacity and surfaces optimization: compared to a biocell system, the plant allows to process more quantities of waste in less space
- Equipment reliability, thanks to a 24/7 automatic control system that minimizes human errors and optimizes process management
- Reduced energy costs due to a smart process approach, based on the controlled management of the air flows and not on the mechanical handling of the material
- Reduction of labor and management costs, thanks to high automation
- Maximum environmental compatibility and safety for operators, not exposed to process air, dust and pathogens
- High productivity, with recovery up to 90% of waste
- Flexibility of application, from composting to the production of alternative fuels

1. VENTILATION SYSTEM











APPLICATIONS

Flexible and reliable, the Bee™ System is suitable for all needs of aerobic biological waste treatment:

- COMPOSTING the organic fraction of waste and sludge
- BIOSTABILIZATION of waste before sending it to landfill
- BIODRYING of waste and biomass to produce SRF (Solid Recoverd Fuel)













PATENTED AND PROVEN CONTAINERIZED
REACTOR SYSTEM, THE COCCINELLE® ARE A
MODULAR, RELIABLE AND PROVEN
TECHNOLOGY FOR AEROBIC COMPOSTING OF
ORGANIC WASTE AND BIODRYING OF
MUNICIPAL SOLID WASTE.

MODULAR AND EASY TO INSTALL, THEY ARE THE MOST VIABLET SOLUTION FOR SMALL AND MEDIUM-SIZED PROCESSING FACILITIES.



ENTSORGA'S COCCINELLE™ ARE **THE MOST SIMPLE AND EFFECTIVE SOLUTION**TO AEROBICALLY STABILIZE BIOMASS, WITH MINIMUM ENVIRONMENTAL IMPACT.
THE COCCINELLE™ USES AN **AUTOMATICALLY CONTROLLED VENTILATION SYSTEM** TO GUARANTEE THE MAXIMUM EFFICIENCY OF THE PROCESS AND A
HIGH EFFICIENCY **BIOFILTER** TO ABATE ODORS

MAIN FEATURES

Entsorga's Coccinelle[™] ensure a **safe and controlled aerobic maturation process**, keeping the biomass in a **closed and slightly depressurized environment**.

This solution ideal for **medium-small systems**, with a capacity from 2,500 to 12,000 t / y.

Each module consists of:

- 1. **8 containers** each of 32 cubic yards net capacity
- 2. an automatically controlled alternated ventilation system that detects and regulates the process parameters, to manage it in the most efficient way
- 3. a high efficiency **biofilter**, which purifies the process air, eliminating odors.

ADVANTAGES

- maximum flexibility: modular and adaptable, the system easily adapts to the most diverse processing needs
- efficient odor control and minimum impact: no odors or other contaminants are released in the external environment
- safety and efficiency: the bioxidation and the reverse flow ventilation are monitored by an automatic control system that allows optimizing the process
- easy installation: the system minimizes the need for civil work and infrastructure

1. THE BASIC MODULE OF 8 CONTAINERS



2. THE VENTILATION SYSTEM



3. BIOFILTER



APPLICATIONS

Entsorga's Coccinelle[™] system is suitable for all types of aerobic biological treatment:

- COMPOSTING to process the organic fraction of waste and sludge
- BIOSTABILIZATION of waste before landfill disposal
- BIODRYING of waste and biomass to produce Solid Recovered Fuel (SRF)













ENTSORGA TURTLE BIOREACTOR
SYSTEM WITH THE Q-RING®
BREATHABLE COVER IS A SIMPLE,
EFFECTIVE AND MODULAR SOLUTION TO
PROCESS FEEDSTOCK IN CONFINED
SPACES.

OUR TURTLE SYSTEM PROVIDES AN **EXCELLENT ODOR CONTROL**, **WITHOUT THE NEED OF AN ADDITIONAL BIOFILTER** TO TREAT PROCESS AIR.



THE RESULT OF TWENTY YEARS OF EXPERIENCE IN THE BIOLOGICAL TREATMENT OF WASTE, THE TURTLE SYSTEM IS AN EXCELLENT SOLUTION TO MINIMIZING CAPEX WHILE DELIVERING PROVEN PERFORMANCE AND LOW IMPACT ON THE SURROUNDINGS.

MAIN FEATURES

The Turtle system is suitable for medium-sized plants (with minimum capacity from 15,000 t/a). The system guarantees safe, fast and clean maturation of biomass, combining the advantages of an enclosed processing to the use of the Q-ring™ cover. This semi breathablke fabric allows reducing water content by evaporation while retaining odors, hence eliminating the necessity of a biofilter.

The system can treat also process **air collected in other plant sections**, improving the overall environmental performance of the plant.





ADVANTAGES

- Excellent process efficiency: the maturation of the material accumulated in the biocells is accelerated by blowing air through a ventilation system embedded in the concrete floor. This forced ventilation system distributes oxygen optimally and regulates the flow according to the material, ensuring achieving optimal process temperature and sanitizing the feedstock (keeping it at 55 ° c for a minimum of 72 h).
- Maximum reliability, thanks to the automatic control system that manages, optimizes and records process data (including temperature, time, quantity, wetting cycles, air flow, door opening and closing)
- Minimum environmental impact: excellent odor control and no dispersion of materials due to rain or wind
- Reduced investment costs (biofilter not required)
- Modularity: the technology adapts easily to the different volumes and types of waste to be treated
- Standardization: the continuous testing and process improvements on industrial scale guarantee maximum efficiency, durability and ease of use

APPLICATIONS

Without need of modifications, the Turtle Q-ring[™] system is **suitable for all types of aerobic biological treatment**:

- COMPOSTING the organic fraction of waste, digestate and sludges
- BIOSTABILIZATION of waste before landfilling
- **BIODRYING** of waste and biomass and subsequent production of Solid Recovered Fuel (SRF)













ENTSORGA'S BAT Q-RING ™ IS A **SIMPLE AND MODULAR** DESIGN FOR EFFICIENTLY COMPOSTING ORGANICS OR STABILIZING UNSORTED MUNICIPAL WASTE BEFORE DISPOSAL.

VERSATILE AND EFFICIENT, IT IS AMONG **THE MOST COST EFFECTIVE** SOLUTIONS ON THE MARKET TO
ALLOW AN EFFICIENT ACCELERATED PROCESSING
OF **UP TO 4 WINDROWS/BATCHES**.



BAT Q-RING™ IS A **«TURNKEY» PATENTED MODULAR SOLUTION** TO AEROBICALLY PROCESS ORGANIC WASTE TO COMPOST OR BIOSTABILIZE **MUNICIPAL SOLID WASTE**. **EASILY TRANSPORTABLE**, THE FORCED AERATION SYSTEM ACCELERATES THE OXIDATION WITHIN THE HEAP TRIGGERING HEAT GENERATION. **A SPECIAL BREATHABLE FABRIC Q-RING™**, GUARANTEES AN EFFECTIVE **ODOR CONTROL**.

MAIN FEATURES

The **Bat Q-Ring™** stabilization system consists of a **single mobile structure**, suitable for managing **up to 4 batches/heaps of waste** (8x16x2m).

The complete solution consists of:

- ventilation system with fans (1), for accelerating aerobic reaction in heaps
- insufflation system (2) consisting of extension tubes that are inserted directly under the waste or are placed within the concrete slab
- **control system**, located in the mobile control cabin, which controls the air flow
- Q-Ring[™] sheet (3), a patented Entsorga breathable fabric that contains process odors

STRENGHTS

- maximum mobility: the system can be easily transported where it is needed
- modularity: it is a flexible solution, which adapts to different system and treatment needs
- extensively proven: already tested in many applications, guarantees durability, reliability and ease of use
- Iow investment cost: this "turnkey" system, does not require civil or structural modifications to an existing site and eliminates material handling costs. A smaller solution, the Bat Q-Ring™ Light (4), further reduces investment costs effective odor control, thanks to the use of Q-Ring™ fabric.

1. FORCED VENTILATION SYSTEM



2. AERATION SYSTEM





3. Q-RING® BREATHABLE FABRIC



4. BAT Q-RING® LIGHT



APPLICATIONS

Entsorga's **Bat Q-Ring**™ system is suitable for all types of aerobic biological treatment:

- COMPOSTING the organic fraction of waste, digestate and sludges
- BIOSTABILIZATION of waste before landfilling
- **BIODRYING** of waste and biomass and subsequent production of Solid Recovered Fuel (SRF)













THE RESULT OF TWENTY YEARS OF EXPERIENCE IN BIOLOGICAL WASTE TREATMENT, THE **Q-RING**™ **SYSTEM** IS AMONG **THE MOST COST COMPETITIVE METHODS** ON THE MARKET TO ALLOW EFFICIENT PROCESSING OF ORGANIC WASTE.

THE SOLUTION COMBINES **LOW INVESTMENTS** WITH **EXCELLENT PERFORMANCES**, THANKS TO THE Q-RING™ BREATHABLE FABRIC STUDIED BY ENTSORGA TO ENSURE OPTIMAL CONDITIONS FOR THE OXIDATION PROCESS, WHILE ALLOWING FOR AN EFFECTIVE ODOR ABATEMENT.

Σ



MOSTLY USED IN THE FINAL CURING PHASE OF COMPOST, THE Q-RING™ SOLUTION GUARANTEES EFFICIENT AND CONTROLLED BIOMASS MATURATION: WHILE FORCED AERATION IMPROVES OXYGENATION, THE Q-RING™ FABRIC PROTECTS THE FEEDSTOCK FROM RAIN AND OUTSIDE HUMIDITY WHILE ALLOW RELEASING PROCESSED AIR AND GUARANTEING EXCELLENT ODOR ABATEMENT.

MAIN FEATURES

This process solution consists of:

A **forced aeration system** (1) provided by a network of **air ducts** (2) embedded in **a concrete floor** (3) and equipped with anti-clogging nozzles, to allow a homogeneous distribution of the air in the heap. In case of existing flooring, it is possible to install air ducts above the floor.

Q-Ring™ cover (4), a semi-breathable fabric in which the mid layer is permeable, to allow **reducing humidity and filter the process air,** abating odors, before release to the atmosphere. The exterior layer of the cover is waterproof and allows avoiding the formation of leachate.

A **wetting system**, is installed between the Q-Ring[™] cover and the feedstock

An **automatic control system** allows monitoring process parameters, and to adjust wetting and air flow rates.

STRENGHTS

- Reduced investment: one of the most cost effective systems on the market
- **Modularity:** the technology adapts easily to different process configuration and existing infrastructure
- Standardization: continuous monitoring guarantee efficiency, durability and ease of use

The Q-Ring[™] fabric ensures:

- Waterproof: avoids uncontrolled wetting of the feedstock and the consequent production of leachate
- Maximum breathability and odor control
- High durability and resistance
- Light, easy to install and customizable: the cover is produced and cut to measure





2. FORCED AERATION DUCTS



3. AERATED CEMENT SLAB



4. Q-RING[™] COVER



APPLICATIONS

Without need of modifications, the Q-Ring[™] system is suitable for all types of aerobic biological treatment:

- COMPOSTING the organic fraction of waste, digestate and sludges
- BIOSTABILIZATION of waste before landfilling
- BIODRYING of waste and biomass and subsequent production of Solid Recovered Fuel (SRF)













FLEXIBLE AND RELIABLE, ENTSORGA HAS DEVELOPED THE SCARABEO™ SYSTEM TO EASILY ACCOMODATE TO ALL TYPES OF ENHANCED AEROBIC WASTE PROCESSING.

THE OXIDATION REACTION IS DRIVEN BY FORCED VENTILATION PROVIDED THROUGH UNDER FLOOR AIR DUCTS. THE USE OF A PROPRIETARY BIOFILTER GUARANTEES AN EXCELLENT ODOR CONTROL.



ENTSORGA'S **SCARABEO™ SYSTEM** IS A **PROVEN AND RELIABLE** SOLUTION FOR A **SAFE**, **FAST AND CLEAN** BIOSTABILIZATION OF BIOMASS. SUITABLE FOR MEDIUM-SIZED SYSTEMS (WITH A CAPACITY OF 15,000 T/A), SCARABEO™ COMBINES THE ADVANTAGES OF A **COMPLETELY ENCLOSED** PROCESSING AREA WITH THE USE OF A PROPRIETARY BIOFILTER.

MAIN FEATURES

Entsorga's Scarabeo™ system consists of modular biocells with an aerated structure, a floor with embedded and special "nozzles" that allow for forced aeration and a roof in PVC(1) or cement(2).

The material to be treated is accumulated in biocells, where the maturation is accelerated thanks to the forced aeration system(3), managed by the Entsorga's control software, which distributes and regulates the air flow, guaranteeing the best temperature to sanitize the processed feedstock.

The process air is then aspirated and sent to the biofilter(4) to be treated before being released into the atmosphere.

STRENGHTS

- Durability and high performance, with low initial investment and maintenance costs
- **Easy installation**
- Maximum reliability, thanks to the automatic control system that records, processes and optimizes data from each single batch (temperature, time, quantity, wetting cycles, air flow, door opening and closing)
- Minimal environmental impact: no dispersion of materials due to rain or wind and excellent odor control thanks to the biofilter
- Modularity and flexibility of use: the technology can be easily adapted to different uses and types of waste to be treated
- Standardization: online continuous process monitoring at industrial scale guarantee efficiency, durability and ease of use

1. BIOCELL WITH PVC COVER



2. BIOCELL WITH CONCRETE COVER



3. FORCED AERATION SYSTEM



4. BIOFILTER TO TREAT PROCESS AIR



APPLICATIONS

Without need for modifications, the Scarabeo[™] system is suitable for all types of aerobic biological treatment:

- **COMPOSTING** the organic fraction of waste, digestate and sludges
- **BIOSTABILIZATION** of waste before landfilling
- **BIODRYING** of waste and biomass and subsequent production of Solid Recovered Fuel (SRF)













THE **SPIDER™** IS AT THE HEART OF ALL THE ENTSORGA'S HIGH VOLUMES SYSTEMS FOR PROCESSING BULK MATERIAL. **FULLY AUTOMATED HIGH SPEED CRANE** ALLOWS FOR ROBUST AND ENERGY EFFICIENT MATERIAL HANDLING.

ENGINEERED TO HANDLE WASTE AND WASTE DERIVED FUELS, IT IS THE OPTIMAL SOLUTION FOR EFFICIENTLY HANDLING LARGE VOLUMES OF BULK MATERIAL AND ALLOW LARGER LOWER COST STORAGE CAPACITY WHEN COMPARED WITH TRADITIONAL SILOS SYSTEMS.



FULLY AUTOMATED AUTOMATIC HANDLING SYSTEM, THE SPIDER™ GUARANTEES **FAST**, **PRECISE AND SAFE** MATERIAL HANDLING. A **PROPRIETARY SOFTWARE** PROVIDES HIGH LEVEL PERFORMANCE AND MAKES THE SYSTEM EASILY ADAPTABLE TO THE NEEDS OF THE MOST DIFFERENT USERS, FROM WASTE PROCESSING TO STORAGE OF LARGE VOLUMES OF ALTERNATIVE FUELS.

MAIN FEATURES

The SPIDER™ bridge crane is an automatic material handling system with a bucket and a crane equipped with load weighing devices.

Particular care is given to the **design of mechanical**, **electrical and electronic parts**, to ensure functionality in environments with **extreme processing conditions** (dust, temperature, humidity).

A proprietary software, entirely designed by Entsorga, controls the load capacity and optimizes the data according to the operational needs of each system. This guaranteeing maximum efficiency and continuity of operation, 24 hours a day and 7 days a week.

STRENGHTS

- Provides maximum flexibility in materials management of bulk material and allows for larger storage areas then silos
- Allows to effectively mixing and homogenizing bulk material, in consideration of different process and production needs
- Enhanced safety and reduction of environmental risks related to bulk waste handling: when compared wheel loaders, the bridge crane limits the intervention of operators to maintenance only
- Incoming material management: the overhead crane allows for easy and safe removal of oversized unacceptable waste items







APPLICATIONS

The **SPIDER™** automatic bridgecrane can be used in all treatment plants:

- BIODRYING and refining of waste and biomass to produce Alternative fuels
- COMPOSTING of organic of waste and biosolids
- BIOSTABILIZATION of waste before landfill disposal
- ANAEROBIC DIGESTION for the handling of waste in reception





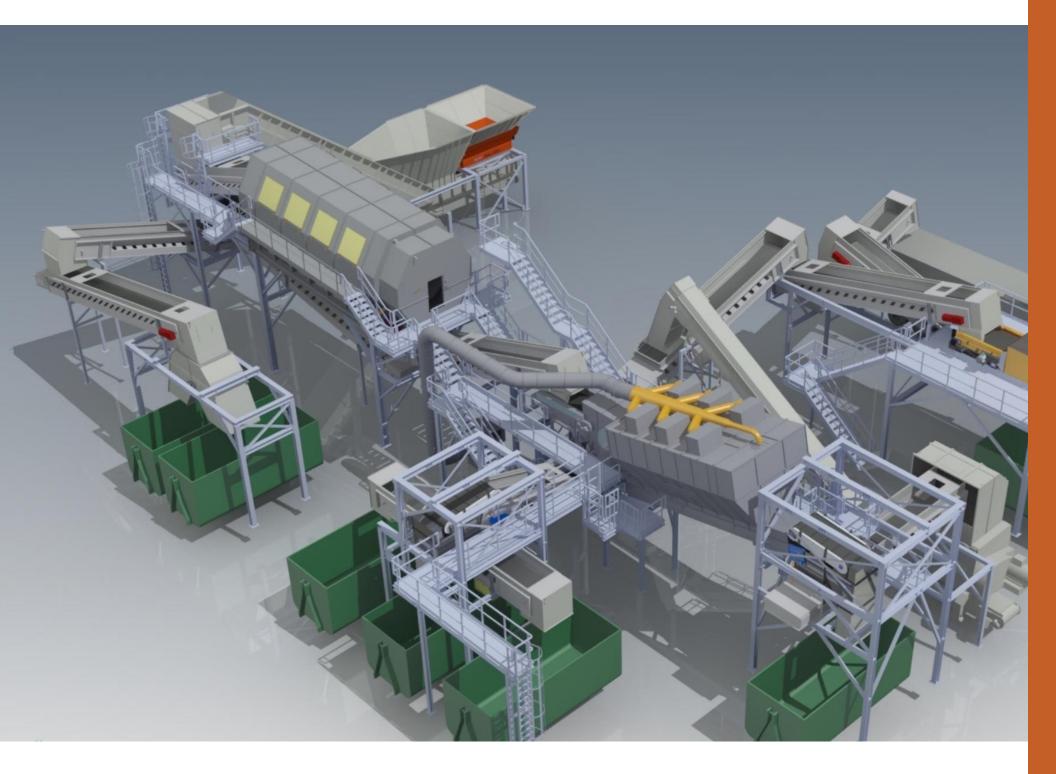






PROMETHEUS™

MECHANICAL REFINING LINE TO PRODUCE SOLID RECOVERED FUEL (SRF)



ENTSORGA'S PROMETHEUS IS A
FLEXIBLE SYSTEM DESIGNED TO REFINE
BIODRIED WASTE AND PRODUCE HIGH
QUALITY ALTERNATIVE FUEL.

THE ALTERNATIVE FUEL, PRODUCED BY SELECTING MATERIALS WITH HIGH CALORIFIC POWER, IS A PARTICULARLY EFFICIENT ALTERNATIVE TO COAL, FOR CEMENT PRODUCERS AND OTHER INDUSTRIAL USERS.



THE PROMETHEUS™ SYSTEM IS A **HIGH PERFORMANCE FLEXIBLE MECHANICAL REFINING LINE** DEVELOPED BY ENTSORGA TO PRODUCE **HIGH QUALITY SRF** *. DEPENDING FROM VOLUMES AND TYPE OF WASTE TO BE

TREATED, THIS SOLUTION USES **DIFFERENT EQUIPMENT CONFIGURATIONS** TO SEPARATE FRACTIONS WITH HIGHER CALORIFIC POWER FROM RECYCLABLES GRITS AND INERTS.

SRF QUALITY

- * SOLID RECOVERED FUEL (SRF) compliant with UNI EN 15358 which has obtained the status of Non Hazardous Secondary Material by the US EPA (Environmental Protection Agency)
- High calorific value (18 Mj/Kg c.a)
- Very low residual humidity (15-20%)
- Minimum chlorine content (<0.7 mg / kg)
- Sizing according to the user's specifications
- Can be delivered as fluff (bulk or baled) or pellet

STRENGHTS

Entsorga's Prometheus™ system allows:

- maximizing yield and quality of the alternative fuel produced
- Minimizes residual waste to be landfilled (15-20%)
- Optimizes recovery (3-10%) of recyclable materials (ferrous metals, aluminum, copper, brass and plastic materials)
- Minimum electrical consumption

APPLICATIONS

High quality, high bioogenic conternt alternative fuels for industrial users (Cement/lime producers, WTE, Gasification and Advanced Thermal Treatment plants).

STATE OF THE ART PROVEN EQUIPMENT

The **Prometheus™ system** is set up as a **complete line of different equipment** entirely designed by Entsorga to optimize the refining process and therefore obtain a fuel with a high calorific value.

PRIMARY SHREDDER,TO HOMOGENIZE SIZE AND ALLOW
BETTER REFINING



ROTATING DRUM SCREENER TO SEPARATE GRITS AND FINES TO BE LANDFILLED OR USED AS LANDFILL COVER



AIR SEPARATOR,
TO SEPARATE HIGH QUALITY FRACTION,
FROM MATERIAL WITH LOW CALORIFIC





MAGNETIC SEPARATOR TO SEPARATE FERROUS METALS



INDUCED CURRENT SEPARATOR, TO RECOVER ALUMINUM, ETC ...



FALCON™, NIR (NEAR INFRA RED) OPTICAL SORTER TO ELIMINATE CLORINATED PLASTICS



SECONDARY SHREDDER TO ADJUST THE SRF TO THE REQUIRED SIZING





ENTSORGA'S PELICANTM SYSTEM PROVIDES A COMPLETE LINE FOR THE SUPPLY OF ALTERNATIVE FUELS TO CEMENT KILNS

THIS SYSTEM ALLOWS SUPPLYING THE KILN IN AUTOMATIC AND CONSTANT MODE, VARYING THE FLOW RATE ACCORDING TO THE NEEDS OF THE PLANT.



ENTSORGA'S PELICAN™ SYSTEM PROVIDES A **COMPLETE SET OF TECHNOLOGIES FOR FEEDING CEMET PLANTS** WITH A WIDE RANGE OF
ALTERNATIVE FUELS. **FLEXIBLE**, **HIGH PERFORMANCE AND LOW ENERGY CONSUMPTION**, OUR PELICAN™ SYSTEM IS DESIGNED TO GUARANTEE A **STEADY AUTOMATED SUPPLY TO KILNS**, WITH A **CONSTANT AND ADJUSTABLE FLOW** ACCORDING TO THE PLANT REQUIREMENTS.

WHY USE THE SOLID RECOVERED FUEL (SRF)

Alternative Fuels Coprocessing
Solid Recovered Fuel (SRF) for cement producers
represents a cheaper and more sustainable
alternative to fossil fuels:

- Cement production costs can decrease (up to 8%)
- reducing greenhouse gas emissions
- limiting the consumption of non-renewable resources

The use of CSS also has **specific advantages in the production of cement**:

- Improves emissions profiles: the long residence time and high process temperatures allow destroying organic compounds and requalify the PCDD / DF (polychlorin-dibenzo-pdioxins), also neutralizing the emission of acidic gas deriving from active lime, sulfur oxides and hydrogen chloride.
- It creates very stable bonds (metal silicates)
 in the clinker structure, which incorporate
 heavy metals without the production of ash or
 liquid residues from gas

STRENGHTS

- Complete automation: Entsorga's in house developed software controls loading and unloading speed from delivery trucks
- Low opex and reduced storage space: the optional automatic overhead crane allows managing large volumes of fuel
- Flexible management of the supply flow, adjustable according to the system needs.
- Safer working conditions for operators:
 thanks to the suction system, the operator is not exposed to dust

APPLICATIONS

Cement/lime producers and other industrial users of alternative fuels

SYSTEM COMPONENTS

Entsorga's Pelican[™] system includes a **complete and customizable line of solutions** to manage each phase of alternative fuel **from receiving and feeding to the injection point,** including an **automatic control system** capable to monitor and manage the flow:

DECEIVING STATION



DOSING AND FEEDING SYSTEM



CONVEYOR BELT



WALKING FLOOR





CHAIN CONVEYOR



AUTOMATED CRANE



MAGNETIC SEPARATOR



SCREENER



FLOW CONTROL SYSTEM





CREATED BY COMBINING THE BEST NIR IDENTIFICATION TECHNOLOGY WITH ENTSORGA'S LONG TIME EXPERIENCE IN WASTE TREATMENT, THE FALCON IS A TOP LEVEL NIR OPTICAL SEPARATOR, CAPABLE OF IDENTIFYING MATERIALS AND PROVIDING REAL-TIME ANALYSIS OF THEIR QUALITY, TO EASILY MEET ALL CUSTOMERS REAL NECESSITIES.



INITIALLY DESIGNED **TO REMOVE PVC FROM SRF** AND **KEEP CHLORINE CONTENT LOW**, THE FALCON™ HAS BEEN FURTHER IMPROVED THANKS TO THE ENTSORGA EXPERIENCE IN THE MANAGEMENT OF WASTE PLANTS.

THIS IS THE RESULT OF THIS LATEST GENERATION NIR SEPARATOR WHICH GUARANTEES **NOT ONLY A PRECISE SEPARATION**, BUT ALSO AN **ONLINE CONTROL OF THE QUALITY OF THE PRODUCT,** TO BETTER SATISFY THE NEEDS OF ANY CUSTOMER.

WHAT IS A NIR SEPARATOR?

All materials have **their own fingerprint**: subjected to the light, according to their chemical-physical characteristics, they reflect a **specific spectrum**.

The Falcon[™] exploits this phenomenon to identify materials that travel on the conveyor belt thanks to a **near Infra Red (NIR) hyperspectral camera** with a higher resolution than the traditional NIR separators.

The true strength of the Falcon[™] system, this detection technology allows a more detailed visualization of the spectrum and hence the even more precise identification of the different materials. In addition, the camera is able to perform a real-time analysis of their quality, providing the content of chlorine, the composition of the material, the humidity and the calorific value.

According to the information gathered by the camera, a **compressed air ejection system**, located at the end of the conveyor, blows away the objects of the targeted material.

Entsorga Falcon[™] detection unit is the best technology in NIR spectrography.

