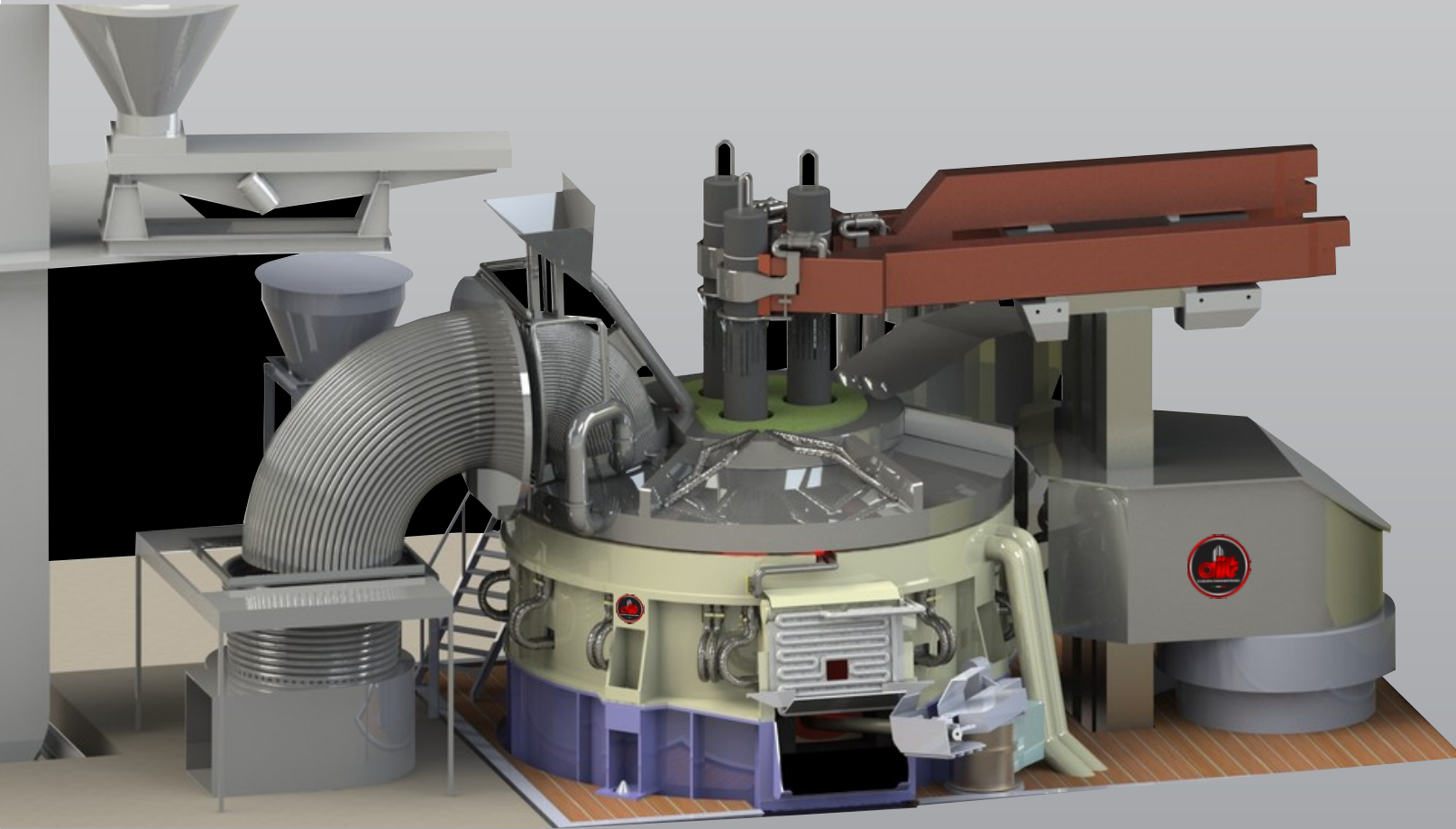


*Porta itineris dicitur longissima esse.
Ubi semper est victoria, ubi concordia est.
Porta itineris dicitur longissima esse.
Ubi semper est victoria, ubi concordia est.*

