

# The role of slags and other by-products within circular economy in the steel industry

- ▶ Pittini Group's experience in valorization and recovery of waste from the production process as new products: the Zero Waste Initiative
- ▶ Matteo Chini, Pittini

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*ESTEP Focus  
Group Circular  
Economy &  
FEhS-Institute*



# By-products

**Steel production** with Electric Arc Furnaces (**EAF**) and Ladle Furnaces (**LF**) generates **residues** that were once considered **waste**. Over time, these materials have gained recognition as valuable **by-products**, including EAF slag, LF slag, and refractories

**EAF Slag** – Formed by lime addition and oxide flotation, creating a second liquid phase above the steel. It mainly consists of iron, calcium, and silicon oxides, with a significant output: 15% of the steel's weight and a similar volume



**LF Slag & Refractories** – Heterogeneous and challenging to handle, they quickly turn into a fine powder rich in CaO and MgO



# ~~By-products~~ Real products – Our approach

Unlike the traditional approach of treating by-products as leftovers, we develop **dedicated processes, plants, and certifications** to create **real, high-value products** that **replace raw materials** in the market

**Granella®** – obtained from processed **EAF Slag** it has enhanced physical and mechanical characteristics compared to high grade aggregates used to prepare high performance **special bituminous concrete** (highly adhering, sound-absorbing and drainage road surfacing)



**Siderlime®** – artificial aggregate derived from **LF Slag & Refractories**. It is used in the production of **bituminous mixtures** as a filler/blend to partially replace natural aggregates and construction materials



# Zero Waste project – From waste to product

## Challenges & Opportunities

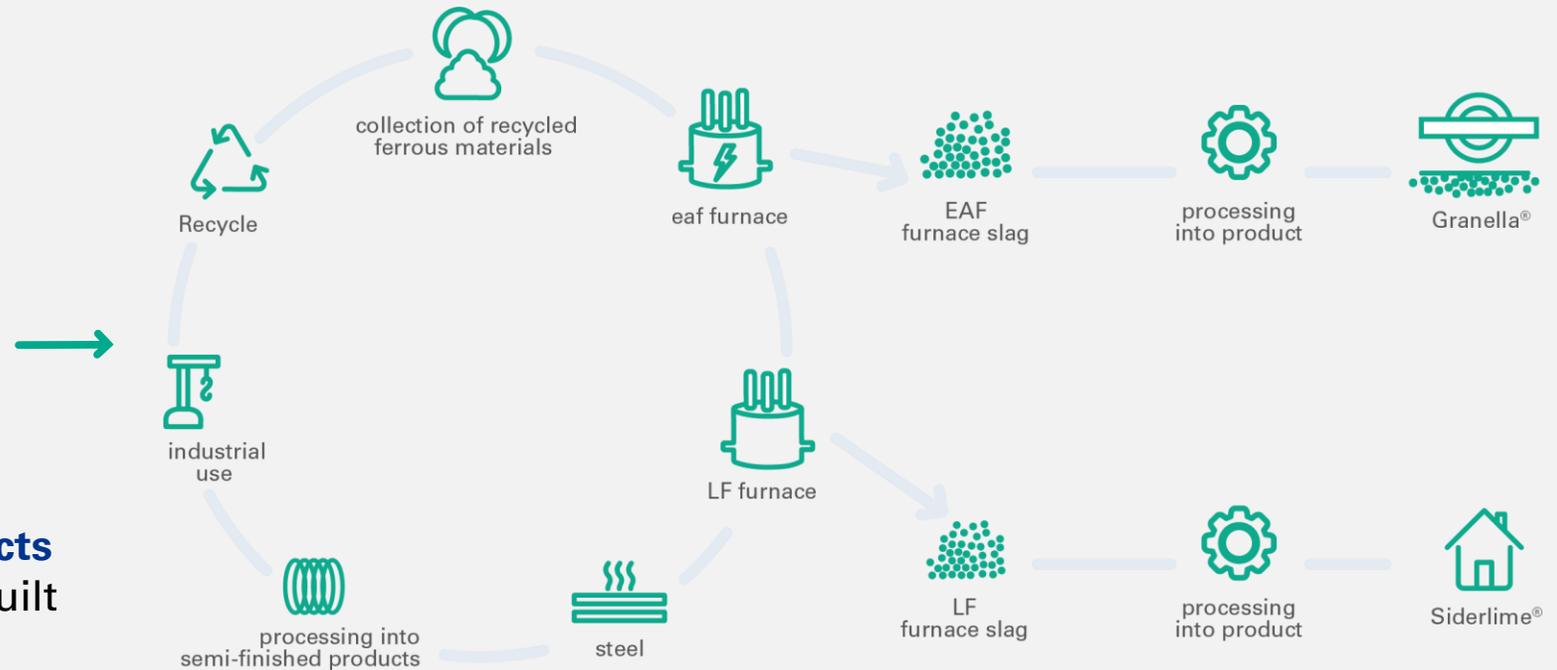
Rising disposal costs and growing environmental awareness drive the need for sustainable solutions