STRENGHTS

- High-speed and low-cost ejection system: unwanted objects are ejected from nozzles located at the conveyor end. These are powered by special speed-up boards that guarantee the quickest opening rate (~1-2 ms), but also allow the saving of 75% of the energy consumed by traditional electrovalves.
- Maximum safety during operation and maintenance: a series of safety interlocks allows the operator to always work in safe conditions, both during normal functioning and during maintenance.
- Automatic cleaning: the hyperspectral camera and deflector mirror are equipped with a copressed air automatic cleaning system that greatly reduces the need for maintenance.
- 100% integrated and connected: the Falcon[™] can be easily installed on any line and remotely controlled by the **system control**.
- On-Line quality analysis: thanks to the data collected by the camera, the machine can be easily configured and adapted to customers' needs.



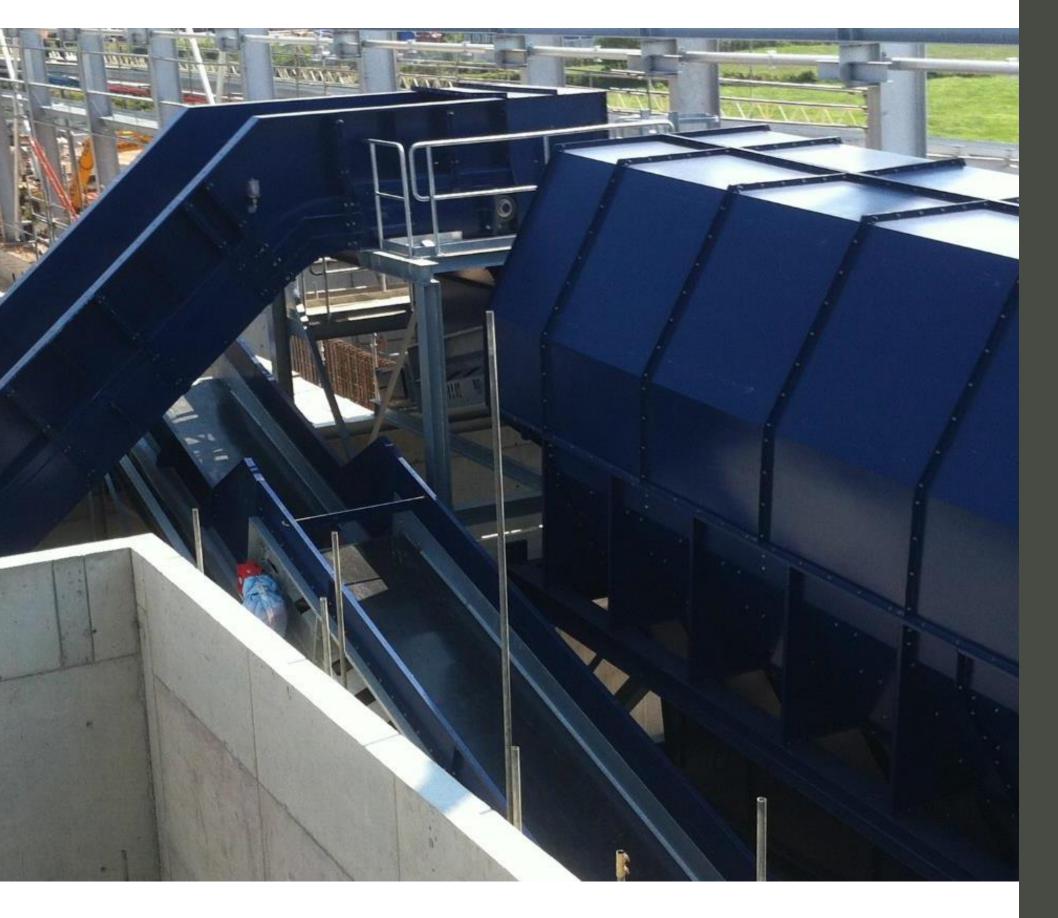




PROCESS APPLICATION

- PVC Removal for SRF production
- Plastic Recycling (PE, PET, PP, PS, PC, PVC and others)
- Paper Recycling





THE SWALLOW MECHANICAL PRE-TREATMENT SYSTEM ALLOWS THE SEPARATION OF UNSORTED WASTE IN TWO STREAMS, WITH A HIGHER AND LOWER MOISTURE CONTENT.

A BASIC OPERATION, WHICH ALLOWS THE **OPTIMIZATION AND EFFICIENCY** OF THE TREATMENTS, BOTH FOR **BIOSTABILIZATION** OR **REFINING** TO PRODUCE ALTERNATIVE FUELS.



MECHANICAL PRE-TREATMENT SYSTEM TO SEPARATE UNDERSCREEN THE WET AND DRY COMPONENTS OF UNSORTED WASTE. THE SWALLOW™ IS THE ENTSORGAS PATENTED SOLUTION TO REDUCE THE MATERIALS TO BE SENT TO THE BIOLOGICAL TREATMENT. THANKS TO THE CUSTOMIZABLE SCREENING SYSTEM, IT IS ALSO POSSIBLE TO OBTAIN MORE HOMOGENOUS FRACTIONS MORE EASILY SUITABLE TO THE SUBSEQUENT USES.

MAIN FEATURES

The mechanical pre-treatment Swallow™ patented by Entsorga is coposed by:

- 1. Chain conveyor with hopper
- 2. Screener with «bag opener» system, completely closed to avoid dust dispersion and equipped with doors for internal visual inspection
- 3. Extraction conveyors

The conveyor carries the unsorted waste to the fast rotating screen with bag opener, with two different output:

- underscreen, containing the organic fraction and other fine fractions; it is the fermentable fraction that really needs to be stabilized:
- **overscreen:** containing the light fractions such as paper and plastics; It can be directly sent to landfill or to the refining line.

STRENGHTS

- High treatment capacity
- Reduced electric consumption compared to a classic shredder/bag opener
- Selection of the underscreen fraction to be sent to biostabilization, with the reduction of volumes that have to be treated in the aerobic phase
- The **bag opener function** optimizes the screening performance and avoids the use of a shredder.
- Dimensional selection and material homogenization concording to the choosen screening holes

1. CHAIN CONVEYOR



2. SCREENER WITH BAG OPENER





3. EXTRACTION BELTS



APPLICATIONS

The Swallow[™] mechanical pre-treatment can be used in all treatment plants:

- BIODRYING and refining of waste and biomass to produce Alternative fuels
- BIOSTABILIZATION of waste before landfill disposal

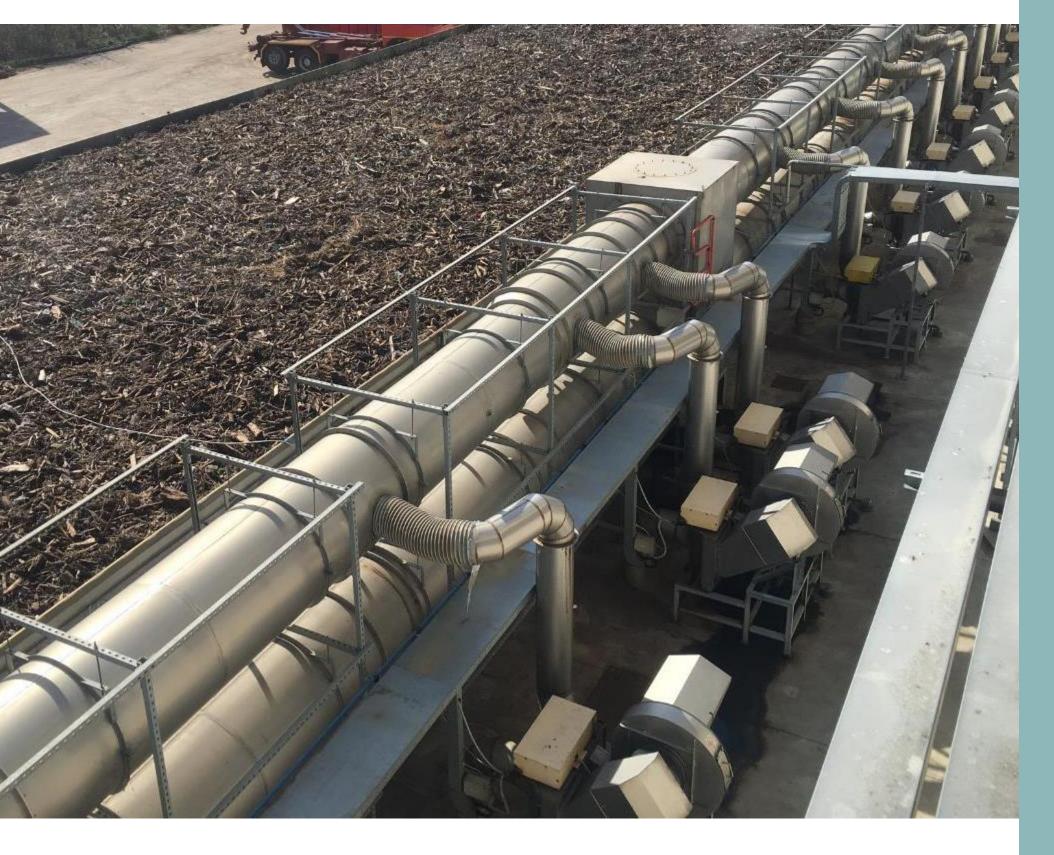












NATURAL AND ENVIRONMENTALLY FRIENDLY, **THE BIOFILTER DESIGNED BY ENTSORGA** IS A **SIMPLE AND EFFECTIVE TECHNOLOGY** TO ABATE AND CONTROL ODOR EMISSINS FROM WASTE PROCESSING AREAS.

LOW MAINTENANCE COST AND LONG
OPERATING LIFE MAKE IT ONE OF THE MOST
USED AND AFFORDABLE ODOR CONTROL
SYSTEMS AVAILABLE ON THE MARKET.



THE ENTSORGA BIOFILTER EFFECTIVELY CONTROLS AND MINIMIZES THE ISSUE OF ODOR EMISSIONS FROM MATERIAL HANDLING AND PROCESSING OF MUNICIAPL SOLID WASTE. THIS NATURAL, BIOLOGICAL PROCESS SOLUTION, IS HIGHLY EFFECTIVE AND SUSTAINABLE, AND IS A GREAT FIT FOR PLANTS LOCATED NEAR RESIDENTIAL AREAS.

MAIN FEATURES

The process air drawn from the processing areas by a **forced aeration system (1)** is conveyed to the bottom of the **biofilter (2)** consisting of slotted plastic plates.

The purification of the air effluents is performed without using any synthetic chemical, but simply by exploiting the action of heterogeneous microbes, composed of bacteria, molds and yeasts, which metabolize up to 99.5% of organic and inorganic substances and transform odorous compounds into carbon dioxide and water vapor.

The microbial activity develops inside a **natural medium (3)**, the filtering bed, which is composed by a mix of barks and wood, through which air effluents are circulated.

STRENGHTS

- excellent odor control
- **natural process,** without synthetic chemical additives
- easy to install
- low energy consumption: the high porosity of the filtering bed ensures reduced pressure drops and therefore allows for overall low energy consumption
- long operating life: the filtering material is replaced every 4-5 years and at the end of its life can be used as bulking agent in composting or economically disposed as landfill cover.
- maximum process reliability, thanks to the automatic control system that records, processes and optimizes process data (temperature and humidity)
- modularity and flexibility of use in different process systems
- standardization: the continuous monitoring and control on an industrial scale guarantees
- maximum reliability and performance

1. FORCED AERATION SYSTEM







3. FILTERING MIX



APPLICATIONS

Without need of modifications, Entsorga's Biofilter system is suitable for all types of aerobic biological treatment including :

- COMPOSTING the organic waste, digestate and sludges
- BIOSTABILIZATION of waste before landfilling
- **BIODRYING** of waste and biomass and subsequent production of Solid Recovered Fuel (SRF)













ENTSORGA'S geCO₂™ IS AN INNOVATIVE
PROPRIETARY SOLUTION THAT ALLOWS TO
EFFECTIVELY ABATE METHANE CONTAINED IN
RESIDUAL LANDFILL GAS THAT CANNOT BE
FURTHER HARVESTED AND THAT DIFFERENTLY
WOULD BE RELEASED TO THE ATMOSPHERE.

BASED ON A **COMPLETELY NATURAL FILTRATION**PROCESS, IT IS A **SAFE** AND **VERSATILE** METHOD TO
REDUCE ENVIRONMENTAL IMPACT OF RESIDUAL
LANDFILL GAS WITHIN THE REGULATORY
FRAMEWORK



WHEN LANDFILL GAS CONCENTRATION IS TOO LOW TO ALLOW ITS HARVESTING AND CONVERSION TO POWER OR EVEN FLARING, THE **RESIDUAL BIOGAS** WITH LOW CONCENTRATION OF METHANE (<25%) ENDS UP BEING RELEASED TO THE ATMOSPHERE FOR SEVERAL YEARS. geCO2™ IS THE SOLUTION DEVELOPED BY ENTSORGA TO REDUCE THESE HARMFUL EMISSIONS WITH AN EFFECTIVE AND LOW COST SOLUTION HARNESSING THE NATURAL MICROBIAL ACTIVITY

MAIN FEATURES

Entsorga's **geCO**₂[™] is a biological biogas treatment system that occurs in two process steps:

- degradation of methane and of the odorgenerating compounds thanks to the naturally occurring microbial activity within the bio-filtering material (1), mostly by methanophilic bacteria and aerobic thermophilic enzymes
- further filtration thanks to a special semipermeable membrane (2) which completes the reduction of methane and odors, allowing the treated air effluents to be released to the atmosphere with minimal environmental impact.

An automatic wetting system ensures optimal process conditions and maximum treatment efficiency.

The bio-filtration system is contained within a roll-off container structure (3), with walls equipped with inspection points and internal flooring (4) with slotted tiles, to ensure aeration and homogeneous air distribution. If preferred, the geCO₂™ can also be equipped with a **specific** aspiration system to capture biogas and convey it inside the container structure.

STRENGHTS

- reduction of the environmental impact of landfills in the surrounding areas, thanks to the excellent levels of methane and odor abatement (> 90%)
- **use of a natural filtration process**, which requires limited management and maintenance costs
- maximum reliability
- ease to use: movable, modular system, with easy and fast installation
- high flexibility, adaptable to different uses and configurations
- allows generation of carbon credits certificates complying with the requirements of international standards.

1. BIOFILTERING MATERIAL





3. ROLL-OFF CONTAINER



4. INTERNAL FLOOR







THE COW SEMI-DRY SYSTEM, BASED ON A DEDICATED PRETREATMENT AND A SEMY DRY PLUG FLOW DIGESTER, IS ONE OF THE MOST INNOVATIVE GREEN TECHNOLOGIES FOR THE RECOVERY OF BIOGAS FROM ORGANIC WASTE ON THE MARKET.

INTEGRATED WITH **COMPOSTING**, ANAEROBIC DIGESTION REPRESENTS ONE OF **THE MOST SUSTAINABLE AND EFFICIENT** SOLUTIONS ON THE MARKET, BOTH IN TERMS OF ENERGY SAVING AND ENVIRONMENTAL IMPACT.



AMONG THE ALTERNATIVES PROPOSED BY ENTSORGA FOR THE ANAEROBIC TREATMENT OF ORGANIC WASTE, THE COW SEMI-DRY SYSTEM IS PRESENTLY ONE OF THE MOST INNOVATIVE AND PROMISING METHODS ON THE MARKET. THE BIOGAS OBTAINED FROM THE FERMEMTATION PROCESS CAN BE USED TO RECOVER ENERGY THROUGH COMBINED HEAT OR POWER (CHP) AND/OR UPGRADED TO BIOMETHANE TO BE INJECTED INTO THE GAS GRID OR USED AS A VECHICLE FUEL.

FEATURES

The anaerobic digestion feed is based on a horizontal "plug-flow" type digester (piston flow) (1), managed in a semi-dry process: the organic waste is placed inside a reinforced concrete digester (2) where the natural biological fermentation is maintained in the absence of oxygen.

A special system of horizontal shaking facilitates the micro organism activity thus maintaining the matter in a condition of perfect mixture and a **wall heating system** maintains an optimal temperature (about 40°C). All the main process parameters are monitored and managed by an **automized control system**.

Two products are obtained from the fermentation; **biogas**, a natural gas composed mainly of methane and carbon dioxide, and, after about 20/30 days, a residual digestate, suitable for **composting** and use as a fertilizer of excellent quality for agriculture.

ADVANTAGES

- incredibly high yield in biogas production
- no need of water cleaning plant
- recycling of plastic scraps as high quality solid recovered fuel
- minimal amount of scraps to be landfilled (<5%)
- maximum environmental compatibility: no smells or dust are released into the environment. The anaerobic digestion takes place inside closed digesters, with no external emissions.
- reduced running and manpower costs: the complete automatization of the plant limits access to waste treatment areas, protecting the health and guaranteeing the safety of the operators.
- high automation industry 4.0 and low consumption: thanks to the automatization of the processes carried out by the automatic control system.
- maximum flexibility: modular and adaptable, the system easily adapts to the most diverse treatment requirements.
- limited footprint

(1) THE PISTON FLOW







UPGRADING SYSTEM



APPLICATION FIELDS

The **COW** system is a method of **ANAEROBIC TREATMENT** used to extract **biogas** from the organic fraction of waste and sludge. Together with the technologies for **COMPOSTING**, it allows for the maximum valorization of matter and energy recovery from waste.





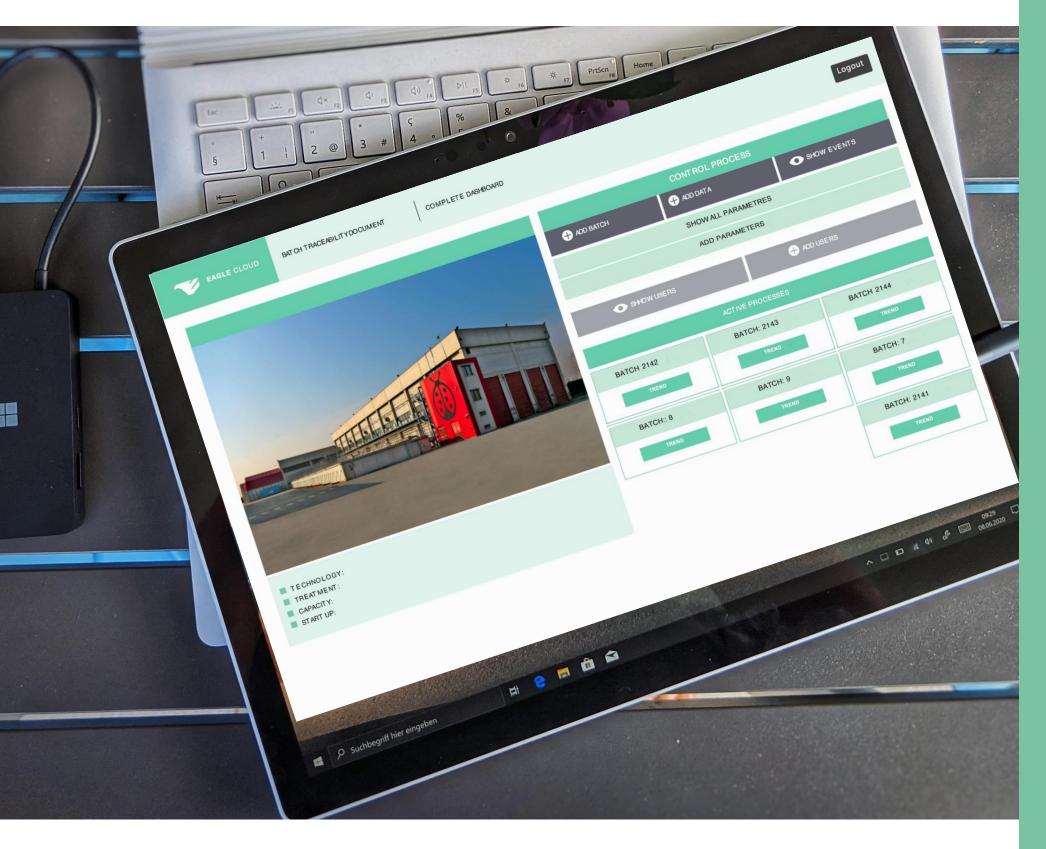






EAGLE CLOUD SYSTEM

PROCESS ASSISTANCE 4.0



CLOUD PLATFORM FOR SUPERVISION AND MANAGEMENT OF WASTE TREATMENT PLANTS, EAGLE CLOUD IS **INDUSTRY 4.0 APPLIED TO YOUR PLANT**:

- PROCESS AND MAINTENANCE ALWAYS UNDER CONTROL
- NEVER MORE INSTALLATION STOPS
- MAXIMUM PLANT YIELDS

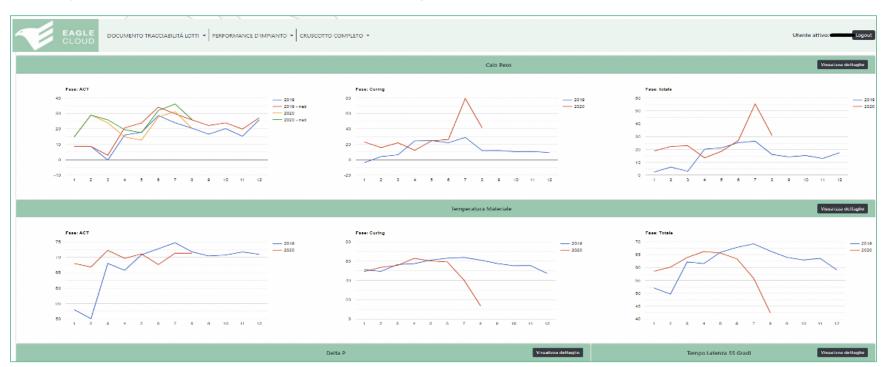


FOR SYSTEMS ALWAYS AT THE TOP

THE SUCCESS OF A PLANT DEPENDS ON THE CONSTANT SUPERVISION AND MONITORING OF BIOLOGICAL TREATMENT PROCESSES: BEING ABLE TO ASSESS PERFORMANCE, ANALYSE AND COMPARE PRODUCTION TRENDS IS AN IMPORTANT GUARANTEE TO ENSURE MAXIMUM PROCESS EFFICIENCY. THE EAGLE CLOUD, ENTSORGA'S **NEW DATA MONITORING PLATFORM**, **SIMPLIFIES MANAGEMENT OPERATIONS** AND **OPTIMISES MAINTENANCE COSTS**, BOTH ROUTINE AND EXTRAORDINARY. THE USE OF ARTIFICIAL INTELLIGENCE ALSO ALLOWS FOR A CONSTANT IMPROVEMENT IN THE SYSTEM'S PREDICTIVE CAPACITY.

PERIODIC AND CUSTOMIZABLE REPORTS

The Eagle Cloud develops **Process Reports** that allow a quick analysis of key process parameters and provide maximum control over the different processing steps. This makes it possible to predict **trends**, identify any **anomalies**, and take **the necessary corrective actions before problems arise**.





ONE PLATFORM, MANY LEVELS OF ANALYSIS

For the CEO, a simple dashboard for quick control at a glance

For the Plant Manager, an effective management tool for analysing and diagnosing critical issues

For the Chief Maintenance Officer, a precise forecasting tool for scheduling timely maintenance



PERFORMANCE AT THE MAXIMUM

The processing of more than 4,000,000 process data allows the Eagle Cloud to keep the biological processes of the plants under control at all times, anticipating any anomalies and ensuring 100% productivity. And, if needed, Entsorga can intervene with remote assistance



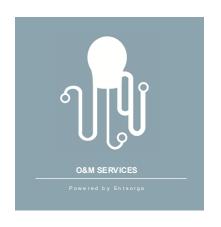
RELIABLE AND RISK-FREE MANAGEMENT

Maximum visibility of the different treatment stages minimises plant shutdowns and maintenance downtime. And above all, it maximises plant operating costs.



INTERFACE INTUITIVE AND UNIVERSAL

Easily accessible from desktop and mobile, the user-friendly interface allows immediate reading of data. A universal and flexible system, suitable for installations built with both Entsorga and third-party technologies.



OPERATION & MAINTENANCE SERVICES







TO GUARANTEE TREATMENT PLANTS ALWAYS AT THE TOP OF EFFICIENCY AND RELIABILITY ENTSORGA OFFERS TAILOR-MADE SERVICES OF ASSISTANCE IN KEY INDUSTRY 4.0.



OVER 20 YEARS OF EXPERIENCE IN THE CONSTRUCTION AND MANAGEMENT OF WASTE TREATMENT PLANTS, ENTSORGA OFFERS **TECHNICAL ASSISTANCE** IN THE FIELD OF INTEGRATED ENVIRONMENTAL SERVICES, **GLOBAL SERVICE O&M** AND **PROCESS CONTROL**. COMPLETE SERVICES, AVAILABLE TO THOSE WHO BUILT THE SYSTEMS WITH ENTSORGA TECHNOLOGIES AND TO THOSE WHO USE DIFFERENT TECHNOLOGIES.

FEATURES

Entsorga's proprietary software to optimize process performances, minimize plant downtime and simplify plant management activities, Entsorga offers:

- Remote technical assistance: supervisors from the control room in Entsorga's headquarters can connect to the plants in order to fix from remote eventual issues of the automation system
- Data recovery and Eagle cloud[™] platform: data collected form plants are stored and processed on a cloud platform by using statistic and Al algorithm to monitor the process and the plant thus providing timely reports to plant managers.
- **O&M technical assistance:** maintanance operations supervised by the cloud maintanance software scheduling and tracing ordinary maintenance, faults, spareparts and consumables use.

THE COW LAB

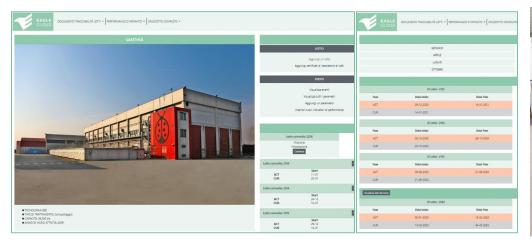
To support the O&M division, Entsorga has also created a **pilot plant**, the **Cow lab**, that was designed as an **anaerobic semi dry plug flow digester** on **1:12** scale.

It recreates recreates the real conditions of anaerobic treatment and allows to study in advance the **process stability**, so that the O&M team can intervene, if necessary, with corrective actions on the main digester during its start-up and standard operating period.

The results of the tests thus allow for better definition of operational choices for larger scale plants, optimizing the process efficiency and the time and cost of the production process.

The prototype, applied for the starting of the anaerobic reactor in Santhià (Italy), thanks to its great flexibility can be chosen by anyone who who wants to **upgrade** or **improve** anaerobic digestion plants already in operation or who wants to **evaluate the opportunity to combine anaerobic digestion** with composting, its natural complement.