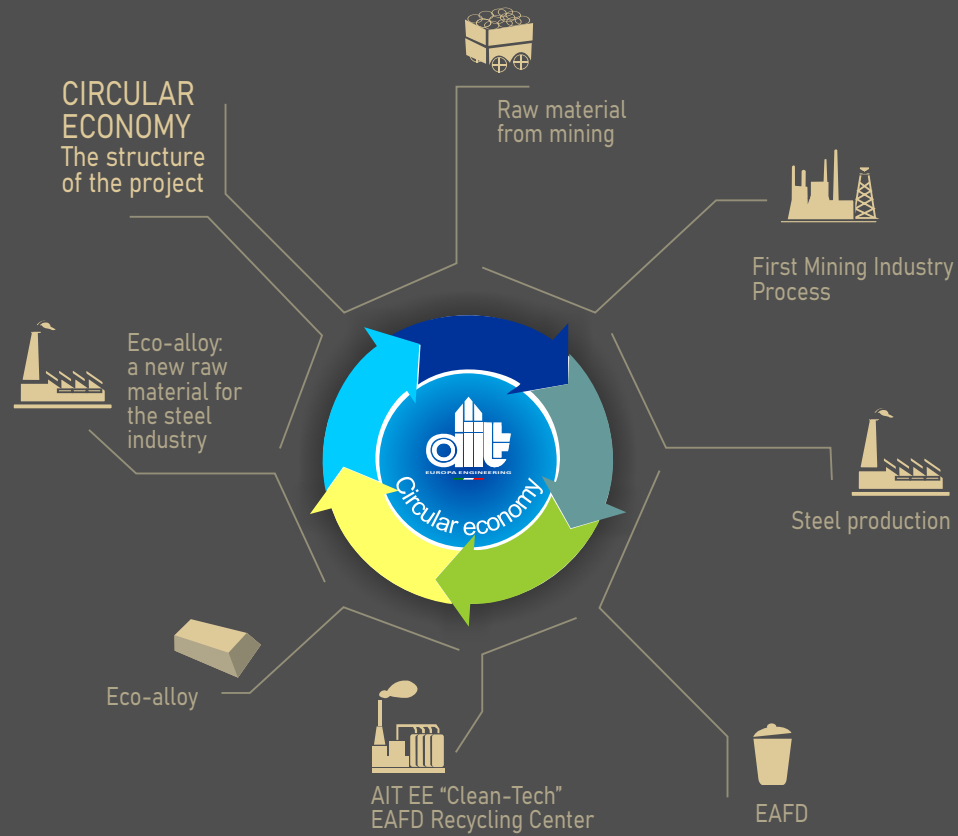


Ad maiora

AIT Europa Engineering
CLEAN-TECH
Recycling Center



*Ibi semper est victoria,
ubi concordia est*



Thinking of a sustainable tomorrow



Designing and
achieving a
green world

TECH FOR THE RECYCLING OF INDUSTRIAL ORIGIN RESIDUES

A VALUABLE PARTNER FOR ENVIRONMENTAL SOLUTIONS

AIT Europa Engineering is a company specialized in manufacturing innovative technological systems with high efficiency, for the recovery and treatment of waste streams from mining and from the production of metals, converting a potentially dangerous waste into a valuable raw material or by-product. The study and implementation of cutting-edge technologies in the field of industrial metabolism make AIT Europa Engineering a world reference for the metallurgical sector. In fact, mines and metallurgical industries generate large quantities of waste, in a variety of forms, such as dust, fines, slag, etc., whose recovery, treatment or disposal is difficult and expensive. AIT Europa Engineering's Clean-Tech technology applied to electric arc furnaces is capable of transforming a large number of metal production waste into raw materials with high added value.

AIT Europa Engineering proposes an innovative method for the treatment of those wastes, through the creation of Recycling Centers made up of cutting-edge technologies: the "Clean-Tech Recycling Center". Thanks to the integration of the AITEE Clean Tech EAF with the Ezinex process and the mineral wool production line, the "Clean-Tech Recycling Center" recovers up to 97% of the metals contained in the inorganic fines and steel residues (fume abatement powders - EAFDust) produced by the steel mills. The system is also applicable for ferroalloys, aluminum and mining sectors, creating a circular economy, without generating wastes. AIT Europa Engineering wishes to become a strong, cost-effective and valuable partner for intelligent environmental solutions.

