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THE CONTRIBUTION OF DIGITAL TECHNOLOGIES IN SCRAP TREATMENT PROCESSES

HOW TO REDUCE CO_2 EMISSIONS IN THE STEEL MANUFACTURING

December 3rd, 2025

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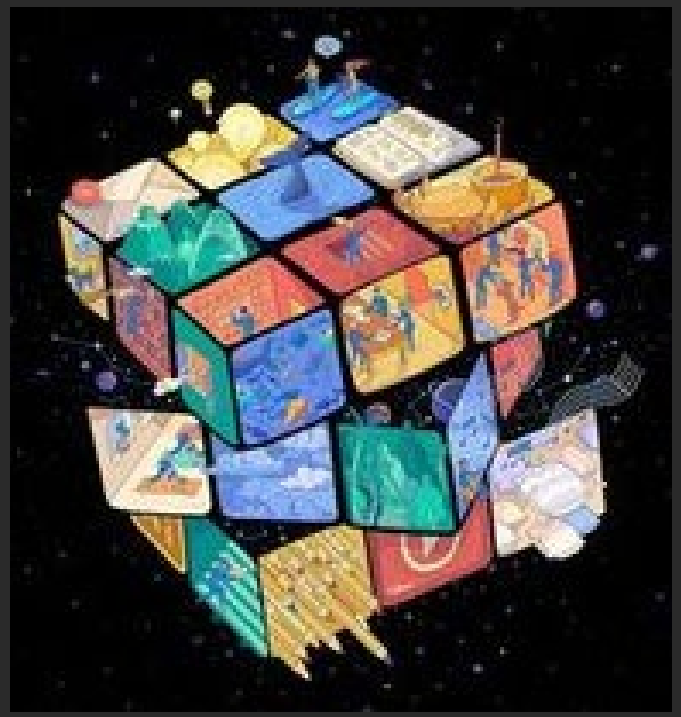

- EUdecarbonization context
- EUCooperation landscape
- Scrap-to-steel process
- Digital enablers
- Impact & Conlclusion

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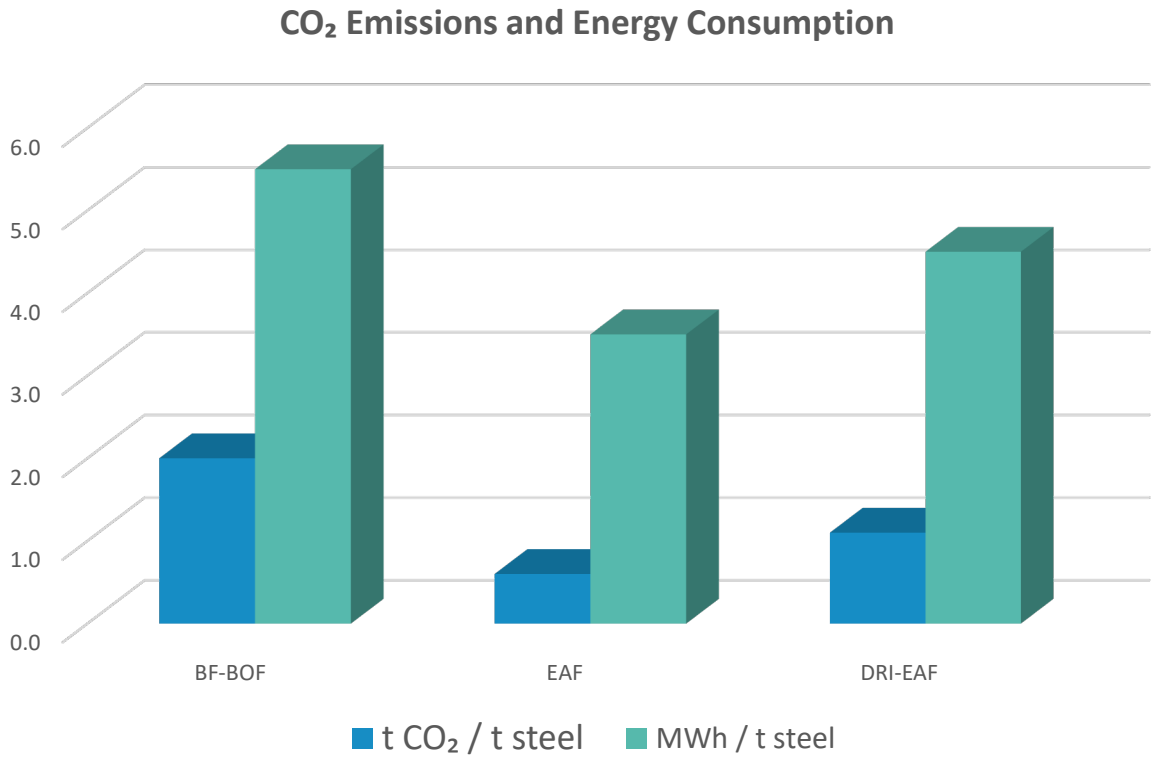
Steel and CO2 footprint

