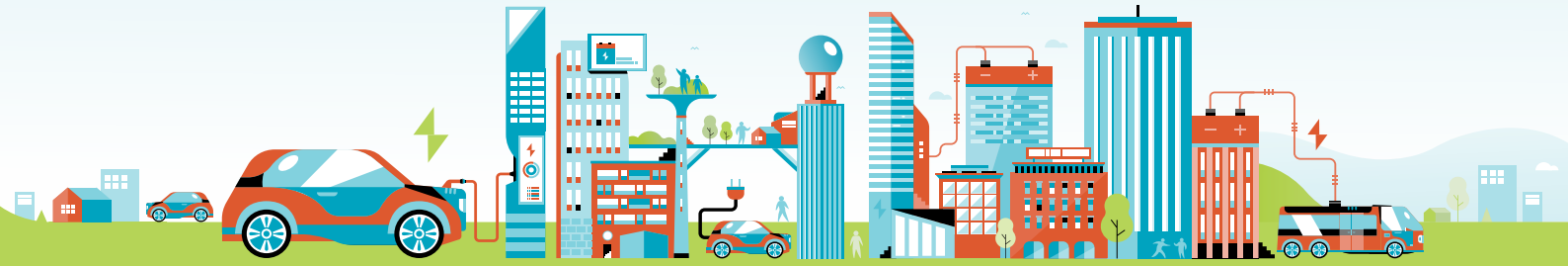
Terrafame

# Choose the climate

Terrafame enhances low-carbon mobility with responsible battery chemicals. We strive to continuously improve the overall climate impact of our products.

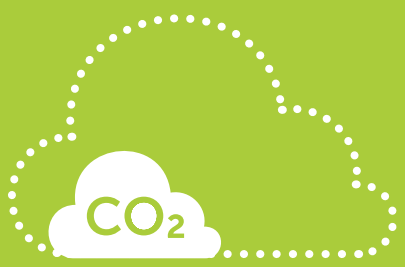


## Terrafame's nickel sulphate product


### 60 % lower

Has the smallest carbon footprint in the industry

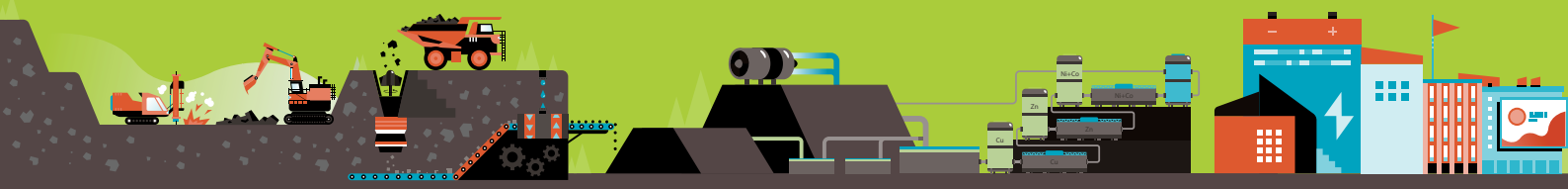
Technologies chosen by Terrafame result in low level of greenhouse gases generated. The carbon footprint of our nickel sulphate is considerably lower than the industry average.




### 80 % lower

Improves our customers' climate impact

Our customers can lower their own carbon footprint by choosing their raw materials and technologies wisely. Processing nickel sulphate to precursor chemicals generates significantly less greenhouse gas emissions compared to the processing of other nickel raw materials.

