ATZWANGER

REFERENCES

ECOMASTER®

A PASSION FOR WASTE & ENERGY

MBT PROJECTS

		Bag opening / Shredding	Organic Waste Sorting	Recyclables Sorting	Recyclables Baling	Bales Wrapping	Transfer Station	RDF Production	RDF Densification	Boiler Feeding	Membrane Composting	Container Composting	ASP Composting	Tunnel Composting / Bio-drying	Compost Post-treatment	Thermal Drying	Wet Anaerobic Digestion	Semi-dry Anaerobic Digestion	Dry Anaerobic Digestion	CHP	Bio-methane	Odour / VOC Control
83	Aielli, Italy																	•				
82	Udine, Italy													•	•							•
81	Maniago, Italy																	•				
80	Peccioli, Italy																	•				
79	Nonantola, Italy	•												•	•							•
78	Cavaglià, Italy																	•				
77	Novo Mesto, Slovenia	•		•				•						•	•							•
76	Beirut, Lebanon													•								•
75	Anzio, Italy																	•				
74	Monterotondo Marittimo, Italy	•	•											•				•		•		•
73	Finale Emilia, Italy	•	•															•			•	
72	Karlovy Vary, Czech Republic	•	•	•				•														
71	Edmonton, Canada													•								
70	Bolzano, Italy				•	•																
69	Tuscania, Italy																	•				
68	Marijampole, Lithuania	•	•	•	•									•	•							•
67	Japan													•								•
66	Siauliai, Lithuania	•	•	•										•								•
65	Mitoyo, Japan													•								•
64	Vilnius, Lithuania	•	•	•	•	•								•	•							•
63	Cluj, Romania										•											
62	Cluj, Romania			•	•																	
61	Lana, Italy																•			•		
60	Mitoyo, Japan											•		•								•
59	Casalvolone, Italy	•											•	•	•				•	•		•
58	Slovenj Gradec, Slovenia	•		•	•			•					•		•							•
57	Sogliano, Italy													•					•			•
56	S. Canzian d'Isonzo, Italy																		•	•		
55	Notaresco, Italy																					•
54	Tessello, Italy												•									
53	Porto Azzurro, Italy										•											
52	South Sinai, Egypt			•			•															
51	Sharm El Sheik, Egypt			•			•															
50	Moraro, Italy	•		•	•																	
49	Carbonia, Italy	•	•	•	•								•									•
48	Marsascala, Malta	•	•	•	•	•		•														
47	Marsascala, Malta			•	•																	
46	Parona, Italy			•						•												
45	Parona, Italy	•		•				•														
44	Sesto Fiorentino, Italy														•							
43	Sesto Fiorentino, Italy													•								•
42	Notaresco, Italy												•									
41	Porto Torres, Italy															•						
40	Guanzate, Italy												•	•								•
39	Carpi, Italy													•								•
38	Pieve Di Coriano, Italy	•	•	•				•	•				•		•							
37	Ceresara, Italy	•	•	•				•	•				•		•							
36	S. Agata Bolognese, Italy													•								•

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35	Massafra, Italy			•				•	•													
34	S. Nazzaro Sesia, Italy																					•
33	Massafra, Italy			•				•	•													
32	Massafra, Italy	•	•	•									•	•								•
31	Lugo Di Ravenna, Italy														•							
30	Piossasco, Italy	•		•	•																	
29	Siderno, Italy													•								•
28	Sambatello, Italy													•								•
27	Crotone, Italy													•								•
26	Massafra, Italy									•												
25	Rossano, Italy			•	•																	
24	Udine, Italy			•	•																	
23	Gioia Tauro, Italy												•	•								•
22	Grassobbio, Italy												•	•								•
21	Monfalcone, Italy										•											•
20	Campi Salentina, Italy			•	•																	
19	S. Nazzaro Sesia, Italy												•									
18	Ortisei, Italy						•															
17	Bagnolo Mella, Italy												•	•								•
16	Cavallino, Italy													•								•
15	Cavallino, Italy	•	•	•	•																	
14	Pontedera, Italy			•																		
13	Poggiardo, Italy	•	•	•	•																	
12	Campi Salentina, Italy	•	•	•	•																	
11	Parona, Italy							•							•							
10	Parona, Italy												•									•
9	Parona, Italy	•		•	•			•		•												
8	Parona, Italy	•	•	•																		
7	Tortona, Italy			•	•																	
6	Tortona, Italy			•	•																	
5	Sedegliano, Italy			•	•	•																
4	Rozzano, Italy			•																		
3	Udine, Italy	•		•																		
2	Padua, Italy						•															
1	Udine, Italy	•		•	•																	

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83 AIELLI (AQ) - ITALY

Year	2023
Client	ACIAM Spa
Operator	ACIAM Spa
System description	Semi-dry anaerobic digestion
Waste processed	Organic source separated waste
Plant capacity	45,000 t/year

ACIAM Spa awarded ATZWANGER with the design and implementation of electro-mechanical works for the production of biomethan gas.

Biogas is recovered from source separated organic waste with a semi-dry anaerobic digestion system, which is designed to process a high-solids feedstock and achieves a top biogas yield.

Atzwanger supplied one digester model TF 3200, dosing and feeding line, digestate dosing systems.

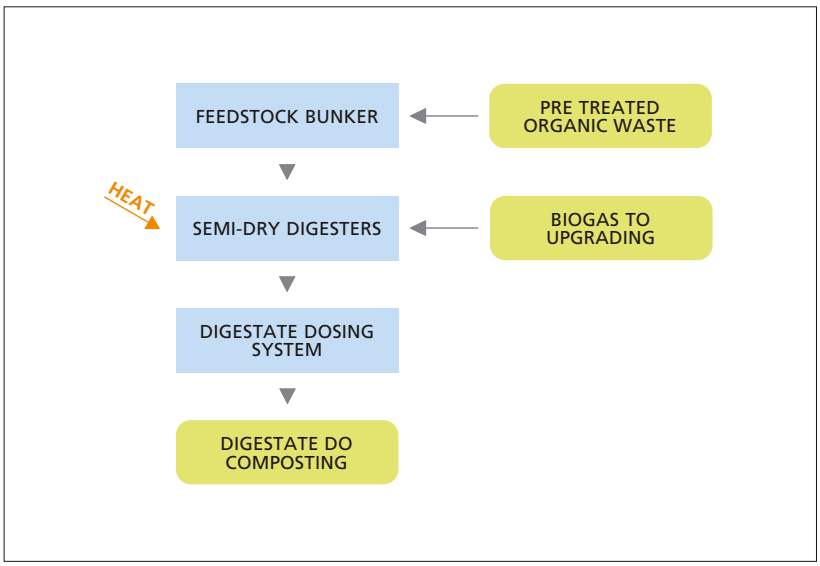
Digester used for this application is substantially a construction made of reinforced concrete having a parallelepiped shape.

The walls and the roof of the digester are insulated and a heating system is provided internally for maintaining the required process temperature.

The functioning of the digester is based on the plug-flow concept. The organic fraction, with a solid content higher than 15% is introduced into the digester by a screw conveyor, which also has the function of sealing the inlet port. Ten horizontal agitators, installed transversally in the digester, prevent the formation of deposits and facilitate the extraction of biogas, which is exhausted from the top of the digester.

The processed material exits digesters by means of a pneumatic system, which prevents air entering the digester. The plug-flow digester needs to be fed with fresh material, which is loaded on a 24/7 basis by an automated system.

The digestate extracted from digesters is sent to a composting line, while the biogas produced in the digesters is treated with an upgrading system which produces pipeline-grade biomethane.



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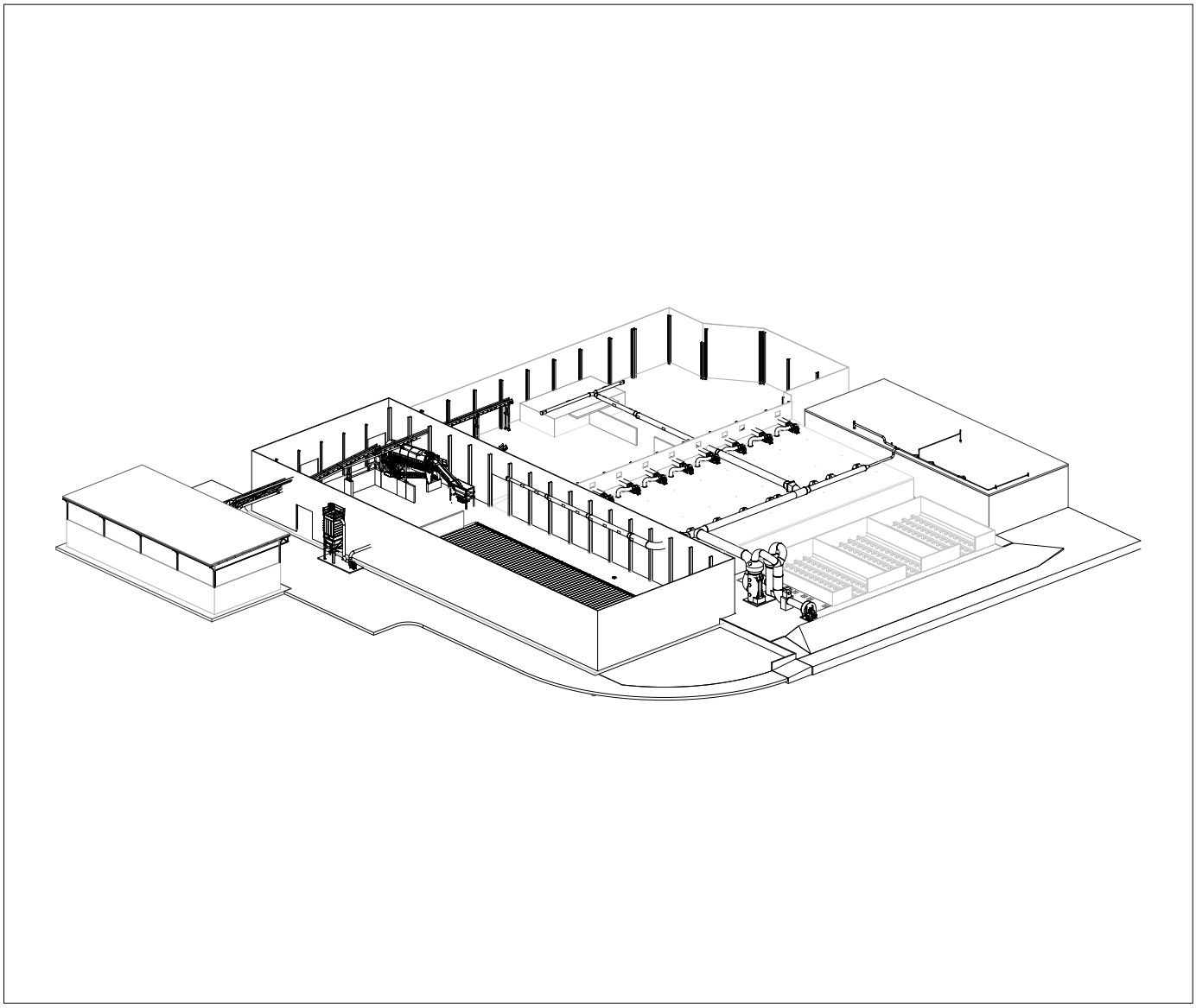
82 UDINE - ITALY

Year	2023
Client	AMUT Ecotech SRL
Operator	BIONET SRL
System description	Composting, stabilization and odour control
Waste processed	Organic source separated digestate waste, mixed municipal digestate waste and bulky waste
Plant capacity	66,500 t/year

AMUT Ecotech SRL awarded ATZWANGER with the design and implementation of electro-mechanical works for the production of compost and stabilized material (used as daily landfill capping).



The whole project involves the construction of a facility with the following sections:

- waste pre treatment.
- wet anaerobic treatment
- digestate dewatering
- biomethan production and feeding into distribution network
- odour control
- product post treatment

The proposed technology is designed to maintain the separation of the treated flows.

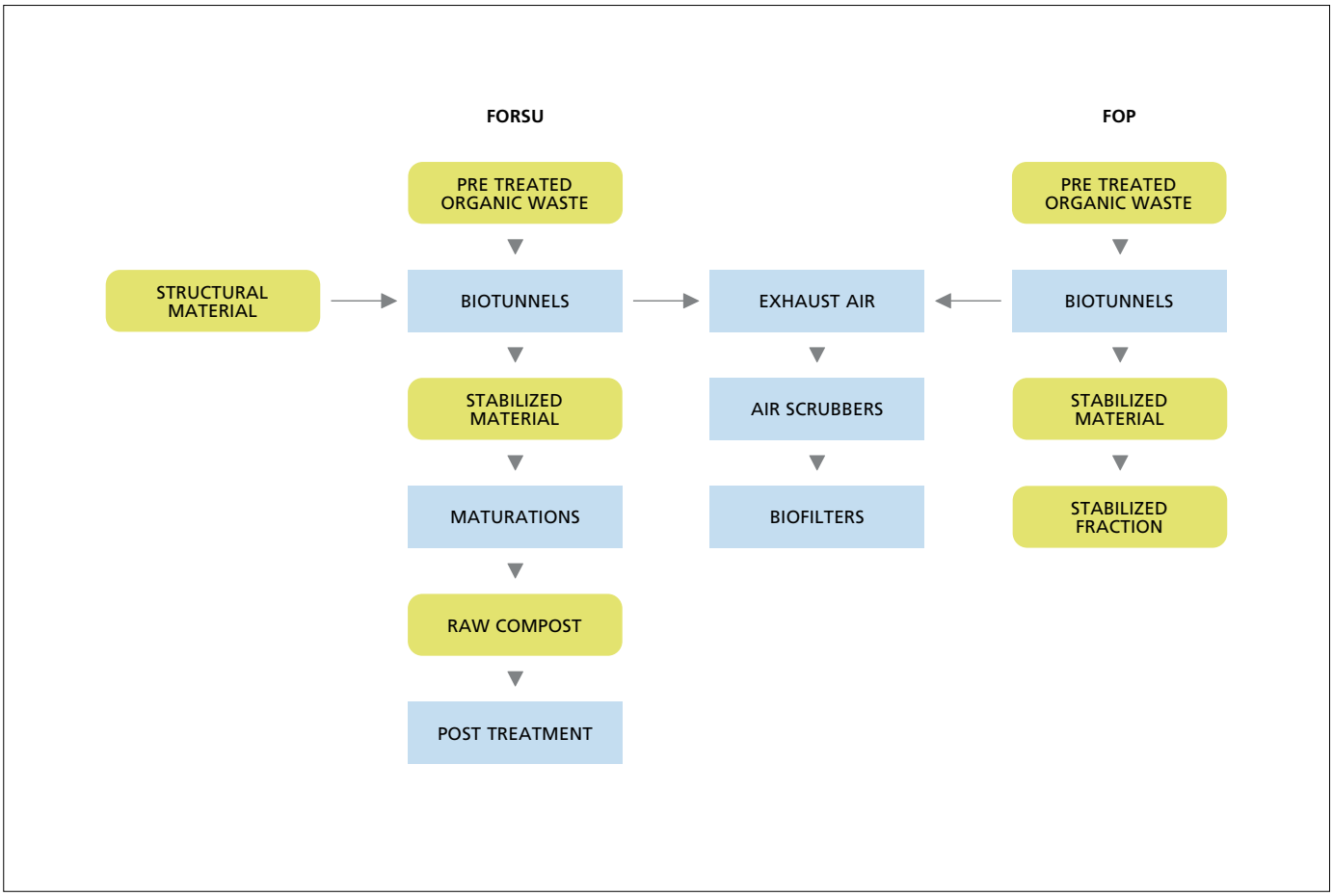
Digestate extracted from digesters is dewatered and mixed with shredded green waste; the mixture is sent to a composting system including biotunnels for intensive composting and an ASP (aerated Static Pile) system for compost maturation.

In each tunnel is fitted with a fan that supplies the process air to the tunnel-aerated floor. In order to have uniform conditions for the composting process, the air supplied by the fan is a mixture of fresh air and recirculated air.

The fresh air for the tunnels is taken from the adjacent material-handling hall and the air exhausted from the tunnels is treated in a centralized biofilter. A variable speed fan is installed upstream of the biofilter.

The biological process is automated by a SCADA system and operates on a 24/7 basis.

The plant is equipped with suction and odour control systems that use the combination of acid scrubbers and biofiltration process to guarantee maximum environmental parameters.



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81 MANIAGO (PN) - ITALY

Year	2023
Client	Bioman Spa
Operator	Bioman Spa
System description	Semi-dry anaerobic digestion
Waste processed	Organic source separated waste
Plant capacity	98,000 t/year

A plug-flow (semi-dry) technology has been used by Atzwanger for this anaerobic digestion project.

Atzwanger supplied a pair of digesters model TF 3200.

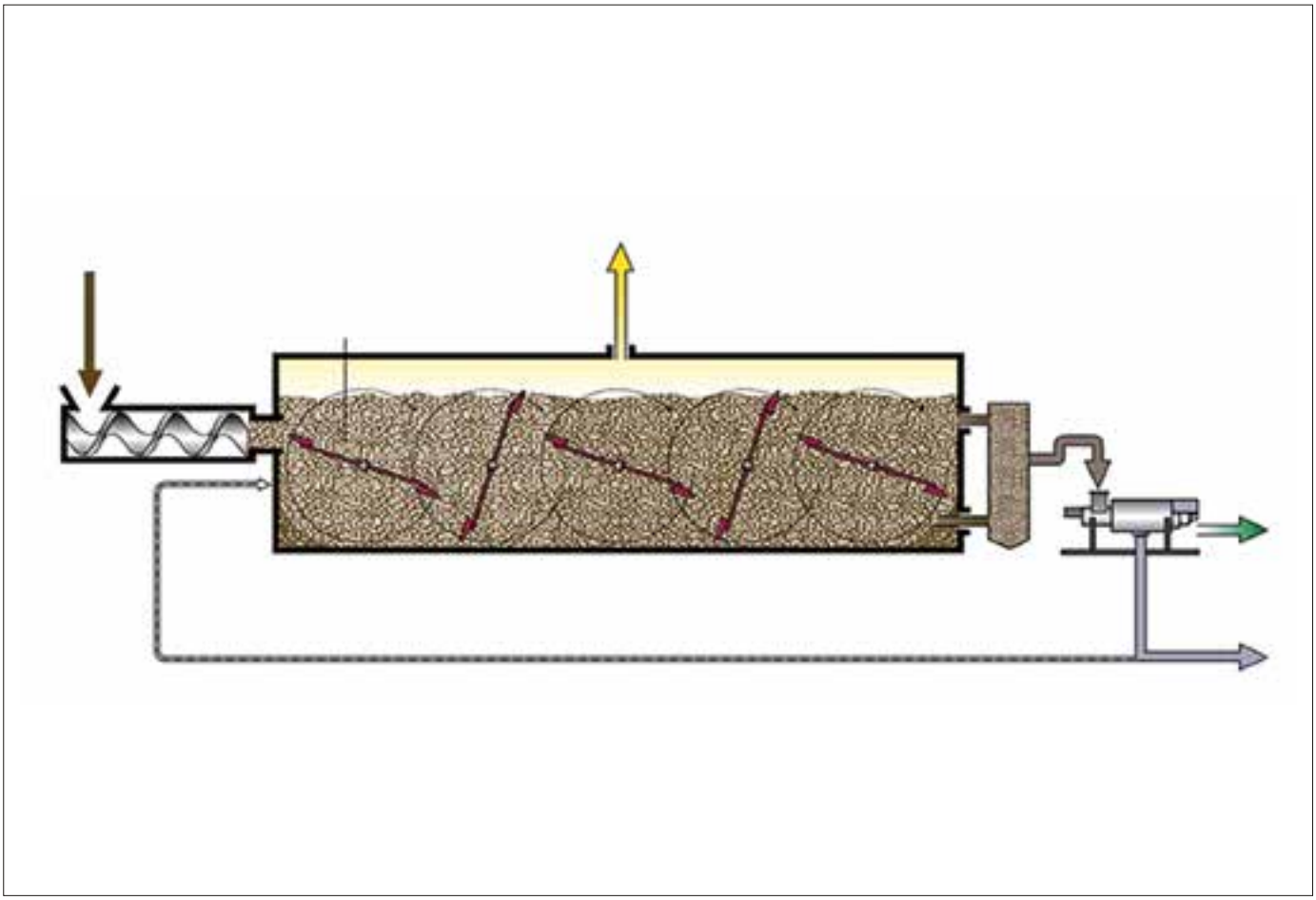
Digesters used for this application are substantially a construction made of reinforced concrete having a parallelepiped shape.

The walls and the roof of the digester are insulated and a heating system is provided internally for maintaining the required process temperature.

The functioning of the digester is based on the plug-flow concept.

The organic fraction, with a solid content higher than 15% is introduced into the digester by a screw conveyor, which also has the function of sealing the inlet port. Ten horizontal agitators, installed transversally in the digester, prevent the formation of deposits and facilitate the extraction of biogas, which is exhausted from the top of the digester.

The processed material exits the digester by means of a pneumatic system, which prevents air entering the digester. The plug-flow digester needs to be fed with fresh material, which is loaded on a 24/7 basis by an automated system.



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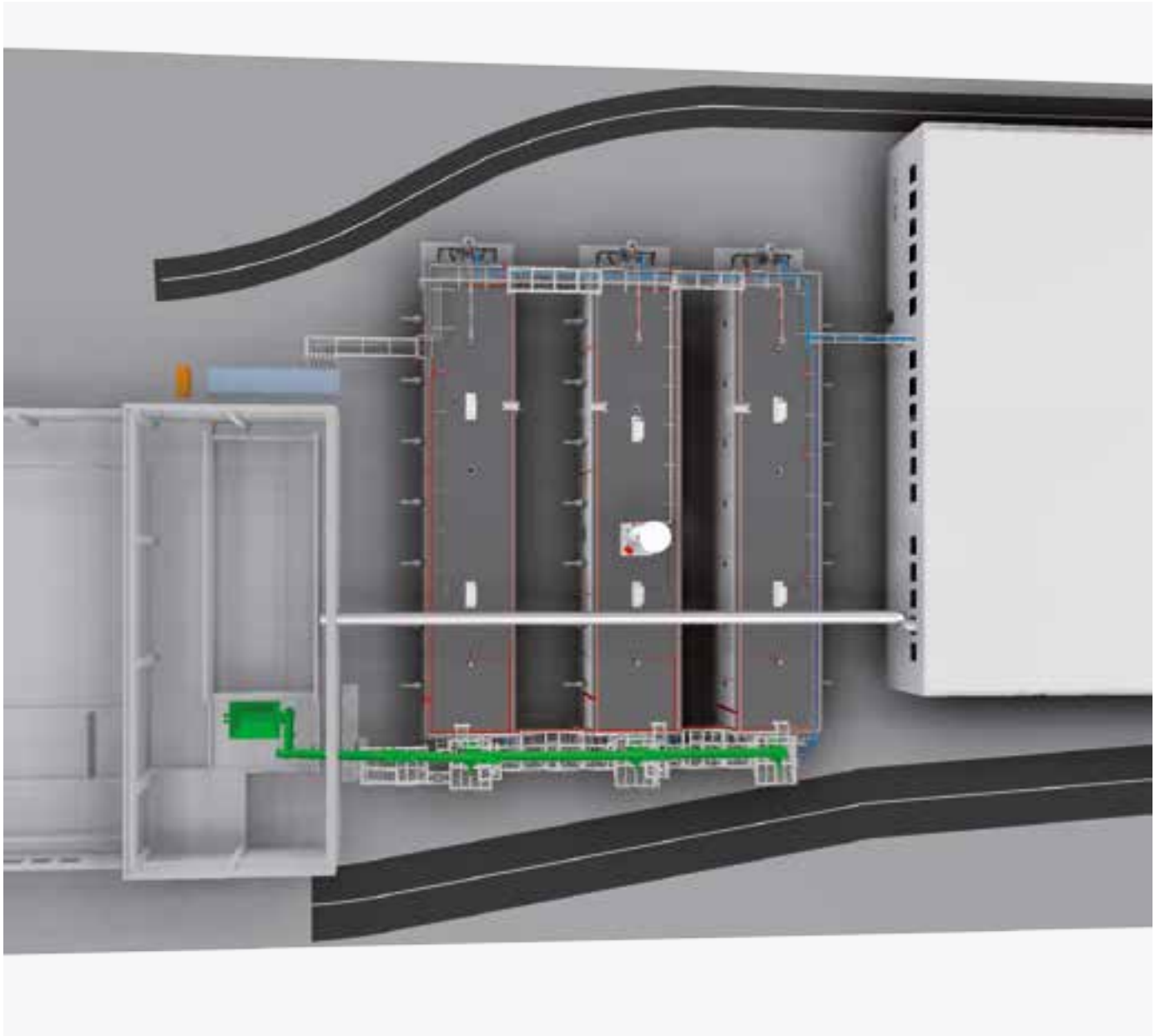
80 PECCIOLI (PI) - ITALY

Year	2022
Client	Renerwaste SRL
Operator	Albe SRL
System description	Semi-dry anaerobic digestion
Waste processed	Organic source separated waste
Plant capacity	83,000 t/year

Atzwanger supplied three digesters model TF 2200, dosing and feeding line, digestate dosing systems.



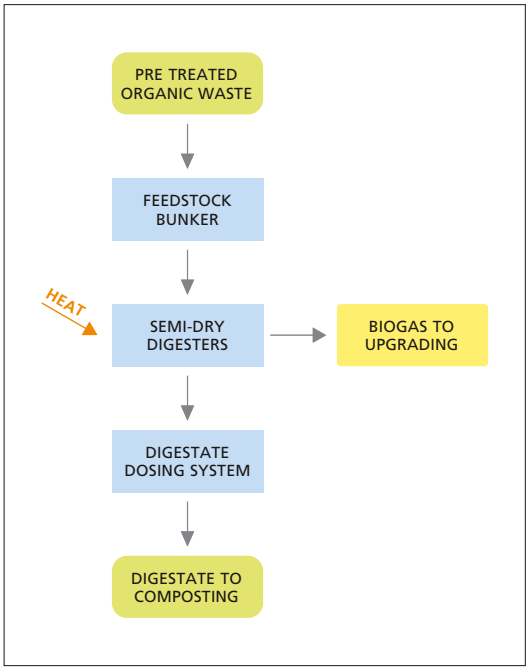
Digesters used for this application are substantially a construction made of reinforced concrete having a parallelepiped shape.

The walls and the roof of the digester are insulated and a heating system is provided internally for maintaining the required process temperature.

The functioning of the digester is based on the plug-flow concept. The organic fraction, with a solid content higher than 15% is introduced into the digester by a screw conveyor, which also has the function of sealing the inlet port. Seven horizontal agitators, installed transversally in the digester, prevent the formation of deposits and facilitate the extraction of biogas, which is exhausted from the top of the digester.

The processed material exits digesters by means of a pneumatic system, which prevents air entering the digester. The plug-flow digester needs to be fed with fresh material, which is loaded on a 24/7 basis by an automated system.

The digestate extracted from digesters is sent to a composting line, while the biogas produced in the digesters is treated with an upgrading system which produces pipeline-grade biomethane.



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79 NONANTOLA - ITALY

Year	2022
Client	SARA SRL
Operator	Biorg SRL
System description	Composting, stabilization and odour control
Waste processed	Organic source separated waste and green waste
Plant capacity	28,000 t/year

SARA SRL awarded ATZWANGER with the design and implementation of electro-mechanical works for pre-treatment and production of compost.

Compost derived from the bio-conversion of source separated organic waste is a high quality compost which may be marketed for agricultural use without restrictions.

The whole project involves the construction of a facility with the following sections:

- Waste pre treatment section
- Biotunnels section
- Maturation section
- Odour control section

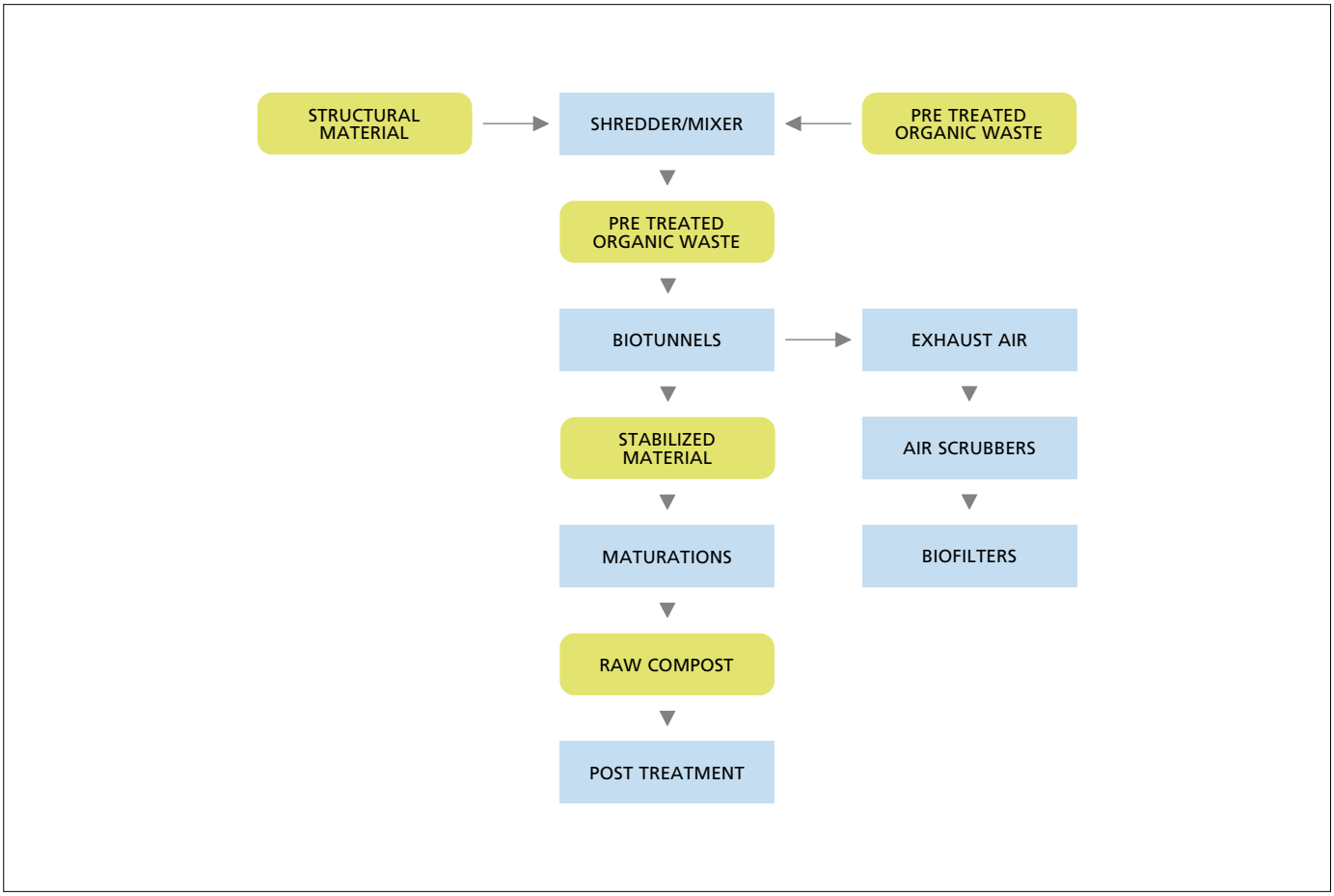
After shredding and mixing, the first phase of biological treatment occurs in five in-vessel reactors, called biotunnels.

After this active composting phase, the material is moved by wheel loader to the primary maturation area, which is based on an aerated floor system.

Raw compost is therefore processed and the fine fraction is sent to the secondary maturation system, which is also based on an aerated static pile.

All biological treatments are completed indoors. The waste air from the biotunnels and from the maturation building is processed by a scrubber and a biofilter for odour control.

The hearth of the plant is the computerised control system, which allows for an automatic operation of the process. The automation system includes a PC based interface for data visualisation, which makes very simple the operation of the plant.



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78 CAVAGLIÀ (BI) - ITALY

Year	2022
Client	A2A Ambiente Spa
Operator	A2A Ambiente Spa
System description	Semi-dry anaerobic digestion
Waste processed	Organic source separated waste
Plant capacity	60,000 t/year

A plug-flow (semi-dry) technology has been used by Atzwanger for this anaerobic digestion project.

Atzwanger supplied a pair of digesters model TF 2100.

Digesters used for this application are substantially a construction made of reinforced concrete having a parallelepiped shape.

The walls and the roof of the digester are insulated and a heating system is provided internally for maintaining the required process temperature.

The functioning of the digester is based on the plug-flow concept.

The organic fraction, with a solid content higher than 15% is introduced into the digester by a screw conveyor, which also has the function of sealing the inlet port. Seven horizontal agitators, installed transversally in the digester, prevent the formation of deposits and facilitate the extraction of biogas, which is exhausted from the top of the digester.

The processed material exits the digester by means of a pneumatic system, which prevents air entering the digester. The plug-flow digester needs to be fed with fresh material, which is loaded on a 24/7 basis by an automated system.

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77 NOVO MESTO - SLOVENJA

Year	2021
Client	CGP d.d.
Operator	CERO-DBK
System description	Composting, stabilization, raw RDF production and odour control
Waste processed	Organic source separated waste, mixed municipal waste and bulky waste
Plant capacity	25,000 t/year

CGP d.d. awarded ATZWANGER Spa with the design and implementation of automated electro-mechanical works for the production of raw Refuse Derived Fuel (RDF) and compost.

The project involves the construction of a facility with one section for aerobic stabilization of organic source separated waste and another section for stabilization and mechanical treatment for mixed municipal waste aimed at the recovery of material.

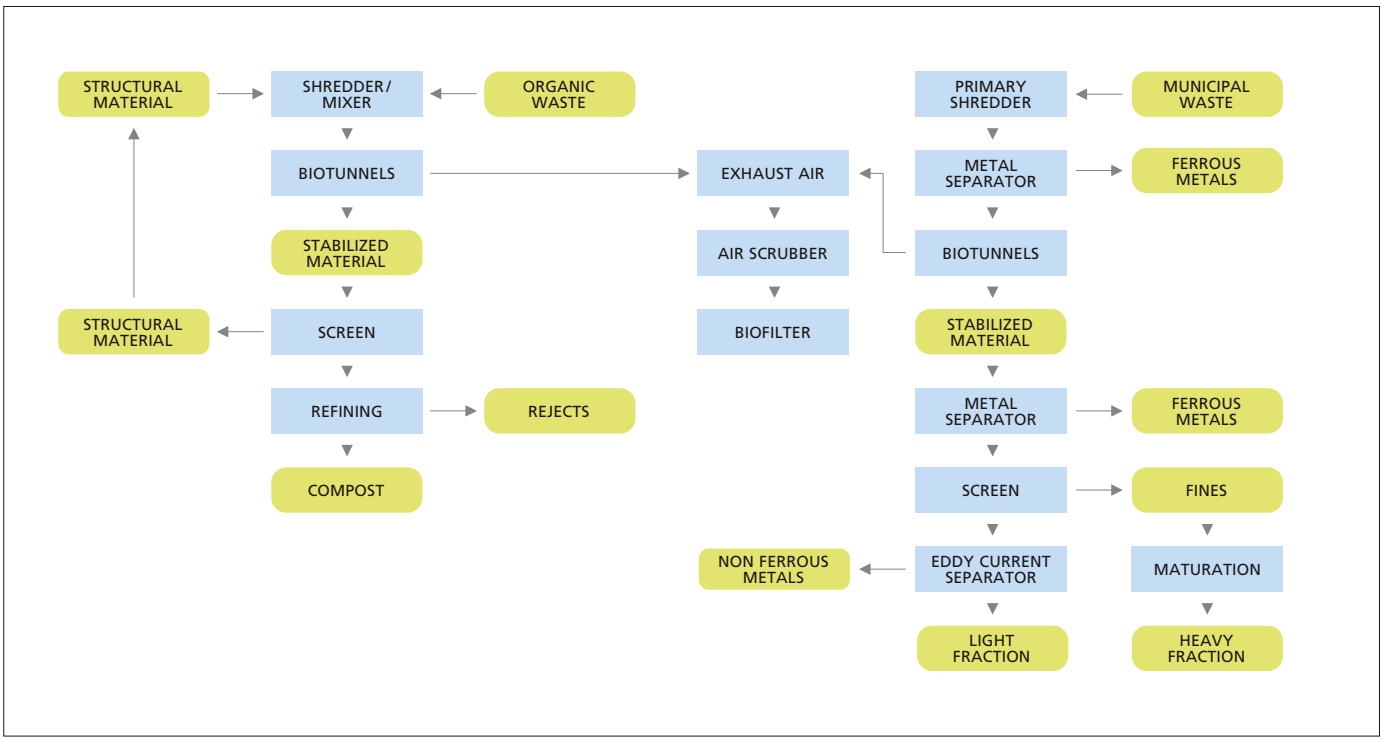
The proposed technology is designed to maintain the separation of the treated flows.

Two sections are foreseen:
- A section for the stabilization and production of a raw refuse derived fuel, characterized by an initial phase of mechanical pre-treatment, a second phase of stabilization inside biotunnels and a subsequent final phase of sorting; an additional maturation area is dedicated to the undersized material, that will be use as a daily capping of the landfill.
- A section for composition, characterized by an initial phase of mechanical pre-treatment, a second phase of composing inside biotunnels, and a final phase of refinement. The second phase is characterized by the stabilization of the organic matrix and results in a final mature raw compost with a higher content of humid substances. The final phase of refinement is obtained with a trommel screen with in-line deplastification unit with the aim of improving the quality of the final product.

The handling of materials in the two sections is done exclusively with the use of wheal loaders.

The final products to be subjected to recovery activities are:
- Raw fuel from waste to be used in "waste-to-energy" plants;
- Mixed compost soil amendment to be used in agriculture.

The plant is equipped with suction and odour control systems that use the biofiltration process and guarantee maximum environmental parameters.



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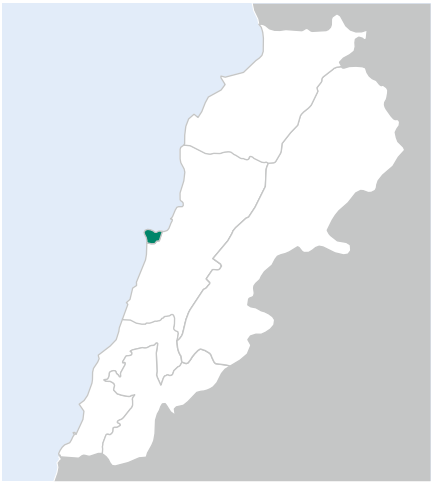
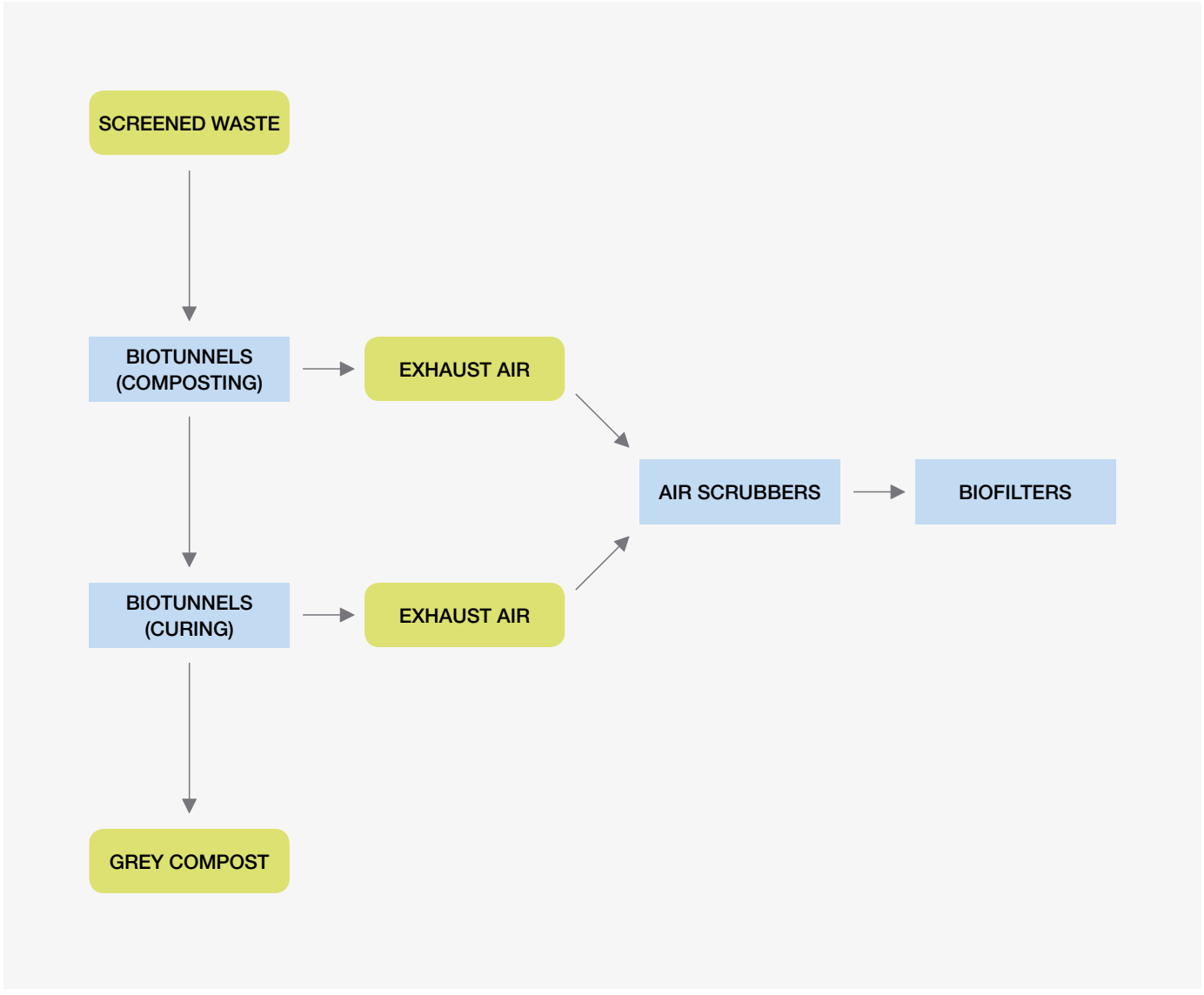
76 BEIRUT - LEBANON

Year	2018
Client	AL-JIHAD FOR COMMERCE CONTRACTING S.A.L.
Operator	AL-JIHAD FOR COMMERCE CONTRACTING S.A.L.
Partner	EMIT Group S.r.l.
System description	Tunnel composting and odour control
Waste processed	Organic fraction from pre-treatment of MSW (Municipal Solid Waste)
Plant capacity	273,750 t/year



Thirty seven bio-tunnels are the core of this composting plant treating organic waste from a mechanical pre-treatment line. The contract includes the design of the biotunnel composting plant complete with air treatment.



The composting plant is meant for the stabilization of organic material coming from the mechanical sorting of mixed municipal solid waste. There are two successive biological phases, both developed inside bio-tunnels.

Wheel loader fills composting bio-tunnels consisting of reinforced concrete cells. Once the first composting phase is completed, the wheel loader moves the material to the second phase (or curing), which develops in another bio-tunnel battery.

Each cell has the shape of a blind tunnel and is equipped with a ventilation system built into the floor.

Once the tunnel has been filled, its sliding door closes tightly in order to ensure odour control.

Process air is blown in through the floor and partly re-circulated in the tunnel.

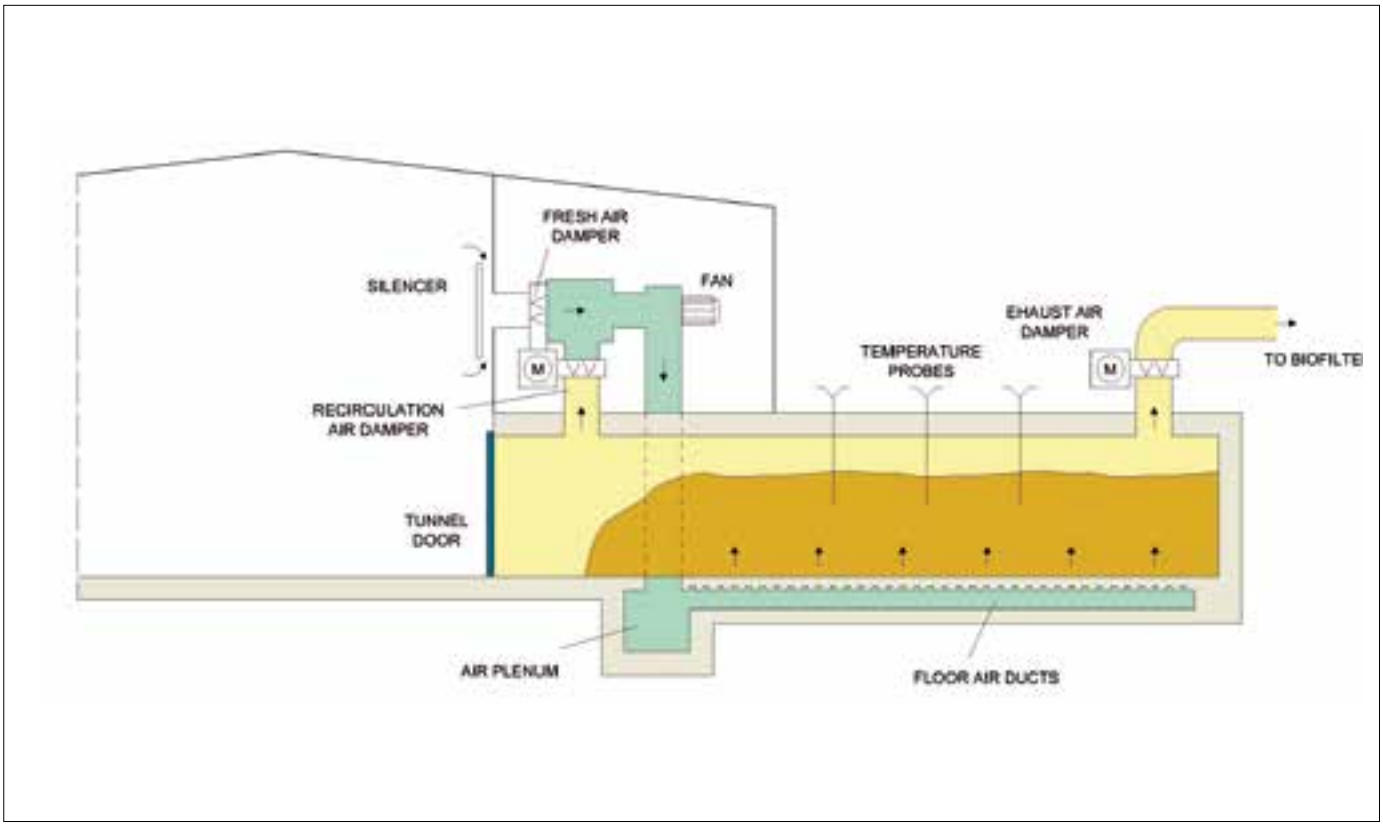
Exhaust air is sent, together with air coming from other areas, to the biological filter, which keeps odour under control.

The composting process is computer-controlled and based on sensors that survey the various process parameters (compost temperature, air pressure, air temperature, oxygen rate, etc.). The surveyed data are processed by the computer to regulate the system according to the process evolution in each one of the tunnels.

The data processing software allows for regulating the biological stabilization process according to the operation requirements. The software has the flexibility to compensate for the variations of treated waste and ambient conditions.

In order to ensure an optimal operation, the biofilter is equipped with an air humidification system at the inlet and a sprinkler system on the surface.

Once the computer-controlled process has been completed, the material is extracted from the tunnel by means of a wheel loader. The tunnel is thus available again for the treatment of a new batch of material.



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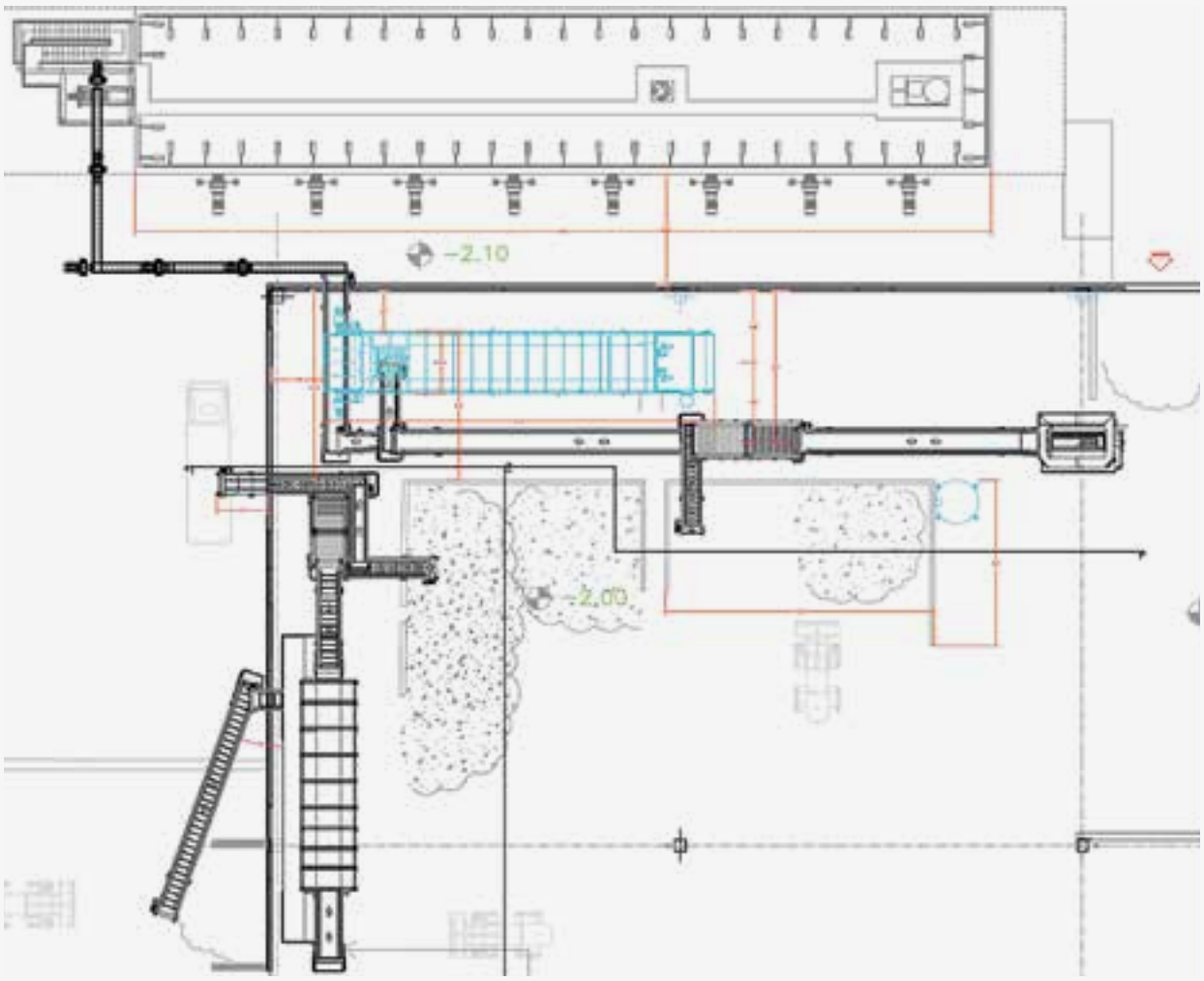
75 ANZIO (RM) - ITALY

Year	2017
Client	TONELLO ENERGIE Srl
Operator	ANZIO BIOWASTE Srl
System description	Dosing system, semi-dry anaerobic digestion
Waste processed	Organic source-separated waste
Plant capacity	40,000 t/year

Biogas is recovered from source separated organic waste with a semi-dry anaerobic digestion system, which is designed to process a high-solids feedstock and achieves a top biogas yield.