- Steel industry ≈ 7–9% global CO_2 emissions
- Blast furnace steel: ~2.0 t CO_2/t steel
- EAF steel: ~0.4–0.7 t CO_2/t steel
- DRI-EAF steel: ~1.1 t CO_2/t steel
- Secondary route (EAF) uses scrap → lower emissions
- Increasing role of circular economy
- Digitalization unlocks optimization



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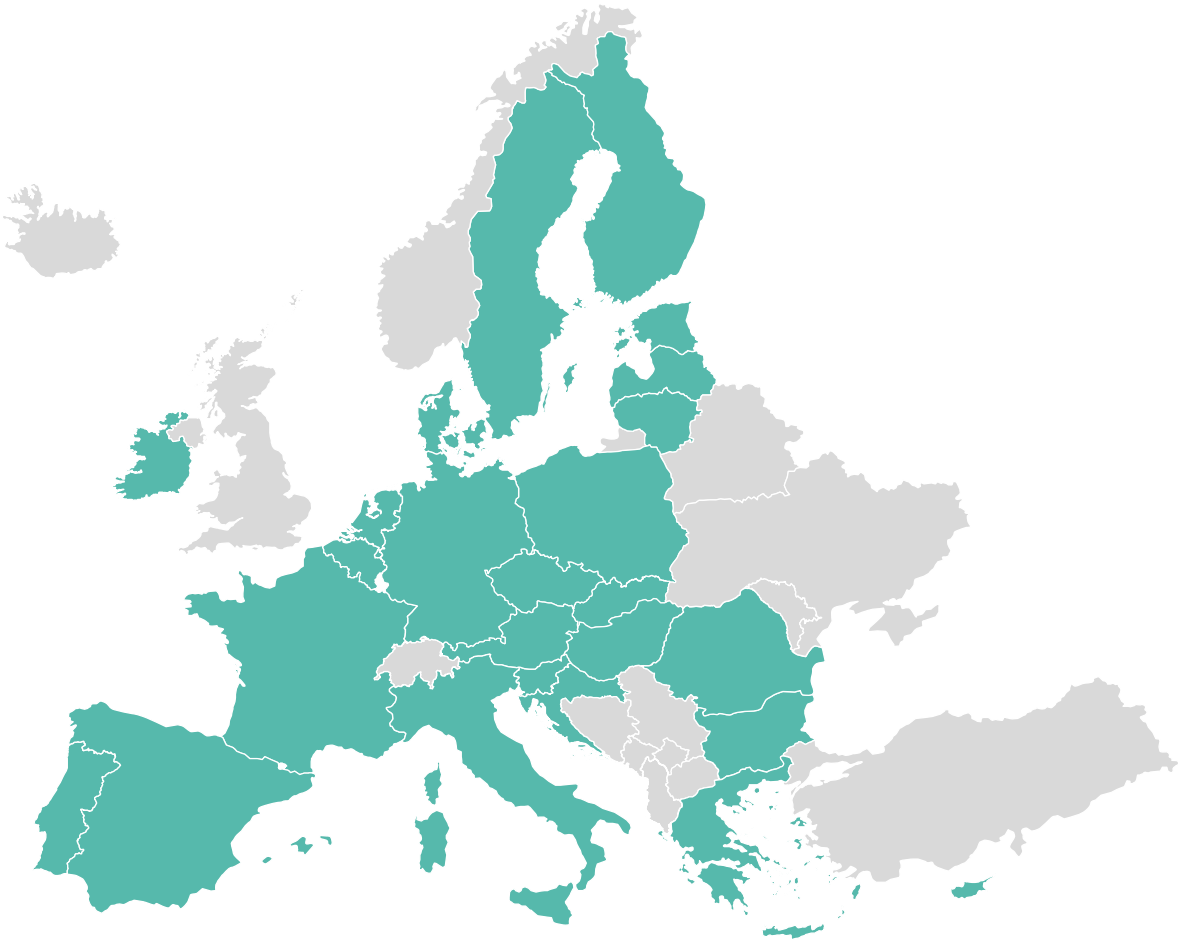
EU climate targets and EU funding programs

