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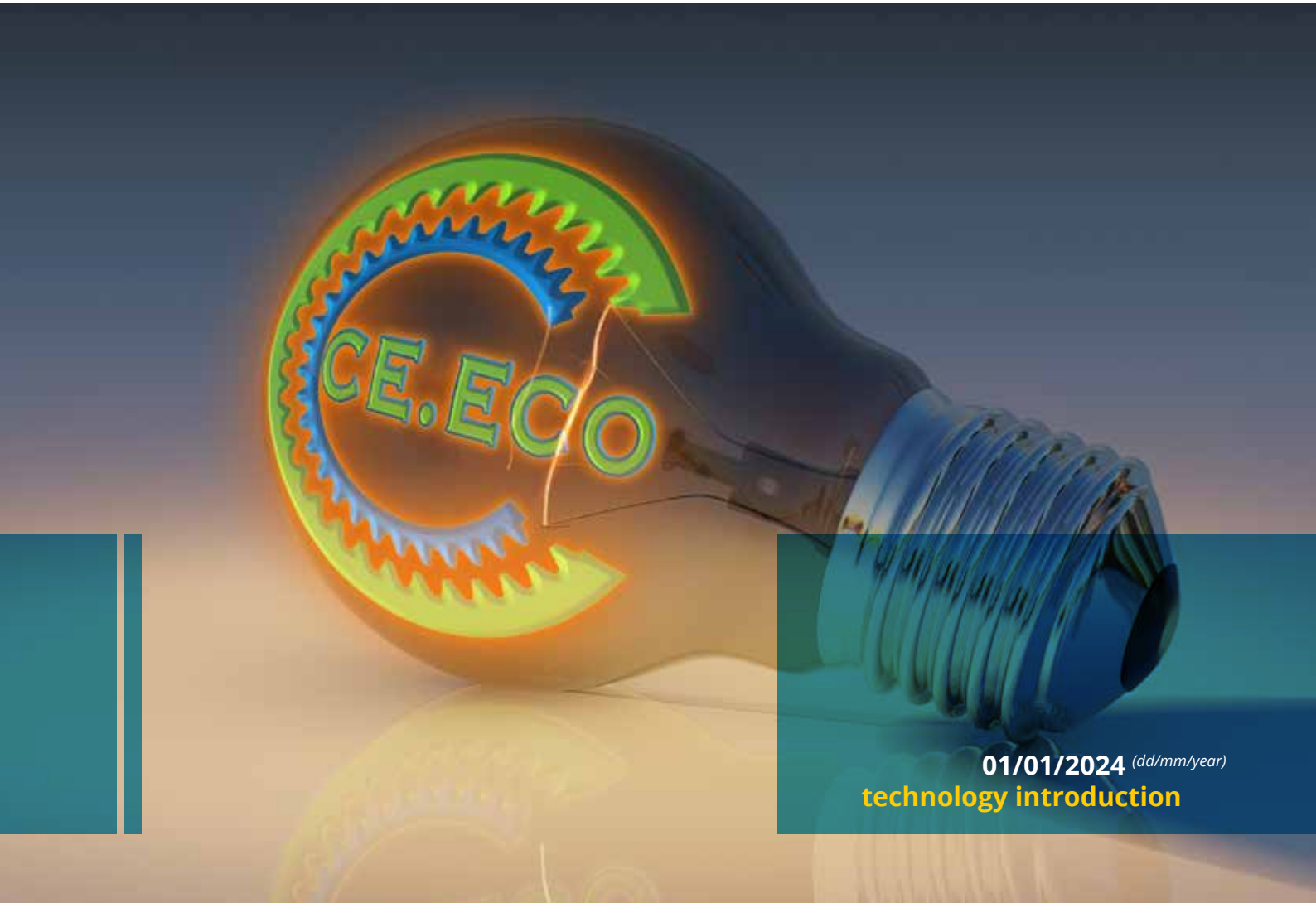
HAZARDOUS WASTE

IN A DEPRESSED ATMOSPHERE ENVIRONMENT

definitive and radical elimination of problems that would otherwise be difficult to treat and dispose of



01/01/2024 *(dd/mm/year)*

technology introduction

something about us

We study and develop, on industrial-scale, systems capable of transforming the causes of pollution into a source of wealth.
Our patents range from the denaturation of asbestos to the treatment of almost every type of waste, from water purification to the production of aluminum without waste.
What's the point of devastating the environment around us to collect a few crumbs of resources when we can use our technologies to live great and achieve anything in a sustainable way?

Our goal

Since we don't have a second home were to go, we need to make our planet more livable without stopping technological development!
Our goal is to make our planet more livable without stopping development.
For this reason we have developed industrial systems that transform the causes of pollution into an immediately usable source of opportunities: low-priced raw materials ready to be reused through further sustainable processes.
Let's protect nature without stopping progress!

Mission:

- Social progress
- Clean environment
- Wealth production
- Sustainable Development

Smartly sustainability

introduction

This plant has been specifically designed for the treatment of dangerous fluids and solids, including medical and / or hospital waste; it has been designed to offer maximum production capacity and guarantee the maximum safety level for operators thanks to the highest level of automation.
In our opinion only by using gasification and plasma there is the mathematical certainty of eliminating any risk of pathogens or virus escaping and, therefore, we will be able to offer a way for a total discharge of any responsibility for the operators involved. Through the Chemical Empowering system, the **waste waters** are introduced AS IS and stirred continuously before being directly sprayed into the gasification chamber while the **solid waste** is pulverized before following the same fate as the waste waters. All the air present in the vacuum environment is introduced into the gasification chamber without any risk of leaks. The complete air replacement takes place every few minutes. The liquids eventually present in the solid fraction are collected and conveyed to an accumulation tank where they are added to the waste waters. From the torch, on the other hand, will come out only lava, that can be molded into objects of common use, and syngas with a very high level of purity.
Our system is not cold, is not an incinerator, applies plasma technology for inertization and is **ZERO emitting**. The syngas released by the organic component cover the energy needs* of the system and allow an interesting surplus to be introduced into the grid (* after analysis of the matrices). The production of electricity takes place through our ORC system **From Heat to Energy**.

who we are...