EAGLE CLOUD™ COW LAB







APPLICATIONS

- COMPOSTING the organic waste, digestate and sludges
- BIOSTABILIZATION of waste before landfilling
- BIODRYING of waste and biomass and subsequent production of Solid Recovered Fuel (SRF)
- ANAEROBIC DIGESTION preprocessing for material handling in the receiving area

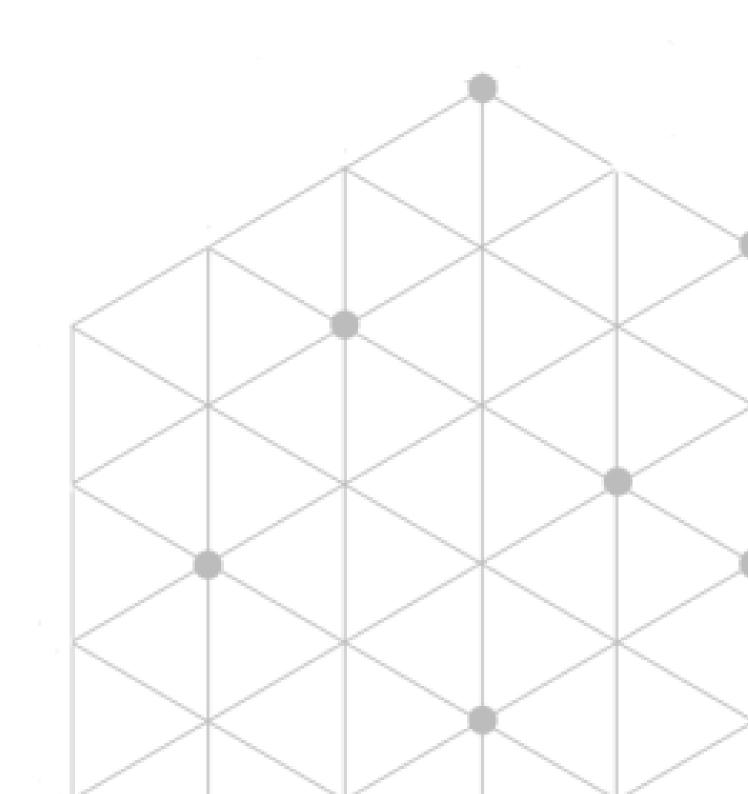




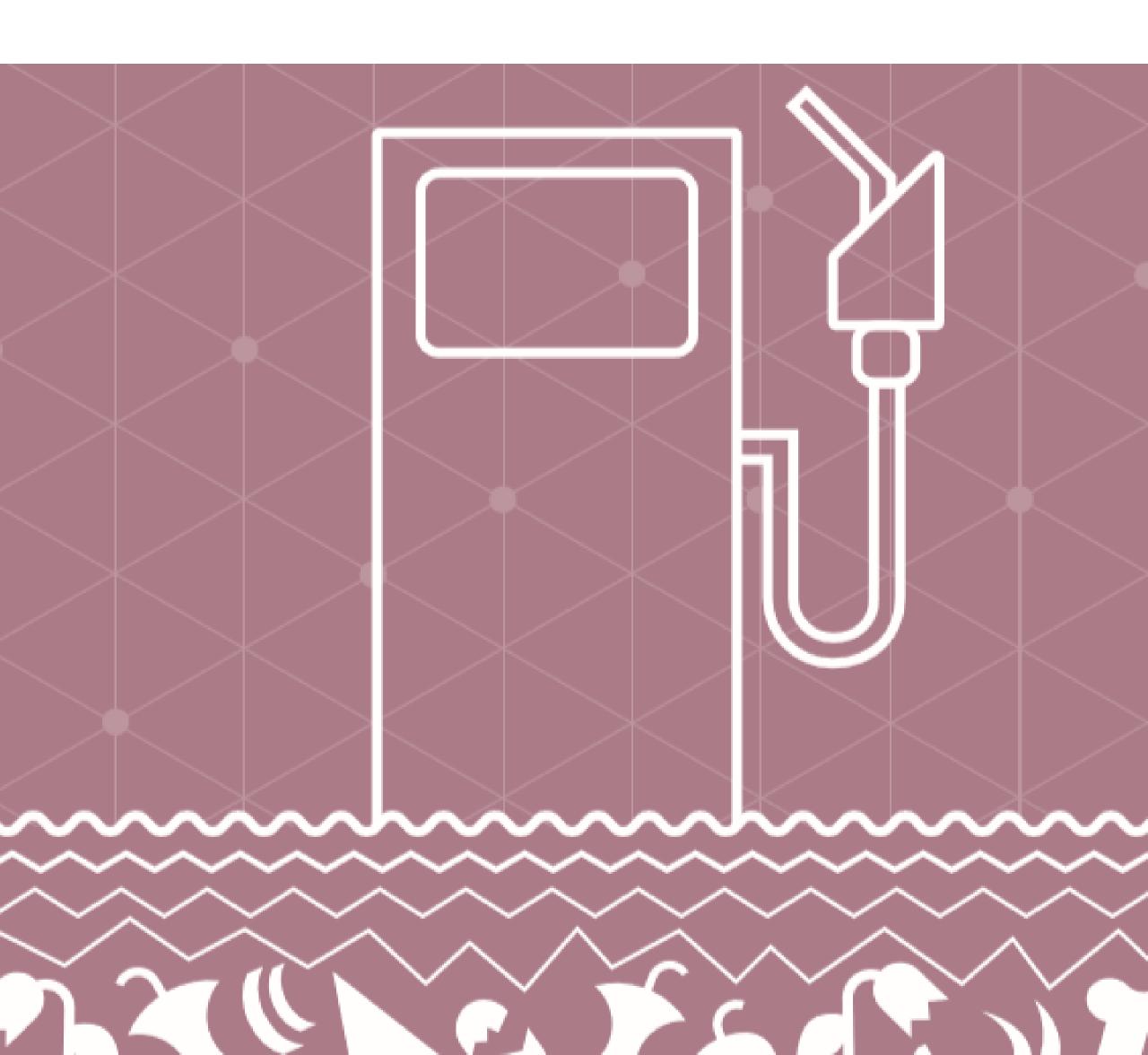




>> ENTSORGA SOLUTIONS AND REFERENCES



ANAEROBIC DIGESTION





A SUCCESSFUL PARTNERSHIP TO UNLOCK NUTRIENTS AND CLEAN ENERGY.

The solution proposed by Entsorga for anaerobic digestion can provide an innovative, integrated pathway that **maximizes the resources that can be extracted from organic waste.**

By combining **Anaerobic Digestion** and **Composting**, Entsorga is able to guarantee the highest level of sustainability, both in terms of energy saving and of environmental impact.

Entsorga offers a range of **flexible** and **modular** technologies: from solutions based on tunnel reactors for small to medium communities to fully automated, high capacity plants. The combination of AD and Composting technology can be fine-tuned and optimized for each project, thus providing a real tailor-made solution for every community.

SIENAMBIENTE SpA

Asciano (SI) Italy

COMPOSTING AND SEMI-DRY ANAEROBIC DIGESTION PLANT



THE "LE CORTINE" PLANT IN ASCIANO, IN THE PROVINCE OF SIENA, IS A **KEY WASTE MANAGEMENT HUB** IN SOUTHERN TUSCANY.

ENTSORGA CONTRIBUTED TO ITS **TECHNOLOGICAL REVAMPING PROJECT**,

THANKS TO THE ADDITION OF THE **ANAEROBIC DIGESTION SECTION**.

THE ENTIRE REVAMPING HAS MADE THE SYSTEM AMONG THE MOST ADVANCED AND VIRTUOUS NATIONWIDE, INCREASING RECYCLING BY 15 PERCENT, FURTHER REDUCING WASTE AND THUS THE USE OF LANDFILLS, AS WELL AS SAVING THE ENVIRONMENT MORE THAN 100,000 TONS OF CO2EQ PER YEAR, EQUAL TO THE ABSORPTION OF A 40-HECTARE FOREST.

PLAND DATA	
Society	Le Cortine, owned by Sienambiente SpA
Capacity	31,000 tons/year FORSU + 10,000 of wood waste
Treated waste	Organic fraction from separate collection
Final Product	 High quality compost for agriculture: up to 12,000 t/y Biogas from which is obtained up to 2,500,000 m³/y of Biomethane to be fed into the grid
Start up	Composting: from 2009 Anaerobic digestion: from 2024
Plant	Composting and Anaerobic Digestion

SOCIETY

The "Le Cortine" plant in Asciano, in the province of Siena, owned by Sienambiente S.p.A., is a key waste management hub in southern Tuscany.

PROJECT

Its revamping project, worth about 40 million euros, was contracted in 2022 to the association of companies composed of **Entsorga Spa**, Secit Impianti Srl and Tecnostrade Srl, and involved all production lines, from the treatment of organic waste to the valorization of separated waste collection, from paper recovery to the treatment of unsorted municipal waste.

THE ENTSORGA SOLUTION

Entsorga provided **4 proprietary technologies** essential to the new biomethane production line: the **Spider**[™] **robotic bridge cranes**, the **pretreatment systems**, **Cow**[™] **semi-dry plug flow** anaerobic digesters, and **Eagle Cloud**[™] plant control and management systems.

THE ANAEROBIC DIGESTION LINE

Anaerobic Digestion complements composting as its natural counterpart. The two processes are organized in series: in the first phase, the organic fraction undergoes mechanical pre-treatment (1) and hot biological degradation in the absence of oxygen in a plug-flow (piston-flow) horizontal digester (2). The section is set up in a fully enclosed environment, ensuring improved effectiveness of the process and reducing its climate-altering and odor emissions.

From the process, **biogas** and an intermediate product, digestate, are obtained; the latter, mixed with a structuring substance consisting mainly of clippings and prunings, is then treated until it is transformed into **compost**, completing the waste recovery cycle. From the biogas, through an **upgrade system**, 2,500,000 Nm3/year of **biomethane** will be extracted to be fed into the grid, enough to cover the annual needs of **1,800 households**. This also prevents the emission of 9,000 tons of CO2 into the environment each year. Sienambiente's Le Cortine anaerobic digestion line also marks a historic milestone for Entsorga. It is in fact the first to be built entirely by Entsorga and fully in Italy. We are responsible for the design of the biodigester, including the agitator shaft, as well as the quality controls on incoming materials.

THE COMPOSTING LINE

The organic fraction treatment line each year will recover about **40,000 tons of waste** from domestic separate collection of organic waste, plant material (clippings, prunings) and organic waste from agro-industrial processing cycles (tomato, vine, etc.), producing about 4,000 tons of compost.

The final product of the process is a compost branded as "Terre di Siena", classified as mixed composted amendment, which can be used for its properties in both conventional and organic agriculture. It is also listed in the green purchasing register, from which local authorities must source at least 30% of their supply purchases. The use of compost in agriculture is considered a practice with high ecological value, encouraged by regional authorities because it enriches the soil with organic matter and helps to progressively accumulate carbon in the ground (carbon sink), an important function in the fight against greenhouse gas emissions. Additionally, it contributes to gradually reducing reliance on landfills, in line with the latest EU regulations.

STRENGTHS

- Total safety and minimal environmental and health impact: no odor or dust is released into the outdoor environment. All operations take place in an enclosed environment with a slight vacuum.
- reduced operating and labor costs: full plant automation reduces access to waste treatment areas, protecting the health and ensuring the safety of operators.
- low energy consumption due to the use of highefficiency equipment (Spider overhead crane).
- maximum yield in biogas production
- no need for a water cleaning plant
- minimum amount of waste to be sent to landfill (depending on the quality of the incoming waste)
- high industry 4.0 automation
- **■** limited area commitment

(1) PRE-TREATMENT AREA





(2) ANAEROBIC DIGESTER





USED TECHNOLOGIES =

The following Entsorga proprietary technologies are applied in the plant: automatic Spider® bridge crane, Cow® with semi-dry anaerobic digestion technology, Eagle Cloud® platform.

TERRITORIO E RISORSE

Santhià (VC) Italy

COMPOSTING AND SEMI-DRY ANAEROBIC DIGESTION PLANT



THE PLANT PRODUCES **QUALITY COMPOST**STARTING FROM ORGANIC **KITCHEN WASTE**AND REPRESENTS THE STATE OF THE ART OF
THE WASTE RECOVERY ENTSORGA
PROPRIETARY TECHNOLOGIES.

FROM 2020 IT ALSO PRODUCES BIOGAS BY USING **ANAEROBIC DIGESTION SEMY DRY** AND THEN **BIOMETHANE FOR NATURAL GAS NETWORK**.

THE SYNERGY OF THESE TWO TREATMENT SOLUTIONS LIMITS FURTHER THE ENVIRONMENTAL IMPACTS AND OPTIMIZES THE MANAGEMENT AND WASTE RECOVERY PROCESSES.

PLAND DATA	WITH EXTENSION TO ANAEROBIC DIGESTION
Company	Territorio e Risorse S.r.l.
Capacity	50.000 tpa of organic waste from separate collection. With the second extension, the plant is able to process 80,000 t/y
Treated waste	organic waste from separate collection
Final Output	 High quality compost for agriculture use: up to 10.000 tpa Biogas: till 4.500.000 m³/y, form which we can obtain up to 2.750.000 m³/y of Bio-methane to be put into the net SRF from residual plastics: up to 3.000 t/y
Start up	Composting: from 2009 Anaerobic digestion: from 2020
Plant	composting and Semi-Dry anaerobic digestion
Served basin	up to 730.000 inhabitants
Staff	14

Territorio e Risorse S.r.I., 100% controlled by IREN Group, is the owner Company of the Santhià (VC) composting plant. It was part of the Entsorga Group in the last 10 years and recently has been subject to extraordinary operation and agreements between Entsorga and IREN Groups.

PROJECT

The company **Territorio e Risorse S.r.l.** was founded in 2009 to build the Santhià plant and produce compost from **organic kitchen waste.**

The company is permitted to double **the treatment capacity**, with an **Anaerobic Digestion** unit that will be added to the composting section. In 2018, also the permit for Advanced Biomethane production was obtained.

COMPOSTING PROCESS

The compost production starts by mixing the organic waste and the digestate from **Anaerobic Digestion** section with a material mainly of vegetable origin, preparing a mixture that is placed in heaps using an automatic bridge crane (1): the material is thus ready to be subjected to the aerobic digestion biological treatment H.E.BIO.T. (High Efficiency Biological **System**)**, an high efficiency and high automation system patented by Entsorga. The process takes place in a closed area and is accelerated through a forced ventilation mechanism, monitoring air, temperature and moisture with a high level automation system (2). This confinement allows also a highly effective odour control, thanks to the use of a patented biofilter (3). After about 40 days the fermented mixture is refined with a screening system to remove the non-compostable parts (intert, plastics, glass, ...) and is then sent to the **biocells** (4) for the slow maturation and storage phases. After a minimum of **90 days** since the waste arrived at the plant, the compost is ready to be used.

(1) AUTOMATIC BRIDGECRANE
SPIDER* FOR MATERIAL HANDLING



(2) CONTROL SYSTEM





(3) **BIOFILTER** FOR THE ODOUR PROCESS AIR ABATEMENT

(4) **SCRABBLE*** **BIOCELLS** FOR THE COMPOST MATURATION

FINAL PRODUCT

The output of the process is a high quality compost branded **«Soil for water land»**, as it is targeted to be to be used on rice crops and it is entirely sold to farmers.

The use of quality compost in agriculture is considered a best practice with a **high environmental value**. It also helps to progressively reduce the use of landfills, as requested in the latest European regulation.

STRENGTHS

- environmental compliance: no odours, dust, or leachate are released in the surroundings. All operations take place in closed areas operated under slight negative pressure
- reduced operation and labour costs: the complete plant automation allows reducing need for operators in the waste processing areas, protecting their health and ensuring the operators security
- low energy consumption thanks to the use of high efficiency and energy recovery equipment (bridge crane)

ANAEROBIC DIGESTION SECTION

Anaerobic Digestion goes alongside composting as its natural complement. The two processes are organized in sets: in the first phase the organic fraction undergoes mechanical treatment (5) and a hot biological degradation in absence of oxygen (6). The anaerobic digestion, based on a horizontal "plug-flow" type digester (piston flow) (7), produces biogas and an intermediate solid product, the digestate. In the second phase the digestate turns into compost, completing the waste recovery cycle and the biomethane is extracted from biogas thanks to the upgrading system (8) equipped with the treatment systems necessary for separation. The line also includes a 500 m³ gasometer and an emergency flare.

The anaerobic digestion plant strengthen the composting advantages and adds **further strengths**:

- incredibly high yield in biogas production
- no need of water cleaning plant
- recycling of plastic scraps as high quality Solid Recovered Fuel
- minimal amount of scraps to be landfilled (<5%)
- high automation industry 4.0
- perfect odour control
- limited footprint

(5) RECEPTION AND PRE-TREATMENT AREA







(7) THE PISTON FLOW

(8) UPGRADING SYSTEM

(6) DIGESTER

USED TECHNOLOGIES =

MOSTOSTAL WARSZAWA

Biala Podlaska Poland

MBT BIOSTABILIZATION AND SEMI-DRY ANAEROBIC DIGESTION PLANT



THE PLANT APPLIES THE MOST INNOVATIVE GREEN TECHNOLOGIES ON THE MARKET TO RECYCLE MATERIAL AND PRODUCE RENEWABLE ENERGY FROM WASTE, PROCESSING ORGANIC WASTE WITH AN INTEGRATED ANAEROBIC, BIOSTABILIZATION/BIODRYING AND MECHANICAL TREATMENT SYSTEM.

ENTSORGA HAS AWARDED WITH AN AEROBIC PROCESSING LINE TO FURTHER STABILIZED DIGESTATE. THE LINE INCLUDES A SYSTEM OF 3 SCARABEO™ BIOCELLS AND A BIOFILTER. A SOLUTION PROVIDING OBVIOUS ENVIRONMENTAL ADVANTAGES, AND THAT ALLOWED THE TOWN OF BIAŁA PODLASKA TO LOWER THE COSTS OF WASTE COLLECTION AND DISPOSAL.

PLANTS DATA	
Company	Mostostal Warszawa SA
Yarly Capacity	20.000 t/y of MSW 10.000 t/y of Food Waste from separated collection
Products	Heat and Power (from CHP) Compost and/or CLO (Compost Like Output) Alternative Fuel (RDF or SRF)
Start up	May 2014
Type of plant	Mechanical Biological Treatment Biostabilization / Composting Semi-Dry Anaerobic digestion
People	100.000 equivalent population c.a

One of the largest construction companies in Poland, Mostostal Warszawa SA has been operating for 70 years investing in all key sectors of the construction market, in Poland and abroad, from the industrial sector to the environmental. Over time the company has acquired significant experience in the development of cutting-edge technological systems and is listed on the Warsaw stock exchange. The main shareholder of the company is Acciona construcción SA, a Spanish company of the Acciona group that operates in over 30 countries in infrastructure, renewable energy, green technologies and water management.

PROJECT

Created to maximize the resources that can be extracted from waste prior to their final landfill disposal, the Biala Podlaska plant uses an integrated treatment system based on two lines: anaerobic digestion, provided by Eisenmann, a world leader in environmental anaerobic fermentation technologies, and the biostabilization line of the digestate, carried out by Entsorga.

This section is also successfully applied as bio-drying unit for the alternative fuel produced by mechanical treatment of MSW.

Not only has the plant significantly improved the entire regional waste management system, but today it is **one of the most innovative facilities in Poland.**

ENTSORGA AND ZENVIRO TECH SOLUTION

The biological treatment line provided by Entsorga is based on the proprietary Scarabeo[™] technology, a **modular, reliable and highly convenient solution**. The system created consists of 3 **Scarabeo**[™] **biocells** and a **Biofilter**, to guarantee **excellent odor control**.

The Zenviro tech Anaerobic Digestion Line is based on "Plug-flow" Horizontal Digester suitable for "Semi-dry" process. The system is composed by **2 medium-size Digesters** and produced Biogas is utilized by Cogenerative unit for Energy production (CHP).

Last but not the least, Entsorga supplied also a **Biofilter** that guarantee the process air treatment and an excellent odor abatement.

(1) **DIGESTERS**





(3) SCARABEO* BIOCELLS

(2) CONTROL SYSTEM





(4) FORCED AERATION SYSTEM

FINAL PRODUCT

Anaerobic Digestion produces Biogas, a Methane-rich gas with high energy content, that is used into CHP unit for Heat and Power production.

The result of **Biostabilization/Composting** is a **stable digestate**, with a very **low moisture content**, suitable for being sent to landfills in compliance with the latest European standards. The process in fact **drastically reduces the greenhouse gases emissions** and the production of leachate, benefiting of the environment.

The plant also produces **Alternative Fuel** from MSW's calorific fraction (such as Plastics) and the energy content is maximized by bio-drying process held into Biocells.

STRENGHTS

- Reduced environmental impact: odors and dust are kept inside the processing area. The biological treatment phase is carried out inside the biocells and the use of the biofilter guarantees the elimination of the odorous molecules emitted by the waste during the treatment phase. Anaerobic digestion is held into enclosed digesters, without any emission to the outside.
- Reduced opex and labor costs thanks to the complete automation of the plant
- low energy consumption thanks to the optimization performed automatically by the control system and thanks to self-consumption of energy produced from Biogas

PROCESS

The waste is subject to a **mechanical pretreatment**. The organic fraction is so continuously fed to **the concrete Digesters (1)** where the fermentation without oxygen is exploited for **Biogas** production (mainly composed by Methane and Carbon Dioxide). Inside the digester the natural biologic process is supported by a **special designed horizontal mixing system** - that enhance microorganisms activity by keeping the substrate well mixed – and by the **wall heating system** – that keep the optimal process temperature around 40 °C. Every main process parameters are monitored and controlled by the **automated control system (2)**.

After about 20/30 days, the digestate is unloaded and placed in the **Scarabeo** biocells (3), where it is biologically processed and stabilizecd/composted for about 15/21 days. The degradation of organic substances is accelerated by using a **forced aeration system** (4) which supplies oxygen through pipes distributed in the concrete floor of the biocells, and at the same time guarantees the **best temperature** to sanitize the mass (keeping it at 55 ° c for minimum 72 h). The process is managed by **the control system** (2), which tracks its evolution and detects the biomass temperatures with thermometric probes, optimizing the air flow.

When needed, the Scarabeo[™] biocells are utilized for Alternative Fuel bio-drying. The aeration process is adapted auytomatically by the control system without any component modification. Before emission to the environment, process air is treated by means of the Biofilter.

TECHNOLOGIES USED=

The plant uses the following Entsorga's proprietary solutions: Scarabeo* Biocells, Cow Anaerobic Digester (Zenviro tech) and Biofilter.

ACEA PINEROLESE

Pinerolo (TO) | Italy

WET ANAEROBIC DIGESTION PLANT



FIRST OF ITS KIND IN ALL SOUTHERN EUROPE

FOR THE COMPLEXITY OF THE SYSTEM AND THE WIDE RANGE OF TECHNOLOGIES EMPLOYED, THE POLO ECOLOGICO INTEGRATO PLANT BUILT BY ACEA REPRESENTS A **COMPLETE AND INTEGRATED SOLUTION** TO THE PROBLEM OF DISPOSAL OF ORGANIC WASTE FROM THE PROVINCE OF TURIN.

THE ANAEROBIC TREATMENT PLANT
PROCESSING SOURCE SPARATED FOOD
WASTE USES A PATENTED AND INNOVATIVE
SYSTEM, THE FLORAWIVA MORETM AND COW,
AN ENTSORGA'S PROPRIETARY SOLUTION.

PLANT DATA	
Company	Polo Ecologico Integrato ACEA
Capacity	90.000 t/a (total yearly processing capacity of organic waste)
Treated waste	Source separated organic waste
Final Output	Biogas to steam and power: 10.241.500 Nm3/y (in 2015)
Start up	2002-2003
Plant	Wet Anaerobic Digestion
Population Served	Up to 800,000 (total waste shed served)
Employees	23 (including AD and composting)

ACEA Pinerolese Industriale S.p.A, an Italian multiutility leader in the renewable energy sector, is also one of the most advanced Italian companies in research and development of innovative technologies for the environment. In early 2000 Acea patented an innovative system for the anaerobic digestion of food waste. The Florawiva MORETM reliably operating at the Ecopark since 2007, is now exclusively distributed by Entsorga.

PROJECT

The concept of Polo Ecologico Integrato grew from the idea of maximizing the value of waste as a "resource" and limiting waste and emissions, impact on the surroundings and liabilities by integrating technically and logistically several process solutions. Building on the concept of integration Acea added to a preexisting composting plant an anaerobic digestion plant capable of processing reliably source separated residential and commercial food waste, providing a complete seamless solution for the needs of the local community.

SOLUTION

The plant, uses the patented Florawiva MORETM associated with the Cow aerobic composting, an innovative system able to recover biogas from organic waste and, for the first time in Italy, produce biomethane. Serving an area with approximately 800,000 residents in the Province of Turin, today the Acea integrated Polo Ecologico Integrato represents one of the most effective state of the art solutions for the processing of organic waste.

PROCESS

Anaerobic digestion is the heart of a more articulated system divided into **three main sections:** the first is a **mechanical pre-treatment**, in which the bags are opened and the materials unsuitable for digestion (plastics, iron ...) are discarded. The organic feedstock is then further refined with the **Florawiva MORE**TM(1), which allows eliminating other contaminants and preparing the slurry that will be used as feedstock for the **anaerobic digestion (2):** Anaerobic Digestion is naturally triggered by bacteria in absence of oxygen and under controlled conditions and produces water, **biogas** (especially methane and carbon dioxide) and digestate. The latter is then further processed into an **aerobic composting** facilities with the resulting production of high quality compost.

(1) FLORAWIVA MORE™







(3) BIOGAS STORAGE TANK

(2) BIODIGESTOR

FINAL PRODUCT

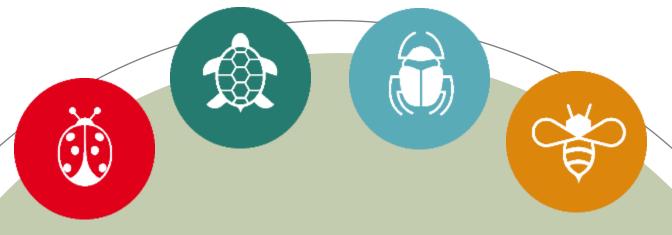
The final result of the process is biogas, a renewable alternative to natural gas, rich in methane and upgradeable to pipeline quality RNG. The biogas flow is stored inside a gasometer and used to feed a cogeneration plant and produce both heat, partly used for the operation of the plant and in part for Pinerolo city district heating, and energy Renewable electricity, used by the Polo Ecologico and sold on the net. Since 2014 part of the biogas is transformed into biomethane, with the intention of putting it on the net and using it for different purposes, from domestic use to motorization.