- EU Green Deal: climate neutrality by **2050**
- Fit-for-55 package → −55% CO_2 by 2030 (vs. 1990)
- ETS incentives + carbon pricing
- Funding: Horizon Europe, Innovation Fund
- Strategic relevance of circular materials
- Industry required to adopt cleaner & efficient technologies



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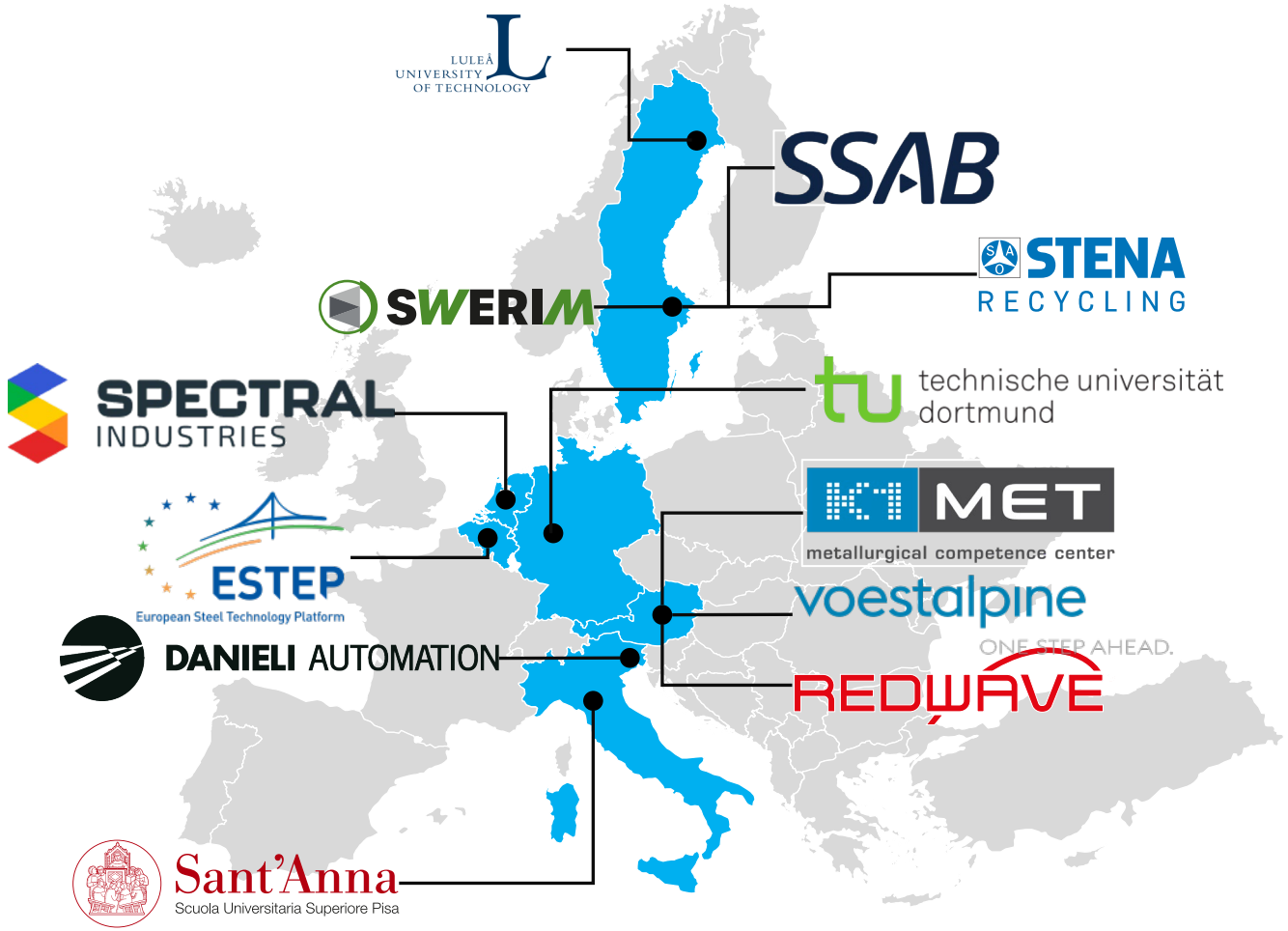
- Focus: digital scrap management & quality prediction
- Consortium: industrial, academic, tech suppliers
- AI-based scrap classification
- Data model for traceability & process optimisation
- Expected outcome: lower EAF energy demand