We born close to the COVID pandemic. We immediately became a meeting point for numerous professionals, research institutions and production companies. All this started in Italy and is now spreading to other countries.

Often our projects precede the times of several years.

Our proprietary technology is totally innovative **but consolidated** and is essentially based on: cavitation, gasification and Coanda effect.

After having implemented and made the above more effective, we have adapted it to everyday life by creating complete processes whose application increases both the quantity and quality of the products obtained, decreasing energy requirements but paying great attention to the creation of a greater number of jobs compared to those eliminated by mechanization.

In addition to the real innovations, we are specialized in engineering and then applying improvements of technologies, mature in their field, to other areas often obtaining, this way, several real technological leaps simply because we had the courage to do what was before under everyone's eyes but no one dared to put it into practice.

We develop technology both independently and in collaboration with Universities (Sassari, Perugia, Amsterdam, Algarve, etc.) or with other public institutions (for example the National Research Center - CNR, Fundación Circe etc.).

We boast a vast proprietary product portfolio with several pilots viewable, by appointment, and several completely innovative process lines.

Some of our products have been defined extremely innovative and promising at international events by panels composed of scientists from all over the world. Our technology and our demo site have been deemed valid and usable in several Horizon Europe projects.

Our patents and innovations have made us immediately designate as members of technology suppliers within the Italian Biogas Consortium.

We have a framework agreement with RINA Consulting - Centro Sviluppo Materiali S.p.A. which allows us to request their supervision and therefore also to certify the production and engineering phase of our products wherever we choose to produce them. Therefore, choosing us also gives access to all the wealth of experience and technology gained in over 70 years by Centro Sviluppo Materiali which, I remember to everyone, was since its establishing the research and development department of IRI (Institute for Italian Industrial Reconstruction, among the top 10 companies in the world by turnover up to 1992).

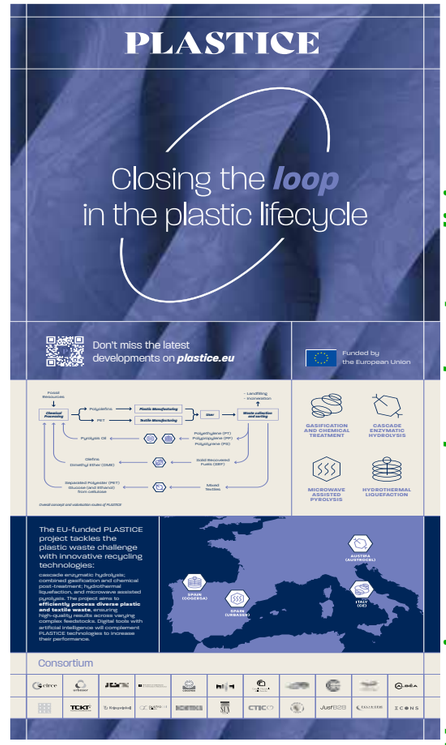
Numerous specialized industrial plants, centres of excellence on their specific sectors, have made the production slots we need available to us; we are equipping ourselves with proprietary factories to carry out final assembly and to start specific productions.

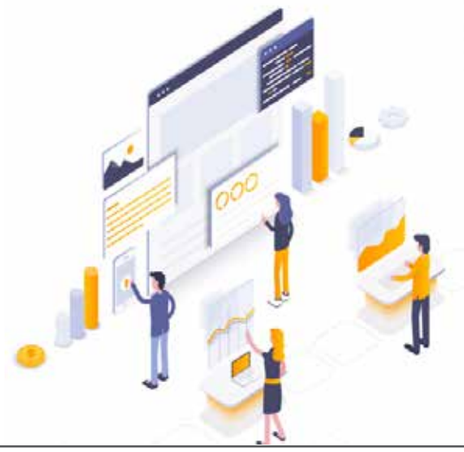
We are present with companies in numerous European countries. We are opening companies in several African countries and in Asia. We have projects underway in various European, African and Asian countries. Our international staff represents our essence: motivated people with a wealth of personal experience who believe in what they are doing and who come from many different countries. In every nation in which we appear we respect local customs and traditions, bringing a bit of Italianness to the place and "*stealing*" part of their culture to ensure that no one is a ***Stranger in a Strange Land***.

Dr Bruno Vaccari

... and what we do

- BIOZIMMI
- EMPOWERING DEVICE
- ZEB
- BIODIGESTERS
- FROM HEAT TO ENERGY
- THERMOELECTRIC PANELS
- ASBESTOS DENATURATION
- GASIFICATION & PLASMA
- INERTIFICATION
- WEEE
- UREA & AMMONIA
- FOOD PROCESSES
- HOSPITAL EQUIPMENT
- SOIL WASHING
- WATER TREATMENT
- WTE & WTC
- DESALINIZATION





OUR MAIN GOAL: environment and workers' conditions respect

our core team

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MARKETING

Jérémie Saltokod

CCIMRDC ITALIE

system description

Designed specifically for the treatment of medical and / or hospital waste, even infected with COVID, it has been designed to offer maximum production capacity thanks to the highest level of automation. Automation is also necessary because the sub-systems are hosted in a huge vacuum chamber with access for inspections guaranteed by a sealed chamber equipped with sterilizing showers.

The treatment of medical and / or hospital waste is regulated by extremely strict legislation. This requires that the waste at the end of processing, given its dangerous and / or potentially infectious nature, must be sterilized and disposed of.