STRENGHTS

- Maximizes the recovery of energy extractable from organic waste
- Minimizes residues to be sent to landfill, and the consequent emission of CO₂ into the atmosphere, in compliance with European standards
- Reduces the use of fossil fuels
- Avoids the release of odors into the surroundings: the "exhaust process air" is biogas, which is entirely recovered
- Guarantees total safety: no odors or particulates are released in the external environment. All operations take place in an enclosed and slightly depressurized environment.
- Reduces labor costs and H&S risk: complete plant automation reduces access to waste treatment areas, protecting health and ensuring operator safety.

COMPOSTING PLANTS





SMART TECHNOLOGY THAT CAN GROW WITH YOUR NEEDS.

Entsorga solutions have been designed to meet the most diverse composting needs. In fact, their limited size and modularity make them easily adaptable to different needs, from modular solutions capable to serve small/medium-sized communities to large, automated industrial systems for large urban areas.

Coccinelle™ was the first modular container reactor system patented 20 years ago to process waste in an enclosed reactor. Ideal for **small-medium communities** or industrial users, capable of processing from 2,500 to 12,000 TPA, it uses a biofilter and an automatically controlled ventilation system.

Over time Entsorga has developed additional technology for processing larger volumes, starting with the **Turtle Q-RingTM** bio-reactor using breathable fabric (one of the most cost-effective systems on the market) and the **ScarabeoTM**, a bio-reactor structure with controlled forced ventilation, connected to a biofilter. Our latest addition, the **BeeTM** bio-reactor, is currently the best performing solution of our line-up for biostabilizing high volumes of organic waste: it is a **large capacity single-reactor** (over 30,000 TPA), completely automated and with minimal environmental impact.

PROVINCIA DI NUORO

Osini(NU) Italia

COMPOSTING PLANT



MANAGED FOR TEN YEARS BY ENTSORGA,
ALLOWED TO ESTABLISH A REAL LIFE CIRCULAR
MODEL THAT RECYCLES RESIDENTIAL AND
COMMERCIAL ORGANIC WASTE TO PRODUCE
HIGH QUALITY COMPOST FOR THE LOCAL
FARMERS. THE MODULARITY OF THE SYSTEM
ALLOWS MANAGING HIGH FLUCTUATIONS OF
VOLUMES PROCESSED DUE TO SEASONALITIES
IN TURISM AND AGRICULTURAL PRACTICES.

PLANT GENERAL INFO		
Company	Provincia dell'Ogliastra	
Capacity	7,000 TPA	
Treated waste	Commercial and Residential organic waste	
Final Output	High Quality Compost	
Start up	October 2005	
Plant type	Composting	
Population Served	Up to 90,000	
Employees	4	

All the municipalities of the Ogliastra region, coordinated by the Province, have partnered to build a composting plant in Quirra.

PROJECT

Entsorga was awarded with an **EPC contract** to build a composting plant in Quirra-Osini. The area and the project were strategically selected to provide a close loop for the community, recycling organic waste, and producing a quality compost suitable for use in the surrounding agricultural areas.

SOLUTION

The plant biogenically processes source separated residential and commercial food waste and green waste from the municipalities in the Ogliastra region. Today its potential capacity is 7,000 t/y, of which 5,200 t/y of food waste, 1,200 t/y of green waste and 600 t/y of recycled bulking agent. The plant started operations in 2005 and for ten years it was directly managed by Entsorga Italia.

PROCESS

The process starts by mixing the organic waste with a lignocellulosic material in a mixer: the material is then ready to be **aerobically processed**. The process takes place in enclosed reactors (2 **Coccinelle™ modules** and 4 insufflate plates) (1), where the reaction is accelerated through a forced ventilation system, monitoring air, temperature and humidity with a **high level automation** (2). The enclosed processing also allows a highly effective control of odors, thanks to the use of **patented biofilters** (3). After about 40 days the stabilized mix is refined with a screening system to eliminate the noncompostable parts (aggregates, plastics, glass, ...) and is then sent to the 2 **Turtle Q-Ring™ biocells** (4) for maturation and storage. After 90 days, the compost is ready to be used.

(1) COCCINELLE™ FOR AEROBIC PROCESSING







(2) FORCED AERATION SYSTEM





(4) TURTLE Q-RING™ FOR MATURATION AND STORAGE

FINAL PRODUCT

The final result of the process is a high-quality, biologically stable compost called "The land of Ogliastra", which is used by local farmers. The use of compost in agriculture is considered in itself of high ecological value, incentivized by the local DEQ because it enriches soil with organic matter and helps the progressive accumulation of carbon (carbon sink), contributing to contrast desertification. Composting also contributes to progressively reducing the landfill disposal, and to reduce methane emissions and other harmful GHGG.





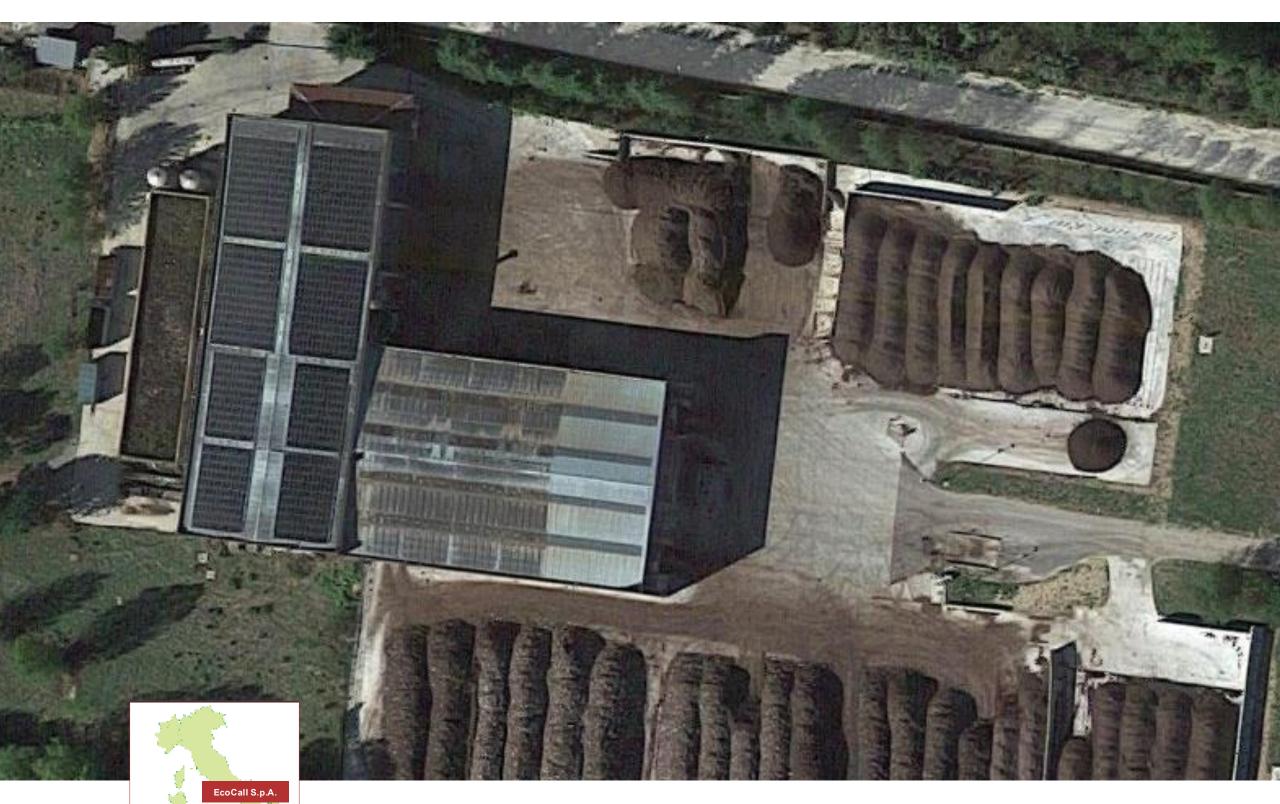
STRENGHTS

- reduction of landfill disposal and maximum recycling of organic fractions
- **environmental compatibility:** no odors or dust are released in the surroundings. All operations are confined in an enclosed and slightly depressurized environment.
- reduced labor costs: complete plant automation reduces access to waste treatment areas, protecting health and ensuring operator safety.
- low energy consumption thanks to the use of high efficiency equipment (overhead crane).

ECO CALL S.p.A.

Vazzano (VV) Italy

COMPOSTING AND BIOSTABILIZATION PLANT



SERVING THE PROCESSING NEEDS OF THE ENTIRE PROVINCE OF VIBO VALENTIA, THE COMPOSTING PLANT IN VAZZANO REPRESENTS ONE OF THE MOST EFFICIENT PLANTS FOR THE TREATMENT OF SOURCE SEPARATED ORGANIC WASTE IN THE AREA. THANKS TO THE USE OF THE MOST INNOVATIVE AND VERSATILE ENTSORGA'S SOLUTIONS, THE PLANY ALLOWS ALSO PROCESSING AND BIOSTABILIZING UNSORTED MUNICIPAL WASTE.

PLANT GENERAL INFO	
Company	ECO CALL S.p.A.
Capacity	18.000 tpa of organic waste
Treated waste	Source separated organic waste
Final Output	High quality compost
Start up	2003
Plant type	Composting and Biostabilization
Population served	170.000
Employees	14

Eco Call S.p.A. was **founded in 1997** by highly qualified local entrepreneurs with the intent of providing environmentally com partible solutions for the waste processing needs of the local community. After more than twenty years of operations, the company remains an example of **well integrated low impact solution provider for processing non hazardous waste**.

PROJECT

On an area that is particularly strategic for the Region, but still lacking infrastructure, Eco Call S.p.A. has worked with Entsorga to create an innovative plant to transform organic waste into quality compost. The plant that is allowing to achieve high levels of landfill diversion and produce a valuable substrate suitable to be used in various agricultural practices, is one of the earliest real life examples of circular economy implemented in Europe.

ENTSORGA'S SOLUTION

The plant based on Entsorga's Composting and Biostabilization platforms allows processing source separated residential and commercial organic waste. Since the start up in April 2003, it has processed approximately 18'000 t/y of organic waste. Initially processed waste was from outside the area. Most recentlky, however, most of the waste processed is generated in the province of Vibo Valentia, with obvious savings in terms of costs and carbon emissions.

PROCESS

After receiving the process starts by mixing the organic waste with a structuring bulking agent, preparing a mix that is then moved to a bioxidation area by the automated bridge crane Spider™ (1): organized in batches, the material undergoes an aerobic biological treatment H.E.BIO.T. (High Efficiency Biological System)™, an high efficiency and high automation system patented by Entsorga. The process takes place in an enclosed building, triggered and managed by a forced ventilation mechanism. A DCS system collects water content and temperature data from the batches and automatically allows managing airflows significantly accelerating and enhancing the efficiency of the process (2). The enclosed processing area kept under slight negative pressure and the use of a patented **biofilter (3)** allow an highly effective odor abatement. The processed batches are then refined with a screening system to eliminate the non-compostable contaminants (plastic, glass, metals ...) and the resulting material is then sent to the biocells (4) for a final slower curing and storage.

FINAL PRODUCT

The final result of the process is a **high quality compost**, **intended for agricultural use**. The use of compost in agriculture is recognized in itself as a practice of **high environmental value**, it allows **enriching soil** with organic matter functioning as a carbon sink and increasing water retention properties of the soil in dry areas. The processing also helps to **progressively reducing landfill volumes**, with additional substantial benefits in terms of GHGG reduction.



STRENGTH

- high landfill diversion rates and maximum recovery of organics
- low environmental impact: no odors, dust, or leachate are released in the surroundings.
- reduced operation and labor costs, thanks to the high plant automation
- maximum safety for operators, which are not exposed to the foul air, dust and potential
- polluants
 - **low energy consumption** thanks to the control system which optimizes air flow rates within the process



(1) AUTOMATIC BRIDGE CRANE SPIDER™ FOR MATERIAL HANDLING



(2) **CONTROL SYSTEM** AUTOMATIC 24/7



(3) **BIOFILTER** FOR THE ODOUR PROCESS AIR ABATEMENT



(4) **BIOCELLS** FOR THE COMPOST MATURATION

CONSORZIO INDUSTRIALE PROVINCIALE DI NUORO

Pratosardo (NU) Italy

COMPOSTING PLANT



ENTSORGA HAS DESIGNED AND BUILT THIS MODULAR SYSTEM HELPING THE COMMUNITY TO MANAGE THE PROCESSING OF RESIDENTIAL AND COMMERCIAL ORGANIC WASTE.

THE PROCESS ALLOWS HIGH QUALITY COMPOST, A SUBSTRATE THAT CAN BE USED IN AGRICULURE TO ENHANCE THE QUALITY OF SOILS IN TERMS OF NUTRIENTS AND WATER RETENTION CAPABILITIES

PLANT DATA	
Company	CONSORZIO INDUSTRIALE PROVINCIALE DI NUORO
Capacity	10.000 tpa source separated organic waste
Treated waste	Source separated organic waste
Final Output	2.000 tpa High quality compost
Start up	2015
Plant	Aerobic Composting
Population	15,000
Employees	6

Consorzio Industriale Provinciale di Nuoro is a public body that manages public infrastructure to support and promote the development in the province of Nuoro (IT).

PROJECT

Consorzio Industriale Provinciale of Nuoro awarded Entsorga with the contract for the **design and construction of the composting plant in Pratosardo (NU)** to process source separated commercial and residential organic waste, and produce high quality compost.

ENTSORGA'S SOLUTION

Entsorga provided the design and construction of a **highly modular and effective composting plant**. The plant allows for flexibility to accommodate seasonal changes in terms of quality and volumes and is a good fit for touristic locations and large resorts.

PROCESS

The process starts from an initial mechanical shredding and screening phase of the organic material and continues with the biological treatment of aerobic composting, accelerated by a forced ventilation system connected to modular bio-containers Le Coccinelle* (1). The biostabilization process is managed by an automatic **control system (2)** which, through a dedicated software, monitors and controls the parameters, regulating the temperature and the correct level of humidity through a special wetting system. Once this first aerobic phase is over, the stabilized mixture is placed in an enclosed shed, equipped with a pit with embedded forced ventilation and maintained in slight negative pressure, where the feedstock undergoes curing. Before release into the atmosphere, all the exhausted process air is sent to the Biofilter (3) that effectively minimized odors and other emissions. The high compost is then stored in an open pit ready to be marketed.

(1) **COCCINELLE™** BIOCONTAINERS FOR AEROBIC COMPOSTING













(4) AUTOMATIC BRIDGE CRANE
SPIDER™ FOR THE MATERIAL
MOVING

FINAL PRODUCT

The final result of the process is a **high quality compost**, intended for agricultural use. The use of compost in agriculture is recognized in itself as a practice of high environmental value, it allows **enriching soil with organic matter functioning** as a carbon sink and increasing water retention properties of the soil in dry areas.

The processing also helps to progressively reducing landfill volumes, with additional substantial benefits in terms of GHGG reduction.



STRENGHTS

- Low environmental impact: no odors, dust, or leachate are released in the surroundings.
- Reduced operation and labor costs, thanks to the automation
- Low energy consumption thanks to the control system which optimizes air flow rates within the process
- Modularity: the plant nameplate capacity can be easily expanded by increasing the number of reactors..

LA CITTÀ VERDE

Crevalcore (BO) | Italy

COMPOSTING PLANT



THE RESULT OF AN AMBITIOUS PROJECT, THIS COMPOSTING PLANT THANKS TO THE HIGH ENVIRONMENTAL COMPATIBILITY AND LOW IMPACT, ALLOWS TO BIOGENICALLY PROCESS ORGANIC WASTES FROM THE NEARBY REGION, AND IS THE NATURAL HUB FOR LOCAL AGRICULTURAL PRODUCERS FOR SOURCUING HIGH QUALITY COMPOST

PLANT DATA	
Company	La CITTÀ VERDE
Capacity	15.000 t/a
Treated waste	Commercial and residential organic waste
Final Output	Up to 4,000 tpa of high quality compost
Start up	2016
Plant type	Composting

La Città Verde Cooperativa Sociale was founded in 1991 to provide quality services and products within the provinces of Bologna, Ferrara and Modena. Over the years, the cooperative has gained experience in the agricultural, environmental, social and rehabilitation

PROJECT

La Città Verde has awarded Entsorga the EPC (Engineering Procurement Construction) contract for the Crevalcore composting plant. This processing plant allows closing the loop with the local community and is a real life example of coircular economy.

ENTSORGA'S SOLUTION

Completed in just over 12 months, the plant has been operational since mid 2016. With a capacity of 15,000 tons / year of organic waste, the Entsorga solution has enabled La Città Verde to optimize the logistics of waste treatment, reducing landfill disposal, and creating value by producing a high quality compost which is marketed and sold in the same area of origin, with clear recovery of both material and economic value for the surrounding territory.

PROCESS

The process starts by mixing organic waste with a lignocellulosic material, preparing a mixture that is placed in heaps using an automated **bridge crane (1)**: the material is thus ready to undergo biological treatment. The process takes place in a closed environment inside **10 Turtle Q-Ring™** (2) where it remains for 15 days to undergo an aerobic fermentation. The reaction is accelerated through a forced aeration mechanism, monitoring air, temperature and humidity with a **high level automation system (3)**. This confinement also allows a highly effective control of odors, thanks to the use of a **patented biofilter** able **to break down 99.5% of odors**. After a minimum of 90 days since the waste arrived at the plant, the compost is ready to be used.

(1) AUTOMATIC BRIDGE CRANE











(3) AUTOMATION SYSTEM 24/7

(4) BIOFILTER

FINAL PRODUCT

The final result of the process is a high quality compost sold to farmers in the surrounding areas. The use of compost in agriculture is considered in itself of high ecological value, incentivized by the local DEQ because it enriches soil with organic matter and helps the progressive accumulation of carbon (carbon sink), contributing to contrast desertification. Composting also contributes to progressively reducing the landfill disposal, and to reduce methane emissions and other harmful GHGG.



STRENGHT

- reduction of landfill disposal and maximum recycling of organic fractions
- environmental compatibility: no odors or dust are released in the surroundings. All operations are confined in an enclosed and slightly depressurized environment.
- reduced labor costs: complete plant automation reduces access to waste treatment areas, protecting health and ensuring operator safety.
- low energy consumption thanks to the use of high efficiency equipment (overhead crane).

EFACEC ENGENHARIA E SISTEMA S.A.

Ghizela Romania

COMPOSTING AND MBT BIOSTABILIZATION



TO ENHANCE THE VALUE OF SEPARATED COLLECTION FOR THE AREA, AND TO MAXIMIZE RECYCLING AND RECOVERY OF URBAN WASTE, TIMIŞ COUNTY HAS CREATED A COMPLETE MANAGEMENT SYSTEM THAT INTEGRATES LANDFILL WITH TREATMENT PLANTS. AN IMPORTANT ASSET, FOR THE 700,000 RESIDENTS, WHO ALSO ALLOWED CITIZENS TO REDUCE COSTS.

ENTSORGA PROVIDED BIOCONTAINERS TO OBTAIN A **HIGH QUALITY COMPOST** AND THE SYSTEM FOR **BIOSTABILIZING** AND SANITIZING THE ORGANIC FRACTION BEFORE LANDFILL DISPOSAL.

PLANTS DATA	
Company	Efacec Engenharia e Sistema S.A.
Yearly throughput	38.000 t/a
Waste Processed	Unsorted Municipal Solid Waste and Organic Waste
Final Product	Compost and CLO (Compost like Output)
Start up	October 2011
Plant	Composting and MBT Biostabilization
Population Served	700,000

Efacec Engenharia & Sistema S.A is a division of the historic Portuguese brand Efacec, operation for over 70 years. Started as a company specializing in the production of electrical components (motors, generators, transformers and accessories), over time the company has progressively expanded its business to sectors such as energy, **environmental and mobility solutions**. Today the company develops products and systems with high technological added value, in 65 countries around the world.

PROJECT

Almost all the waste from the separated collection from the county of **Timisoara** (700,000 residents) is processed in the municipality of Ghizela. The County Council has implemented a project, co-financed with **European funds**, to build an ecological landfill completed by a waste processing facility; the objective of the integrated system was to adequately process the differentiated waste fractions, to maximize recycling and recovery, minimizing landfill storage, in accordance with Romania's environmental commitments.

ENTSORGA'S SOLUTION

Efacec Engenharia & Sistema S.A awarded Entsorga with the design of the entire biocontainer system dedicated to process MSW and organic waste. The solution identified consists of 12 modules of **12 Coccinelle[™] biocontainers**, to biostabilize the waste to be sent to landfill, and 6 modules of 6 Coccinelle™ for composting. Entsorga has also supplied the **biofilter**, essential for treating the process air and avoiding the release of unpleasant odors in the environment, particularly important because the closest residential community is only 1.5 km from the landfill.

PROCESSES

Compost production starts by processing green waste through a biological aerobic digestion treatment. The process takes place in closed Coccinelle™ **biocontainers** (1), where the reaction is accelerated through a **forced aeration system** (2), monitoring air, temperature and humidity with an advanced automation system (3). This confinement also allows a highly effective control of odors, thanks to the use of biofilters. After the phases of final maturation and storage, the compost is ready.

The waste fraction not suitable for composting, which commercial and industrial waste, is instead sent to the biostabilization process. First mechanically shredded, it is then treated in the 12 modules of 12 Coccinelle™ biocontainers (4), also equipped with a forced ventilation system regulated by a control system. After stabilization and a slower maturation phase, the waste can be sent to landfill.

COMPOST

The quality compost produced is a biologically stable material, entirely used by the agricultural community in the surrounding area. The use of compost in agriculture is considered in itself a practice of high ecological value, encouraged because it enriches the soil with organic matter and helps the progressive accumulation of carbon in the soil (carbon sink), fighting desertification of soils.

It also contributes to progressively reducing the use of landfills, in line with the latest EU regulations, and avoids the emission of methane into the atmosphere, reducing the greenhouse effect.

BIOSTABILIZATION OUTPUT

Before being landfilled, the waste fraction that cannot be turned into compost needs be biostabilized. The process, "sanitizing" and stabilizing the putrescible part of the waste, allows reducing biogas and leachate **emissions**, benefiting the environment.

The final result is a waste with a very low moisture content, the CLO (Compost Like Output), suitable for landfill daily coverage and in compliance with the most recent European standards.

STRENGHTS

- reduction of the environmental impact of landfills, guaranteeing substantial savings in terms of CO2eq emissions and leachate
- maximum recovery of the recyclable organic fractions
- high health and safety standards: no odors or dust are released in the external environment. All operations take place indoor and are kept in a slightly depressurized environment.
- ■reduced operations and labor costs: the complete automation of the plant reduces the need for access to waste processing areas, protecting health and guaranteeing the safety of the operators.



(1) COCCINELLE™ BIOCONTAINERS FOR (2) FORCED AERATION SYSTEM TO (3) H24/7 CONTROL SYSTEM COMPOSTING



ACCELERATE PROCESS SPEED





(4) COCCINELLE™ FOR AEROBIC **BIOSTABILIZATION**

USED TECHNOLOGIES =

MBT (Mechanical Biological Treatment) BIODRYING AND PRODUCTION OF SRF FROM MSW





FROM BIO-DRYING TO MECHANICAL REFINING SYSTEMS. A COMPLETE SYSTEM FOR A CUSTOM-MADE ALTERNATIVE FUEL.

Entsorga has developed a complete set of solutions to process waste biologically and mechanically, producing a high quality renewable fuel, easily tailored to different users' needs.

The flexibility of the patented technologies makes it possible not only to provide the customer with the entire treatment system, but also to upgrade existing systems, adding the biodrying section.

Thanks to the high level of customization of the system designed for mechanical treatment, called PrometheusTM, Entsorga can easily provide a product tailored to the specifications and sizes required, by varying the equipment configuration and refining steps. This flexibility allows the production of a Solid Recovered Fuel that is particularly suitable for cement facilities. Entsorga has also developed and provides the PelicanTM feeding system, a highly efficient solution to automatically feed industrial plants with alternative fuel at the required flow rate.

ENTSORGA WEST VIRGINIA

Martinsburg (West Virginia) USA

MBT BIOSTABILIZATION PLANT WITH SRF PRODUCTION



PLANT LOCATED IN MARTINSBURG, WEST VIRGINIA IS DESIGNED TO RECEIVE AND HANDLE MUNICIPAL SOLID WASTE GENERATED IN BERKELEY COUNTY AND PRODUCE N.H.S.M. ALTERNATIVE FUELS FOR INDUSTRIAL USERS. THIS PROJECT REPRESENTS AN IMPORTANT MILESTONES FOR ENTSORGA, WHICH CONCLUDES A LONG PATH OF RESEARCH STARTED 15 YEARS AGO TO FIND A SAFE, SUSTAINABLE AND CLEAN ALTERNATIVE TO LANDFILL DISPOSAL, AND THE FIRST ENTSORGA FACILITY IN NORTH AMERICA.

PLANT DATA	
Company	Entsorga West Virginia LLC
Capacity	105.000 t/y MSW (and C&I)
Treated waste	Unsorted Municipal Solid Waste
Final Output	SRF: 55,000 t/y Stabilized residual for landfilling: 8,000 t/y Recyclable Metals: 5,500 t/y
Start up	March 2019
Plant	Biostabilization Mechanical Biological Treatment with SRF production
Population Served	400.000

THE COMPANY

Entsorga West Virginia is a joint venture between Entsorga Italia, Biohitech and Apple Valley Waste supporting the development and operations of the first Entsorga proprietary plant in the USA. BioHiTech Global, a technology & service company providing high technology solution for waste management solutions in the East Coast, is partially owned by EntsorgaFin, and is publicly traded as BHTG (NASDAQ). Apple Valley Waste is a full service solid waste company providing waste collection, transfer, recycling and disposal services to residential, commercial and construction customers within the states of West Virginia, Pennsylvania and Maryland.

THE PRODUCT

Entsorga has provided the technology design and proprietary equipment for operations just for the biological mechanical treatment plant (MBT) which is processing unsorted MSW and post MRF waste streams to an EPA approved NHSM alternative fuel. This \$30 mil project, is demonstrating how an internationally proven circular model can be adapted and delivered here in US within \$50 / ton tipping fees markets.