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Scrap -to -steel process overview

Gathers material from industrial and end-of-life sources, often with variable composition.

Clean, shred, and separate the scrap to improve density and reduce contaminants.

Manage transport and storage and define the optimal scrap mix based on target chemistry.

Converts the prepared scrap into liquid steel through controlled electrical and chemical energy input.

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Scrap collection & sourcing

- Sources: industrial, post-consumer, demolition
- High variability in chemistry and density
- Manual selection → limited precision

Digital tools

- Material databases
- Supplier scoring
- Chemical prediction

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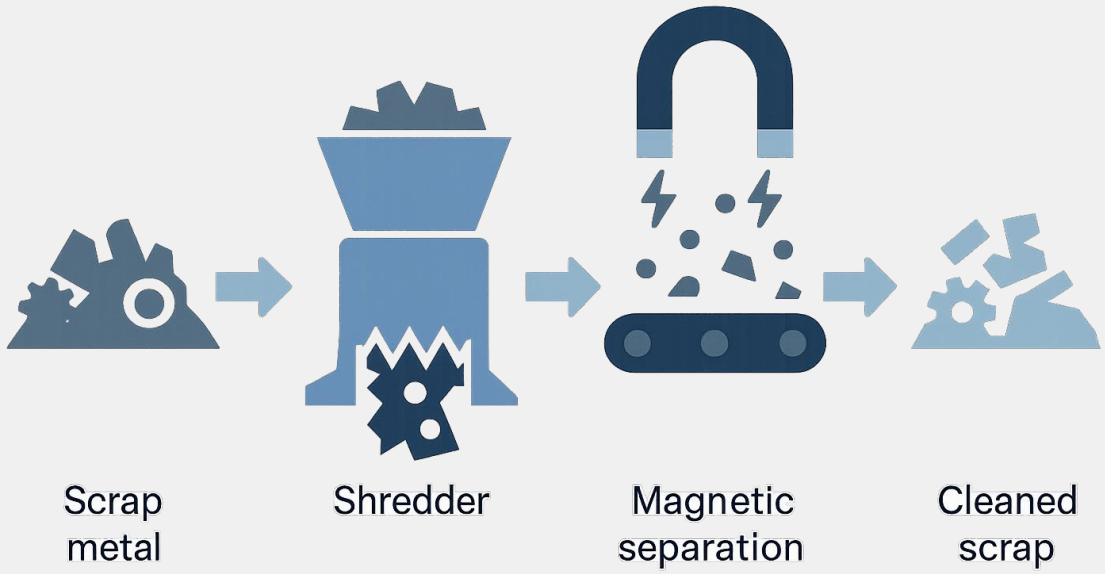
Scrap treatment

- Shredding, sorting, cleaning
- Magnetic, eddy current, density sorting
- Sensor-based (XRF, LIBS) → composition measurement
- Automatic picking station
- Reduced contaminants (Cu, Sn...)
- Digital tracking: chemistry + mass
- Intelligent sorting and classification → reduced variability
- Improved furnace stability
- Better scrap → reduced energy → lower CO_2



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- Storage, tracing, sampling practices
- Material tracking via sensors & IDs
- Real-time inventory
- Optimised material flows → energy savings

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Batching & feeding strategy

- Recipe-based scrap selection
- Quality-driven charging

Data integration improves

- Chemical predictability
- Energy efficiency
- Tap-to-tap time
- Reduced carbon injection

