P&P INDUSTRIES

Waste Engineering and Waste to Energy

CORPORATE PRESENTATION

(Updated 07/2023)

WHO WE ARE

Company for engineering and trade: P&P Industries doo Skopje

- Republic of North Macedonia (5 years)
- English technology (20 years)
- Italian investment (30 years)

Activity of the company:

- Engineering
- Development and promotion of controlled landfills
- Development and promotion of alternative energies

WE OFFER PROVEN SOLUTIONS FOR EACH TYPE OF WASTE

TYPE WASTE	**Municipal Solid Waste (MSW)**			**Industrial Non Hazardous waste**		
				WWTP Sludge Waste Water Treatment plant	Industrial non-hazardous sludge	Solid Industrial non-hazardous waste
TECHNOLOGY	Pharaon ®	Matrix ®	Eco Roll ®	Axis ®		Reverse ©
ACTION	*Sorting & Valorizing*	*Sorting & Valorizing*	*Compacting & storing / transporting*	*Stabilization & landfilling*		*Sorting & Valorizing*
END-PRODUCT	SOF	SOF	Balls	**HAZARDOUS WASTE**		Secondary products
	RDF/SRF			**SOF**		RDF/SRF
	Residual part landfilled (<20%)					Residual part landfilled (<20%)

Acronyms
MSW: Municipal Solid Waste
WWTP: Waste water treatment plant
SOF: Stabilized Organic Fraction
RDF: Refused Derive Fuel
SRF: Solid Recovered Fuel

Definition
Stabilization processes change the dangerousness of the constituents in the waste and thus transform hazardous waste into non-hazardous waste. Solidification processes only change the physical state of the waste (e.g. liquid into solid) by using additives without changing the chemical properties of the waste.

PHARAON ® Treatment of Municipal & Industrial non hazardous Waste - Recycling and production of SOF and RDF/SRF

In the 1st phase, the dry fraction is separated from the organic fraction and directly transported from the plant.:

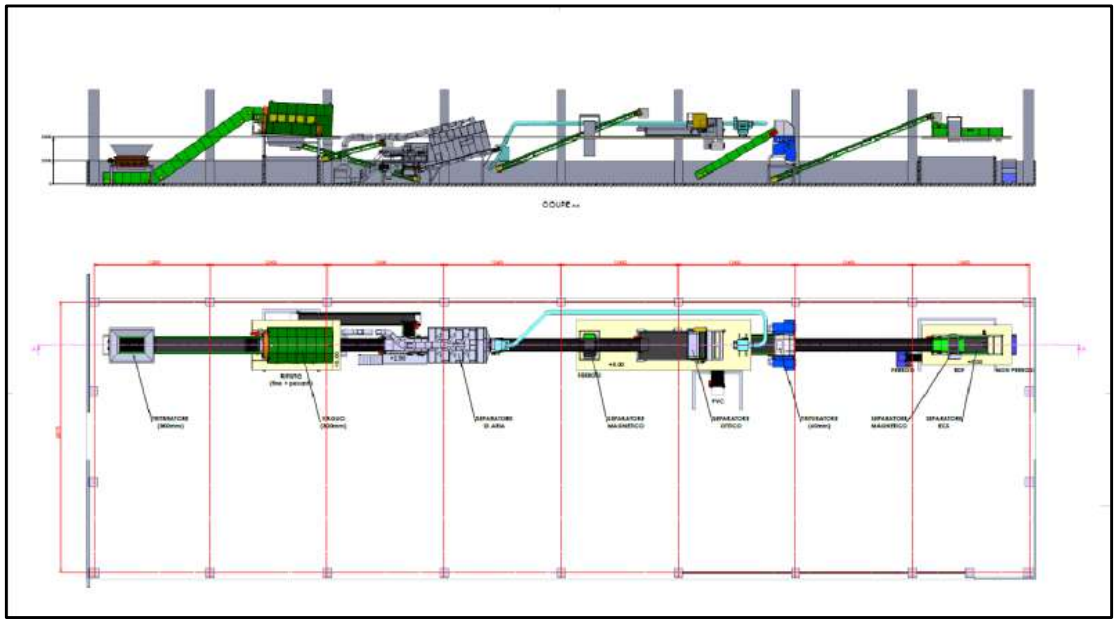
- Dry fraction
  - Dimension > 50 mm
  - destination: Recycling/Production of RDF/SRF
- Organic fraction:
  - Homogenized and treated to obtain the stabilized organic fraction (SOF)
  - The SOF which has a fixed granulometric composition is loaded directly into transport vehicles without interim storage to be used as recycled composting material
  - SOF: Dimension 20/40 mm / Destination: Recycling.