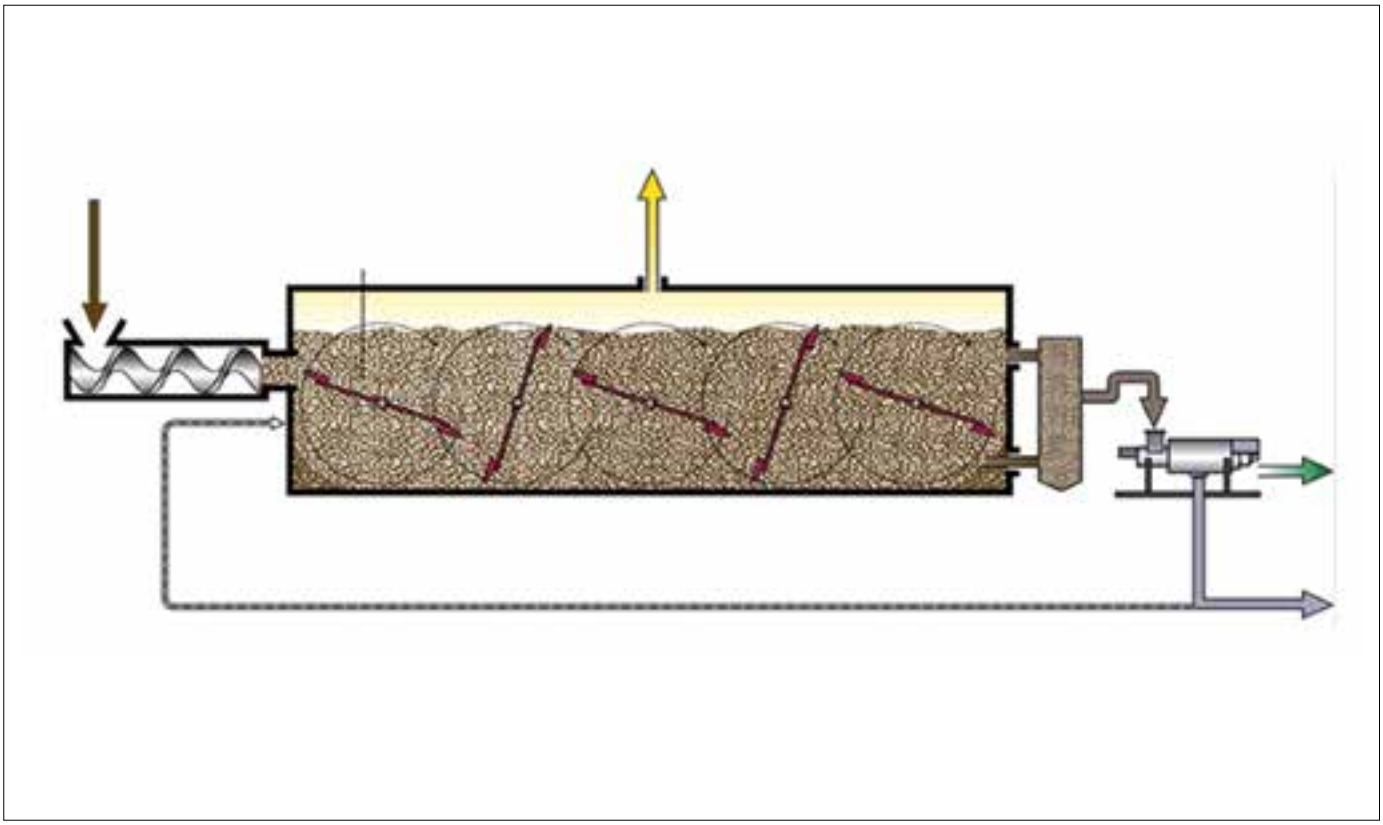


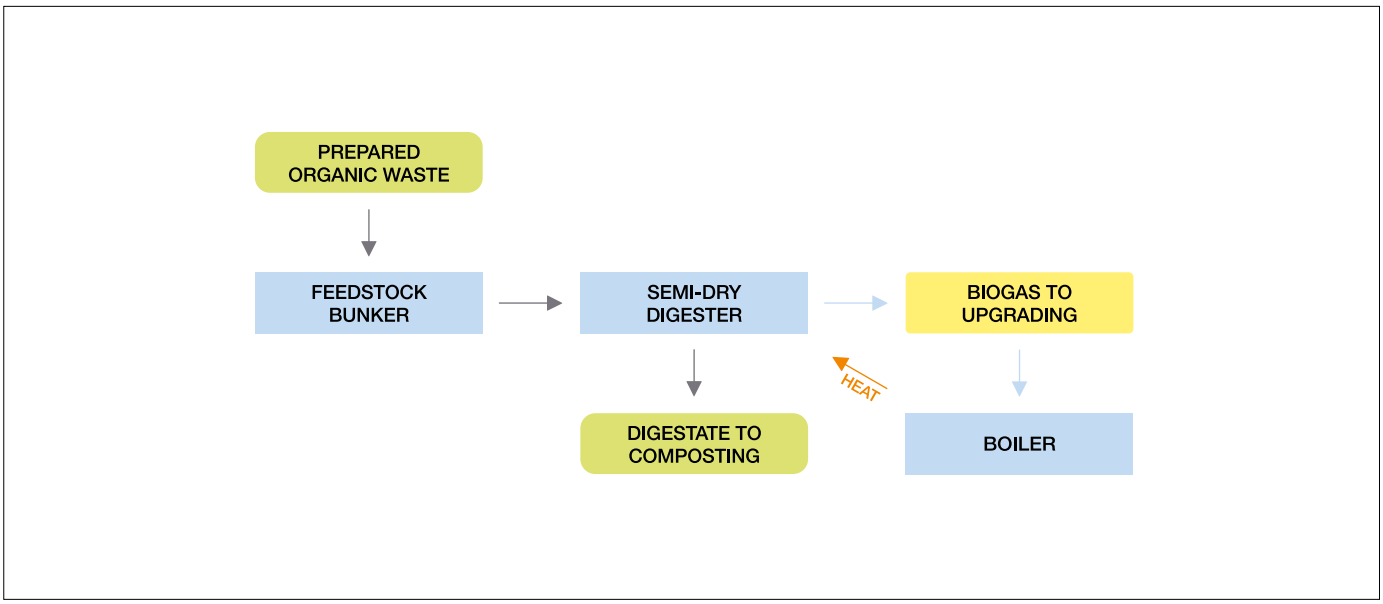
Source separated organic waste is processed by a pre-treatment line and loaded into a storage bunker, which automatically feeds the material to the digester. The digester vessel has the shape of an elongated parallelepiped and is made by steel-reinforced concrete.

Some slow-speed rotors, with a horizontal shaft driven by a planetary gear-motor, are provided inside the digester. The rotors agitate the material contained by the digester, which proceeds with a plug-flow pattern.

The organic material is heated by heat exchangers located along the longitudinal walls of the digester. The biogas extracted from the digester is treated with an upgrading system which produces pipeline-grade biomethane.

A small part of the produced biogas is used to fuel a boiler for generating the hot water required by the digester heating system. The digestate extracted from the digester is sent to a composting line.





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74 MONTEROTONDO MARITTIMO (GR) - ITALY

Year	2017
Client	ACEA AMBIENTE SRL
Operator	ACEA AMBIENTE SRL
System description	Pre-treatment, semi-dry anaerobic digestion, composting, CHP
Waste processed	Organic waste, biosolids, green waste
Plant capacity	70,000 t/year

Biogas is recovered from source separated organic waste with a semi-dry anaerobic digestion system, which is designed to process a high-solids feedstock and achieves a top biogas yield.

Source separated organic waste is processed by a pre-treatment line for sorting the organic components to be digested from rejects consisting of plastic bags and other non-biodegradable waste. The organic material produced in the pre-treatment line is then mixed with shredded green waste, which acts also as a bulking agent for the digestion process. The bulking agent derives from green waste shredding and compost screening operations.

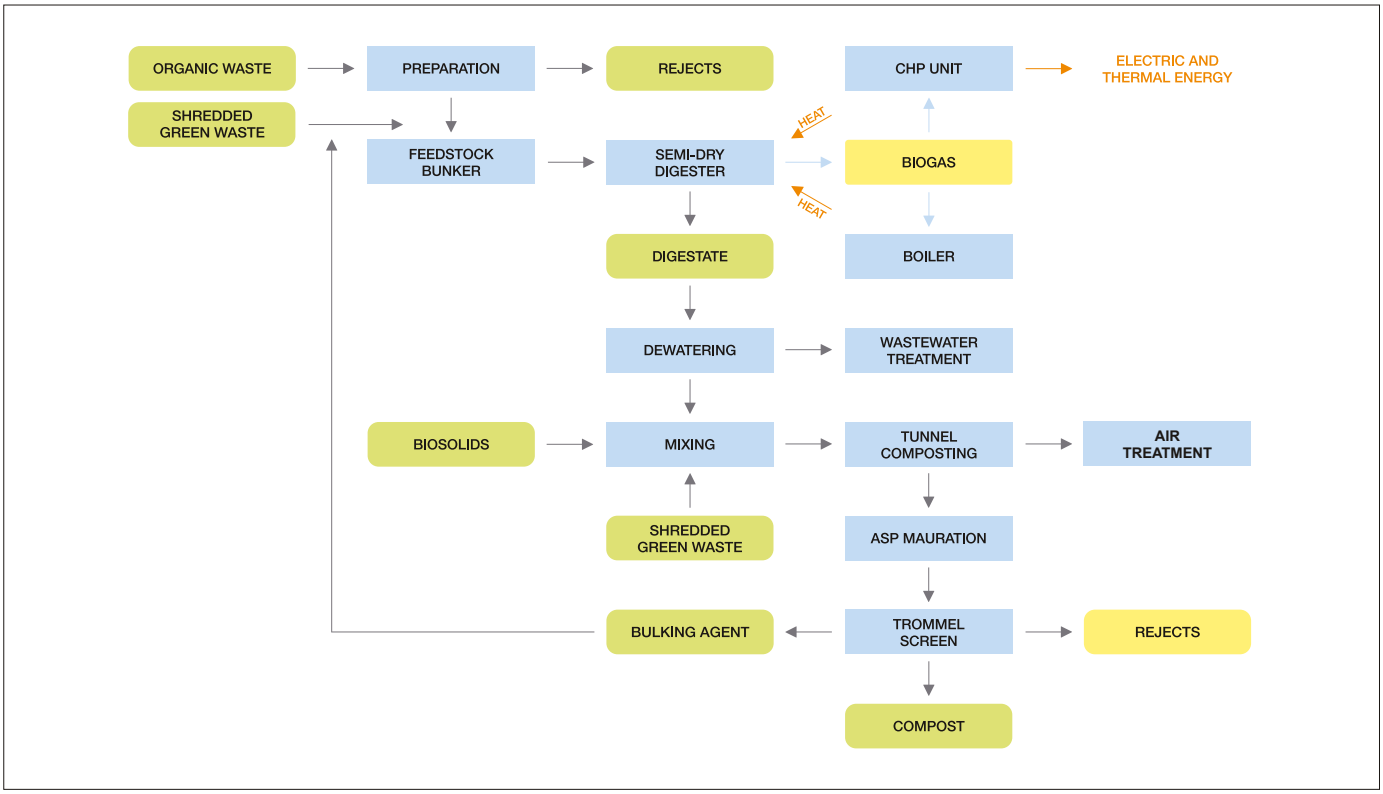
A feeding bunker is used to store the digester feedstock, which has a high solids content. This semi-dry digestion process achieves a high biogas yield from a single digestion vessel. The loading of the feedstock from the storage bunker into the digester is fully automated.

The digester vessel has the shape of an elongated parallelepiped and is made by steel-reinforced concrete.

Some slow-speed rotors, with a horizontal shaft driven by a planetary gear-motor, are provided inside the digester. The rotors agitate the material contained by the digester, which proceeds with a plug-flow pattern. The organic material is heated by heat exchangers located along the longitudinal walls of the digester. The produced biogas is used in a CHP unit, which generates heat and power. Part of the heat produced is used for heating the digester, which is also provided with a biogas-fueled boiler.

The digestate extracted from the digester is dewatered and mixed with shredded green waste and biosolids derived from wastewater treatment. The mixture is sent to a composting system including tunnels for intensive composting and an ASP (Aerated Static Pile) system for compost maturation.
After maturation, a trommel screen is used to sort a fine fraction (quality compost) from the oversized materials, which are either used as bulking agent in the digestion and composting processes or disposed at a landfill.

Air scrubbers and engineered biofilters are used to treat the air exhausted from the composting tunnels, which, prior to treatment, is mixed with the flow collected by the plant ventilation system.



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73 FINALE EMILIA (MO) - ITALY

Year	2017
Client	AIMAG Spa
Operator	AIMAG Spa
System description	Pre-treatment, semi-dry anaerobic digestion, biogas upgrading
Waste processed	Organic source-separated waste
Plant capacity	50,000 t/year

Pipeline-grade biomethane, a highly valuable form of chemical energy, is recovered from source separated organic waste with a high-tech system including semi-dry anaerobic digestion and biogas upgrading.

Source separated food waste and green waste are processed by the same pre-treatment line. The preparation of the digestion feedstock includes a shredder, for opening the bags and reducing the size of the waste components, and a magnetic separator for sorting ferrous metals.

After the metal sorting phase, a disc screen is used to separate the organic waste to be digested from plastic bags and other large-sized rejects. A feeding bunker is used to store the digester feedstock, which consists of a mixture of organic waste and bulking agent derived from green waste shredding and compost screening operations.

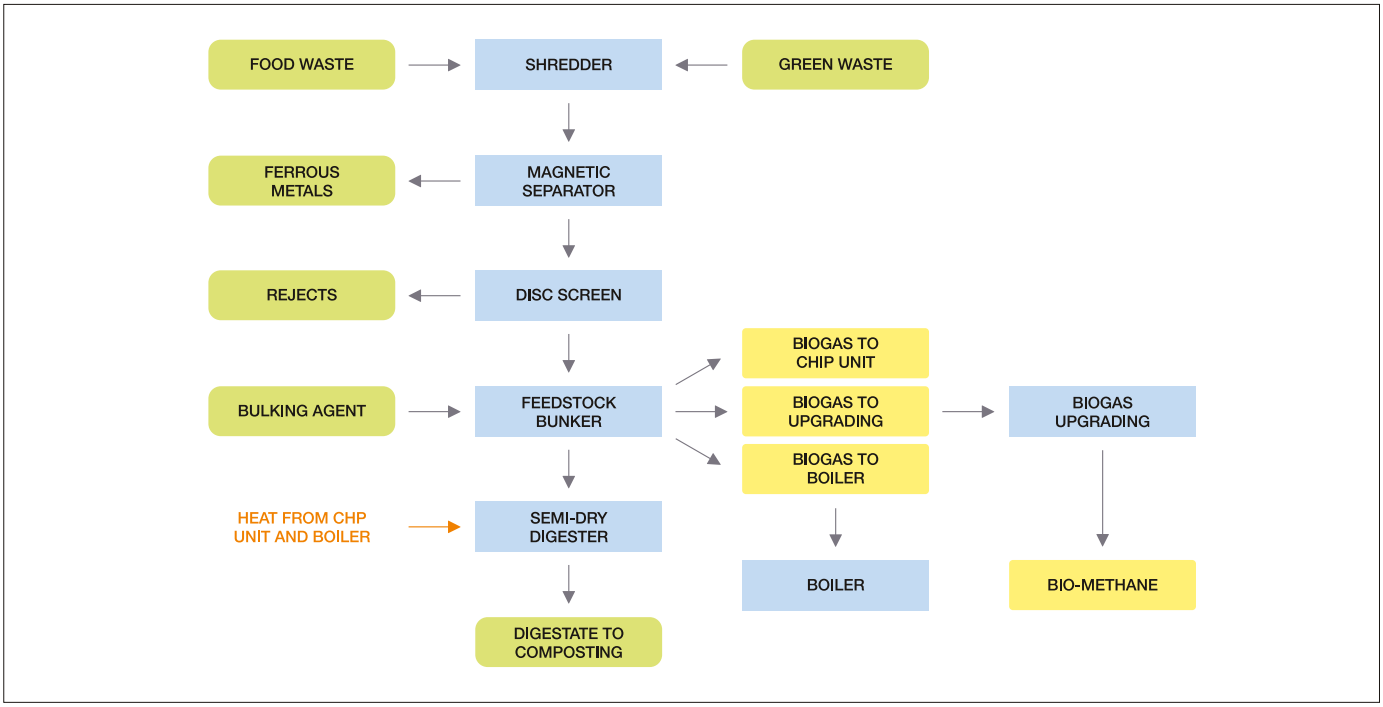
The semi-dry digester is designed to process a high-solids feedstock, which achieves a high biogas yield from a single anaerobic digestion vessel. The loading of the feedstock from the storage bunker into the digester is fully automated.

The digester vessel has the shape of an elongated parallelepiped and is made by steel-reinforced concrete.

Some slow-speed rotors, with a horizontal shaft driven by a planetary gear-motor, are provided inside the digester. The rotors agitate the material contained by the digester, which proceeds with a plug-flow pattern. The organic material is heated by heat exchangers located along the longitudinal walls of the digester.

The digestate extracted from the digester is sent to a composting line, while the biogas produced in the digester is treated with an upgrading system which produces pipeline-grade biomethane.

Part of the produced biogas is used as a fuel in a co-generation unit and in a boiler, which provide the heat required by the digester.



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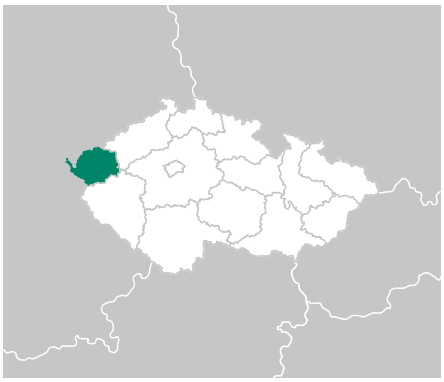
72 KARLOVY VARY - CZECH REPUBLIC

Year	2016
Client	METROSTAV s.a.
Operator	SOKOLOVSKA' UHELNA' s.a.
System description	RDF production
Waste processed	Mixed municipal waste
Plant capacity	60,000 t/year



Sorting of mixed MSW (Municipal Solid Waste) is accomplished in this plant to recover ferrous and non-ferrous metals and produce SRF (Solid Recovered Fuel) to be beneficially co-fired in a power station.

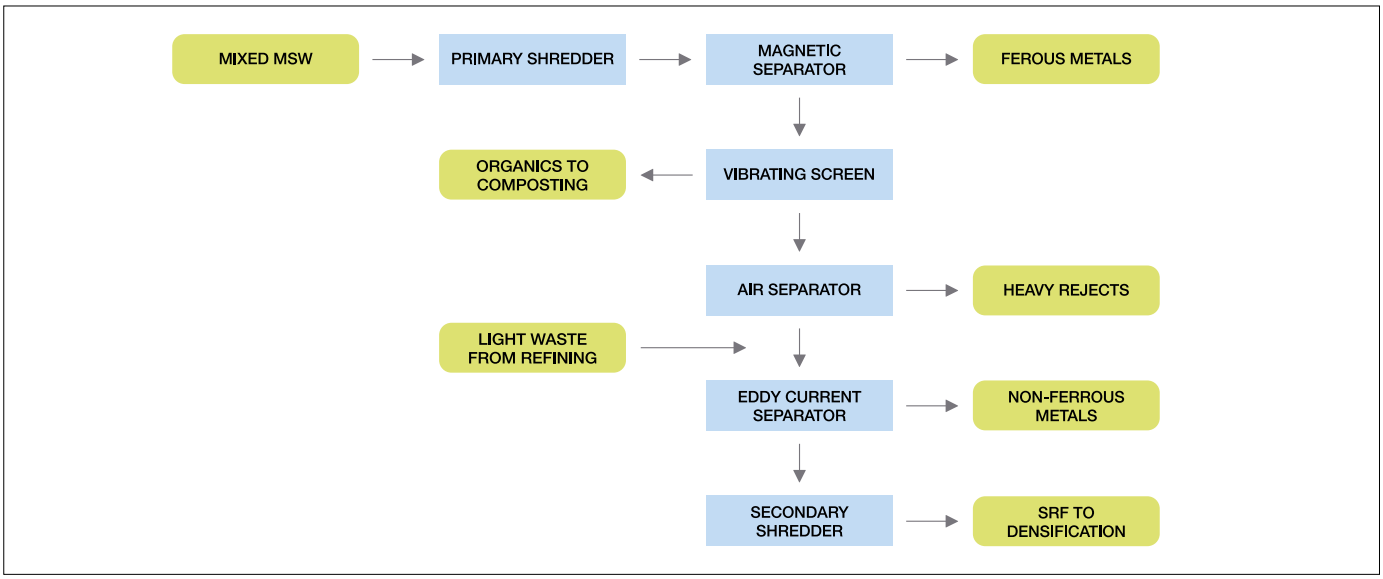
Pre-shredding of mixed MSW (Municipal Solid Waste) is required to facilitate the following sorting process. A slow-speed primary shredder is used to open and empty the bags containing the waste and, at the same time, reduce the particle size of the various waste components.
Sorting of ferrous metals takes place in a vibrating flat screen provided with an unbalanced shaft. The screen panels are arranged in cascades and have efficient screen openings.

The screen undersized fraction, rich of organic materials and small-sized inerts which are separated to increase the heating value of the waste, is sent to a composting line, while the oversized fraction is processed by an air separator.

The separator has an "air knife" which sorts the light materials, such as plastic film and paper, from the heavy components that fall and are collected by a conveyor. A rotating drum is used to assist in the separation process.

The light waste components settle on an inclined conveyor, contained by an enclosure for collecting the air used in the sorting process, which is recycled back to the air knife fan. This design is beneficial because it substantially reduces the volume of air which requires to be exhausted from the machine and treated for dust control.

The light fraction sorted by the air separator is combined with another stream of combustible waste coming from a post-treatment line and processed by an Eddy current separator to recover non-ferrous metals.
The high-speed rotating magnet, installed in the driving drum of the belt conveyor of the separator, forcefully rejects the non-ferrous components which fall into a collection chute.
The SRF (Solid Recovered Fuel) is finally processed by a secondary screen to further reduce its particle size and produce a fluff fuel which is sent to a densification line.



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71 EDMONTON - CANADA

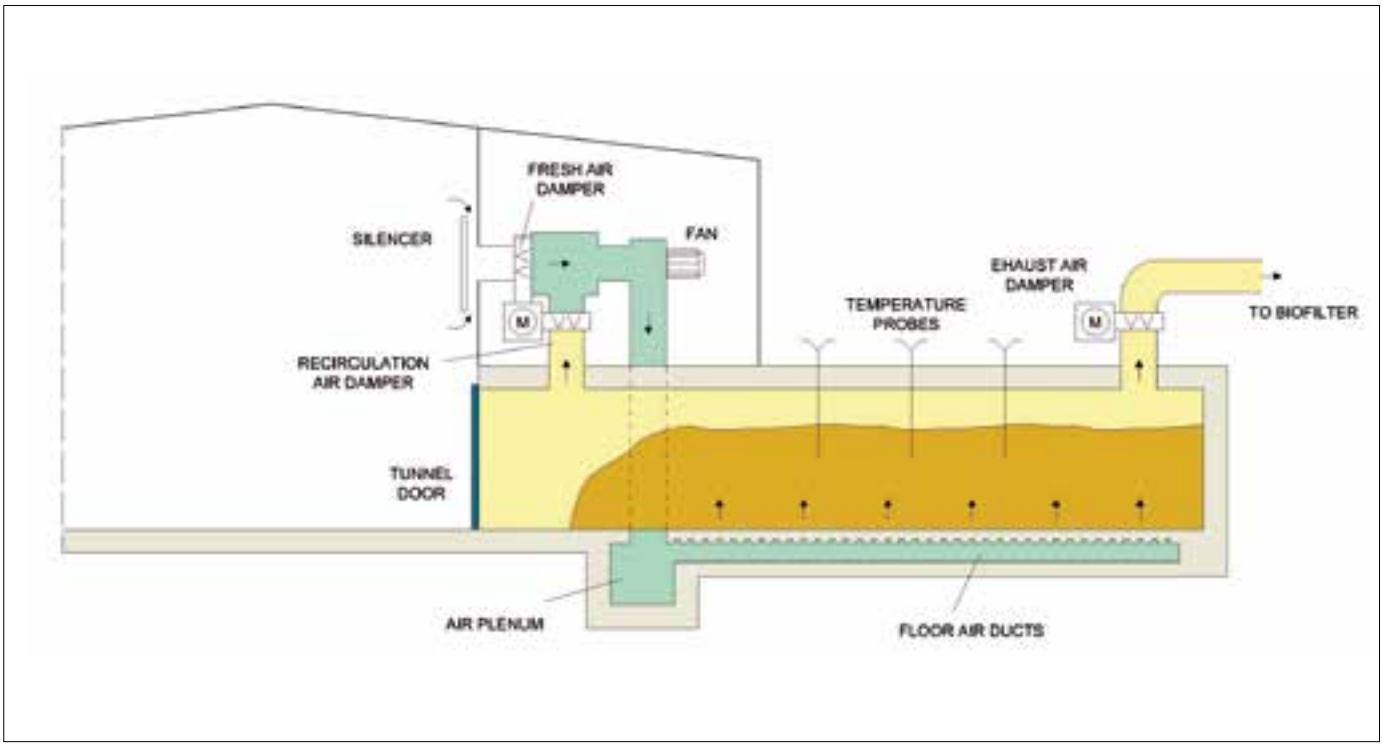
Year	2015
Client	BioMRF Technologies, Inc.
Operator	City of Edmonton
System description	Tunnel composting
Waste processed	Material from high solids anaerobic digestion
Plant capacity	48,000 t/year

BioMRF Technologies, Inc., the North American licensee of the Atzwanger tunnel composting technology, will provide BIOFerm USA, Inc. (Viessmann Group) with design, equipment and technical support for the construction of the aeration boxes included in the OPF (Organic Processing Facility) developed by the City of Edmonton.

The tunnel composting system included in this project has three functions:

- To further stabilize the digestate prior to final composting and curing stages;
- To reduce the moisture content of the material coming from the dry anaerobic digestion (percolation process) and facilitate the following aerobic treatment;
- To control the emissions of ammonia, VOC and sulfur compounds.

Each tunnel is provided with three dampers, which automatically control the flow rate of fresh, process and exhausted air based on the various process parameters. The system is fully automated and operates on a 24/7 basis under the control of the PLC. The SCADA system allows for a simple process monitoring and remote troubleshooting.



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70 BOLZANO (BZ) ITALY

Year	2015
Client	ECOCENTER SpA
Operator	ECOCENTER SpA
System description	Bypass baling and bales wrapping
Waste processed	Mixed MSW (Municipal Solid Waste)
Plant capacity	30-60 t/hour

This addition to the waste-to-energy facility built by Atzwanger allows for baling and wrapping the waste to be combusted after its temporary storage.

On the occasion of planned or unplanned maintenance of the combustion system and relative sub-systems the waste-to-energy facility might need to be by-passed to avoid interrupting the deliveries of waste.

It has been planned that, during a shutdown of the plant, the waste delivered be baled to reduce the space required for its storage.

In addition, the by-pass system includes an automated bale wrapper able to package the bales for outdoor storage and prevent environmental problems caused by the baled waste, such as leachate leaks, emission of odors and dispersion of light waste by wind.

The waste to be baled can be loaded directly into the hopper of the baler by using the bridge crane grapple or, if required, bulky waste can be shredded prior to baling.

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69 TUSCANIA (VT) - ITALY

Year	2015
Client	SEA Spa
Operator	TUSCIA AMBIENTE SRL
System description	Semi-dry anaerobic digestion
Waste processed	Source separated organic waste
Plant capacity	20,000 t/year

A plug-flow (semi-dry) technology has been used by Atzwanger for this anaerobic digestion project located in Etruria, a land inhabited by the Etruscans between the 9th and 3rd centuries BC.

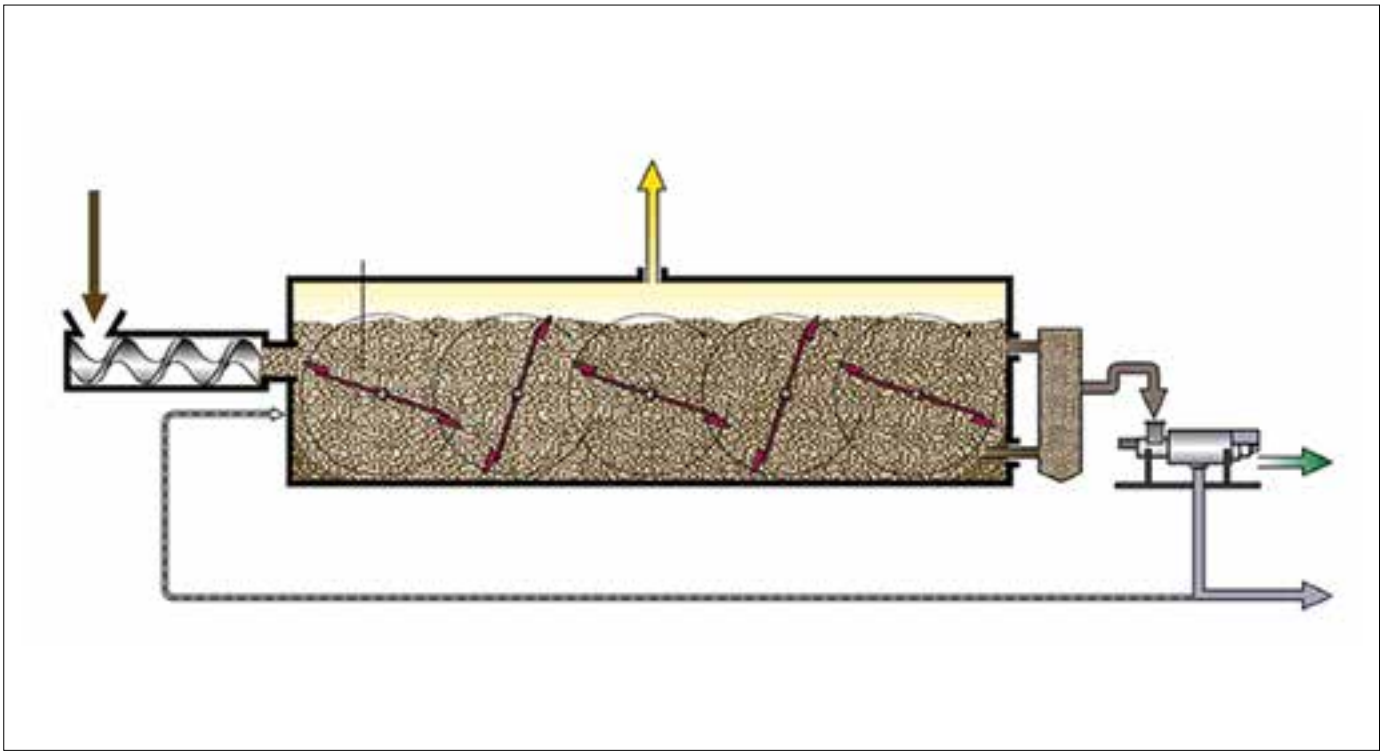
The digester used for this application is substantially a construction made of reinforced concrete having a parallelepiped shape. The walls and the roof of the digester are insulated and a heating system is provided internally for maintaining the required process temperature.

The functioning of the digester is based on the plug-flow concept.

The organic fraction, with a solid content higher than 15% is introduced into the digester by a screw conveyor, which also has the function of sealing the inlet port. Five horizontal agitators, installed transversally in the digester, prevent the formation of deposits and facilitate the extraction of biogas, which is exhausted from the top of the digester.

The processed material exits the digester by means of a pneumatic system, which prevents air entering the digester.

The plug-flow digester needs to be fed with fresh material, which is loaded on a 24/7 basis by an automated system.



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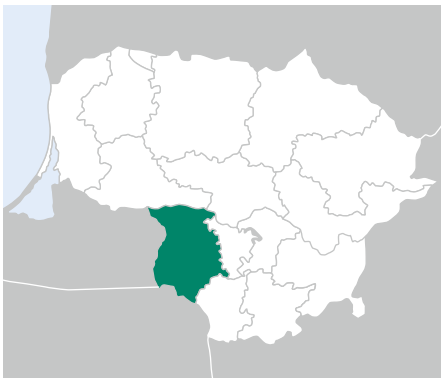
68 MARIJAMPOLE - LITHUANIA

Year	2014
Client	UAB NEG RECYCLING / UAB VERSINA
Operator	UAB NEG RECYCLING / UAB VERSINA
System description	Sorting, baling and RDF bio-drying
Waste processed	Mixed MSW (Municipal Solid Waste)
Plant capacity	65,000 t/year



MAATC, the authority responsible for waste management in the Marijampole region, will use this MBT facility for the recovery of the waste generated in the Marijampole region. The project is co-financed by the European Union.

The feeding bag opener is loaded by the mobile equipment and provides for the opening and empting of the waste containing bags.

The waste processed by the bag opener is taken by a conveyor to a trommel screen, which has two different perforations. The screen sorts the waste into the following three fractions:

- An undersized fraction which falls directly into a collection area communicating with the composting building, where a wheel loader takes it out for loading into the composting tunnels;
- A mid-sized fraction, which contains most of the metals, HDPE, PET and PVC and is processed by the following automated sorting equipment;
- An oversized fraction, which is taken to the relative manual sorting conveyor.

In the sorting room, the following materials are manually sorted from the sorting conveyors and dropped through channels located above temporary storage bunkers: paper products, RDF or rejects, plastics (LDPE, PET and HDPE) and glass.

Glass is collected in roll-off container, while the other materials are temporarily stored on the floor of the relative bunker prior to baling.

After the separation of the plastics, the mid-sized fraction coming from the manual sorting line is processed by the metal separation system, which includes the following equipment:

- Primary magnetic separator which sorts magnetic ferrous metals;
- Eddy current separator, which sorts non-ferrous metals.

A secondary magnetic separator is installed cross-line over the conveyor, which receives the fine organic fraction unloaded from the composting tunnels.

After the separation of metals, the mid-sized fraction is unloaded onto the accelerator conveyor of an optical separator, which can sort out up to three qualities of plastics (HDPE, PET and PVC). The optical separator is able to detect the quality of plastic using NIR (Near InfraRed) technology and uses jets of compressed air for removing the plastic components wanted.

The accelerator conveyor (1-CN11) reduces the height of the layer of waste on the conveyor belt and facilitates the detection of the items to be sorted.
The plant includes two automatic balers provided with an automatic bale tying system using steel wire.

A bale wrapper is provided for wrapping film part of the bales of recyclables and/or RDF with plastic.

A wheel loader transfers the undersized waste to be biologically treated in six composting tunnels.

The composting tunnels each consist of a garage-like structure made of corrosion-proof reinforced concrete, which is sealed by a manually sliding front door. In each tunnel, air is provided by a fan to the composting process through a set of floor-embedded air ducts having high-speed nozzles for distributing the process air uniformly along the entire length of the tunnels.

The composting tunnels work according to a batch-operation. During the treatment, the temperature of the waste is increased using the self-generated heat deriving from the biological activity.

The tunnel fans and also the fan of the biofilter are driven by VFD (Variable Frequency Drive) which adjusts their speed based on the process requirements. The reduction of the rotation speed achieves substantial saving on the electricity consumption of the fans.

The tunnel dampers are automatically activated by electric actuators based on the process parameters. The composting tunnels are controlled by a FLC (Fuzzy Logic Control) software, which is able to achieve both stabilization and drying of the processed material.

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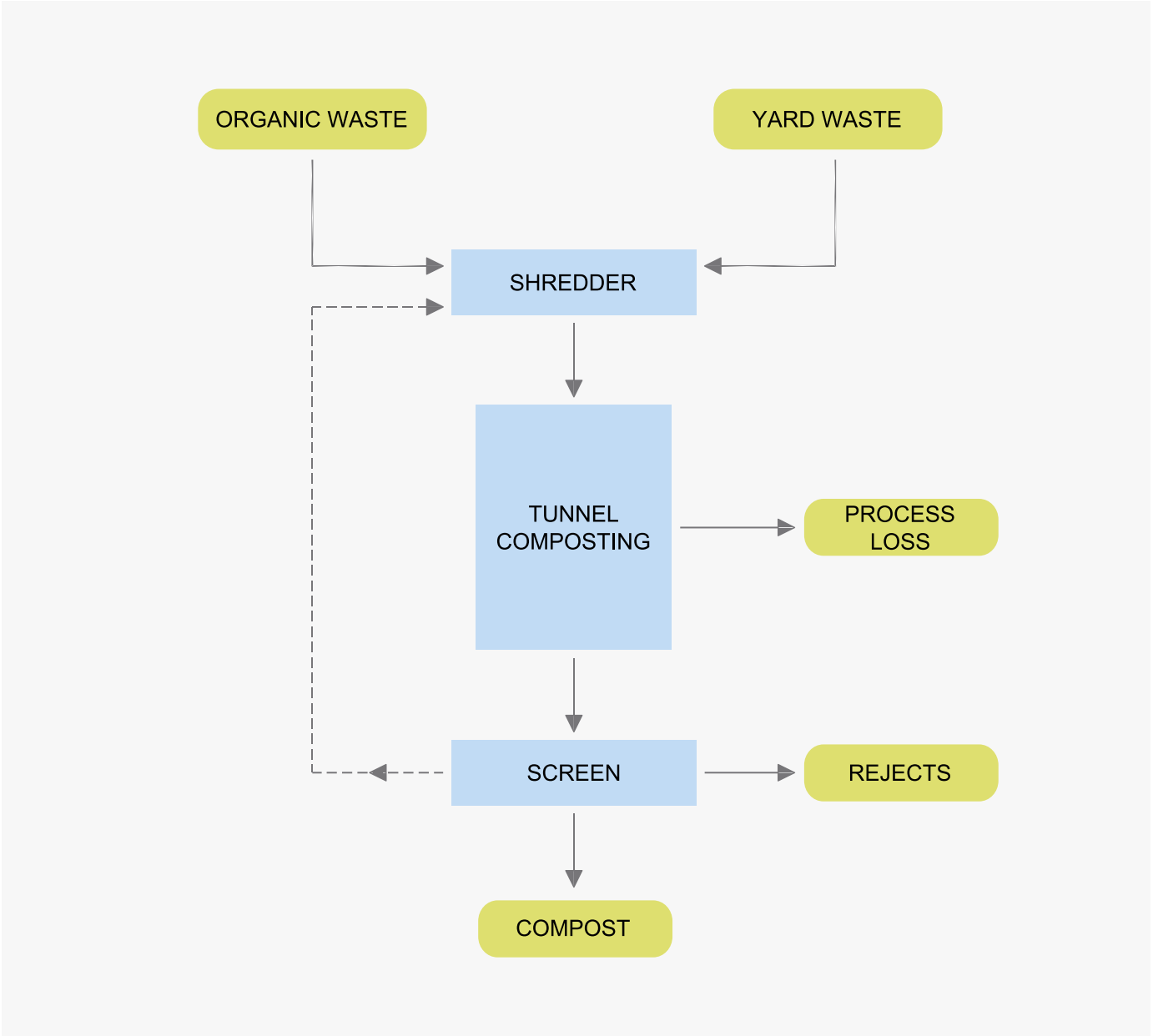
67 JAPAN 3

Year	2014
Client	SHINWA SANGYO Co., Ltd.
Operator	
System description	Tunnel composting
Waste processed	Source separated organic waste
Plant capacity	15,000 t/year

This facility will process source separated organic waste with a state-of-the-art tunnel composting technology provided by Atzwanger.



After mechanical treatment, substantially consisting of the opening and emptying of the waste containing bags, the composting tunnels are loaded with organic waste, the door is closed and the process begins.

Each tunnel is provided with a fan that provides air to its aerated floor with a uniform distribution. The fan is driven by an electric motor provided with a VFD (Variable Frequency Drive) that adjusts the fan speed to the lowest value compatible with the specific process phase. This feature offers significant energy saving compared to a fixed speed fan.

Fresh air is metered to the batch of the tunnel to maintain the oxygen level above the set minimum value, while process air is exhausted to keep the vessel under a slight negative pressure and to allow for a continuous evaporation of the excess moisture to be removed.

The three air dampers of each tunnel are continuously adjusted by their electric actuators, which are controlled by the PLC software. The system uses a custom-made FLC (Fuzzy Logic Control) software developed by Ecomaster, which automatically controls the process using a set of proprietary weighed rules.

When the set stabilization level has been achieved, the tunnel door is opened and the material is removed by a wheel loader and transferred to the final mechanical treatment, which produces high quality compost.

The exhaust port of each composting tunnel is connected to a centralized air treatment system providing hall ventilation and odor control. Before being released into the atmosphere, the flow of exhausted air is processed by a system including scrubbing and bio filtration.

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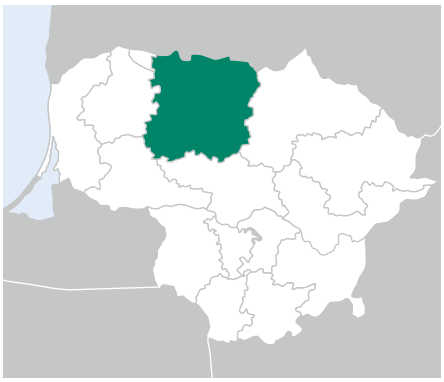
66 SIAULIAI - LITHUANIA

Year	2014
Client	UAB NEG RECYCLING / UAB VERSINA
Operator	UAB NEG RECYCLING / UAB VERSINA
System description	Sorting and bio-stabilization
Waste processed	Mixed MSW (Municipal Solid Waste)
Plant capacity	50,000 t/year



SRATC (Siauliai Regional Waste Management Centre) will use this MBT (Mechanical Biological Treatment) facility for the recovery of the waste generated in the Siauliai region. The project is co-financed by the European Union.

The facility includes two substantially independent processes:

- Sorting of mixed waste for the separation of the organic fraction, flat material (2D) and rolling materials (3D);
- Composting of the organic fraction.

A bag opener provided with a large receiving hopper is used for metering the waste to a ballistic separator, which separates the above-mentioned three fractions simultaneously.

The 2D and 3D fractions are collected in roll-off containers, which are automatically filled by two swiveling and reversible conveyors.

It is planned to further process these two fractions off-site for recovering recyclable material (paper, plastics and non-ferrous metals).

A magnetic separator is installed cross-line over the conveyor of the 3D fraction for separating magnetic ferrous metals (empty steel cans), which are collected in a self-damping hopper.

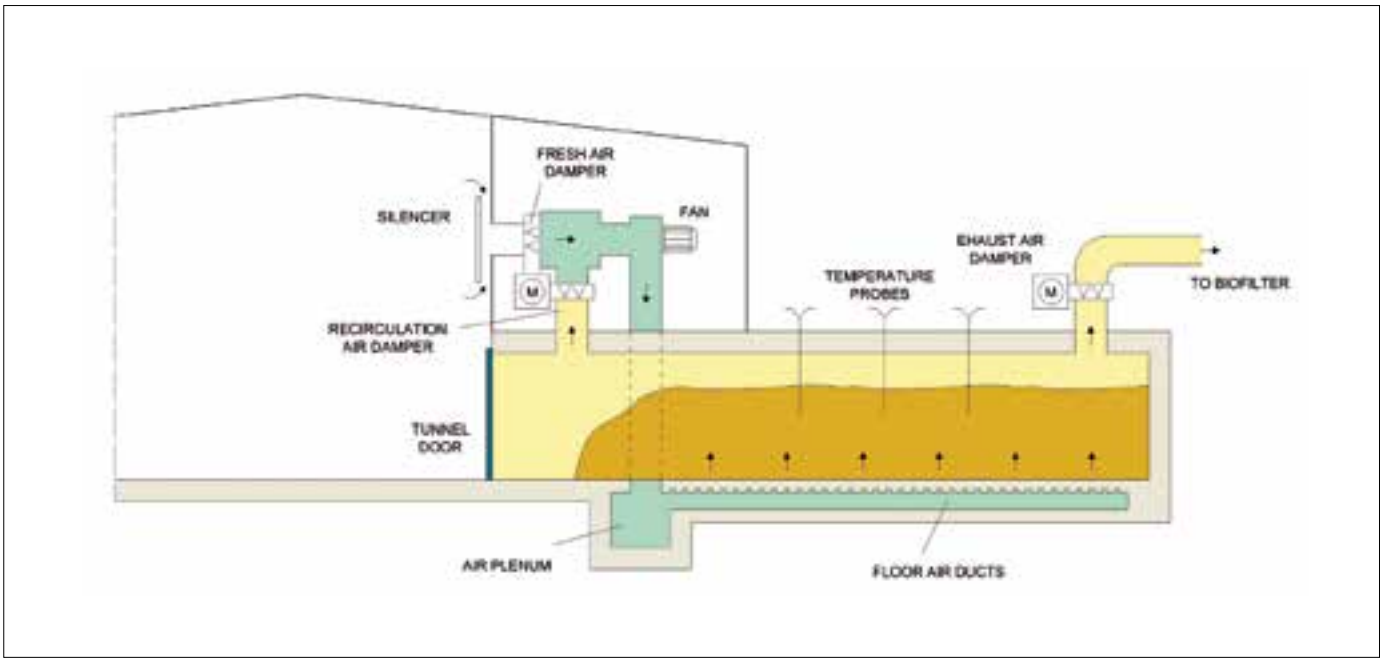
The undersized fraction (fines) sorted by the ballistic separator is processed in 7 composting tunnels provided with an odor control system.

In each tunnel is fitted with a fan that supplies the process air to the tunnel-aerated floor. In order to have uniform conditions for the composting process, the air supplied by the fan is a mixture of fresh air and recirculated air.

The fresh air for the tunnels is taken from the adjacent material-handling hall and the air exhausted from the tunnels is treated in a centralized biofilter. A variable speed fan is installed upstream of the biofilter.

The biological process is automated by a SCADA system and operates on a 24/7 basis.

The biological process occurring in the tunnels has a duration of 21 days and is followed by maturation.



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65 MITOYO - JAPAN

Year	2014
Client	SHINWA SANGYO Co., Ltd.
Operator	
System description	RDF bio-drying
Waste processed	Mixed MSW (Municipal Solid Waste)
Plant capacity	20,000 t/year

Producing bio-dried RDF is the purpose of this project, which will convert municipal solid waste into an alternative fuel to be co-fired in the boiler of a paper mill. Drying will not require any fossil fuel, because the required heat is self-generated by the composting process occurring in the tunnels.

After a mechanical pre-treatment process, the material to be converted to RDF is loaded by a wheel loader into six bio-drying tunnels.

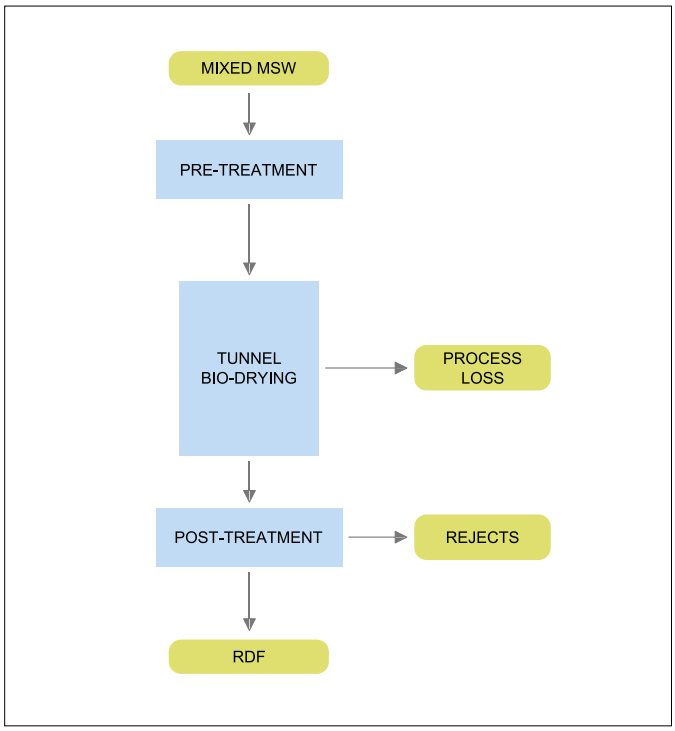
The biological process occurring in the tunnels has the function of drying the organic fraction without the addition of any external heat source.

The tunnels are totally enclosed and provided with a front door and an aerated floor. They are maintained under slight negative pressure by the odor control system, which consists of an acid/basic scrubber, a fan and a biofilter.

Exhaust air from the halls is used as process air for the biological process.

Each tunnel is provided with three dampers that automatically control the flow rate of fresh, process and exhausted air based on the various process parameters. The system is fully automated and operates on a 24/7 basis under the control of the PLC. The SCADA system allows for a simple process monitoring and remote trouble-shooting.

After the treatment in the bio-drying tunnels, the material is further processed mechanically to meet RDF specifications.



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64 VILNIUS - LITHUANIA

Year	2014
Client	UAB ENERGESMAN
Operator	UAB ENERGESMAN
System description	Sorting, baling and bio-drying
Waste processed	Mixed MSW (Municipal Solid Waste)
Plant capacity	277,000 t/year

VAATC, the authority responsible for the management of Vilnius municipal waste, has developed this project, which is co-financed by the European Union. The contract includes the design, construction and commissioning of the entire processing equipment of a highly automated recycling and bio-drying MBT facility.

After the bag opening process, the waste is manually sorted from the three conveyors passing through a single room, where glass containers and large sized plastic and paper products are recovered. In the same room, some of the reject components contained in the processed waste are also sorted.

Through channels in the floor of the sorting room, the recyclable materials are dropped into concrete bunkers, where they wait their turn to be baled. Glass and rejects are collected into roll-off containers.

Three trommel screens sort the following fractions:

- An undersized fraction which is transferred to the bio-drying tunnels after the separation of ferrous metals;
- A mid-sized fraction which is processed by three optical sorters separating a single stream containing PET, HDPE and PVC;
- An oversized fraction containing combustible components, such as wood, plastic, paper and textiles, which is RDF

Three secondary optical sorters are used to automatically separate PET, HDPE and PVC, which is separated to limit the chlorine content of RDF. The same baler processing the manually sorted materials is used for PET and HDPE.