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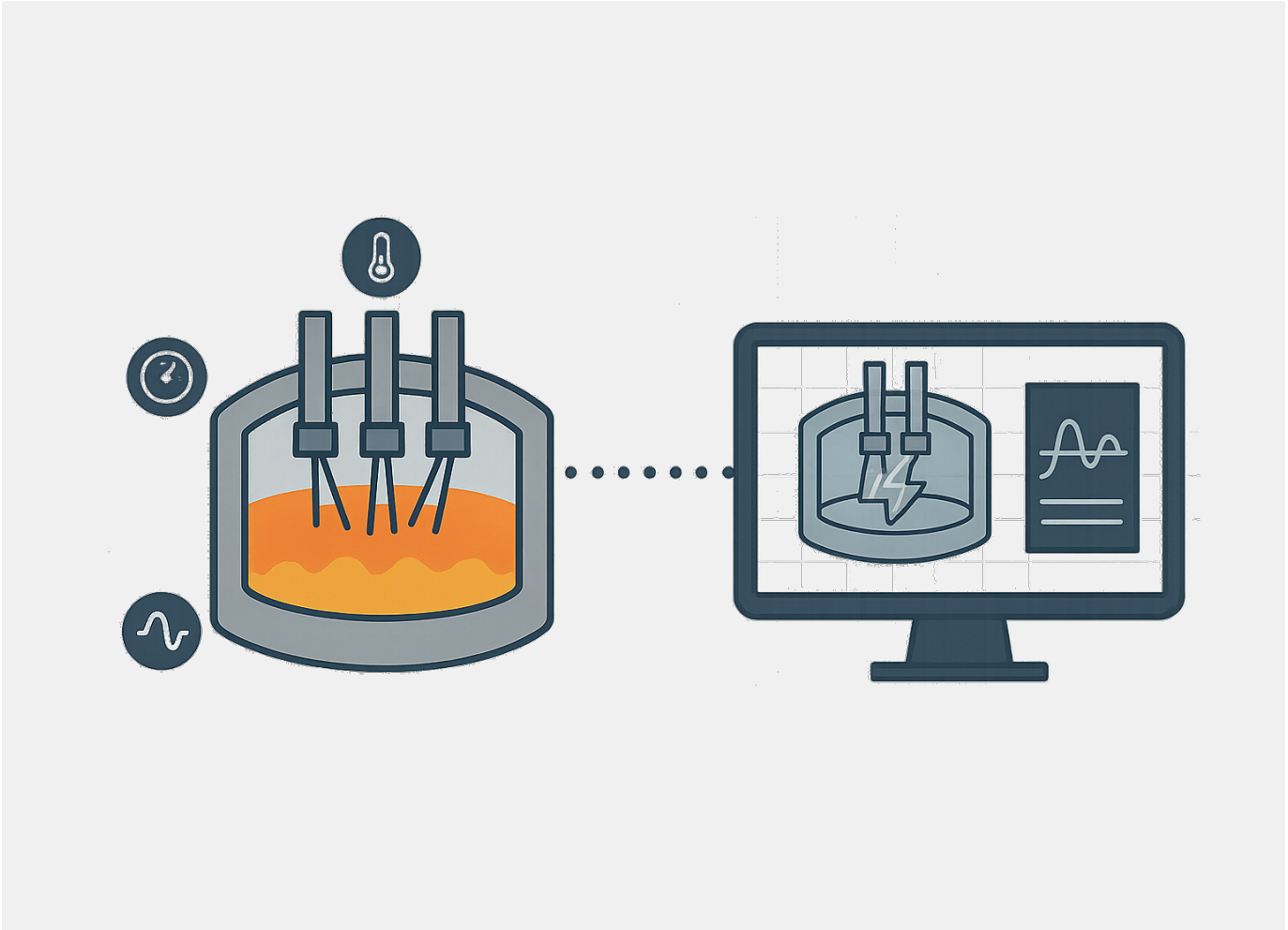
Digitalized EAF melting

- Control of electrical/chemical energy
- Oxygen + carbon injection
- Slag formation control

Digital tools

- Digital twin furnace model
- Real-time feedback systems
- Advanced process control