For us this is not enough as there is no sterilization system able to compete with the inertization guaranteed thanks to the temperatures of thousands of degrees released inside the plasma chamber: only from the use of the plasma torch in line is there the mathematical certainty to eliminate any risk of spillage of pathogens and, therefore, to be able to offer total relief from responsibility for the operators involved also from COVID!

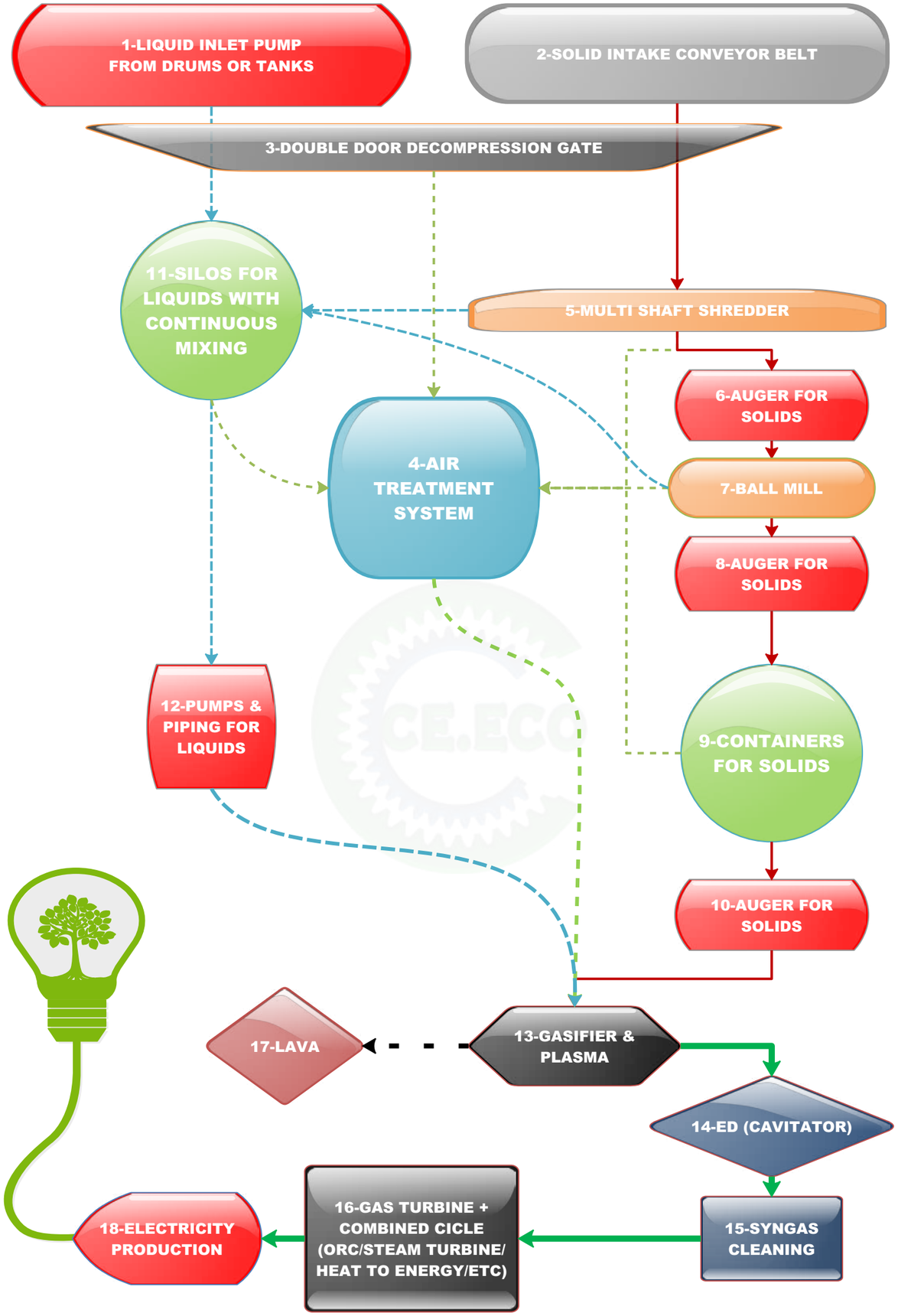
Medical and / or hospital waste must be definitively inerted and, to date, the most economically sustainable, as well as safer system, both for operators and for the environment and which, at the same time, ensures their definitive inertization and also allows recovery of parts of the elements that form them in the form of energy or chemicals is represented by high temperature treatment. Through the system developed by Chemical Empowering, the sanitary and / or hospital waste, at infectious and / or dangerous risk, even if it comes into contact with COVID, is pre-treated in a vacuum environment by shredding and, once deprived of any liquids present, moved through hermetic augers, up to the grinding and placing first in the storage container and then in the real plasma chamber.

The ambient air in depression, as well as all liquids contained in the shredded medical and / or hospital waste, are placed in the plasma torch without the possibility of leaks or spills.

From the torch, on the other hand, only lava that can be molded into objects of common use will come out, and syngas with a very high level of purity.

Our system is not cold, does not use incinerators and applies plasma technology for the definitive inertization of waste, thus also skipping the possible step of creating RDFs because they will be the syngas released by the organic component of medical waste and / or hospitals to be subsequently and possibly used in the high-performance ORC system used to produce electricity.