ECO INNOVATION FOR THE ENVIRONMENT PROTECTION

CLEAN-TECH R.C. TECHNOLOGIES WITH POSITIVE ENVIRONMENTAL IMPACT

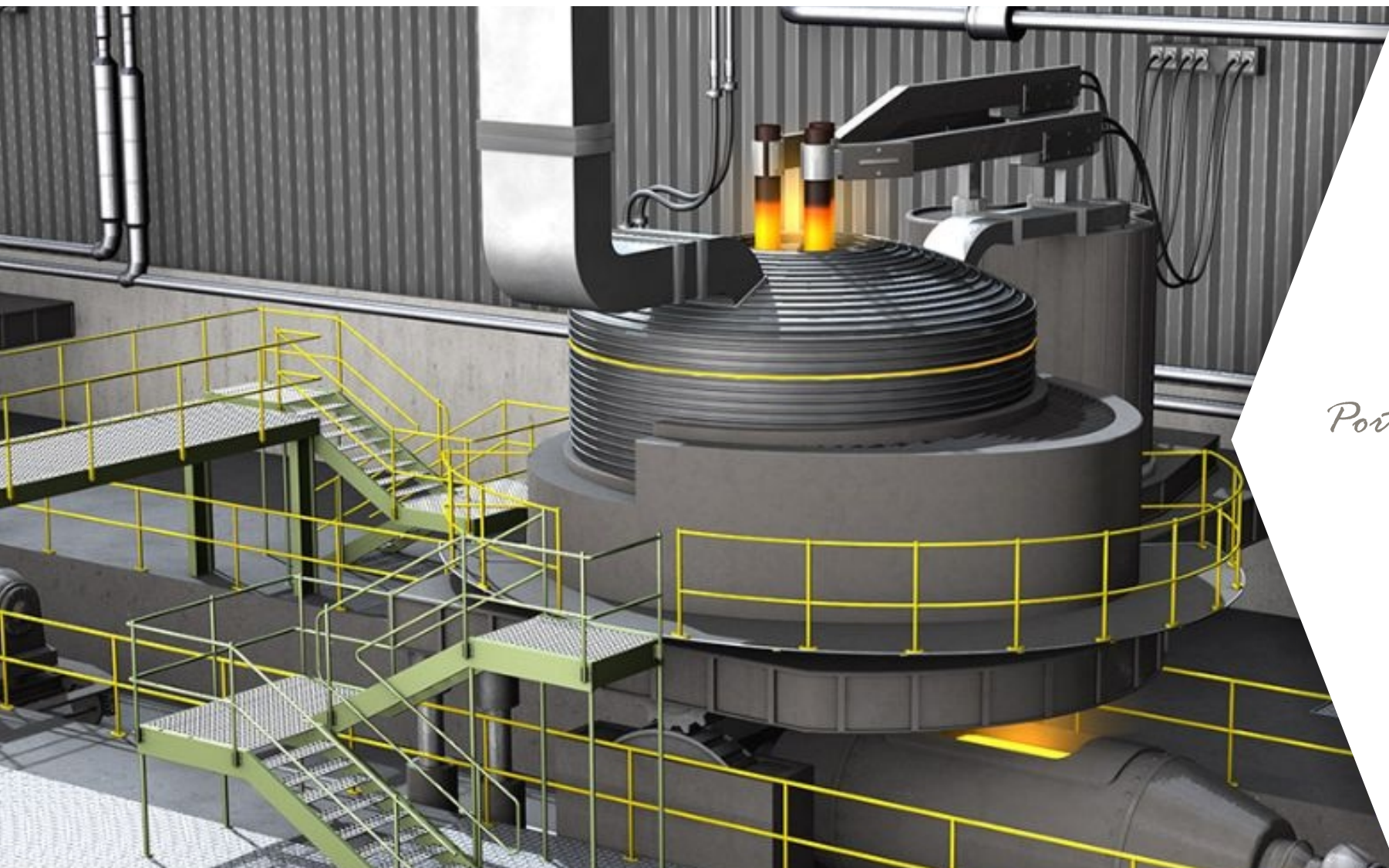
The Clean-Tech Recycling Center process transforms EAF Dusts, classified as a special hazardous waste (CER 10.02.07), into a new raw material; it is economically sustainable; creates a circular economy and has a positive impact on greenhouse gas emissions.

The AIT Europa Engineering Clean-Tech Recycling Center limits and / or eliminates the negative effects on the environment:

- **it reduces CO2 emissions into the atmosphere.**
- **it does not generate liquid wastes.**
- **it does not generate bad smells.**
- **it reduces noise emissions.**
- **it has a low impact on transport.**
- **it avoids the use of soil.**

The AIT EA Furnaces and the integrated Clean-Tech Recycling Center process are an eco-innovation which, when applied, raise the level of environmental protection established by European regulations.