→ Higher efficiency → Lower kWh/t → Lower CO_2



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Scrap stage

- Improved quality
- Reduced impurities
- Less transport emissions

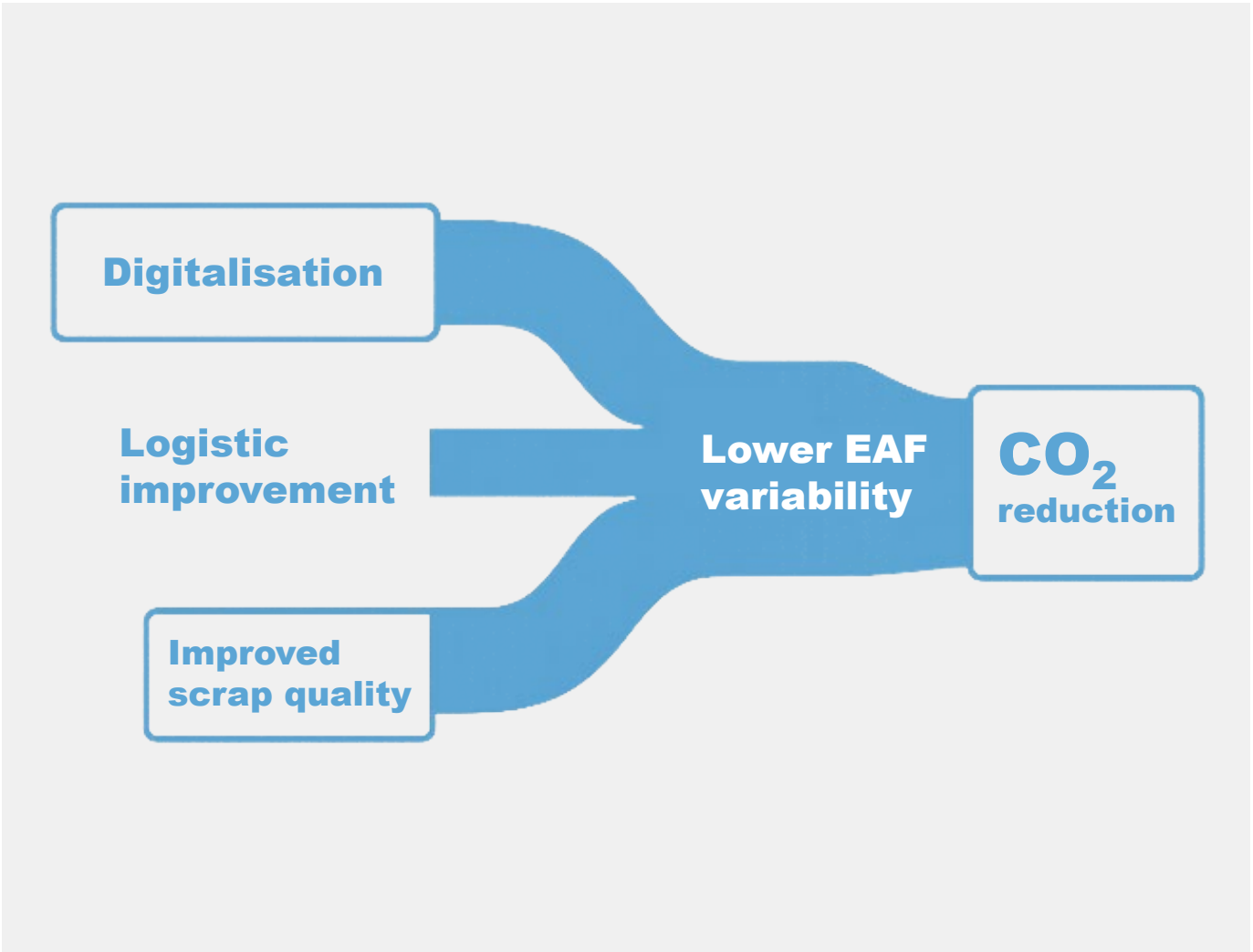
EAF stage

- Lower energy per ton
- Better carbon/oxygen ratio
- Reduced slag → fewer emissions

KPIs

- kWh/t reduction
- CO_2/t steel reduction
- Scrap yield improvement

Overall impact on CO_2



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Scrap is key to decarbonisation

Digitalisation improves scrap value

Energy & CO_2 reduced through:

Quality prediction

Smart batching

Digital EAF control

EU funding accelerates adoption

A fully digital scrap-to-steel chain is feasible

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