The syngas obtained from the treatment, even if used to produce energy, is, in its own right, to be considered a green energy as it derives from the synthesis of the syngas obtained from the treatment by gasification and plasma of mostly carbon-based waste.



how it works

The numbering shown below recalls the attached flowchart
The entire system is housed in an environment with a depressed atmosphere where all the air, as it is introduced again, is pushed and conveyed inside the plasma torch also in order to pursue its complete and definitive sterilization .
A double door decompression chamber **(3)** allows operators to access for maintenance of what is contained within the environment.
The **fluids** and **solids** are introduced through 2 different systems: a pumping system from drums and / or tanks **(1)** is dedicated to **fluids**, therefore to everything whose degree of humidity makes it pumpable while a conveyor belt **(2)** introduces the **solids** in the environment in depression by means of a special tunnel that prevents air from escaping from the inside and is therefore dedicated to the management of everything whose humidity is low enough to make it solid or not pumpable.
Once introduced into the vacuum area, the **fluids** are conveyed to an accumulation tank **(11)** equipped with suitable high-resistance devices that allow continuous mixing. The size of the storage tank is such as to allow the torch to be able to continue working for a few hours.
From the storage tank the **fluids** are pumped and sprayed inside the plasma torch chamber **(13)**by a system of pumps and pipes **(12)** according to the commands given by the control system.
The conveyor belt makes the **solids** fall directly into the mouth of a multi-shaft shredder **(5)** capable of comminuting and uniforming the size of the material. Any **fluids** contained in the **solid** component are collected and forwarded to the storage tank **(11)** where they are mixed, from above, with the other waste contained therein. Aspirators placed over the shredder's mouth will convey the air towards the plasma torch.
An auger **(6)** will bring the **solids** reduced in size to a ball mill **(7)** which will further homogenize their dimensions, aiming for pulverization. Any **fluids** still contained in the **solid** component are also collected at this stage and forwarded to the storage tank **(11)** where they are mixed, from above, with the other waste contained therein. Aspirators placed over the shredder's mouth will convey the air towards the plasma torch.
By means of a second auger **(8)**, the **solids** are sent to the appropriate container designed to collect them **(9)** and then dose their constant outflow to feed the plasma torch **(13)** by means of a further auger **(10)** according to the commands given by the control system. The dimensions of the storage container are such as to contain sufficient material for the torch to be able to continue working for some hours.
A slow but constant air recirculation system **(4)** will allow you to introduce more from the outside while preventing it from escaping and to forward all the air from the depression area directly to the plasma torch **(13)**.
A peculiar syngas cleaning system **(14-15)** will allow them to be purified to a level that does not allow impurities to pass.
The syngas, almost completely pure, are thus sent to the internal combustion engine **(16)** for the production of electricity **(18)**. From the plasma torch, the non-organic material and therefore that cannot be transformed into syngas will flow outside in the form of lava **(17)** completely inert but malleable in objects, tiles or simple construction material.

security

The whole processing area is in depression.
The air is introduced into the area by means of special pumps while other pumps maintain a constant flow by conveying it directly to the plasma torch.
The PLC, organized according to Industry 4.0 standards and therefore also equipped with remote control, regulates the entire system and, by means of sensors, can block the entrance of each single matrix to be processed, both the fluid and the solid component, or regulate the flow to and from the storage tank and the container.
The flows entering the plasma torch can be set independently so that they can only be activated when you are sure of the availability of a certain quantity of matrix or speed up the processing of a particularly aggressive or dangerous matrix.
The entrance to the waste area is equipped with nozzles capable of spraying the clearing room with disinfectants (for example 4% sodium hypochlorite) and high temperature ozonated water which will, in any case, be collected and sent to the tank for the liquids located inside the system. From here the liquids will be introduced directly into the plasma torch to be inertized, in turn.
A safety torch will be positioned outside to allow any gas release.

How the system can produce energy

Based on the matrices introduced, the system may, or may not, produce electricity. Based on the matrices introduced, the system may, or may not, produce thermal energy transformable, through an optional ORC systems, into electricity.
Ignoring, until doing a Feasibility Study, the real nature of the fluid matrices and therefore their real energy potential, prudentially, we believe plausible only a condition of balance between what is produced and what is consumed, limiting ourselves to the production of electricity using the syngas in an internal combustion engine of adequate power.
By adopting a combined cycle, net of self-consumption, a gasifier with good quality organic matrices can easily exceed 1,200 kWh for each ton treated.
Professor Louis J. Circeo of Georgia Tech University, the greatest living expert in plasma torch technology, claims that a ton of MSW entered in a plasma torch provides over 800kWh using an internal combustion engine. We conservatively reduce this value to 550kWh.
As we are not manufacturer of technology linked to the production of electricity, we will choose each suppliers' products on a case by case basis depending on the size of the plant and on the quality of the syngas produced. Each technology that will be adopted will have different yield parameters.
To date, these yields are only possible by adopting such cutting-edge technologies; moreover, the mounting ecological sensitivity pushes to the margins of legality some technologies, once considered also promising, such as the transformation of plastics into fuel oil by autoclave treatment, a technology now banned by almost the whole European Community due to the very high pollution associated with this technology that does not present any applicable improvement margin.

process and maintenance

The plant is suitable for the continuous treatment of hazardous waste, 24 hours / day for around 330 days / year of operation.
The maximum capacity at full capacity is approximately 70 tons per day of inlet matrices, both solid and fluid.
The system can be stopped and started almost instantaneously, however, considering that the plasma chamber will have to be restarted at each ignition cycle and therefore the operation could lead to a reduction in efficiency: the system is designed to work or continuously or, at least, for several hours in a row.
All possible ordinary and extraordinary maintenance operations to be carried out in the depression area will be carried out by entering through the appropriate entrance with integrated shower and wearing the safety equipment provided or equivalent.
The automatic greasing of the elements will be controlled by PLC.
The first year, 2 interventions by Chemical Empowering technicians are planned for a maximum duration of one day at the customer's site to verify the correct functioning of the Plant.
The plant will be monitored remotely for the first year directly by Chemical Empowering personnel; said service will be extended year by year upon payment of a subscription.
The details of the plant will be provided at the end of the basic engineering since, following a feasibility study, it may be necessary to vary the process described to meet specific needs that emerged during the drafting.
The system is intended, in any case, as a single system supplied turnkey at and, therefore, includes all the equipment, subsytems, piping, carpentry and electrical systems necessary for the its functioning as well as the project of the necessary civil works.