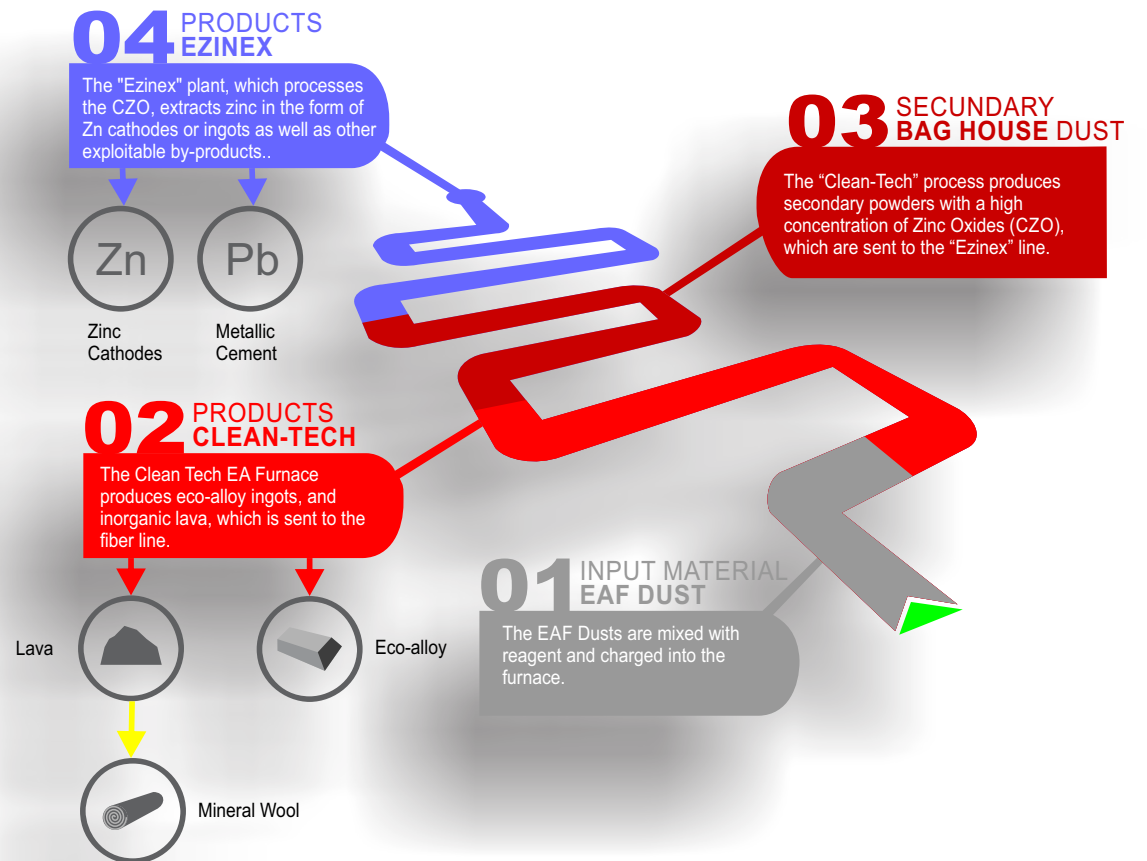


*Porta itineris dicitur
longissima esse.*

INTEGRATION THAT DOES NOT IMPACT INTEGRATED TECHNOLOGIES: THE FUTURE OF EAFDs RECYCLING

Unique of its kind, AIT EE Clean Tech Recycling Center, is the new industrial process applied to Steel EAFDs, capable of totally recover metals without generating waste, through the use of:

- AIT EE Clean Tech EA Furnace (pyro-metallurgical process), that recovers all ferrous metals;
- Ezinex technology by Engitec Technologies Spa (hydro-metallurgical process), that recovers the zinc contained in the Clean Tech fumes in form of high purity Zn ingots;
- Fiber Line for the transformation of the inorganic lava produced by the Clean Tech EA Furnace into mineral wool mattresses.