THE SOLUTION

Entsorga has supplied a Mechanical Biological treatment plant Bee with H.E.Bio.T.TM (High Efficiency Biological System) process to receive Municipal Solid Waste (MSW) in addition to 30,000 t / y of industrial and commercial waste, for a total capacity of 110.000 t/a, The plant, located about 80 miles west of Washington D.C. will handle Municipal Solid Waste from Berkeley county, producing renewable fuel suitable for coprocessing in cement facilities.

THE PROCESS

The Municipal Solid Waste is biodryied for approximately 15 days in a bioxidation area in which, thanks to forced aeration, the natural degradation of the organic fraction is accelerated and the material loses most of its water content. The biodrying area is divided into **24 sub-areas**, each managed independently from the others. Each subarea is equipped with a temperature probe that transmits the data to the **control system (1)**, which **automatically** processes and optimizes the process by intervening on the direction, flow rate and mixing ratio of the air. Subsequently the biodried mass is **mechanically refined** to select the components with the highest energy content (plastic, paper, textile fibres, etc.) form which SRF (Solid Recovery Fuel) is produced, removing inerts and chlorinated plastics, with our proprietary opticals sorter Falcon™ (2). The configuration of the refinement steps allows tailoring the quality of the SRF to customer's needs. The ventilation **system** extracts exhausted air from inside the bioreactor and conveys it to the **biofilter (3)** to purify it from odors and other contaminants.

THE FINAL PRODUCT

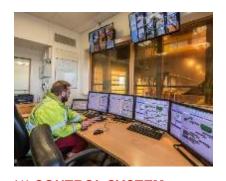
The final result is a **Solid Recovered Fuel (SRF)** with a high calorific value, in accordance with the EN 15358 standards and which has been classified from the EPA as a "non hazardous secondary material and is traded as a commodity

The main advantage of the Entsorga's **H.E.Bio.T.**TM (solution is in the **biodrying process**, unlike other processes where the SRF is produced only by mechanically sorting and shredding waste.

Experience and scientific literature have shown that the moisture embedded in waste waste heavily compromises the final quality of the alternative fuel keeping its calorific value low. The use of high quality, high biogenic content SRF also guarantees the **reduction of greenhouse gas (GHG) emissions** and therefore direct environmental benefits.

STRENGTHS

- environmental compatibility: no odor or dust are released in the surroundings. All operations are kept within slightly depressurized enclosed areas to prevent any odor emission form the building
- reduced operation and labour costs, thanks to the complete plant automation that reduces the need for operator access to the processing areas
- maximum safety and minimum health impact for operators, which are not exposed to stale air, dust and any polluting agents
- low energy consumption thanks to the use of high efficiency [bridge crane Spider™ (4)]



(1) **CONTROL SYSTEM** AUTOMATIC 24/7



(2) NIR SEPARATOR FALCON ™
TO REMOVE CHLORIBNATED
PLASTICS



(3) **BIOFILTER** FOR PROCESS AIR TREATMENT



(4) AUTOMATIC BRIDGE CRANE SPIDER TM

ARGOS CEMENT

Martinsburg (West Virginia) USA

ALTERNATIVE FUEL FEED SYSTEM FOR CEMENT KILNS



A DOUBLE IMPORTANT PROJECT THAT CREATED WITH ARGOS CEMENT, WHICH TESTIMONIES THE PROJECT FINANCING CAPACITY OF ENTSORGA. ARGOS CEMENT USE ENTSORGA PELICAN™ FEED LINE FOR THE CONTINUOUS FEEDING AT ITS CEMENT KILNS WITH ENTSORGA PROMETHEUS™, THE ALTERNATIVE FUEL PRODUCED IN THE ENTSORGA WEST VIRGINIA PLANT, NEAR THE CEMENT PLANT.

AT THE SAME TIME, THIS CONTRACT HAS GUARANTEED ARGOS A MORE SUSTAINABLE PRODUCTION PROCESS WHILE OUR PLANT IN MARTINSBURG HAS FINDED A NATURAL MAKET FOR HIS SRF.

PLANT DATA	
Company	Argos Cement
Capacity	about 60.000 t/y of SRF Prometheus™
Start up	March 2019
Plant	Alternative fuel feed system for cement kilns



For over 70 years now, Argos has been a part of Colombia's progress. Throughout its history, Cementos Argos has been taking on a more and more significant leading role in the cement and concrete industry, becoming the fifth largest cement producer in Latin America and making history in countries such as Colombia, the Dominican Republic, Haiti, Honduras, Panama, Suriname, French Guiana, Puerto Rico and the Antilles.

ENTSORGA SOLUTION

Entsorga's Pelican ™ feed system, is a **high performance**, **low energy consumption solution** that guarantees a direct and automated feed of alternative fuels, with a constant flow that can be easily adjusted according to the different needs of the user. The feed station, with a nameplate capacity of around 60,000 t/y, is similar to a feed station already delivered in 2016 in **Nazareth PA**.

Entsorga's Pelican™ system consists of:

- receiving station with auger
- Chain conveyor
- Weighing and feeding dosage system
- Pneumatic injection system.

HOW THE SYSTEM WORKS

The Pelican™ system is designed to receive the alternative fuel Prometheus™ and directly feed it to the pre heater through a pneumatic line, with variable flow controlled according to process needs.

The material arrives at the plant and is unloaded from the moving bed trailers on augers within the **docking station(1)**; an hydraulic unit allows to unloading without the need of the tractor.

Once operations are started, the whole system can be managed in **automatic mode**.

Through the auger bed, alternative fuel is conveyed to a **chain conveyor**, which transfers it to a **dosing system (2)**. The dosing system, is managed through a software developed by Entsorga, that allows **seamlessly and automatically controlling feed volumes** throughout the feeding line.

To prevent the airflow within the pneumatic line to affect the precision of the feeding in the rest of the system, the pneumatic section is insulated with a special **star valve**.

DOCKING STATION





STRENGTH

- continuity of fuel supply, thanks to the two docking stations that avoid interruptions due to the replacement of the unloading truck.
- complete automation
- possibility to manage and maintain constant the flow of the power supply according to the requirements of the plant

ADVANTAGES OF SUSTAINABLE ALTERNATIVE FUELS FOR CEMENT PRODUCERS

This contract for the supply of an alternative fuel supply stationfollows the long-term agreement entered into with Argos for the supply of alternative fuel and allows Entsorga West Virginia, the fuel supplier alternatively, to complete a new profitability circular model for landfill diversion.

Use of **renewable alternative fuel Prometheus**[™] in cement plants is a viable alternative to fossil fuels 'mainly coke and petroleum derivatives), and allows:

- decreasing the costs of cement production
- reducing greenhouse gas emissions
 addressing the goals set by international policies
 on climate change and in line with general
 principles of energy efficiency and circular
 economy by limiting the consumption of nonrenewable resources



DUNA DRAVA CEMENT HEIDELBERG GROUP

Vac Hungary

ALTERNATIVE FUEL FEED SYSTEM AND AUTOMATION CRANE FOR CEMENT KILNS



AN AVANTGUARD PLANT, CREATED, DESIGNED AND BUILT ENTIRELY AND INTERNALLY BY ENTSORGA, FOR **DUNA DRAVA CEMENT**, A FORWARD LOOKING CLIENT. THANKS TO THE USE OF AN **ALTERNATIVE COMBUSTIBILE FUEL** WHICH HAS A HIGH BIOGENIC CONTENT AND TO THIS PLANT WHICH IS HIGHLY INTEGRATED AND HIGHLY AUTOMATED, THE CEMENT PLANT WILL MAKE **SIGNIFICANT SAVINGS IN CO₂ EMISSIONS**, THUS RESPECTING THE MOST UP TO DATE REGULATIONS REGARDING ENVIRONMENTAL SUSTAINABILITY.

PLANT DATA	
Company	Duna Drava Cement, Heidelberg Group
Capacity of movement	>40 T/H of SRF
Feeding capacity	>11 T/H of SRF
Start up	January 2019
Plant	Alternative fuel feed system and automation crane for cement kilns



DDC is a joint venture owned by two Germany based company: the SCHWENK Zement KG and **HeidelbergCement Group** - both of them operate in building materials industry. The cement, concrete and aggregates business lines and the Beton Technológia Centrum Kft. employ more than 700 people.

THE PROJECT

Started at the beginning of 2019. thanks to adjudication of a tender put out by **Duna Drava Cement LLC**, Entsorga planned and constructed a **completely automized plant** for the moving and fuelling with alternative combustibile fuel of an oven for the Hungarian cement manufacturer. The project was successfully concluded in March, within the established time frame and in the middle of the maximum intensity of the COVID sanitary crisis that has struck our continent. Thanks to the replacement of part of the fossil fuel with renewable alternative fuel, the cement factory can save significant amounts of CO₂ by limiting its emissions into the atmosphere and thus making its production processes more sustainable.

ENTSORGA SOLUTION

The plant uses **two Entsorga proprietary technologies**, the **Automatic Crane Spider**[™] and the **Pelican**[™] **system**.

HOW THE INTEGRATED SYSTEM WORKS

The Automatic Crane Spider™ manage the fuel in a 24H warehouse, thanks to our propriety control system. The Pelican system™ is designed to receive the alternative fuel and directly feed it to the pre heater through a pneumatic line, with variable flow controlled according to process needs.



(1) AUTOMATIC BRIDGE CRANE SPIDER * FOR MATERIAL HANDLING



(2) **PELICAN SYSTEM** ® FOR FEEDING THE KILN

STRENGTH

- continuity of fuel supply, thanks to the docking stations that avoid interruptions due to the replacement of the unloading truck.
- complete automation
- possibility to manage and maintain constant the flow of the power supply according to the requirements of the plant

ADVANTAGES OF SUSTAINABLE ALTERNATIVE FUELS FOR CEMENT PRODUCERS

Use of **renewable alternative fuel** in cement plants is a viable alternative to fossil fuels (mainly coke and petroleum derivatives), and allows:

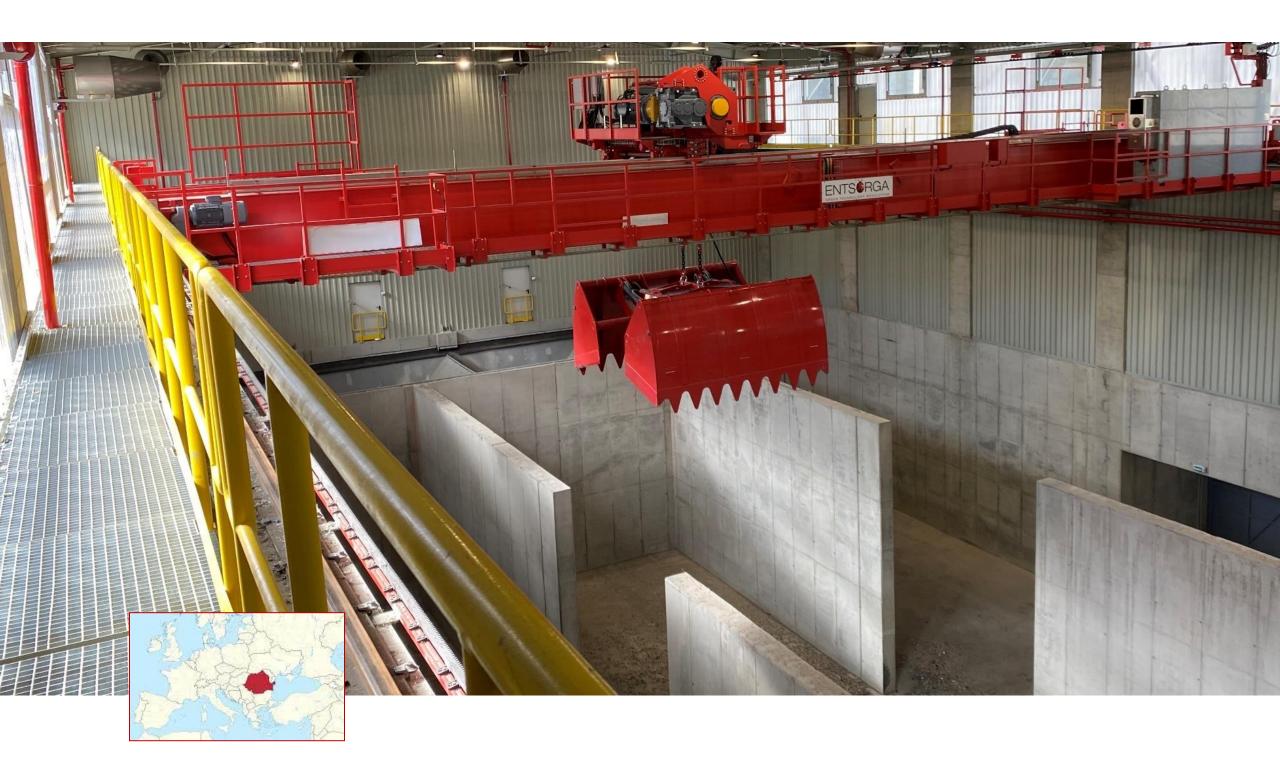
- decreasing the costs of cement production
- reducing greenhouse gas emissions addressing the goals set by international policies on climate change and in line with general principles of energy efficiency and circular economy by limiting the consumption of non-renewable resources



HEIDELBERG MATERIALS

Tasca Romania

ALTERNATIVE FUELS HANDLING AND FEEDING SYSTEM FOR CEMENT PLANTS



HEIDELBERGCEMENT GROUP, THE ROMANIAN PLANT IN NEAMT COUNTY HAS DISTINGUISHED ITSELF OVER THE PAST THREE DECADES IN EASTERN EUROPE FOR THE SUBSTANTIAL INVESTMENTS IT HAS MADE IN THE ENVIRONMENTAL FIELD, STARTING WITH THE USE OF ALTERNATIVE FUELS TO MAKE ITS CEMENT PRODUCTION PROCESSES INCREASINGLY SUSTAINABLE.
HENCE THE MEETING WITH ENTSORGA AND ITS LINE TO MOVE AND FEED THE CEMENT PLANT'S KILNS WITH SOLID RECOVERED FUEL (SRF).

PLANT DATA	
Society	Heidelberg Materials
Handling capacity	> 42 t/h
Feeding capacity	Total capacity at the 2 main burners: 10 t/h
Treated material	SRF-Biomass
Start up	2024
Plant	Alternative fuel handling and feeding system for cement plants

THE COMPANY

With investments totaling more than 550 million euros, **Heidelberg Materials** is one of the most important German investors in Romania. The Group entered the Romanian market in 1998, from which time the company's investments in environmental protection have increased to more than 61 million euros, again with the aim of improving **standards and technologies for reducing noise, dust and emissions**.

ENTSORGA SOLUTION

Heidelberg Materials chose Entsorga technologies for the Tasca plant in Romania to succeed in making the use of green fuels also cost-effective.

Entsorga provided the Group with a **highly automated line to move** and **feed the kilns**, which was entirely designed and built to ensure that the cement plant not only saves emissions but also saves energy.

HOW THE SYSTEM WORKS

The heart of the handling line is the **Spider®** automatic overhead crane, with a 22-meter gauge and a 12-ton hook load capacity. The fully automatic handling system stores and moves SRF quickly and safely and, thanks to proprietary software, can handle large quantities of fuels, even in small spaces, controlling the loading and unloading speed always with maximum precision. The **Pelican®** conveying and dosing system, with a total capacity of 10 tons per hour, feeds the 2 main kilns, ensuring a continuous and constant flow rate. To maximally improve the calorific value of the SRF by selecting its constituent materials, Entsorga also supplied the **material refining line**, including a **deferizer** and **an induction separator** to recycle ferrous and non-ferrous materials, and a **biofilter** for odor control.



STRENGTHS OF THE SYSTEM

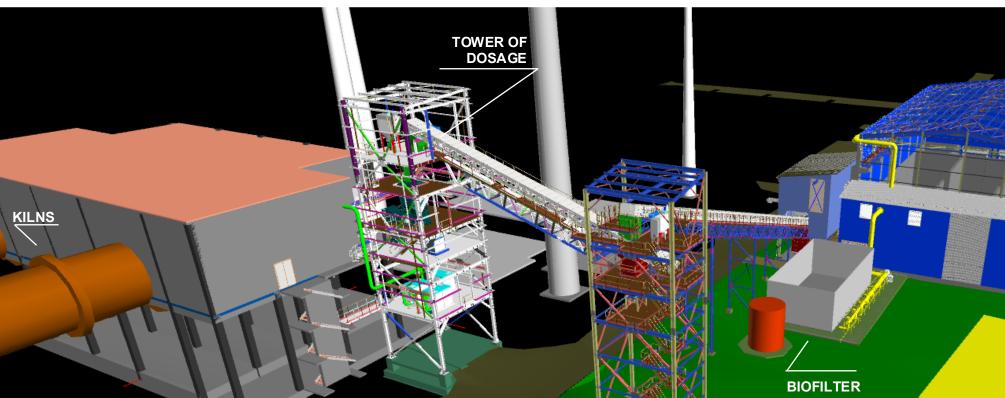
- Continuity of fuel supply, thanks to docking stations that avoid interruptions due to dump truck replacement.
- Full automation
- Ability to manage and maintain constant fuel flow rate according to plant needs



THE ADVANTAGES OF USING SRF IN CEMENT KILNS

Solid Recovered Fuel (SRF) for cement plants is a cheaper and more sustainable alternative to fossil fuels (mainly coke and petroleum derivatives):

- decreases the costs of cement production
- reduces greenhouse gas emissions to the environment, meeting general principles and international policies on energy efficiency, climate change and waste management
- limits consumption of non-renewable resources



INDOCEMENT (HEIDELBERG GROUP)

Citeureup-Bogor (West Java)

SORTING, HANDLING AND FEEDING SYSTEM ALTERNATIVE FUELS FOR FOR CEMENT KILNS



INDOCEMENT, THE SECOND-LARGEST CEMENT PRODUCER IN INDONESIA, HAS CHOSEN OUR TECHNOLOGIES TO MAKE ITS PROCESSES MORE SUSTAINABLE, BOTH ENVIRONMENTALLY AND ECONOMICALLY. THIS VIRTUOUS PRACTICE IS NOW BEING INTRODUCED IN INDONESIA AND HAS THE POTENTIAL TO BECOME A SIGNIFICANT REFERENCE POINT IN A COUNTRY WHERE ENVIRONMENTAL AWARENESS IS BEGINNING TO TAKE ITS FIRST STEPS.

PLANT DATA	
Company	Indocement (Heidelberg Group)
Handling and feeding capability	40 t/h + 10 t/h (Annual total: 88,000 tpa of alternative fuel)
Storage capacity	6,000 m ³ + 1,845 m ³
Processed material	SRF-RDF-AF-Biomass
Start up	2023
Plant	Alternative Fuel Selection, Handling and Feeding System for Cement Plants

THE COMPANY

PT Indocement Tunggal Prakarsa TnK is the second largest cement producer in Indonesia, with a total of 13 plants. Today, it is engaged in several business segments, including the production and sale of cement (as its core business) and ready-mix concrete, with about 5,000 employees.

Indocement is a subsidiary of the **German** Heidelberg Group, the world's leading manufacturer of cement and building materials.

ENTSORGA'S SOLUTION

Indocement chose Entsorga technologies for the Citeureup plant in Bogor (West Java), one of the largest in the world: a complex of nine plants with an annual design capacity of 11.9 million tonnes of cement.

For the cement plant, the challenge was to make **the use** of green fuels economically advantageous. Entsorga provided the Group with two highly automated lines for handling and feeding the kiln, entirely designed and built to ensure Indocement both emission savings and energy savings.

HOW THE SYSTEM WORKS

The automatic bridgecranes Spider™ (1) handle the fuel in the warehouse 24 hours a day automatically thanks to our control systems, while the two Pelican™ conveying and dosing systems feed the kiln, ensuring a continuous and constant flow of capacity. The first line has a handling and feeding capacity of 40 t/h, the second of 10 t/h.

In the lower-capacity line, the material is transferred from the overhead crane to a roller conveyor and from there to an existing line within the plant. In the higher-capacity line, two roller conveyors feed a weighing conveyor that adjusts its speed based on the desired flow rate and the type of fuel. The weigher is also equipped with a magnetic separator to remove any ferrous metals. Finally, two long conveyors transport the material to the burner.

ADVANTAGES OF SUSTAINABLE ALTERNATIVE FUELS FOR CEMENT PRODUCERS

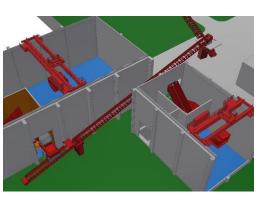
Use of **renewable alternative fuel** in cement plants is a more **economical and sustainable** alternative to fossil fuels (mainly coke and petroleum derivatives), and allows:

- decreasing the costs of cement production
- reducing greenhouse gas emissions addressing the goals set by international policies on climate change and in line with general principles of energy efficiency and circular economy
- limiting the consumption of non-renewable resources



(1) SPIDER * AUTOMATIC OVERHEAD CRANE HANDLING SYSTEM





(2) FEEDING SYSTEM PELICAN[®]





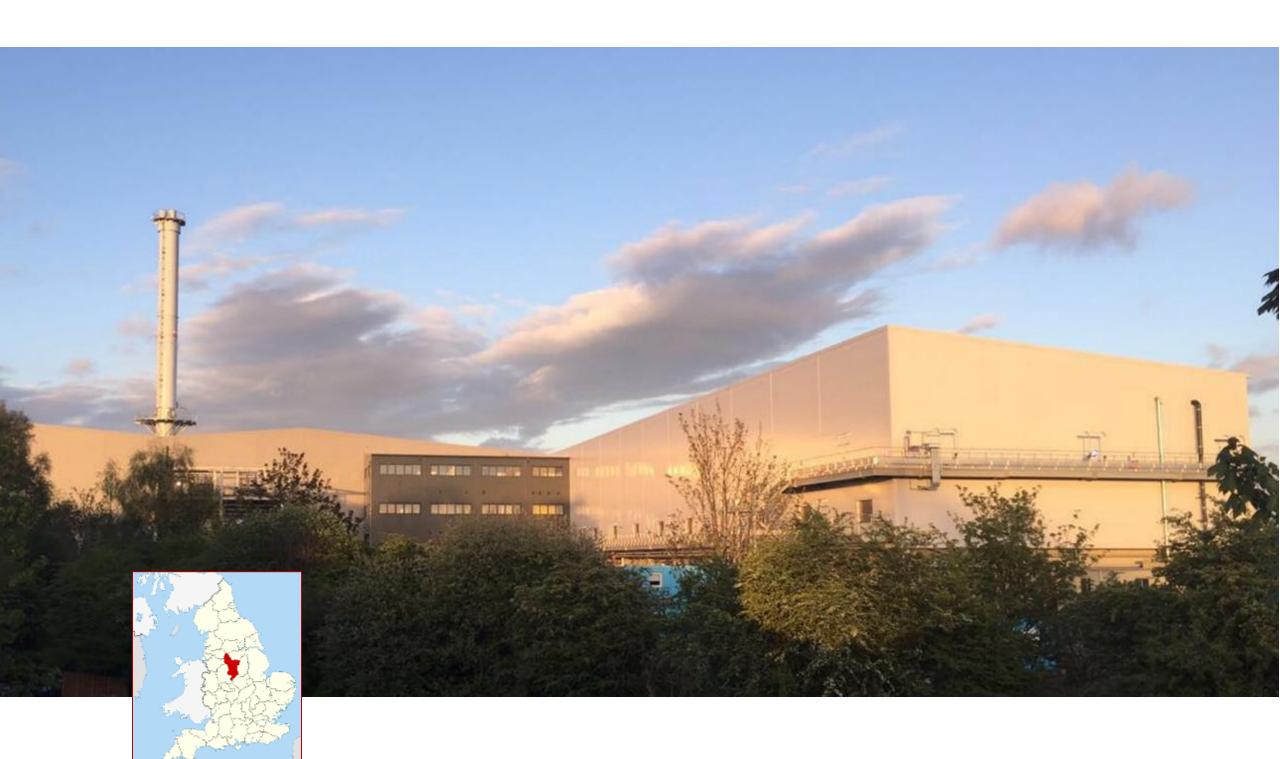
STRENGTH

- continuity of fuel supply, thanks to the two docking stations that avoid interruptions due to the replacement of the unloading truck.
- complete automation
- possibility to manage and maintain constant the flow of the power supply according to the requirements of the plant

RESOURCE RECOVERY SOLUTIONS (RRS)

Derbyshire UK

MBT BIOSTABILIZATION PLANT WITH SRF PRODUCTION



THE PROJECT IS PART OF **ONE OF THE LARGEST RECENT PROJECT FINANCE DEALS IN THE WASTE SECTOR IN THE UNITED KINGDOM**, THE ENTSORGA SYSTEM ALLOWS TRANSFORMING MUNICIPAL SOLID WASTE IN A **HIGH QUALITY HIGH BIOGENIC VALUE ALTERNATIVE FUEL** USED BY A COLOCATED DOWNSTREAM GASIFICATION UNIT.

THE PROJECT IS THE FIRST COMMERCIAL SCALE PLANT THAT INTEGRATES A MECHANICAL AND BIOLOGICAL TREATMENT WITH THE USE OF THE HIGH BIOGENIC ALTERNATIVE FUEL PRODUCED IN AN ADVANCED GASIFICASATION TO POWER UNIT.

PLANT DATA	
Company	Resource Recovery Solutions (RRS), JV between Interserve plc e Renewi plc.
Capacity	190.000 tpa of MSW
Treated waste	Residual MSW after source separation
Final Output	Solid recovered fuel
Start up	January 2017
Plant	Biostabilization Mechanical Biological Treatment with SRF production
Population Served	630.000

THE COMPANY

RRS is a consortium of companies including Interserve Construction Limited and Renewi plc (formerly Shanks Group plc), both leaders in their respective areas of expertise. Listed on the London stock exchange, Interserve is one of the largest construction service providers. Renewi is one of the most successful European companies in environmental services.

THE PROJECT

Interserve awarded Entsorga a contract for the supply of Engineering Procurement Construction services of a biological mechanical treatment plant (MBT) in Derbyshire, UK. The plant is located in an industrial area not far from residential areas. The process configuration and technical solutions adopted have been specifically designed to maximize the mitigation of possible impact on the surroundings (especially odors).

THE SOLUTION

Entsorga has supplied the patented **Bee™ system** for advanced biological and mechanical treatment of **urban municipal solid waste.** The plant, with a nameplate capacity of **190'000 t** / **yr** of MSW, **allows for up to 98% of landfill diversion**.

THE PROCESS

Residual Municipal Solid Waste undergoes a biological treatment process that accelerates its natural degradation and uses the heat developed to dry the waste itself. Subsequently the bio dried feedstock is mechanically refined (1) to separate any recyclable fractions and select the components with the highest energy content (plastics, paper, textile fibers, etc.) from which alternative fuel is produced. An automatic ventilation system (2) extracts exhausted air from inside the building (which is kept under slight negative pressure) and conveys it inside the biofilter (3) to purify air from odors and other pollutants.