REVERSE®: Treatment of Industrial non-hazardous Waste - Recycling and production of RDF/SRF

The treatment of inert and industrial non-hazardous waste in the REVERSE technology line includes the following activities:

I. Fractional separation of size> 300 mm;
II. Fractional separation of size <100 mm;
III. Separation of nonferrous metals;
IV. Separation of non-ferrous metals;
V. Manual selection of waste from plastic strips and containers in the primary selection section;
VI. Alternative fuel production (RDF/SRF) with granulation of 0 - 50 mm;
VII. Landfilling of the residue

Production line capacity: 20 tons / h.



Environmental benefit

- Decrease quantity of landfill waste;
- Allow a recycling of the waste to produce an alternative fuel

SRF: Solid recovered fuel

1) SRF is a fuel derived from non-hazardous waste produced in accordance with the requirements of the European standards for SRF, specifically in accordance with EN15359.
2) If no declaration of conformity to the requirements of EN15359 can be provided, a waste derived fuel may not be considered to constitute SRF

Classification of SRF

Classification characteristic	Statistical measure	Unit	Classes				
			1	2	3	4	5
Net calorific value (NCV)	Mean	MJ/kg (ar)	≥ 25	≥ 20	≥ 15	≥ 10	≥ 3
Classification characteristic	**Statistical measure**	**Unit**	**Classes**				
			1	**2**	**3**	**4**	**5**
Chlorine (Cl)	Mean	% (d)	≤ 0,2	≤ 0,6	≤ 1,0	≤ 1,5	≤ 3
Classification characteristic	**Statistical measure**	**Unit**	**Classes**				
			1	**2**	**3**	**4**	**5**
Mercury (Hg)	Median 80th percentile	mg/MJ (ar) mg/MJ (ar)	≤ 0,02 ≤ 0,04	≤ 0,03 ≤ 0,06	≤ 0,08 ≤ 0,16	≤ 0,15 ≤ 0,30	≤ 0,50 ≤ 1,00

Environmental benefit

- Decrease quantity of landfill waste;
- * Circular economy;
- Very competitive and stable price
- Prevents air pollution: SRF has lower greenhouse gas emissions than coal or petcoke

RDF: Refuse Derived Fuel

RDF - 'Refuse Derived Fuel'. This is an alternative fuel. It is a secondary material made from sorting of waste. The composition is a mix of paper, plastic, textile, rubber, wood. RDF is widely used in Western and Northern Europe. In Germany, it is substituting up to 70% of fossil energy (coal and fuel oil) in the cement industry.