The remaining mid-sized fraction is further processed by a magnetic separator and an Eddy current separator for recovering non-ferrous and, respectively, ferrous metals prior to being combined with the RDF stream.

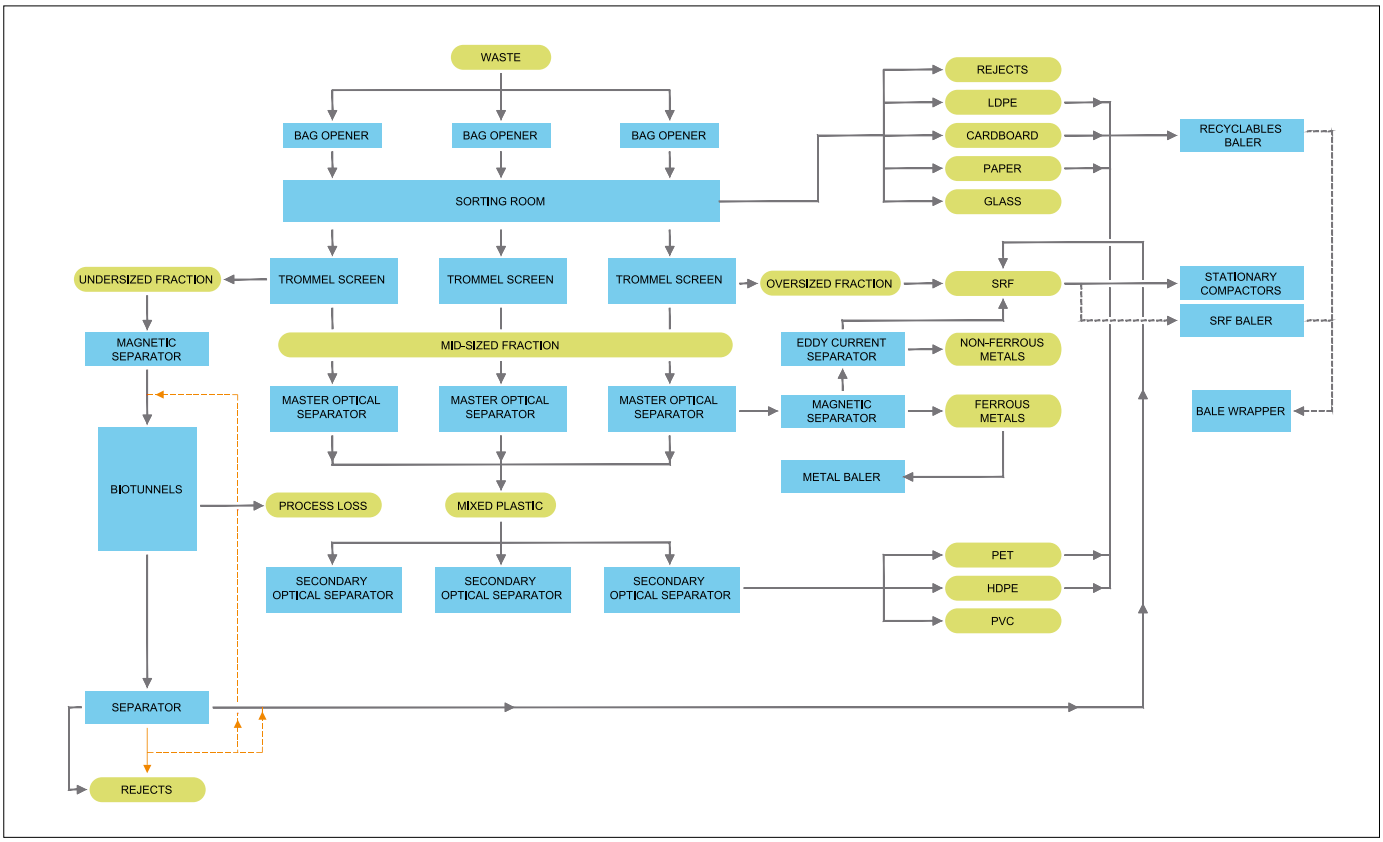
RDF can either go to two stationary compactors or to a baler. A wrapper is included for packing, when required, of the bales of RDF and/or the bales of some recyclable materials.

A specialized baler is used for baling ferrous and non-ferrous metals. The biological process occurring in the tunnels has the function of stabilizing and drying the organic fraction. The tunnels are totally enclosed and provided with a front door and an aerated floor. They are maintained under slight negative pressure by the odor control system, which consists of two independent systems, each including an air scrubber, a fan and a biofilter.

Exhaust air from the halls is used as process air for the composting process.

Each tunnel is provided with three dampers, which automatically control the flow rate of fresh, process and exhausted air based on the various process parameters. The system is fully automated and operates on a 24/7 basis under the control of the PLC. The SCADA system allows for a simple process monitoring and remote troubleshooting.

After the completion of the biological process, the material is treated by a separator and the sorted fractions can be disposed of at a landfill, recirculated for further stabilization or sent to the SRF compactors/baler.



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63 CLUJ - ROMANIA

Year	2012
Client	Consiliul Judetean Cluj
Operator	Consiliul Judetean Cluj
System description	Shredding, composting and refining
Waste processed	Mixed MSW (Municipal Solid Waste)
Plant capacity	206,000 t/year

A two-line sorting system separates the organic fraction from mixed municipal waste and then stabilizes it biologically. The project is co-financed by the European Union.

The sorting system has two identical lines, which both include the following processing phases:

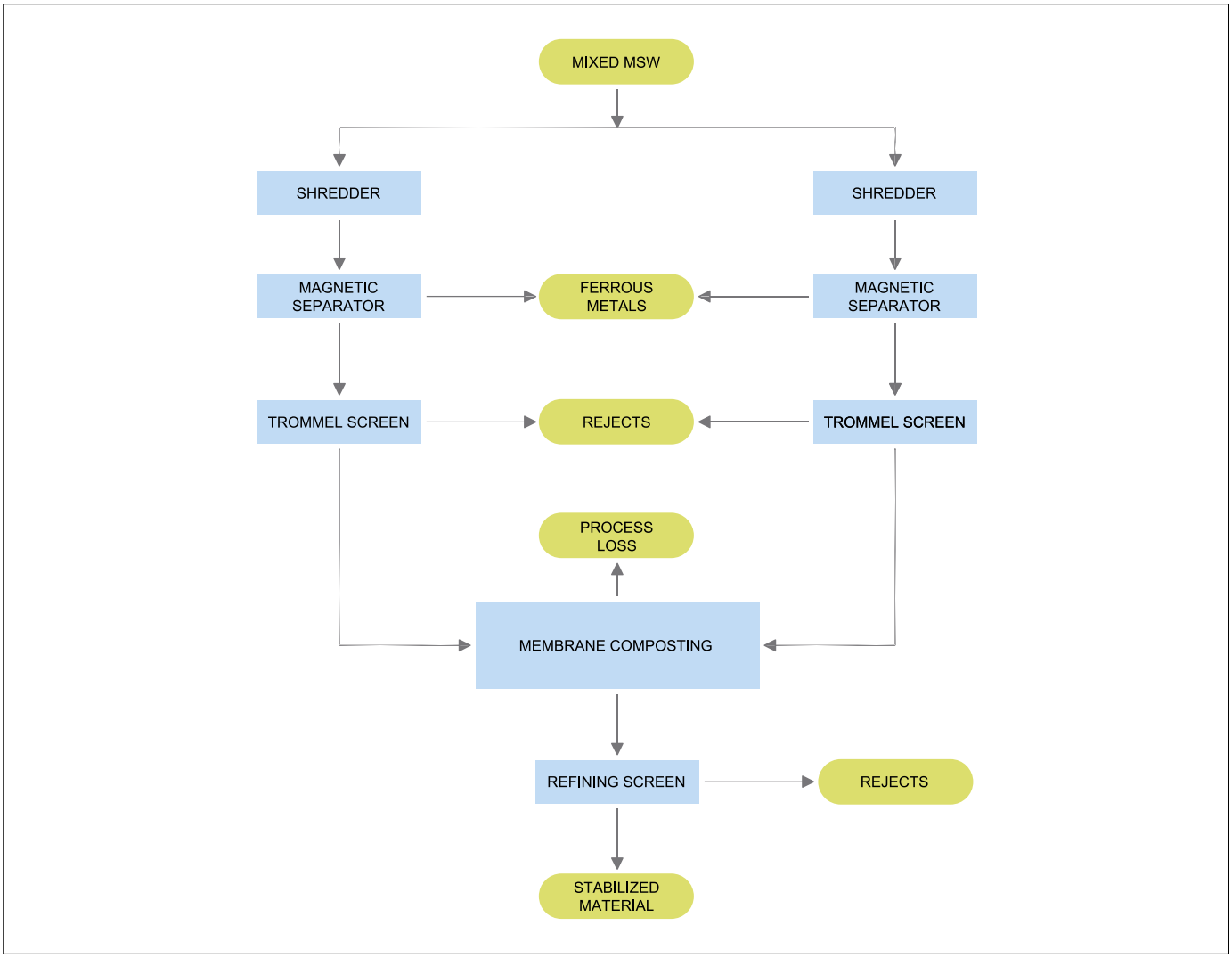
- Bag opening and emptying;
- Sorting of waste;
- Magnetic separation of the ferrous metals;
- Sorting of organic fraction by a trommel screen.

The screen undersized fraction includes most of the organic waste components which require to be stabilized.

The screen undersized fraction includes most of the organic waste components that need to be stabilized.

The technology selected by the client for stabilization is membrane composting, i. e. an aerated static pile process protected by a semi-permeable membrane. A special machine is used for the periodic installation and removal of the membrane.
After composting, a mobile screen is used for producing a more uniform compost material.

A biofilter is used for controlling the odors deriving from the waste receiving and sorting operations.



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62 CLUJ - ROMANIA

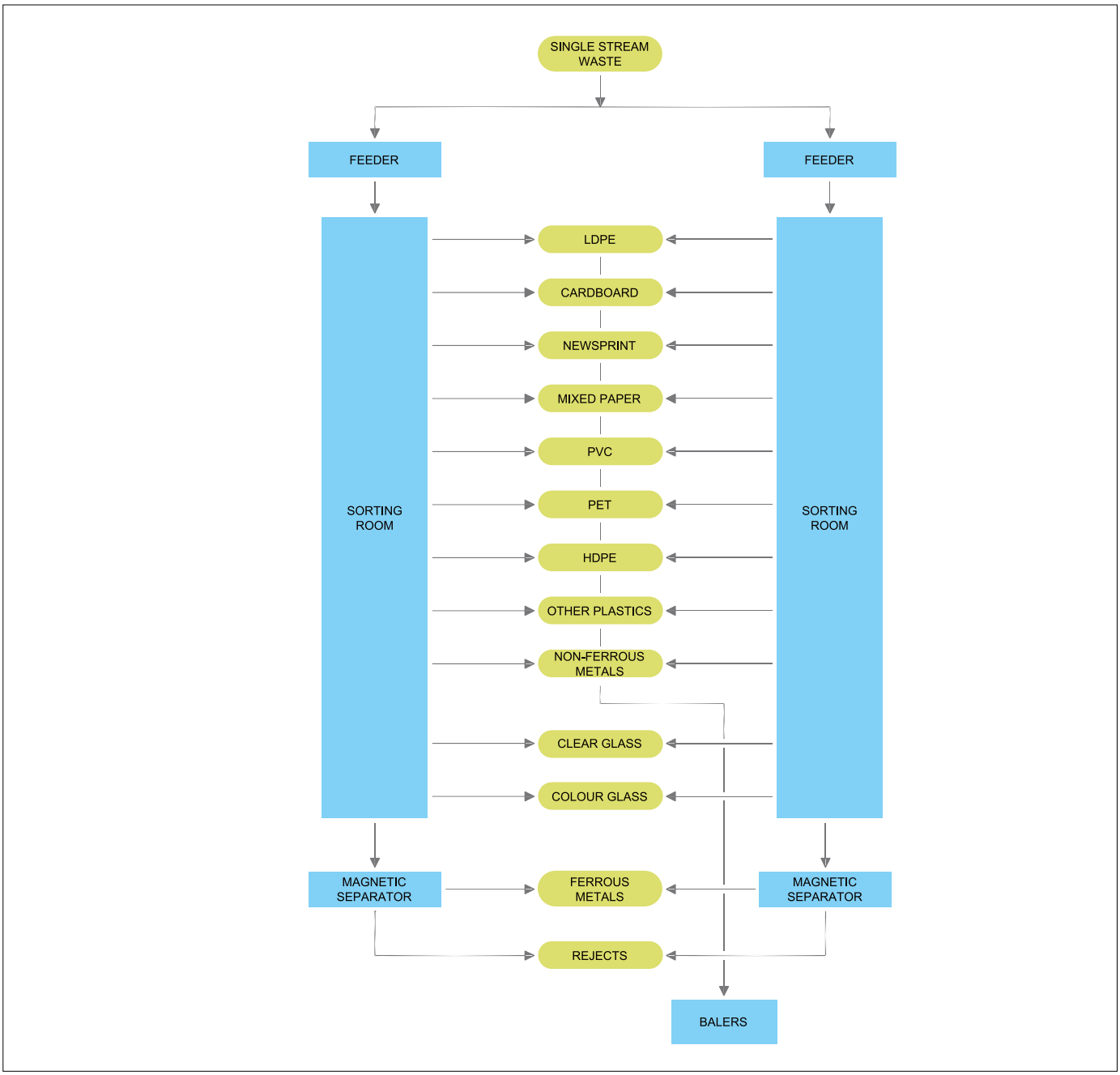
Year	2012
Client	Consiliul Judetean Cluj
Operator	Consiliul Judetean Cluj
System description	Sorting and baling
Waste processed	Single stream municipal waste
Plant capacity	92,000 t/year

A two-line sorting system, which combines manual sorting, magnetic separation and automated baling to process recyclable waste derived from source separation, has been designed and built by a joint-venture including Atzwanger (lead) and Ladurner. The project is co-financed by the European Union.

The two sorting lines included in this plant are identical, thus only one is described. The waste to be sorted is loaded into the receiving hopper of a feeder, which uniformly feeds the sorting line. An inclined conveyor transfers the waste to the sorting conveyor, which goes through all the manual sorting positions.

The operators sort the recyclable materials and drop them into channels passing through the floor of the sorting platform.

Reinforced concrete bunkers are located underneath the platform to temporarily store the recovered recyclable materials, which except for glass and ferrous metals are baled in turn by a baler complete with an automated bale tying system. As illustrated in the process diagram, up to twelve different materials can be positively sorted, while the waste remaining after completion of the sorting process includes residuals to be disposed of at the landfill.



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61 LANA (BZ) ITALY

Year	2005
Client	ECO-CENTER SpA
Operator	ECO-CENTER SpA
System description	Wet digestion and power generation
Waste processed	Source separated organic waste
Plant capacity	12,000 t/year

This anaerobic digestion facility recovers renewable energy from source separated organic waste generated in Bolzano, Merano and about thirty other Municipalities in South Tyrol.

SSOW (Source Separated Organic Waste) is shredded before a liquid suspension is prepared in a pulper. Contaminants, such as plastics, wood, etc. are removed during the pulping process, while a grit separator is used for sorting out broken clamshells, glass, stones and other heavy materials.

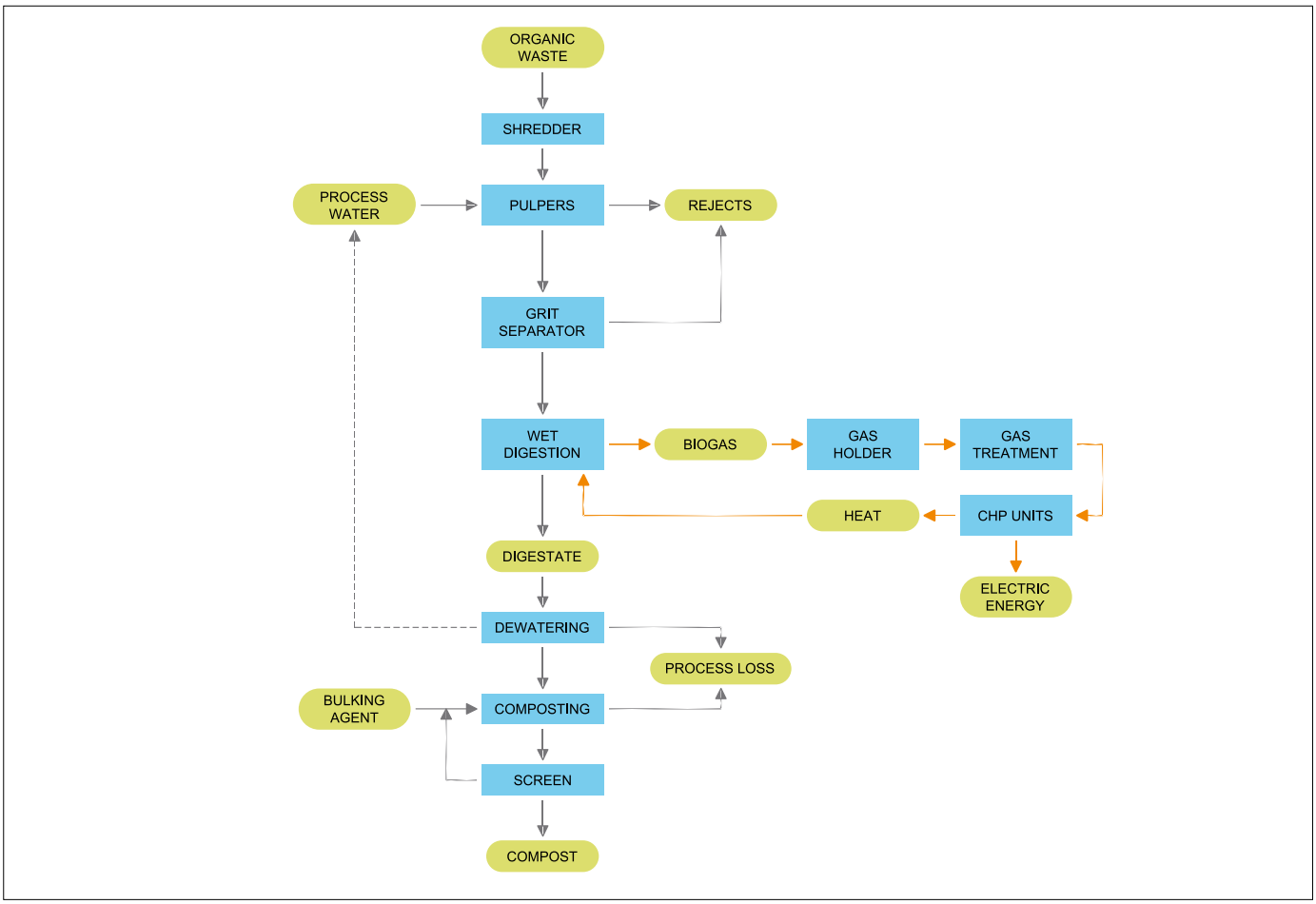
The suspension has initially a dry matter content of 4%, which increases after sedimentation. The suspension, with a dry matter content of 11%, is then pumped into the anaerobic digester, where volatile organic matter is converted by bacteria to biogas containing up to 60% methane. The biogas produced is temporarily stored and treated prior to fueling the engines of two CHP (Combined Heat & Power) units.

The heat recovered is used to heat the digester, which is maintained at 37 degrees Celsius, while the electrical energy produced by the generators is partly used for internal consumptions and the remaining fraction is sold to the power grid. The total electric power of the two CHP units is 870 kW.

The digestate exiting the digester is dewatered by a centrifuge and mixed with a bulking agent (wood chips) prior to composting. A mobile screen is used to separate compost from the wood chips, which are recycled to prepare the feedstock of the composting process.

To reduce the quantity of wastewater and the requirement of process water, liquid from the dewatering unit is used in the waste pulping process.

A biofilter is used to control the odorous compounds contained by the air exhausted from the buildings.



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60 MITOYO (JAPAN)

Year	2010
Client	SHINWA SANGYO Co., Ltd.
Operator	SHINWA SANGYO Co., Ltd.
System description	Mobile bio-container for composting and odour control
Waste processed	Source-separated organic waste

The core of this plant is a mobile bio-container designed for composting organic waste and treating the odours contained by the process exhaust air.

Thanks to a detailed study of the space arrangement, all equipment is installed in a commercial size container (40 foot long), which is divided into three specialized sections:

- Composting section;
- Odour treatment section;
- Electric section for process control and monitoring.

The system is based on the bio-tunnel technology, successfully used by Ecomaster Atzwanger in many composting plants of industrial scale. The process cycle includes various phases of biological treatment, from pathogens control to compost stabilization.

The composting process takes place in an enclosed vessel bio-cell with an aerated floor which uniformly distributes the process air in the reactor. Part of the air passed through the waste pile is recycled back to the reactor floor and part is exhausted through the odour control system.

The bio-cell floor includes collection system for the percolated liquid, which can be recycled to the process by means of a spraying system located above the waste pile.

The operating cycle is very simple: after loading the material into the container by means of a wheel loader, the front doors are closed and the process starts. At the end of the cycle, the bio-cell is emptied and a new composting cycle can begin.

The computerized system, complete with colour graphics, controls all equipment and maintain the process parameters within their pre-set limits. The probes and instrumentation of the system monitor the various process parameters, such as temperatures of processed material and bio-filter media, oxygen content of recycled process air, air pressure, levels of tanks, etc. For each batch, it is possible to monitor all steps of the composting cycle and record in the computer the values of the more significative process parameters.

The odour control system is based on the bio-filtration technology: the malodorous chemical compounds included in the exhausted process air are adsorbed by the superficial moisture of the bio-filter media (wood chips) and quickly eliminated.

Also the bio-filtration process is controlled by the centralized monitoring system. The waste water produced by the bio-filter is collected into a storage tank and used for wetting the filtering material.

The bio-container system is modular, because its composting and odour control units can be set up to build composting plants of any size, suitable for processing all kinds of organic waste. The system does not require the construction of expensive civil works and can be installed and put in commercial operation in a very short time.

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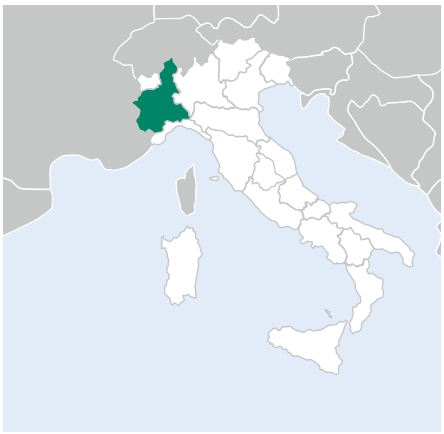
59 CASALVOLONE (NO) ITALY

Year	2010
Client	EC.AM. SRL
Operator	EC.AM. SRL
System description	Dry anaerobic digestion, tunnel composting, odour control and screening system
Waste processed	Organic Waste and sludge
Plant capacity	88.000 t/year. Installed electrical capacity 998 kW



EC.AM. has awarded ATZWANGER with the design and construction of the equipment of an integrated waste treatment system.

The plant uses a combination of an anaerobic (digestion) and aerobic (composting) processes for the treatment of source separated organic waste, food waste, green waste, sludge and municipal organic waste with recovery of electric energy and matter (compost).

The process includes two successive phases:

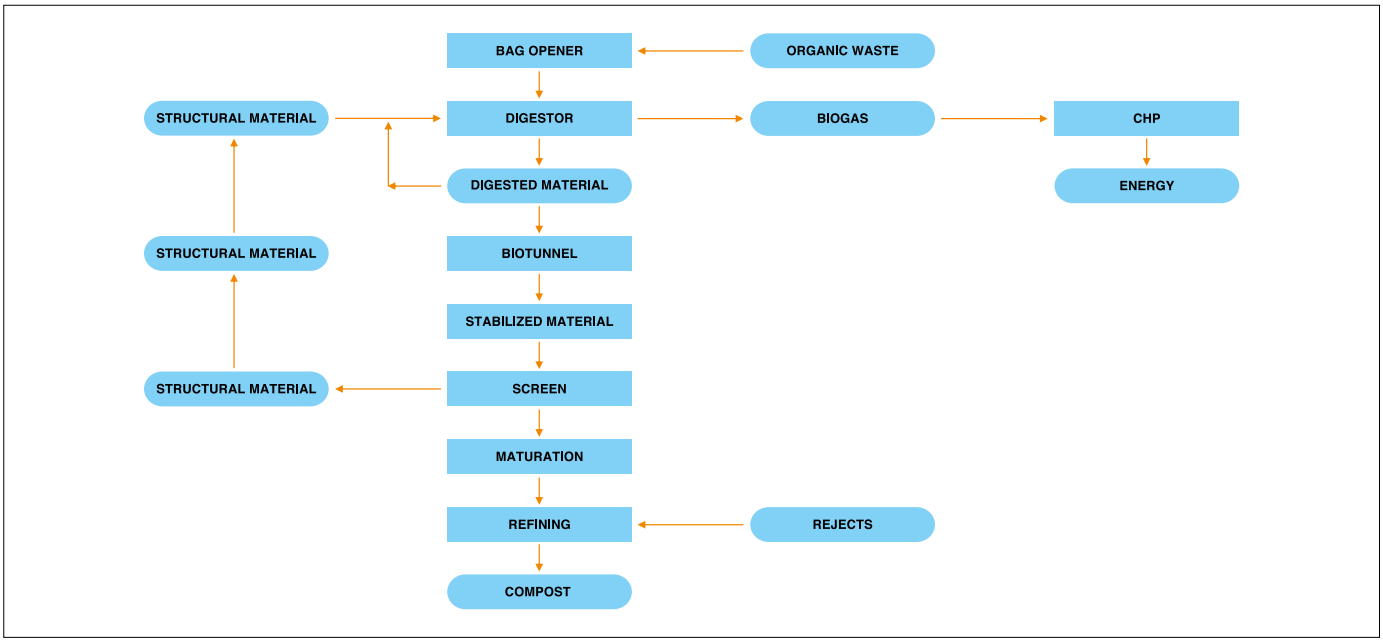
- Fermentation phase in an anaerobic environment, with degradation of the organic matter and formation of biogas (methane gas and carbon dioxide); the biogas recovered in this phase is used to fuel two engines which produce electrical energy and heat;
- Composting phase, organized in two successive phases, intensive bio-oxidisation and maturation (curing). The first phase, that takes place in bio-tunnels, is marked by a rapid decomposition of the organic matter, with an intense metabolic activity and rise in temperature; the resulting product is fresh compost. The second phase, called "curing", takes place on the maturation floor and the final product is mature compost with a higher content of humic substances.

The final products of the recovery process are:

- Biogas used in gas engines for the production of electrical energy and heat;
- Quality compost to be used in agriculture.

The plant is equipped with an air extraction system and a bio-filter for the control of the odours generated by the process.

The project is completed with screening system to collect structural material and refining system for the final product (compost).



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58 SLOVENJ GRADEC - SLOVENIA

Year	2010
Client	KOCEROD
Operator	REGIONAL WASTE MANAGEMENT CENTER OF KOROSKA
System description	Composting, stabilization, RDF production and odour control
Waste processed	Organic source separated waste and mixed municipal waste
Plant capacity	25,000 t/year

Primorje awarded ATZWANGER Spa with the design and implementation of automated electro-mechanical works for the production of Refuse Derived Fuel (RDF) and compost.

The project involves the construction of a facility with a section for aerobic stabilization of organic source separated waste and another section for stabilization and mechanical treatment for mixed municipal waste aimed at the recovery of material.

The proposed technology is designed to automate the process and to maintain the separation of the treated flows.

The plant includes two sections:

- A section for the stabilization and production of refuse derived fuel, characterized by an initial phase of mechanical pre-treatment, a second phase of stabilization in aerated piles and a subsequent final phase of refining and shredding. RDF can be produced as follows: pressed in bales, shredded to small sizes or supplied as it is at medium size;

- A section for composting, characterized by an initial phase of mechanical pre-treatment, a second phase of composting in aerated piles with automatic turning over and a final phase of refinement. The second phase is characterized by the stabilization of the organic matter and results in a mature raw compost with a higher content of humic substances. The final phase of refinement is obtained with a double step of ballistic screening with in-line deplastification unit, with the aim of improving the quality of the final product.

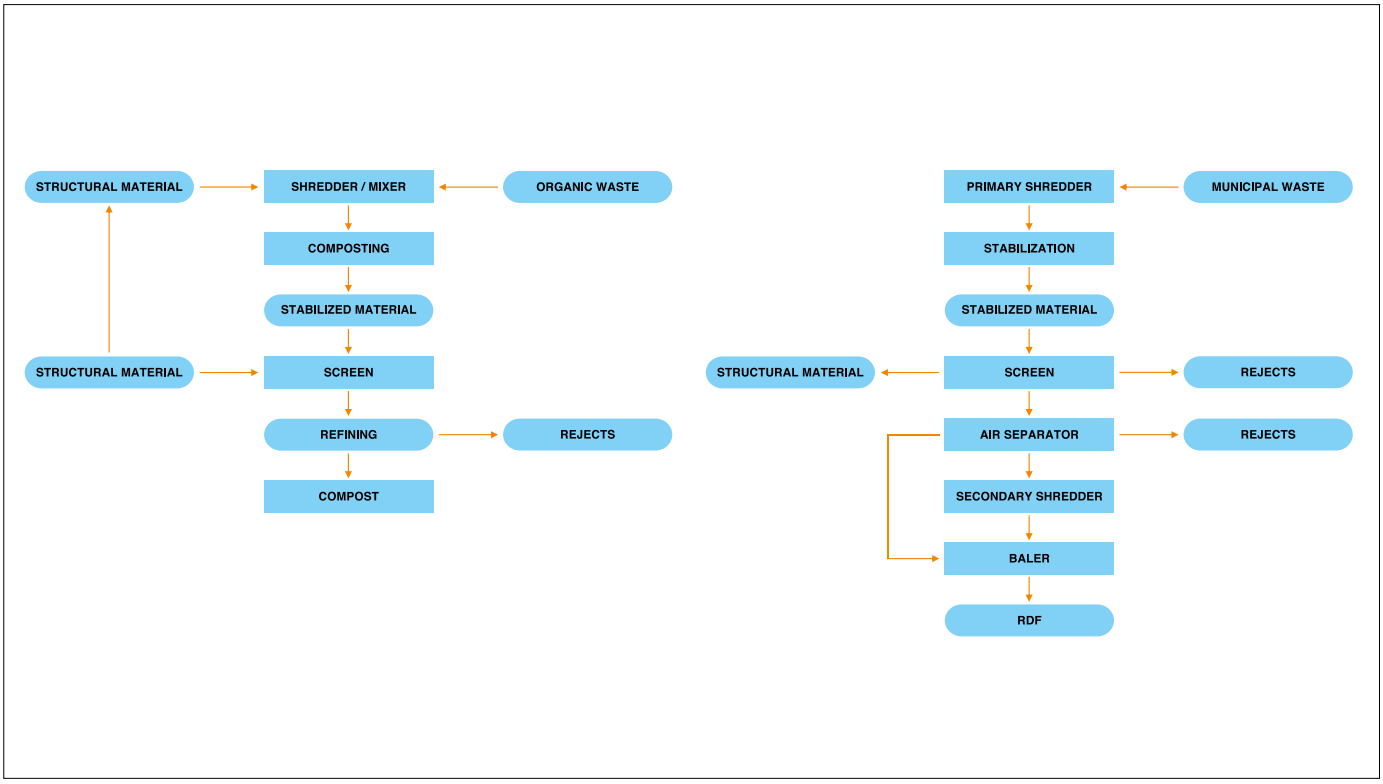
The handling of materials in the two sections is done exclusively with the use of a bridge crane.

The final products to be subjected to recovery activities are:

- Fuel from waste to be used in "waste-to-energy" plants;

- Mixed compost (soil amendment) to be used in agriculture.

The plant is equipped with air suction and odour control systems that use the biofiltration process and guarantee the required environmental parameters.



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57 SOGLIANO AL RUBICONE (FC) ITALY

Year	2010
Client	SOGLIANO AMBIENTE SpA
Operator	SOGLIANO AMBIENTE SpA
System description	Dry anaerobic digestion, tunnel composting and odour control
Waste processed	Organic from mixed municipal solid waste and recyclables
Plant capacity	50,000 t/year. Installed electrical capacity 998 kW

Sogliano Ambiente has awarded ATZWANGER with the design and construction of the equipment of an integrated waste treatment system.

The plant uses a combination of anaerobic (digestion) and aerobic (composting) processes for the treatment of organic waste with recovery of electric energy and compost.

The process includes two successive phases:

- Fermentation phase in an anaerobic environment, with degradation of the organic matter and formation of biogas (methane gas and carbon dioxide): the biogas recovered in this phase is used to fuel two engines which produce electric energy and heat;

- Composting phase, organized in two successive phases, intensive bio-oxidisation and maturation (curing). The first phase, that takes place in bio-tunnels, is marked by a rapid decomposition of the organic matter, with an intense metabolic activity and rise in temperature; the resulting product is fresh compost. The second phase, called "curing", takes place on the maturation floor and the final product is mature compost with a higher content of humic substances.

The final products of the recovery process are:

- Biogas used in gas engines for the production of electrical energy and heat;

- Quality compost to be used in agriculture;

- Bio-stabilised material.

The plant is equipped with an air extraction system and a bio-filter for the control of the odours generated by the process.

The project is completed by Sogliano Ambiente with the installation of a photovoltaic plant on the roof of the building that contains the stabilisation process.

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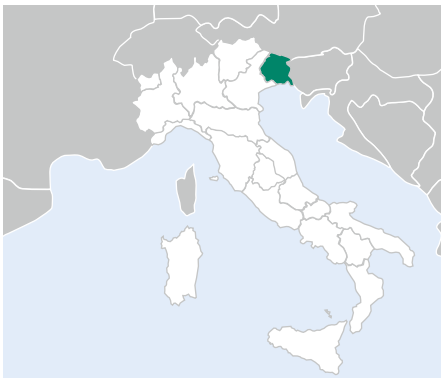
56 S.CANZIAN D'ISONZO (GO) ITALY

Year	2009
Client	SOCIETÀ AGRICOLA AZIENDE BENNATI SPA
Operator	BIOFerm GmbH
System description	Dry anaerobic digestion with electric power generation
Waste processed	Mais silage, bovine manure
Plant capacity	28,000 tpy. Installed electrical capacity 950 kW



Eleven dry anaerobic digesters are the heart of this plant that produces electrical energy from renewable resources.

The treatment plant of bovine manure and corn silage, created in San Canzian d'Isonzo, uses the process of dry anaerobic digestion, developed in a battery of fermenters arranged in a parallel formation.

The work aims to produce electrical energy and heat from renewable sources.

The quality of the treated material is not a determining factor for the execution of the process since on entering they can also be presented inert, without compromising the effective functioning of the system.

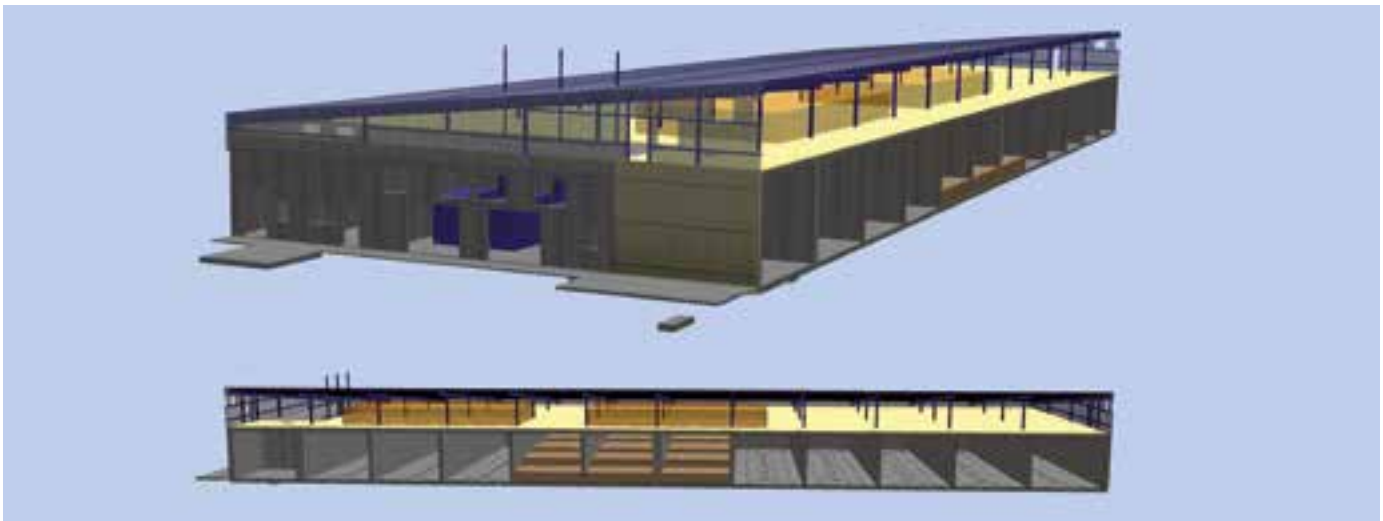
The plant in substance consists of the following systems:

- Digestion system, made up of 11 fermenters;
- System for the capturing and storing of the biogas;
- Co-generation system, made up of 3 endothermal motors.

The fermenters are parallelepiped reactors in reinforced concrete, that are loaded by means of a mechanical digger. The mixing on entrance is made up of fresh and pre-digested material derived from a previous cycle. Once the organic treatment which lasts 28 days is completed, the emptying is carried out once again by a mechanical digger. The fermenters are completely isolated from the external environment and maintained in uniform anaerobic conditions.

The material originating from the agricultural company is loaded into the fermenters without any pre-treatment process. The mixing of the pre-digested material with the fresh material is a fundamental operation, because the presence of the bacteria ensures the diffusion of the same in the treated biomass. The floor of the fermenters consists of a heated base, equipped with a system for the collection of the leachate, that is re-used in successive cycles. The leachates are filtered, heated and recycled in the process by means of a series of pipes with sprinklers installed at the top inside the fermenters themselves. The process of anaerobic organic conversion is assisted by a computerised control system (PLC), that allows development of the process to be maintained within the range of the pre-arranged parameters.

Numerous variables of the process are controlled, such as for example: the temperature of the treated material, the quality and quantity of the extracted biogas and the pressure within the fermenter. A system of acquisition and visualisation of the parameters of the process allows for it to be checked in real time to see if the process is correctly within these parameters. All of the relevant values are memorised and can be visualised in a graphic representation of the trend of the various parameters. All of the equipment is installed in an area dedicated to the structure, in such a way as to minimise the overall visual impact.



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55 NOTARESCO (TE) ITALY

Year	2009
Client	CIRSU SpA
Operator	SOGESA SpA
System description	bio-filtration system for composting plant
Waste processed	organic waste
Plant capacity	18,000 - 25,000 cu.m/h

The air exhausted from an organic waste composting plant is conveyed into the bi-filtration section, where the odours are controlled before the cleaned air is released to the atmosphere.

The operations regarding the creation of three bio-filters:

F1) intensive composting;
F2) maturation process (25,000 cu.m/h);
F3) organic material storage (18,000 cu.m/h).

Bio-filtration is a very efficient process for controlling odours produced by the organic degradation of an organic substance (composting).

The process involves two phases: initially the malodorous gasses are absorbed by the surface moisture of the bio-filter mass and subsequently are digested by the organic activity developed spontaneously on the mass itself.

Both processes of absorption and digestion of the gases take place in the presence of water and therefore it is fundamental to ensure that there is a certain level of moisture in the filter mass, that consists of wood chips. On the surface of the chips a watery film is formed (biofilm), in which the entire process takes place.

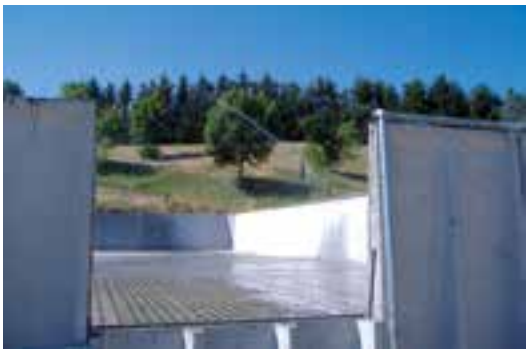
A centrifugal ventilator located outside the building exhausts the waste air through an air duct installed under the ceiling. The air to be processed is conveyed to the construction containing the bio-filter mass.

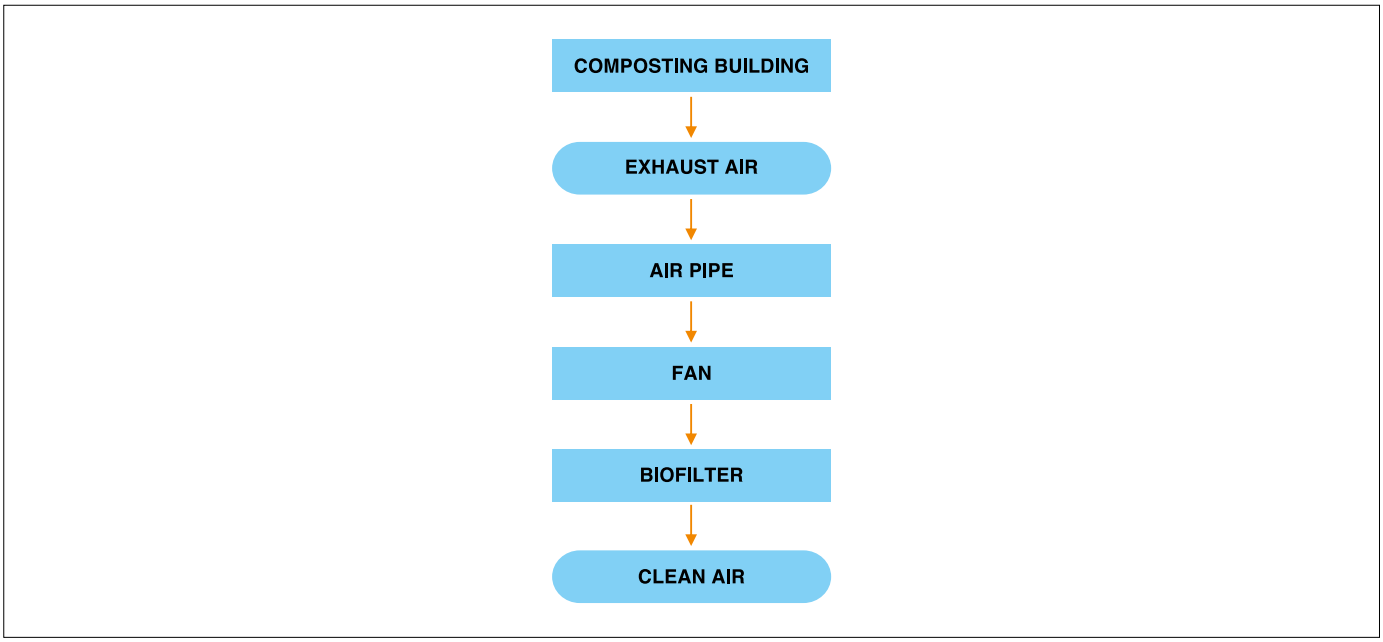
The action of the ventilator allows for the capturing of the malodorous air and, at the same time, fresh air is sucked into the building. The ventilator is equipped with a motorised damper that is closed during the starting phase to reduce the power absorbed.

The floor of the bio-filter is made of prefabricated reinforced concrete slabs with a structural resistance sufficient to bear the load of a wheeled loader; this feature makes the maintenance of the bio-filter easy.

The slabs are perforated to allow for the passage of air that comes out of the plenum underneath.

The plant includes a water spraying system to maintain constant the moisture of the bio-filtration mass.





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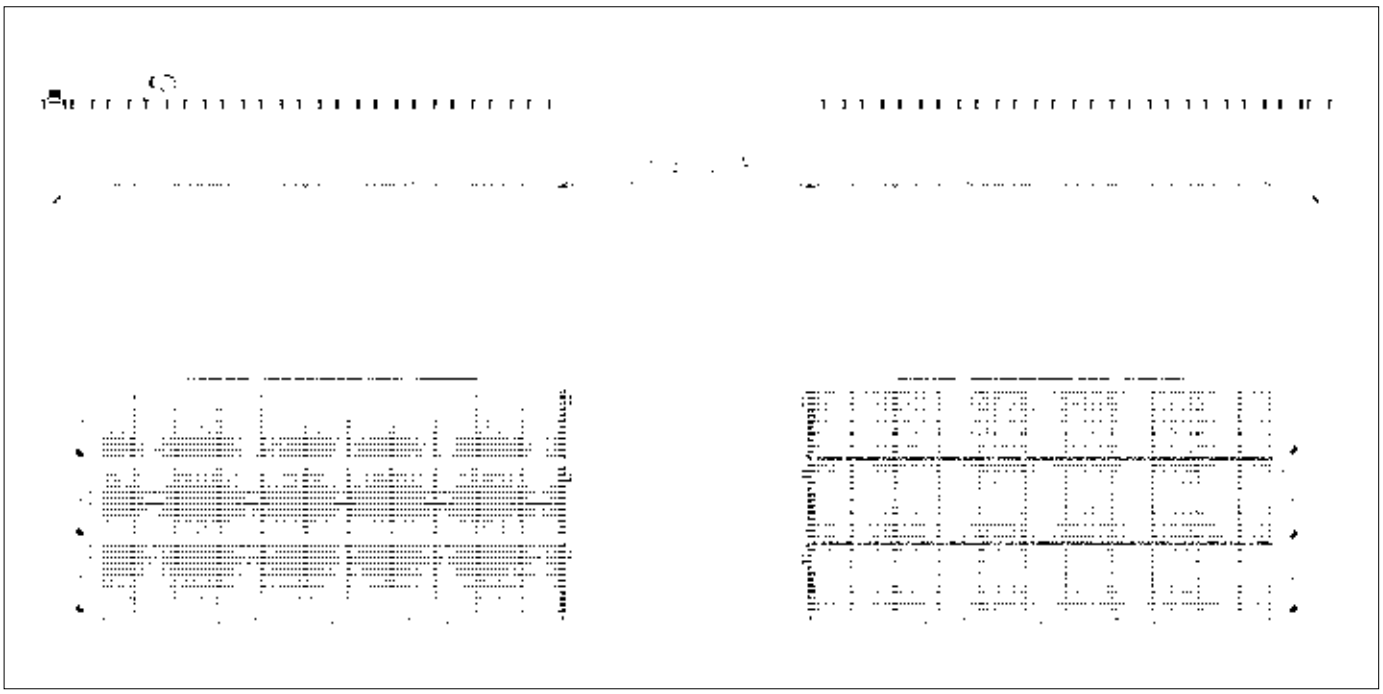
54 TESSELLO (FC) ITALY

Year	2008
Client	ROMAGNA COMPOST SRL
Operator	ROMAGNA COMPOST SRL
System description	Aereted static pile composting
Waste processed	Organic waste
Plant capacity	6 aereted pile

Romagna Compost S.r.l. has awarded ECOMASTER ATZWANGER with the design and construction of the equipment of a composting system based on the aerated pile composting technology.

Romagna Compost owns and operates a treatment plant that receives organic waste and treats it mechanically and biologically. The composting plant is installed in a pre-existing building and is part of an integrated processing cycle. The pre-treated organic waste is conveyed by means of a wheeled loader to the stabilisation plant, where it is stacked in six ventilated piles. The internal dimensions of each aerated pile are 5 m x 32.5 m. The piles are bordered on three sides by concrete walls and are equipped with a system for the distribution of the process air built into the floor. Each pile is equipped with a ventilator that takes the process air from the building and blows it into the flooring. The flooring is equipped with traps for the percolated effluent. The temperature of the treated material is monitored for each stabilisation pile.



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53 PORTO AZZURRO - ISOLA D'ELBA (LI) ITALY

Year	2007
Client	ELBANA SERVIZI AMBIENTALI E.S.A. SpA
Operator	ELBANA SERVIZI AMBIENTALI E.S.A. SpA
Partner	IMPRESA EDILE ODINO PETROCCHI
System description	Biostabilisation
Waste processed	Organic waste
Plant capacity	77 t/day

ESA has chosen a composting technology based on the aerated static pile covered by a breathable membrane and has awarded the construction contract to Ecomaster.

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ESA owns and operates a treatment plant that receives solid waste generated by the municipalities which are shareholders of ESA. Ecomaster is leader of a temporary joint-venture that also includes the civil contractor Impresa Edile Odino Petrocchi, which has been contracted by ESA for the construction of the stabilisation system of the waste organic fraction sorted in an adjacent sorting plant.

The composting plant is located in an existing building that is transformed according to the same construction contract of the composting plant.

The composting plant includes eight open biocells, each segregated on three sides by concrete walls and provided with an air distribution system cast in the concrete floor.

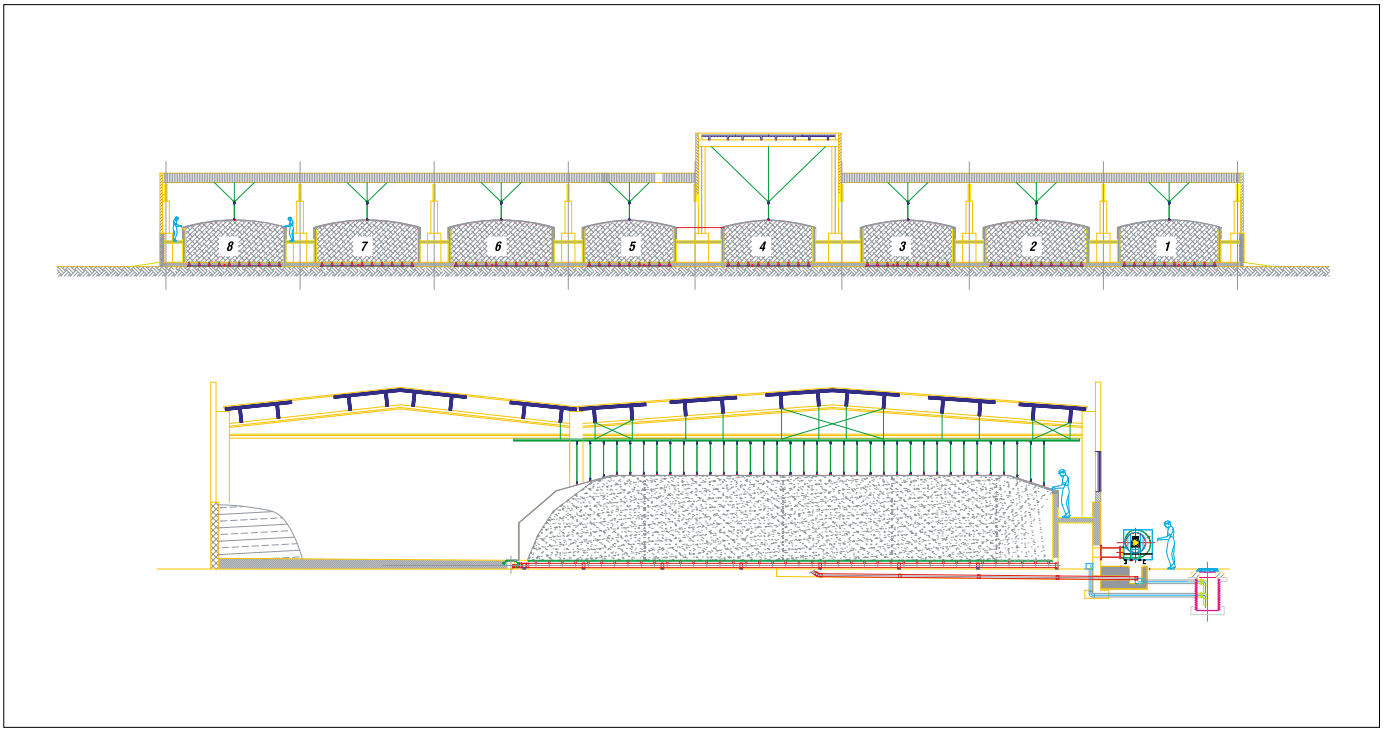
After formation of the pile, the biocell is covered by a breathable membrane, which lets the process air pass through, but holds moisture, spores and bacteria.