(1) MECHANICAL SCREENER
TO SEPARATE DIFFERENT
COMPONENTS





(3) **BIOFILTER** FOR ODOR ABATEMENT

(2) 24/7 AUTOMATIC VENTILATION SYSTEM





(4) BRIDGECRANE SPIDER™ FOR HIGH EFFICIENCY MATERIAL HANDLING

THE FINAL PRODUCT

The final result is a bio-dried product, Solid Secondary Fuel, suitable for being processed in a downstream gasification unit.



The strength of the Entsorga solution lies in the **efficient biodrying process**, which unlike other processes harnesses the heat naturally generated by the degradation process before mechanical refinement and shredding.

Years of commercial operations as well scientific literature have shown that the humidity within the waste heavily compromises the final quality of the alternative fuel and keeps its calorific value low reducing substantially the overall efficiency of the recovery systems.

The alternative fuel produced by the Entsorga solutions is a renewable fuel with a high calorific value, high biogenic content and is suitable for replacing fossil fuels by large industrial users such as cement and lime producers and power plants. Thanks to the high biogenic content the Entsorga's alternative fuel provides the maximum benefit in terms of greenhouse gas emissions and carbon credits.

STRENGHTS

- environmental compliance: no odors, dust, or leachate are released in the surroundings. All operations take place in closed areas operated under slight negative pressure to prevent any odor emission
- reduced operation and labor costs, thanks to the complete plant automation that allows reducing manpower needs and need for operators in the waste processing areas
- maximum safety and minimum health impact for operators, which are not exposed to the harsh conditions and potential hazards of the processing areas
- low energy consumption thanks to the use of high efficiency and energy recovery equipment [bridge crane (4)]

BELVEDERE S.p.A.

Peccioli (PI) Italy

BIODRYING OF MSW TO COMPOST LIKE OUTPUT (CLO)



THE "PUBLIC COMPANY" BELVEDERE S.p.A.
HAS ENTSORGA AS SUPPLIER OF CHOICE TO
DELIVER AN BIODRYING SYSTEM TO STABILIZE
UNSORTED MUNICIPAL SOLID WASTE AND
SUBSTANTIALLY REDUCE ITS CARBON
FOOTPRINT.

THE SYSTEM IS PARTICULARLY WELL SUITED TO ADDRESS NEEDS OF COMMUNITIES LOOKING TO IMPLEMENT QUICK AND EFFICIENT SOLUTIONS TO PREPROCESS UNSORTED MSW BEFORE DISPOSAL, AS REQUIRED BY THE CURRENT EUROPEAN REGULATIONS

PLANT DATA	
Company	Belvedere S.p.A.
Capacity	90,000 Tpa MSW
Treated waste	Unsorted Municiapl Solid Waste
Final Output	60,000 t / a with respirometric index (RI) <1000
Start up	August 2015
Plant type	Biodrying system
Population	300.000
Employees	6

THE COMPANY

Belvedere S.p.A. was founded in 1997 as a public company owned by the Municipality of Peccioli (PI). The company **manages the local landfill** and waste disposal plant, producing also renewable power. Belverdere S.p.A. is also active in biomass to power, solar and wind energy.

THE PROJECT

Belvedere S.p.A. has selected the Entsorga as supplier of choice for the plant in Peccioli to process Municipal Solid Waste collected in the area.

THE SOLUTION

Entsorga has supplied the **biological treatment section** based on its own proprietary **Turtle Q-Ring™ technology**, a solution that combines reliability and reduced capital investment.

This system is composed of 13 biocells covered by a breathable Q-Ring[™] fabric, a special patented Entsorga fabric that guarantees air and water vapor perspiration, while at the same time keeping odors and other pollutants confined inside the biocells.

The year intake capacity of the plant is **90,000 tons of MSW**.

THE PROCESS

Municipal Solid Waste is loaded by wheel loaders into the biocells (1), where for about 21 days the feedstock is processed, dried and stabilized. The decay of organic substances due to the natural action of microorganisms is accelerated by a forced ventilation system that supplies oxygen through pipes distributed within the concrete floor of the biocells. At the same time the heat naturally generated allows sanitizing the biomass. The process is automatically managed by the Entsorga designed control system (2), which allows monitoring detecting the feedstock temperatures with and optimizing the airflow.

(1) **BIOCELLS** FOR ENCLOSED PROCESSING OF MSW



(2) 24/7 AUTOMATIC DCS DRIVEN CONTROL SYSTEM



THE PRODUCT

The result is a **stable processed material** with **very low moisture content and respirometric index** (<1000 mg O2 / kg s.v. * h-1) suitable for being disposed, in compliance with the latest European standards. The biostabilization process, making the putrescible part of the undifferentiated waste **inert**, in fact **reduces the emissions of greenhouse gases** (biogas) and the production of leachate, providing a **great benefit for the environment**.

STRENGHTS

- Low environmental impact: no odors, dust, or leachate are released in the surroundings. The biological treatment phase takes place in an enclosed area and thanks to the semi-permeable membrane, the odorigenic molecules generated in the treatment phase are effectively abated.
- reduced operation and labor costs, thanks to the high plant automation
- maximum safety and minimum health impact for operators, which are not exposed to the foul air, dust and potential polluants
- low energy consumption thanks to the control system which optimizes air flow rates within the process

NORTHACRE RESOURCE RECOVERY CENTRE

Westbury, Wiltshire UK

MBT BIOSTABILIZATION PLANT WITH SRF PRODUCTION



THE WESTBURY MECHANICAL BIOLOGICAL TREATMENT PLANT (MBT) IS THE KEYSTONE OF THE WILTSHIRE ENVIRONMENTAL STRATEGY. THANKS TO THIS SOLUTION, THE COUNTRY CAN FULFILL THE NATIONAL AND EUROPEAN OBJECTIVES OF LANDFILLING REDUCTION, ENSURING IN THIS WAY YEARLY 3 MILION POUNDS SAVING.

IN ADDITION, THE PRODUCT OBTAINED FROM THE TREATMENT, A **HIGH QUALITY SOLID RECOVERY FUEL**, IS USED TO PRODUCE **ENERGY AND HEAT**,
ENSURING THE ENVIRONMENT AN ADDITIONAL SAVING **IN TERMS OF CO₂ EMISSIONS**.

PLANT DATA	
Company	Hills Waste Solution Ltd
Capacity	160.000 tpa
Treated waste	Unsorted Municipal Solid Waste
Final Output	SRF, Stabilized residual for landfilling and Metals
Start up	October 2013
Plant	Biostabilization Mechanical Biological Treatment with SRF production
Served basin	400.000 approx. inhabitants
Staff	16

THE COMPANY

Hills Waste Solution is one of the main English companies specialized in waste treatment, which has been serving private and public customers for 50 years in Wiltshire, in central South England. The company provides a complete range of waste collection, disposal and recycling services, and is part of The Hills Group Limited, a group founded in 1900 that today brings together companies that operate also in the aggregates, concrete

THE PRODUCT

Hills has asked Entsorga to provide EPC (Engineering Procurement Construction) services to build a **mechanical biological treatment plant (MBT) for municipal solid waste** in Westbury, the first of this kind in Wiltshire (UK). The plant, located only 100 miles west of London, serves about **300.000 inhabitants**; its proximity to residential areas has required particular care in avoiding any environmental impact and above all **the odours emissions**.

THE SOLUTION

Entsorga has supplied a Mechanical Biological treatment plant **Bee with H.E.Bio.T.*** (**High Efficiency Biological System**) process to treat **Municipal Solid Waste (MSW)** to produce SRF for the cement kilns, initially of 60.000 tpa increased afterwards to **80.000 tpa**.

THE PROCESS

The Municipal Solid Waste is subjected to a biodrying biological treatment process of about 15 days in which, thanks to **forced aeration**, the natural degradation of the organic fraction is accelerated and the material loses most of its water content. The biodrying area is divided into 30 **sub-areas**, each managed independently of the others. Each sub-area is equipped with a temperature probe that transmits the data to the **control system (1)**, which automatically processes and optimizes the process by intervening on the direction, flow rate and mixing ratio of the air. Subsequently the biodried mass is mechanically refined to select the matrices with the highest energy content (plastic, paper, textile fibres, etc.) form which we obtain the SRF (Solid Recovery Fuel). The management of refining machineries depends on the SRF quality required. The ventilation system (2) extracts exhausted air from inside the bioreactor and conveys it to the biofilter (3) to purify it from unpleasant odours.

(1) **CONTROL SYSTEM** AUTOMATIC 24/7





(3) **BIOFILTER** FOR THE PROCESS ODOURS ABATEMENT

(2) **VENTILATION SYSTEM** FOR EXHAUST AIR EXTRACTION





(4) AUTOMATIC BRIDGE CRANE SPIDER[®] FOR THE MATERIAL MOVING

THE FINAL PRODUCT

The final result is a **Solid Recovered Fuel (SRF)** with a high calorific value, in accordance with the EN 15358 standards. The true strengths of the Entsorga solution can be found in the **biodrying process**, unlike other processes where the SRF is obtained only by waste mechanically sorting and shredding. Scientific literature and experience have shown that the moisture of waste heavily compromises the final quality of the alternative fuel and keeps its calorific value low. The use of SRF also guarantees the **reduction of greenhouse gas (GHG) emissions** and therefore direct environmental benefits.





STRENGTH

- environmental compatibility: no smells or dust are released in the external environment. All operations take place in closed areas placed in depression to prevent any odour emission form the building
- reduced operation and labour costs, thanks to the complete plant automation that reduces the operator access to the waste treatment areas
- maximum safety and minimum health impact for operators, which are not exposed to stale air, dust and any polluting agents
- low energy consumption thanks to the use of high efficiency and energy recovery equipment [bridge crane (4)]

DECO S.p.A.

Chieti Italy

MBT BIOSTABILIZATION PLANT WITH SRF PRODUCTION



ONE OF THE LARGEST AND MOST INNOVATIVE BIOSTABILIZATION PLANT IN EUROPE, THANKS TO ITS FLEXIBILITY IT CAN TRANSFORM LARGE VOLUMES OF MUNICIPAL SOLID WASTE INTO SOLID RECOVERED FUEL (SRF) FOR VARIOUS USES, FROM CEMENT KILNS TO DEDICATED POWER GENERATION PLANTS.

PLANT DATA	
Company	Deco S.p.A.
Capacity	300.000 tpa of unsorted Municipal Solid Waste
Treated waste	Unsorted Municipal Solid Waste
Final Output	135.000 tpa of SRF
Start up	November 2009
Plant	Biostabilization Mechanical Biological Treatment for SRF production
Population served	1.000.000
Employees	25

Deco S.p.A., Located in the Abruzzo region, the company operates since 1989 in the environmental sector. Founded by the **Di Zio industrial group**, the company has evolved into a large Group with highly skilled resources and deep expertise throughout the entire integrated waste cycle.

PROJECT

Deco S.p.A. commissioned to Entsorga a biostabilization plant in Chieti (CH) to treat Municipal Solid Waste (MSW) and produce quality SRF.

SOLUTION

The biostabilization plant has a **processing capacity of 270.000 tpa** of Municipal Solid Waste. It is also capable of processing **commercial and industrial** waste.

PROCESS

The waste treatment process is divided into **three key phases:**

- pre treatment
- biodrying phase: waste is dried using an automatically controlled ventilation system (1), so to avoid any direct contact between waste and operators.
- final mechanical refining: the dried material can be further and more easily mechanically refined to obtain a specific product from the point of view of energy efficiency, easy and safe to use.

During the whole process the **ventilation system** extracts exhaust air form inside the bioxidation area and conveys it to a **biofilter (2)** to purify it from unpleasant odors.

(1) **VENTILATION SYSTEM** AUTOMATIC CONTROL 24/7



(2) **BIOFILTER** FOR THE PROCESS AIR CLEANING AND ODORS ABATEMENT



FINAL PRODUCT

The final result is a **biodried product**, **the Solid Recovered Fuel (SRF)**, a renewable fuel with **high calorific value** and suitable to substitute fossil fuels
(mainly coal) in several processes.

The **flexibility** of the Chieti plant allows to **modify the SRF specifics** and to produce fuels **suitable for different uses**, from cement kilns to dedicated cogenerators or waste-to-energy plants.

Its use allows for achieving **80%** of **landfill diversion** and consequently reduces greenhouse gas (GHG) emissions and other environmental impacts (land consumption, leachate production, etc.). Under various European regulations, the SRF which contains usually > 50% of biogenic fraction can be defined as **a renewable energy source**.





STRENGTH

- environmental compliance: no odors, dust, or leachate are released in the surroundings. All operations take place in closed areas operated under slight negative pressure to prevent any odor emission
- reduced operation and labor costs, thanks to the complete plant automation that allows reducing manpower needs and need for operators in the waste processing areas
- maximum safety and minimum health impact for operators, which are not exposed to the harsh conditions and potential hazards of the processing areas
- low energy consumption thanks to the use of high efficiency and energy recovery equipment [bridge crane]
- maximum flexibility: the plant can produce alternative fuel with different specifications by changing equipment settings in the refinement section



THE SIMBIO PLANT

Celje Slovenia

MBT BIODRYING PLANT WITH SRF PRODUCTION



THE INTRODUCTION OF THE ENTSORGA MECHANICAL AND BIOLOGICAL TREATMENT METHOD ALLOWED THE MUNICIPALITY OF CELJE (SL) TO SUBSTANTIALLY DECREASE THE QUANTITY OF MUNICIPAL SOLID WASTE SENT IN LANDFILL AND TO OBTAIN A RENEWABLE FUEL TO PRODUCE ELECTRICITY AND HEAT THAT SUPPORTS 60% OF THE ENERGY NEEDS OF THE CITY.

PLANT DATA	
Company	Simbio doo
Capacity	62.000 tpa MSWr 15.000 tpa Organic waste
Treated waste	MSWr Selected Organic waste, recyclable matrices from separated collect
Final Output	31.460 tpa SRF Lower Heating Value (LHV) SRF: 17 MJ/kg Compost: approx. 8.900 tpa used in agriculture
Start up	September 2008
Plant	Biostabilization Mechanical Biological Treatment with SRF production + Compost production
Population Served	250.000 (including 24-municipalities of the "Savinjska" Region)
Employees	12

Founded on May 1996, **Simbio** provides waste management services as regional centre for Celie and other 24 municipalities of the Savinjska Region in the Central-Eastern Slovenia, serving a population of approximately 250.000 people.

PROJECT

The project was supported by EU funds and has helped to solve the problems of Municipal Solid Waste and waste water disposal for Celjie. The plant includes a section of Mechanical Biological Treatment (MBT) for unsorted Municipal Solid Waste, a section for Organic Waste composting and a section for recyclables commodities (plastics, paper, cardboard).

ENTSORGA SOLUTION

The Entsorga mechanical biological treatment plant has drastically reduced the biodegradable waste sent to landfill, helping to ensure compliance with the latest European environmental standards.

The renewable fuel produced is used in a Biomass cogeneration plant to produce power (which is directly sent to the distribution network) and thermal energy (used for the needs of the Celjie heating system)

PROCESS

Municipal Solid Waste undergoes a biodrying treatment process for about 15 days during which forced aeration accelerates the natural degradation of the organic fraction allowing for substantial water evaporation and mass loss. The biodrying area is divided into **30 sections**, each managed independently. Each section is equipped with sensors transmitting live data to a control system (1), which automatically processes and optimizes the process by determining direction, flow rate and mix ratio of the air used. Subsequently the bio dried mass is **mechanically refined** to retain the components with the highest energy content (plastic, paper, textile fibres, etc.) from which the **SRF** (Solid Recovery Fuel) is produced. The configuration and fine tuning of the refining equipment depends on the SRF quality required by the users. A **ventilation system** (2) extracts exhaust air from inside the bioreactor and conveys it to a **biofilter (3)** to purify it from unpleasant odours.

Produced fuel is sent to the nearby cogeneration plant, to generate **electricity and heat**. The thermal power of the cogeneration plant is 15 thermal MW and 2 electric MW.

(1) **CONTROL SYSTEM** AUTOMATIC 24/7



(2) **BIOFILTER** FOR THE PROCESS ODOURS ABATEMENT





FINAL PRODUCT

The final result is a Solid Recovered Fuel (SRF).
The quality of the product is ensured by the advanced biodrying, true strength of the Entsorga solution, that differentiates it form other solutions where the SRF is produced only by mechanical sorting and waste shredding.



Scientific literature and experience have shown that waste moisture heavily compromises the final quality of the alternative fuel and keeps its calorific value low.

The SRF produced by the Entsorga technology, on the other hand, is a renewable fuel with a **high calorific value**, suitable for replacing fossil fuels in the production of power and thermal energy. The use of SRF also guarantees the reduction of greenhouse gas (GHG) emissions and therefore substantial direct environmental benefits.

STRENGTHS

- environmental compliance: no odours, dust, or leachate are released in the surroundings. All operations take place in closed areas operated under slight negative pressure to prevent any odour emission
- reduced operation and labour costs, thanks to the complete plant automation that allows reducing manpower needs and need for operators in the waste processing areas
- maximum safety and minimum health impact for operators, which are not exposed to the harsh conditions and potential hazards of the processing areas
- low energy consumption thanks to the use of high efficiency and energy recovery equipment (bridge crane)

LEHIGH CEMENT COMPANY LLC

Nazareth (Pennsylvania) | USA

ALTERNATIVE FUEL FEED SYSTEM FOR CEMENT KILNS



THIS PROJECT IS ENABLING HEIDELBERG
CEMENT, THE FIRST PRODUCER OF
CONSTRUCTION AGGREGATES, AND THE SECOND
PRODUCER OF CEMENT WORLDWIDE, TO INCRESE
THE SUSTAINABILITY OF ITS CEMENT PRODUCTION
OPERATIONS IN NAZARETH (PA). BY REPLACING
THE FOSSIL FUELS WITH ALTERNATIVE SOURCES,
CAN IMPROVE EMISSION PROFILES AND INCREASE
PLANT CAPACITY FOR THIS PROJECT ENTSORGA
SUPPLIED HEIDELBERG CEMENT WITH THE
PELICAN™ SYSTEM, A FEEDING STATION FOR
SOLID ALTERNATIVE FUELS SPECIFICALLY
DESIGNED FOR THE NEEDS OF CEMENT
PRODUCERS.

PLANT GENERAL DATA	
Company	Essroc Nazareth, Heidelberg Group
Nameplate Capacity	7 t/h of solud alternative fuel
Start up	2016
Plant	Alternative Fuel feed station for the cement industry

Heidelberg Cement is a German publicly traded company headquartered in Heidelberg (D) and is one of the largest building materials companies in the world. With the acquisition of a 45% of Italcementi in 2016, Heidelberg Cement is now the first producer of construction aggregates in the world, and the second producer of cement worldwide.

ENTSORGA'S SOLUTION

Entsorga's Pelican™ system is a complete solution for the feed of alternative fuels to cement producers, built with proven world class equipment and compliant with ATEX and NFPA standards. The system consists of: receiving station with auger, Chain conveyor, Weighing and feeding dosage system, Pneumatic injection system.

HOW IT WORKS

The Pelican™ system is designed to receive the alternative fuel and directly feed it to the pre heater through a pneumatic line, with variable flow controlled according to process needs.

The material arrives at the plant and is unloaded from the moving bed trailers on augers within the **docking station(1)**; an hydraulic unit allows to unloading without the need of the tractor.

Once operations are started, the whole system can be managed in **automatic mode**.

Through the auger bed, alternative fuel is conveyed to a **chain conveyor**, which transfers it to a **dosing system** (2). The dosing system, is managed through a software developed by Entsorga, that allows **seamlessly and automatically controlling feed volumes** throughout the feeding line.

To prevent the airflow within the pneumatic line to affect the precision of the feeding in the rest of the system, the pneumatic section is insulated with a special **star valve**.

(1) DOCKING STATION







STRENGTH

- continuity of fuel supply, thanks to the two docking stations that avoid interruptions due to the replacement of the unloading truck.
- complete automation
- possibility to manage and maintain constant the flow of the power supply according to the requirements of the plant

ADVANTAGES OF SUSTAINABLE ALTERNATIVE FUELS FOR CEMENT PRODUCERS

Use of **renewable alternative fuel** in cement plants is a viable alternative to fossil fuels (mainly coke and petroleum derivatives), and allows:

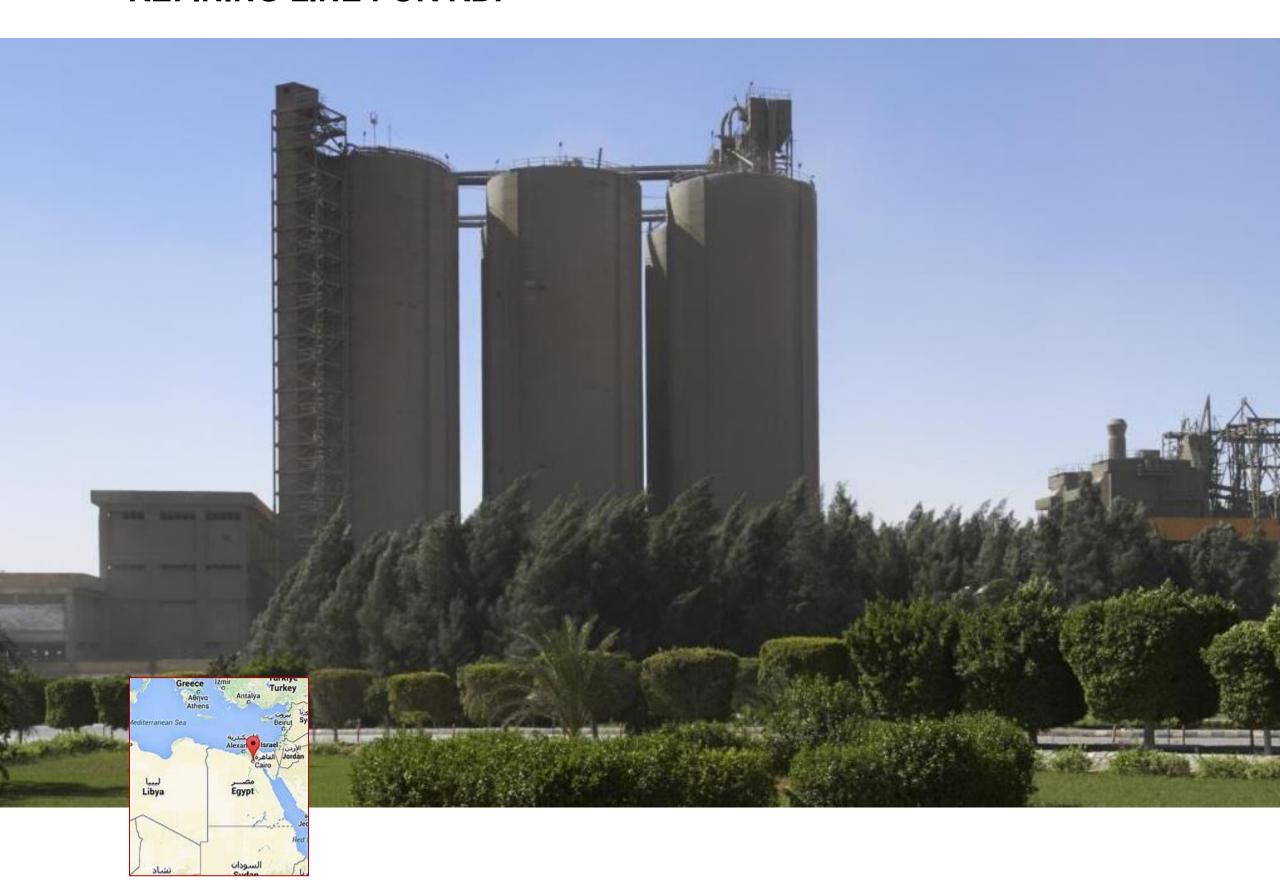
- decreasing the costs of cement production
- reducing greenhouse gas emissions
 addressing the goals set by international policies
 on climate change and in line with general
 principles of energy efficiency and circular
 economy by limiting the consumption of nonrenewable resources



SUEZ CEMENT

Kattameya (Cairo) Egitto

REFINING LINE FOR RDF



SENSITIVE IN THE FIELD OF SAFETY AND ENVIRONMENTAL POLICIES, **SUEZ CEMENT** HAS TAKEN VARIOUS ACTIONS TO REDUCE ITS CARBON DIOXIDE EMISSIONS USING ALTERNATIVE FUELS OBTAINED FROM WASTE.

TO MAXIMIZE THE QUALITY OF THE ALTERNATIVE FUEL USED IN THE ITS KATTAMEYA PLANT, SUEZ CEMENT HAS INSTALLED A **MECHANICAL REFINING SYSTEM** OF THE **PROMETHEUS™ LINE**, A HIGHLY EFFICIENT SOLUTION THAT GUARANTEES FUEL WITH **HIGH CALORIFIC POWER** AND **LOW ENVIRONMENTAL IMPACT**.

PLANT DATA	
COMPANY	Suez Cement
PLANT TYPE	Alternative fuels refining line
WASTE TREATED	Rifiuto Solido Urbano (RSU)
FINAL PRODUCT	RDF
START UP	2014

Founded in 1977, **Suez Cement Company** is part of the Suez Cement Group and **the largest cement producer in Egypt**, as well as an important exporter in Arab, African and European countries. The company has plants in Suez and Kattameya, both of which produce very high quality cement using cutting-edge technologies.

PROJECT

Suez Cement Company awarded Entsorga with the supply and construction of a **refining line** to produce **alternative fuel** in its Kattameya cement plant.

ENTSORGA'S SOLUTION

Entsorga supplied a drum screener, a Squirrel air classifier and a magnetic separator, Entsorga's patented **Prometheus™** line machinery for mechanically **refining** waste and producing **high-quality alternative fuel**.

HOW THE SYSTEM WORKS

The Entsorga mechanical refining system processes Urban Solid Waste by first using a **drum screener** (1), which separates two fractions, the underscreen, to be sent to a landfill, and a larger overscreen fraction. The latter is further subdivided thanks to the **Squirrel aeraulic classifier** (2) in two sytreams with different density. The high density flow (with glass, wood, cement, stones, bricks) generates a fraction to be further disposed in landfills, while the low density flow, which mainly contains materials with higher calorific value (plastic, paper, cardboard and substances organic), is the source of the solid fuel (RDF).

The refining line is completed by a **bag filter** (3) and a **magnetic separator** (4), to recover metals.