The single shaft grinder is configured to obtain high energy savings, to let fast maintenance and to reduce downtime. The single shaft grinder is equipped with a special safety system that prevents damage by blocking, if necessary, the machine in case of introduction of non-compliant materials.

The multi-shaft shredder is characterized by strength, reliability and control of the size of the output material: the ideal solution in case of intensive processing. Is is equipped with a system of interchangeable shafts and grids with anti-wear treatments, in order to optimize management costs and maintenance interventions.

Ball mills are precise and flexible tools, suitable for grinding and granulometric reduction of hard, brittle or fibrous materials. The multiple grinding modes, the different usable volumes and the available materials make ball mills the perfect solution for a wide range of applications.

“zero emissions” target

With our technology that combines plasma torches, gasifiers, cavitators and advanced gas management systems, every molecule that escapes from the process represents a loss of profit. Applying the transitive property, therefore, a damage to the planet is equivalent to an economic damage caused to our customer.
Therefore, even beyond any ecological sensitivity we may have, we cannot allow any emissions into atmosphere because gas leaks would not allow us to maintain the contractual performance levels.
Even the same carbon dioxide produced, once “cleaned” and made food grade, is sealed to be sold to the vast market of beverage producers.
With regard to the liquid component, everything whose level of pollution cannot be reduced by using our cavitator will be directly sent to the plasma torch to be inerted.
With regard to the solid component, the ash produced during the gasification and the lava produced with the plasma torch are completely different from the waste products with incineration: in both cases, they are not any more a waste to be conferred to landfill but a new raw material useful for a new process. The ash will be analyzed on a sample basis and continuously to verify its effective inerting; if the parameters are not adequate, the batch in question would be sent to the plasma torch to be transformed into vitrified lava.
It is a well-known and incontrovertible fact that vitrified lava leaking from any plasma torch does not leaks anything, even less than glass, and it was precisely this fact that pushed French legislators to authorize the asbestos supply chain to be interrupted only in cases of plasma treatment. In the presence of biodigestors, the compost deprived by the bacterial loads thanks to the passage in our cavitator, after an adequate period of stoppage in the open air also necessary for the natural evaporation of excess nitrogen, becomes one of the agricultural fertilizers par excellence. Metals and glass will instead be isolated and sent to the appropriate external industries for a complete recovery as raw materials.
As for the emissions into the atmosphere, the reducing environments do not allow the formation of nitrogen oxides (NOx) but simply of N_2 which cannot be considered an emission since nitrogen in this form represents almost 80% of the Earth’s atmosphere.
The CO_2 that is recomposed at the outlet after cooling can either be “clean”, made food-grade and sealed or directly reduced (therefore reduced below 50 parts per million residual) thanks to our special engineering developed for biomethane and considered so innovative to be co-opted as technology suppliers by the Italian Biogas Consortium. In the same way we can easily break down any sulfur residue present in the syngas.
These are all technologies developed by our researchers improving and simplifying procedures that have been used for decades in the extraction and natural gas processing.
Lastly, our controlled cavitation system will allow to recover the residual abatement chemicals and to prepare any, negligible, residual particles to be placed for final inertization inside the plasma torch. Also the emissions from internal combustion engines and turbines will also be conveyed to the cavitation system and, from here, to the plasma torch.
The plant will be built in depression, in such a way all the internal air, including the annoying odor molecules, will be directed to the gasifiers or plasma torches.

Reading key

RED: negative AND/OR harmful to the environment
BLUE: neutral AND/OR no effect on the environment
GREEN: positive AND/OR zero environmental impact

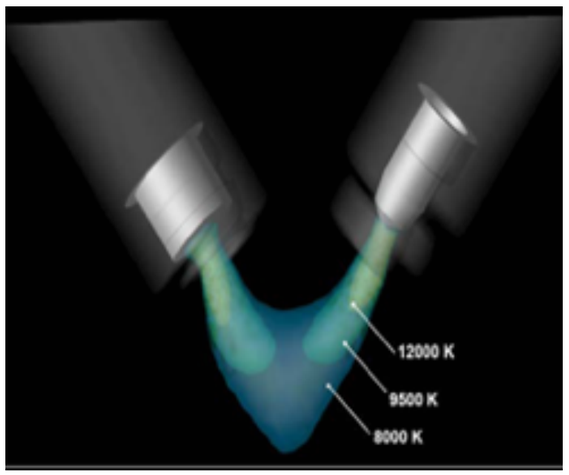
	INCINERATOR	WASTE TO ENERGY PLANT	GASIFICATION	PLASMA	COMBINED GASIFICATION & PLASMA	BIOZIMMI (COMBINED GASIFICATION & PLASMA)
MSW from differenziated collection	Yes	Yes	Yes	Yes	Yes	Yes
MSW from undifferentiated collection	it depends on the facility					Yes
Manual preselection	it depends on the facility					No
Automated preselection	it depends on the facility					Yes
Multiple matrices' simultaneous processing	it depends on the facility					Yes
Immediate recovery of raw materials	No	No	No	No	No	Yes
Special waste treatment	partial	No	No	Yes	Yes	Yes
Hazardous Waste Treatment	partial	No	No	Yes	Yes	Yes
Toxic Waste Treatment	partial	No	No	Yes	Yes	Yes
Nuclear waste treatment *(low radioactivity)*	No	No	No	Yes	Yes	Yes
Hospital waste treatment	partial	Yes	No	Yes	Yes	Yes
Military waste treatment	partial	Yes	No	Yes	Yes	Yes
Treatment in oxygen environment	Yes	Yes	Yes	No	partial	partial
Treatment in argon environment	No	No	No	Yes	partial	partial
Slag to be disposed of in landfills	Yes	Yes	-	No	No	No
Ashes to be disposed of in landfills	Yes	Yes	Yes	-	No	No
Inertization of slag and ash	No	No	Yes	Yes	Yes	Yes
Furan production	Yes	Yes	Yes	No	No	No
Dioxin production	Yes	Yes	Yes	No	No	No
NOx production	Yes	Yes	Yes	No	No	No
Matrices water's reuse	No	No	No	No	No	Yes
Hazardous filters to be disposed in landfills	Yes	Yes	Yes	Yes	Yes	No
Matrices are in contact with the flame	Yes	Yes	No	No	No	No
Matrices are the fuel	Yes	Yes	No	No	No	No
Syngas is the only used fuel	No	No	Yes	Yes	Yes	Yes
Leakage of odors	Yes	Yes	it depends on the facility			No
Electricity production	No	Yes	Yes	Yes	Yes	Yes
Thermal Energy Production	Yes	Yes	Yes	Yes	Yes	Yes
High energy yield	No	No	it depends on the facility			Yes
Methanol and Avio Fuel production	No	No	No	it depends on the facility		
Avio fuel production	No	No	No	it depends on the facility		
Bio Fuel Production	No	No	it depends on the facility			
Compact system footprint	No	No	it depends on the facility			Yes
System modularity	No	No	No	No	No	Yes
System flexibility	No	No	No	No	No	Yes
Rapid plant design	low	low	high	low	low	high
Plant construction speed	low	low	medium	low	low	medium
Plant commisioning speed	low	low	medium	low	medium	high