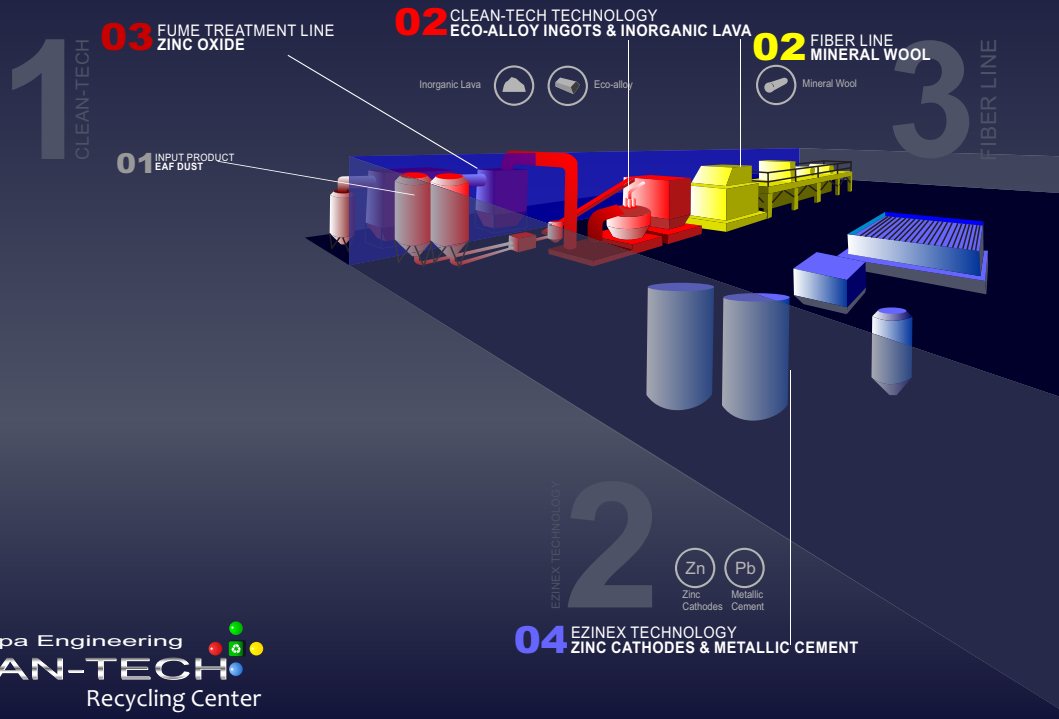


AIT Europa Engineering Clean-Tech Recycling Center

Integration that does not impact



3 Integrated Innovative Technologies for a **ZERO Residue** production process



AIT Europa Engineering
CLEAN-TECH
Recycling Center

A new environmental technological horizon of AIT Europa Engineering



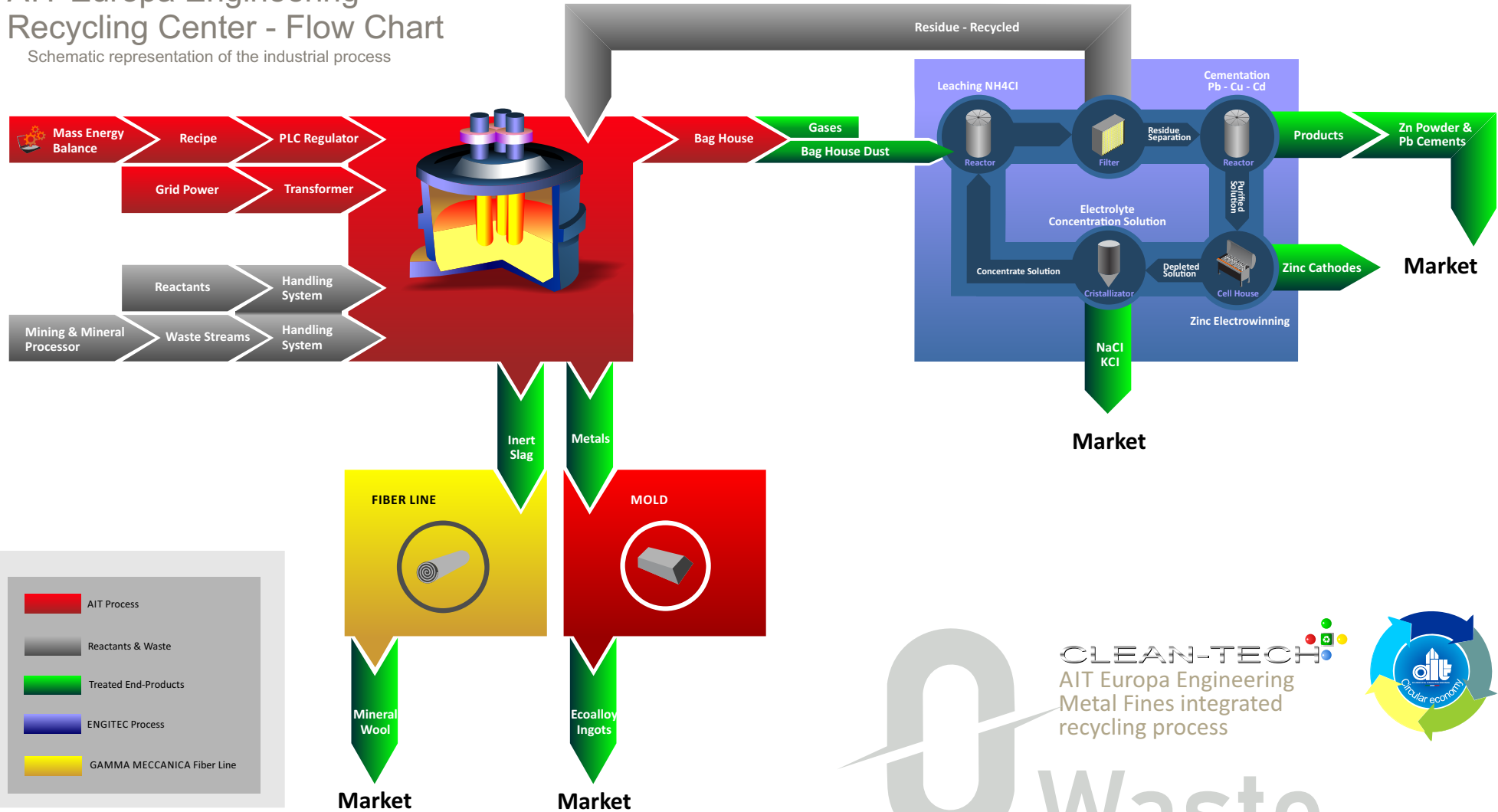
FEATURES AND BENEFITS OF THE CLEAN-TECH RECYCLING CENTER

We transform hazardous waste into by-products



AIT Europa Engineering Recycling Center - Flow Chart

Schematic representation of the industrial process



CLEAN-TECH
AIT Europa Engineering
Metal Fines integrated
recycling process

Waste



1 STORAGE & HANDLING SYSTEM

The EAF Dusts and the Reagents are separately stored in silos and introduced in the production process according to a recipe pre-calculated by the Clean Tech Software. A system of hoppers, weighing and mixer will create a homogeneous compound, which will subsequently be placed directly into the EA Furnace, without the need of pre-agglomeration.



2 AIT "Clean-Tech" TECHNOLOGY

The AC EA Furnace is managed by a software that regulates the entire Clean-Tech melting process. It calculates the quantities of the metal fines and reagents in the smelt. It automatically regulates the electrodes position, so to constantly maintain the condition for the simultaneous melting-reduction process.

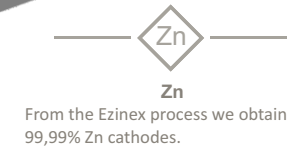


3 BAG HOUSE

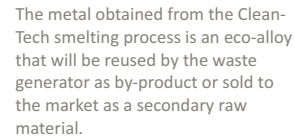
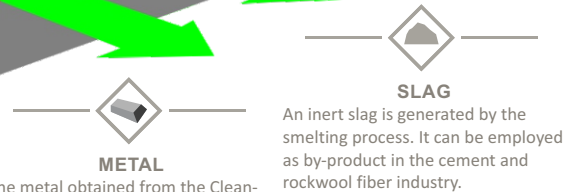
The Bag-House collects the highly concentrated ZnO secondary dust from the smelting process fumes. The secondary dust is then transported to the Ezinex plant for the subsequent processing and extraction of the Zn.

4 ENGITEC "Ezinex" TECHNOLOGY

Secondary dusts are now processed through the Ezinex plant, an innovative Engitec Technology for the complete recovery of the Zn, based on a hydro metallurgical process.



99,99%



5 MINERAL WOOL

The inert slag is converted into loose mineral wool suitable for industrial use.

GAMMA MECCANICA - Fibration Line