Characteristics of treated waste:

density: 0.15 t / m3dimensions: 30-300 mm

(1) TROMMEL





(3) **BAGHOUSE**

(2) AIR CLASSIFIER





(4) MAGNETIC SEPARATOR

FINAL PRODUCT

Thanks to Entsorga's technology solutions, **the Secondary Solid Fuel** produced is a high quality renewable fuel, particularly suitable for cement kilns due to its high calorific value, on average equal to 14,000 - 18,000 kJ/kg.

For cement factories it is a valid alternative to fossil fuels (mainly coke and petroleum derivatives), more economical and sustainable it allows decreasing cement production costs, reducing greenhouse gas emissions in the environment, in line with international best practices and policies on climate change and waste management limiting the consumption of non-renewable resources.



STRENGHTS

- Flexibility: the line offers different possibilities for mechanical and electrical settings to optimize separation.
- Easy to install
- Easy maintenance
- Capacity > 15 t/h

TITAN CEMENT COMPANY

Beni Suef (Cairo) | Egypt

MECHANICAL REFINING AND PRODUCTION OF SOLID RECOVERED FUEL



FOR CEMENT AND LIME PRODUCERS REPLACING FOSSIL FUELS WITH MORE SUSTAINABLE ALTERNATIVE AND RENEWABLE FUELS IS AN IMPELLENT NEED, BUT NOT ALL FUELS DERIVED BY WASTE INPUTS ARE THE SAME IN TERMS OF QUALITY AND ENERGY EFFICIENCY.
ENTSORGA'S MECHANICAL REFINING LINE COMMISSIONED AS AN UPGRADE TO THE SOLID RECOVERED FUEL PRODUCTION LINE IN BENI SUEF, HAS ENABLED TO OBTAIN HIGHER QUALITY ALTERNATIVE FUELS, ENSURING A HIGHLY ECONOMICALLY VIABLE AND LOW ENVIRONMENTAL IMPACT SOLUTION.

PLANT DATA	
Company	TITAN CEMENT COMPANY & MISR BENI-SUEF CEMENT COMPANY
Input capacity	92.000 tpa
Type of input	Pre proprocessed MSW
Final Product	78.000 tpa of Solid Recovered Fuel
Residual waste	14.000 tpa to be landfilled
Start up	October 2017
Plant type	Mechanical refining for Cement producers

Titan is a cement company, which was founded in Greece in 1902, it is an independent and vertically integrated producer of cement. Headquartered in Greece, the Group owns cement factories in 10 countries and employs more than 5,400 people worldwide (including joint ventures). Misr Beni-Suef Cement Company is a corporation that produces all types of Portland cement and related materials for the

PROJECT

Titan Cement has awarded Entsorga the **upgrade of the alternative fuel production plant,** including the supply of an **aeraulic separator** to provide a higher quality Solid Recovered Fuel.

SOLUTION

Within its scope, Entsorga supplied the **Squirrel™ air** classifier (1), an key equipment part of the **Prometheus™ refining line** patented by Entsorga to mechanically separate plastics and produce a high quality CSS.

PROCESS

The Entsorga system separates streams of pretreated Municipal Solid Waste using the **compressed air**, obtaining two fractions, **a low stream and high density stream**.

The low-density material mostly contains plastic, paper, cardboard and organic substances that have a **higher calorific value** and are the source for Solid Recovered Fuel

The high-density flow (glass, wood, grit, stones, and other inerts) can be disposed in landfills as landfill cover.

To prevent the air flow from reaching the material flowing in the feed system, the pneumatic line is insulated with a **special star valve (2)**. The separation line is completed by a **loading hopper (3)** with extraction belt, **conveyor belts (4)** and **a bag filter (5)**, with a capacity of 8,000 m3 / h.

Characteristics of the treated waste:

- density: 0.15 t / m3
- dimensions: 30-300 mm

(1) SQUIRREL AIR SEPARATOR™



(2) STAR VALVE



(3) HOPPER





(4) CONVEYOR BELTS

(5) BAG FILTER

PRODUCT

This upgrade provided by Entsorga is allowing Titan to produce a **higher quality Solid Recovered Fuel**, a high biogenic content feedstock, particularly suitable for cement coprocessing because of its **high calorific** value averaging 14,000 - 18,000 kJ / kg.

For cement producers this renewable feedstock is a viable alternative to fossil fuels, providing **financial and air emissions benefits:**

- · Reduces overall cost of raw material
- Reduces greenhouse gas emissions in the environment in line with the general principles and international policies on energy efficiency, climate change and circular economy
- limits the consumption of non-renewable resources.

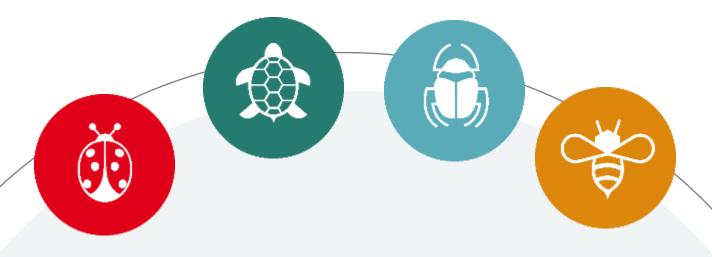
STRENGHTS

- Flexibility: the line configuration offers various possibilities for mechanical and electrical settings to optimize separation.
- Ease of installation
- Easy to maintain
- Capacity > 15 t / h

USED TECHNOLOGIES

MBT(Mechanical Biological Treatment) BIOSTABILIZATION





SMART TECHNOLOGY THAT CAN GROW WITH YOUR NEEDS.

Entsorga solutions have been designed to meet the most diverse biostabilization needs. In fact, their limited size and modularity make them easily adaptable to different needs, from modular solutions capable to serve small/medium-sized communities to large, automated industrial systems for large urban areas.

CoccinelleTM was the first modular container reactor system patented 20 years ago to process waste in an enclosed reactor. Ideal for **small/medium** communities or industrial users, capable of processing from 2,500 to 12,000 TPA, it uses a biofilter and an automatically controlled ventilation system.

Over time Entsorga has developed additional technologies for processing larger volumes, starting with the **Turtle Q-RingTM** bio-reactor using breathable fabric (one of the most cost-effective systems on the market) and the **ScarabeoTM**, a bio-reactor structure with controlled forced ventilation, connected to a biofilter. Our latest addition, the **BeeTM** bio-reactor, is currently the best performing solution of our line-up for biostabilizing high volumes of organic waste: it is a **large capacity single-reactor** (over 30,000 TPA), completely automated and with minimal environmental impact.

COGERSA

Gijon, Asturie Spagna

MBT BIOSTABILIZATION PLANT



THANKS TO THE MECHANICAL BIOLOGICAL TREATMENT SYSTEM BEE BY ENTSORGA, ASTURIAS IS FULLY ENTERING THE ERA OF ENVIRONMENTAL TECHNOLOGICAL INNOVATION. THE PLANT'S OBJECTIVE IS TO PROCESS MIXED SOLID WASTE TO MAKE IT SUITABLE FOR LANDFILL DISPOSAL. THIS IS A HIGHLY ENVIRONMENTALLY COMPATIBLE SOLUTION THAT ENSURES A REDUCTION IN GREENHOUSE GAS EMISSIONS AND LEACHATE.

PLANT DATA	
Company	Setec Buildings (Valtalia)
Capacity	160.000 t/a of mixed municipal solid waste
Treated waste	Unsorted MSW
Plant	Biostabilization with Mechanical Biological Treatment
Start up	2022

The government of Asturias and 78 municipal councils created the public consortium **COGERSA** to develop integrated solutions for municipal waste disposal. The objective of the new structure is to recycle the mixed fraction, thus to make the most of it instead of sending it directly to landfill.

PROJECT

The overall contract for the work was awarded in 2022 by the Consortium to the Galician company **Setec Buildings (Valtalia),** which chose Entsorga for the engineering of the biostabilisation section, a large line that will process 160,000 tonnes of waste per year.

SOLUTION

The system designed is a Bee, complete with two **Spider**[™](1) automatic overhead cranes to handle the waste. This is Entsorga's most advanced biostabilisation technology, incorporating the most up-to-date control and automation systems, ensuring the plant operates in line with Industry 4.0 standards.

Also state-of-the-art is the **ventilation and extraction system(2)**, equipped with 34 fans, which completely eliminates any emissions, sending the process air to the biofiltration system.

PROCESS

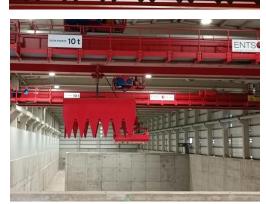
The municipal solid waste (MSW) undergoes a **biological biostabilization treatment process** lasting approximately 21 days in which, thanks to forced aeration, the natural degradation of the organic part is accelerated and the material is dried, losing most of the moisture it contains. The process is managed automatically by a **control system**, which processes the data and optimises the air flow supplied to the biomass being treated. The process air is conveyed to a **biofilter** to purify it of bad odours.

(1) AUTOMATIC BRIDGECRANE SPIDER



(2) FORCED AERATION

SYSTEM





FINAL PRODUCT

The output is a biogenically **stable substrate**, the CLO (Compost Like Output), suitable for landfill coverage, compliant with the most recent European standards. The biostabilization process, **"sanitizing" and stabilizing** the putrescible part of the unsorted waste, allows to **reduce biogas and leachate emissions**, for a substantial environmental benefit.

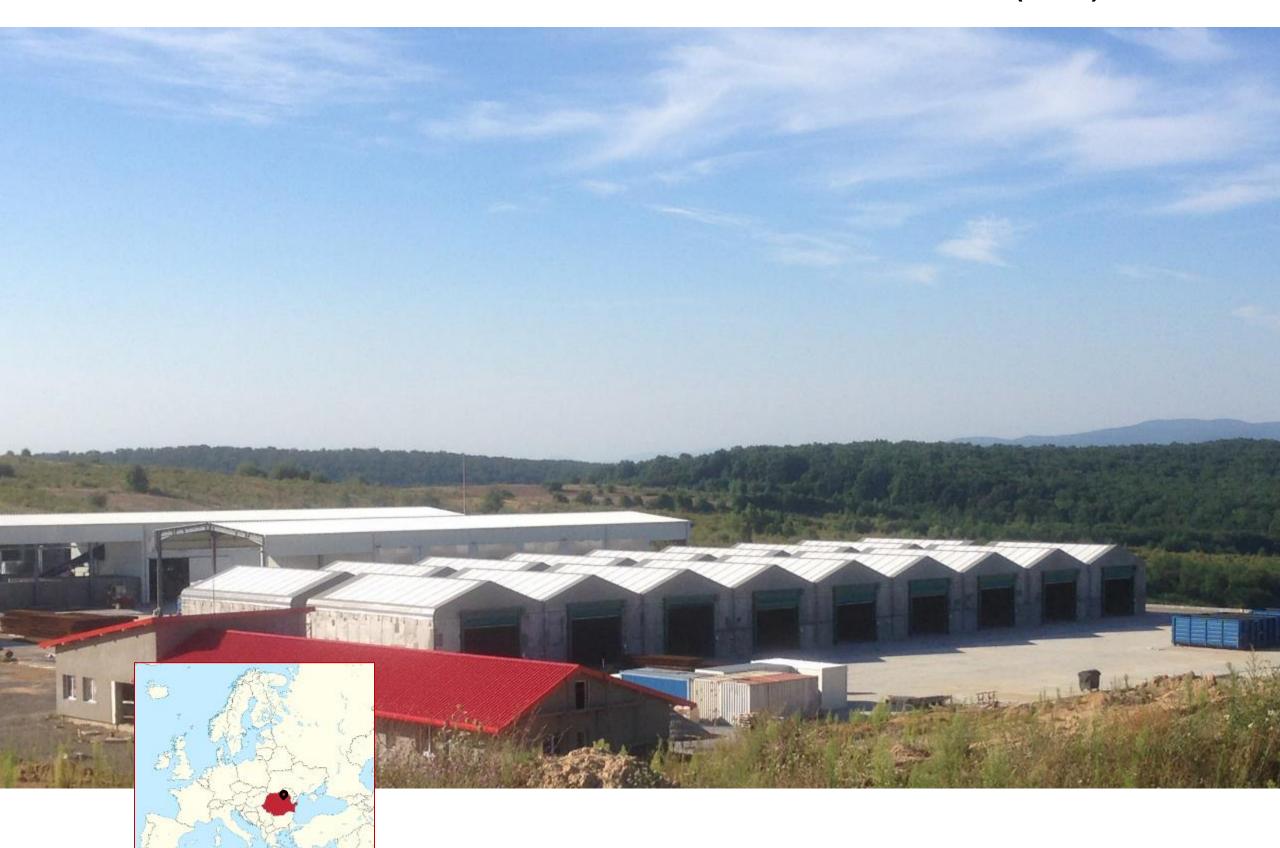
STRENGHT

- Low environmental impact: no odors, dust, or leachate are released in the surroundings.
- reduced operation and labor costs, thanks to the high plant automation
- maximum safety and minimum health impact for operators, which are not exposed to the foul air, dust and potential polluants
- low energy consumption thanks to the control system which optimizes air flow rates within the process

TEHNIMARKET S.r.I.

Maramures Romania

BIOSTABILIZATION OF MSW TO COMPOST LIKE OUTPUT (CLO)



BY PROVIDING A BIOCELLE TURTLE™ SYSTEM, ENTSORGA IS HELPING THE COMMUNITY IN THE MARAMURES DISTRICT TO STABILIZE THE UNSORTED SOLID WASTE, REDUCE ITS VOLUME AND PRODUCE A COMPOST LIKE OUTPUT SUITABLE FOR A SAFER LOWER IMPACT DISPOSAL.

A HIGH ENVIRONMENTAL COMPATIBILITY
SOLUTION THAT EFFECTIVELY REDUCES THE
GREENHOUSE GAS EMISSIONS AND THE
PRODUCTION OF LEACHATE.

PLANT DATA	
Company	Tehnimarket SRL
Capacity	112,000 tpa of MSW
Treated waste	Unsorted MSW
Final Output	44,000 tpa of compost like output
Start up	Successful test run in 2017
Plant	Biostabilization with Mechanical Biological Treatment
Population	330,000
Employees	6

In line with the local regulation for regional development, the Maramures District (Romania), a public administration body in in northern Romania, has started and completed the construction of an integrated system for the treatment of undifferentiated urban solid waste.

PROJECT

Tehnimarket SRL a Romanian company located in Bacau has developed a biological waste treatment system consisting of 18 Turtle Q-Ring™ biocells, designed and supplied by Entsorga Italia.

SOLUTION

The solution proposed allows processing MSW stabilizing and sanitizing it to a Compost like output through a forced and controlled aeration using Entsorga's **Turtle Q-Ring™ technology**. The semi-permeable membrane installed as biocells cover eliminates odors without the need of any additional filtering system.

PROCESS

Unsorted MSW is stabilized in the **biocells (1)**, where feedstock undergoes an aerobic biological process for **about 15 days**, driven by a **forced aeration system (2)**. During the process the natural degradation of the organic fraction is accelerated and the material is dried, by harnessing the heat naturally produced. The whole process is automatically managed by a **control system (3)**, which monitors data continuously and optimizes the flow of air to be supplied.

(1) TURTLE Q-RING™ FOR ACCELERATED WASTE MATURATION









(2) FORCED AERATION SYSTEM

(3) **CONTROL SYSTEM**AUTOMATIC 24/7

FINAL PRODUCT

The output is a biogenically **stable substrate**, the CLO (Compost Like Output), suitable for landfill coverage, compliant with the most recent European standards. The biostabilization process, **"sanitizing" and stabilizing** the putrescible part of the unsorted waste, allows to **reduce biogas and leachate emissions**, for a substantial environmental benefit.

STRENGHT

- Low environmental impact: no odors, dust, or leachate are released in the surroundings. The biological treatment phase takes place in an enclosed area and thanks to the semi-permeable membrane, the odorigenic molecules generated in the treatment phase are effectively abated.
- reduced operation and labor costs, thanks to the high plant automation
- maximum safety and minimum health impact for operators, which are not exposed to the foul air, dust and potential polluants
- low energy consumption thanks to the control system which optimizes air flow rates within the process

WASTE INTEGRATED MANAGEMENT CENTER

Galda de Jos Romania

MBT BIOSTABILIZATION PLANT



WITH THE TURTLE™ BIOCELLS SYSTEM,
ENTSORGA ENABLED THE COMMUNITY OF
GALDA DE JOS AND THE PROVINCE OF ALBA
JULIA TO MANAGE MORE EFFICIENTLY
MUNICIPAL SOLID WASTE BY PREPROCESSING
MSW PRIOR TO LANDFILLING. THIS
SUBSTANTIALLY IMPROVED THE
ENVIRONMENTAL IMPACT OF THE DISPOSAL
SYSTEM BY REDUCING VOLUMES LANDFILLED,
LEACHATE PRODUCED AND RELEVANT
GREENHOUSE GASES EMISSIONS.

PLANT DATA	
Company	Porr Construct S.r.I.
Capacity	85.000 tpa of Unsorted Municipal Solid Waste
Treated waste	Unsorted Municipal Solid Waste
Final Output	35.000 tpa of Compost Like Output (CLO) sent to landfill
Start up	2018
Plant	Biostabilization with Mechanical Biological Treatment
Population	200.000
Employees	6

The Alba Julia District (Romania), a public body administrating the province of Alba Julia, has completed the construction of an integrated system for the **Municipal Solid Waste** treatment based on regional government ordinances.

PROJECT

PORR Construct SRL (part of the PORR Group with Headquarter in Vienna), in joint venture with Entsorga Italia SpA, has developed the project for the "Construction of a waste management integrated center" of Galda de Jos, which includes a landfill, a sorting plant and a biological mechanical treatment plant. Specifically Entsorga Italia has designed and supplied a biological organic treatment system, consisting of 18 Turtle Q-Ring™ biocells, that allow stabilizing waste and produce CLO (Compost Like Output), a stable material suitable to be used as a daily landfill cover. The system is supported by an Entsorga aspiration system (air flow rate 30.000 m³/h) serving the mechanical pre-treatment section, and from an Entsorga proprietary biofilter odour abatement.

SOLUTION

The solution proposed allows stabilizing and sanitizing organic waste through an aerobic digestion process using the **Turtle Q-Ring™ technology**. The semi-permeable membrane installed as biocells cover eliminates odours without the need of any additional filtering system.

PROCESS

The input Municipal Solid Waste (MSW) undergo a biostabilization treatment process for about 21 days in which, forced aeration, accelerates the natural degradation of the organic fraction resulting in heat produced and mass loss by evaporation of the intrinsic moisture content. The process is automatically managed by an automated control system (1), which processes the data and optimizes the air flow sent to the biomass being treated. The process air of the pre treatment area is conveyed to the biofilter (2), to purify it from unpleasant odours.

(1) **VENTILATION SYSTEM**AUTOMATICALLY CONTROLLED 24/7



(2) **BIOFILTER**: PRE-TREATMENT AREA ODOUR TREATMENT





FINAL PRODUCT

The output is a biogenically **stable substrate**, the CLO (Compost Like Output), suitable for landfill coverage, compliant with the most recent European standards. The biostabilization process, "sanitizing" and stabilizing the putrescible part of the unsorted waste, allows to **reduce biogas and leachate emissions**, for a substantial environmental benefit.

STRENGTH

- low environmental impact: no odours, dust, or leachate are released in the surroundings. The biological treatment phase takes place in an enclosed area and thanks to the semi-permeable membrane, the smelly molecules generated in the treatment phase are effectively abated.
- reduced operation and labour costs, thanks to the high plant automation
- maximum safety and minimum health impact for operators, which are not exposed to the foul air, dust and potential pollutants
- low energy consumption thanks to the control system which optimizes air flow rates within the process

USED TECHNOLOGIES

ITHAKI S.A.

Island of Kelfalonia | Greece

MBT BIOSTABILIZATION PLANT



THANKS TO TURTLE Q-RING™ BIOCELLS
DESIGNED BY ENTSORGA, THE ISLAND OF
KEFALONIA IS ABLE **TO HYGIENIZE UNSORTED MUNICIPAL SOLID WASTE**, STABILIZING IT
BEFORE LANDFILL DISPOSAL.
A **CONVENIENT** AND **ENVIRONMENTALLY FRIENDLY SOLUTION** THAT ALLOWED THE
TOWN TO RESOLVE THE PROBLEM OF WASTE
IN AN **EFFICIENT AND SAFE MANNER**,
DRASTICALLY REDUCING RELATED
GREENHOUSE GAS EMISSIONS.

PLANT DATA	
Company	ITHAKI S.A. (100% partecipata da MESOGEOS S.A.)
Yarly Capacity	25.000 tpa
Waste	Unsorted Municipal Solid Waste
Final Product	Compst like Stabilized waste
Start up	July 2007
Plant	MBT and Biostabilization
Population served	36.000 residents

ITHAKI S.A. is 100% owned by the MESOGEOS Group, leader in Greece in the field of environmental solutions. The company's core business are water, wastewater and solid waste, as well as renewable energy production and energy efficiency. In addition to Greece, MESOGEOS also operates in Cyprus, Romania, Azerbaijan, Albania, Croatia, Montenegro.

PROJECT

The Consortium of Kefalonia has awarded ITHAKI S.A., which has commissioned Entsorga with the **design**, **construction and six months of testing** of the MBT biostabilization plant for the management of solid waste on the island.

ENTSORGA'S SOLUTION

Entsorga has supplied a **bio-stabilization plant** for the island's waste processing needs, reducing the total volume of waste and stabilizing it before disposal. The core of the solution is the **biological treatment of the organic fraction**, which allows an efficient recovery and re-use as a daily cover in landfills.

PROCESS

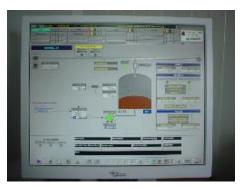
Municipal Solid Waste is first weighed and inspected, and then sent to a pre-treatment system, where it is shredded and then screened, to separate the dry fraction from the wet fraction, to be used for aerobic biological treatment. The bio-oxidation of the organic part takes place in a closed and modular system formed by 4 Turtle Q-Ring™ biocells (1) where, for about 15 days, thanks to a forced aeration system (2) the natural degradation of the material is accelerated. This allows decreasing substantially water content, reducing waste volumes by approximately 35%. The whole process is managed automatically by a control system (3), which monitors the data and optimizes the air flow to be supplied to the biomass.

(1) **BIOCELLS WITH Q-RING™ BREATHABLE FABRIC** FOR ACCELERATED BIOSTABILIZATION OF WASTE









(2) FORCED AERATION SYSTEM

(3) 24/7 AUTOMATIC CONTROL SYSTEM

FINAL PRODUCT

The result is a stable waste, the **CLO** (Compost Like Output), suitable for the daily coverage of the landfill, in compliance with the most recent European standards.

The biostabilization process allows biodrying and "sanitizing" putrescible part of unsorted Municipal Solid Waste (MSW) and makes it possible to reduce biogas and leachate emissions, benefiting the environment.

STRENGHTS

- reduced environmental impact: odors and dust are kept inside the processing area. The biological treatment phase takes place in a closed environment and the semi-permeable membrane Q-RingTM eliminates the odorous molecules emitted by the waste during treatment, without the need of a biofilter.
- reduced opex and labor costs thanks to the complete automation of the plant
- maximum safety and minimum health impact for the operators, who are not exposed to process air, dust and any polluting agents
- low energy consumption thanks to the optimization of the airflows performed automatically by the control system.

INSTAL WARSAWA S.A.

Siedlce Poland

MBT PLANT BIOSTABILIZATION



THE MBT PLANT IN SIEDLCE, POLAND, USES THE ENTSORGA FORCED AERATION SYSTEM. HEART OF THE PROCESS OF BIOSTABILIZATION, THE SYSTEM ALLOWS TO ACCELERATE THE REACTION IN A CONTROLLED AND EFFICIENT WAY, TO OBTAIN A STABLE REJECTION, WITH VERY LOW MOISTURE CONTENT, SUITABLE FOR THE LANDFILL IN ACCORDANCE WITH THE TERMS OF LAW.

PLANT DATA	
Company	Instal Warsawa S.A.
Yearly capacity	25.000 tpa
Waste processed	Unsorted Municipal Solid Waste
Final Output	19.000 t/a
Start up	2015
Plant	MBT and biostabilization

INSTAL WARSZAWA S.A. is a well established Polish company that has been operating in the environmental field for 60 years, with several industrial plants dedicated to waste treatment in Poland and abroad. Founded in 1951, it has always been a market for the high level of quality and excellent technical level of service provided, able to meet the highest international engineering standards.

PROJECT

INSTAL WARSZAWA S.A. has awarded Entsorga **the forced ventilation system** for the MBT Biostabilization plant based in Siedlce, Poland.

ENTSORGA'S SOLUTION

Entsorga supplied the forced ventilation system managed by proprietary software, a **highly efficient and automated solution** to manage incoming and outgoing air flows by adjusting and fine tuning process parameters reliably.

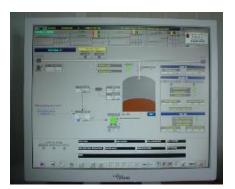
PROCESS

Unsorted Municipal Solid Waste is placed into biocells, where for about 14 days undergoes a biological treatment process being sanitized and stabilized. The main driver allowing to accelerate the processing of the organic matter is the forced aeration system (1) which accelerates the reaction by supplying oxygen through pipes distributed in the concrete floor of the biocells and, simultaneously, monitoring the best temperature to sanitize feedstock (maintained at 55 °C for a minimum of 72 h). The process is completely managed by an automated control system (2), which monitors process parameters including biomass temperatures with online thermometric probes, allowing to optimize the air flow.

(1) FORCED AERATION SYSTEM







(2) AUTOMATIC CONTOL SYSTEM

FINAL PRODUCT

The result is a **stable waste**, with a very low moisture content, suitable for being landfilled, in compliance with the latest European standards.

The biostabilization process, stabilizing the putrescible part of unsorted Municipal Solid Waste (MSW) inert, drastically reduces greenhouse gas emissions (biogas) and leachate production, with great environmental benefits.



STRENGHTS

- Accelerates the natural degradation processes through forced and controlled aeration
- Reduces variable and labor costs: the complete automation of the plant minimizes access to waste treatment areas, protecting health and guaranteeing the safety of operators.
- Limits waste handling and energy consumption, thanks to the optimization of the airflows performed automatically by the control system.

P.G.KiM Sp.Z.o.o.