Synoptic table of technologies for the treatment of so-called "Waste" and / or "secondary materials"

plasma torches

Opposed to what happens in other systems used for waste disposal, since the dissociation of the products subjected to treatment takes place in the absence of oxygen, the application of plasma technology does not involve the emission of volatile substances such as combustion gases or harmful substances such as furans and dioxins.
With this process it is possible to treat - mixed or singularly - all solid and liquid waste of toxic-harmful nature. There is no need for a preventive selection of the waste but a Feasibility Study must be carried out beforehand for the system to be adopted to convey the products to be treated hermetically to the torch.
A system that uses this plasma technology is composed by a reactor including a plasma torch, the equipment required for its operation and the cleaning system for the fuel gas produced. This gas will be used for the combined production of electricity and thermal energy in cogeneration plants, or to produce chemicals including methanol.
The system is essentially constituted by a reactor to which the plasma torch is connected. In the upper part of the reactor occurs mainly the thermal transformation of the organic component of the waste generating a combustible gas: the syngas. In the lower part of the reactor there is both a thermal transformation and a kinetic transformation due to the plasma particles with energy higher than the thermal. The non-dissociated organic component, together with the inorganic component falls by gravity into the plasma area.
Here the organic part is completely dissociated generating other syngas, while the inorganic part is mixed in a molten bath possibly enriched with a fluidifier to improve its castability.
The molten slag is extracted from the bottom of the reactor while the gases produced exit from the top of the reactor: the formation of dioxins and furans and other toxic compounds resulting from the dissociation and molecular recombination is practically canceled and, in any case, if were to be present, they falls broadly within

the limits of the law.
The heavy metals in the reactor and those from the felling sections of the syngas are inerted forming a vitrified material. Even the non-combusted fraction of the waste, after its removal from the reactor in molten form (slag), is cooled by solidifying into a material that can be used for useful purposes without environmental risks (road and / or railway ballast, objects, nourishment of sandy shores etc.).
In general, the extremely fast thermal reaction and the treatment at extremely high temperatures allow the total destruction of toxic organic compounds and the vitrification and encapsulation of inorganic compounds.



For Plasma refers to a conductive gas, highly ionized. The torch or the non-transferred arc electrodes are capable of producing plasma at very high temperatures (the highest achieved in controlled industrial processes) and such as to cause thermochemical dissociation of what is being treated. Unlike other incineration systems, since the dissociation of waste occurs in the absence of oxygen, the application of plasma technology does not result in emissions of volatile substances such as combustion gases or harmful substances such as furans and dioxins.

The main reactions that occur during the process within our plasma torch are:

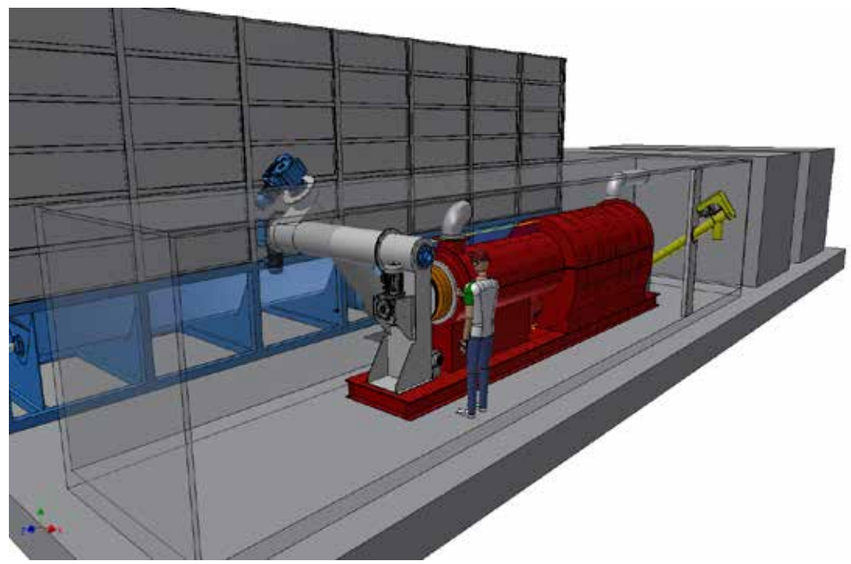
1. disintegration of the components: it allows the dissociation of the organic components that are transformed into synthesis gas. All the hydrocarbons present in the treated waste are gasified and form a synthesis gas composed essentially of hydrogen and carbon monoxide.
This mixture is highly energetic and is reacted to produce electricity or distilled to produce methanol and ethanol. Moreover, the high temperatures reached avoid the formation of toxic compounds such as dioxins and furans.