The membrane also controls the odours generated by the composting process. In order to have the maximum odour filtration efficiency, the building is served by an existing biofiltration system, which processes the waste air before it is exhausted. Each biocell is provided with a variable speed electric fan, which blows external air into the floor of the biocell. The temperature of the composted material is measured and recorded by the computerised system controlling the fans.

The plant is complete with a leachate control system, that is collected in two tanks and sent to safe disposal.

In addition to the organic fraction of mixed waste, the plant can also process source separated organic waste, which is mixed with an adequate quantity of structural material having a controlled particle size.

The compost produced from source separated organic waste is matured and refined in other areas excluded from this contract. The final compost product derived from source separated waste can be used in agriculture.



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52 SOUTH SINAI - EGYPT

Year	2007
Client	GOVERNORATE OF SOUTH SINAI
Operator	GOVERNORATE OF SOUTH SINAI
System description	Transfer station
Waste processed	Hotel waste
Financing	European Union - South Sinai regional development programme

With an international tender procedure, the Governorate of South Sinai has awarded to Ecomaster the supply of eight stations for the transfer of the hotel waste generated in the following areas: Ras Sudr, Abu Zeneima, Abu Rudeis, El Tur, Dahab, Nuweiba e St. Catherine. The project is financed from the general budget of the European Union.

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51 SHARM EL SHEIKH - EGYPT

Year	2007
Client	GOVERNORATE OF SOUTH SINAI
Operator	GOVERNORATE OF SOUTH SINAI
System description	Sorting and composting
Waste processed	Hotel waste
Financing	European Union - South Sinai regional development programme

With an international tender procedure the Governorate of South Sinai has awarded to Ecomaster the supply of a waste sorting plant for the recycling and composting of solid waste generated by the hotels of the touristic area of Sharm El Sheikh. The project is financed from the general budget of the European Union.

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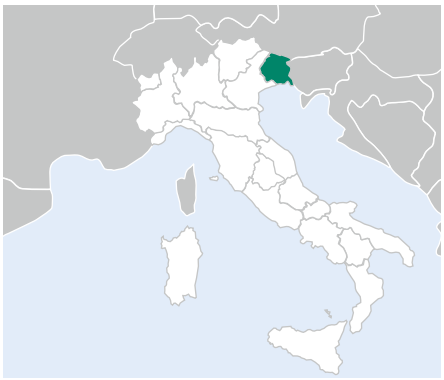
50 MORARO (GO) ITALY

Year	2007
Client	MAINARDO Srl
Operator	MAINARDO Srl
System description	Sorting
Waste processed	Dry source separated waste
Plant capacity	40,500 t/year



Ecomaster has designed and built an efficient sorting plant, characterized by a high automation level, for the recovery of dry recyclable wastes derived from the source separation of municipal waste.

The plant is designed for the treatment of dry recyclable material deriving from the source separation of municipal waste.

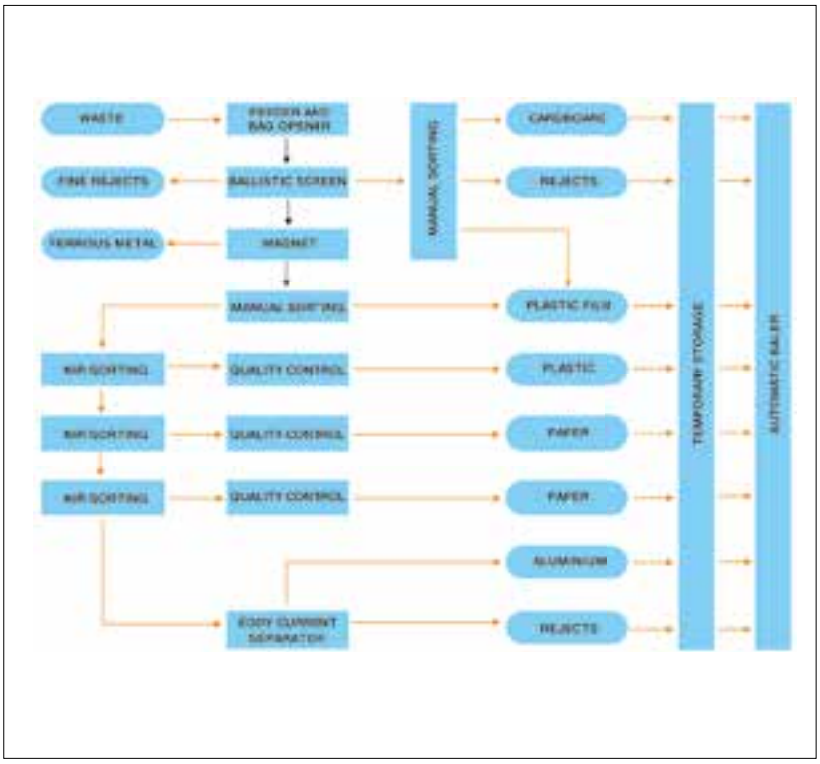
After the separation of bulky waste and other unsuitable material, waste is loaded by wheel loader into the feeding hopper of the metering bag opener. This equipment is provided with a mobile floor, hydraulically driven, and an elevator which pushes the waste against the bag opening knives.

Downstream of the bag opener, a conveyor feeds a two-step ballistic screen, which sorts the waste in the following fractions:

- The first step oscillating slats sort a fine fraction, which is collected as a reject;
- The oversize material is processed by the second step slats, which has opening larger than the first step. The materials to be processed by the automatic sorting line go through the screen openings;
- The oversize material, consisting mainly of large packaging materials, such as cardboard, film plastic and plastic containers, is collected by the manual sorting conveyor.

The large size materials are manually sorted and separately stored in their silos located underneath the floor of the sorting room, waiting for their turn of baling. The second undersize material produced by the ballistic screen is collected by a conveyor in order to be processed by a magnet for the separation of magnetic ferrous metal. At the end side of this conveyor there are two manual sorting stations for the control of the quality of the waste which is processed by the automatic sorter. The sorter functioning is based on compressed air jets, which are controlled by optical sensors.

The optical sensors, of NIR (Near InfraRed) type, work in the light field near the infrared and are able to detect the quality of the various materials based on their light adsorption. The system electronic processor activates the compressed air jets in the area interested by the material. The timing of the jets is also controlled by the computer. The material passing over the active jets is projected into a collection hopper and collected by another conveyor.



The first optical sorter is programmed for the sorting of plastic, which is inspected and manually cleaned by two operators. The other waste, different from plastic, is conveyed to a second optical sorter, similar to the previous one, which is programmed for the sorting of paper products. Also here there are two stations for the visual inspection and manual cleaning of the recovered product. The manually sorted waste is reprocessed in order to by recovered. A third NIR sorter processes the material remaining on the conveyor, which consists mainly of paper, plastic and used beverage aluminium cans. Usually, this automatic sorter is programmed for the recovery of paper, which is the material having a higher concentration. Two additional stations are included for the inspection and manual cleaning of the material automatically sorted.

At the end of the line, the remaining material is processed by an eddy current separator for the automatic recovery of aluminium. All recovered materials, together with the process rejects, are temporarily stored in silos located underneath the sorting rooms. The handling of these materials is by means of a wheel loader, that pushes them, in turn, into the receiving pit of a large steel apron conveyor, which conveys them to the baler feeder. The baler, and its feeder conveyor, were pre-existing.

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49 CARBONIA (CI) ITALY

Year	2007
Client	Diciannovesima Comunità Montana “Sulcis Iglesiente”
Operator	Diciannovesima Comunità Montana “Sulcis Iglesiente”
System description	Sorting, baling and composting
Waste processed	Mixed municipal waste
Plant capacity	48,400 t/year

This municipal waste treatment plant, located in Sardinia and owned by the Municipality of Carbonia, has been designed to stabilise the organic fraction and to bale the components having a higher heating value separately.

The plant consists of three lines:

- Mechanical treatment to sort the organic fraction and bale the combustible waste;
- Biological treatment to stabilise the organic fraction;
- Biofiltration of the process odours.

A slow-speed shredder is used to reduce the particle size of bulky waste and to open the bags containing the waste.

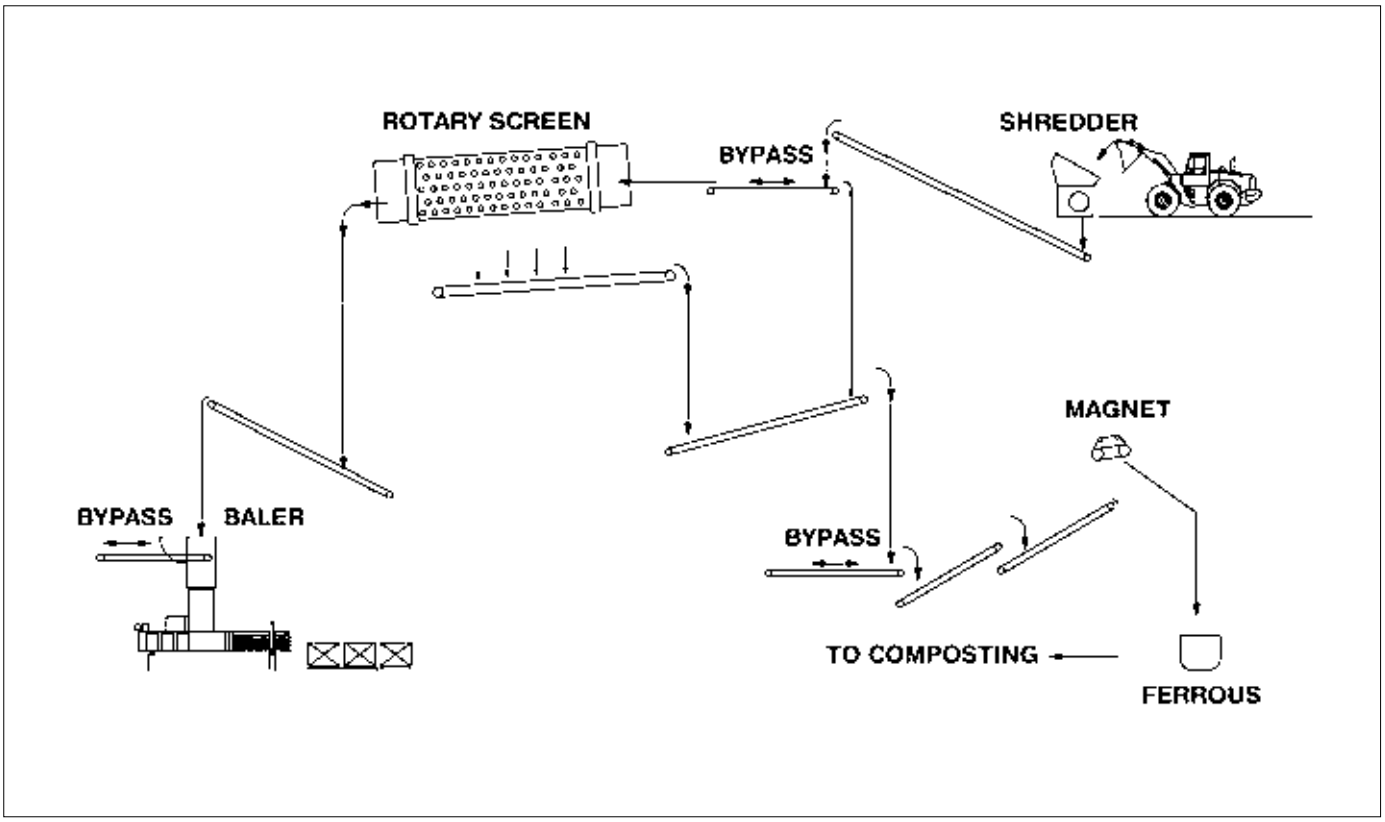
After shredding, the waste is processed by a rotary screen, which sorts two fractions based on their particle size. The larger sized fraction, containing materials with higher heating value, is processed by a baler, while the organic fraction, after sorting of ferrous metals, is sent to the biological treatment area. The continuous channel baler has an automatic bale tying system and a by-pass conveyor that is used when baling is not required.

The biological treatment line is based on a static pile composting system placed on an aerated platform.

Eight fans are used to blow process air into the composting pile through an air distribution system integrated in the platform construction.

After composting, the stabilised material is disposed at a sanitary landfill, where the emission of greenhouse gas is much less than in the case of untreated municipal waste.

The plant is provided with a well sized odour control system that uses the biofiltration process. Two centrifugal fans, that process the exhaust air from the waste treatment plant, are installed in parallel upstream the biofilter.



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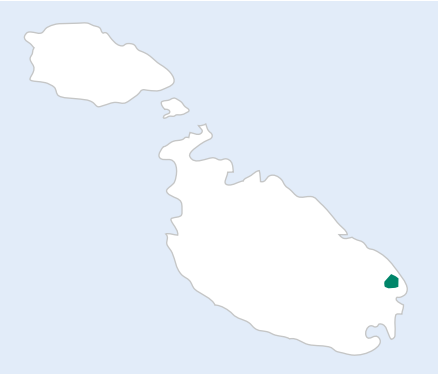
48 MARSASCALA - MALTA

Year	2006-2007
Client	WASTESERV MALTA LTD
Operator	WASTESERV MALTA LTD
System description	Sorting and baling
Waste processed	Organic and mixed municipal waste
Plant capacity	71,000 t/year



A completely automatic plant recovers from mixed municipal waste RDF, metals and organic matter to be used for the production of biogas, a valuable form of renewable chemical energy.
The plant can also treat source separated organic waste.

In addition to the process rejects to be disposed at a landfill, the plant automatically recovers four materials from municipal waste:

- RDF, Refuse Derived Fuel
- Biomass to be anaerobically digested
- Ferrous metals
- Non-ferrous metals.

The first treatment of mixed waste consists in the opening and emptying of the bags, which is carried out by a special machine provided with a hydraulically driven mobile floor. A whell loader loads the waste into the feeder hopper.

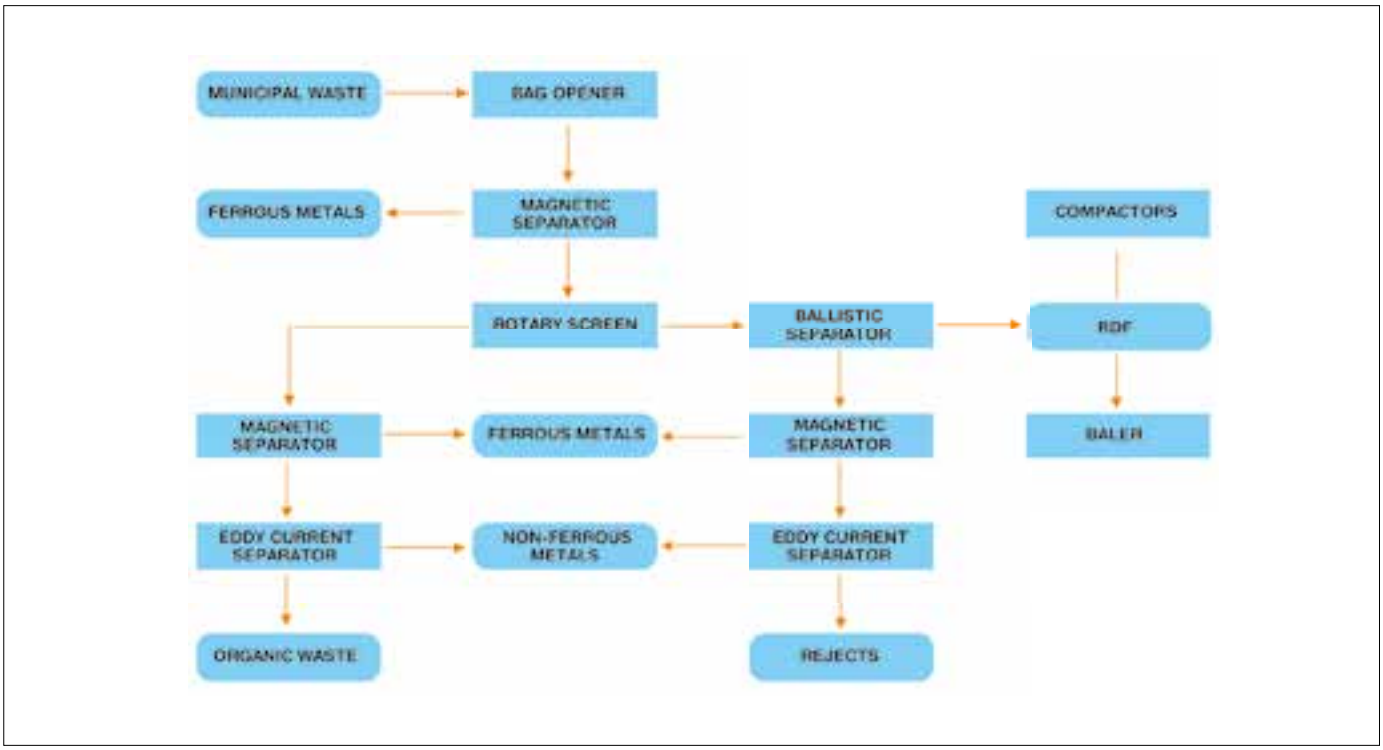
The bag opener does not reduce the particle size of the waste excessively, because this is required for a high efficiency of the sorting operations that follow.

After the sorting of the magnetic ferrous metals, a rotary drum sorts two fractions based on their particle size. The organic fraction goes to the undersized fraction, while the larger size materials are collected in the oversized fraction.

A ballistic separator sorts the heavier components from the oversized fraction. These materials are disposed at a landfill after the recovery of ferrous and non-ferrous metals. To recover metals, a magnetic separator and an induction sorter are used in series.

The combustibile waste is then compacted into roll-off compactors, or baled by a continuous channel automatic baler. The RDF bales are handled by a fork-lift truck.

The undersized fraction from the rotary screen, after further treatment to recover ferrous and non-ferrous metals, is ready to be sent to the adjacent anaerobic digestion plant.



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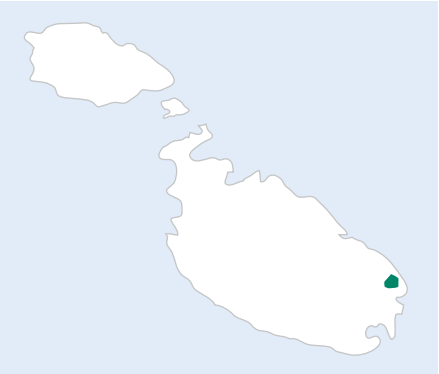
47 MARSASCALA - MALTA

Year	2006-2007
Client	WASTESERV MALTA LTD
Operator	WASTESERV MALTA LTD
System description	Sorting and baling
Waste processed	Dry source separated waste
Plant capacity	23,500 t/year



The source separation of recyclable waste is one of the methods used in Malta for reducing the dependency from landfill. This plant, co-financed by the European Union, is part of the integrated system for the treatment of municipal waste developed by the governmental authority WasteServ Malta Ltd.

The recyclable waste sorting plant includes various lines which, depending on the type of waste processed, can be combined with great flexibility. Paper and cardboard, mixed with plastic containers and plastic bags, are automatically sieved before being subject to manual sorting (positive or negative), while steel and aluminium cans are automatically sorted from non-metallic waste.

All sorted materials can be pressed to produce bales, which are exported to foreign countries where the recycling industries, such as paper mills and steel works, are located.

The continuously fed hydraulic baler used in the plant is completely automatic and produces high density bales tied with steel wire. The length of each bale can be adjusted according to the type of material processed. This equipment can process over 30 tonnes of paper per hour.

The plant is fed by a wheel loader that, depending on the sorting process required, loads one of the three available feeder conveyors. For instance, paper and cardboard, if sorting is not required, can be sent directly to the baler, without the need to pass through the sorting lines.

Metal containers, once loaded in the specific feeder that conveys them to the sorting equipment, are processed first by a magnetic separator, which sorts out the magnetic ferrous metals. After separation of the steel cans, an induction separator sorts non-ferrous metals (aluminium beverage containers) from the waste, that is conveyed to a container by means of a belt conveyor.

The more sophisticated process is that used for treating mixed paper-plastic material. First of all, a ballistic separator sorts cardboard that proceeds directly to the baler. The smaller sized material generated by the ballistic screen is taken to the primary sorting room, where up to six different materials are manually sorted. Under the sorting room there are six storage bunkers with a special hydraulically driven bottom, which is known as a “walking floor”. The stored materials are baled by activating in turn the bunker emptying system.

If required, it is possible to direct the residual material to a secondary manual sorting room, where up to three additional materials can be sorted. A mobile conveyor is used to convey the material from the primary to the secondary sorting room. This conveyor can move between two different working positions depending on the required sorting process. The above mentioned metals sorting line is installed downstream the secondary sorting room.

A computerized system controls the whole plant to allow proper start-up and shut-down sequences in a safe manner.

During the design of the plant, particular care has been given to safeguarding the operators’ health. In addition to pressurization of the sorting rooms with conditioned air taken outdoors, the plant includes a centralized system for the suction and filtration of dusty air.

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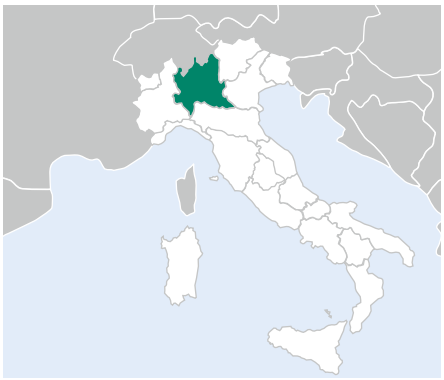
46 PARONA (PV) ITALY

Year	2005
Client	FOSTER WHEELER ITALIANA SpA
Operator	LOMELLINA ENERGIA Srl
System description	RDF feeding to second boiler
Waste processed	RDF
Plant capacity	380,000 t/year (total with first lot)



This project includes the design and construction of the RDF feeding line for the second boiler of the waste-to-energy facility of Lomellina Energia. The project is relative to the expansion of the plant built by Ecomaster.

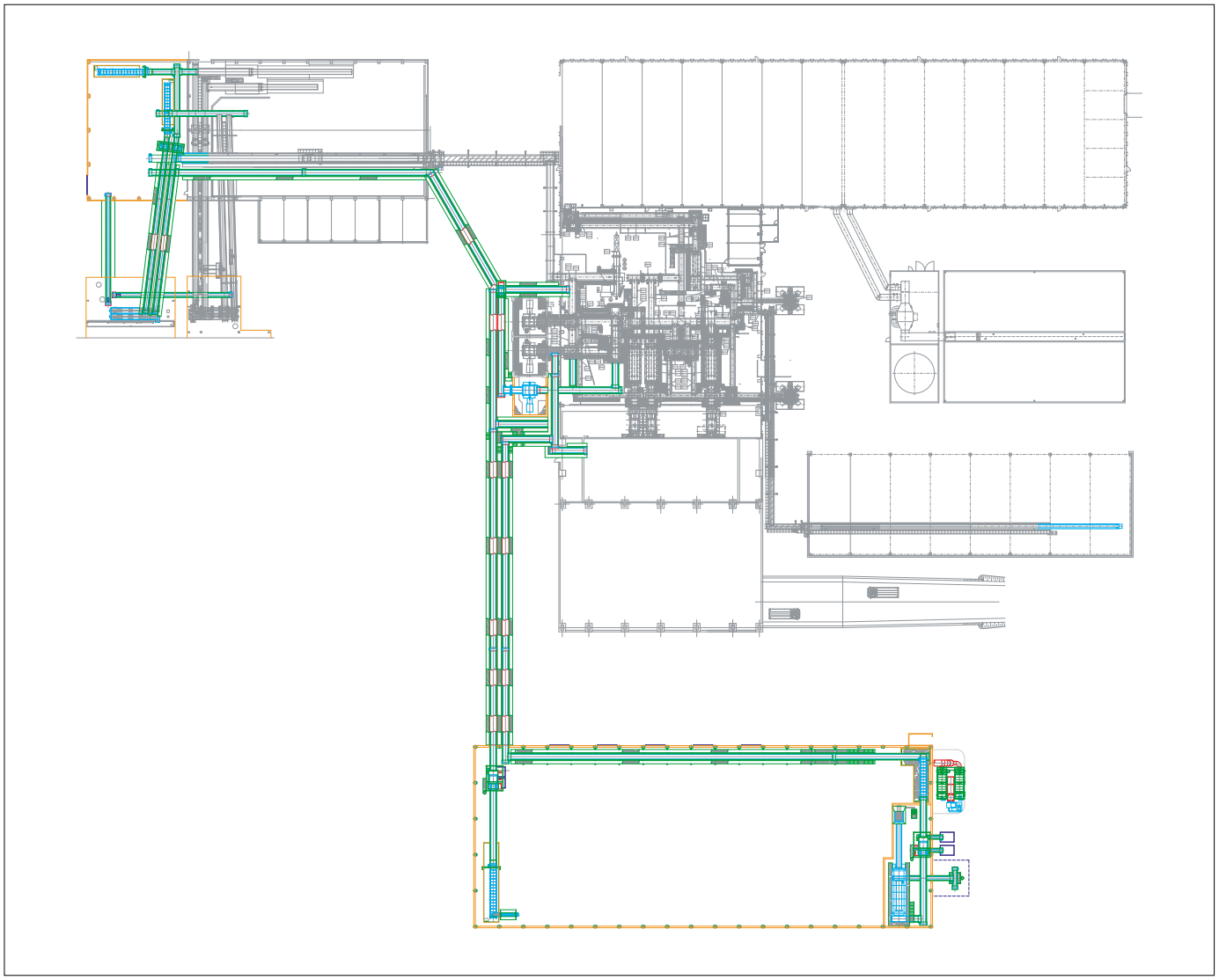
The feeding line of the second boiler consists of various long belt conveyors that connect the RDF receiving building with the storage area located nearby the boiler. The flexibility of the design is such that RDF can be received and stored in both areas depending on the operational requirements.

The usual functioning consists in pre-treating the received RDF in the new receiving building and in transporting it to the storage area, where the fuel is handled by a tractor loader for feeding the boiler line.

The pre-treatment process substantially consists in the separation of ferrous and non-ferrous metals by means of a magnetic separator and an eddy current sorter installed in series.

In addition to the elevating conveyors, the boiler feeding line also includes a system of conveyors that return the excess fuel to the RDF storage area. This design ensures that the boiler always has available all fuel required for combustion.

To provide full system redundancy, the system includes a complete spare line, that is used in case of any break-down and when scheduled maintenance is being carried out to the other line.



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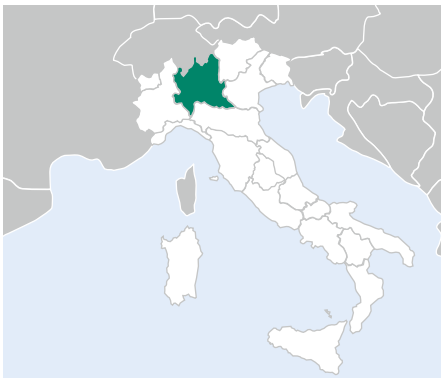
45 PARONA (PV) ITALY

Year	2005
Client	FOSTER WHEELER ITALIANA SpA
Operator	LOMELLINA ENERGIA Srl
System description	RDF plant expansion
Waste processed	Mixed solid waste
Plant capacity	380,000 t/year (total with first lot)



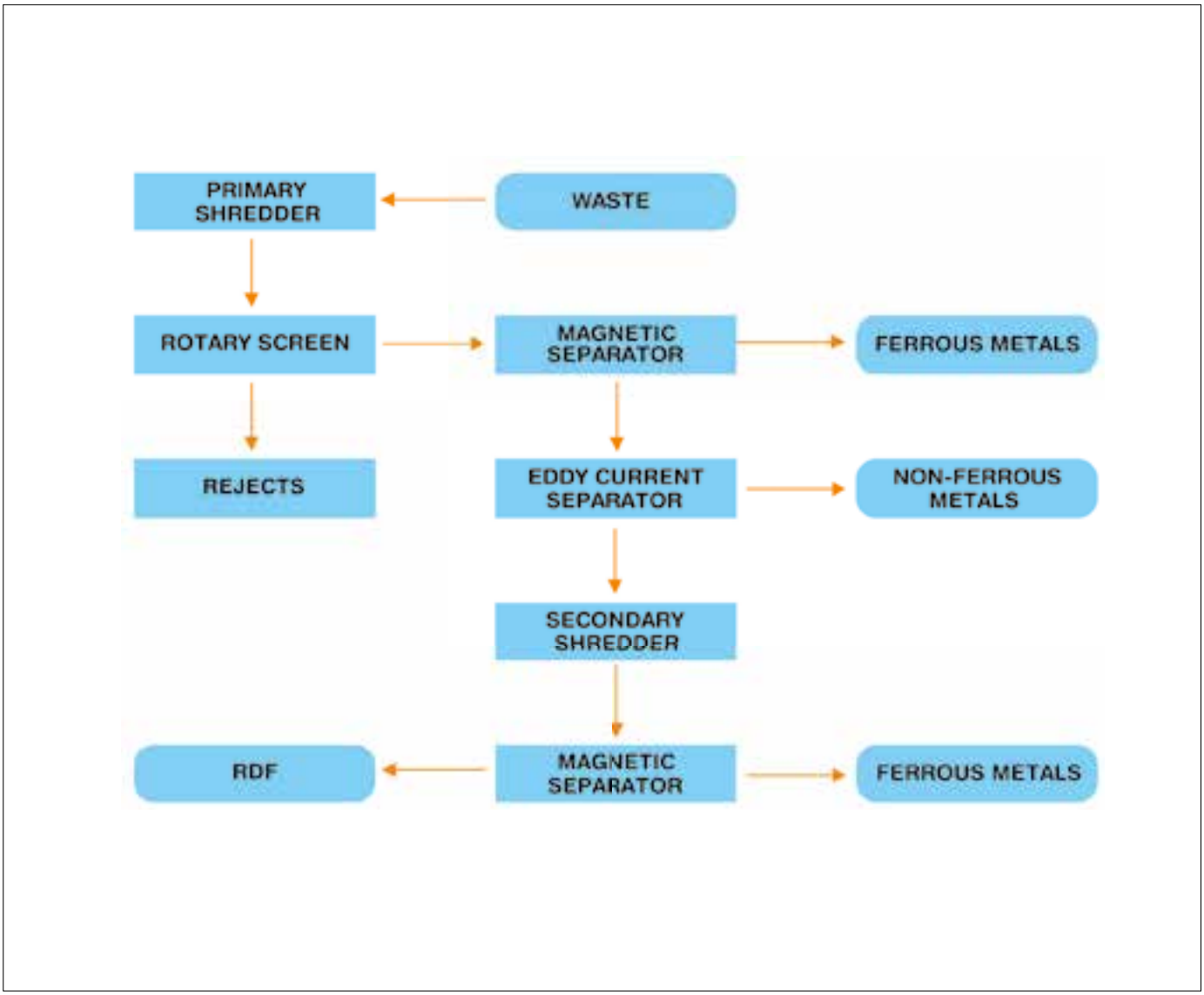
This project includes the design and construction of the fourth line for the production of refuse derived fuel (RDF) of the Lomellina Energia waste-to-energy facility.
The works are relative to the expansion of the plant built in 1999 by Ecomaster.

The fourth waste sorting line is designed for the treatment of industrial and commercial waste, consisting mainly of packaging materials and similar wastes. The bulky nature of the processed waste has required the use of a special double rotor, slow-speed primary shredder, which is able to reduce the particle size of the waste to facilitate the sorting operations that follow.

After shredding, waste is treated by a rotary screen that sorts out fine inerts. The screen oversized fraction is processed by a magnetic separator and by an eddy current sorter that collect magnetic and non-ferrous metals, respectively.

A high-speed hammermill shredder reduces the waste particle size below the value required for the combustion in a circulated fluidized bed boiler.

Before combustion, the shredded RDF is processed by another magnetic separator for the separation of any residual ferrous metal.



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44 SESTO FIORENTINO (FI) ITALY

Year	2005
Client	QUADRIFOGLIO SERVIZI AMBIENTALI AREA FIORENTINA SpA
Operator	QUADRIFOGLIO SERVIZI AMBIENTALI AREA FIORENTINA SpA
Partner	UNIECO Soc. Coop.
System description	Compost refining
Waste processed	Organic waste
Plant capacity	70,000 t/year

QUADRIFOGLIO SpA, which carries out environmental services in the Florence area, has awarded to the joint-venture including UNIECO Soc. Coop. and ECOMASTER ATZWANGER the contract for the design and construction of a biotunnel composting plant complete with air treatment and compost refining systems.

The production of quality compost to be used in agriculture requires the refining of the composted material by means of a screening process. The purpose of this process is to produce a material with a fine particle size, substantially free of contaminants such as plastics, textiles, etc.

The refining line has been built using some pre-existing pieces of equipment, such as a feeder and a rotary screen.

The feeder of the compost refining line is loaded with a wheel loader. A belt conveyor takes the material to the inlet opening of the rotary screen. The rotary drum type screen separates two flows of material as follows:

- An undersized fraction, having a particle size smaller than 50 mm, that is collected by a conveyor and sent to the secondary screening process;
- An oversized fraction, having a particle size greater than 50 mm, that is rejected or recycled as structural material;

The secondary "flip flow" type screen, consists of two oscillating structures that are elastically interconnected. The oscillation loosens and then tensions the screening mat, that is made of plastic material and is connected to both structures.

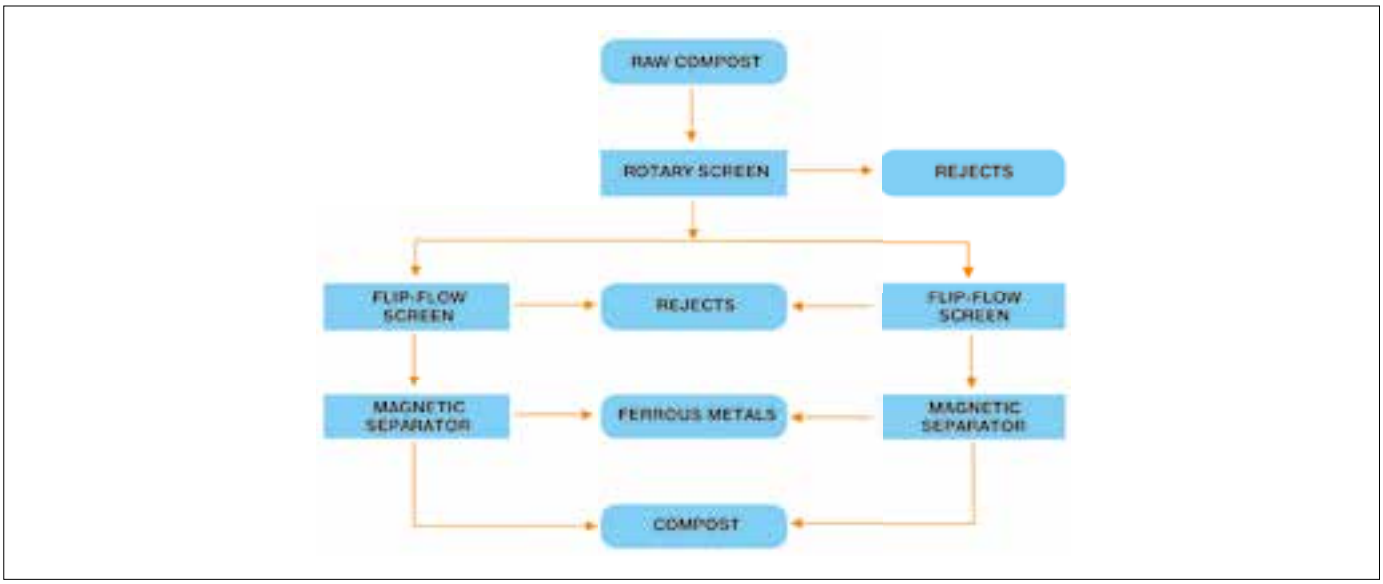
This screening process causes a periodic acceleration of the particles that are on the screening mat, with subsequent greater screening efficiency and capability of processing material with a high moisture content without clogging the screen mat. The oscillating screen separates two flows of material as follows:

- An undersized fraction, having a particle size smaller than 8 mm, which is the compost product and can be further matured prior to its marketing;
- An oversized fraction, having a particle size greater than 8 mm and smaller than 50 mm, that can be recycled as structural material to be mixed with the organic waste prior to their composting inside the bio tunnels.

As illustrated in the process diagram, the refining line also includes the sorting of ferrous materials, such as nails or steel caps.

The refining line, which has a capacity of 36 tonnes per hour, is already designed for the future installation of equipment to sort inert waste (glass particles, stones, etc.), which at the moment is not required due to the high quality of the organic material delivered to the composting plant.

The refining line includes a dust collection and filtering plant, consisting of a centrifugal fan and a bag filter with automatic bag cleaning by means of compressed air jets. After filtration, the waste air is conveyed to the centralized odour control system of the factory.



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43 SESTO FIORENTINO (FI) ITALY

Year	2005
Client	QUADRIFOGLIO SERVIZI AMBIENTALI AREA FIORENTINA SpA
Operator	QUADRIFOGLIO SERVIZI AMBIENTALI AREA FIORENTINA SpA
Partner	UNIECO Soc. Coop.
System description	Tunnel composting and odour control
Waste processed	Organic waste
Plant capacity	70,000 t/year

QUADRIFOGLIO SpA, which carries out environmental services in the Florence area, has awarded to the joint-venture including UNIECO Soc. Coop. and ECOMASTER ATZWANGER the contract for the design and construction of a biotunnel composting plant complete with air treatment and compost refining systems.

The organic waste treatment plant built by the temporary joint-venture Ecomaster-Unieco, uses the bio tunnel composting process. The plant has two purposes:

- Treatment of organic waste derived from the source separation of municipal waste mixed with garden waste;
- Stabilization of the organic fraction produced by the mechanical sorting (screening) of mixed municipal waste.

The quality of treated waste is fundamental for characterization of the product of the process; in fact only uncontaminated organic waste can be used for the production of compost to be used in agriculture.

The processing of the organic fraction derived from mixed municipal waste allows producing a stabilized material, that depending on the applicable rules can be used in particular applications, such as landfill cover material.

The plant includes the following sub-systems:

- Composting system including 14 bio-tunnels;
- Odour control system for the entire waste treatment complex.

Bio-tunnels are reinforced concrete built reactors having a parallelepiped shape, which are loaded by wheeled loader. Once the biological process has been completed, unloading is carried out by wheeled loader as well. Bio-tunnels are completely segregated by the other work areas with special sliding doors that contain the process.

The material sorted by screening mixed municipal waste is produced in another part of the plant (excluded from this project) and loaded into the bio-tunnels without any pre-treatment, while organic waste is mixed with shredded garden waste. Mixing with a wood-rich material ensures the presence of structural material and allows high air permeability of the mix.

The floor of the bio-tunnels consists of an aerated platform with an air distribution system cast into the concrete platform itself. The system is made of plastic ducts with air distribution nozzles.

In each reactor, a fan supplies the process air, which thanks to three air dampers, can be one of the following air flows:

- Fresh air sucked from the bio-tunnel material handling area;
- Air sucked from the inside of the bio-tunnels;
- A mix of the above two streams in a 0 to 100% ratio.

The three flows (fresh air, waste air and recirculated air) is controlled by electrically-driven air dampers.

The aerobic composting process is assisted by a PLC - Programmable Logic Controller based on a "fuzzy" logic (i.e. undefined), which maintains the process parameters within preset ranges.

Various process factors are controlled, such as temperature of the treated material, pressure and temperature of the process air, air pressure inside the bio-tunnel. Also, the oxygen level in the process air is monitored for each bio-tunnel.

The active composting process, that has a time length of 2 to 3 weeks, is divided in various phases: heating, pathogen control, stabilization and mass cooling.

A system for the acquisition and visualization of the process factors allows real-time monitoring of the process. All values measured are recorded and can be used for showing the trend in graphic form.

The 14 bio-tunnels are dedicated to the two different input materials (screened mixed waste and organic waste mixed with garden waste) depending on the quantities to be processed.

The two materials are always kept segregated to prevent contamination of the compost to be used for agricultural applications. The plant includes a collection system for the waste liquids, which are filtered and sprayed for recycling into the reactors that process mixed waste. Fresh water is used in the reactors that process organic waste.

The bio-tunnel intensive composting process is followed by a maturation treatment that includes turning of the material.
Two interconnected sub-systems are included in the odour control plant:

- The waste air of the bio-tunnels is first treated by three double-step scrubbers and then by a bio-filter;
- The air coming from the areas with less odour is treated by five double-phase scrubbers.

The plant has been built according to a phased schedule to avoid stopping the existing operations and causing organizational difficulties. The following functional lots have been completed one after the other:

- Odour control system with 3 scrubbers and bio filter;
- First group of 5 bio-tunnels;
- Odour control system with 5 additional scrubbers;
- Additional 9 bio-tunnels.

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42 NOTARESCO (TE) ITALIA

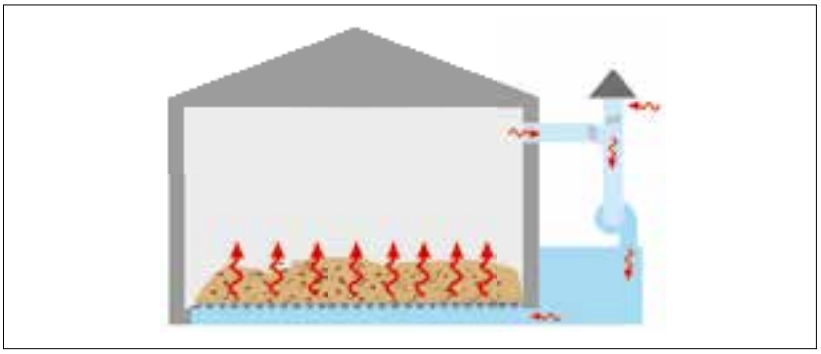
Year	2005
Client	SOGESA SpA
Operator	SOGESA SpA
System description	Aereted static pile composting
Waste processed	Organic waste
Plant capacity	62,000 t/year

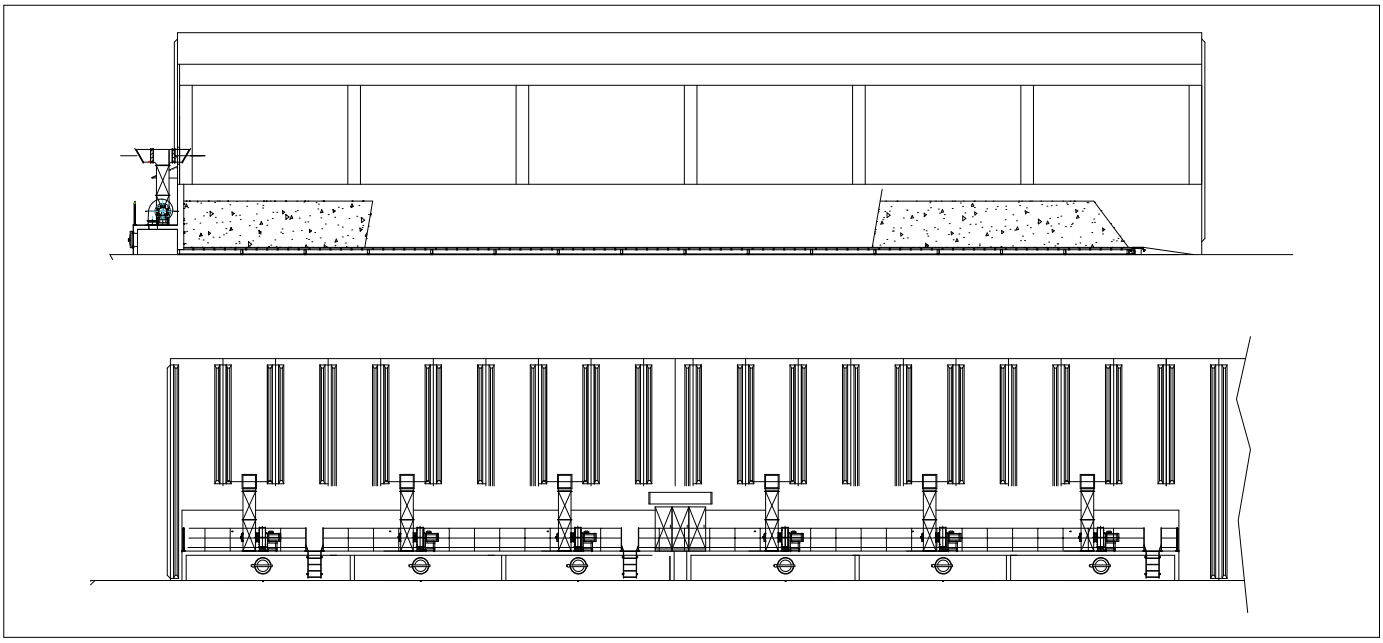
SOGESA SpA has awarded ECOMASTER ATZWANGER with the design and construction of the equipment of an aerobic composting system based on the aerated static pile composting technology.

The system is installed in an enclosed building, with forced ventilation by means of insufflation of air from the floor. The material, after a mixing and shredding treatment in another section of the pre-existing plant, is deposited in piles by means of a wheeled loader; the piles are arranged parallel to the ventilation piping, which runs underneath the floor. Three piles are formed in each ventilated platform. At the end of the biological treatment cycle, the material is collected by wheeled loader and transported to the successive treatment processes. Each pile is served by an insufflation ventilator, that delivers the process air through a duct. The air is sucked from the interior of the building, or from the exterior, according to the phase of the process.

The capture of the air is managed by two electronically controlled dampers operated by the control system. The air intake duct is connected to the suction opening of the insufflation ventilator. The ventilator blows the process air into a distribution plenum connected to the PVC piping of the ventilated floor.

The flooring is equipped with sumps at the two ends of the ventilated floor. The sumps have manhole that allow for their periodic cleaning. The underground system of pipes allows for the collection and conveying of the waste water to the storage tanks.





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41 PORTO TORRES (SS) ITALY

Year	2004
Client	ASI CONSORZIO PER L'AREA DI SVILUPPO INDUSTRIALE Sassari - Porto Torres - Alghero
Operator	ASI CONSORZIO PER L'AREA DI SVILUPPO INDUSTRIALE Sassari - Porto Torres - Alghero
System description	Thermal drying
Waste processed	Waste water treatment sludge
Plant capacity	35,000 t/year

Ecomaster has built a plant for thermal drying of sludge deriving from waste water treatment. The works, carried out on a "turn-key" basis, have included the architectural and engineering design and the construction of equipment and related civil works.

The sludge to be processed is unloaded by the transport vehicles directly in a storage hopper where it is extracted and then conveyed to the drying line. The drier consists of a cylindrical double wall construction, which is heated by diathermic oil. An internal rotor projects the sludge towards the heated wall.

After evaporation of the water, the sludge powder is conveyed by the gas stream passing through the drier to a cyclone followed by a bag filter, where it is separated from the gas flow.

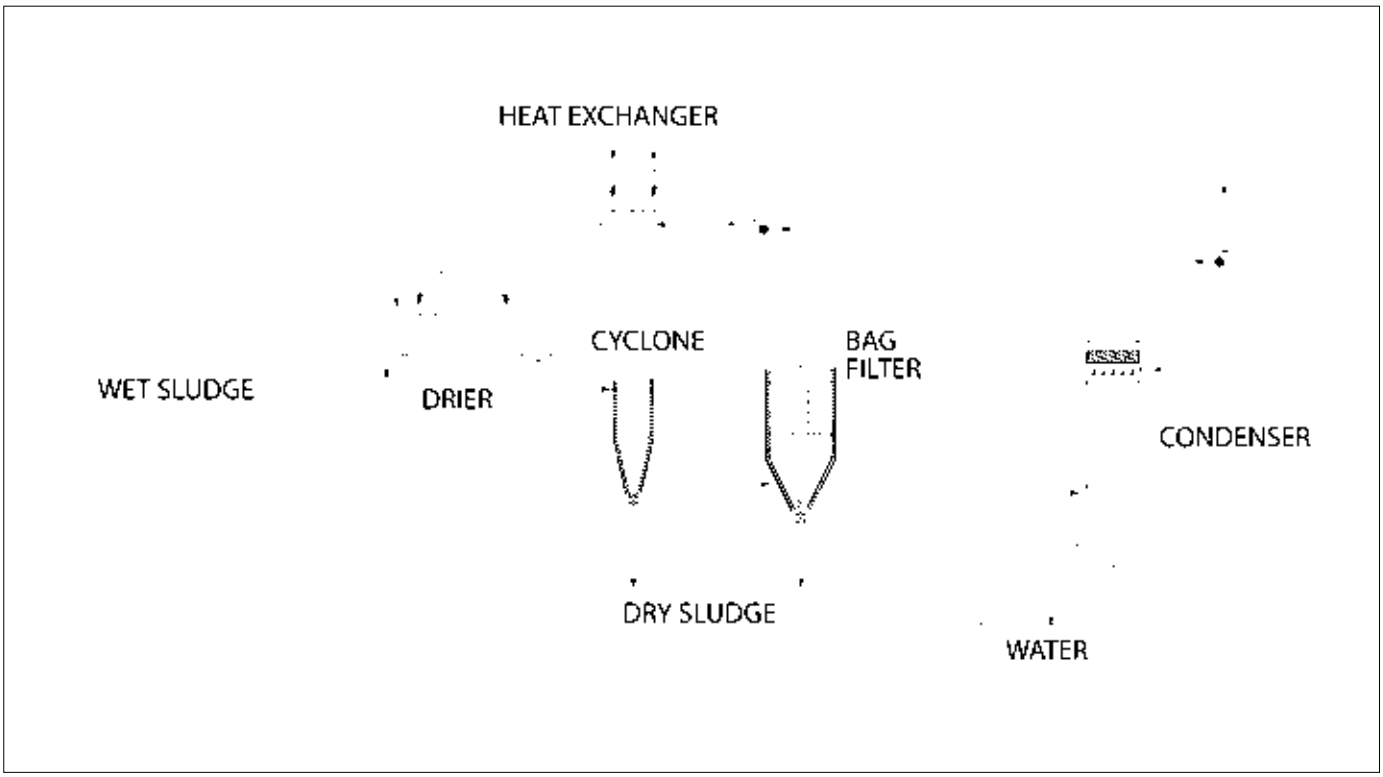
The energy for the evaporation is supplied by an oil-fuelled diathermic oil boiler. To prevent condensation of the water vapour inside the circuit, ducts, cyclone and bag filter are thermically insulated. Downstream the filter there is a condenser and heat exchanger. The condensate is collected and discharged to the waste water treatment system, while the gas stream returns to the drier.