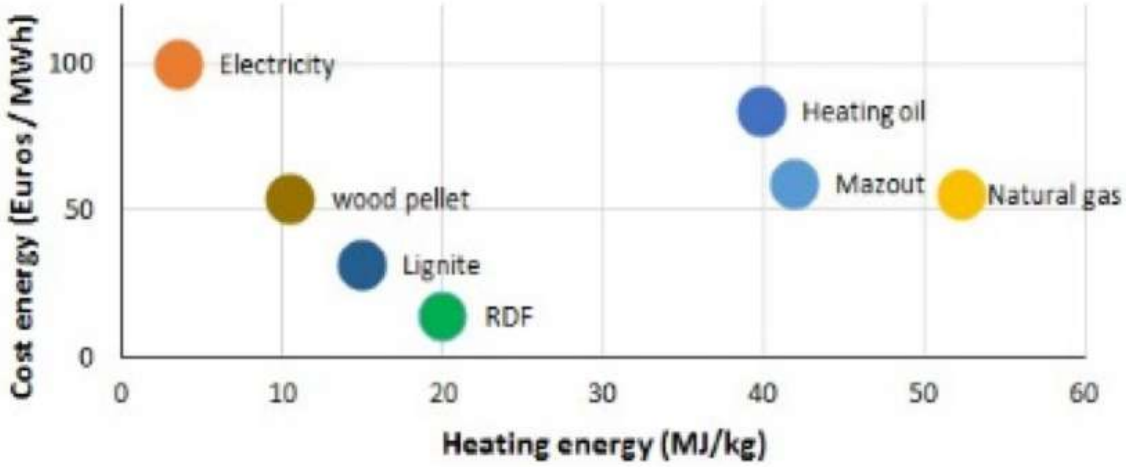
Main specifications

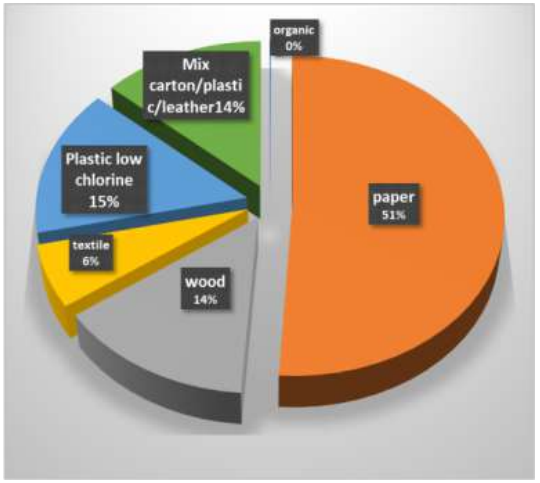
- Calorific value: 17 – 22 MJ/kg (similar as wood)
- Moisture content < 15%
- Bulk density 0.25 (bulk) – 0.70 (pellets) t/m^3
- <0.5% S / <0.9% Chlorine

Environmental benefit

- Decrease quantity of landfill waste;
- * Produced locally from local economy;
- * Circular economy;
- Very competitive and stable price (not linked to the petroleum prices).

INDICATIVE COST OF ENERGY SOURSES





MATRIX ® Mobile plant for the treatment of organic waste derived from MSW and biological sludge and production of SOF

WHAT IS MATRIX®

MATRIX® is a rapid installation, transportable mobile system designed for treating organic waste derived from MSW and biological sludge to obtain SOF (Stabilised Organic Fraction).

WHY MATRIX®

To stabilize MSW, making safe
To reduce waste treatment time to a minimum
To get good quality material output
To significantly reduce waste volume
Because of its low atmospheric emissions

HOW IT WORKS

The MATRIX® process uses CaO (Calcium Oxide) in a two phase process:
Stabilization: addition of materials which ensure that dangerous substances in the waste are kept in a state of low solubility, mobility and toxicity.
Micro-encapsulation: contaminants are mechanically captured and encapsulated inside the solidified matrix.

ARCHITECTURE

The machine is divided into three main sections that distinguish the three phases of the process, from MSW input to SOF output
1.MIXING
2.MATURING
3.COOLINC

MATRIX® M/15	**mobile plant capacity**	**15ton/h**
MATRIX® 20	fixed system capacity	20ton/h
MATRIX® 25	fixed system capacity	25ton/h
MATRIX® 25DUO	fixed system capacity	50ton/h

SOF – Stabilized Organic Fraction

Municipal Solid Waste are pre-treated in order to obtain 2 fractions: Dry Fraction / Organic Fraction

- Dry fraction: Dimension > 50 mm / destination: Recycling/Production of RDF
- Organic fraction: Homogenized and treated to obtain the stabilized organic fraction (SOF)

SOF specifications

- Appearance of mixed gravel with light gray to dark brown color
- Dimension 20/40 mm
- Total or partial absence of smell
- Density less than 1 g / cm^3
- Hydrophobic and lipophobic characteristics
- Very low water permeability
- pH between 8 and 12
- Moisture content usually between 15-30%.
- The soft, porous nature of the material shows a reduction of volume thanks to the change in the porous structure and mineral phase. This stabilized product may be further compressed.

How it works

The process uses CaO (Calcium oxide) in a 2 phases process:

- **Stabilization**: addition of materials which ensure that hazardous substances in the waste are kept in a state of low solubility, mobility and toxicity
- **Micro-encapsulation**: contaminants are mechanically captures and encapsulated inside the solidified matrix.

During the process is added calcium oxide CaO, a reagent that allows the process to be initiated through an exothermic reaction:

$CaO + H_2O \rightarrow Ca(OH)_2 + 15\ 500$ cal

SOF applications

The SOF which has a fixed granulometric composition is loaded directly into transport vehicles without interim storage to be used as:

- Coverage of landfill
- recycled composting material

AXIS ®- Treating sludge from industrial hazardous and non-hazardous waste

Principle of work

- **Stabilisation**: involving the addition of those materials ensuring that the waste hazardous components are maintained in their smallest solubility-mobility and toxicity form.
- **Microencapsulation**: this phenomena concerns the contaminating agents which do not necessarily react from a chemical point of view with the reagents, being automatically attached-absorbed in the inner part of the solidified matrix.
- **Solidification**: involves, as a result, a solid thin weaving matrix easy to handle avoiding any volatilisation, deliquescence or percolation risks.