2. fusion: it involves the fusion of all inorganic compounds and the formation of an inert and non-leachable material (slag). All the toxic elements contained in the treated waste are subject to physical-chemical transformations that allow their total inertization.

gasifiers

Our system consists of a fluidized bed rotary furnace combined with a plasma placed in the queue for the vitrification of the aggregates. Schematically the rotating tube can be divided into three zones: in these three different reactions can take place. Furthermore, the system that supplies the oxidant for the reactions can be installed at will in one area or another allowing the differentiation of application mentioned above. The type of oxidizer can be air, oxygen or water vapor and the entire tube can be brought to operating temperature using gas torches.
If a process based on **combustion** was necessary, we would place the system that provides the oxidant for the reactions in the first part of the tube thus providing an excess quantity of air and thus favoring the combustion of the organic material - understood as a substance carbon base. Depending on the needs, the system that supplies the oxidant for the reactions could instead be placed in the final part of the tube: by heating the tube it allows pyrolysis to be obtained in the first part, reduction in the central part and combustion in the final part. The resulting products of the entire process are ashes which will be vitrified and then inertized using a plasma placed at the end. The heat generated can be used for the production of electricity. If the air is supplied in the first part, all the heat is supplied by the material to be treated.
If a process based on **pyrolysis** is necessary, the tube will be heated using gas torches and brought to a temperature of 500-600°C depending on the material to be treated. The resulting products are bio-oil (similar to diesel produced with the Fisher-Tropsch reaction), coal and gas, the latter can be used to heat the system. In this case there is no oxidizing agent and the organic molecules are split thermally.
If a process based on **gasification** is necessary, the system that supplies the oxidant for the reactions will be positioned in the central part, the quantity of oxidant will be stoichiometric, the tube will be heated to the reaction temperature, i.e. above 900°C.
With this treatment process the main product obtainable is syngas.
The degree of purity of the gas depends on the oxidizer used. By using air, the gas that will form will have a high percentage of nitrogen which will lower its calorific value; using steam, the gas that will be formed will have both high calorific value and purity, allowing easy use of the gas for the synthesis of chemicals; using oxygen instead, the gas formed will have median values.
In the first part of the tube we will have pyrolysis of the material, in the central part there will be partial oxidation and in the final part there

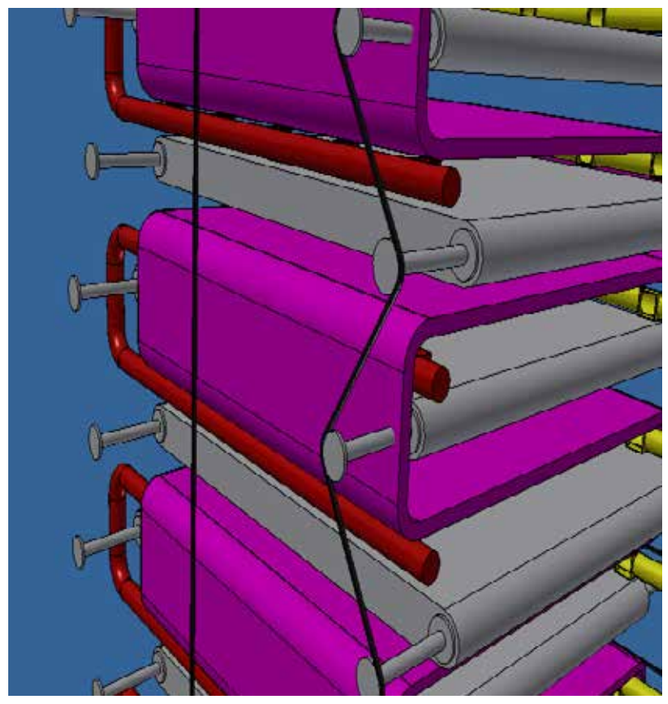
will be a reduction of the gas produced.
The system is particularly flexible, this allows it to treat multiple materials and the ashes produced are vitrified and inertized through a plasma which transforms them into lava. In addition to eliminating the ash problem, this purifies the syngas and increases the percentage of hydrogen present through dry reforming of the methane present in the mixture.
The bed is fluidized by the rotation of the cylinder and by the particular geometry of the system which provides the oxidant for the reactions which, exploiting the Coanda affection, creates a vortex which in addition to pushing the gas forward, offers a more intimate contact with the oxidant itself and, therefore, better efficiency of the system. The rotating drum and the dispenser guarantee the fluidity of the system, ensuring temperature homogeneity; in fact, temperature gradients could create serious problems such as the creation of harmful substances such as, for example, dioxins and furans.
Unlike other systems that can be used for treatments, these are systems of decidedly small dimensions but with very high energy efficiency: in fact the combination of various jumps and the use of high efficiency turbines, as well as the use of our thermoelectric system for the recovery of waste heat allows obtaining an electrical efficiency of up to 65%.
The small dimensions, far from representing a limitation of the rotary kiln, are one of its strong points: since the systems are modular, only the equipment necessary for the treatment will be used.
The system developed by us, when compared with other systems, has numerous advantages. First of all, each plant is containerized and therefore modular and expandable according to treatment needs; at the same time, however, it can be used for small quantities of material, maintaining high efficiency from both an energy and environmental point of view. During chemical reactions we have a very high control which guarantees the formation of unwanted molecules.
The gasifiers take advantage of the molecular dissociation, called pyrolysis, used to directly convert the organic materials present in the waste into gas, by heating, in the presence of small quantities of oxygen.
The processed materials are completely destroyed because their molecules are dissociated. This process allows, if compared with the direct burning, a number of significant