A set of auger conveyors conveys the dry sludge to the roll-off container. One of the auger conveyors is water cooled to reduce the sludge temperature.

A fan provides the pressure required to compensate the system pressure loss and to recirculate the gas stream. A small fraction of the gas is sent to the combustion chamber of the boiler, where the organic compounds are burnt.

The plant includes the required safety equipment and is certified according to the ATEX regulations.

Drying of the sludge drastically reduces its weight and this allows a significant saving in landfill fees. In addition, the heating value of the dried sludge is high enough to use it as an alternative solid fuel. The energy generated from the combustion of dry biomass is renewable energy.



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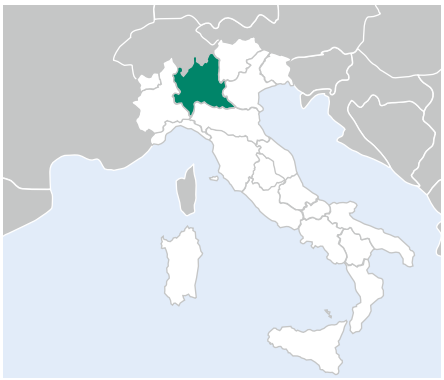
40 GUANZATE (CO) ITALY

Year	2004
Client	ECONORD SpA
Operator	ECONORD SpA
System description	Tunnel composting
Waste processed	Organic waste
Plant capacity	15,000 t/year



The end product deriving from the bio-conversion of source separated organic waste is a high quality compost which may be marketed for agricultural use without restrictions.

Ecomaster has designed and supplied on a "turn-key" basis the biological treatment system, while the equipment for mechanical treatment has been purchased directly by the Client.

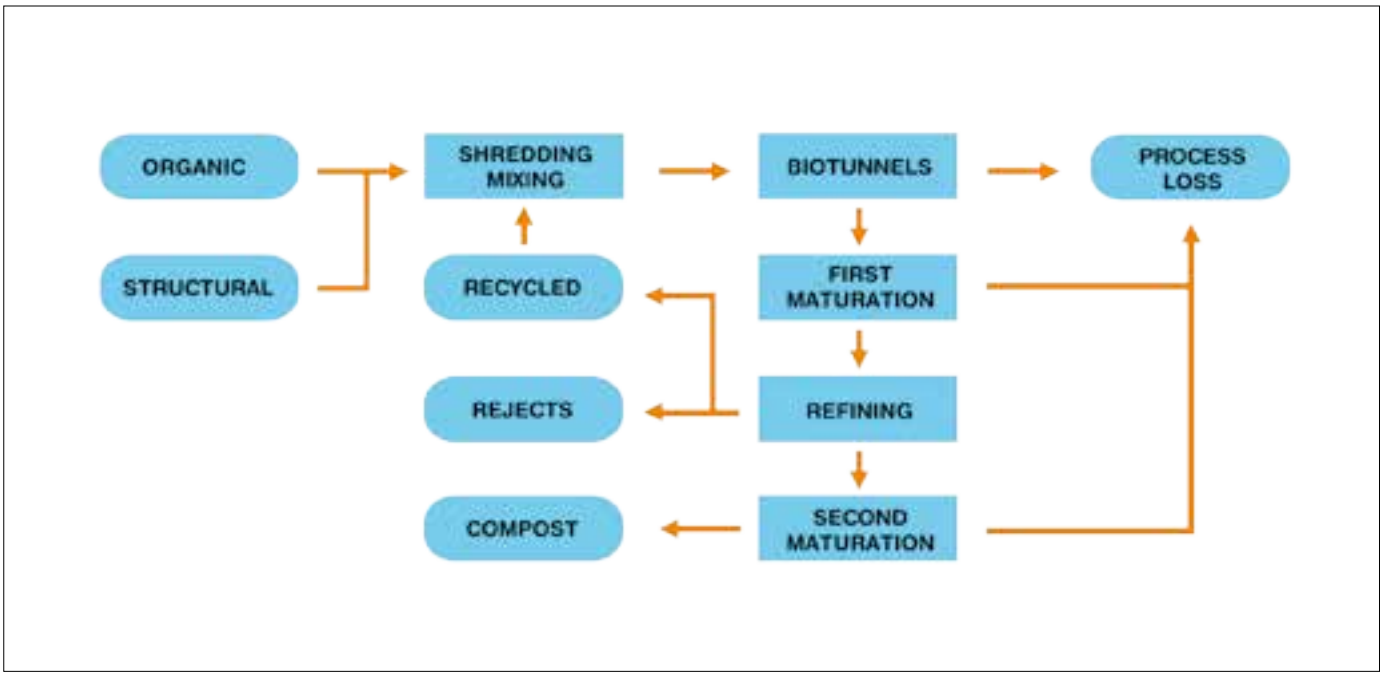
After shredding and mixing, the first phase of biological treatment occurs in five in-vessel reactors, called biotunnels.

After this active composting phase, the material is moved by wheel loader to the primary maturation area, which is based on an aerated floor system.

Raw compost is therefore processed and the fine fraction is sent to the secondary maturation system, which is also based on an aerated static pile.

All biological treatments are completed indoors. The waste air from the biotunnels and from the maturation building is processed by a scrubber and a biofilter for odour control.

The hearth of the plant is the computerised control system, which allows for an automatic operation of the process. The automation system includes a PC based interface for data visualisation, which makes very simple the operation of the plant.



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39 CARPI (MO) ITALY

Year	2003
Client	AIMAG SpA
Operator	AIMAG SpA
System description	Tunnel composting
Waste processed	Organic waste
Plant capacity	60,000 t/year

Eighteen biotunnels are at the core of this composting plant treating organic waste coming from source separation.

To produce compost from source separated organic waste, it is necessary to mix it with a given quantity of structural material, such as chipped wood waste. This allows the mixture to become air permeable.

The mixture to be biologically treated is prepared by a mixer (pre-existing) that is fed by two independent feeder conveyors, one for organic waste and the other for the structural material.

A conveyor system transfers the mixture to the biotunnels that are filled by means of a wheel loader.

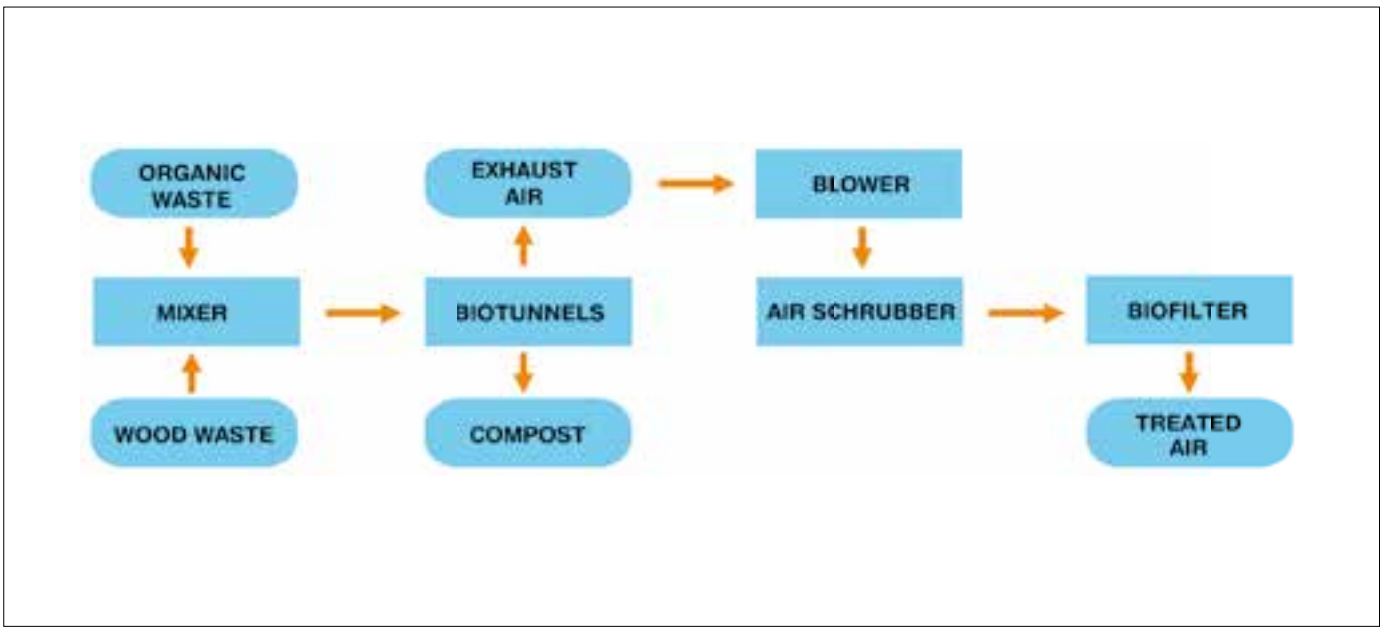
The tunnels consist of reinforced concrete cells. Each cell has the shape of a blind tunnel and is equipped with a ventilation system built into the floor.

Once the tunnel has been loaded, its sliding door closes tightly in order to ensure odour control.

Process air is blown in through the floor and partly re-circulated in the tunnel. Exhaust air is sent to the biological filter to keep odours under control.

In order to ensure an optimal operation, the biofilter is equipped with an air scrubber on the inlet and a sprinkler system.

Once the biological process has been completed, the material is extracted from the tunnel and conveyed to the refining area (pre-existing).



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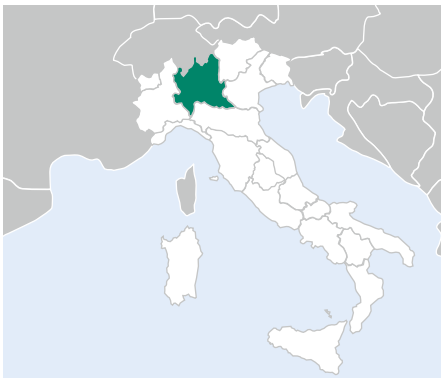
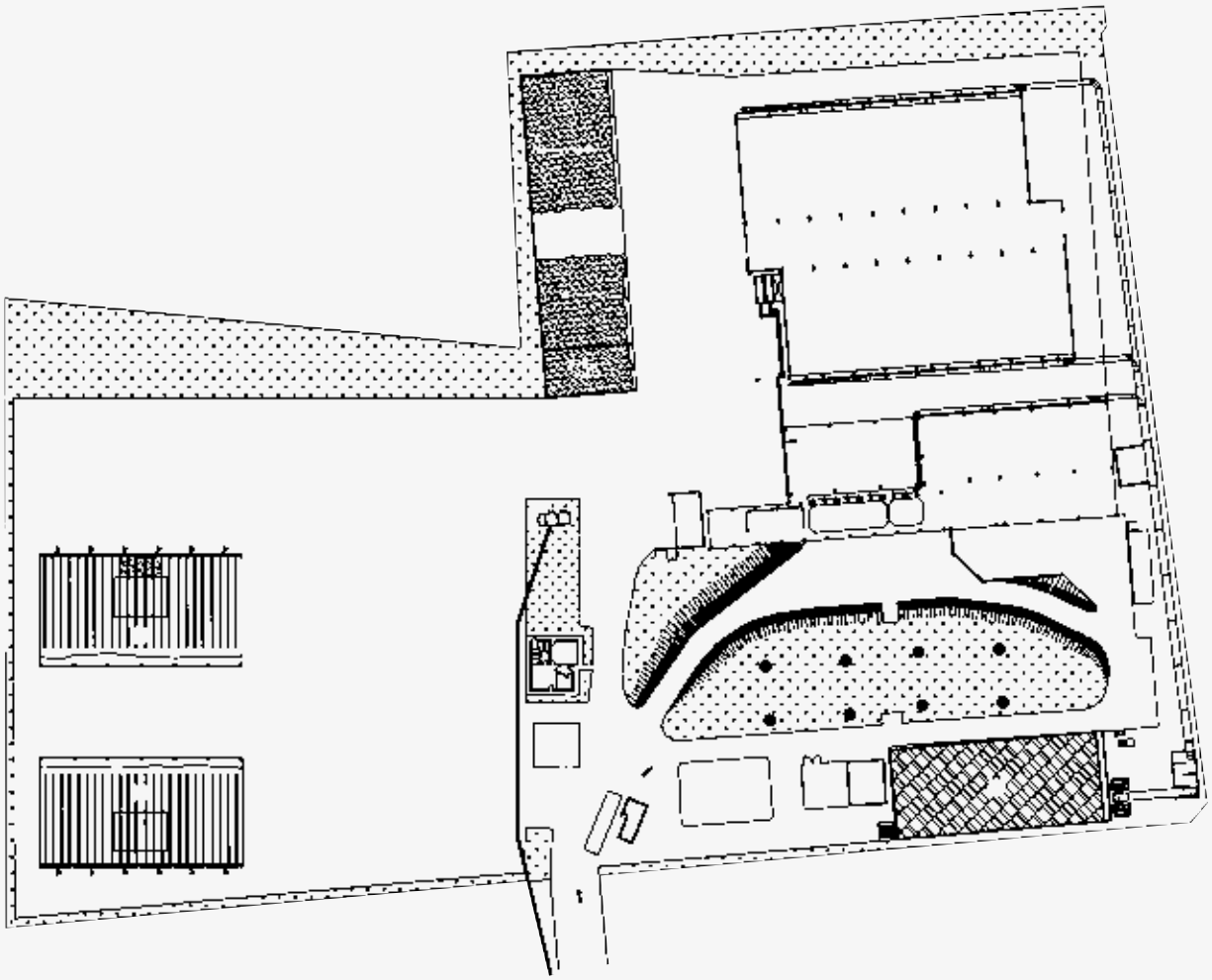
38 PIEVE DI CORIANO (MN) ITALY



Year	2003
Client	S.I.E.M. Società Intercomunale Ecologica Mantovana SpA
Operator	S.I.E.M. Società Intercomunale Ecologica Mantovana SpA
System description	Design of composting - RDF production plant
Waste processed	Mixed municipal solid waste
Plant capacity	80,000 t/year

Ecomaster has designed the revamping of this municipal solid waste treatment plant, which was built by another company in the late '70 and produces RDF and compost.



A primary shredder, with two hydraulically driven low-speed rotors, is fed with mixed municipal solid waste by means of a crane equipped with a hydraulic bucket.

The material coming from the shredder is processed through a rotary drum screen, which sorts waste into two flows having different particle sizes.

The undersize material, containing a high quantity of organic components, goes through a composting process in a building having a ventilation system built into the floor.

Once the composting process has been completed and the material screened, inerts are separated from compost by means of two fluidized bed separators with oscillating table.

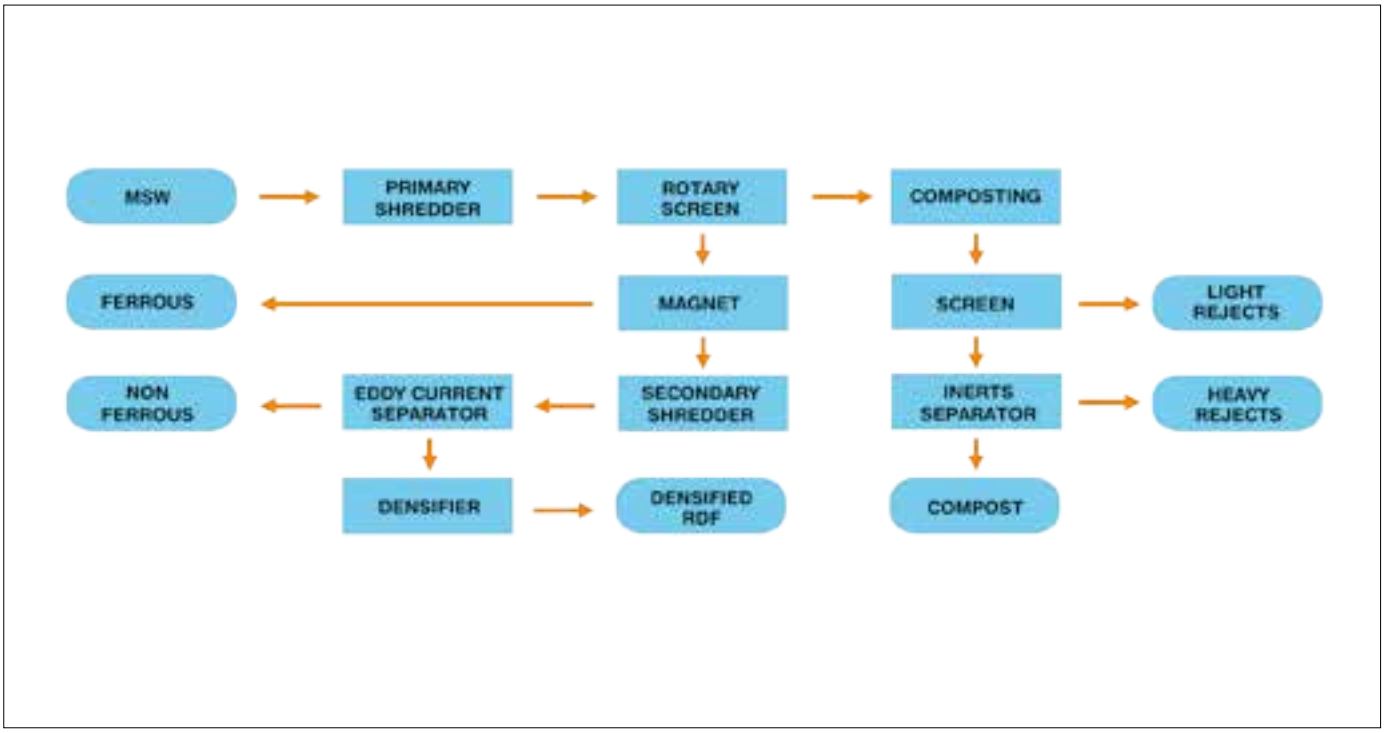
On the other hand, the oversize material coming out from the screen is treated by a magnetic separator to separate ferrous materials. It is then sent to the secondary shredder that is followed by a separator of non-ferrous metals.

A densifyng machine is used to produce densified RDF.

Pressure rolls push RDF through the die holes, thus ensuring material densification as well as size control.

The RDF coming from this plant is used in other industrial facilities as an alternative fuel for the generation of heat and power.

Ecomaster has designed the additional equipment for the revamping of this facility, that includes also the construction of a new biofilter to control odours and dust.



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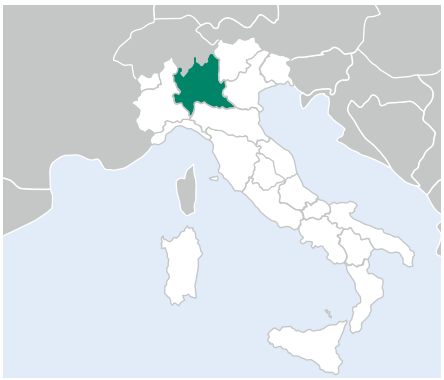
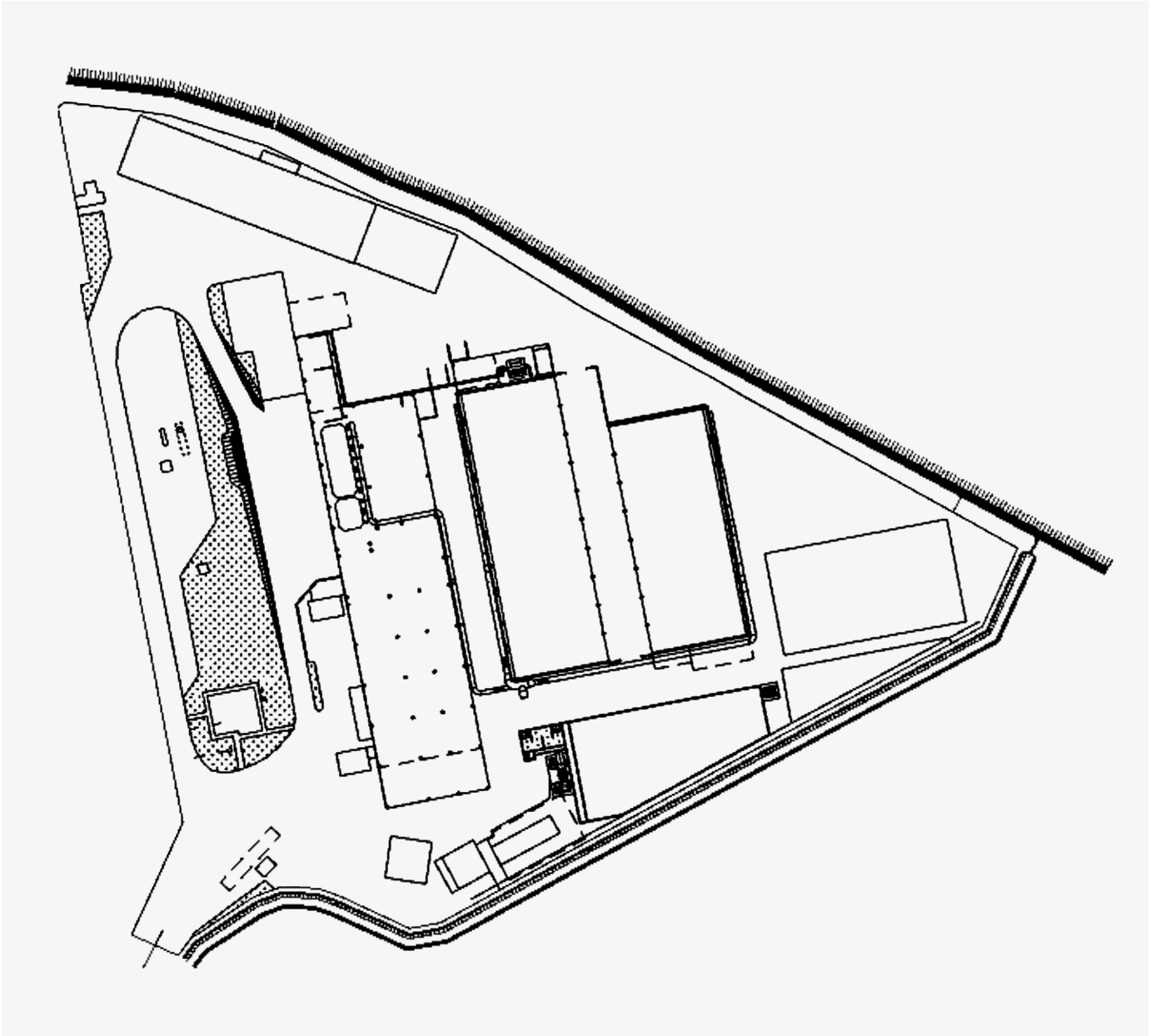
37 CERESARA (MN) ITALY

Year	2003
Client	S.I.E.M. Società Intercomunale Ecologica Mantovana SpA
Operator	S.I.E.M. Società Intercomunale Ecologica Mantovana SpA
System description	Design of composting - RDF production plant
Waste processed	Mixed municipal solid waste
Plant capacity	80,000 t/year



Ecomaster has designed the revamping of this municipal solid waste treatment plant, which was built by another company in the late '70 and produces RDF and compost.



A primary shredder, with two hydraulically driven low-speed rotors, is fed with mixed municipal solid waste by means of a bridge crane equipped with a hydraulic bucket.

The material coming from the shredder is processed through a rotary drum screen, which sorts waste into two flows having different particle sizes.

The undersize material, containing a high quantity of organic components, goes through a composting process in a building having a ventilation system built into the floor.

Once the composting process has been completed and the material screened, inerts are separated from compost by means of two fluidized bed separators with oscillating table.

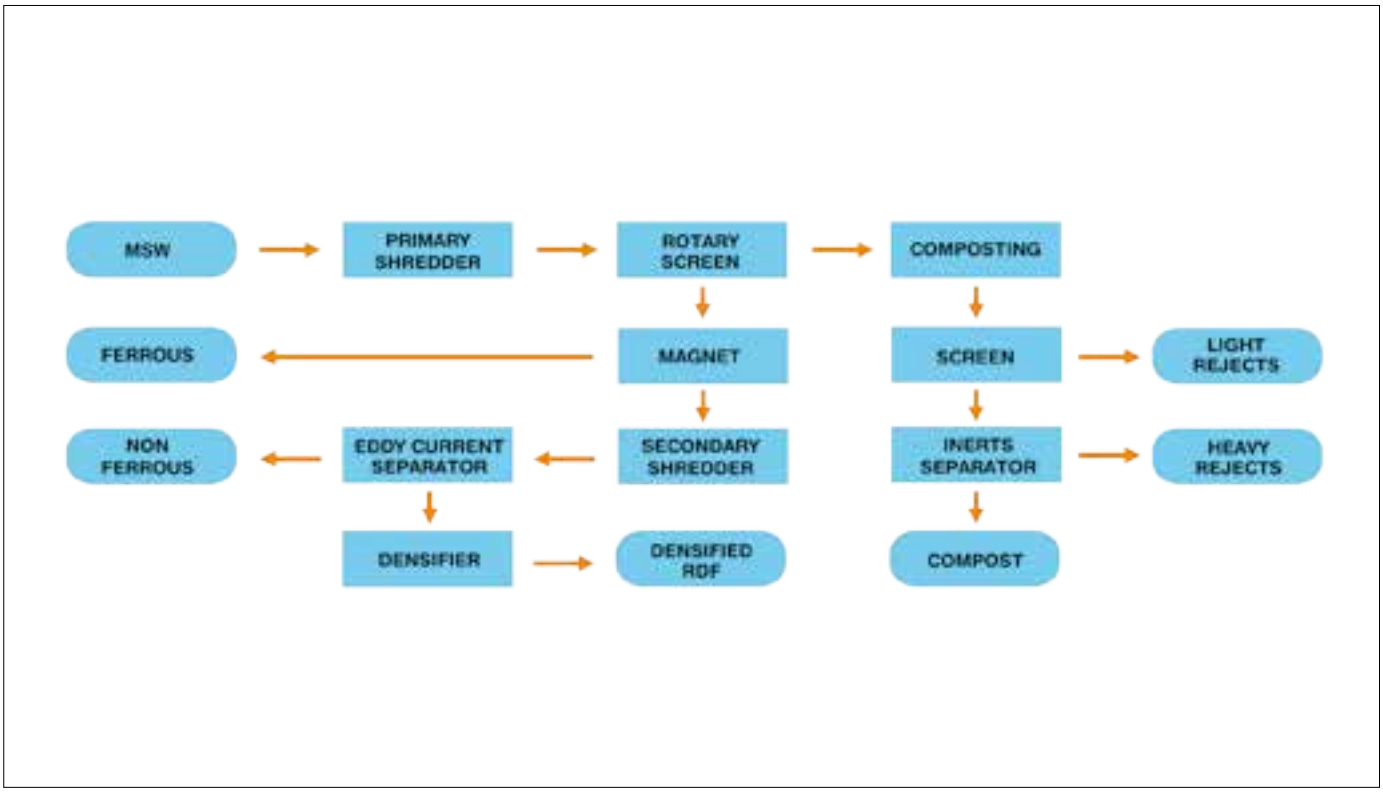
On the other hand, the oversize material coming out from the screen is treated by a magnetic separator to separate ferrous materials. It is then sent to the secondary shredder that is followed by a separator of non-ferrous metals.

A densifyng machine is used to produce densified RDF.

Pressure rolls push RDF through the die holes, thus ensuring material densification as well as size control.

The RDF coming from this plant is used in other industrial facilities as an alternative fuel for the generation of heat and power.

Ecomaster has designed the additional equipment for the revamping of this facility that includes also the construction of a new biofilter to control odours and dust.



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36 S. AGATA BOLOGNESE (BO) ITALY

Year	2003
Client	UNIECO Scrl
Operator	NUOVA GEOVIS SpA
System description	Tunnel composting
Waste processed	Organic from mixed municipal solid waste
Plant capacity	70,000 t/year

NUOVA GEOVIS will use this state-of-the-art composting plant, consisting of twelve biotunnels, for the stabilization of organic waste.

The composting plant is meant for the stabilization of organic material coming from the mechanical sorting of mixed municipal solid waste.

A wheel loader fills the bio-tunnels consisting of reinforced concrete cells. Each cell has the shape of a blind tunnel and is equipped with a ventilation system built into the floor.

Once the tunnel has been filled, its sliding door closes tightly in order to ensure odour control.

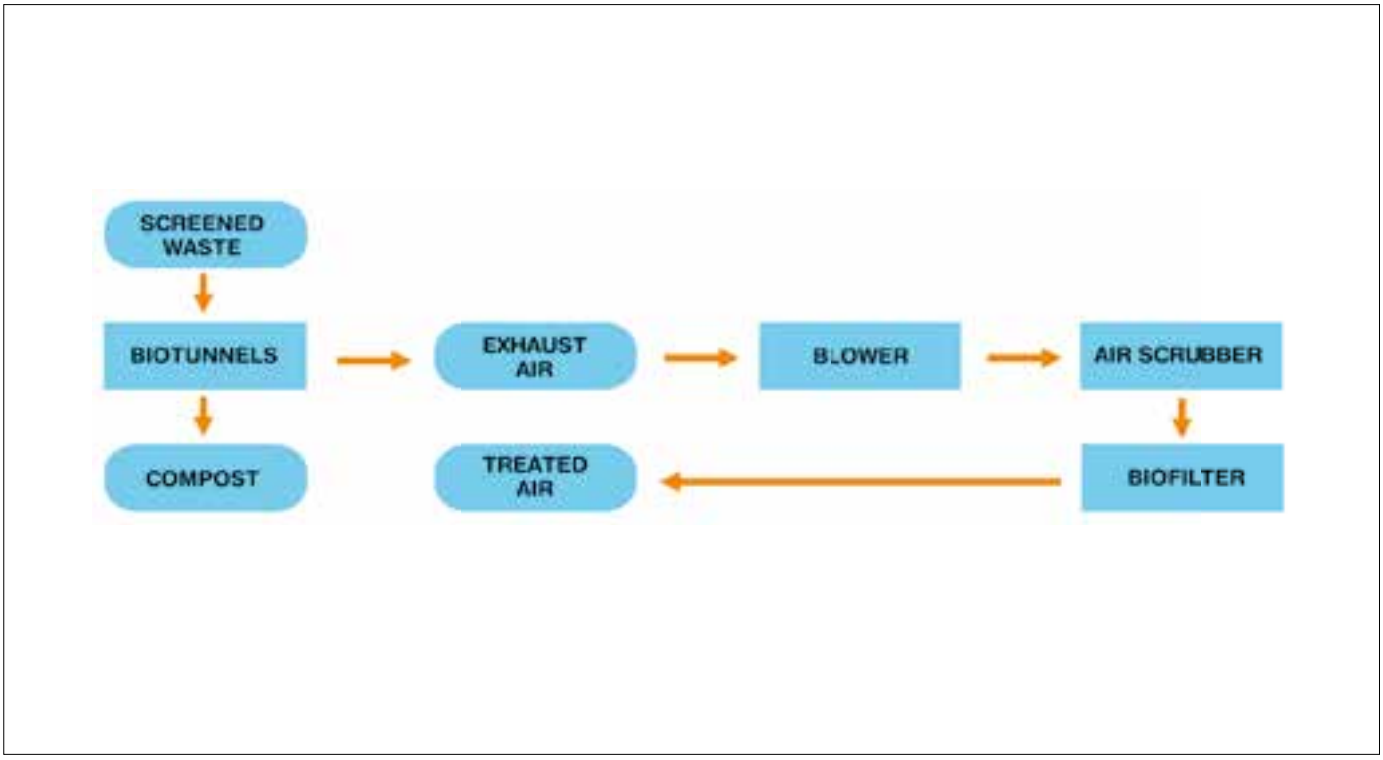
Process air is blown in through the floor and partly re-circulated in the tunnel. Exhaust air is sent, together with air coming from other areas, to the biological filter, which keeps odours under control.

The composting process is computer-controlled and based on sensors that survey the various process parameters (compost temperature, air pressure, air temperature, oxygen rate, etc.). The surveyed data are processed by the computer to regulate the system according to the process evolution in each one of the twelve tunnels.

The data processing software developed by Ecomaster is tailor-made for this facility. It allows regulating the biological stabilization process according to the operation requirements. The software has the flexibility to compensate for the variations of treated waste and ambient conditions.

In order to ensure an optimal operation, the biofilter is equipped with an air scrubber on the inlet and a sprinkler system.

Once the computer-controlled process has been completed, the material is extracted from the tunnel by means of a wheel loader. The tunnel is thus available again for the treatment of a new batch of material.



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35 MASSAFRA (TA) ITALY

Year	2003
Client	CISA SpA
Operator	CISA SpA
System description	Production of densified RDF
Waste processed	Mixed municipal solid waste
Plant capacity	93,600 t/year

For this plant, Ecomaster has designed the general treatment process, followed up some purchases and assisted the Client during installation and start-up.

This system treats special non-hazardous waste, as well as the light fraction deriving from the sorting of municipal solid waste.

First of all, the material is treated by a low-speed shredder loaded by means of a wheel loader, after waste that cannot be shredded has been separated.

A magnetic separator sorts out ferrous metals; then two ballistic separators separate heavy inerts from the material to be used for RDF production.

Each double-stage ballistic separator is equipped with slanted oscillating elements that move the light fraction forward.

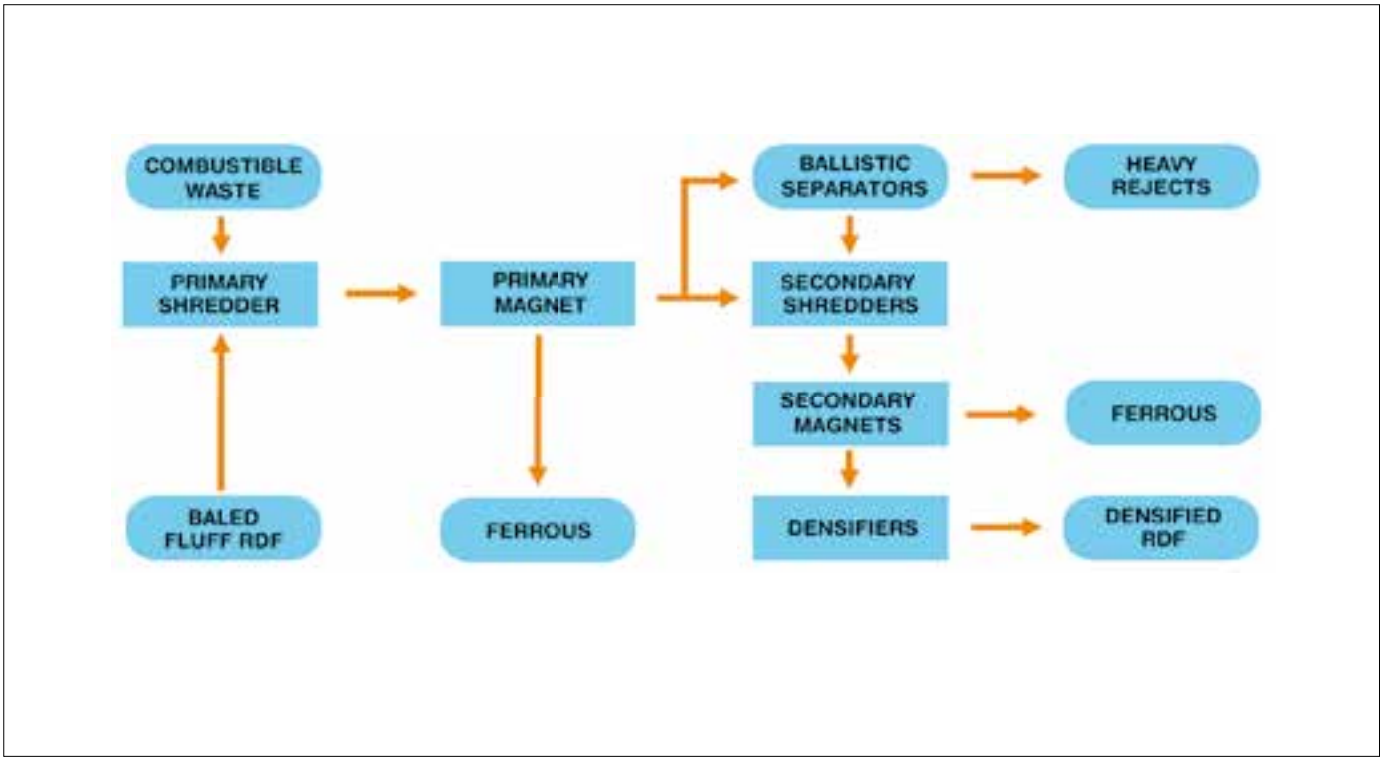
This material, containing a high quantity of combustible components, is then processed by two secondary shredders working in parallel.

The shredders have one single rotor with a low rotation speed and a grate to control the product size.

After further ferrous separation, four densifiers work in parallel. Pressure rolls push RDF through the die holes, thus ensuring material densification as well as size control.

Densified RDF is then conveyed to a system loading trucks that take the material to the neighboring resource recovery power station.

This facility also allows densifying finished RDF coming as bales.



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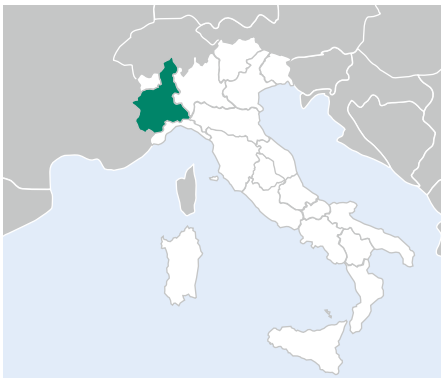
34 S. NAZZARO SESIA (NO) ITALY

Year	2003
Client	AGRITER Srl
Operator	AGRITER Srl
System description	Biofiltration of air from composting process
Waste processed	Organic waste, garden waste and sludge
Plant capacity	94,500 cu.m/hour



The exhaust air coming from the composting of organic waste and sludge is channelled to a large biofilter where odours are controlled before the air is released into the atmosphere.

Biological filtration is a very efficient process to control odours deriving from composting.

The process includes two steps: first, malodorous gases are absorbed by the superficial moisture of the filter media; then they are digested through the biological process developing spontaneously in the bio-filter.

Both processes, whether gas absorption or digestion, need water to take place. It is thus very important to keep the moisture under control in the filtering material made of wood chips. The whole process takes place in the biofilm forming on the chips surface.

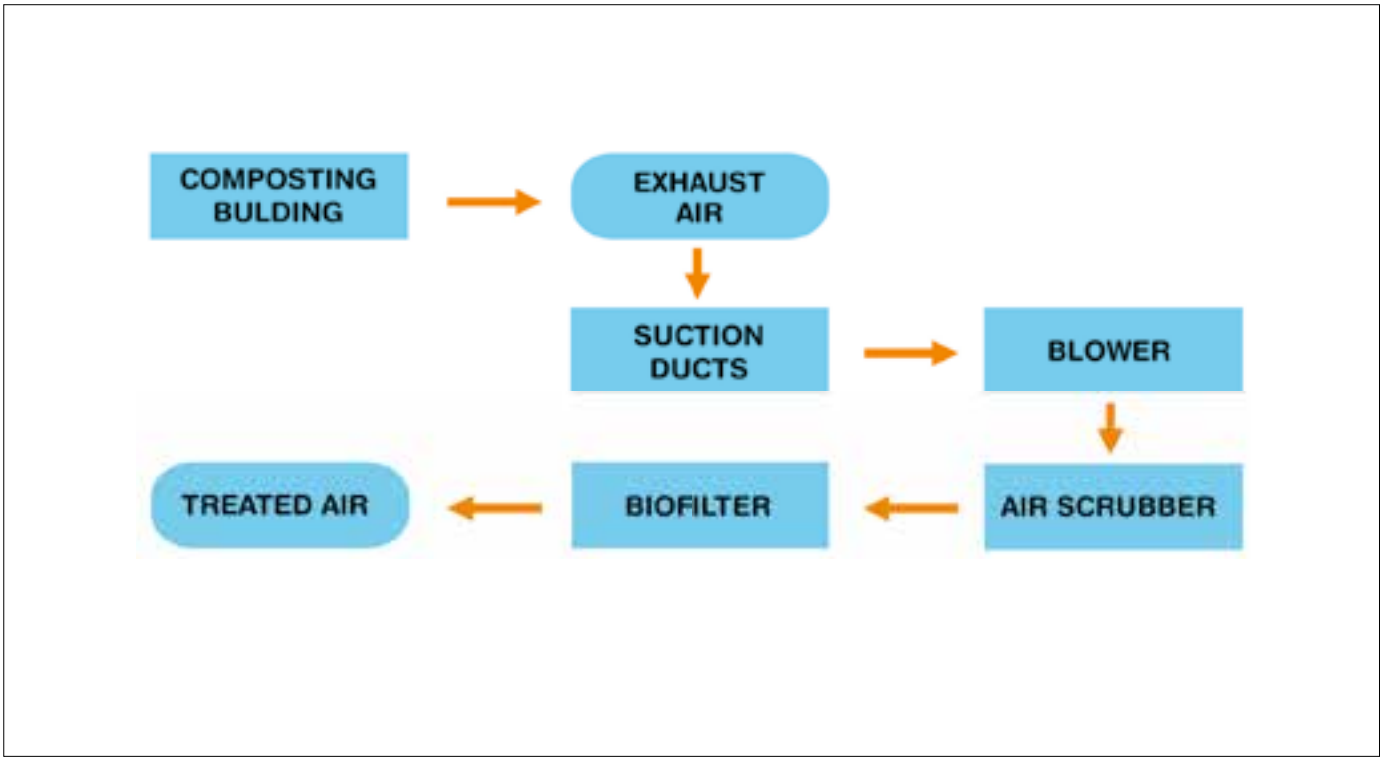
The flow of waste air is collected through a duct set up under the ceiling of the composting building by a centrifugal blower installed outdoors.

In such a way, the building is maintained at negative pressure and ventilation is provided.

The blower is equipped with a motor-driven air lock, which closes to reduce absorbed power uring start-up and opens automatically once the equipment is started.

The biofilter floor consists of prefabricated elements made of reinforced concrete, strong enough to withstand the weight of a wheel loader; this facilitates the biofilter maintenance operations. There are openings in the aerated floor elements through which the air coming from the underneath plenum goes through.

A sprinkler system has also been designed to keep the biofilter moisture under control.



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33 MASSAFRA (TA) ITALY

Year	2002
Owner	MUNICIPALITY OF MASSAFRA
Operator	CISA SpA
System description	Production of densified RDF
Waste processed	Mixed municipal solid waste
Plant capacity	110,000 t/year

Metals and inerts are sorted from waste and the resulting RDF is densified to meet the specifications of the user.

This line is designed to treat processed waste coming from the shredding, biological drying and screening system.

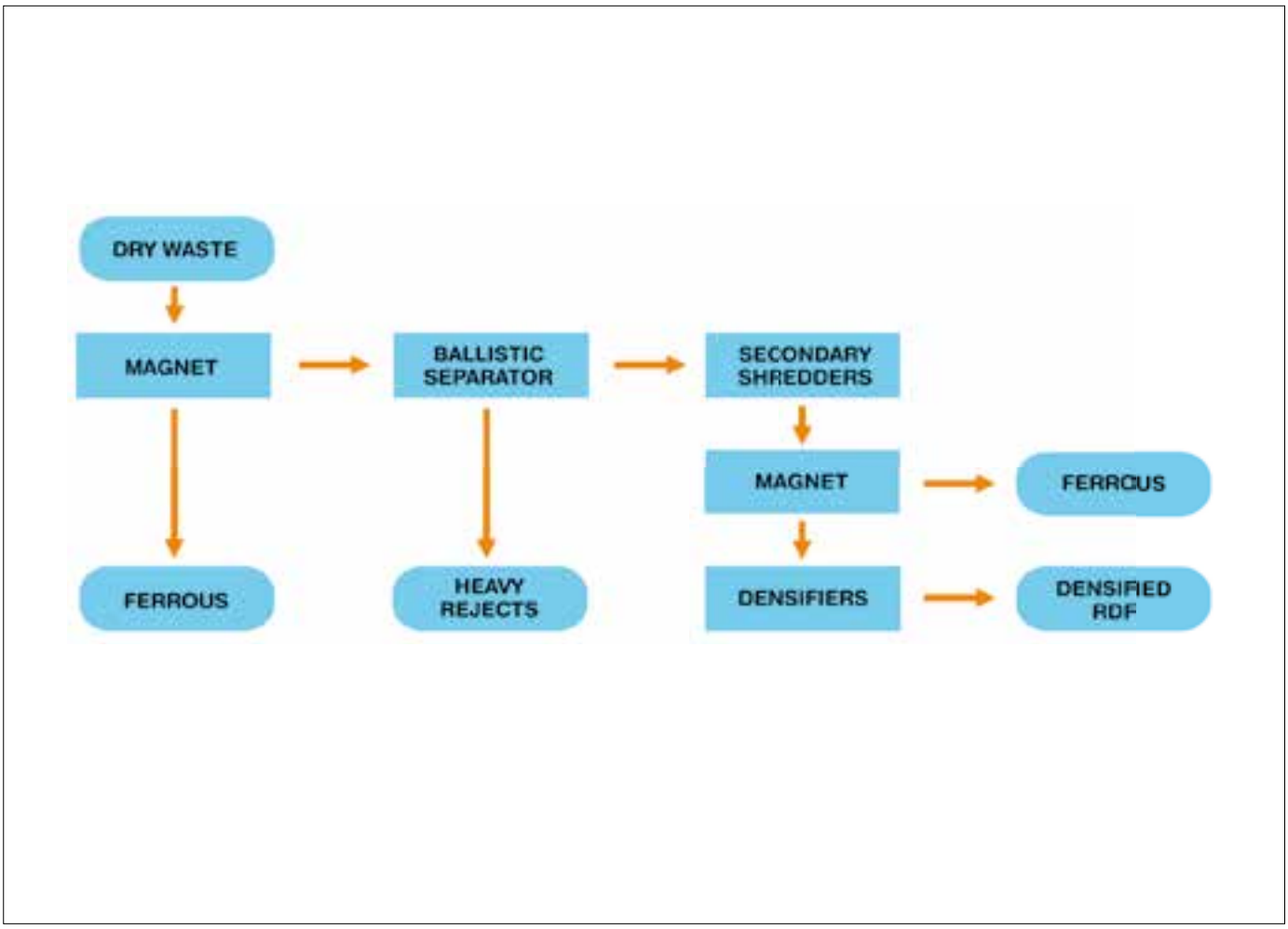
After ferrous separation, a ballistic separator separates heavy inerts from the light material to be converted into RDF.

The double-stage ballistic separator is equipped with slanted oscillating elements that move the light and flexible fraction forward. This material, containing a high quantity of combustible components, is then treated through two secondary shredders.

The shredders have one low-speed rotor and a grate to control the product size. Another magnetic separator attracts further ferrous materials after the shredding process, before they are fed to the RDF densifiers.

The two densifiers work in parallel. Pressure rolls push RDF through the die holes, thus ensuring material densification as well as size control.

Densified RDF is then transferred by means of conveyors to the system loading roll-off containers that are trucked to the neighboring resource recovery power station.



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32 MASSAFRA (TA) ITALY

Year	2002
Owner	MUNICIPALITY OF MASSAFRA
Operator	CISA SpA
System description	Tunnel bio-drying
Waste processed	Mixed municipal solid waste
Plant capacity	110,000 t/year

The drying of municipal waste is fuelled by the biological heat generated in the biotunnels through an intensive composting process.

Municipal solid waste is treated by a low-speed shredder fed by means of a chain conveyor with a rubber belt. The shredder is loaded directly by means of a wheel loader, after the separation of non-processible waste.

After ferrous separation, shredded waste is transferred to the biological stabilization system by means of a belt conveyor equipped, at the end, with a magnetic separator. Another wheel loader fills the bio-tunnels, consisting of reinforced concrete cells. Each cell has the shape of a blind tunnel and is equipped with a ventilation system built into the floor.

Once the tunnel has been filled, its sliding door closes tightly in order to ensure odour control.

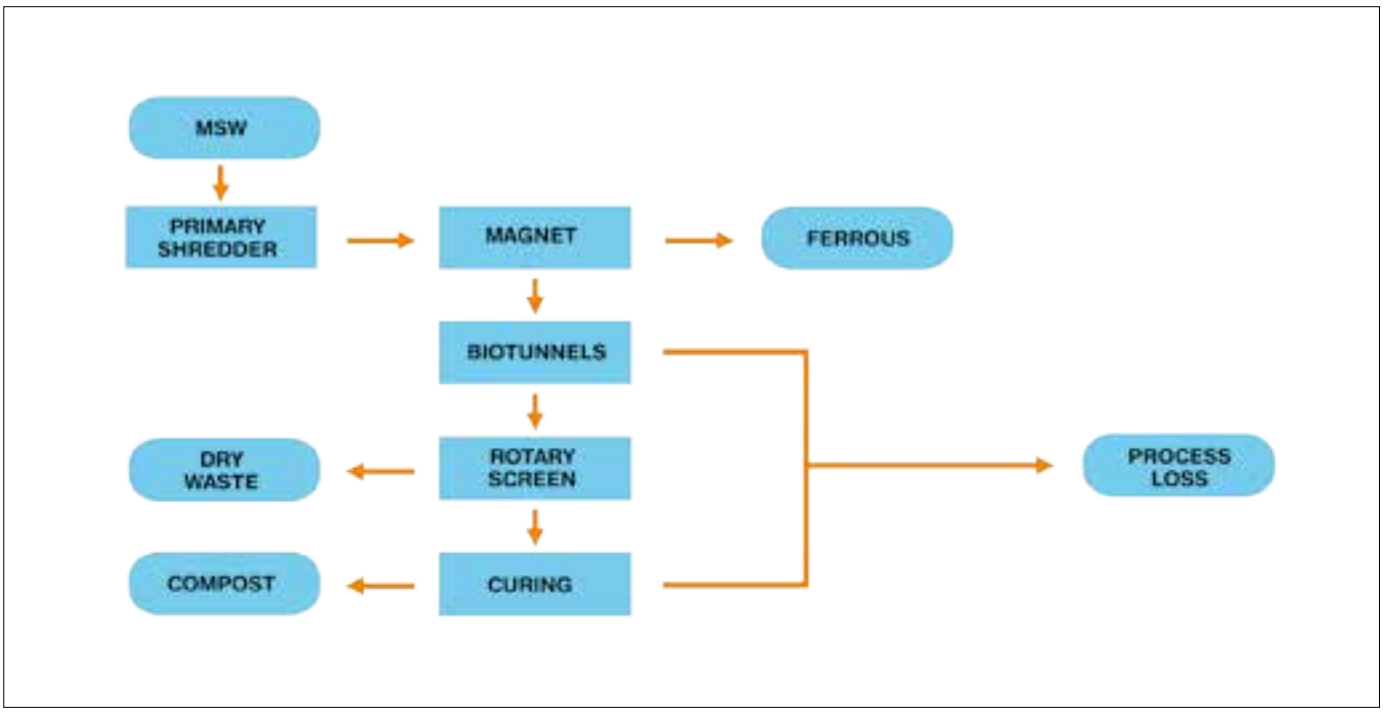
Process air is blown in through the floor and partly re-circulated in the tunnel. Exhaust air is sent to the biological filter to control odours. The excess water present in waste is evaporated and discharg-ed through the biofilter.