Process:

- Transfer of the waste in the production hall for temporary storage;
- Transfer of the waste by mixer / dozer that brings the waste to the technological line AXIS (AXIS 3000/a to AXIS 11000/b);
- Process of stabilization of the waste (CaO);
- Isothermal process for the dehydration;
- Final product: Waste in solid form (matrix) with decreased potential pollutants.

sludge before treatment

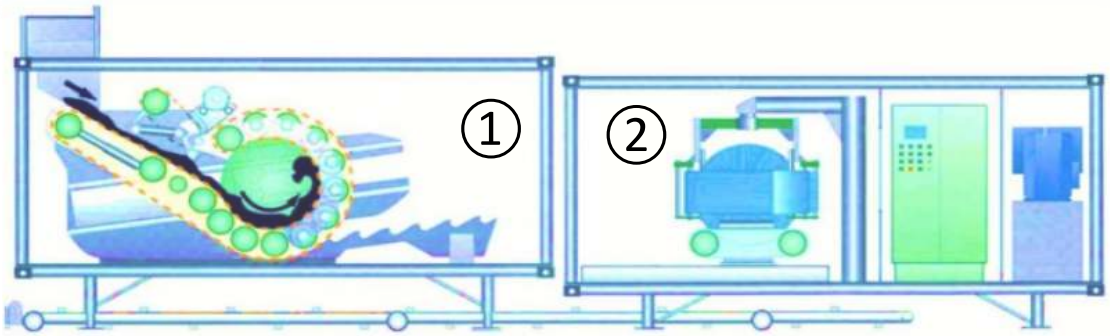
sludge after treatment

AXIS ® throughout the years

AXIS

ECO ROLL: Waste balling system: Compacting and balling MSW

Principles of work



① The press
The rotating action in the press eliminates small cavities and minimizes the residual air content.

The residual oxygen content present in the waste bales is minimized which results in a decrease in

② The wrapper
Wraps bales in waterproof plastic film. Protects waste from air contact.
Prevents methane gas (and other) production.
Allows long term storage,
Prevents foul smelling leakage.

Output: the bale

- Cylindrical
  Compacting ratio of 1:3, 1:4 Weight 800 – 1400 kg.
- Guarantees perfect seal and safe storage of waste.
  Safe, easy transport. Maximizes storage space.

Applications

1. Temporary Storage

- Transfer stations - Emergency
- Small footprint, storage-site approvals for inner-city areas.
- Accepted by neighbors, communities, farmers etc.
- Cost-efficient turn-around of waste.
  Accepted in environmentally highly sensitive countries – EU.
- Rapidity of installation, reduced dimensions of area. Baling site activation even for a few months only.
- Immediate stop to emission of liquid or foul odors in the area.

2. Others

- LDPE covering keeps waste in safe conditions.
- No smell or leachate.
- No special waste transport vehicles required
- Standard flat-bed, articulated lorries
- Clean loading floors for return trips
- Cost effective logistics
- Long-distance transport now possible

WASHTRU® : Wheel and truck washing unit

Versatility: Easily transportable, it is suitable for temporary purposes and easy to move;

Rapidity: In about 30 seconds, WASHTRU® is able to effectively clean the wheels, the under frame and the entire truck;