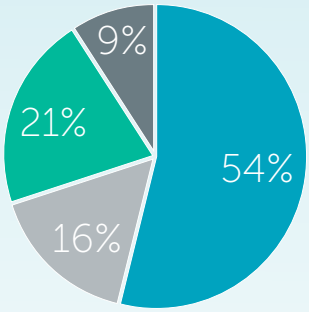


see more:
www.terrafame.com

# Small carbon footprint with high energy efficiency

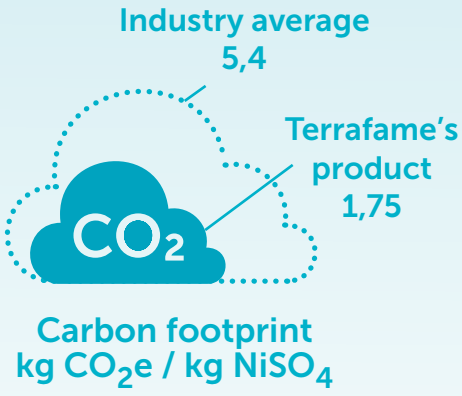
The main contributor to the smaller carbon footprint is the high energy efficiency in Terrafame's production process. Terrafame's process uses over 90% less of both electricity and thermal energy in the production of nickel sulphate. Energy use is lower in all phases of the production chain compared to the industry average.

## Contribution of various sources to the carbon footprint



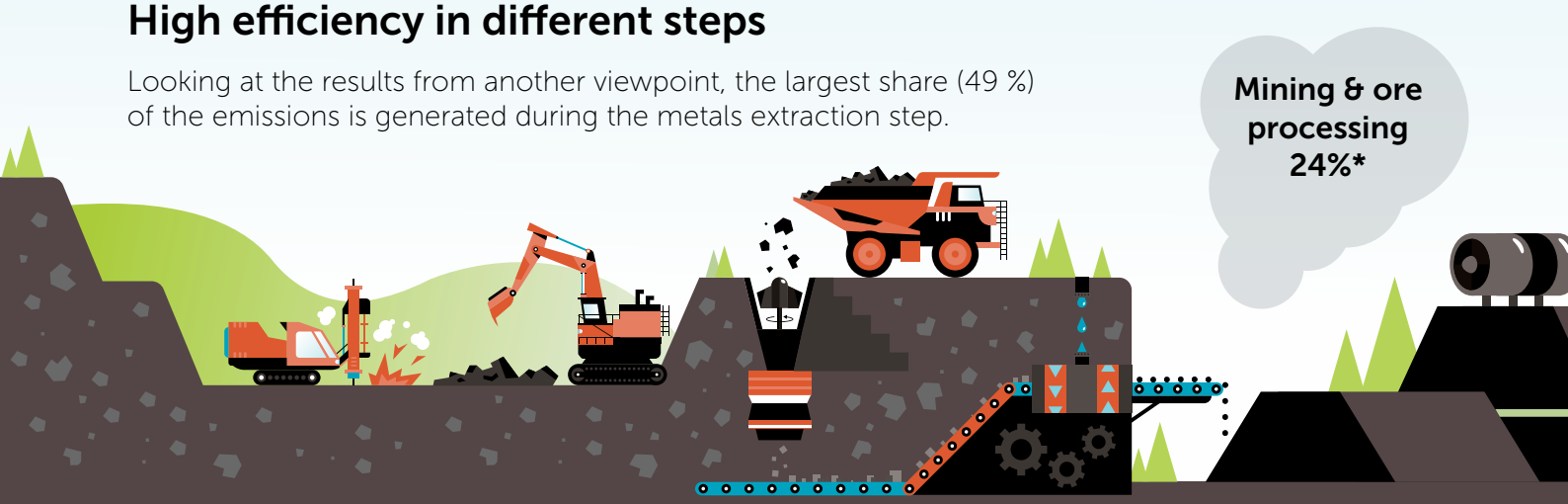

The largest share (54 %) of the emissions is generated in the production of auxiliary raw materials such as chemicals used in the Terrafame process.

- Production of auxiliary raw materials
- Electricity (from the grid)
- Thermal energy and fuel combustion
- Others




## High efficiency in different steps

Looking at the results from another viewpoint, the largest share (49 %) of the emissions is generated during the metals extraction step.




## Integrated production process – all steps on the same site

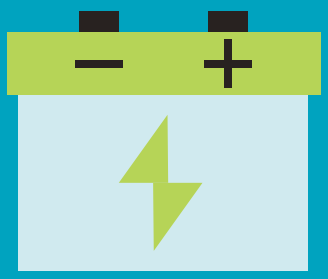
### No grinding

Ore is first mined at the open pit mine, then crushed, agglomerated, transported and stacked to the bioleaching heaps. Crushing to relatively big particles (8 mm) is adequate for the operation of the bioleaching process.

The Life Cycle Assessment (LCA) study was performed by Sphera Solutions GmbH and critical review of the study was performed by a third party, Prof. Dr. Matthias Finkbeiner from Technical University of Berlin to ensure the quality of the study and the conformity with ISO 14040/44 LCA standards. The results of Terrafame's products were compared to the industry average based on the LCA study commissioned by the Nickel Institute.

* contribution to the carbon footprint.

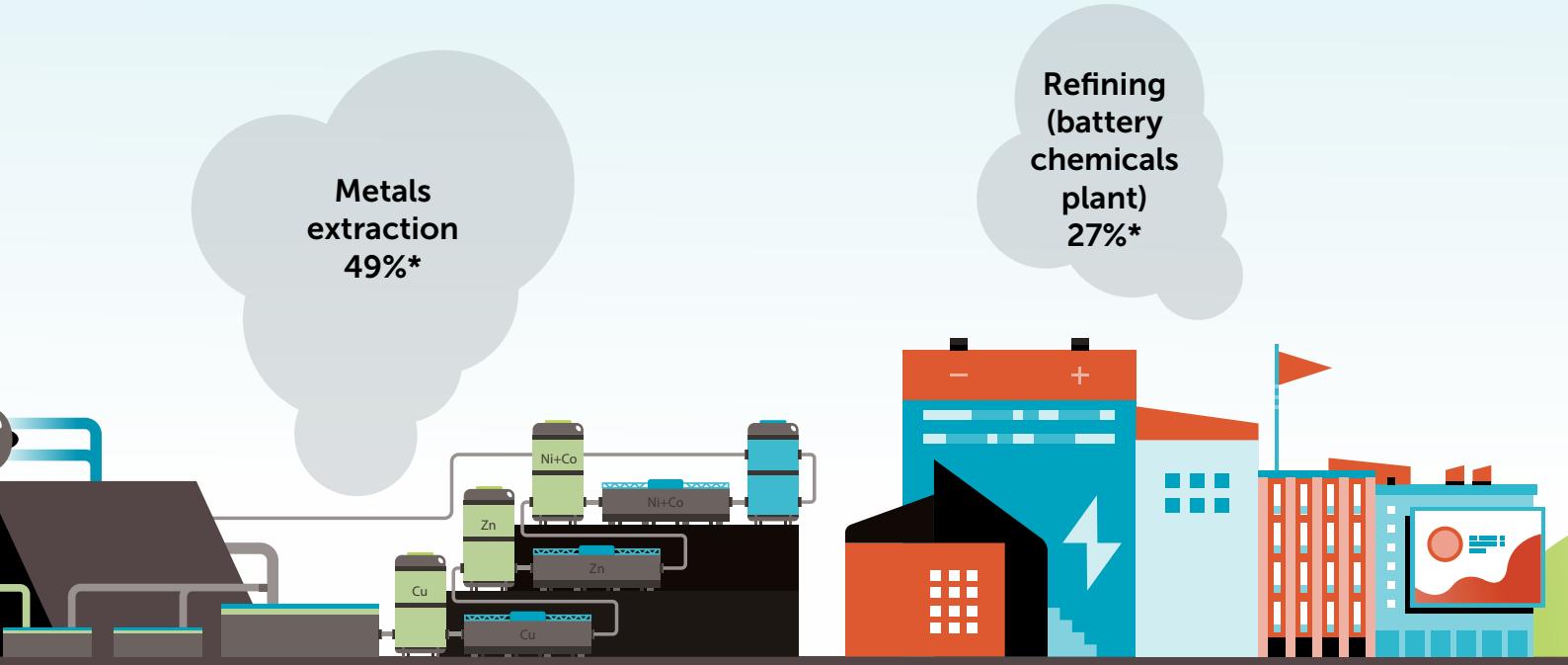
CO2e = carbon dioxide equivalent describes the combined global warming potential of different greenhouse gas emissions.



## Large impact on customers' carbon footprint

By using nickel sulphate as the raw material for battery precursors in stead of for example nickel powder, briquettes or cut cathodes, our customer can decrease their own carbon footprint by over 80%. The lower climate impact is due to less chemicals and energy needed for the processing of nickel sulphate compared to the processing of other raw materials.

(Source: Metso Outotec)




## Microbial action

The bioleaching process utilises microbes to efficiently extract metals from ore. Air is blown into stacks of ore and the stacks are irrigated with an acidic production solution. This creates optimal conditions for microbial activity.

Metals are extracted from the pregnant leach solution (PLS) and precipitated as sulphides in phases at the metals production plant.

## Low temperatures and pressures

In 2021 a battery chemicals plant will complement the integrated production process. The nickel-cobalt sulphides will then be refined into battery chemicals used as the raw materials for EV batteries.

Terrafame's production process operates under relatively low temperatures and high pressures are needed only in small part of the process.

Terrafame

# Terrafame's responsibility covers more than just climate impacts

**Safety** - Safety is at the core in all our operations. We ensure safe working conditions for everyone and our permanent goal is zero accidents.

**Environment** – The impacts to the surrounding environment are closely monitored and managed.

**Transparency** – We interact proactively with our stakeholders and inform our employees, partners, neighbors and other stakeholders openly and honestly about our mining and production activities and their impacts.

**Traceability** – Our unique integrated production process from open pit to battery chemicals provides a short and traceable supply chain for our customers.

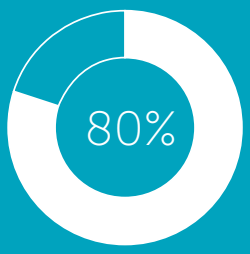
We operate in Finland, one of the least corrupt countries in the world, and a country with strict and enforced regulations concerning human rights, work safety and environmental performance.

## Continuous improvement

We aim to continuously improve our operations, and in our Sustainability Programme for 2020-2024 we have set tangible objectives regarding safety, water management, energy efficiency and by-product recycling, among other things. For more information and the full list of targets, see Sustainability Review 2019.

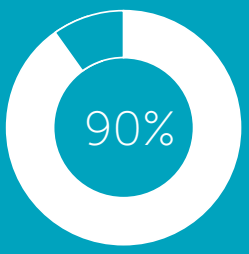
### Targets set for year 2024

**Sulphate recycled**



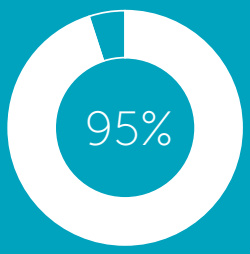

Of the sulphate form the process ending up in water treatment, over 80% is recycled back into the bioheapleaching.

**Renewable energy**




Over 90% of steam and heat production is carried out with renewable energy.

**Waste recovered**




The recovery rate of conventional municipal and industrial waste is over 95%.

**Carbon neutral energy**


Carbon neutral energy accounts for 100% of electricity.

Terrafame's management systems for quality, environment and occupational health and safety are certified according to ISO 9001, ISO 14001 and BS OHSAS 18001 standards, respectively.

In mining we are committed to the Finnish Towards Sustainable Mining Standard.

We are committed to the Ten Principles of the UN Global Compact act and respect the ILO Declaration on Fundamental Principles and Rights at Work.

Terrafame