In order to ensure an optimal operation, the biofilter is equipped with an air scrubber on the inlet and a sprinkler system.

Once the computer-controlled process has been completed, the material is extracted from the tunnel and conveyed to the sorting area, where it goes through a screen with a rotary drum.

The undersized material is sent to the curing area where the stabilization process is completed in a static pile. The material is accumu-lated on a floor equipped with a forced ventilation system that is similar to that of the tunnels. Before the second biological phase begins, moisturizing of the material takes place for a better biological development.

It must be underlined that both stages of the biological treatment have different purposes: the first treatment (in biological cells) basically aims at drying the material, while during the second step (curing) it is important to prevent any drying of the material and allow for a better stabilization.



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31 LUGO DI RAVENNA (RA) ITALY

Year	2002
Client	MONTICAVA STRADE Srl
Operator	GRUPPO HERA SpA
System description	Compost refining
Waste processed	Raw compost
Plant capacity	25 t/hour

This compost refining line is part of the municipal waste composting facility that Ecomaster's client has built at Lugo di Ravenna. Refining includes screening and separation of inerts.

This compost refining line is part of the composting plant that Ecomaster's client has built in Lugo di Ravenna.

Stabilized compost is loaded by wheel loader into the line feeder which, besides allowing material feeding, is equipped with a dosing system consisting of two swiveling rotors.

A conveyor belt receives the material unloaded by the feeder and takes it up to the inlet of a rotary screen. The screen has a double-stage trommel, equipped with two sets of screening panels with different-sized openings.

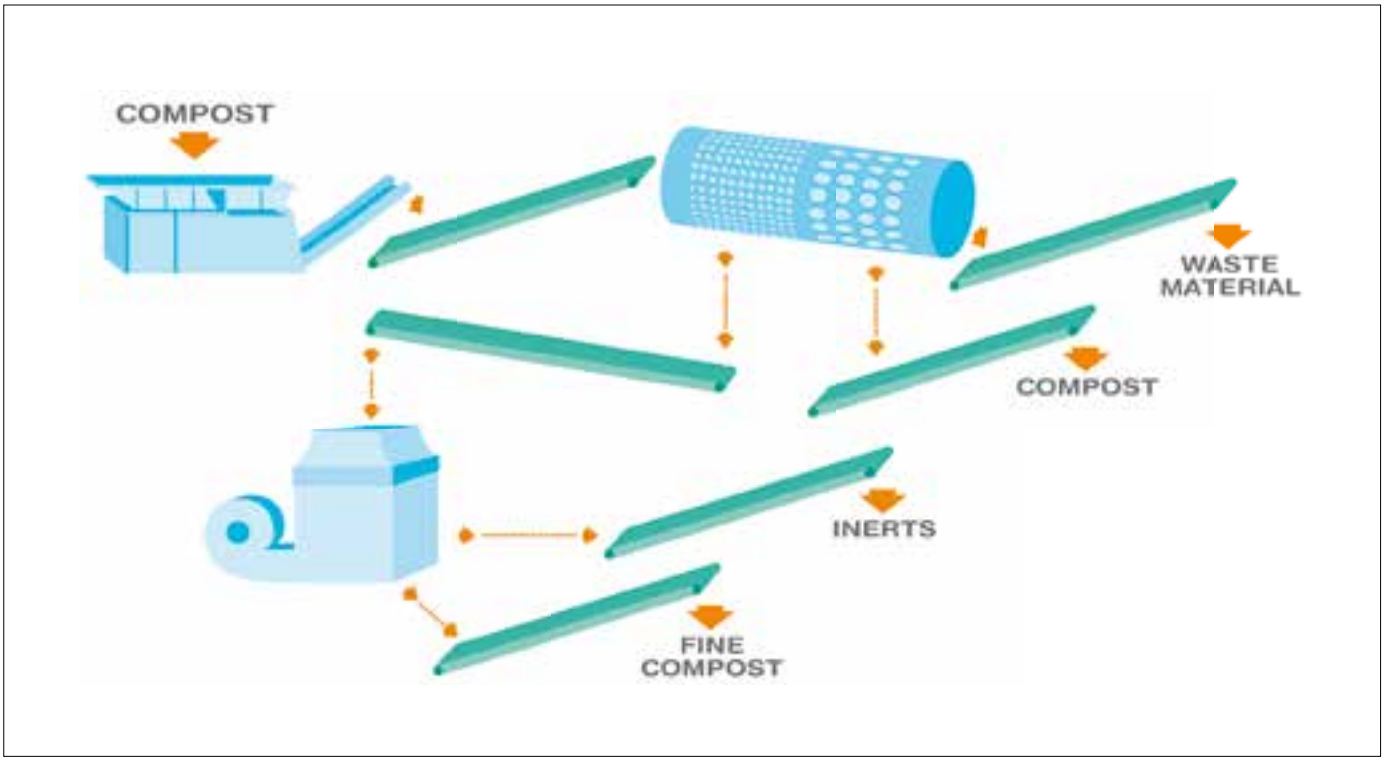
The first undersize material, the small-size one, is collected by a conveyor built into the screen and taken to a fluidized-bed separator to separate inerts. This machine performs ballistic separation of inert materials, such as glass and stones. Inerts are separated from compost by the oscillating movement of the separation chute and by the fluidification of the processed material.

Fluidification air is blown into the material by a ventilator through the holes of the perforated plate which forms the bottom of the oscillating chute.

A dust control system, including a second ventilator, an air cyclone and a bag filter, treats the air drawn from the hood of the inerts separator and from the screen covering.

Two conveyor belts collect the refined compost and inerts coming out from the fluidized bed separator. Two other conveyors are used to take large-size material and intermediate-size material separated by the rotary screen to their respective collection areas.

The intermediate-size material may be recycled in the composting process, while the large-size material is composed largely of rejects.



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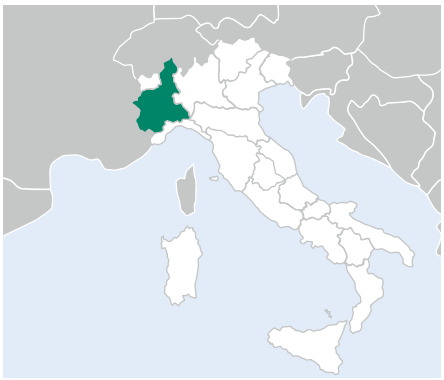
30 PIOSSASCO (TO) ITALY

Year	2002
Client	COVAR 14
Operator	COVAR 14
System description	Shredding, sorting and baling
Waste processed	Commercial, industrial waste and recyclables
Plant capacity	7,500 t/year



The material recovery facility sorts and bales commingled recyclables deriving from source-separated municipal waste and commercial and industrial waste.

The purpose of this material recovery facility is to sort commingled recyclable materials deriving from source-separated municipal solid waste, as well as waste coming from commercial and industrial activities.

A shear shredder, with double rotor, is used to shred bulky waste, which once it has been processed, can be sent by means of a reversible conveyor to roll-off containers.

Another conveyor feeds the manual sorting room, where operators sort the waste transported by the sorting conveyor that goes across this room.

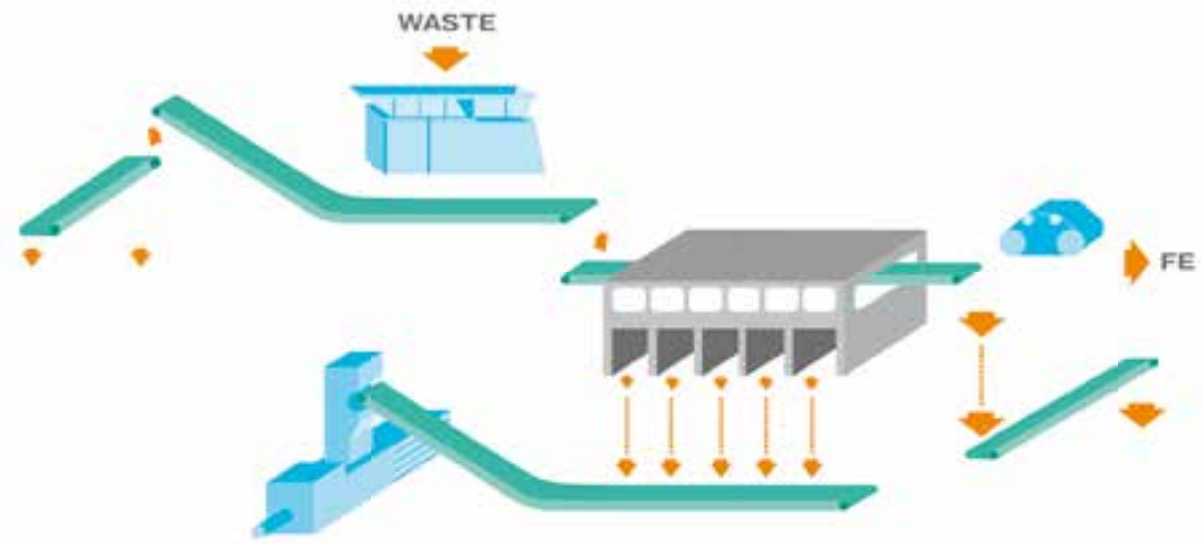
It is possible to separate up to five different materials, stored in the bunkers under the sorting room, from where they can be transferred, by means of a wheel loader, to the baler feeder.

The hydraulic baler is of the continuous type and is provided with an automatic bale-tying system. The bales are handled by means of a forklift.

The baler can also be fed directly with materials that do not need to be sorted. This is done by pushing these materials onto the press feeder, by means of a wheel loader on the opposite side of the feeder.

At the end of the sorting conveyor there is a magnetic separator for recovering ferrous metals, while the remaining flow is taken by conveyor belt to a roll-off container.

For this plant, Ecomaster's contract includes not only the supply, installation and start-up of the equipment, but also the construction of the buildings and other civil works.



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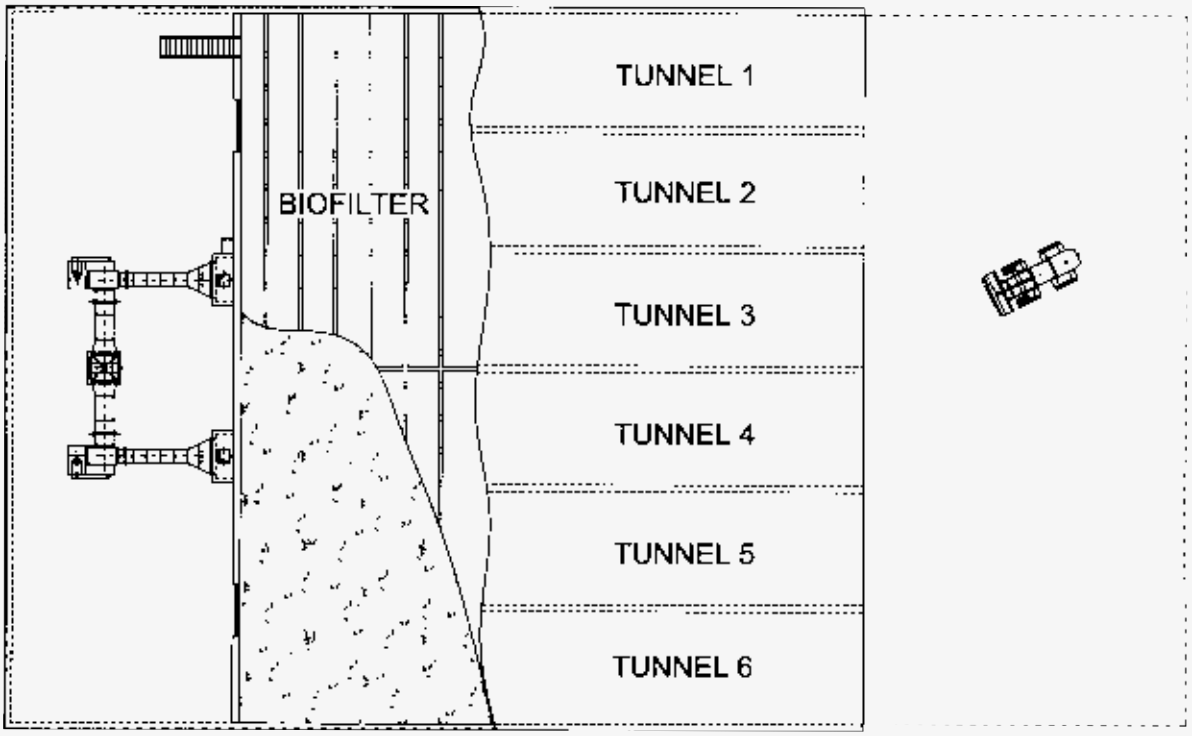
29 SIDERNO (RC) ITALY

Year	2002
Client	TM.E. SpA - TERMOMECCANICA ECOLOGIA
Operator	TM.E. SpA - TERMOMECCANICA ECOLOGIA
System description	Tunnel composting
Waste processed	Mixed and source separated organic
Plant capacity	32,000 t/year

Tunnel composting technology is used to process organics from mixed and source-separated municipal waste.
The biological process takes place inside closed reactors, consisting of tunnels made of reinforced concrete with an aeration system integrated into the floor.



The plant uses biotunnel composting technology for the biological treatment of or-ganic waste deriving from screened mixed municipal waste, as well as organic material deriving from source separation.

The process takes place in six closed reactors, consisting of reinforced concrete tunnels with an aeration system integrated in the floor.

The air blown into the material through the floor is in part re-circulated inside the tunnel and in part sent to the odour control system. Air coming from the waste-sorting areas is used as fresh process air in the tunnels, so the total volume of waste air is lowered without negatively affecting the ventilation of the buildings. A sophisticated collection and treatment system for leachates ensures correct tunnel drainage and allows the liquid to be re-used for moisturizing the processed material by means of nozzles set up under the ceiling of each tunnel.

Once the tunnel has been loaded with the wheel loader, its special door is closed and the process begins. At the end of the treatment the tunnel is emptied and a new cycle begins.

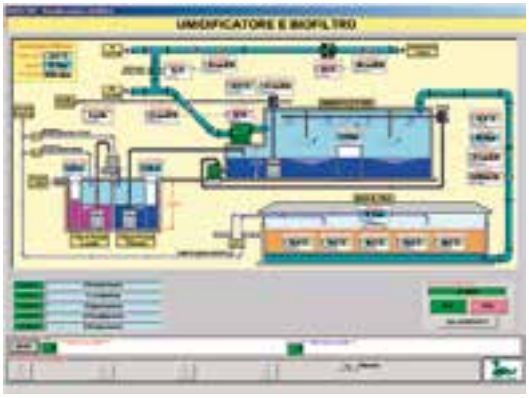
A computerized control system, including visualization on PC with colour graphics, monitors the process and keeps its parameters within preset ranges, which differ according to each stage of the process.

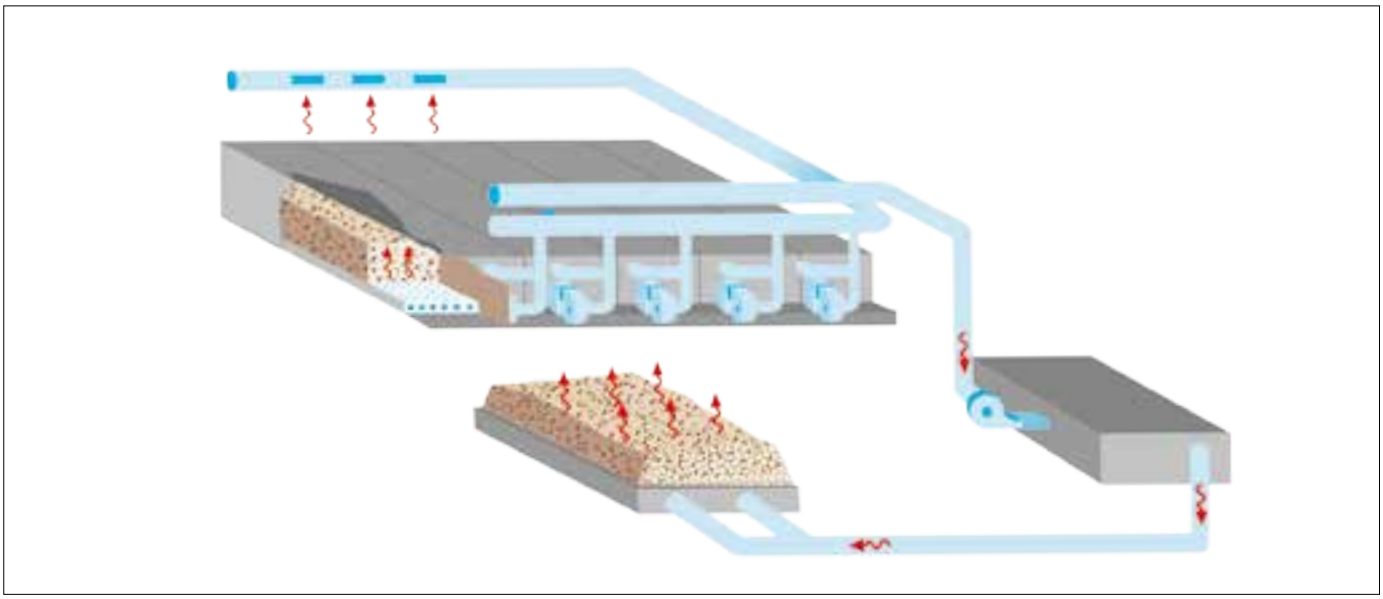
Many process parameters are measured by sensors set up in various parts of the system. For instance, material temperature, air temperature, oxygen content in the air, air pressure and air flow are continuously monitored and recorded.

To control odours, the air exhausted from the tunnels, mixed with the air flow coming from the areas where waste is mechanically processed, is treated in a large biofilter. Biofiltration controls odours very efficiently because malodorous gases, absorbed by the superficial moisture of the filter media, are quickly digested through a biological process.

The centralized control system also monitors the biofiltration process, which takes place after the air flow has gone through a scrubber.

Due to the lack of space in this facility, the biofilter was installed on top of the roof of the composting tunnels.





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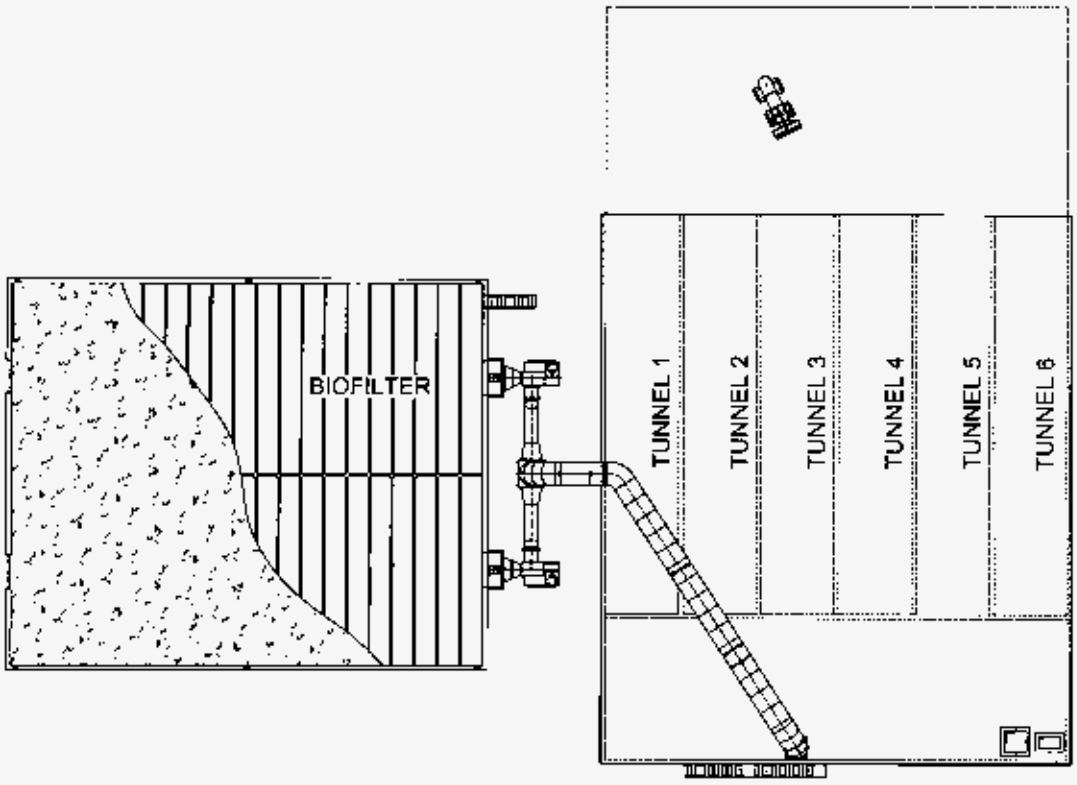
28 SAMBATELLO (RC) ITALY

Year	2002
Client	TM.E. SpA - TERMOMECCANICA ECOLOGIA
Operator	TM.E. SpA - TERMOMECCANICA ECOLOGIA
System description	Tunnel composting
Waste processed	Mixed and source separated organic
Plant capacity	32,000 t/year

Tunnel composting technology is used to process organics from mixed and source-separated municipal waste.
The biological process takes place inside closed reactors, consisting of tunnels made of reinforced concrete with an aeration system integrated into the floor.



The plant uses biotunnel composting technology for the biological treatment of organic waste deriving from screened mixed municipal waste, as well as organic material deriving from source separation.

The process takes place in six closed reactors, consisting of reinforced concrete tunnels with an aeration system integrated in the floor.

The air blown into the material through the floor is in part re-circulated inside the tunnel and in part sent to the odour control system. Air coming from the waste-sorting areas is used as fresh process air in the tunnels, so the total volume of waste air is lowered without negatively affecting the ventilation of the buildings. A sophisticated collection and treatment system for leachates ensures correct tunnel drainage and allows the liquid to be re-used for moisturizing the processed material by means of nozzles set up under the ceiling of each tunnel.

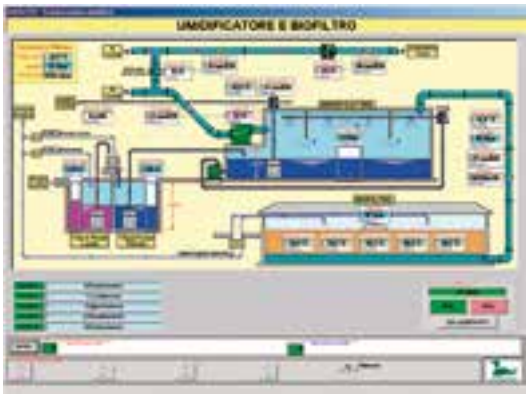
Once the tunnel has been loaded with the wheel loader, its special door is closed and the process begins. At the end of the treatment the tunnel is emptied and a new cycle begins.

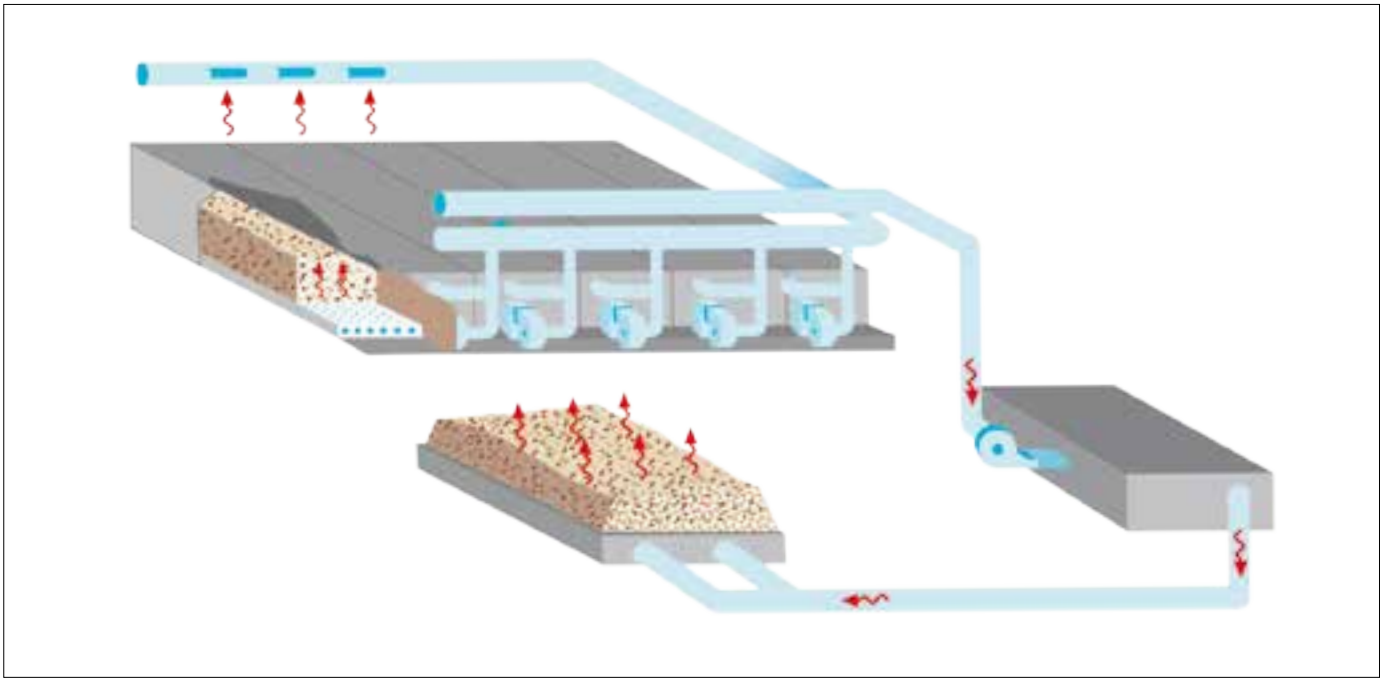
A computerized control system, including visualization on PC with colour graphics, monitors the process and keeps its parameters within preset ranges, which different according to each stage of the process.

Many process parameters are measured by sensors set up in various parts of the system. For instance, material temperature, air temperature, oxygen content in the air, air pressure and air flow are continuously monitored and recorded.

To control odours, the air exhausted from the tunnels, mixed with the air flow coming from the areas where waste is mechanically processed, is treated in a large biofilter. Biofiltration controls odours very efficiently because malodorous gases, absorbed by the superficial moisture of the filter media, are quickly digested through a biological process.

The centralized control system also monitors the biofiltration process, which takes place after the air flow has gone through a scrubber.





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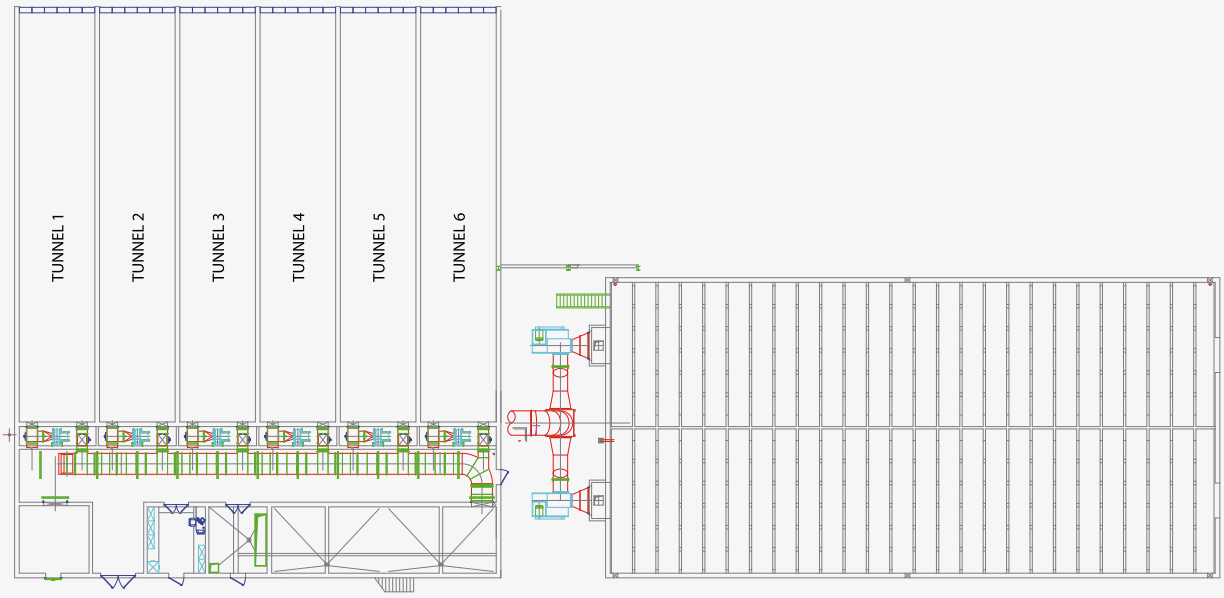
27 CROTONE (KR) ITALY

Year	2002
Client	TM.E. SpA - TERMOMECCANICA ECOLOGIA
Operator	TM.E. SpA - TERMOMECCANICA ECOLOGIA
System description	Tunnel composting
Waste processed	Mixed and source separated organic
Plant capacity	25,000 t/year

Tunnel composting technology is used to process organics from mixed and source-separated municipal waste.
The biological process takes place inside closed reactors, consisting of tunnels made of reinforced concrete with an aeration system integrated into the floor.



The plant uses biotunnel composting technology for the biological treatment of or-ganic waste deriving from screened mixed municipal waste, as well as organic material deriving from source separation.

The process takes place in six closed reactors, consisting of reinforced concrete tunnels with an aeration system integrated in the floor.

The air blown into the material through the floor is in part re-circulated inside the tunnel and in part sent to the odour control system. Air coming from the waste-sorting areas is used as fresh process air in the tunnels, so the total volume of waste air is lowered without negatively affecting the ventilation of the buildings. A sophisticated collection and treatment system for leachates ensures correct tunnel drainage and allows the liquid to be re-used for moisturizing the processed material by means of nozzles set up under the ceiling of each tunnel.

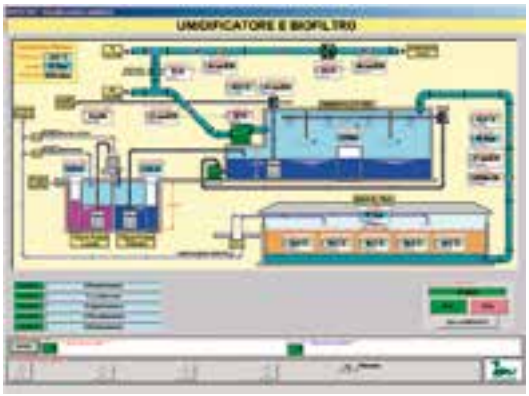
Once the tunnel has been loaded with the wheel loader, its special door is closed and the process begins. At the end of the treatment the tunnel is emptied and a new cycle begins.

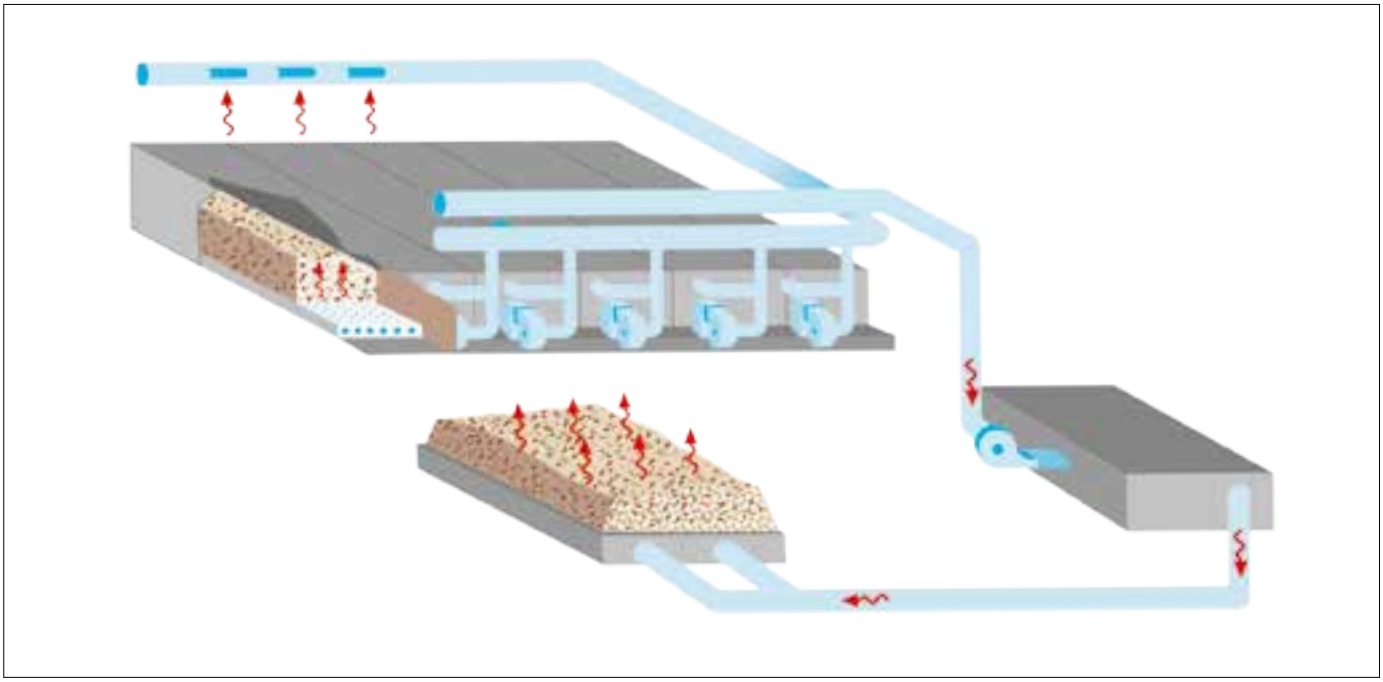
A computerized control system, including visualization on PC with colour graphics, monitors the process and keeps its parameters within preset ranges, which differ according to each stage of the process.

Many process parameters are measured by sensors set up in various parts of the system. For instance, material temperature, air temperature, oxygen content in the air, air pressure and air flow are continuously monitored and recorded.

To control odours, the air exhausted from the tunnels, mixed with the air flow coming from the areas where waste is mechanically processed, is treated in a large biofilter. Biofiltration controls odours very efficiently because malodorous gases, absorbed by the superficial moisture of the filter media, are quickly digested through a biological process.

The centralized control system also monitors the biofiltration process, which takes place after the air flow has gone through a scrubber.





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26 MASSAFRA (TA) ITALY

Year	2001
Client	EUROENERGY GROUP Srl
Operator	APPIA ENERGY Srl
System description	Fuel feeding system for power generation
Waste processed	DF-Refused derived fuel and biomass
Plant capacity	15 t/hour

Ecomaster supplied the fuel feeding system for the Appia Energy project using RDF and biomass to generate electric power.

For this project, Ecomaster supplied the fuel feeding system for the Appia Energy plant, which uses RDF and biomass to generate electric power.

In the fuel receiving and storing building there is a floor feeder, which is loaded by means of a wheel loader.

The rubber conveyor belt is chaindriven.

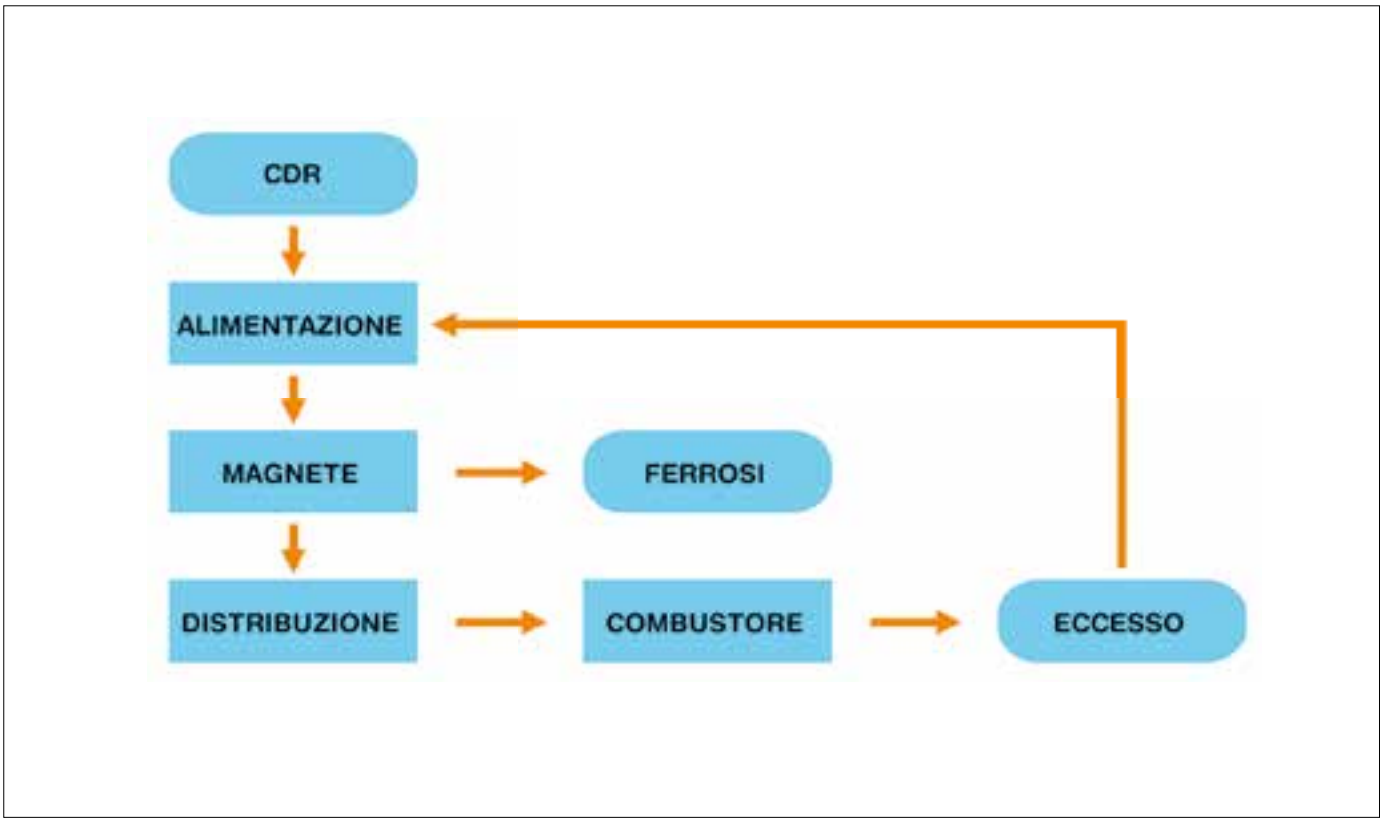
A conveyor belt takes the fuel up to the level of the steam-generator feeder. A magnet with a self-cleaning belt is set up on this line, separating possible ferrous metals from the fuel.

In order to feed the steam generator contin-uously, excess fuel is unloaded into the distribution auger conveyor, also supplied by Ecomaster. The auger conveyor distributes fuel to the two feeding inlets on the steam generator.

A conveyor belt takes the excess fuel back to the storage building, where a reversible conveyor can unload it onto the floor or send it to a recirculating conveyor, which brings it back to the feeder.

The plant includes an odour control system for the fuel storage building. A centrifugal ventilator draws air from the ventilation ducts and sends it to a biofilter.

Upstream of the biofilter there is a scrubbing chamber in which water is sprayed to prevent the filtering material from drying. In fact, to ensure odour control, the filter material must be constantly covered by a superficial layer of moisture where malodorous gases are absorbed before being biologically digested by the microorganisms that develop in the water layer.



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25 ROSSANO (CS) ITALY

Year	2001
Client	TM.E. SpA - TERMOMECCANICA ECOLOGIA
Operator	TM.E. SpA - TERMOMECCANICA ECOLOGIA
System description	Sorting and baling
Waste processed	Commingled recyclables (paper, plastic and metals)
Plant capacity	3 t/hour

The facility is designed to recover commingled recyclable materials deriving from source-separated municipal waste. Sorting is done both automatically and manually.

This material recovery facility is de-signed to process commingled recyclable materials deriving from source separation of municipal waste.

A belt feeder, located in a receiving building whose floor is set at a higher level than that of the sorting building, unloads the material to be treated directly on the sorting conveyor. The conveyor is in a room where operators perform manual sorting of recyclable materials that are dropped in the three underlying bunkers made of reinforced concrete.

The recyclable materials, separated in the sorting room, are cardboard, paper and plastics. They are loaded on the baler feeder by means of a wheel loader.

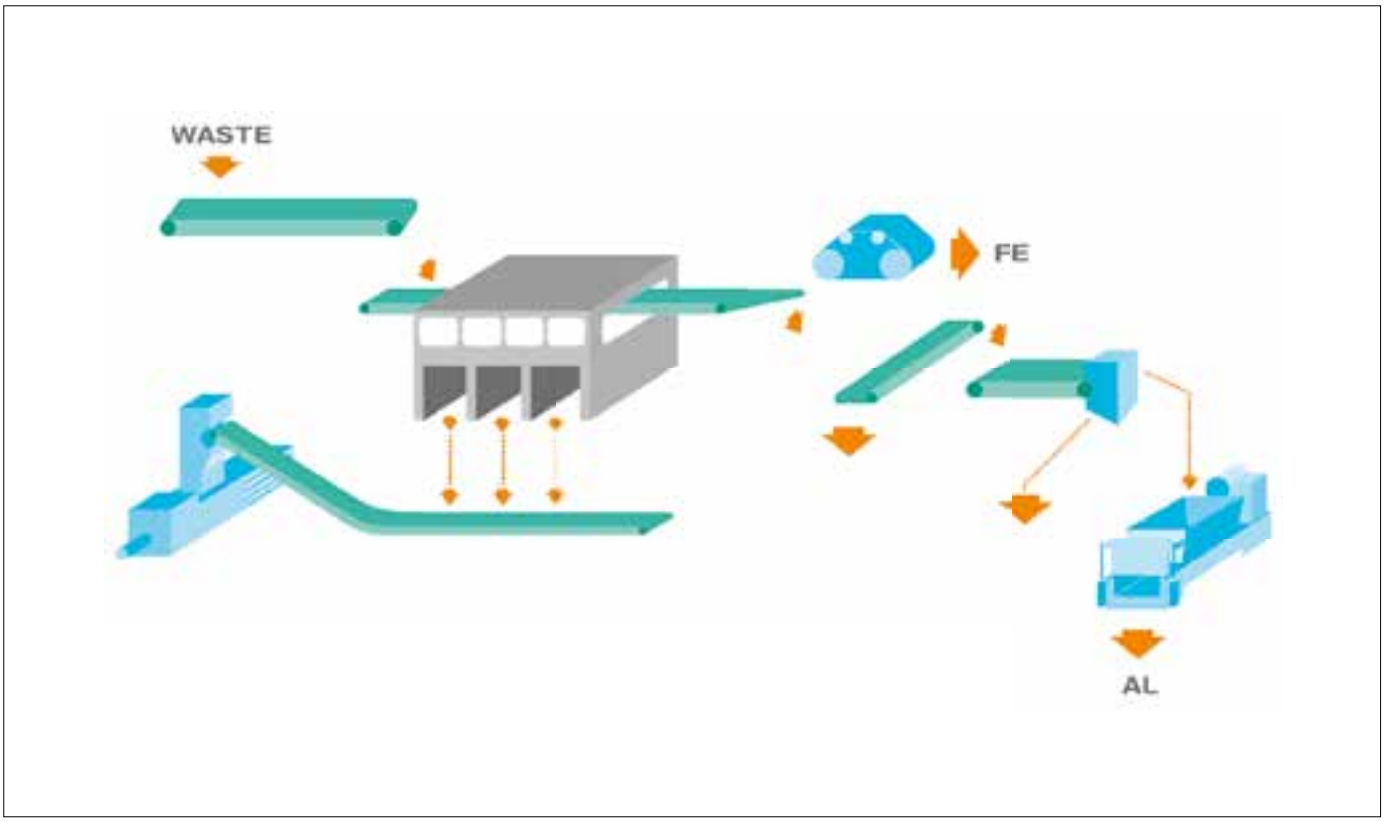
The hydraulic baler is of the continuous type and is provided with an automatic bale-tying system. A forklift handles the bales.

At the end of the sorting conveyor there is a magnet for the separation of ferrous cans. A conveyor belt transfers the remaining flow to an induction separator, which automatically separates aluminum cans.

A second, smaller baler processes metals.

The conveyor feeding the non-ferrous metals separator can be reversed, so that it is possible to by-pass the separator by directly sending the material to the last storage bunker. This design makes the plant more flexible because operations can be adjusted to suit the type of treated material by choosing positive or negative manual sorting, according to need.

Negative sorting means that the material to be recovered is left on the sorting belt and reject materials are picked off the belt. This increases the sorting line's throughput capacity.



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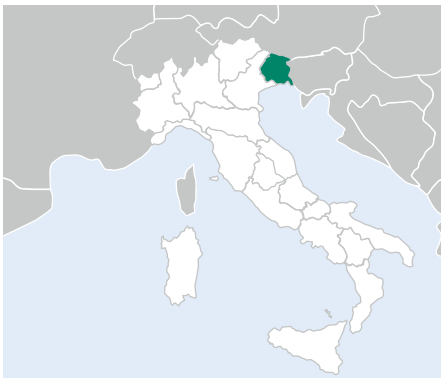
24 UDINE (UD) ITALY

Year	2001
Client	CENTRO RECUPERO CARTA SpA
Operator	CENTRO RECUPERO CARTA SpA
System description	Sorting of paper for de-inking
Waste processed	Mixed paper from municipal waste
Plant capacity	15 t/hour



The Centro Recupero Carta facility has a plant with two ballistic separators for automatic waste-paper sorting, which significantly reduces the manpower required for manual sorting.

Centro Recupero Carta SpA acquired this, the third, plant from Ecomaster, which had supplied the first one in 1994.

Paper mills now produce paper for newspapers using 100% recycled paper treated in their de-inking plants. This has made specifications even more restrictive for the acceptance of waste paper as raw material. In particular, newsprint must be separated from cardboard and small-size paper as they are not suitable for deinking.

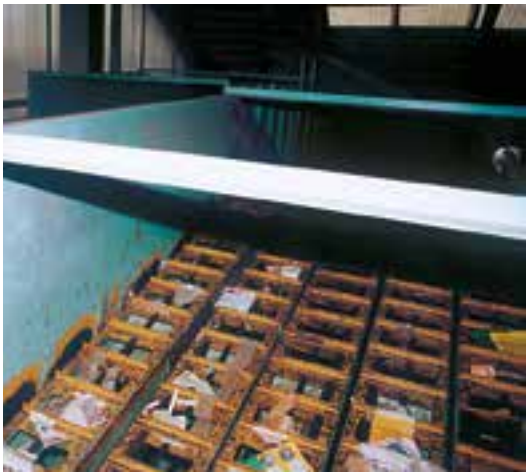
Centro Recupero Carta's plant has two ballistic separators set up in sequence; they automatically select paper, thus limiting the use of manpower for manual selection.

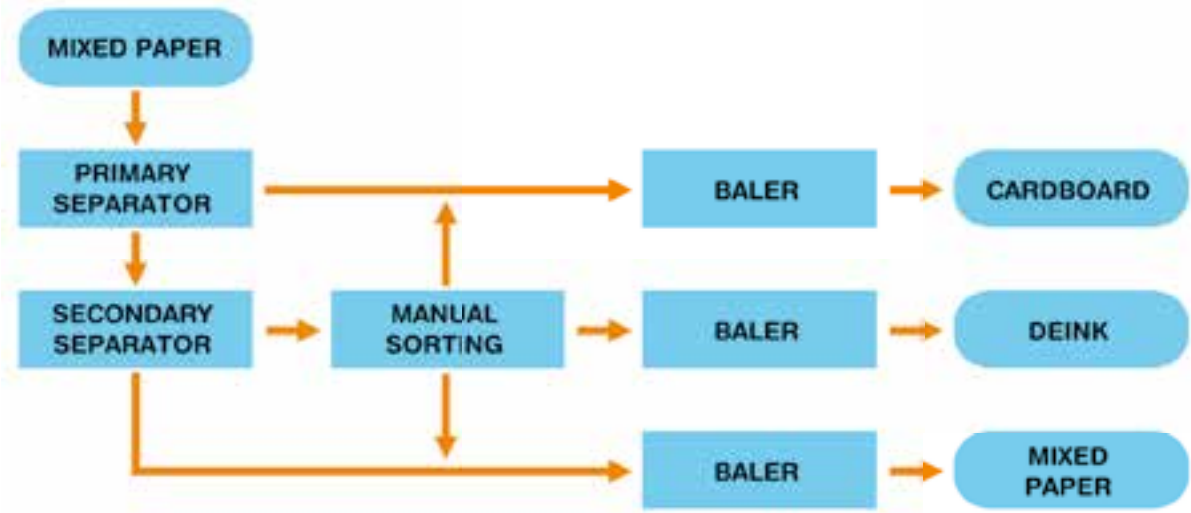
Ballistic separators are special screens where screening is favored by the ballistic effect induced by oscillating elements that form the screening surface.

The first ballistic separator screens cardboard, which is sent to one of three balers, which were bought by the customer, while small-size material is sent to the second separator. This machine eliminates small size paper, which is then packed by the press used only for less valuable paper product.

The large size material separated by the secondary ballistic separator, in other words material to be de-inked, is manually sorted in the plant previously designed by Ecomaster because cardboard and low quality paper are still present, even if in a limited quantity.

The conveying system of the plant is designed so that each product is taken directly to the relative baler, without any need for further handling.