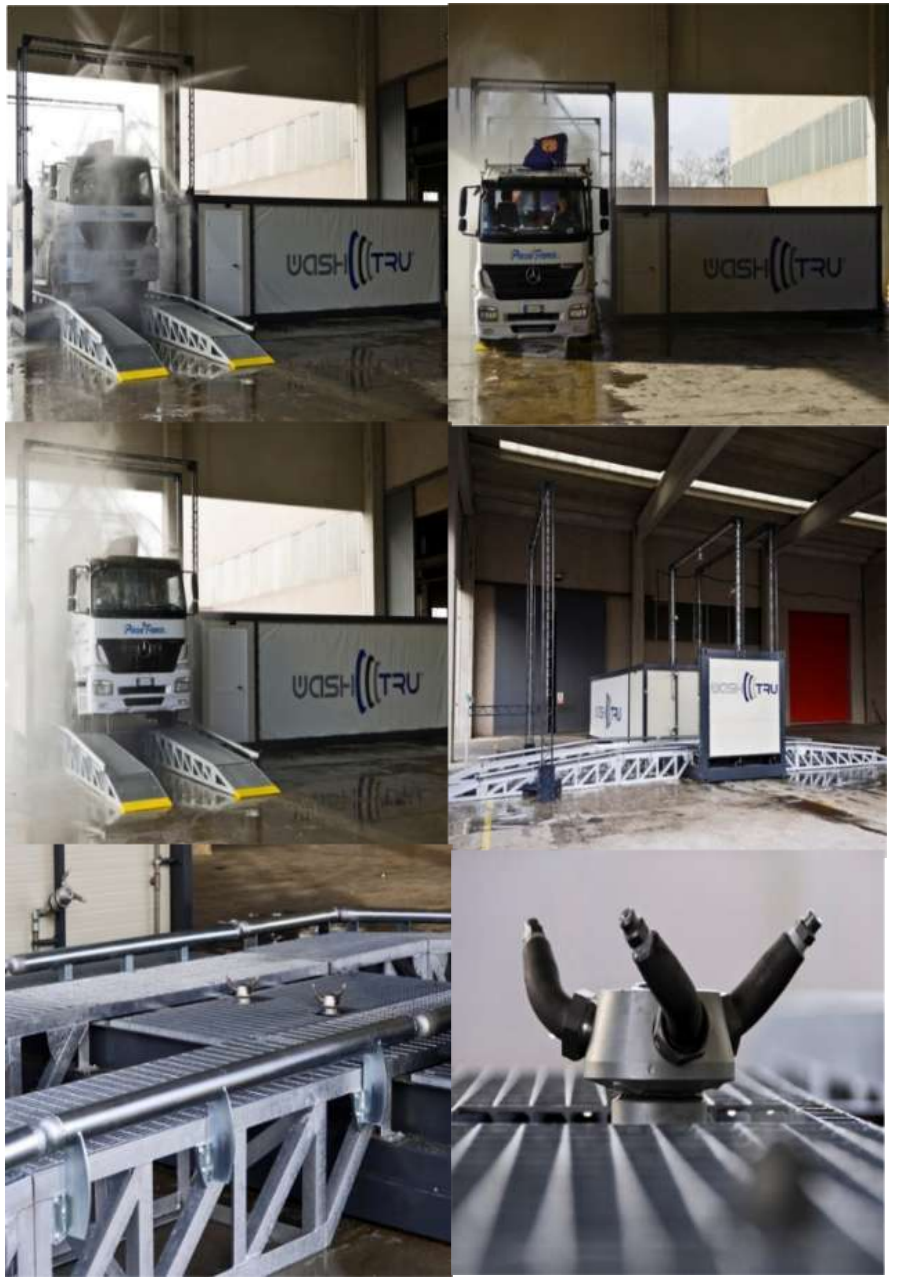
Effectiveness: Through the best high pressure technology and specific hygienically products, WASHTRU® guaranties an optimal result for vehicles that needs to be washed very often;

Efficiency: Without moving mechanical parts or brushes, WASHTRU® requires no significant servicing and ensures the highest safety of all workers;

Convenience: WASHTRU® does not require building or civil works. Just connect to water and electricity supply and the system is operational immediately. A real Plug & Play system;

Benefit: Minimal operating expenses, maximum result;