Inowroclaw Poland

MBT BIOSTABILIZATION PLANT



AFTER THE INTRODUCTION OF RECENT EUROPEAN REGULATIONS ON WASTE TREATMENT, THE MUNICIPALITY OF INOWROCŁAW HAS CHOSEN ENTSORGA AS A CERTIFIED SUPPLIER TO DELIVER A BIOLOGICAL MECHANICAL TREATMENT PLANT (MBT) TO STABILIZE URBAN WASTE AND REDUCE THEIR GREENHOUSE GAS EMISSIONS. TODAY THE PLANT, MADE WITH ENTSORGA'S SCRABBLE™ TECHNOLOGY AND A BIOFILTER, IS ONE OF THE MOST ADVANCED IN POLAND.

PLANT DATA	
Company	PGKiM SP. z o.o.
Yearly Throughput	20.000 TPA MSW
Waste processed	Unsorted Municipal Solid Waste
Final Output	60.000 t/y
Start up	May 2014
Plant Type	Mechanical Biological Treatment
Population Served	10.000

PGKiM SP. z o.o. is a company controlled by the municipality of Inowrocław, which provides real estate management services, to both new and historic buildings, in the city of Inowrocław and Złotniki Kujawskich. Currently the company manages 139 buildings, also providing them with waste collection and treatment services.

PROJECT

With the introduction in 2013 of new rules for urban waste management, many of the plants in operation in Poland were inadequate and were forced to close. This did not happen at the Inowrocław disposal plant, which was instead renovated according to **the most innovative treatment solutions** to comply with the recent regulatory requirements. As part of these upgrades, Entsorga was awarded with the project for a bio-stabilization line of unsorted municipal solid waste.

ENTSORGA'S SOLUTION

Entsorga provided the biological treatment section based on the proprietary **Scrabble**[™] **technology**, a modular and reliable solution, convenient also in terms of capital investments. The system created is composed of **4 Scrabble**[™] **biocells** and a **Biofilter**, to guarantee **excellent odor control**.

PROCESS

Municipal Solid Waste is processed in **Scrabble**[™] **biocells** (1), where undergoes a biological treatment process to be stabilized. The degradation of organic substances due to the natural action of the bacteria is accelerated by **a forced aeration system (2)** supplying oxygen through air pipes distributed in the concrete floor of the biocells, and at the same time guarantees the best temperature to sanitize the mass (keeping it at 55 ° c for minimum 72 h). The process is totally managed by the **control system** (2), which tracks its evolution and detects the biomass temperatures with thermometric probes, thus optimizing the air flow. The process air is then aspirated and sent to the **biofilter (4)** to be treated before being released into the atmosphere.

(1) **SCRABBLE BIOCELLS**[™] FOR ACCELERATED STABILIZATION



(2) FORCED AERATION SYSTEM





(3) 24/7 AUTOMATIC CONTROL SYSTEM

(4) **BIOFILTER** TO TREAT PROCESS AIR EFFLUENTS

FINAL PRODUCT

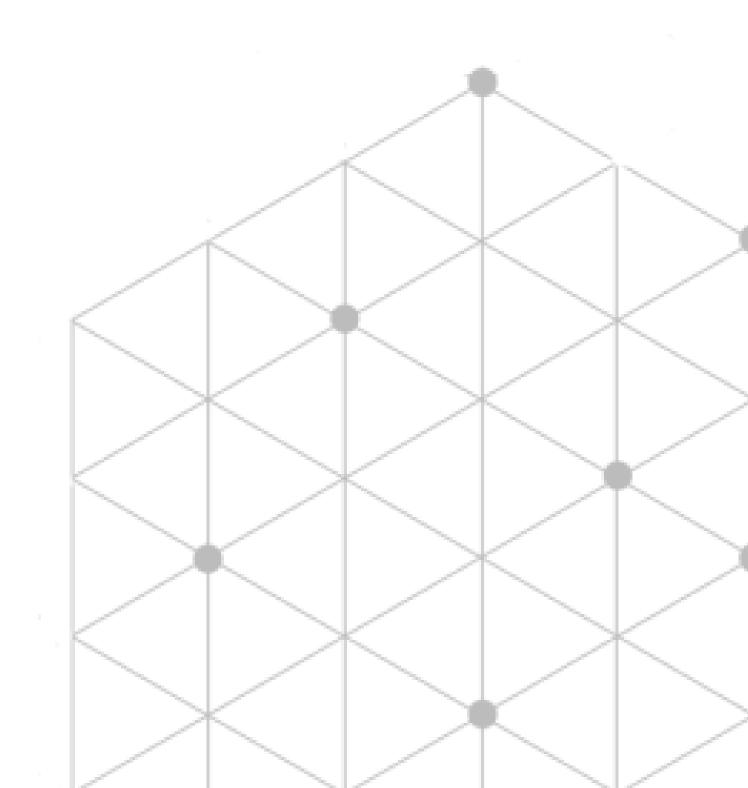
The result is a **stable output** with a very **low moisture content** (respirometric index <1000 mg O2 / kg s.v. * h-1) suitable for being sent to landfills, in compliance with the most recent European standards. The biostabilization process, making the putrescible part of undifferentiated waste (MSW) inert, in fact **drastically reduces greenhouse gas emissions (biogas)** and **leachate** production, to greatly decrease impact on the environment.

STRENGHTS

- Minimum environmental impact: The biological treatment phase is carried out inside the biocells and the use of the biofilter guarantees the elimination of the odors during the treatment phase.
- reduced operation and labor costs: the complete automation of the plant limits access to the waste treatment areas, protecting health and guaranteeing the safety of the operators.
- low energy consumption thanks to the optimization of the airflows, performed automatically by the control system.

USED TECHNOLOGIES

>> COMPLETE REFERENCE LIST



CLIENT - OWNER	DESCRIPTION	PROCESS TYPE	TECHNOLOGY	INPUT PLANT CAPACITY (t/y)
SETEC BUILDING, S.L.U - Asturia region (Spain)	Supply of BEE plant for 160.000 t/y for biodrying for SRF line	SRF from MSW - Advanced MBT	BEE	160.000
Siena Ambiente SpA Asciano (SI) Italy	Semi Dry Anaerobic Digestion plant	Composting - AD	Semi Dry Anaerobic Digestion - COW	36.000
Territorio e Risorse Srl Santhià (Italy)	Upgrading Semi Dry Anaerobic Digestion plant up to 80.000 t/y for composting	Composting - AD	Semi Dry Anaerobic Digestion - COW	80.000
Romanian Cement Plant (Heidelberg Group)	Alternative Fuel Feeding system - SRF mechanical/pneumatical feeding system and Bridgecrane storage/feeding system	AFFS - Altenative fuel Feeding system	9	
Indonesian Cement Plant (Heidelberg Group)	Alternative Fuel Feeding system - SRF mechanical/pneumatical feeding system and Bridgecrane storage/feeding system	AFFS - Altenative fuel Feeding system	Pelican and Spider	
Risorse Ambiente Palermo - Palermo (Italy)	Non Standard: N° 1 Super BAT Q-Ring® N° 1 BAT Q-Ring® Light and N° 1 BAT Q- Ring® and plant mamagemen	-	BAT Q-Ring®	40.000
Territorio e Risorse Srl	Supply of Semi Dry Anaerobic Digestion plant for 50.000 t/y for composting	Composting - AD	Semi dry anaerobic digestion - COW	50.000
Hungary Cement Plant	Alternative Fuel Feeding system - SRF pneumatical feeding system and Bridgecrane	AFFS - Altenative fuel Feeding system	Pelican and Spider	7t/h
Argos Cement (USA)	Alternative Fuel Feeding system - SRF pneumatical feeding system to main burner of Argos Cement pant in Martinsburg	AFFS - Altenative fuel Feeding system	Pelican	7t∕h
Entsorga WV Martinsburg (USA)	Complete Advanced MBT plant for SRF production from MSW (and C&I); Swallow - BEE - Prometheus technologies.	SRF from MSW - Advanced MBT	BEE & Prometheus	105.000
Interserve Ltd. (UK)	Supply of BEE plant for 190.000 t/y for biodrying for SRF line	SRF from MSW - Advanced MBT	BEE	190.000
Titan Cement (Egypt)	Upgrading of SRF line production	SRF from MSW - SRF refinement	Prometheus	160.000
Tehnimarket Maramures (Romania)	N° 18 Turtle Q-Ring [®] biocells for waste biostabilization before landfilling. Plant capacity 112.346 tpa	Biostabilization	Turtle Q-Ring®	112.346
Heidelberg Essroc (USA)	Alternative Fuel Feeding system - SRF pneumatical feeding system to main burner of Essroc Cement pant in Nazareth	AFFS - Altenative fuel Feeding system	Pelican	7t/h
Porr Construct Galda de Jos (Romania)	N° 18 Turtle Q-Ring [®] biocells for waste biostabilization before landfilling. Plant capacity 85.600 tpa	Biostabilization	Turtle Q-Ring®	85.000
Consorzio Industriale Provinciale Nuoro (Italia)	Costruction of quality composting plant for kitchen waste quality composting. The plant is made of LE COCCINELLE modules and Q-Ring® systems and biofilters. Plant capacity 10.000 tpa	Composting	Ladybugs/Coccinelle & Q- Ring®	10.000
La Città Verde Crevalcore (Italy)	N° 10 Turtle Q-Ring [®] biocells for waste composting and n° 1 bridgecrane. Plant capacity 15.000 tpa	Composting	Turtle Q-Ring® & Automated overhead crane	15.000
Belvedere SpA Peccioli (Italia)	N° 13 Turtle Q-Ring [®] biocells for waste stabilization before landfilling. Plant capacity 43.200 tpa	Biostabilization	Turtle Q-Ring®	90.000
Ramognina Ambiente Spa Varazze (Italia)	N° 3 Turtle Q-Ring [®] biocells for waste stabilization before landfilling. Plant capacity 15.000 tpa	Biostabilization	Turtle Q-Ring®	15.000
Instal Warsawa Sieldce (Poland)	Supply of n° 8 Scarabeo biocells and n° 1 biofilter for stabilization plant	Biostabilization	Scrabble/Scarabeo®	25.000
IBP - Italian Bio Products Crescentino (Italy)	Biomass pre treatment and dosing system for the ethanol plant			
Suez Cement Company – Italcementi Group (Egypt)	Design and construction and supply of the electromechanical equipment for the Pre sorted MSW treatment plant to Produce SRF - Kattameya Cement plant	SRF from MSW - SRF refinement	Prometheus	200.000
Tecnocostruzioni Alte Madonie (Italia)	Super BAT Q-Ring [®] supply	Biostabilization	BAT Q-Ring®	
P.G.K.M.I.Sp.Z.o.o. Inowroclaw (Poland)	Supply of n° 4 Scarabeo biocells and n° 1 biofilter for stabilization plant	Biostabilization	Scrabble/Scarabeo®	20.000
Mostostal Warszawa	Supply of n° 3 Scarabeo biocells and n° 1)biofilter for stabilization plant	Biostabilization	Scrabble/Scarabeo®	20.000
Votorantim (Brasil)	Project for 155.000 tpa MSW/C&I and 70.000 tpa SRF and Project for 350.000 tpa MSW/C&I and 180.000 tpa SRF	SRF from MSW - Advanced MBT	BEE & Prometheus	505.000
Holcim (Thailand)	Aggreement for the supply of SRF for Jakarta plant			
Hills Group Wiltshire (UK)	Supply of BEE [®] plant for 160.000 t/y for biostabilization with RDF production for cement works.	SRF from MSW - Advanced MBT	BEE & Prometheus	160.000

CLIENT - OWNER	DESCRIPTION	PROCESS TYPE	TECHNOLOGY	INPUT PLANT CAPACITY (ton/y)
Territorio e Risorse Srl Santhià (Italy)	Supply of Automatic Scarabeo [®] plant for 36.000 t/y for composting and n° 3 biocells	Composting - Advanced MBT	BEE & Scrabble/Scarabeo® & Turtle Q-Ring®	50.000
Halmat (Kurdistan)	Design of n° 9 Scarabeo biocells and n° 2 biofilters for composting plant	Composting	Scrabble/Scarabeo®	20.000
Comunità Montana Urbania - Urbania (Italy)	Extension of the LE COCCINELLE plant with n° 3 Turtle Q-Ring [®] biocells and n° 1 Le Coccinelle System for household waste composting	Composting	Ladybugs/Coccinelle & Turtle Q-Ring®	18.500
Efacec Ghizela (Romania)	Supply of electromechanical works for n° 180 containers (Le coccinelle plant) for biostabilization and composting	Biostabilization and Composting	Ladybugs/Coccinelle	38.000
Ato Ambiente CL2 SpA Gela (Italia)	Costruction of quality composting plant for kitchen waste quality composting. The plant is made of n.4 LE COCCINELLE modules and n.4 Q-Ring® systems. Plant capacity 12.000 t/y	Composting	Ladybugs/Coccinelle & Q- Ring®	12.000
Nivo d.d. Celje (SLOVENJA)	Supply of BEE [®] plant for 12.000 t/y of composting and 62.000 t/y biostabilization	SRF from MSW - Advanced MBT	BEE & Prometheus	62.000
Nivo d.d. Celje (SLOVENJA)	Supply of BEE [®] plant for 12.000 t/y of composting and 62.000 t/y biostabilization	Composting - Advanced MBT	BEE & Prometheus	12.000
DECO Spa Chieti (Italy)	Delivery of pilot plant LE COCCINELLE operational in company in Lodigiano, Italy.	Composting	Ladybugs/Coccinelle	
DECO Spa Chieti (Italy)	Mechanical Biological Treatment plant for residual municipal Solid waste. Capacity 270.000 t/y	SRF from MSW - Advanced MBT	BEE & Prometheus	270.000
Ecologia e Ambiente Spa Castelbuono (Italy)	Supply of 2 plants LE COCCINELLE plants for household waste composting, 2 Q-Ring [®] systems and reception area biofilter	Composting	Ladybugs/Coccinelle & Q- Ring®	
Etnambiente srl Misterbianco (Italy)	Supply of half module LE COCCINELLE plant for household waste composting, 1 Q-Ring® systems and reception area biofilter	Composting	Ladybugs/Coccinelle & Q- Ring®	
Provincia dell'Ogliastra Osini (Italy)	LE COCCINELLE plant capacity doubling for household waste composting	Composting	Ladybugs/Coccinelle	3.500
Ecomaster Atzwanger S.p.A. Isola d'Elba (Italy)	Supply of 8 non standard Q-Ring® systems	Biostabilization	Q-Ring®	
Ente Parco Cilento Vallo della Lucania (Italy)	Supply of 1 plant LE COCCINELLE plants for household waste composting, 3 Q-Ring [®] systems and reception area biofilter	Composting	Ladybugs/Coccinelle & Q- Ring®	
Alto Belice Ambiente Bisacquino (Italy)	Costruction of quality composting plant for kitchen waste quality composting. The plant is made of n.2 LE COCCINELLE modules and n.2 Q- Ring® systems. Plant capacity 8000 t/y	Composting	Ladybugs/Coccinelle & Q- Ring®	8.000
Fertilsud snc Modica (Italy)	Supply of n° 1 non standard Turtle Q- Ring [®] biocell	Biostabilization	Turtle Q-Ring®	
Torre Guaceto	Supply of 1 container LE COCCINELLE, 1 biofilter for scientific research on composting	Composting	Ladybugs/Coccinelle	
Mesogios SA Kefalonia (GR)	Turtle Q-Ring [®] biocells for waste stabilization before landfilling. Capacity 20.800 tpa	Biostabilization	Turtle Q-Ring®	21.000
CRPA Spa Reggio Emilia (Italy)	Supply of 2 container LE COCCINELLE, 1 biofilter for scientific research on composting for Animal by product	Composting	Ladybugs/Coccinelle	
Comunità Montana Basso Sinni (Italy) Comunità Montana	LE COCCINELLE plant capacity doubling for biostabilization	Biostabilization	Ladybugs/Coccinelle	
Ogliastra Comune di Osini (Italy)	5 years management for the LE COCCINELLE plant for household waste composting	Composting	Ladybugs/Coccinelle	
Hills Group Wiltshire (UK)	Supply of 1 container LE COCCINELLE, 1 biofilter for scientific research on biostabilization	Biostabilization	Ladybugs/Coccinelle	
Papir Servis d.d. <u>Maribor - (SLOVENJA)</u>	realization of 200 sq.m. fixed biofilter with aluminium modular walls	Biofiltration	Biofilter	
ECOCOMPOST MARSICA srl AVEZZANO - (Italy)	Aeration system for the biotunnel implementation	Biostabilization	Q-Ring®	
SCS Canavesana Servizi Colletetto TO - Italy	Test on biofilters treating exhaust air from landfill in the post closure period.	Biofiltration	Biofilter	

CLIENT - OWNER	DESCRIPTION	PROCESS TYPE	TECHNOLOGY	INPUT PLANT CAPACITY (ton/y)
C&G Costruzioni srl	Supply of 16 non standard Q-Ring [®]	Biostabilization		
Cerignola (BA) - (Italy)	systems	DIOSTABILIZATION	Q-Ring®	
Istituto sperimentale per l'Agrumicultura Acireale - (Italy)	Supply of 1 container LE COCCINELLE, 1 biofilter for scientific research on composting	Composting	Ladybugs/Coccinelle	
Comunità Montana Medio Agri Medio Agri (PZ) - (Italy)	LE COCCINELLE plant capacity doubling for biostabilization	Biostabilization	Ladybugs/Coccinelle	
Provincia di Enna - (Italy)	Supply of 3 plants LE COCCINELLE plants for household waste composting, 3 Q-Ring [®] systems and reception area biofilter	Composting	Ladybugs/Coccinelle & Q-Ring®	
CSA S.p.A. Spoleto PG - (Italy)	Technological refitting of the composting plant in Loc. Casevecchie for quality composting	Composting	Ladybugs/Coccinelle	
ECOCOMPOST MARSICA srl AVEZZANO - (Italy)	SCARABEO biotunnel plant for household waste composting. Capacity 20.000 tpa	Composting	Scrabble/Scarabeo®	20.000
Comunità Montana Sant'Arcangelo (PZ) - (Italy)	Supply of containers LE COCCINELLE for the Comunità Montana Sant'Arcangelo (PZ)	Composting	Ladybugs/Coccinelle	
SRT Novi Ligure (AL) - (Italy)	Mobile Q-Ring [®] plant for the biostabilization of approx. 9.400 t/y os MSW over landfill	Biostabilization	BAT Q-Ring®	9.400
Comunità Montana Ogliastra Comune di Osini (NU) - Italy	Supply of 1 complete LE COCCINELLE plant for household waste composting	Composting	Ladybugs/Coccinelle	3.500
Istituto Agronomico Mediterraneo Valenzano (BA) - Italy	Supply of 1 container LE COCCINELLE, 1 biofilter and 1 Q-Ring [®] for scientific research on composting	Composting	Ladybugs/Coccinelle & Q-Ring®	
Comune di Potenza Plant in Loc. Potenza (PZ) - Italy	LE COCCINELLE plant capacity doubling for household waste composting	Composting	Ladybugs/Coccinelle	
Ponticelli Srl Imperia - Italy	Turtle Q-Ring [®] biocells for waste stabilization before landfilling. Capacity 17.000 tpa.	Biostabilization	Turtle Q-Ring®	17.000
ECODECO Fertilvita Corteolona LO - Italy	PHOENIX VOC abatement system, test on exhaust air from Biocubi-Ecodeco plant. Capacity 20.000 m ³ /h.	Air treatment	Phoenix	
Acea S.p.A. Pinerolo TO - Italy	Test on biofilters treating exhaust air from landfill in the post closure period.	Biofiltration	Biofilter	
Pirelli Ambiente SpA -	PHOENIX VOC abatement system, test on exhaust air from Idea Granda plant. Capacity 20.000 m ³ /h.	Air treatment	Phoenix	
Comunità Montana Urbania Urbania (PU) - Italy	Supply of 3 plants LE COCCINELLE plants for household waste composting, 2 Q-Ring [®] systems and reception area biofilter	Composting	Ladybugs/Coccinelle & Q-Ring®	
Quadrifoglio SpA Firenze - Italy	Realization of 150 sq.m. biofilter dedicated to composting plants.	Biofiltration	Biofilter	
Eco Call S.p.A. Plant in Vazzano (VV) - Italy	BEE® composting system of 18.000 tons/year with automatic movements and process management	Composting - Advanced MBT	BEE	18.000
Erminio Cornacchini Sant'Eraclio (PG) Plant in Loc. Medio Agri (PZ) - Italy	Supply of 1,5 plants LE COCCINELLE for organic waste composting	Composting	Ladybugs/Coccinelle	
Ibi Idroimpianti spa (Napoli) Plant in Loc. Basso Sinni (PZ)	Supply of 2 plants LE COCCINELLE for organic waste composting	Composting	Ladybugs/Coccinelle	
Monticava Strade Spa Campi Salentina (LE) Plant in Loc. Potenza (PZ) - Italy	Supply of 1 plant LE COCCINELLE for organic waste composting	Composting	Ladybugs/Coccinelle	
San CARLO S.r.I. Fossano (CN) - Italy	Q-Ring [®] plant for composting 3.000 tons/year of organic/structural material	Composting	Q-Ring®	3.000
Coparm srl Ferrandina (MT) Plant in Loc. Venosa (PZ) - Italy	Supply of 2 plants LE COCCINELLE for organic waste composting	Composting	Ladybugs/Coccinelle	
Unieco scrl Reggio Emilia Plant in Loc. Magliano Alpi (CN) - Italy	4 non standard Q-Ring [®] plants for the biostabilization of MSW	Biostabilization	Q-Ring®	
AMIU Pordenone - Italy	Scarabeo [®] biocells system in collaboration with ASWS (MI)	Biostabilization	Scrabble/Scarabeo®	
Olmo Srl Magliano Alfieri (AT) - Italy	Insufflation plateau - Q-Ring®	Biostabilization	Q-Ring®	

CLIENT - OWNER	DESCRIPTION	PROCESS TYPE	TECHNOLOGY	INPUT PLANT CAPACITY (ton/y)
Eden '94 Srl	Supply of 4 Q-RING [®] plants	Biostabilization	· · · · · · · · · · · · · · · · · · ·	mi et i zami e, ii , iei i (iei ii) j
Manduria (TA) - Italy		Diostabilization	Q-Ring®	
Consorzio Alessandrino Rifiuti Castelceriolo (AL) - Italy	Realization of pilot plant for the stabilization with Q-Ring [®] system based on aerated sheets	Biostabilization	Q-Ring®	
Romagna Ecologia Srl Bologna - Italy	Implementation of 20 sq.m. disposable biofilter.	Biofiltration	Biofilter	
Seconde Iniziative Srl Agrigento	Realization of 880 sq.m. biofilter dedicated to composting plants. Realization of a control and management system of insufflation phase ACT Implementation of aerated sheets for composting with Q-Ring® system	Composting	Q-Ring®	
BioCiclo s.r.l. Castiglione Stiviere (MN)	Realization of 1200 sq.m. biofilter dedicated to composting plants.	Biofiltration	Biofilter	
FerGEO S.r.I. Boffalora d'Adda (LO) - Italy	Plant realization for slow maturation of compost with Q-Ring [®] system based on aerated sheets	Composting	Q-Ring®	
Nilo Costruzioni Srl Composting plant in Grammichele (CT) - Italy	Realization of 234 sq.m. fixed biofilter with aluminium modular walls dedicated composting plants. Realization of aerated plateau for the ACT phase of compost. realization of aspirating and deodorising plant with a 234 sq.m. fixed biofilter with aluminium modular walls dedicated composting plants.	Composting	Q-Ring®	
STAF Srl Palazzolo sull'Oglio (BS) - Italy	Q-Ring [®] plant for composting 5.800 tons/year of mixture sludge/structural material.	Composting	Q-Ring®	5.800
Agrisesia S.r.I. Plant in Ghemme (NO) - Italy	Plant revamping by biocells for 20.000 tons/year material treatment	Biostabilization	Scrabble/Scarabeo®	20.000
San CARLO S.r.I.	Q-Ring [®] for slow maturation of 3.000	Composting	Q-Ring®	3.000
Fossano (CN) - Italy FerGEO Srl Boffalora d'Adda (Lodi, Italy)	tons/year of compost Composting plant LE COCCINELLE for Organics from Municipal Solid Waste from selective collection. Capacity of treatment: 12.000 tons/year.	Composting	Ladybugs/Coccinelle	12.000
Agrisesia S.r.l. Ghemme (NO)	Realization of a 420 sq.m. biofilter dedicated to greenhouses where the first step of composting takes place (designing, supply of grill flooring, supervising to odour tests).	Biofiltration	Biofilter	
FerGEO S.r.l Boffalora D'Adda (Lodi) - Italy	Realization of 100 sq m. hiofilter dedicated	Biofiltration	Biofilter	
Agrisesia S.r.I.	Realization of aired plateau for the	Composting	Q-Ring®	
Ghemme (NO) - Italy SEABO S.r.I Italy	secondary maturation of compost. Completion plant of 4000 tons/year.		Q-Ring®	4.000
Waste Emergency Campania Region - Italy	Supply of 4 plants LE COCCINELLE for composting of organics from Municipal Solid Waste from selective collection. Treatment capacity: 3000+6000+6000+6000 tons/year.	Composting Composting	Ladybugs/Coccinelle	21.000
University of Padova -	Realization of 200 sq.m biofilter dedicated to landfill site services.	Biofiltration	Biofilter	
ECODECO S.p.A. Cantiere Bonifica Istituto Sieroterapico (MI) - Italy	Implementation of 20 sq.m. disposable	Biofiltration	Biofilter	
Ecodeco SpA and others	agro industrial plants sq.m. 1140.	Biofiltration	Biofilter	
Compostaggio Lodigiano S.r.l. Cascina Postino- Villanova Sillaro (Lodi - Italy),	Doubling of the plant LE COCCINELLE for composting of organic waste from selective collection; capacity of treatment 16.000 tons/year.	Composting	Ladybugs/Coccinelle	16.000
Seabo S.p.A. – Ozzano Emilia (BO)	LE COCCINELLE plant to assess the process capability. Treatment capacity: 1500 tons/year	-	Ladybugs/Coccinelle	1.500
Biofiltration	Creation and trading of biofiltration plants, biofiltering beds, probes to measure humidity, monitoring system and management of biofilters.	Biofiltration	Biofilter	
Compostaggio Lodigiano S.r.l. Cascina Postino - Villanova Sillaro (LO)	LE COCCINELLE composting plant dealing with organics from MSW from selective waste collection. Treatment capacity: 8.000 t/y	Composting	Ladybugs/Coccinelle	8.000
DECO Spa Chieti (Italy)	Delivery of pilot plant LE COCCINELLE operational in company in Lodigiano, Italy.	Composting	Ladybugs/Coccinelle	