## 1998 – The Zero Waste Project

Every material in the production process is re-evaluated through a circular economy approach

## From Waste to Market-Ready Products

Since launching the project, we've built dedicated processes, plants, and networks to create **products** that replace raw materials from mines and quarries



An example of industrial symbiosis

# Granelle® and Siderlime® development

**Material Analysis** – Study properties and potential applications

**Feasibility & Economics** – Assess technical and economic viability at lab scale

**Process Development** – Scale up from lab to pilot and industrial plants

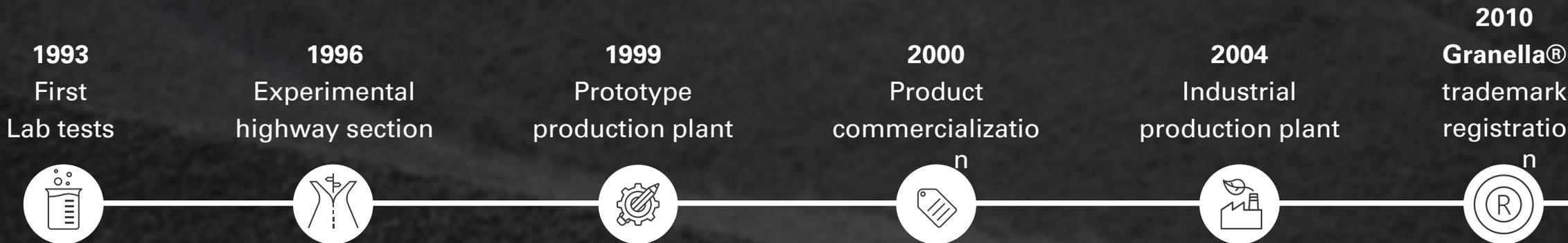
**Client Partnership** – Ongoing collaboration to meet performance and market demands