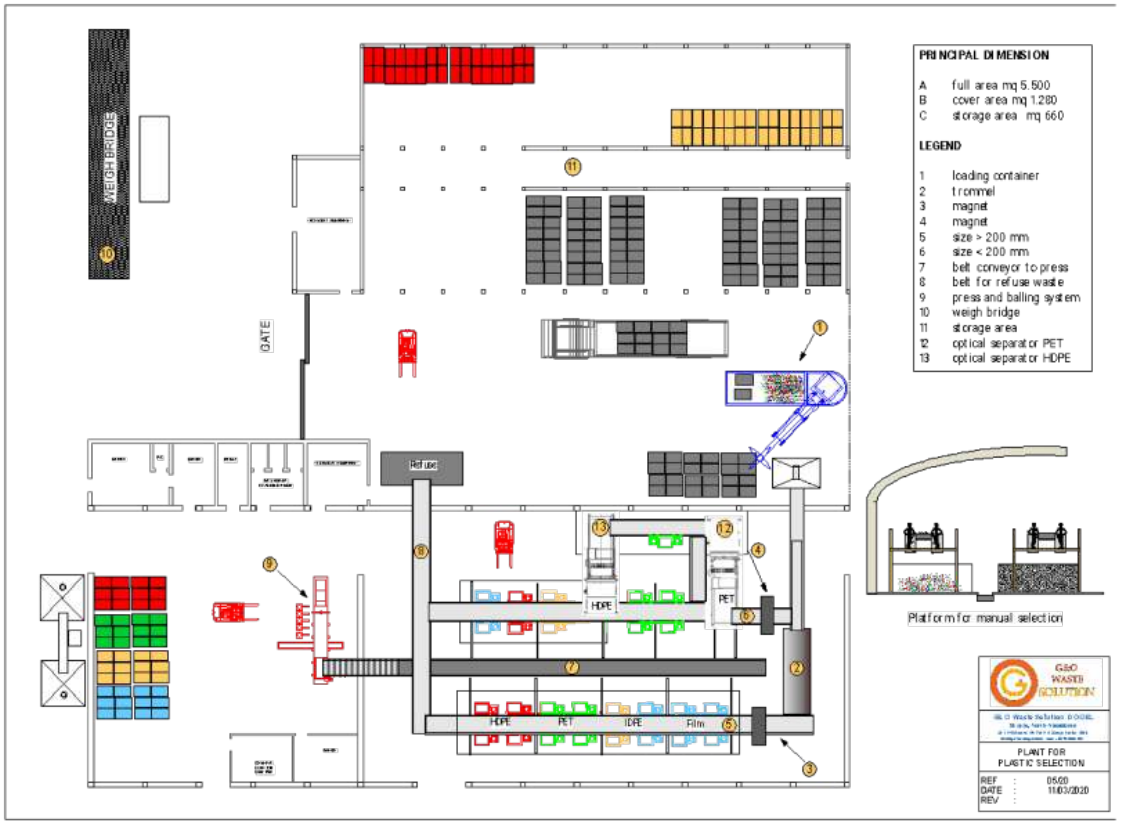
Eco-friendly: the water used in the washing cycles can be completely recycled to avoid any environmental contamination.



G&O Waste Solution plastic recycling and treatment plant

This installation for the treatment of plastic waste is designed in the Municipality of Gevgelija.
The plant is completed and put into operation in 2020.

Example of mechanical selection



The plant includes selection and recycling of plastic generated on the territory of the Republic of Northern Macedonia, as well as import of plastics from other European countries. Our production is then exported.
Recycling is carried out to an acceptable extent for potential buyers who would use plastic as a raw material in their production process of their own products for various purposes.

Hazardous/Non-Hazardous waste export in EU and Non EU countries

DIRECT CONNECTION WITH
- Power plant
- Cement factory
- Plant for treatment

FOR
- Waste to energy R1
- Waste for recycling and reuse R12

WE TAKE CARE OF
- Transport by truck or ship
- Control of loading process
- Document for final dismissing

Delivery by truck

Loading at the port

Loaded ship

Hazardous/Non-Hazardous waste export in EU and Non EU countries

References for our technologies

1988- PIACENZA (IT) : First plant MID-MIX for treatment of hazardous waste

1994- PIACENZA (IT) : Industrial plant AXIS for treatment of hazardous waste – 5.000 ton/y

1997- S.CROCE sull'ARNO (PI) : Industrial plant AXIS for hazardous sludge – 30.000 ton/y

1998- UNIVERSITAD ROVIDI&VIRGILI – Tarragona (E) : AXIS facilities international certification

1998- CERRO al LAMBRO (IT): Area sanitation from hazardous waste by AXIS facilities – 100.000 ton

2000- TAJO (IT): ECOROLL facilities for balling of municipal waste

2002- CREMONA (IT): Plant for production of alternative fuel for Cement (BUZZI UNICEM)

2004- BOLOGNA (IT): MATRIX facilities for the treatment of organic waste and production of RDF

2005-PALERMO (IT): Plant PHARAON for treatment of Municipal Waste – 160.000 ton/y

2011- SKOPJE (MK): Full project for the waste treatment in Drisla landfill

2014- KAVADARCI (MK): Plant for treatment of municipal waste

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