AIT EUROPA ENGINEERING

A STORY OF A TECHNOLOGY DRIVEN BY DREAM, INSPIRATION, CREATIVITY

José Almeida is the inventor of Clean Tech technology and founder of AIT (Applied Industrial Technologies) a company based in Johannesburg-South Africa, specialized in the study, design and production of furnaces for the treatment of waste from the mining and metallurgical industry. A first prototype of Clean Tech furnace was produced and installed in Greece at ALSA (Aluminum of Greece) as part of the ENEXAL research project, promoted by the European Commission. It was a 1MVA power furnace that was used in numerous tests from 2010 to 2014. 100% of the ferrous metals present in the red mud (a waste derived from the reduction of bauxite into alumina) were recovered.

In the same period a 2 MVA and a 5MVA Clean Tech furnaces were produced and installed for the South African customer RST. The two furnaces were used successfully to recover ferrous metals from steel mill EAF Dusts for a few years. Today they are employed to process fine platinum ores.

In 2019 AIT created AIT Europa Engineering, to which it transferred its know-how and IP. Today the research and development, production and sale of Clean Tech furnaces takes place in the new headquarters in Italy.

2022 opens with the construction of a 5MVA Clean Tech furnace that will be used for a period of 4 years in the Hephaestus research project, funded by the European Commission.





CLEAN TECH TECHNOLOGY APPLIED TO THE EAFDust

CLEAN-TECH TECHNOLOGY OUR INNOVATIVE SYSTEM IS NOW AVAILABLE

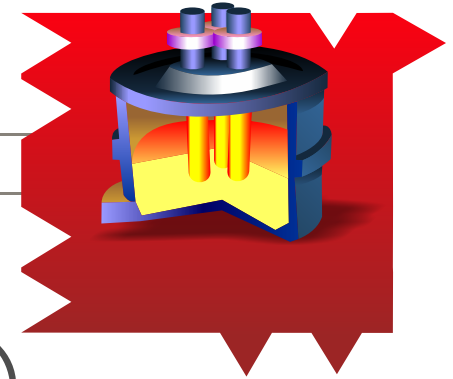
With our Clean Tech technology metal and minerals industries can now exploit fine metal wastes, eliminating all the issues related with their disposal. Toxic waste like stainless steel EAF dusts can be transformed into ferroalloy ingots. No toxic wastes are produced during the smelting process: the slag is an inert material suitable to be used as by-product in the rock wool or cement production, the bag-house dust has a high concentration of ZnO and can be sold to Zn refineries.

The Clean Tech process do not release any pollutant. The heart of the technology is represented by an AC Furnace and two technological innovations that enable the direct melting of inorganic dusts: the Digital Impedance Regulator (DIR), that controls the furnace electric power absorption and the Thermodynamic Model (TM), that calculates the reagents recipe to be added to the dust in order to maximize the metal recovery.

THE SECRET OF THE CENTER

THE CLEAN-TECH TECHNOLOGY EA FURNACE

The "Clean-Tech" arc furnaces are of the new generation and, thanks to the use of an exclusive proprietary technology, are suitable for the direct melting of fine-sized materials (100% particle size <2mm). The main technical characteristics and the main advantages that this type of oven offers are the following:



AC Electric Arc Furnace

AIT Clean-Tech technology is applied to AC Electric Arc Furnaces. The 3 Electrodes are made of carbon or graphite and powered by three-phase alternating current.



The Arc Zone

The arc is set between the electrodes and the charge. The 3 tips of the electrodes are in slight contact with the slag.



The Current Density

The maximum current density is about 30 A / cm² for each electrode. The adjustment is carried out by means of a vertical movement of the electrodes driven by an electric or hydraulic motor.



The Thermal Energy

The electrical energy that passes between the 3 tips of the electrodes forms a resistive heating equivalent to an increase in thermal energy in the system.



Hot-Top charging mode

The advantage of AIT CleanTech technology is that, because of the extended triply-induced hot arc zone that continuously resides on the surface of the charge 'hot-top' mode is applied.



Pelletizing / Briquetting

pelletizing / briquetting is not necessary before pouring the fine material into the Furnace.



Melt Reduction

In stead of being in melting mode, AIT Clean-Tech EA Furnaces have been transformed in meltreduction mode.



97% Metals

AIT Clean-Tech EA Furnaces make it possible to recover over 97% of the metals contained in the dusts



Easy to operate

This by virtue of our unique PLC-based control system which continuously automatically resets all 3 of the graphite electrodes according to the level of the slowly rising molten bath.



Easy to manipulate

Any person, even with a secondary-school certificate, can be quickly trained to operate and maintain our furnace.



Easy to maintain

Occasional new electrode addition/replacement and minor re-patching of worn parts of the refractory lining of the bowl constitutes a large percentage of the furnace maintenance.



Versatility

Clean-Tech EAFs can be easily converted from a smelting process to another, according to our TM (Thermodynamic Model).





www.engitec.com

TOTAL RECOVERY OF METALS FROM CLEAN-TECH FURNACES FUMES EZINEX TECHNOLOGY: CRUDE ZINC OXIDE REFINING LINE

The “Ezinex” process makes it possible to recycle the secondary powders produced by the “Clean-Tech” smelting process. Encapsulated by the filters of the furnace fumes treatment system, this residue has a high content of ZnO. The result will be the production of zinc cathode (or ingots) and the recovery of the other non-ferrous metals (Pb, alcały salts etc.). The process, developed and patented by Engitec S.p.A. is a hydrometallurgical process of zinc based on leaching, which uses ammonium chloride as a leaching medium by virtue of the selectivity of the attack of this reagent towards the zinc contained in the powders. It consists of 4 main operations:

- Leaching of the powders and separation of the residue
- Purification of the electrolyte by cementation
- Electrolysis of zinc
- Concentration and crystallization