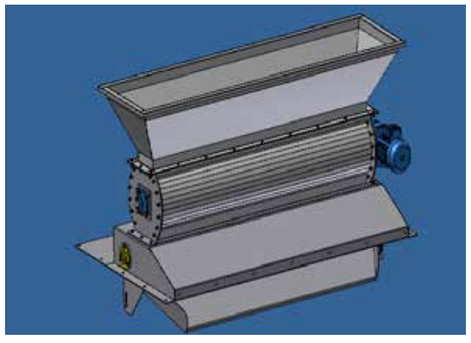


advantages:

- increased fuel usability;
- use of relatively simple and tested technological solutions;
- higher energy efficiency;
- definitive Destruction of such waste;
- No contributions in special landfills;
- No harmful emissions;
- Production of steam and then of demineralized water from its condensation, with easy addition of saline charge additives for water purification;
- Possible production of Chemicals, primarily methanol, usable in automotive engines or sold on the market;
- Low visual impact.

The synthesis gas, even when of a low calorific value, once filtered and purified, can be used for the feeding of a cogenerator, thus enhancing the calorific value of the organic matrix used and can be contain costs simultaneously producing electrical and thermal energy, or it can be used for the production of reusable chemicals.
We also have **small size gasifiers**, with a lower system capacity than the one of a single standard reactor. These represent the ideal size for the needs of the so-called **circular economy**.
Our gasifiers have been developed in collaboration with the **RINA Consulting - Centro Sviluppo Materiali spa**, a subsidiary of RINA Group, also on the basis of their previous studies. In their industrial area in Rome - Italy -, there is a pilot that can be visited, fully equipped also with a plasma torch.
Our gasification system involves the use of drying systems for pre-treating the incoming material or matrix. The dryer is fed through the process' heat and allows to bring the input humidity of the matrix by the value of the conferral (normally value between 70% and 30%) to, approximately, 10%.
The matrix is dried in this way, is transported inside the reactor, where it is raised to temperatures ranging from 400 to 650° C, by recovering the heat generated by the same syngas and by the same gasification process that takes place in the last part of the reactor where the temperature rises up to 1,200° C. The matrix / waste is thus subjected, rapidly, to total drying, pyrolysis and consequent gasification.
Said produced gas (syngas) will be sent, after having been properly washed and purified, to the turbine. In the absence of a plasma torch it is not possible to reach the zero emissions level but, in any case, these will be below the levels allowed by the various national regulations.
The use of syngas will produce thermal kW and electric kW. Part of the produced electricity will be used for the process.
Thermal energy can in turn be partially transformed into electricity.
Once the gasification process has taken place, the only resulting waste product is the ash, on average about 5-10% of the matrix entering the gasifiers.





EMPOWERING DEVICE

EMPOWERING DEVICE has been fully conceived, developed and implemented by our team and is able to simultaneously manage different types of controlled cavitation, of which 5 of a different nature but which coexist harmoniously to the point that no significant vibrations are detected.
The summation of the effects produced by each cavitation further implements the efficiency of the chemical, physical and biological processes that take place within the apparatus, resulting in a subsequent cut in the already low energy consumption as well as a sharp reduction in processing times.
A prototype with a special set-up, prepared for experimentation and of 1:1 size, has been used by us since the beginning of 2017 to conduct the required tests on the samples of materials brought by our customers.
Our machinery is equipped with test certificates and international operating certifications with different types of liquids on different chemical, physical and biological processes.
What makes our system, today, unique compared to what the market offers in the field of controlled cavitation is the fact that although it is already extremely difficult to control a cavitation, in our system there are controlled cavitation's numerous and of different kinds, at least one of which is sonic.
The machine body has an element, with the functions of a static mixer, called by us "Il Cedro" (the Cedar) for the peculiar conformation of the "leaves" that make up its design.
This special monobloc mixer, in the presence of processes that involve the formation of crystalline chemical elements, has the ability to favor the formation of Crystallization Germs, with further acceleration of chemical reactions.
Another significant improvement compared to what has existed so far is represented by the evident lower pressure drops compared to machines equipped with motors of similar installed power, with a sensible and consequent energy savings during operation: the **EMPOWERING DEVICE** requires only a fraction of the electrical energy used by the other cavitators.
This is due to the fact that the machine body of the **EMPOWERING DEVICE** is structured to form a true "diffuser", with the consequent recovery of a percentage of the outlet

pressure.
Furthermore, it has been designed to be easily and quickly reconfigured according to the use: some of its parts can be removed if very dense and / or viscous liquids have to be treated and / or with extensive granularity or they can be added, inlet or outlet, accessory elements suitable for almost any use.
Moreover, in the presence of organic matter, cavitation leads to the consequent partial physical destructuring, a lysis of the cell walls and the consequent release of the intracellular content.
This action translates into a greater availability of cellular juices, an acceleration of hydrolysis processes and, consequently, an acceleration of the anaerobic digestion process as a whole.
In our cavitator, based on experiments conducted and certified by third parties, the rate of bacterial degradation can accelerate from 4/5 times to over 10 times compared to conventional treatments.
The certifications performed by the Rina Group show that the COD of the waste water from a gasifier is reduced by 90% in just 15 minutes.
By using the supplied inverter system, at the start, consumption is less than the 25kWh of rated installed power, similarly during full use; in the absence of an inverter, at least 36kWh would be required to start.
The standard version can treat up to 60 cubic meters of fluid per hour.
Compactness, simplicity of installation and use, are undoubtedly some of the peculiarities of our cavitation apparatus but it is the total flexibility of use that makes it unique.

SAMPLE	COD mg/L
AS IS material	15.380
after cavitation material	1.508
COD reduction percentuage	90,2%

Chemical Empowering

AG

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MAIN PARTNERS: