



Steel

Value Chain

**MINED
MADE**

**IN EUROPE
IN EUROPE**

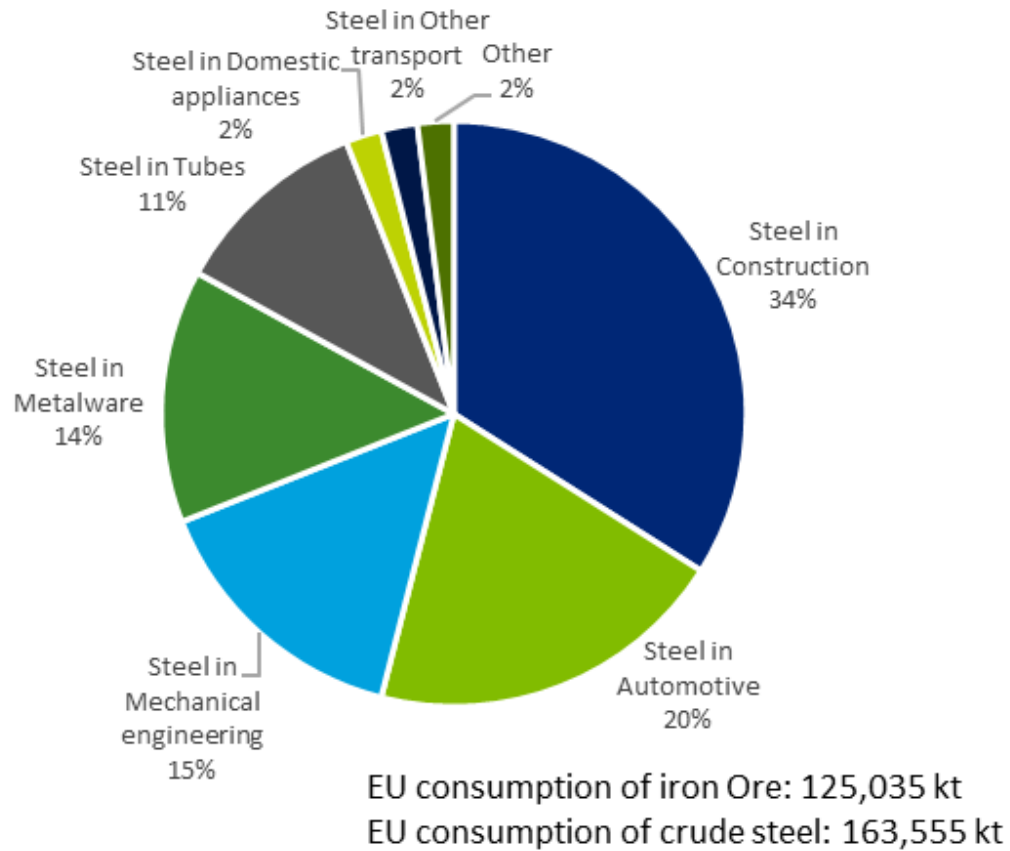
Towards a Sustainable Value Chain



Providing metals and minerals
for carbon neutrality

The example of the steel value chain

End uses of steel in 2018

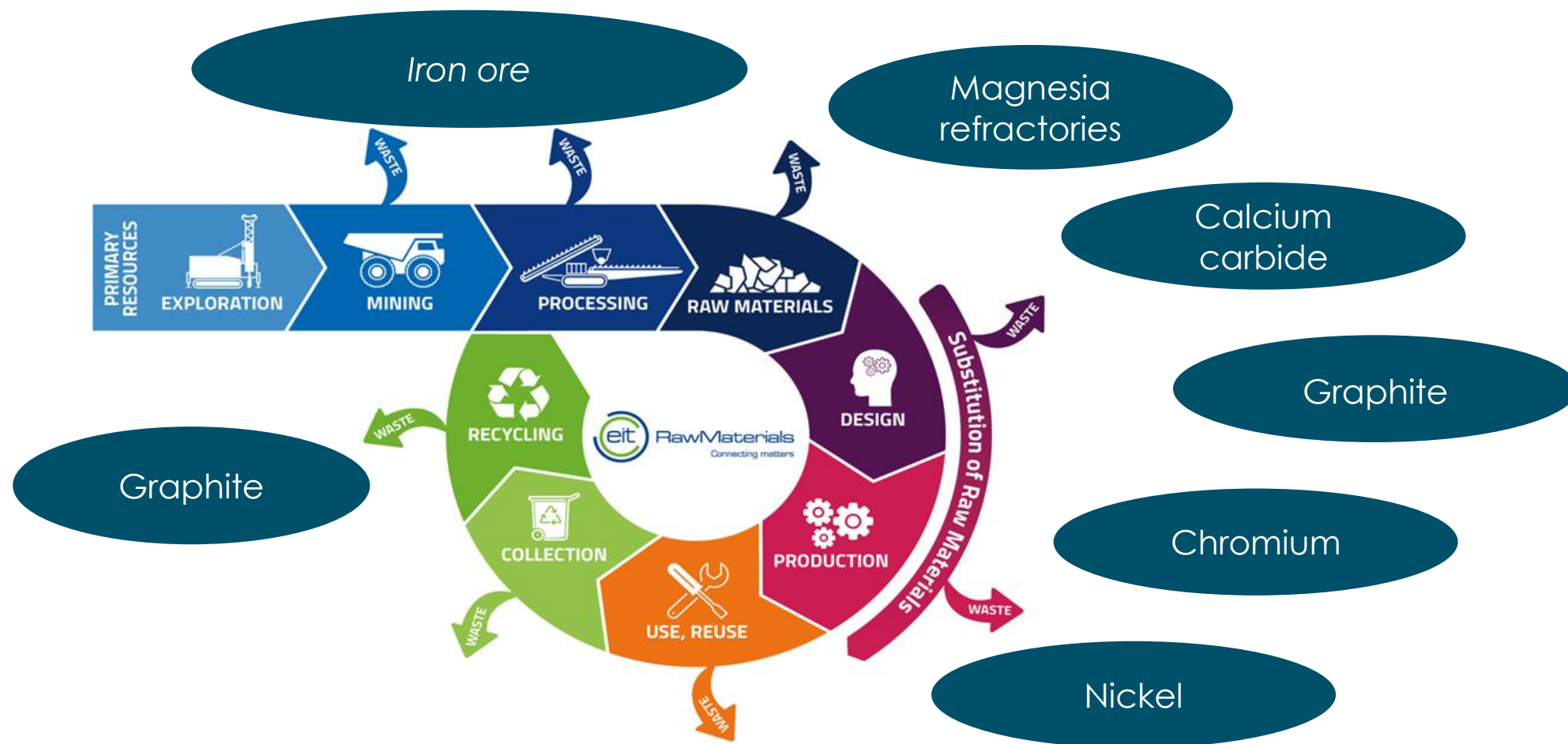


Energy

Mobility

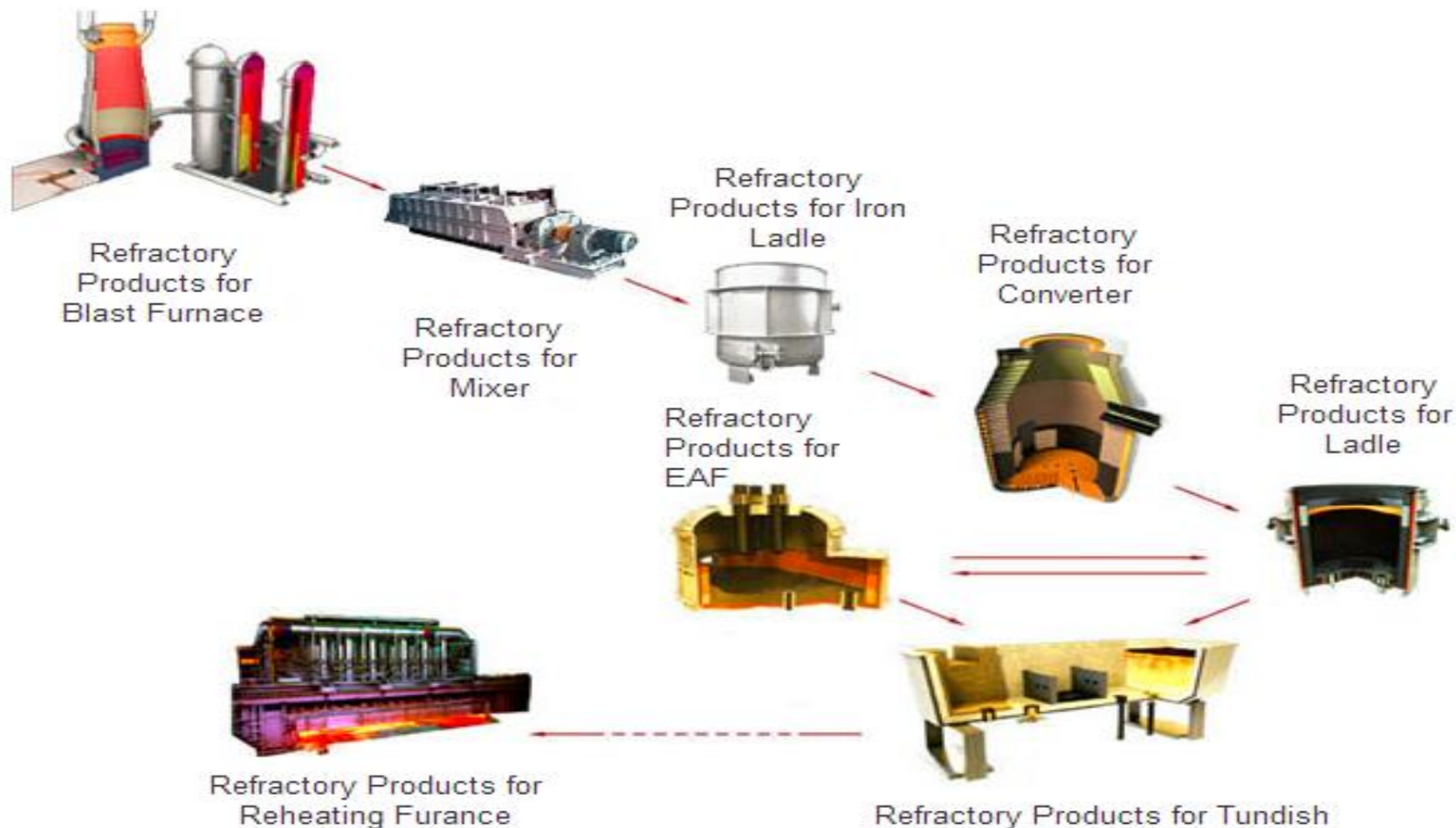
All of the raw material and auxiliary supplies are energy intensive in their production

Supply industries require higher energy due to electrification and high temperature processing



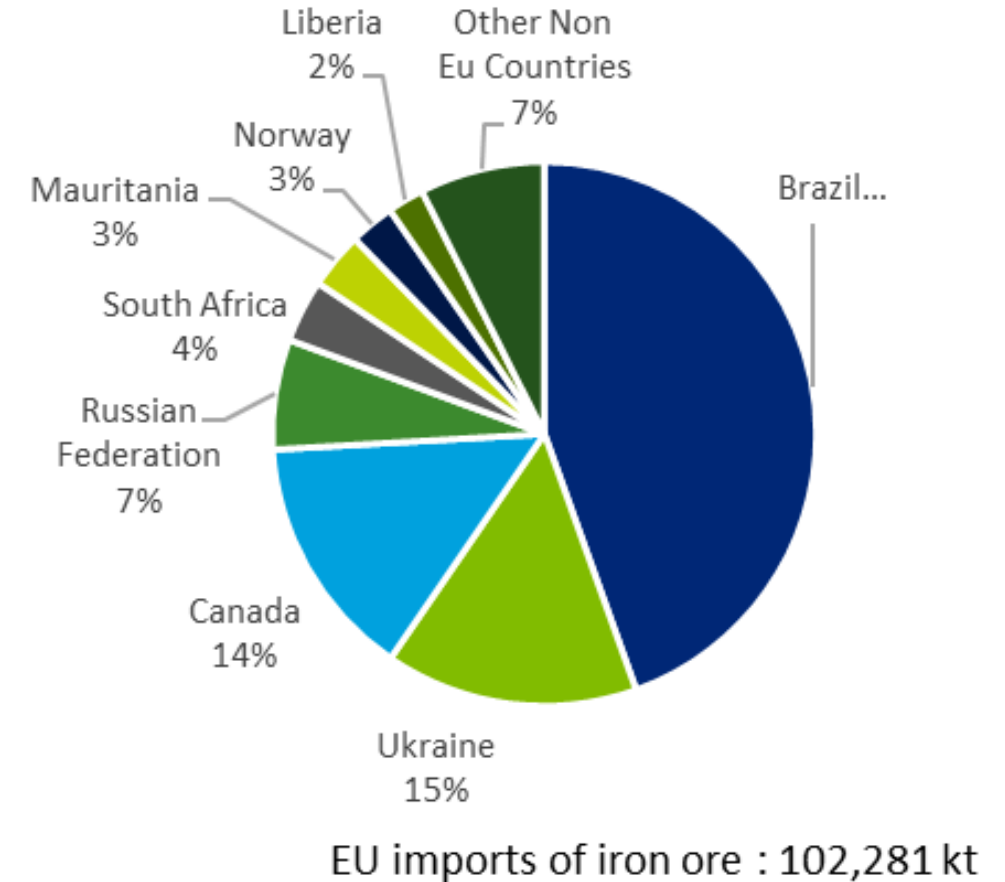
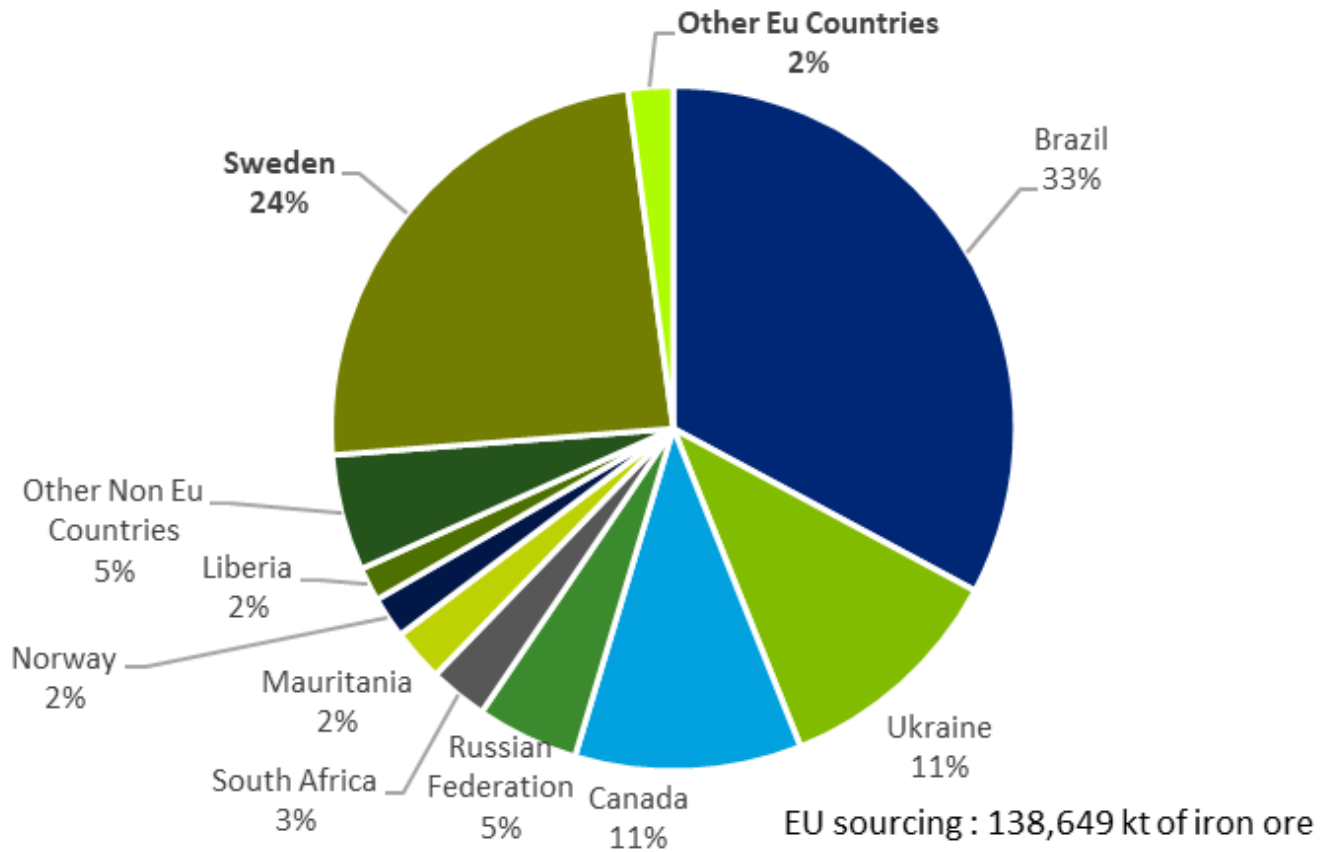
Steel furnace technology

Steel-making Process



Most refractory products are carbon based and in their process will release CO₂ as a result of the chemical reaction of the naturally occurring mineral.

Europe's iron ore supply



EU sourcing(domestic production + imports) of iron ore.
Average 2012-2016

EU imports of iron ore . Average 2012-2016
(Eurostat, 2019b)



Europe's Iron Ore Cluster



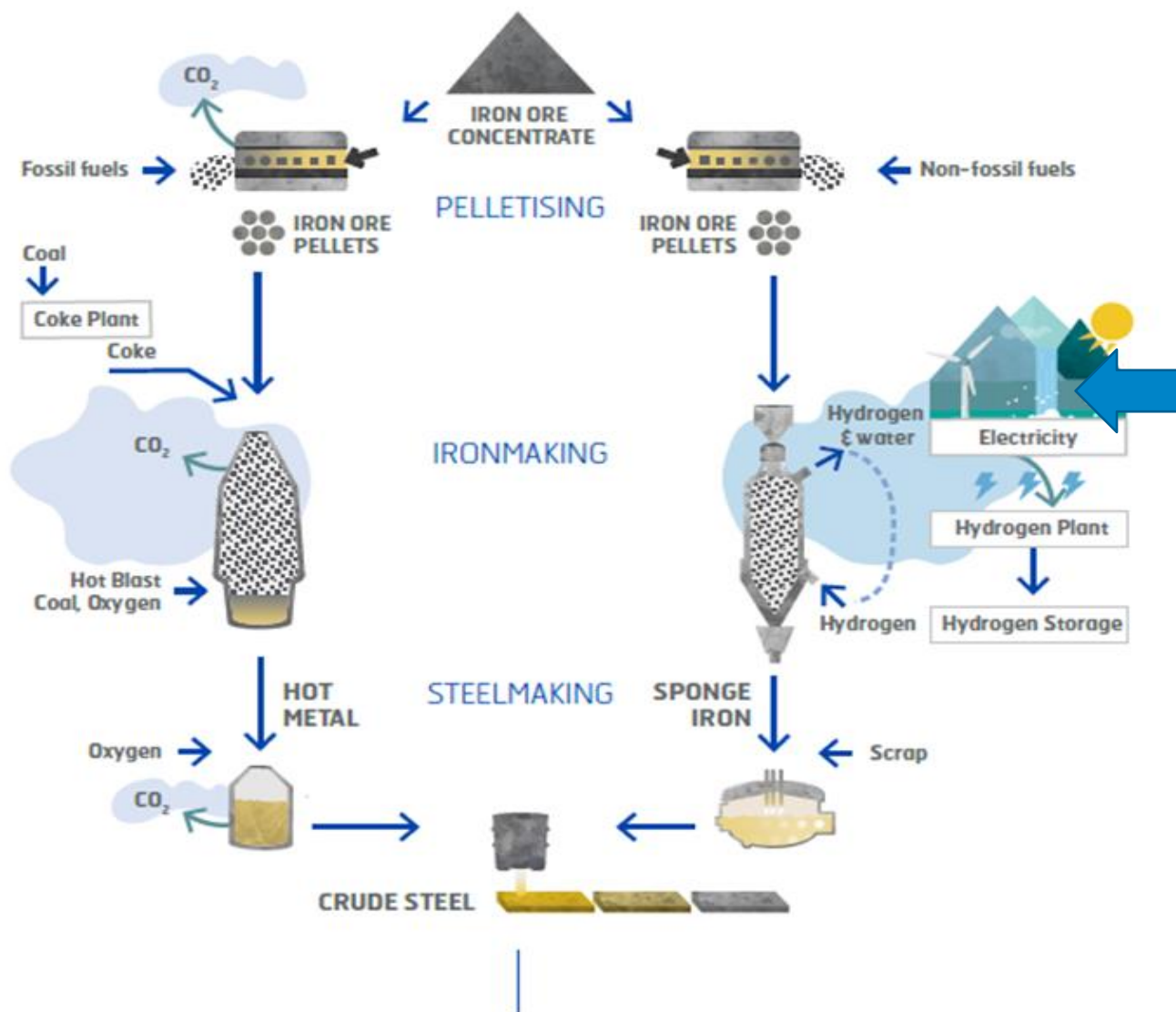
--- Sweden
--- Germany
--- Austria

HYBRIT

- ≡ The global iron and steel industry is one of the sectors whose processes emit the most carbon dioxide.
- ≡ A growing population in combination with greater urbanisation means that demand for steel will continue to grow until 2050.
- ≡ If the HYBRIT initiative succeeds, Sweden's carbon dioxide emissions will decrease by ten percent.
- ≡ Construction will soon begin on a world-unique test facility which is a key component of HYBRIT, a joint initiative of LKAB, SSAB and Vattenfall. In the plant, fossil fuels will be replaced with biofuel to achieve fossil-free production of iron ore pellets. The aim of the HYBRIT initiative, which is supported by the Swedish Energy Agency, is to develop a process for fossil-free steelmaking by 2035.

BLAST FURNACE ROUTE

HYBRIT ROUTE



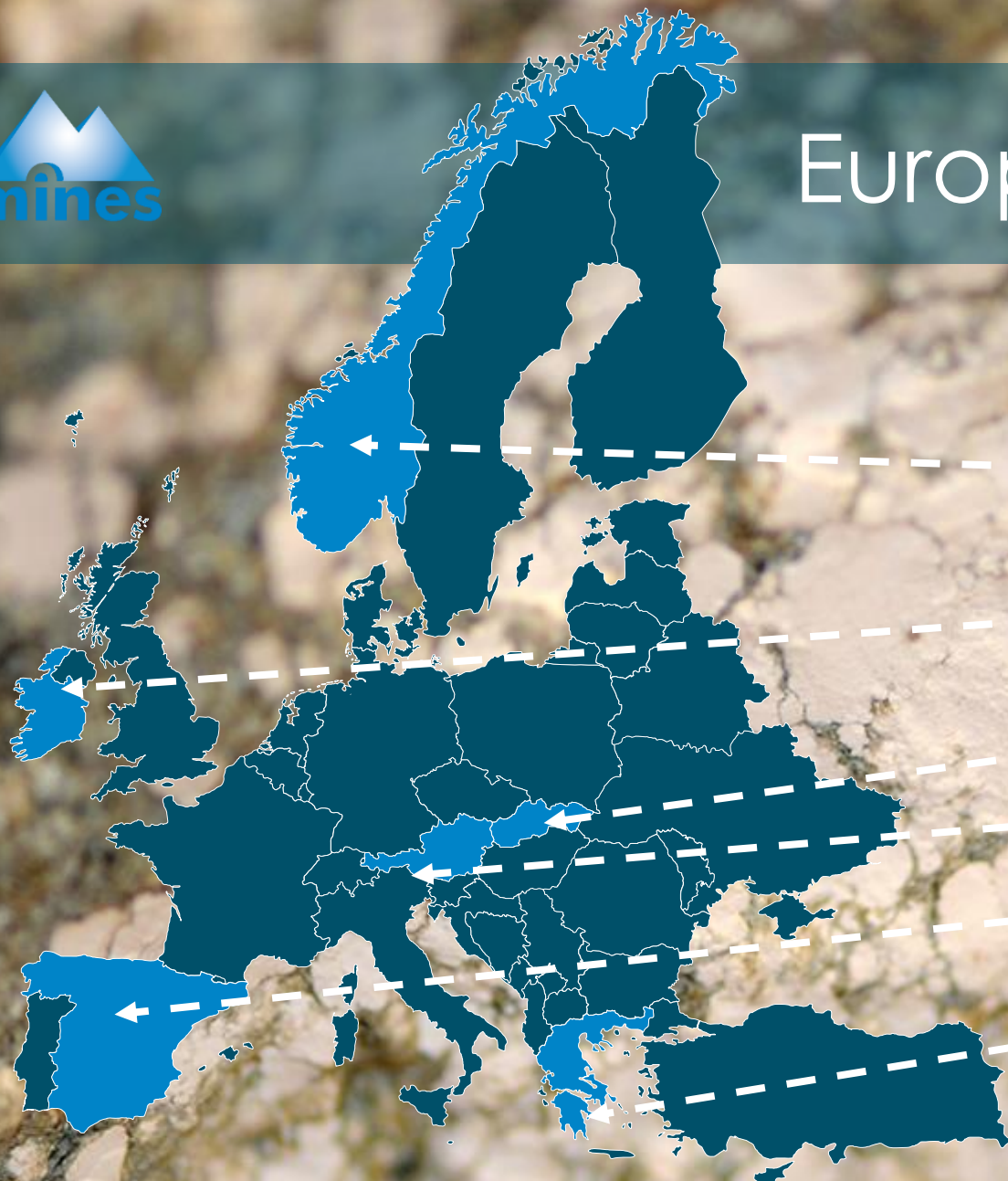
Horizon 2050

**switching to lower carbon fuels
(including hydrogen);
industrial carbon capture;
and energy and material efficiency**

Recent announcements for CO₂ emissions reduction/decarbonisation projects:

- ≡ SSAB (Sweden) HYBRIT project. A JV with LKAB & Vattenfall.
- ≡ SALCOS hydrogen steelmaking by Salzgitter & Fraunhofer.
- ≡ Paul Wurth (SMS group) to partner with Sunfire (with technology in Solid Oxide Electrolytic Cells) for H₂ steelmaking.

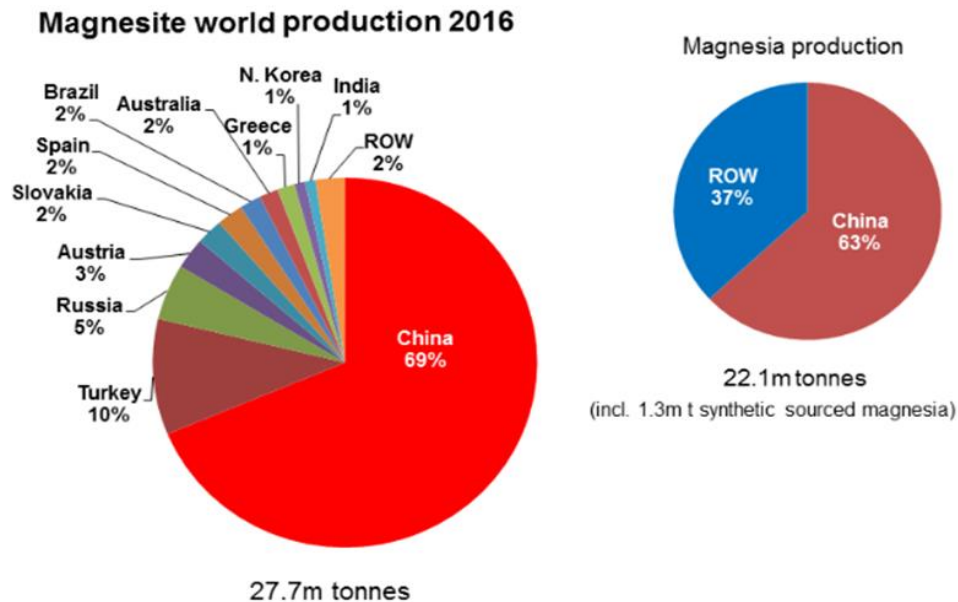
Europe's Magnesite Cluster



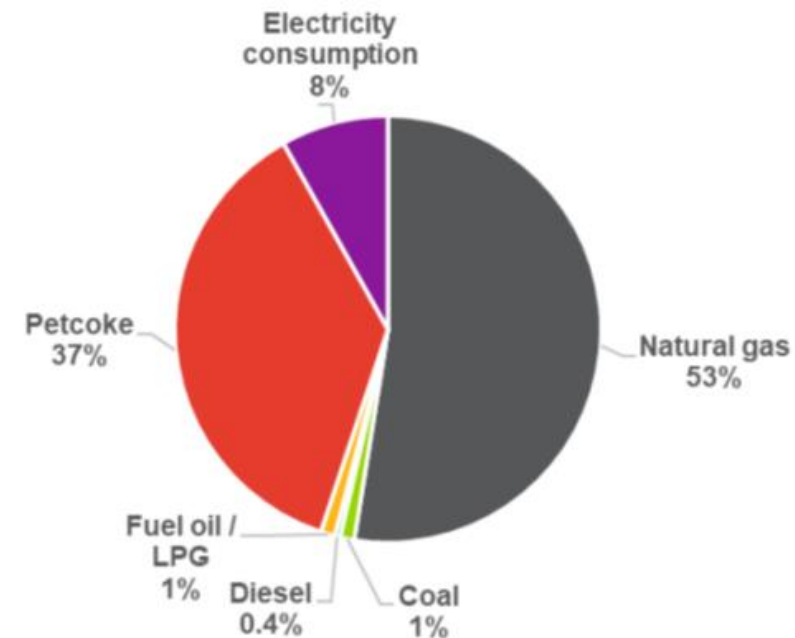
Norway
Ireland
Slovakia
Austria
Spain
Greece

Europe's magnesite

The competition



2014 - 2016 average fuel mix for EU magnesia companies



Horizon 2020
and Horizon
Europe :
Research in
Carbon
Capture
needed!

Achievements in improving energy efficiency

- Decrease of thermal energy consumption supported either by the installation of heat exchangers or through the use of pure O₂, which had allowed to use less natural gas
- Reduction of electric energy intensity with at least 20% since 2001 (in kW/t production)
- Optimisation of the raw material pre-heater in rotary kilns
- Implementation of a predictive control system for rotary kilns
- Recovering at least 10% of the thermal energy waste
- Reduction in specific fuel consumption in rotary kilns
 - o Shaft kilns by at least 20% since 1995, 10 % since 2001
 - o Rotary kilns by at least 15% since 1995, 5 % since 2001
 - o Calcination unit and shaft kiln by at least 40% since 2001

The future

Actions will include a minimum 5% energy efficiency increase by 2025 through:

- New generation transformers
- Replacement of electrical motors with new generation low consumption motors (class IE3 and IE2 with converters)
- Progressive replacement of all lights with LED
- Recovery of thermal energy
- Improvement the quality of the kiln feed

Europe's Graphite Cluster



Natural:

Norway
Sweden
Germany

Synthetic:

Norway
UK
Poland
Germany
Slovakia
France
Austria
Spain

Europe's food logistics: stainless steel

A steel alloy, with a minimum of 11% chromium content by mass and a maximum of 1.2% carbon by mass.

Stainless steels are most notable for their corrosion resistance, which increases with increasing chromium content.

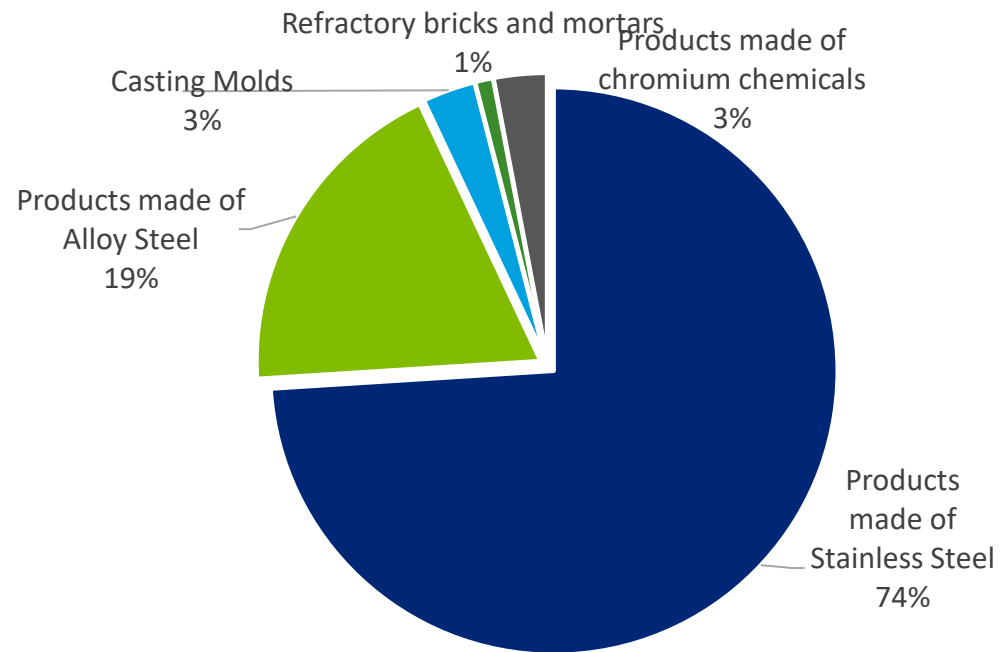


Europe's Chromium Cluster



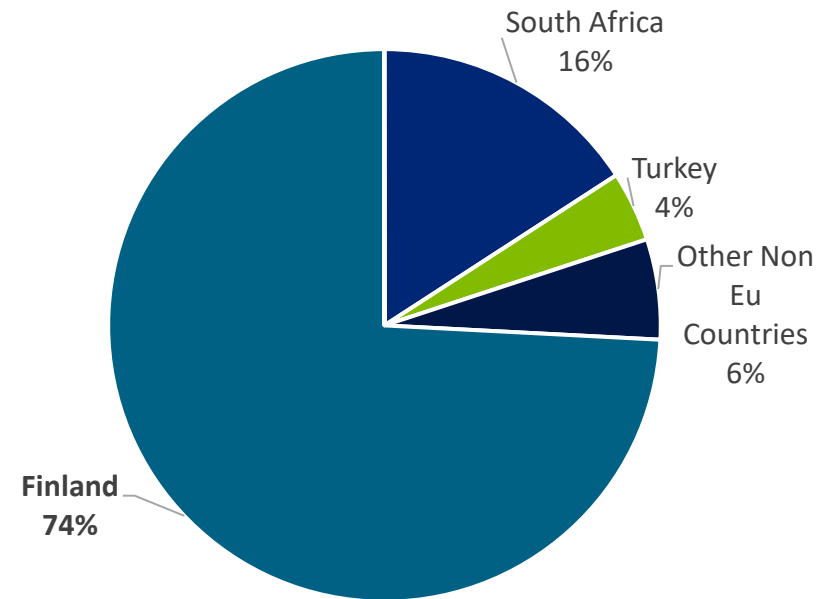
Finland

Europe's chromium



EU consumption of chromite: 358,847 tonnes
EU consumption of ferrochrome: 811,647 tonnes

EU end uses of chromium



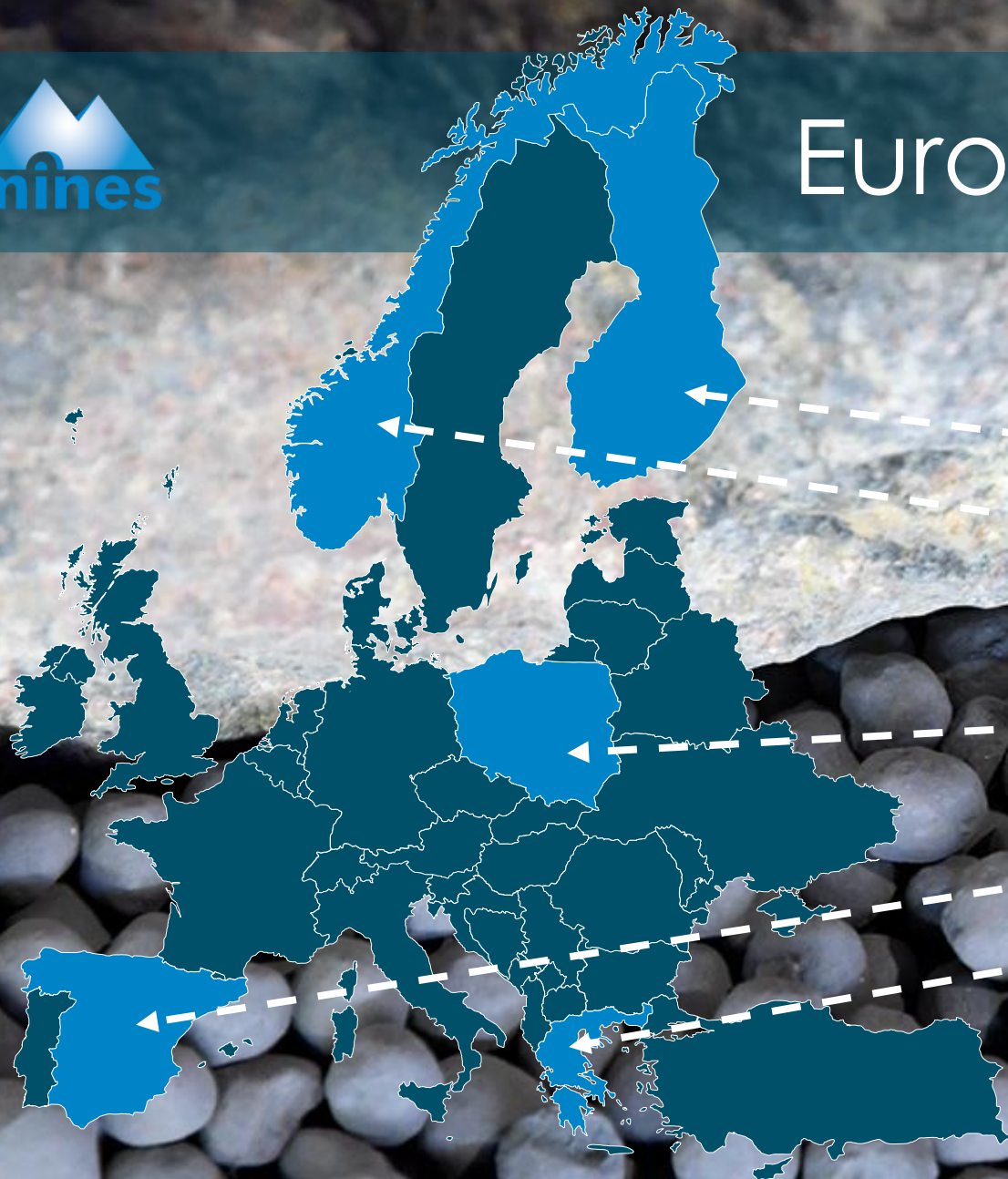
EU sourcing of chromite : 372,410 tonnes

EU sourcing of chromite and ferrochrome

Electrification
of mine
needed,
more
exploration,
More
investments
needed!

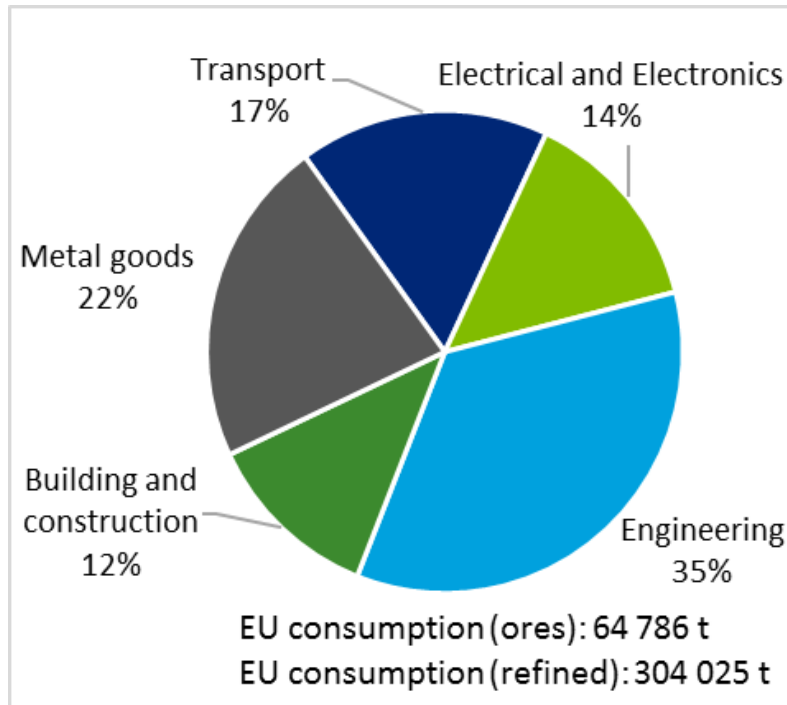


Europe's Nickel Cluster

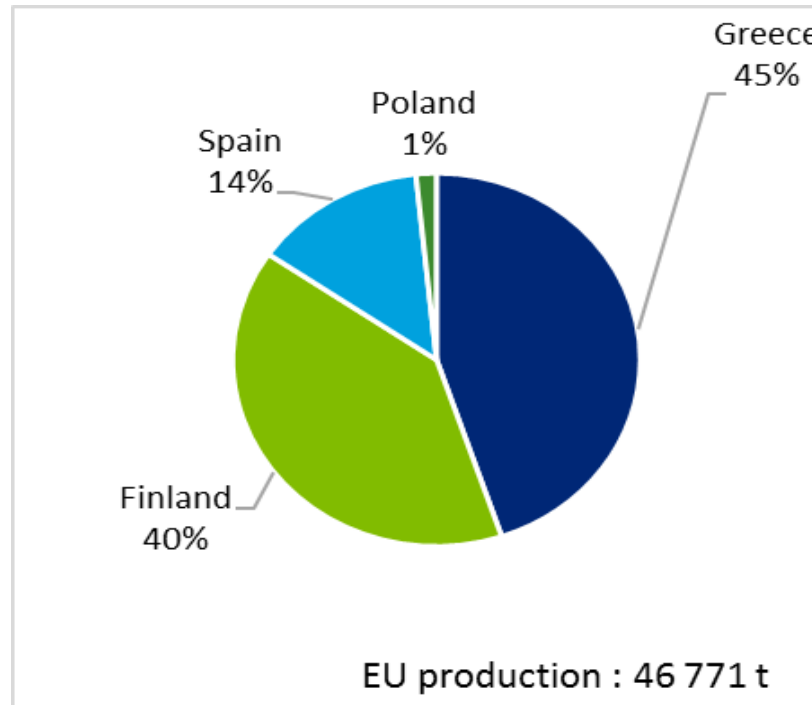


- Finland
- Norway
- Poland
- Spain
- Greece

Europe's nickel



End uses and EU sourcing of Nickel



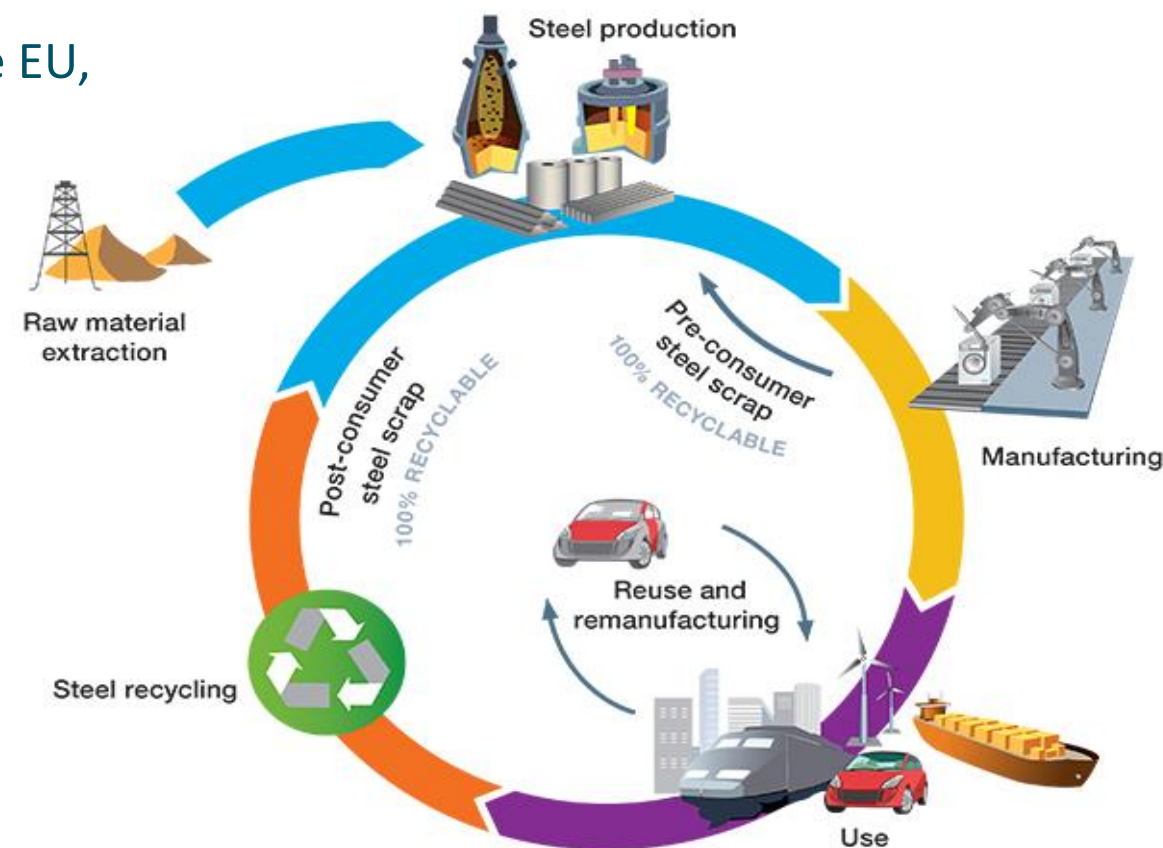
EU mine production of Nickel ores in tonnes and percentage. Average for the years 2012-2016

Electrification of mine, more exploration, higher degree of processing!

Contribution to circular economy

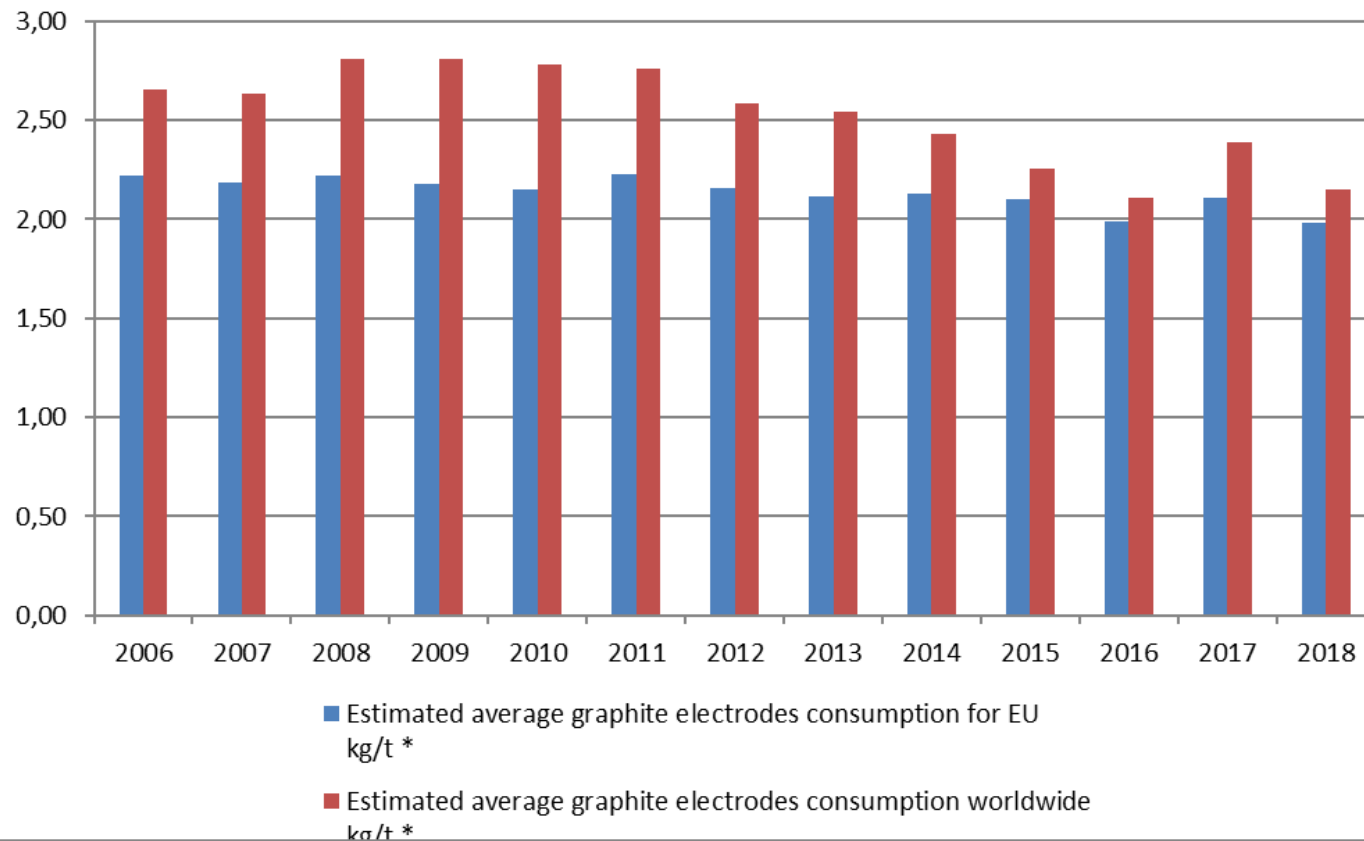
Graphite electrodes used in EAFs contribute to 84 million mt reduction in CO₂ emissions per year in the EU, equivalent to emissions from 28 million passenger cars.

EU EAF steel production	67,500,000 MT	
Quantity of EAF CO ₂ generated per year *	33,750,000 MT	
Quantity of CO ₂ generated per year should the same steel amount be produced at BOF	118,125,000 MT	
CO ₂ emissions savings by using EAF vs BOF	84,375,000 MT	



Material and energy efficiency

**Average Graphite Electrode Consumption
(kg/t of steel) 2006-2018**



Higher quality processing
(= more electricity)
yields higher energy
efficiency in steel
recycling in Europe.

Conclusions

- ≡ A European value chain has many EU and non-EU players.
- ≡ The EU raw materials sector is actively working on « **greening of** » and « **greening by** ».
- ≡ The raw materials sector has and continues to contribute to CO2 reductions.
- ≡ Electricity consumption in the raw materials sector will rise due to the switch to greener energy and to higher quality products leading to energy savings in the downstream processing industries.
- ≡ The EU raw materials sector provides the basis for many industrial sectors and their decarbonisation strategies by providing the materials as key enablers.

We must shape the future of
our industry in Europe!
We need to resolve
the carbon dioxide issue worldwide!

But we also need to make sure
that in the course of this the price we pay is not losing our industry!

Thank you!