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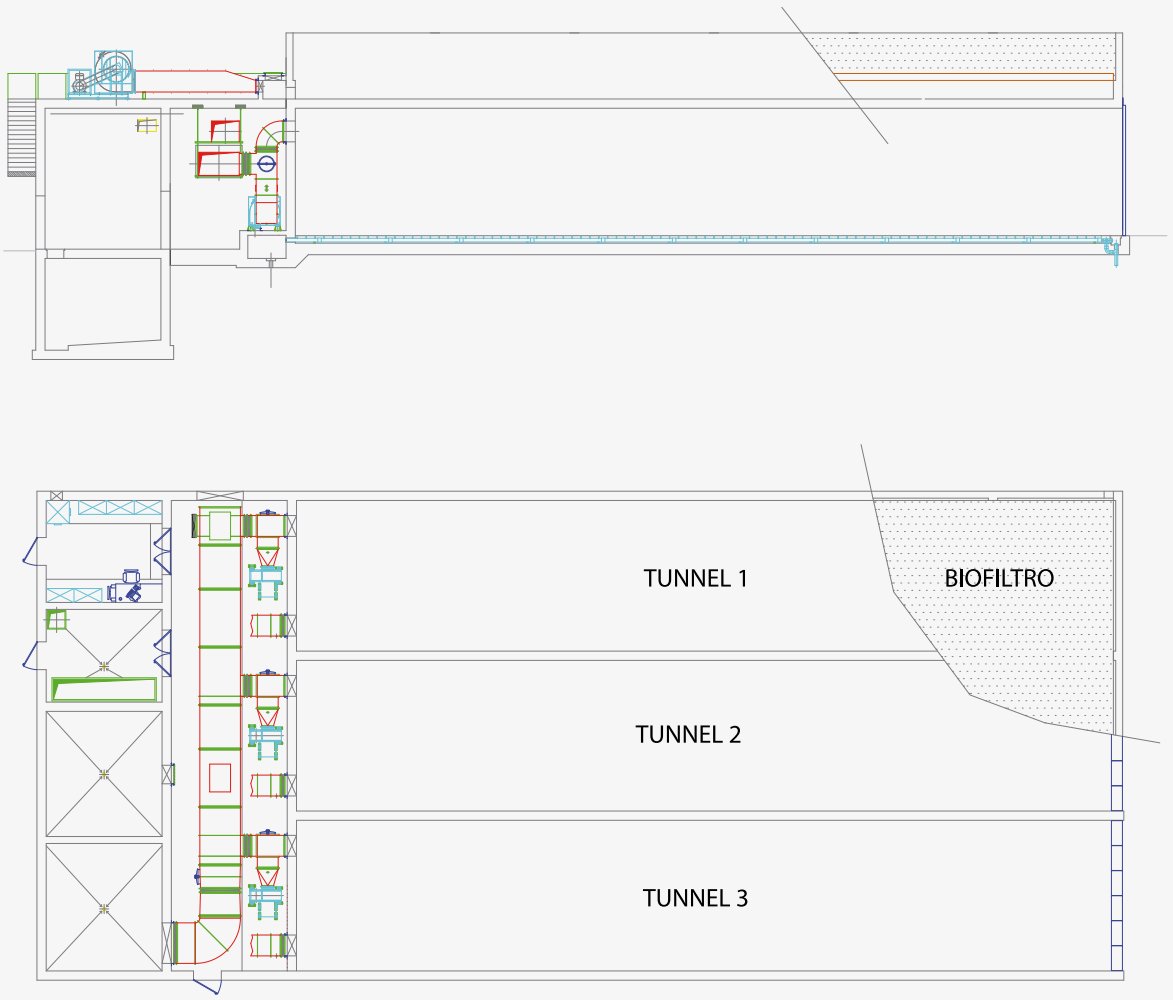
23 GIOIA TAURO (RC) ITALY

Year	2001
Client	TM.E. SpA - TERMOMECCANICA ECOLOGIA
Operator	TM.E. SpA -TERMOMECCANICA ECOLOGIA
System description	Tunnel composting
Waste processed	Organic from mixed municipal solid waste
Plant capacity	16,000 t/year

Tunnel composting technology is used to process organics from mixed municipal waste. The biological process takes place inside closed reactors, consisting of tunnels made of reinforced concrete with an aeration system integrated into the floor.



The plant uses the biotunnel composting technology for the biological treatment of organic waste deriving from the screening of mixed municipal waste.

The process takes place in three closed reactors, consisting of reinforced concrete tunnels equipped with a ventilation system integrated in the floor.

The air blown into the material through the floor is in part re-circulated inside the tunnel and in part sent to the odour control system. Air coming from the waste-sorting areas is used as fresh process air in the tunnels, so the total volume of waste air is lowered without having a negative effect on the buildings' ventilation.

A sophisticated collection and treatment system for leachates ensures correct tunnel drainage and allows the liquid to be re-used for moisturizing the processed material by means of nozzles set up under the ceiling of each tunnel.

Once the tunnel has been loaded with the wheel loader, its special door is closed and the process begins, which lasts approximately two weeks. At the end of the treatment the tunnel is emptied and a new cycle begins.

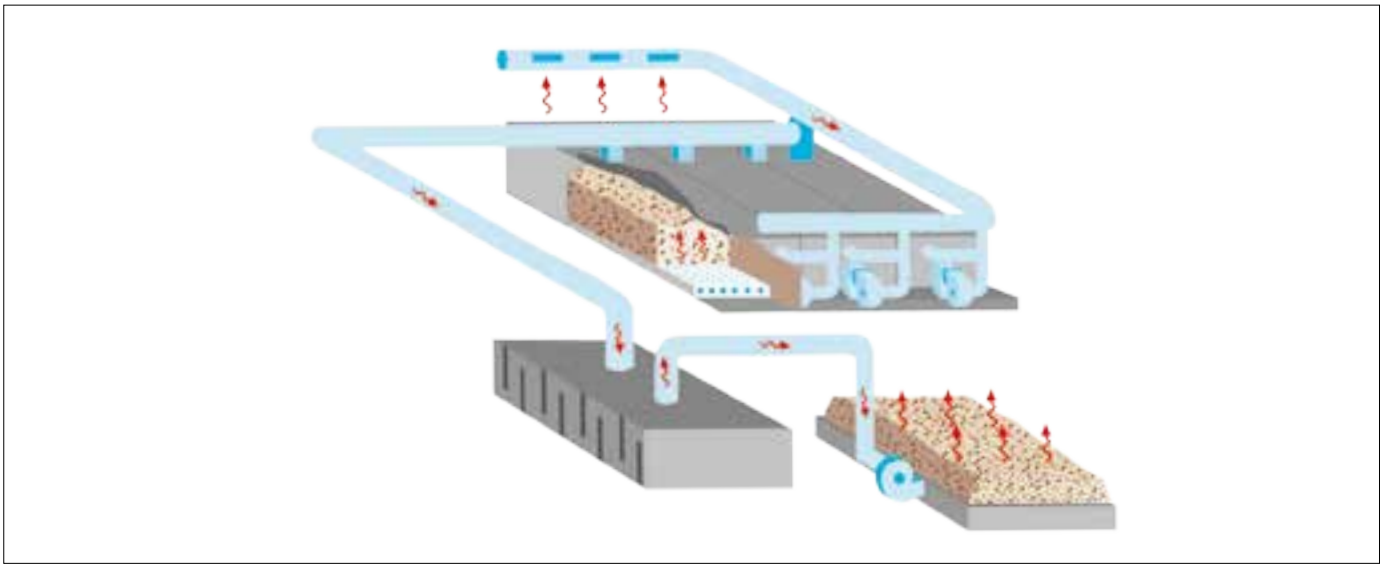
A computerized control system, including visualization on PC with colour graphics, monitors the process and keeps its parameters in preset ranges, which are different for every stage of the process.

Many process parameters are measured by sensors set up in various parts of the system. For instance, material temperature, air temperature, oxygen content in the air, air pressure and air flow are continuously monitored and recorded.

To control odours, the air exhausted from the tunnels, mixed with the air flow coming from the areas where waste is mechanically processed, is treated in a large biofilter. Biofiltration controls odours very efficiently because malodorous gases, absorbed by the superficial moisture of the filter media, are quickly digested through a biological process.

The centralized control system also surveys the biofiltration process, which takes place after the air flow has gone through a scrubber.

In this plant, due to lack of space, the biofilter was set up on top of the roof of the composting tunnels.



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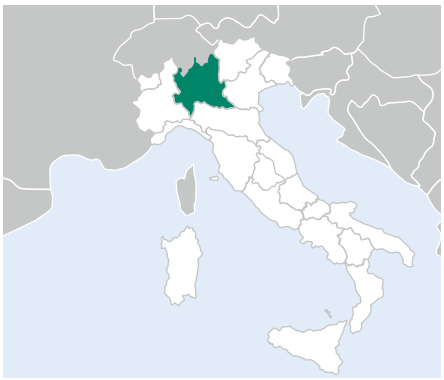
22 GRASSOBBIO (BG) ITALY

Year	2001
Client	SPURGHI F.LLI TERZI Srl
Operator	SPURGHI F.LLI TERZI Srl
System description	Tunnel composting
Waste processed	Organic waste, garden waste and sludge
Plant capacity	30,000 t/year



Tunnel composting technology is used to process organics from source-separated municipal waste and sludge from waste water treatment. The biological process takes place inside closed reactors, consisting of tunnels made of reinforced concrete with an aeration system integrated into the floor.

The plant uses tunnel composting technology for biological treatment of source-separated organic waste in order to hygienize and stabilize it, which, after the curing phase, produces quality compost. The process takes place in three closed reactors, consisting of reinforced concrete tunnels equipped with a ventilation system integrated in the floor.

The air blown into the material through the floor is partly re-circulated inside the tunnel and partly sent to the odour control system. Air coming from the areas where waste is sorted is used as fresh process air in the tunnels, so the total volume of waste air is reduced without negatively effecting on the ventilation of the buildings.

A sophisticated collection and treatment system for leachates ensures the correct drainage of tunnels and allows re-using the liquid for moisturizing the material processed by means of nozzles set up under the ceiling of each tunnel.

The material to be biologically treated is prepared by mixing source-separated organic waste, shredded green waste and recycled material deriving from the final screening of produced compost. Once the tunnel has been loaded with the wheel loader, its special door is closed and the process begins. At the end of the treatment the tunnel is emptied and a new cycle begins.

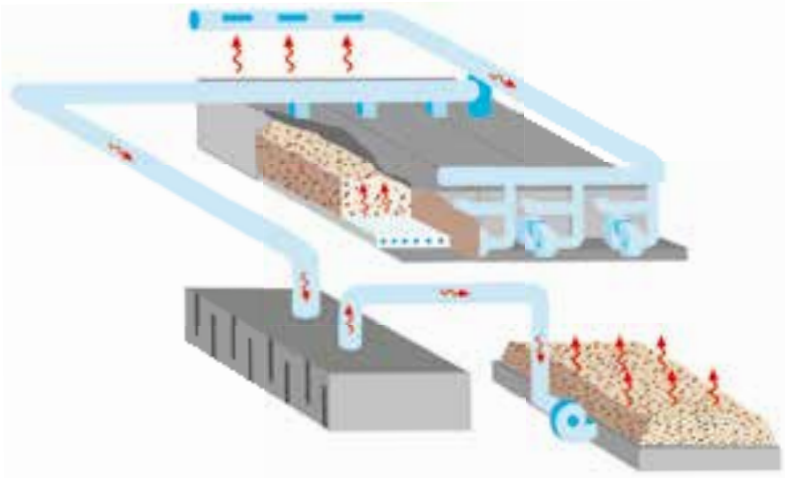
A computerized control system, including visualization on PC with colour graphics, surveys the process and keeps its parameters in the preset ranges, that are different for every stage of the process.

Many process parameters are measured by sensors set up in various parts of the system. For instance, material temperature, air temperature, oxygen content in the air, air pressure and air flow are continuously monitored and recorded.

To control odours, the air exhausted from the tunnels, mixed with the air flow coming from the areas where waste is mechanically processed, is treated in a large biofilter. Biofiltration controls odours very efficiently because malodorous gases, absorbed by the superficial moisture of the filter media, are quickly digested through a biological process.

The centralized control system also surveys the biofiltration process, which takes place after the air flow has gone through a scrubber.

After the treatment in the biotunnels, the material is moved to the curing area, which has an aerated floor.



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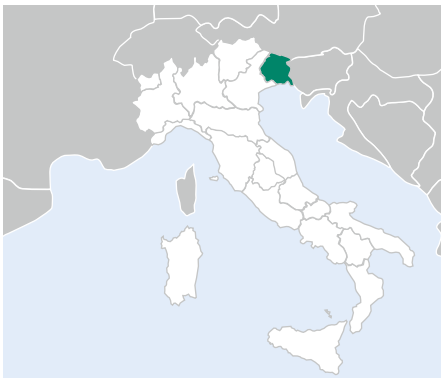
21 MONFALCONE (GO) ITALY

Year	2000
Client	MUNICIPALITY OF MONFALCONE
Operator	MUNICIPALITY OF MONFALCONE
System description	Big Bag composting
Waste processed	Garden waste
Plant capacity	24 big bags



The core of this facility is its big-bag composting system, a technology invented and developed by Ecomaster whose innovative content was recognized by both the European Patent Office and the United States Patent Office.

This plant is based on the big bag composting system, a technology ideated and developed by Ecomaster which has innovative content recognized both by the European Patent Office and the United States Patent Office. These two bodies, after a severe examination procedure, have both accepted the patent application submitted by Ecomaster for this industrial invention.

Organic waste from gardens is composted in big bags made of a synthetic fabric permeable to air. Each big bag may contain approximately 1,400 liters of material, which corresponds to a weight of 700 kg approximately.

Aerobic conditions, fundamental for a proper biological process, are maintained by forced ventilation of the mass through a perforated duct, which is placed inside the big bag before its filling. These ducts are connected to the system ventilator through flexible air ducts with quick release connections.

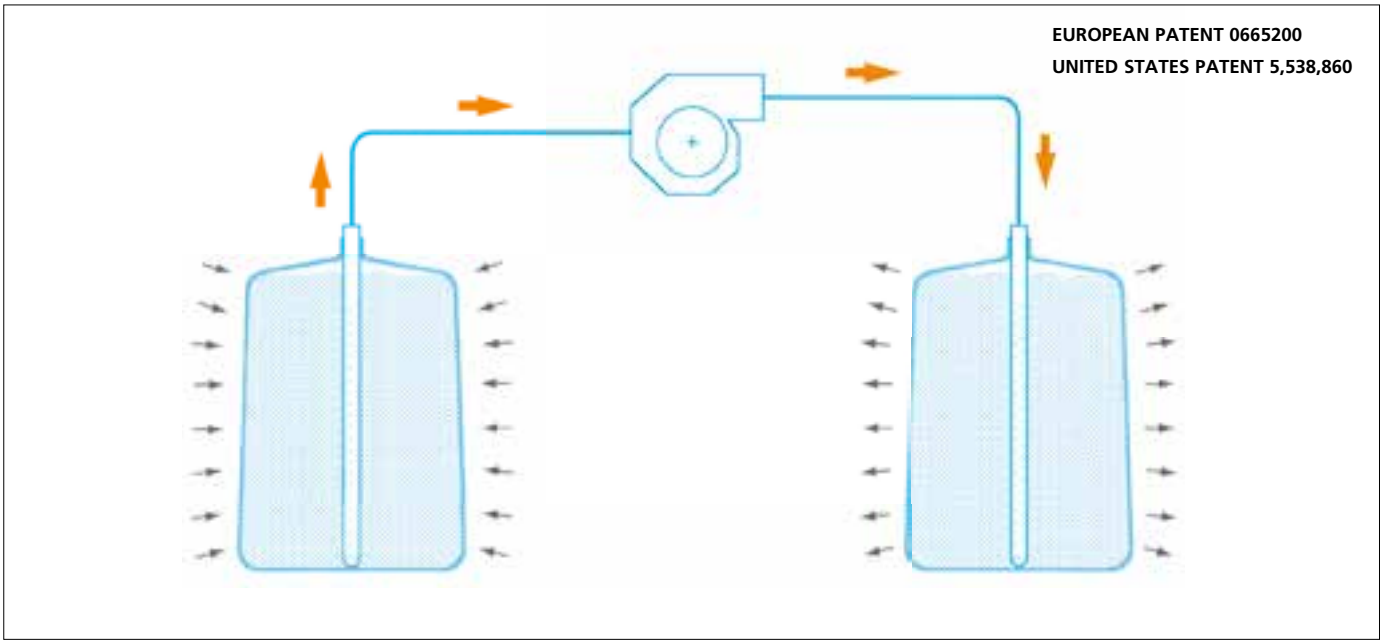
The control system includes temperature sensors surveying both the temperature inside the big bags and ambient air temperature. For larger applications, the system also includes measuring equipment for monitoring the temperature and oxygen content of process air. This data, together with other parameters, are used by the computerized control system which includes a PC graphics display.

The big bags hang on a metal structure, made of hot galvanized steel; big bags can be handled using a fork lift and they can be stacked up to three levels.

This modular system permits any size of plant to be built. The time needed for the installation of the plant is very short.

A further advantage may be obtained at the end of the biological treatment, as the composted material is already bagged and ready to be sent to compost users, such as firms preparing soil for plant nurseries and floriculture businesses.

Customized solutions can be designed for the treatment of any kind of organic material.



EUROPEAN PATENT 0665200
UNITED STATES PATENT 5,538,860

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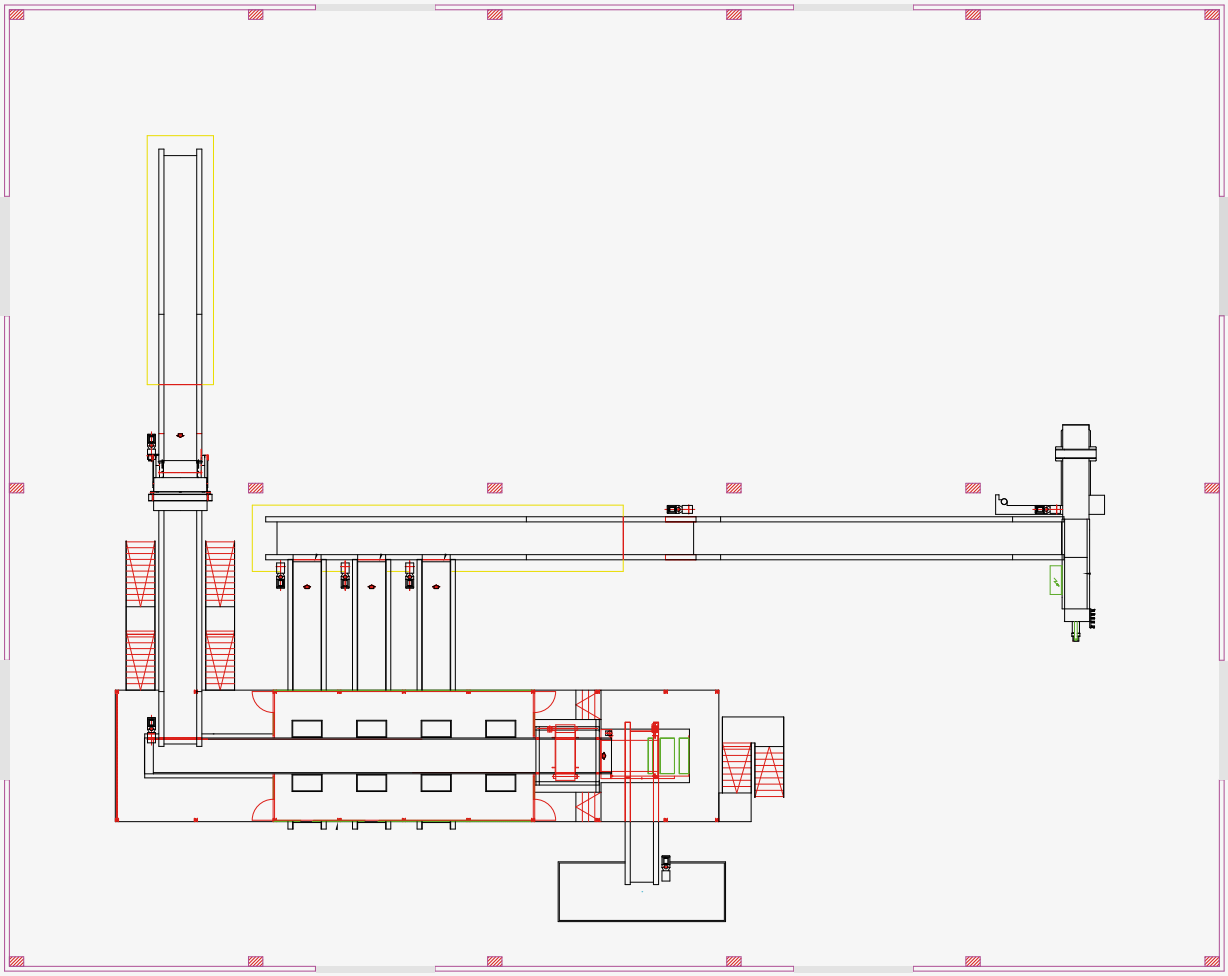
20 CAMPI SALENTINA (LE) ITALY

Year	2001
Client	MONTICAVA STRADE Srl
Operator	MUNICIPALITIES OF LECCE ONE AREA
System description	Sorting and baling
Waste processed	Commingled recyclables (paper, plastic and metals)
Plant capacity	50 - 60 t/day

The sorting and baling facility was designed to treat commingled recyclables deriving from source-separated municipal waste consisting of paper, cardboard, plastic containers, and steel and aluminum cans.



This material recovery facility is designed for the treatment of source-separated municipal waste, containing commingled recyclables such as paper, cardboard, plastic containers and metal cans made of steel and aluminum.

Ecomaster developed the design for this plant, selected the suppliers for the main equipment and supplied the baler.

The sorting of various materials takes place through a combination of manual and automatic operations.

The system is fed by a chain-driven rubber conveyor belt, which is set up under floor level and loaded by wheel loader. The conveyor feeds a bag opener at a throughput capacity controlled electronically by a variable frequency drive.

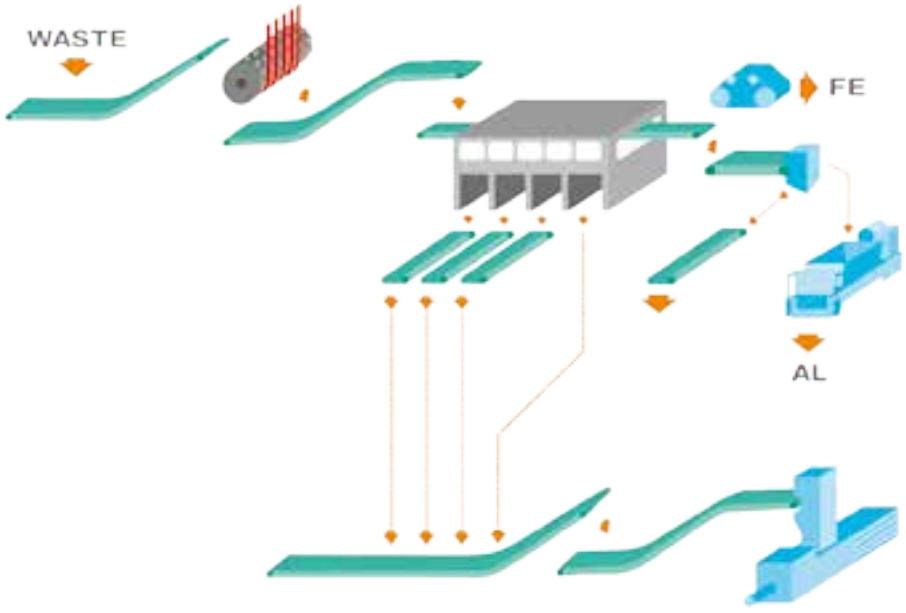
After the bags have been opened and emptied, the materials are unloaded onto a lifting conveyor that brings them to the sorting conveyor moving through the sorting room. Along the sorting conveyor there are four pairs of channels leading to the material storage bunkers. The first three bunkers are equipped with conveyors for the automatic removal of the dropped materials, while in the last area the material is collected in a roll-off container.

Moreover, the sorting conveyor is provided with a variable frequency drive with a wide-ranging belt-speed control.

At the end of the sorting conveyor, outside the room, a magnetic separator with a self-cleaning belt automatically recovers magnetic ferrous metals.

After this magnet there is an induction separator, that rejects aluminum cans from the belt. A rotor equipped with magnets rotating at a high speed induces the magnetic field.

A hydraulic baler processes, in-line, ferrous metals as the magnet automatically separates them. This baler can also be used at the end of waste sorting operations to press aluminum cans. All the materials separated inside the plant can be baled by means of a continuous hydraulic baler equipped with an automatic bale-tying system. The baler can also be fed directly with material that does not need to be sorted.



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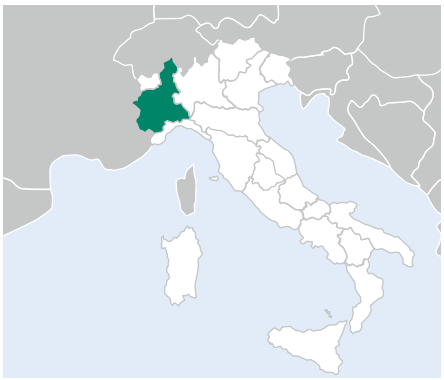
19 S. NAZZARO SESIA (NO) ITALY

Year	2001
Client	AGRITER Srl
Operator	AGRITER Srl
System description	Composting
Waste processed	Organic waste, garden waste and sludge
Plant capacity	50,000 t/year



The facility includes composting of organic waste and sludge. The waste-hygienization process is based on a spontaneous rise in temperature caused by bacteria and molds which develop in the biologically-treated mass.

The plant is designed for composting a waste mixture consisting of the following components:

- Organic waste from source separation, such as kitchen waste or market waste;
- De-watered sludge from the biological treatment of waste water;
- Shredded structural material, e.g. wood waste from gardens.

The waste hygienization process is based on the spontaneous increase in temperature induced by bacteria and molds developing in the organic mass undergoing forced aeration.

The floor of the composting building has built-in air ducts with nozzles for the distribution of air through the piles of material.

The aeration system is modular. Therefore, the air flow can be varied according to the stage of the process in each area of the composting building.

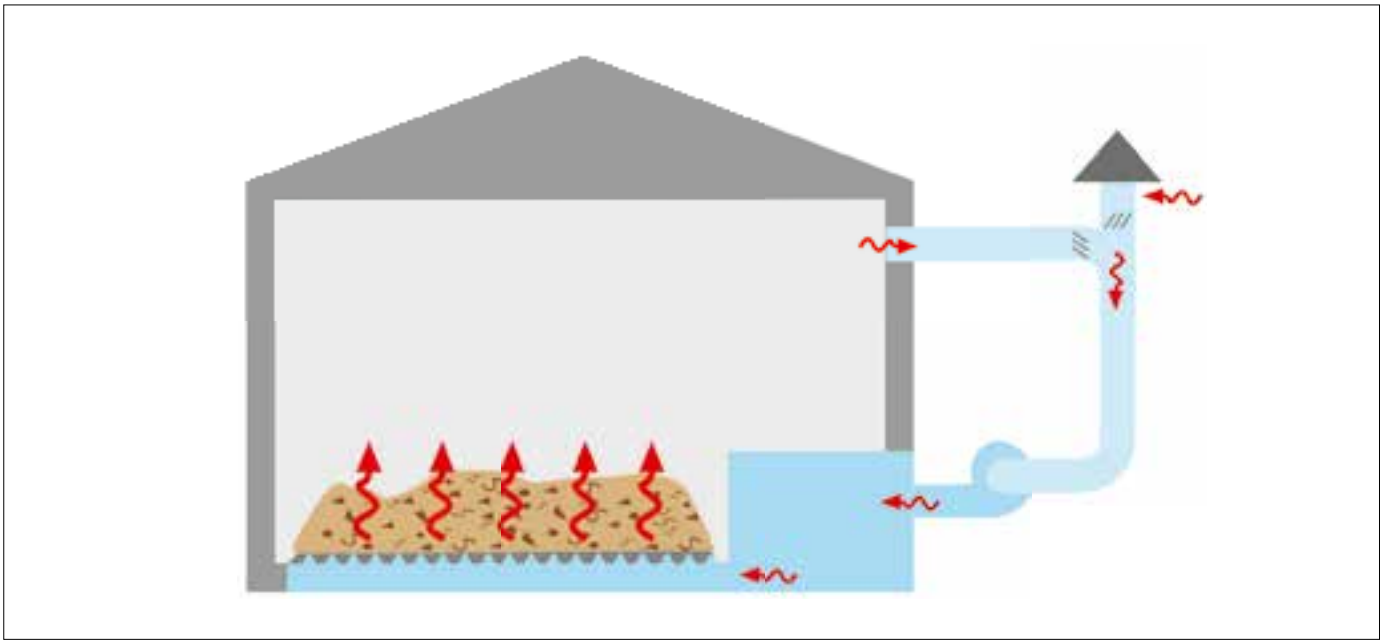
The material which first starts the process is the first to leave the composting building to be further processed.

Centrifugal ventilators, made of stainless steel and set up outside the building, are used to keep the longitudinal air duct under positive pressure so as to distribute air to the ducts integrated in the floor.

The building is equipped with a pre-existing odour control system supplied by third parties.

The composting process is monitored by a computerized system that keeps the material temperature under control, as well as the pressure and airflow rate in each unit. The system includes a sensor for measuring the oxygen content in the air being blown in. Its purpose is to adjust the ratio between the air drawn inside the building and the fresh air coming from outdoors.

Air flow is adjusted automatically by means of the electric drives of the air dampers. To limit power consumption, every ventilator has a motor with a variable frequency drive that adjusts the speed of the ventilator according to the requirements of the process.



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18 ORTISEI (BZ) ITALY

Year	2000
Client	CENTRO TUTELA AMBIENTE Srl
Operator	CENTRO TUTELA AMBIENTE Srl
System description	Transfer station
Waste processed	Mixed municipal solid waste and sludge
Plant capacity	40 t/hour

Ecomaster's role in this project consisted in revamping the material handling system of a transfer station receiving and mixing municipal waste and sludge from waste water treatment.

Ecomaster's role in this project regards the revamping of the material handling system in a transfer station for municipal solid waste and sludge from waste water treatment.

The material brought into the transfer station by waste-collection vehicles is treated by a shredder and collected by a conveyor belt, which unloads it onto a second conveyor.

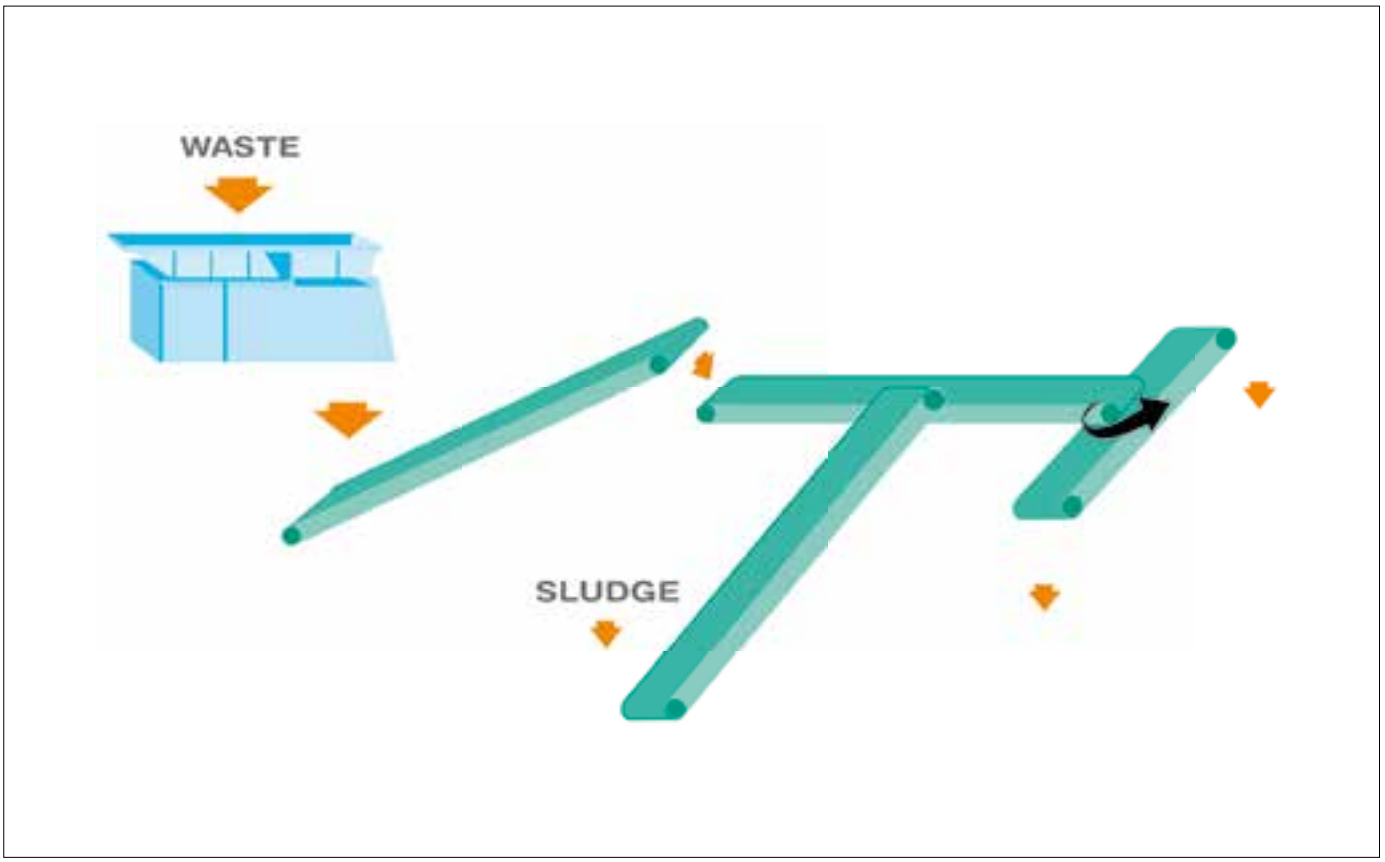
Sludge from biologically-treated waste water is mixed with solid waste. A duct pressurized by a pump is used to handle the sludge, which is partially de-watered. Solid waste mixed with sludge is collected by a conveyor, which takes the material to the loading area.

Roll-off containers are used to transfer the waste to the landfill. The loading station for the containers is designed to handle two containers at a time, one is loaded while the other awaits its turn.

Waste is distributed inside the roll-off containers by means of a reversible and swiveling conveyor belt controlled by ultrasound level meters.

This conveyor stops and swivels once a container has been filled. The direction of the belt is then reversed.

While the containers are exchanged, automatic control of the distribution conveyor is passed to the level sensor installed near the active un-loading area.



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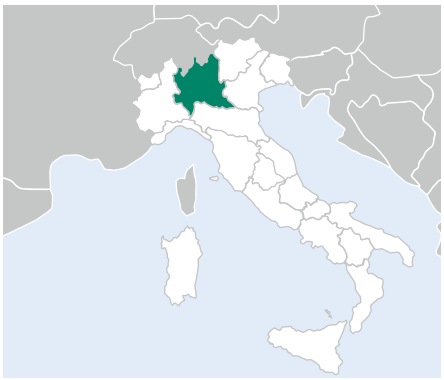
17 BAGNOLO MELLA (BS) ITALY

Year	2000
Client	SYSTEMA AMBIENTE Srl
Operator	SYSTEMA AMBIENTE Srl
System description	Tunnel composting
Waste processed	Source separated organic and garden waste
Plant capacity	26,000 t/year



Tunnel composting technology is used to process source-separated organics from municipal waste and to produce a quality compost which can be used in agriculture. The biological process takes place inside closed reactors, consisting of tunnels made of reinforced concrete with an aeration system integrated into the floor.

The plant uses tunnel composting technology for biological treatment of source-separated organic waste in order to hygienize and stabilize it, which, after the curing phase, produces quality compost. The process takes place in five closed reactors, consisting of reinforced concrete tunnels equipped with a ventilation system integrated in the floor.

The air blown into the material through the floor is in part re-circulated inside the tunnel and in part sent to the odour control system. Air coming from waste-sorting areas is used as fresh process air in the tunnels, so the total volume of waste air is reduced without negatively effecting on the buildings' ventilation.

A sophisticated collection and treatment system for leachates ensures correct tunnel drainage and enables the liquid to be re-used for moisturizing the processed material by means of nozzles set up under the ceiling of each tunnel.

The material to be biologically treated is prepared by mixing source-separated organic waste, shredded garden waste and recycled material deriving from the final screening of produced compost. Once the tunnel has been loaded with the wheel loader, its special door is closed, the process begins and lasts approximately two weeks. At the end of the treatment the tunnel is emptied and a new cycle begins.

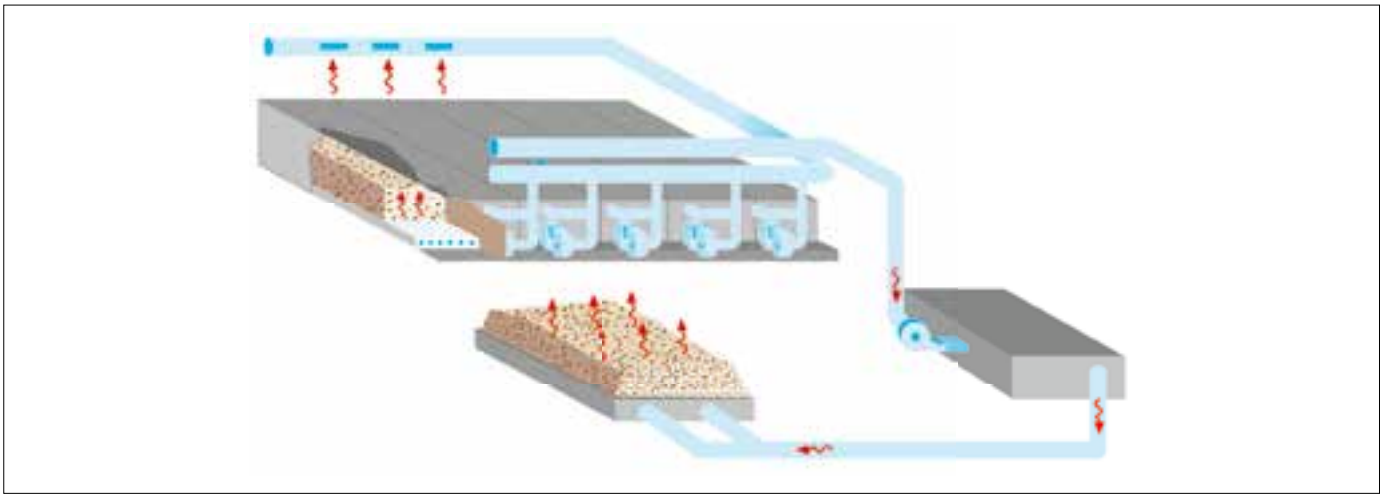
A computerized control system, including visualization on PC with colour graphics, monitors the process and keeps parameters in the preset ranges, which are different for every stage of the process.

Many process parameters are measured by sensors set up in various parts of the system. For instance, material temperature, air temperature, oxygen content in the air, air pressure and air flow are continuously monitored and recorded.

To control odours, the air exhausted from the tunnels, mixed with the air flow coming from the curing area and from areas where waste is mechanically processed, is treated in a large biofilter. Biofiltration controls odours very efficiently because malodorous gases, absorbed by the superficial moisture of the filter media, are quickly digested through a biological process.

The centralized control system also surveys the biofiltration process, which takes place after the air flow has gone through a scrubber.

After the treatment in the biotunnels, the material is moved to the curing area, which has an aerated floor.



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16 CAVALLINO (LE) ITALY

Year	2000
Client	AMBIENTE & SVILUPPO Scrl
Operator	AMBIENTE & SVILUPPO Scrl
System description	Tunnel composting
Waste processed	Compostable waste
Plant capacity	1,200 cubic metres

Tunnel composting technology is used to process organics from mixed municipal waste. The biological process takes place inside closed reactors, consisting of tunnels made of reinforced concrete with an aeration system integrated into the floor.

The plant uses tunnel composting technology developed by Ecomaster for treating organic waste biologically in order to hygienize and stabilize it. The process takes place in modular, closed reactors consisting of reinforced concrete tunnels equipped with a ventilation system integrated in the floor.

The main advantages of this technology are high control of the biological process and reduction of waste air volume to be treated for odour control.

The air blown into the material through the floor is in part re-circulated inside the tunnel and in part sent to the odour control system. Air coming from waste-sorting areas is used as fresh process air in the tunnels, so the total volume of waste air is reduced without negativ-ely affecting the buildings' ventilation.

A sophisticated collection and treatment system for leachates ensures correct tunnel drainage and allows the liquid to be re-used for moisturizing the processed material by means of nozzles set up under the ceiling of each tunnel.

Once the tunnel has been loaded using the wheel loader, the special door is closed and the process starts. It is programmed to go through various steps including heating, hygienization, stabilization and cooling of the material. At the end of the treatment the tunnel is emptied and a new cycle begins.

A computerized control system, including visualization on PC with colour graphics, monitors the process and keeps its parameters in the preset ranges, which are different for every stage of the process.

Many process parameters are measured by sensors set up in various parts of the system. For instance, material temperature, air temperature, oxygen content in the air, air pressure and air flow are continuously monitored and recorded.

To control odours, the air exhausted from the tunnels, mixed with the air flow coming from the areas where waste is mechanically processed, is treated in a large biofilter. Biofiltration controls odours very efficiently because malodorous gases, absorbed by the superficial moisture of the filter media, are quickly digested through a biological process.

The centralized control system also surveys the bio-filtration process, which takes place after the air flow has gone through a scrubber.

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15 CAVALLINO (LE) ITALY

Year	2000
Client	AMBIENTE & SVILUPPO Scrl
Operator	AMBIENTE & SVILUPPO Scrl
System description	Shredding, sorting and baling
Waste processed	Mixed municipal solid waste
Plant capacity	60 t/hour

The facility treats mixed municipal waste that is sorted into two fractions: small size material, suitable to go through a composting process, and large size material containing combustible components.

This sorting facility treats mixed municipal solid waste to produce the three following fractions:

- Small size material;
- Large size material;
- Ferrous materials.

Small-size material can go through the biological stabilization process, i.e. composting. On the same site Ecomaster built the first unit of a composting plant using biotunnels.

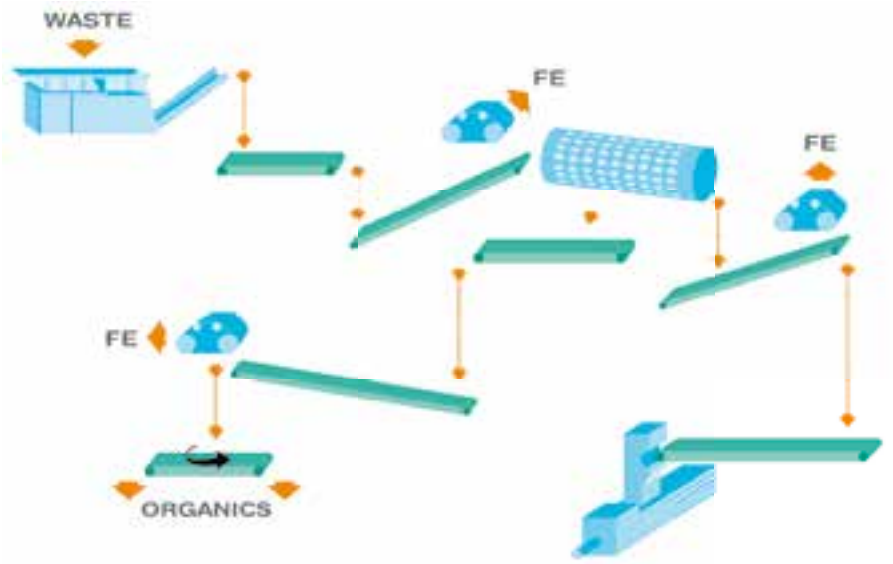
The large-size material contains combustible materials, such as paper, plastics and wood. Therefore, it is suitable for the production of RDF (refuse derived fuel) to be used for generating heat or electricity. In any case, this material can be disposed of in a landfill with a lower environmental impact compared to that of untreated municipal waste. In fact, it generates less biogas and leachate. Besides, the shredding of bulky components and compacting into bales occupies less landfill space.

Ferrous metals recovered at the plant can be recycled for the production of steel by electric arc furnace, after refining if this is required by the steel scrap specifications.

A slow speed shredder opens the bags containing waste and reduces the size of the bulkiest components. Both this shredder and the baler were supplied by third parties, while their installation in the plant was coordinated by Ecomaster.

A conveyor belt lifts the shredded material up to the inlet chute of a rotary screen. This conveyor has a magnet to separate magnetic metals. Small size materials go through the screen and form the undersize fraction, which is collected by a conveyor set up under the screen. This fraction is then unloaded into roll-off containers by means of a swiveling conveyor equipped with ultrasound level meters. A second magnet is set up before the station of the roll-off containers and separates further metals from the undersize fraction.

The large-size material that did not go through the screen is collected at the outlet of the screen drum, processed by a third magnet and sent to the baler by means of a conveyor belt.



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14 PONTEDERA (PI) ITALY

Year	2000
Client	ECOFOR SpA
Operator	ECOFOR SpA
System description	Sorting and baling
Waste processed	Commingled recyclables (paper, plastic and metals)
Plant capacity	12 t/hour

This material recovery facility treats recyclable waste, such as paper, cardboard, plastic bottles and metals. Products meet the specifications of the recycling industry.

The plant is designed for the sorting of dry municipal waste coming from source separation and containing recyclables, such as paper, cardboard, plastic bottles and metals.

A belt feeder, loaded by means of a wheel loader, goes through an inspection room, where bulky objects and waste that cannot be treated are removed. In the case of materials contained in bags, these are opened in this inspection room.

The material moves forward on a lifting conveyor that brings it up to the inlet of a two-stage rotary screen, so that waste is separated into three fractions:

- Small size material, consisting of fine materials that are discarded because they are not recoverable;
- Intermediate size material;
- Large size material.

The intermediate size material contains metallic cans, which is why this part goes through a magnetic separator. A conveyor belt takes ferrous metals to a container. Intermediate-size and large-size materials are sent through distinct transport systems to the manual sorting room. Sorting is performed along two parallel conveyor belts.

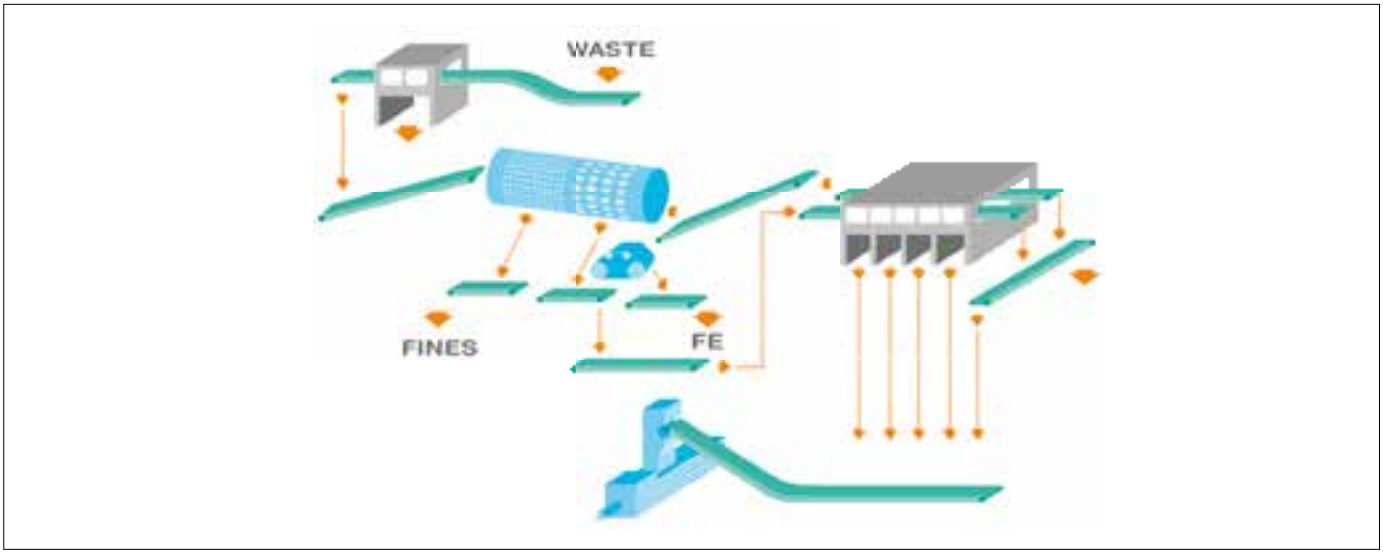
The preliminary screening is meant to increase the efficiency in manual sorting operations as each one of the conveyors transfers materials with a more uniform size, thus facilitating the operators' job. It is also easier to perform negative sorting, i.e. rejects are removed from the conveyors.

At the outlet from the sorting room, the materials transported by both sorting belts are unloaded on a reversible conveyor, which can unload the material in a storage area for loose material, or send it to the baler feeder.

The baler, which was already in place before the Ecomaster plant was built, produces bales that are handled by a forklift.

The materials separated in the sorting room are dropped by the operators through channels into four bunkers below. From there, they can be taken to the baler by means of wheel loader.

To process materials that do not need to be sorted, it is possible to load the baler feeder directly.



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13 POGGIARDO (LE) ITALY

Year	1999
Client	SUDGAS Srl
Operator	SUDGAS Srl
System description	Shredding, sorting and baling
Waste processed	Mixed municipal solid waste and recyclables
Plant capacity	30 t/hour

The facility treats mixed municipal waste that is sorted into two fractions: small size material, suitable to go through a composting process, and large size material containing combustible components. Commingled recyclables can also be sorted.

The plant treats, in different shifts, either mixed municipal waste or dry waste from source separation.

The three following fractions are obtained from mixed municipal waste:

- Small size material;
- Large size material;
- Ferrous metals.

The small size material is suitable to go through a biological stabilization process, i.e. composting. In fact, this fraction of municipal waste contains organic components that may be composted. Furthermore, after treatment in the sorting plant, it is more homogeneous and uniform in size. The production of compost is a technology that may reduce significantly the environmental impact deriving from organic waste disposal in a sanitary landfill.

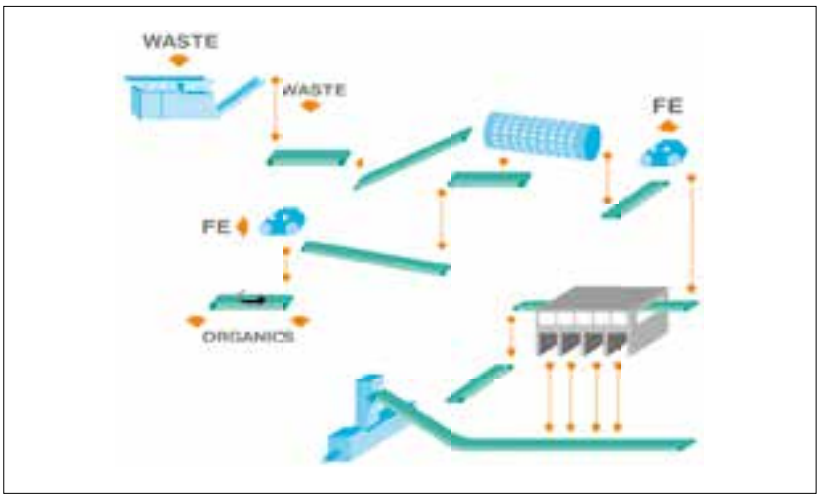
The larger size fraction contains combustible mate-rials, such as paper, plastics and wood. It is thus suitable for the production of RDF (refuse derived fuel) to be used for generating heat or electricity.

In any case, this material can be disposed of in a landfill with a lower environmental impact, if compared to the disposal of untreated municipal waste. In fact, this mate-rial contains less organic matter and therefore it generates less biogas and leachate. Besides, shredding the bulky components and compacting material in bales occupies less landfill space.