**Quality & Market Readiness** – Factory Production Control (FPC) ensures long-term reliability and competitiveness



# Granella® and Siderlime® development

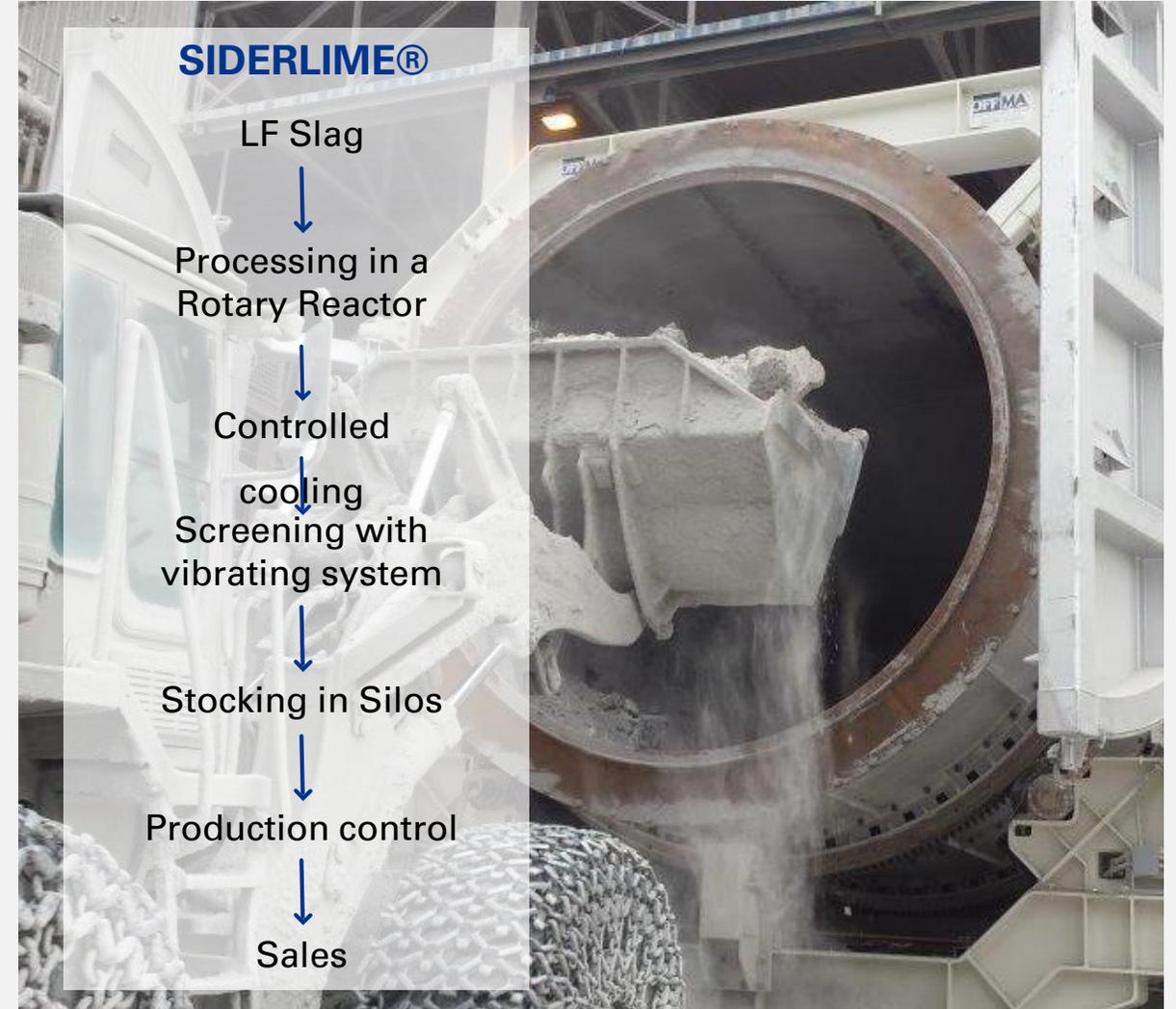
GRANELLA®



SIDERLIME®



# Why are they products? – Production plants



# Why are they products? – Certifications

## Granella®

- **CE Marked & Certified** under Regulation (EU) No. 305/2011
- Complies with **UNI EN 13043**, **UNI EN 12620**, and **UNI EN 13242** standards
- **REACH Registered** (EAF-C product N° 01-2119485979-09-0071) since 2010
- **EPD Certified and audited by ICMQ** for environmental transparency
- **Factory Production Control (FPC) Certified** since 2004 (ZAG – Slovenia, IGQ – Italy)

## Siderlime®

- **REACH Registered** as **SMS (Secondary Metallurgical Slag)**
- **EPD Certified and audited by ICMQ** and compliant with **CAM Strade & Edilizia** requirements
- Meets additional premium criteria as it is produced in an **EMAS-certified** plant
- Subject to **EU ETS Directive**, ensuring environmental responsibility

# Granella® – Production

3 Granella® production plants:

- **Ferriere Nord**  
~ 300.000 Ton/year
- **Siderpotenza**  
~ 100.000 Ton/year
- **Acciaierie di Verona**  
Plant in construction



# Granella® – We've come a long way

Look how far we've come:

- More than **6.000km of roads** paved since 1998
- Some of the main **highway sections** completed:

A2 Salerno – Reggio Calabria

A4 Padova – Trieste

A13 Bologna – Padova

A23 Palmanova – Tarvisio

Acciaierie di  
Verona  
Verona, Italy

Ferriere Nord  
Osoppo, Italy

Siderpotenza  
Potenza, Italy



# Granella® – Applications: Bari Airport

## Karol Wojtyła Airport – Bari

Puglia Airports renewed and extended the flight runway paving of Bari Airport in March 2018.

- **Track dimension of 2500 x 45 mt** of which 1800 x 45 mt performed in 8 days
- Total **surface of 104,530 square meters**
- **3.300 m<sup>3</sup> of Pittini's Granella®** 4-8 mm and 8-14 mm was supplied
- **7,300 tons** of bituminous concrete



# Siderlime® – Applications

- **High calcium oxide content** makes it ideal for cement manufacturing
- **Replaces natural raw materials** like marl and limestone
- **Used in raw kiln-fired Portland cement clinker** production
- **Enhances hydraulic properties**, essential for cements and hydraulic binders



# Siderlime® – CO<sub>2</sub> savings

Thanks to its already decarbonised calcium oxide content, **Siderlime®** reduces CO<sub>2</sub> emissions from the clinker burning process

**Siderlime®** is eco-efficient with a significant reduction in the consumption of natural raw materials

# Benefits for our clients



**High-Performance Product**  
Advanced characteristics,  
competitive with traditional  
alternatives



**Sustainable Choice**  
Made from recycled materials,  
reducing reliance on natural  
resources



**Lower Carbon Footprint**  
Reduced Scope 3 emissions  
compared to mining processes



# Thank you for your attention

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