ENGITEC “Ezinex” Process Flow

Schematic representation of the Process and Procedures

Process description

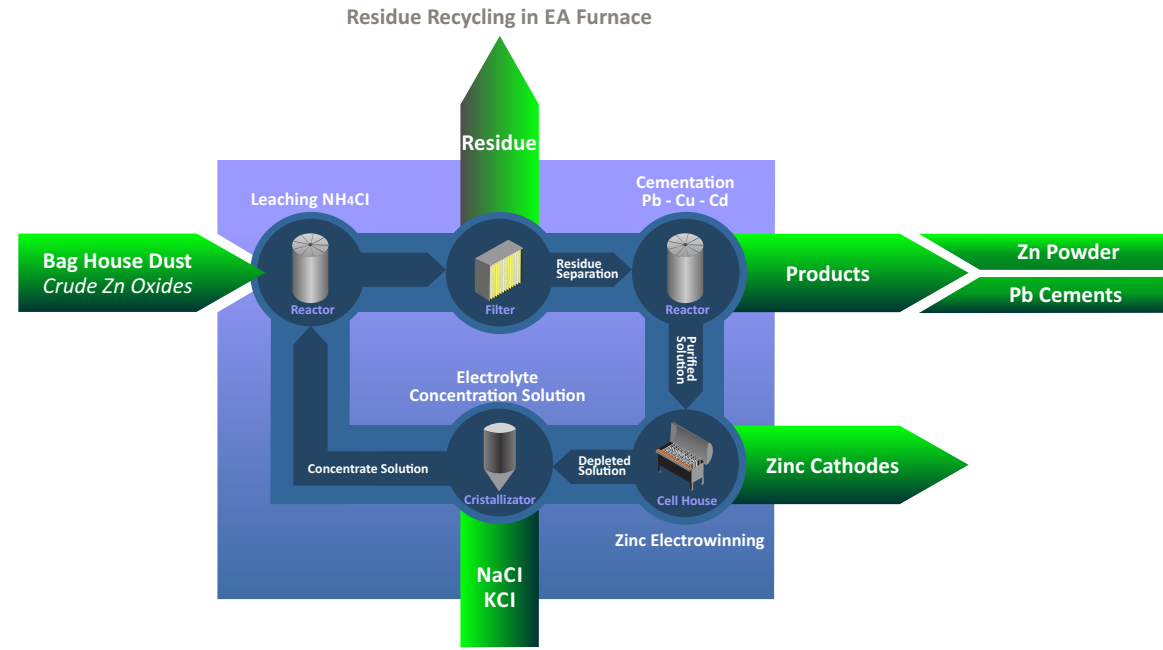
1. Crude ZnO dust obtained by the pyrometallurgical process of the steel dust is free of FeO and present an high concentration of ZnO (50-60% from austenitic stainless steel, up to 90% from ferritic steel).

2. Crude ZnO dust is stored in a dedicated silos.

3. A leaching step takes place where Zn and some heavy metals are dissolved. By adding Zn powder, heavy metals precipitate (cementation) purifying the solution.

4. The precipitated cements are separated from the purified solution by filtration and are suitable for further recovery of the lead by a smelter.

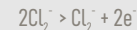
5. The purified electrolyte is then fed to the EZINEX cells, composed by titanium cathodes and graphite anodes and provided of an air sparging system.



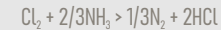
At the cathode, Zn is deposited according to the following reaction



At the anode, the electrochemical chlorine evolution as per the reaction



is immediately followed by the very fast reaction



converting the chlorine in nitrogen.

A single cathode runs at an average of 350 A/m², producing approx. 7 t/y of Zn.

The stripping time is 48 hours.

6. The water balance is kept by a cristallizator, which concentrates the electrolyte and extract the alkali chlorides brought into the solution by the EAF flue dusts.

EZINEX is a ZERO WASTE process.

The process outputs have a market destination: Zn - steel industries, metal market; Pb cement - Pb smelters; Alkali chlorides - secondary aluminium smelters



www.mst-techsrl.com



ENVIRONMENTAL CONTROL SYSTEMS

MST TECHNOLOGY, FLUE GAS TREATMENT SYSTEMS

is an engineering company, established in 2013 by a team of engineers with previous experience in the waste to energy, iron and steel, power generation and industrial wastewater treatment markets.

Based in Udine, Daneco operated mainly in two markets:

- Waste sorting plants;
- Industrial air pollution systems.

In 1995, the industrial division became part of ABB Flakt Italia. Udine was the worldwide lead center for the iron and steel market within ABB Flakt. In 1999, ABB and Alstom formed the ABB ALSTOM Power group and in 2001 ALSTOM gained the complete control of the power business. Udine (Daneco Unit) was still competence center for the iron and steel and the waste to energy markets. In 2005, Alstom decided to shut the operation in Udine and concentrate only on the power business. The engineering group in Udine decided to create ETEAM to continue working as consultants for industrial air pollution systems. In 2013, MST replaces ETEAM.



EXPERTISE

Flue gas treatment systems:

- Dedusting systems: cyclones, fabric filters, electrostatic precipitators (ESP);
- DeNO_x SCR type;
- Wet flue gas desulphurization (FGD) with lime and limestone;
- Dry FGD with lime injection and fabric filter;
- Spray driers;
- Removal of halogenic acids (HCl, HF, HBr) with soda and lime injection (single and dual stage);
- Wet ESP for the removal of submicron particulate, heavy metals, dioxins and furans, mists and fumes.

Energy recovery systems:

- Heat generation;
- Power generation;
- Combined heat and power (CHP).

Water and wastewater treatment plants:

- Physical and chemical treatments;
- Biological wastewater treatments;
- Residual treatment;
- Effluent polishing.

Power generation from biomass:

- Traditional Rankine cycles;
- Organic Rankine cycles (ORC);
- Gasification.

MARKETS

- Iron and steel;
- Aluminum;
- Waste to energy;
- Power generation from fossil fuels and renewables;
- Cement;
- Glass.



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