Ferrous metals recovered at the plant can be recycled for the production of steel by electric arc furnace, after refining if this is required by the steel scrap specifications. A slow speed shredder opens the bags containing waste and reduces the size of the bulkiest components. Both this shredder and the baler were supplied by third parties, while their installation in the plant was coordinated by Ecomaster.

A conveyor belt lifts the shredded material up to the inlet chute of a rotary screen. This conveyor has a magnet to separate magnetic metals. Small size materials go through the screen and form the undersize fraction, which is collected by a conveyor set up under the screen. This fraction is then unloaded into roll-off containers by means of a swiveling conveyor equipped with ultrasound level meters.

A second magnet is set up before the station of the roll-off containers and separates further metals from the undersize fraction. The material that did not go through the screen is collected at the outlet of the screen drum and sent to the baler. The dry waste coming from source separation contains recyclable materials, such as paper, cardboard, plastic bottles and metals that are sorted to be recycled. A by-pass feeder prevents the shredder from processing this waste stream.



After screening the small size materials and separating magnetic metals, the material is sent to the sorting room. The materials recovered are dropped into bunkers located under the sorting room. The baler can process, in turn, materials from the storage bunkers, handled by wheel loader, or residual material from the sorting conveyor. Moreover, the baler can process directly recyclable materials which do not require sorting.

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12 CAMPI SALENTINA (LE) ITALY

Year	1999
Client	SUDGAS Srl
Operator	SUDGAS Srl
System description	Shredding, sorting and baling
Waste processed	Mixed municipal solid waste
Plant capacity	30 t/hour

The facility treats mixed municipal waste that is sorted into two fractions: small size material, suitable to go through a composting process, and large size material containing combustible components.

The plant treats mixed municipal waste, which is sorted to obtain the three following fractions:

- Small size material;
- Large size material;
- Ferrous metals.

The small size material is suitable to go through a biological stabilization process, i.e. composting. In fact this fraction of municipal waste contains organic components that may be composted. Furthermore, after treatment in the sorting plant, it is more homogeneous and uniform in size.

The production of compost is a technology that may significantly reduce the environmental impact of organic waste disposal in a sanitary landfill.

The larger-size fraction contains combustible materials, such as paper, plastics and wood. It is thus suitable for the production of RDF (refuse derived fuel) to be used for generating heat or electricity.

In any case, this material can be disposed of in a landfill with a lower environmental impact, if compared to the disposal of untreated municipal waste. In fact this material contains less organic matter and therefore it generates less biogas and leachate. Besides, shredding the bulky components and compacting material in bales occupies less landfill space.

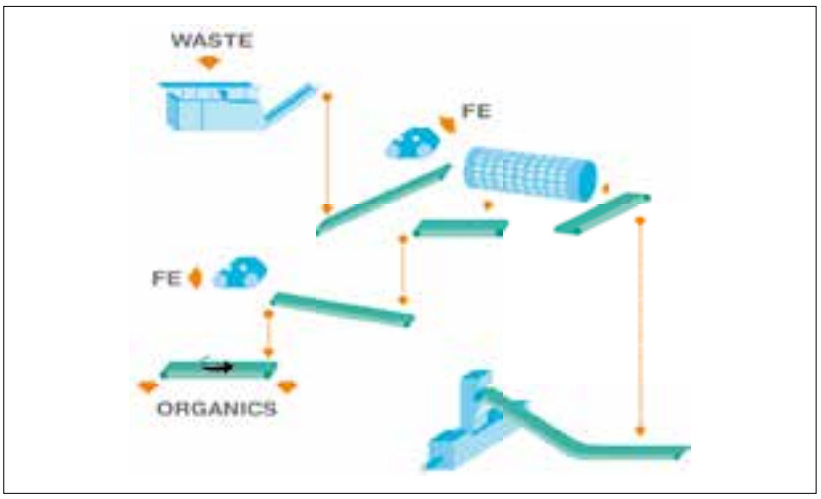
Ferrous metals recovered at the plant can be recycled for the production of steel by electric arc furnace, after refining if this is required by the steel scrap specifications.

A slow speed shredder opens the bags containing waste and reduces the size of the bulkiest components.

Both this shredder and the baler were supplied by third parties, while their installation in the plant was coordinated by Ecomaster.

A conveyor belt lifts the shredded material up to the inlet chute of a rotary screen. This conveyor has a magnet to separate magnetic metals.

Small-size materials go through the screen and form the undersize fraction, which is collected by a conveyor set up under the screen. This fraction is then unloaded into roll-off containers by means of a swiveling conveyor equipped with ultrasound level meters.



A second magnet is set up before the station of the roll-off containers and separates further metals from the undersize fraction.

The material that did not go through the screen is collected at the outlet of the screen drum and sent to the baler by two conveyors.

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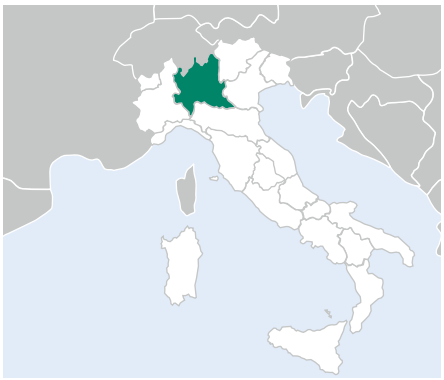
11 PARONA (PV) ITALY

Year	1998
Client	FOSTER WHEELER ITALIANA SpA
Operator	LOMELLINA ENERGIA Srl
System description	Compost refining
Waste processed	Mixed municipal solid waste
Plant capacity	200,000 t/year



A refining system was built to reduce plastic and inert content in mixed waste compost.
It separates inerts and recovers an extra volume of RDF.

A compost refining system is used to separate inert and combustible material from the stabilized organic fraction produced in the composting building.

A rotary screen separates the flow of material into two differently-sized fractions. This screening enables the subsequent operation of two specific separators, suited to the size of the treated material.

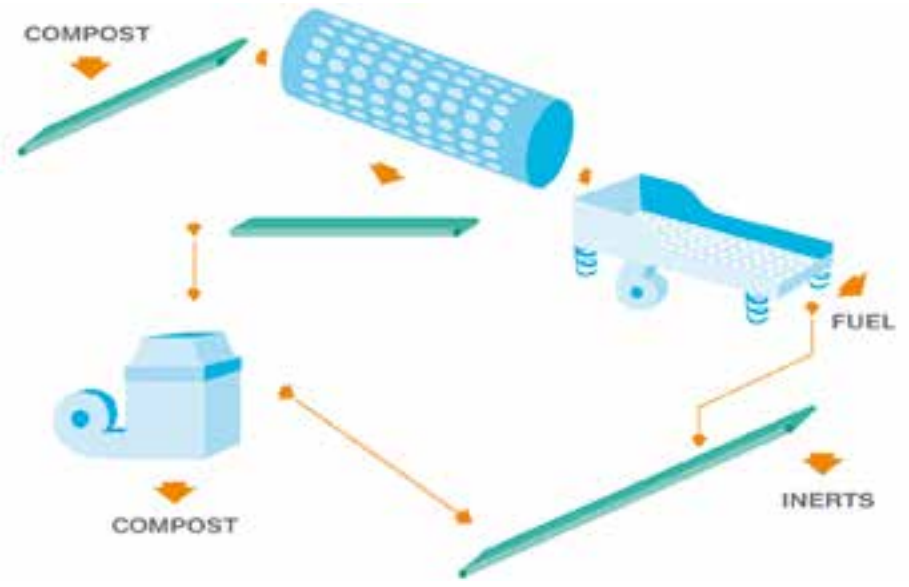
An air knife separator treats the larger size fraction. Its air flow separates the light materials from the heavy ones. The light fraction, which has some heating value, joins the main flow of RDF to be used for power generation. This helps in reducing process rejects and maximizing fuel recovery.

A fluidized-bed separator treats the small size fraction and separates inert materials - consisting mainly of glass and stones - from the compost. The fluidification of the material, essential for separation, is performed by blowing air through an oscillating table.

The heavy rejects produced by the fluidized bed separator are collected together with those produced by the separator treating the larger fraction of stabilized material.

The refined compost is sent to the storage building, where it is piled by means of a shuttle conveyor belt.

To reduce dust emissions, a suction system is connected to hoods located above both separators. The sucked air is processed by two cyclones. The light material unloaded by the rotating air valves of the cyclones is also recovered as fuel.



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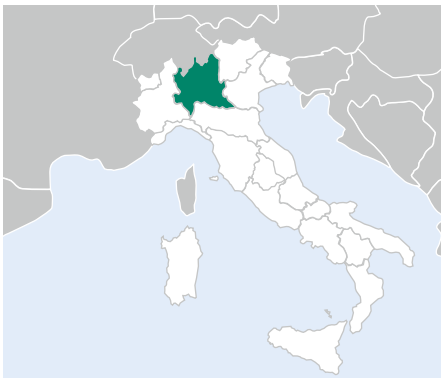
10 PARONA (PV) ITALY

Year	1998
Client	FOSTER WHEELER ITALIANA SpA
Operator	LOMELLINA ENERGIA Srl
System description	Production of RDF - Refuse Derived Fuel
Waste processed	Mixed municipal solid waste
Plant capacity	200,000 t/year



The undersized screen material deriving from sorted mixed municipal waste contains a large quantity of organic material and is stabilized through composting.

The small-sized material produced by the screens in the sorting area of the plant is collected by conveyor belts and transferred to the adjacent building to go through a biological stabilization process. Before entering the building, the material is processed by a magnet, which separates small-sized ferrous materials.

The composting process takes place in a closed building, equipped with a ventilated floor, where the material is piled and turned over.

Storage, turning and final recovery of the material are performed by two self-moving turners, which perform the following operations:

- During the waste sorting and treatment operations, a machine automatically piles the material into one of the composting fields, while the second machine reclaims the stabilized material and sends it to the refining area;
- During the turning operations, a machine reclaims the material to be turned and sends it through a group of conveyors to the other machine that piles it again.

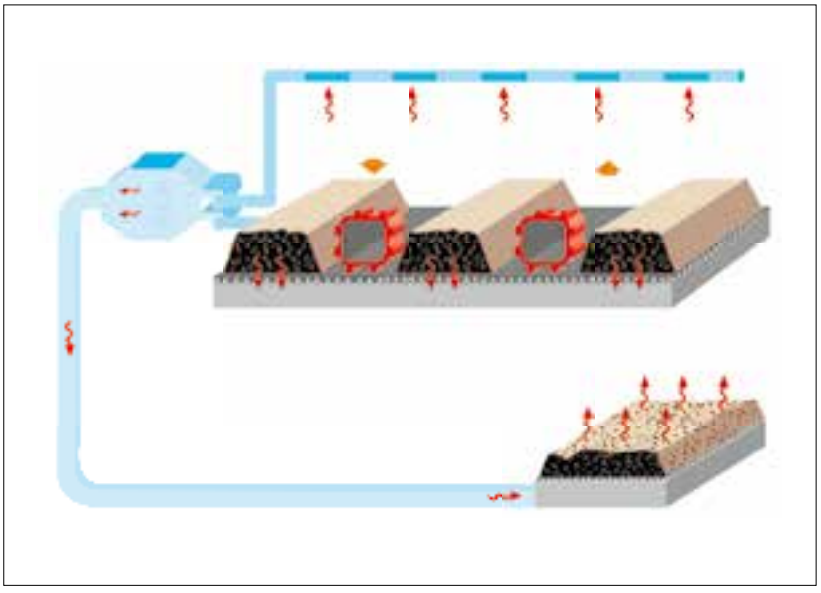
Two longitudinal conveyors, for material handling, have been installed inside the building. A conveyor equipped with a tripper enables material to be unloaded onto the self-moving machines anywhere along its length.

A second conveyor belt, set up at floor level, receives the material reclaimed by the turner and takes it, according to the operation, to the compost refining area (material already stabilized), or to the conveying system feeding the other self-moving machine (material to be turned).

Each self-moving machine is equipped with a sort of bucket elevator, to reclaim the material, and with distribution conveyors. The operation is completely automatic and is based on a numerical control system.

To adjust the moisture of the material and speed up biological activity, water from the waste-water tank is sprinkled on the material during turning operations. The ventilated floor consists of 22 independent fields, each of which is equipped with a suction duct with a servo-controlled adjustable damper. Waste air from the floor is sent to the odour control system, together with the air flow coming from the hall ventilation system.

The double air-exhaust system keeps the composting building at a slightly negative pressure, so preventing odours from leaving the building.



Two centrifugal ventilators, with variable frequency drive, blow air through a scrubber, where the airflow is humidified, dust abated, and some of the malodorous gases are absorbed.

A large biofilter has been set up downstream of the air scrubber. Here, malodorous gases are first absorbed by the superficial moisture of the filtering material and then digested by the bacteria and molds which formed naturally in the biofilter following plant start-up.

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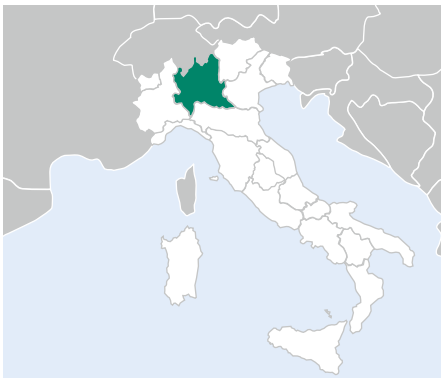
09 PARONA (PV) ITALY

Year	1998
Client	FOSTER WHEELER ITALIANA SpA
Operator	LOMELLINA ENERGIA Srl
System description	Production of RDF - Refuse Derived Fuel
Waste processed	Mixed municipal solid waste
Plant capacity	200,000 t/year



The sorting system, for the production of fuel from mixed municipal waste, recovers RDF with stringent specifications as regards particle size and inerts content.

The fuel production sub-system in the Lomellina Energia plant is designed to obtain a material with controlled size. This part of the plant includes two identical lines; one is used for operations, while the second is on stand-by.

Each line is equipped with a secondary shredder fed by a conveyor belt. An electromagnet is placed upstream from the shredder for the removal of possible ferrous residues.

The shredder is a hammer type of mill, with a high-speed horizontal rotor. The hammers, which can rotate freely around the pivots set up around the rotor disks, reduce the size of the RDF. A grate located at the outlet controls product size.

Each shredder is set up in a bunker with reinforced concrete walls and is equipped with a vent that releases any overpressure generated inside the shredder.

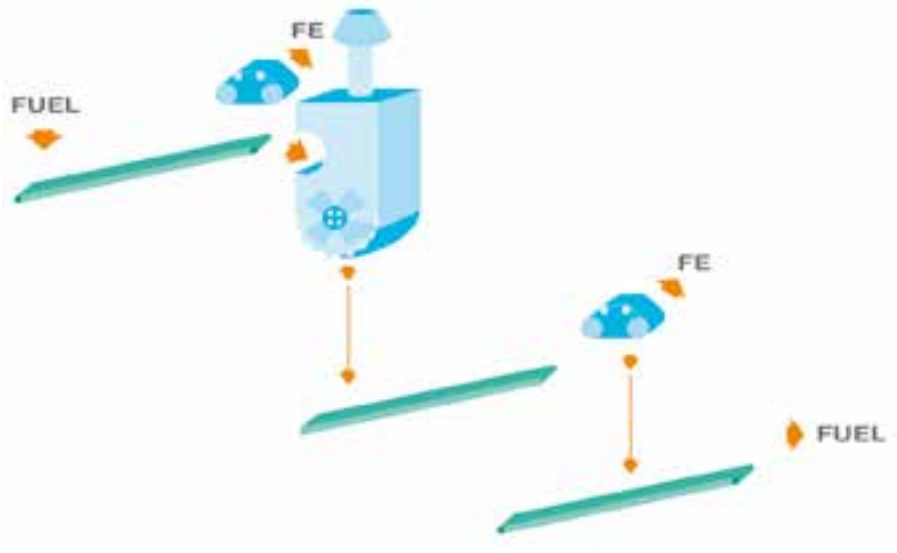
Vibrations and temperature of the shredders' bearings are monitored, as well as the temperature of the motors' windings.

A dust control system also helps to keep the shredder grate free. Air-tightness is ensured at the shredder-unloading conveyors by rotating devices designed by Ecomaster.

The material treated by the shredders is collected by conveyor belts with in-line magnetic separators at the end; this is a further sign of the attention paid in this project to the removal of metals from RDF.

The fuel is sent through conveyor belts to the storage building, where it is piled through a shuttle belt.

A sophisticated feeding system is used to send the fuel to the fluidized-bed steam generator, consisting of two lines, one of which is on stand-by. Each line is equipped with a horizontal feeding conveyor, fed by wheel loader, and with a set of conveyors that bring the material to the steam generator distributor and take back the excess material to the storage building.



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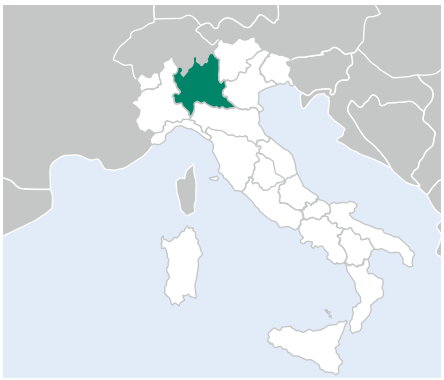
08 PARONA (PV) ITALY

Year	1998
Client	FOSTER WHEELER ITALIANA SpA
Operator	LOMELLINA ENERGIA Srl
System description	Sorting
Waste processed	Mixed municipal solid waste
Plant capacity	200,000 T/year



Ecomaster supplied a turn-key system for RDF production and stabilization of process rejects, which is part of the Lomellina Energia waste-to-energy project built by Foster Wheeler Italiana.

Ecomaster supplied a turnkey system for producing RDF (refuse derived fuel) and stabilizing the organic fraction of municipal waste, which is part of the Lomellina Energia waste-to-energy project. This facility, generating electric power from municipal solid waste, was built by Foster Wheeler Italiana for Lomellina Energia, owner and operator of the project.

The plant processes 200,000 tons per year of municipal solid waste and other waste with a high heating value pre-selected in other facilities.

The sorting sub-system includes three lines; two are used for operations while the third remains on stand-by. The waste stored in the pit is loaded onto the line-feeding hoppers by means of a bridge crane with a hydraulic grapple.

Each line is equipped with a feeder with a movable floor consisting of hydraulically operated elements, which move at turns. The movable floor unloads waste into the slow-speed primary shredder, reducing waste size and preparing it for the following screening operation.

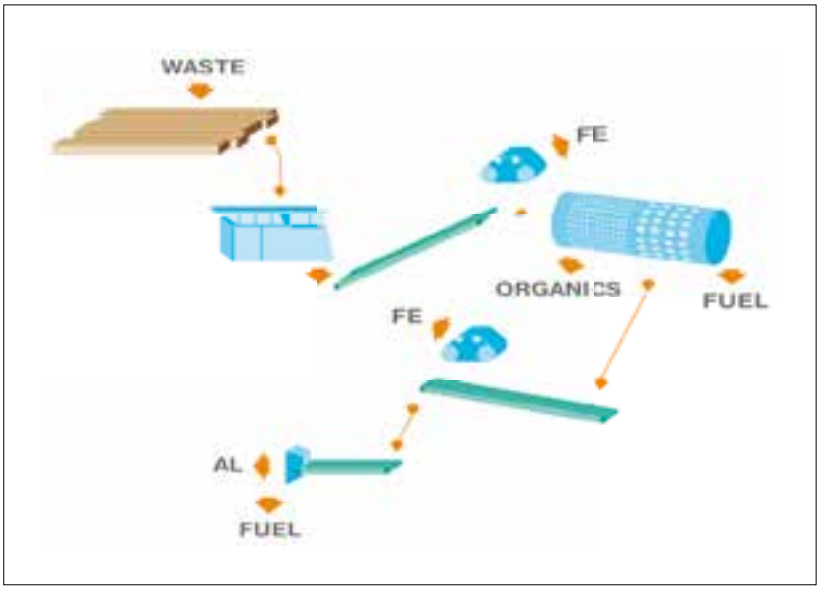
An electromagnet separates magnetic ferrous materials before waste goes into the rotary screen. The ferrous materials recovered by the various separators are collected by a transfer system which takes them to roll-off containers outside the building.

The screen is a two-stage trommel and separates three fractions:

- A small size fraction, with a high content of or-ganic material, that is sent to the composting system;
- A mid size fraction, containing metals, which is treated for recovering ferrous and non ferrous metals;
- A large size fraction, consisting mainly of plastic, paper, wood and textiles.

Mid-size fraction metals are first separated by a conventional magnetic separator, which separates magnetic ferrous metals, and then by an induction separator which automatically selects non ferrous metals.

The separation of metals is particularly important as the system using the fuel produced by Foster Wheeler is based on a steam generator with a fluidized bed. This system has significant advantages from the point of view of environmental impact and has to be fed with fuel containing virtually no metals.



Once the metals have been separated, the mid-size fraction is added back to the large-size fraction coming from the rotary screen. These two fractions together constitute the material that is treated to produce fuel.

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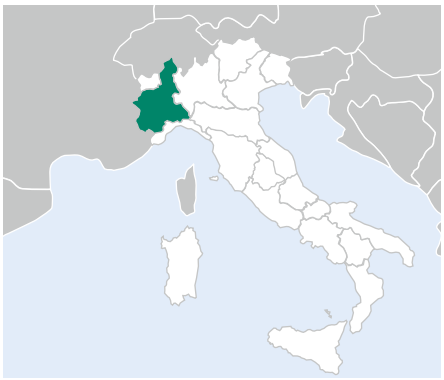
07 TORTONA (AL) ITALY

Year	1998
Client	MONTICAVA STRADE Srl
Operator	S.R.T. SpA
System description	Material recovery facility
Waste processed	Commercial and industrial waste
Plant capacity	6 T/hour



This material recovery facility also processes bulky waste materials, especially commercial and industrial packaging.

This sorting and baling plant is designed for the treatment of large size recyclable waste, especially pack-aging materials from commercial and industrial facilities.

The plant is also used to bale pre-selected recyclable material.

An apron conveyor is fed by a wheel loader that pushes the material onto the horizontal part of the conveyor set up in a floor pit. The material is lifted and unloaded on the sorting conveyor set up longitudinally in the sorting room.

The motors of the feeding and sorting conveyors are provided with variable frequency drives.

In the sorting room, close to the conveyor, there are four pairs of channels where manually-picked materials are dropped. These materials are collected in containers below, which are used for transporting them to the baler.

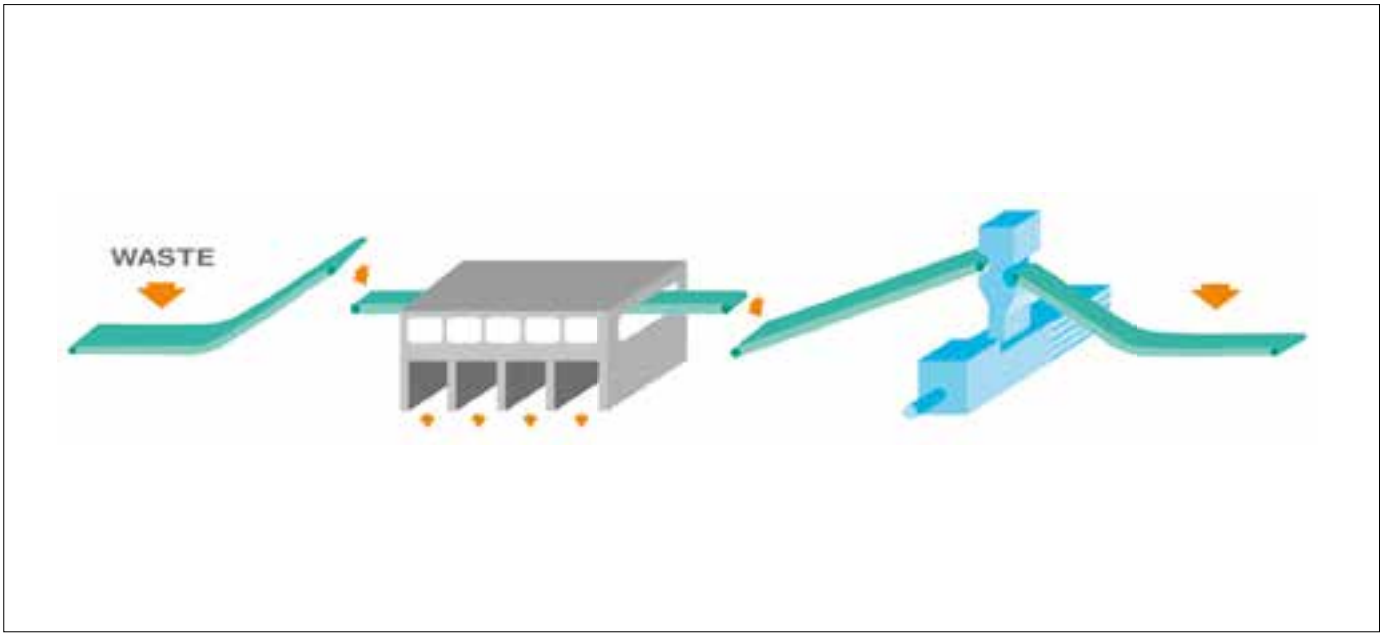
The sorting conveyor unloads the remaining material onto a conveyor feeding the baler. The latter works in line with the sorting conveyor.

This high-capacity baler can also be fed directly with pre-selected material that does not go through the sorting room. A separate feeder has been provided on the other side of the sorting room for this purpose.

The baler is a continuous channel press, with a pushing trolley operated hydraulically by the main cylinder. A second hydraulic cylinder is used to regulate the pressure in the output channel.

The baler is fitted with an automatic device to bind bales with steel wires.

Hydraulically operated needles push the wires through the material. An automatic device then knots and cuts the wires.



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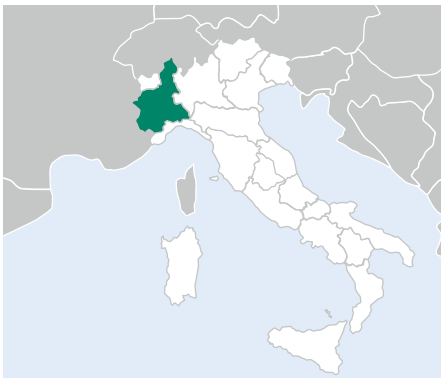
06 TORTONA (AL) ITALY

Year	1998
Client	MONTICAVA STRADE Srl
Operator	S.R.T. SpA
System description	Material recovery facility
Waste processed	Commingled recyclables (paper, plastic and metals)
Plant capacity	4 T/hour



The facility, designed to sort and bale dry not-bulky waste deriving from source-separated municipal solid waste, includes a variety of automatic sorting equipment.

The plant is designed to sort recyclable materials from source-separated municipal waste.

An apron conveyor, fed by wheel loader, lifts the waste up to a horizontal conveyor belt installed under a magnetic separator which separates ferrous materials, consisting mainly in cans.

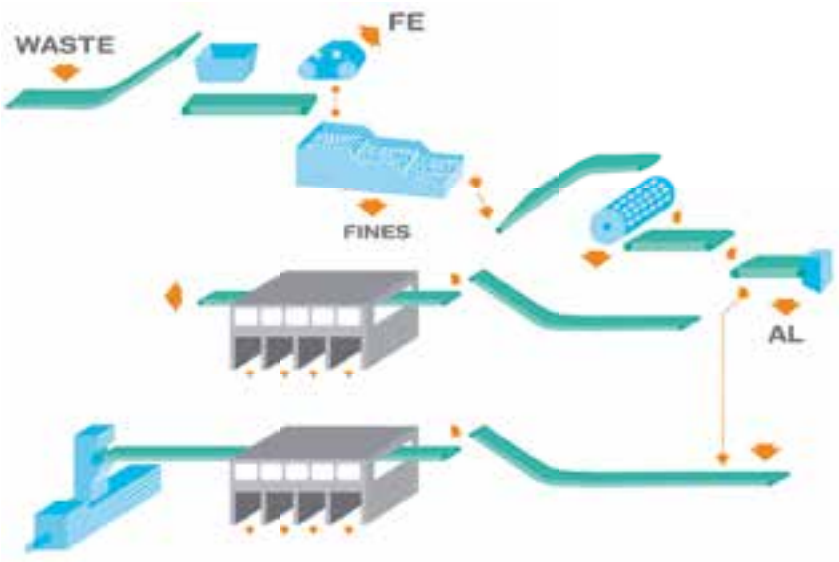
A vibrating screen then separates fine materials before the waste is processed by a separator with a rotating drum made of perforated plate. Flexible materials, such as shopping bags, stick to the drum, as they are attracted by the negative pressure generated inside the drum by a ventilator. On the other hand, rigid materials that are not attracted by the drum fall into the hopper below. This equipment is able to separate aluminum cans and plastic bottles from plastic foil and paper.

On the line processing rigid materials, there is an induction separator rejecting aluminum cans from its belt. A rotor with magnets rotates at a high speed to create a magnetic field. Two variable-frequency drives are used to adjust the speed of the conveyor belt and that of the magnetic rotor. In this way, the equipment is tuned according to operational requirements.

Flexible materials, i.e. paper and light plastic, are sent to a room to be sorted manually. Four materials sorted manually and a fifth, which remains on the sorting conveyor belt, are collected in containers. These materials are taken to a baler.

A second sorting room is used to sort rigid materials manually. These consist mainly of bottles and other plastic containers. The fraction remaining on the sorting conveyor is sent to a baler working in line.

Both sorting rooms can be fed directly by two apron conveyors which by-pass the automatic sorting equipment set upstream of the rooms.



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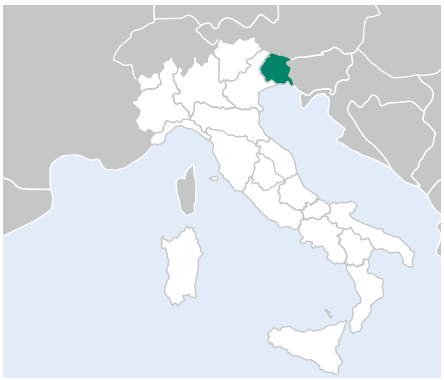
05 SEDEGLIANO (UD) ITALY

Year	1996
Client	GESTECO SpA
Operator	CARTIERA ROMANELLO SpA
System description	Sorting and baling
Waste processed	Commercial, industrial waste and recyclables
Plant capacity	10 T/hour



This sorting plant, built for a Luci Group company, recovers waste from commercial, industrial and handicraft activities, as well as commingled recyclables from source-separated municipal solid waste.

The sorting plant built for the Luci Group in the Municipality of Sedegliano, primarily treats two types of materials:

- Waste from commercial and industrial activities, consisting of wood, paper packaging and plastics;
- Dry waste from source-separated municipal waste, consisting of paper, cardboard, metal cans and plastic containers.

There are three main process phases: feeding, sorting and baling.

Two conveyors set up in sequence perform feeding. The first conveyor is located in a floor pit and is easily loaded using a wheel loader. This conveyor unloads the material onto the lifting conveyor, which takes the waste to the room where the sorting conveyor is set up.

The feeder conveyor and the sorting conveyor are provided with variable-frequency drives.

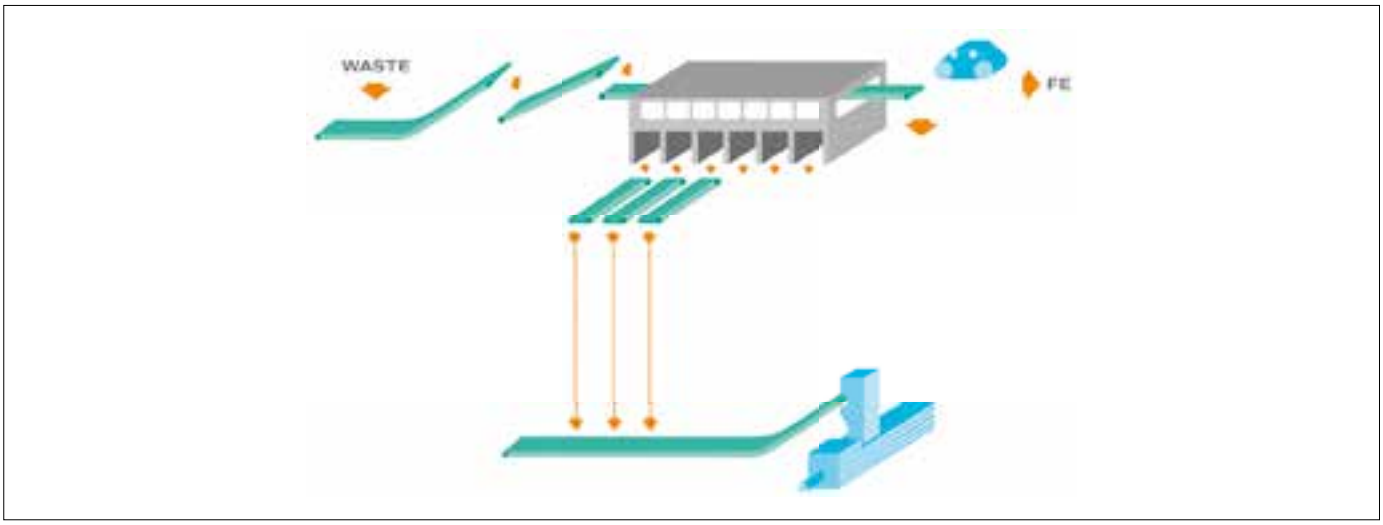
The sorting of various materials is performed through a combination of manual and automatic operations.

Six pairs of channels are set up along the sorting conveyor to receive materials sorted manually from the belt and to convey them into six separate storage bunkers. The first three bunkers have containers equipped with conveyors for the automatic removal of materials; in the other three bunkers, collection is carried out by means of roll-off containers.

The sorting room is provided with a ventilation, heating and air-conditioning system. A self-cleaning electromagnet at the end of the sorting conveyor, outside the operators' room, automatically separates magnetic ferrous metals, which are then collected in a container.

After the sorting operations have been performed, the remaining fraction is collected in a bunker with reinforced concrete walls, from where it is taken by wheel loader to the baler conveyor.

The baler, bought directly by the client, is fed by a chain-driven rubber-conveyor belt, which is designed to receive the various materials from the bunker conveyors, or to be fed directly with the waste remaining at the end of the line, or with other materials that do not need sorting.



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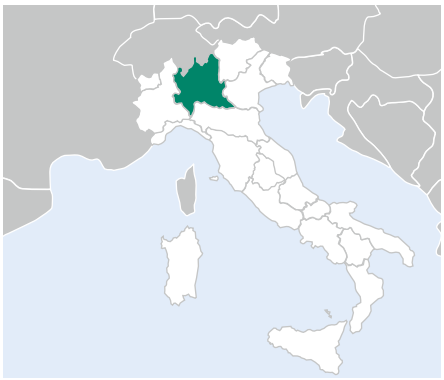
04 ROZZANO (MI) ITALY

Year	1995
Client	ITALMACERI SpA
Operator	ITALMACERI SpA
System description	Sorting
Waste processed	Waste paper, office paper and magazines packs
Plant capacity	Two lines, 5 t/hour each



Unsold, returned magazines, especially women's magazines, often contain small gifts that have to be separated in order to recover these magazines as waste paper.

The sorting plant built by Ecomaster for Italmaceri SpA is primarily used to treat the following materials:

- Packs of unsold magazines returning from stores;
- Paper and cardboard from source-separated municipal waste;
- Paper from offices;
- Cardboard packaging material from commercial activities.

Magazines, especially women's magazines, often contain some gadgets, such as jewels, perfume bottles and small watches, which must be separated to use such magazines as recycled paper. One of the lines in the plant is mostly used to open the packs of magazines and separate gadgets and wrappings from paper.

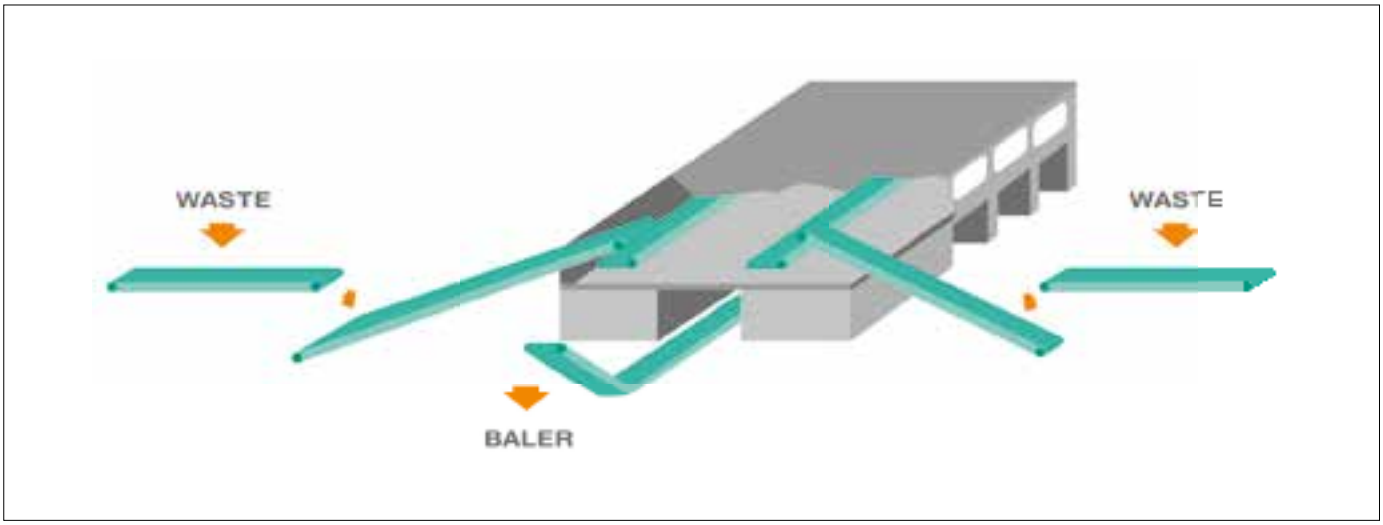
The plant includes two lines, each one of which is equipped with a horizontal feeder, a lifting conveyor and a sorting conveyor.

The horizontal feeder conveyors and the sorting conveyors are equipped with variable frequency drives, to adapt the flow of input material to the type of material treated and to the operations that must be performed in the sorting room.

Both sorting conveyors are set up in a large room, equipped with ventilation and heating systems. Operators remove the packs of magazines, cut the strings and separate wrappings and gadgets. The magazines are then dropped in the channels that bring them below into storage bunkers, while unwanted materials proceed on the sorting conveyor that collects them in a third bunker.

The second line of the material recovery facility is normally used to sort paper and cardboard deriving from the collection of source-separated municipal waste, or consisting of waste paper products from offices. It is possible to separate the waste into three fractions with a higher market value than mixed material, e.g. white paper, newsprint and cardboard. Under the sorting room, in a longitudinal position, there is a conveyor receiving the various materials from the storage bunkers. By means of a wheel loader, the materials are pushed onto this conveyor which takes them in turn to the adjacent building for baling. The baler and the other equipment operating in this building has been acquired directly by the client from third parties.

To prevent the various materials stored in the bunkers from falling into the conveyor pit, every bunker is equipped with an electrically driven door, which is opened only when that specific bunker needs to be emptied.



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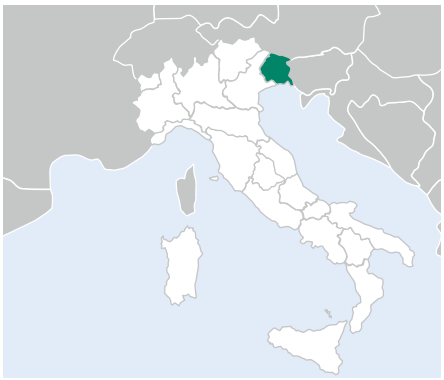
03 UDINE - ITALY

Year	1995
Client	CENTRO RECUPERO CARTA SpA
Operator	CENTRO RECUPERO CARTA SpA
System description	Shredding and metals separation
Waste processed	Wood and plastic waste
Plant capacity	3 - 5 t/hour



Centro Recupero Carta has a wood-waste processing plant, where such waste is reduced in size and separated from ferrous materials, as required by the wood-recycling industry.

The plant is designed to recover wood and plastic waste.

Transporting and disposing of wood waste, particularly if it comes from commercial and industrial activities, is often a problem due to its bulky volume.

Centro Recupero Carta has a plant to chip wood waste, so as to reduce its size down to the values required by the industry producing wood fiber panels. For such use ferrous metals, nails in particular, must be separated by a magnetic separator.

Wood chips are also used by some factories as an alternative fuel for heat and power generation.

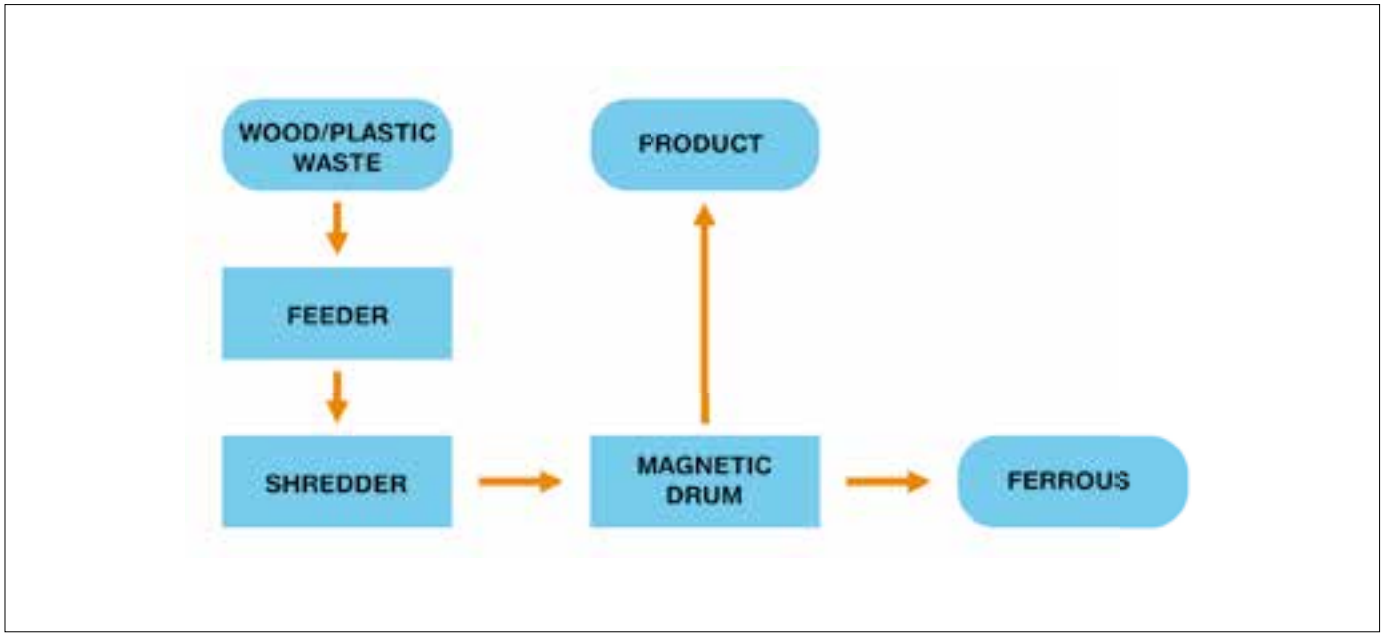
A machine with a low-rotation-speed, single rotor is used to shred the material; this machine was bought directly by the plant owner, while Ecomaster supplied the feeding system and coordinated the design of the whole treatment system.

The shredder is fed through a rubber-conveyor belt driven by chains. This type of conveyor is of the appropriate size and strength required to receive heavy and bulky waste, such as used pallets. The feeder conveyor is set up below the floor level, to enable loading using a wheel loader.

The control system of the plant automatically stops the feeder according to the level reached by the material in the shredder hopper.

A magnetic drum is used after shredding for the separation of the ferrous materials, which stick to the drum and are unloaded into a collection container.

The plant is also used to treat plastic waste deriving from commercial and industrial activities. The shredded plastic is sent to recycling centers which use it as raw material for products made of recycled plastics.



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02 PADOVA - ITALY

Year	1995
Client	AMNIUP
Operator	ACEGAS-APS SpA
System description	Transfer station
Waste processed	Mixed municipal solid waste and similar waste
Plant capacity	Two lines, 50 t/hour each

In Padua, municipal solid waste is collected by compactor trucks which then take it to a two-line transfer station, where waste is automatically loaded onto trailer trucks for transport to a sanitary landfill.

In Padua municipal solid waste collected by compactor trucks is taken to a transfer station, where waste is loaded into trailer trucks that transport it to a sanitary landfill.

Ecomaster supplied this facility turnkey; it was commissioned by AMNIUP, which later merged into Azienda Padova Servizi SpA.

The transfer station includes two identical and symmetrical lines. Each line has two large conveyors: a conveyor for receiving and storing and a second designed for receiving and lifting waste.

All conveyors have rubber belts driven by chains, this type being suitable to withstand heavy wear caused by waste falling on the conveyors belts. All belts have a width of 2.5 meters to allow waste to be unloaded directly by the vehicles on the conveyors' end.

In each line, the vehicles delivering waste can unload it directly onto the lifting conveyor or, if this is being used by another vehicle already, onto the storage conveyor. This conveyor has adequate length and slight inclination allowing for a temporary storage of waste until the other conveyor becomes available to receive waste and lift it.

The lifting conveyors of both lines normally unload waste on trailer trucks equipped with hydraulically-driven movable floors, so the load is automatically distributed evenly over the whole length of the trailer floor, without having to move the truck.

The control system of both transfer lines allows for quite a wide range of belt transfer speeds. This is enabled by the variable frequency drives of the conveyors' motors, each of 15 kW power.

Each line also has two optic barriers, consisting of photocells allowing for automatic operation of the system. If vehicles cross over an optic barrier while moving backwards toward the lifting conveyor, this stops the movement of the storage conveyor to avoid interference. A second optic barrier is set up in the final part of the storage conveyor.

The system allows for an automatic control of the forward movement of the waste piled up on the belt of the storage conveyor, so as to reduce dead times as much as possible and increase the hourly transfer capacity, which is very high so as to deal with peak times which happen particularly in the morning, when many vehicles come at the same time to the transfer station to deliver waste.

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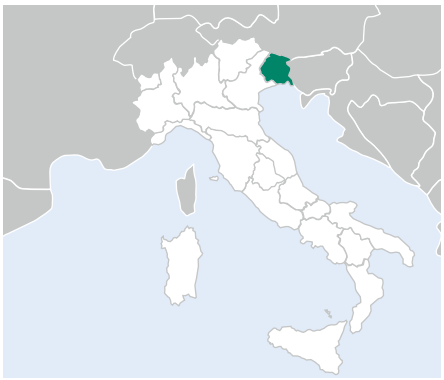
01 UDINE - ITALY

Year	1994
Client	CENTRO RECUPERO CARTA SpA
Operator	CENTRO RECUPERO CARTA SpA
System description	Sorting, shredding and baling
Waste processed	Paper, cardboard and other recyclables
Plant capacity	8 t/hour



The sorting plant built in 1994 at Centro Recupero Carta, Udine,
was Ecomaster's first project in the field of material recovery facilities.

The sorting facility commissioned in 1994 by Centro Recupero Carta SpA in Udine was the first plant recovering recyclable materials which was designed by Ecomaster.

The facility sorts source-separated paper into the followings fractions:

- Newspapers and magazines to be used as raw material for the production of printed paper in paper mills equipped with "de-inking" lines;
- Waste cardboard to be used for producing new packaging cardboard;
- Mixed waste paper.

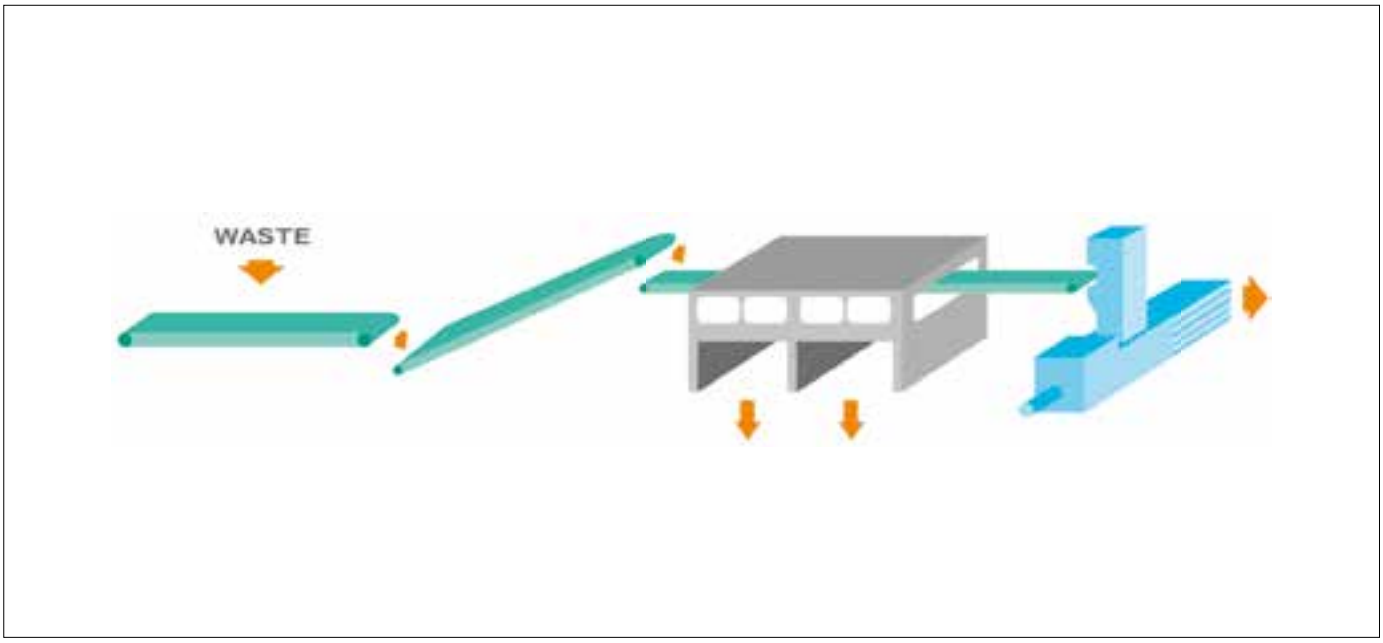
Two different materials are manually separated in a sorting room with a sorting conveyor.

Two conveyors feed the sorting belt. The first one, located under the floor level, is loaded by a wheel loader and transfers the material to be treated onto the lifting conveyor. All conveyors are equipped with variable frequency drives for speed adjustment.

The material remaining on the sorting belt, after manual sorting operations have been carried out, falls into the hopper of a continuous hydraulic baler. Two other balers, with a lower capacity, are used to bale the materials that were manually sorted in the sorting room.

If required, a transfer device automatically positions a two-rotor shredder between the outlet of the sorting conveyor and the baler. The shredder is used to destroy confidential documents. The balers and the shredder were bought directly by the customer from third parties.

Besides the source-separated paper coming from municipal waste, the plant is also used for sorting commercial and industrial waste, particularly waste packaging.



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