

## Terrafame's nickel sulphate production offers the lowest carbon footprint in the industry - altogether 60% lower than in existing conventional processes

Terrafame fights climate change by enhancing low-carbon mobility with responsible battery chemicals. In Terrafame's production process, the carbon footprint generated through the production of one kilogram of nickel sulphate is 1.75 kg CO<sub>2</sub>-eq<sup>1</sup>, compared to the industry average of 5.4 kg CO<sub>2</sub>-eq.<sup>2</sup> The carbon footprint of 1 kg of Terrafame's nickel sulphate corresponds to driving 10 km with an average petrol-powered passenger car<sup>3</sup>. The value for industry average is 30 km/kg. When Terrafame's nickel sulphate hexahydrate is used in electric vehicle batteries, the annual savings in CO<sub>2</sub> emissions correspond to a total of 3,400 million kilometres of driving with petrol car, i.e. approximately 85,000 journeys around the world.

- Terrafame will soon move downstream and start the production of battery chemicals in early 2021.
- A certified<sup>4</sup> life cycle assessment shows that the carbon footprint of Terrafame's nickel sulphate hexahydrate is more than 60% lower than that produced through conventional production technologies.
- Terrafame's bioleaching-based production process uses about 90% less electricity and thermal energy in the production of nickel sulphate than the industry average.<sup>5</sup>
- Terrafame's integrated production process – which begins in its own mine and ends with battery chemicals production on one industrial site – is a unique and energy-efficient entity that provides customers with a transparent, traceable, and truly European battery chemical production chain.

### The amount of electric vehicles is rapidly increasing

Concerns about climate change, and in particular the high CO<sub>2</sub> emissions generated through transport, is increasing the demand for electric vehicles - EVs. Around 1.6 million battery electric vehicles - BEVs were sold worldwide in 2019, with this figure expected to reach nearly 9 million cars by 2025.<sup>6</sup> The transition to electric vehicles is also being accelerated through various governmental control measures. For example, the EU has set stricter CO<sub>2</sub> emission limits for new cars, as well as sanctions for car manufacturers that do not adhere to these limits. The aim is to reduce CO<sub>2</sub> emissions from transport by 60% by 2050.

Electric vehicles are an important means of reducing greenhouse gases. They do not generate emissions at all while being driven, and as future electricity supply is expected to be increasingly based on carbon-neutral production methods, emissions stemming from the electricity production processes required to run electric vehicles will also decrease.

Advancements in vehicle technology are being driven by the increase in demand for electric vehicles. By 2030, the average range of an electric vehicle is forecasted to be 350-400 km.<sup>7</sup>

While this will increase the demand for the materials used in the production of EV batteries, the cost and sustainability aspects of technological developments in battery production will lead to an increase in nickel use and reduce the reliance on cobalt. For example, in January 2019, the average proportion of nickel used in cathode structures was 39%. This figure had already risen to an average of 47% by July 2020. Forecasts suggest this trend is set to continue, with the proportion of nickel used in cathodes expected to reach up to 60% by 2030.<sup>6</sup>

## Terrafame fights climate change

Production at the battery chemicals plant under construction on Terrafame's current industrial site is set to begin in early 2021. Once completed, this will be the largest nickel sulphate production plant in the world. The plant's annual production capacity for nickel sulphate and cobalt sulphate equates to approximately one million and three-hundred thousand electric vehicles, respectively.<sup>8</sup> Once production begins at the plant, Terrafame's entire nickel-cobalt sulphide production (the current nickel intermediate), will be refined into battery chemicals (nickel sulphate and cobalt sulphate) used as the raw materials for EV batteries.

After the investment in the battery chemicals plant is completed, Terrafame's bioleaching-based production process will produce nickel sulphate used in EV batteries whose carbon footprint is over 60% smaller than if produced by conventional production technologies. In fact, the carbon footprint of one kilogram of nickel sulphate produced at Terrafame's integrated production plant is 1.75 kg CO<sub>2</sub>-equivalent, compared to the industry average of 5.4 kg CO<sub>2</sub>-equivalent. The most significant difference between Terrafame and other nickel sulphate manufacturers is in the energy use, which is significantly lower at Terrafame than that of other production processes. Overall, Terrafame's bioleaching-based production process uses about 90% less energy than in the average production of nickel sulphate.

## CEO Joni Lukkaroinen:

"The construction of our new battery chemicals plant is in the final phase and commercial production will begin there in early 2021. An externally certified life cycle assessment shows that the carbon footprint of the nickel sulphate produced by Terrafame is more than 60% lower than the industry average. In fact, the carbon footprint of one kilogram of nickel sulphate produced at Terrafame's integrated production plant is 1.75 kg CO<sub>2</sub>-eq, compared to the industry average of 5.4 kg CO<sub>2</sub>-eq. If we put this in practical terms, the carbon footprint of 1 kg of Terrafame's nickel sulphate corresponds to driving 10 km with an average petrol-powered passenger car whereas the value for industry average is 30 km/kg. When the nickel sulphate hexahydrate used in electric vehicle batteries is produced by Terrafame, the annual savings in CO<sub>2</sub> emissions correspond to a total of 3,400 million kilometres of driving, or approximately 85,000 journeys around the world.

## Further information:

Joni Lukkaroinen, CEO, Terrafame Ltd, tel. +358 50 590 0720

Janne Palosaari, Chief Commercial Officer, Terrafame Ltd, tel. +358 40 569 9160

<sup>1)</sup> The CO<sub>2</sub>-eq, i.e. the CO<sub>2</sub> equivalent, represents the combined climate warming effect of various greenhouse gases

<sup>2)</sup> Life cycle assessment of Terrafame nickel products, Sphera Solutions GmbH, August 2020.

<sup>2)</sup> Gaia Consulting Oy

<sup>3)</sup> The LCA analysis of Terrafame nickel products has been verified by Prof. Dr. Matthias Finkbeiner, Technical University of Berlin, Germany, September 2020.

<sup>4)</sup> Life Cycle Assessment of Nickel Products, Nickel Institute, May 2020

<sup>5)</sup> Rho Motion

<sup>6)</sup> IEA Global EV Outlook 2020

<sup>7)</sup> Assuming battery size 50kWh and NCM811 battery technology

## About Terrafame

Terrafame's purpose is to enhance low-carbon mobility with responsible battery chemicals. Terrafame's integrated production process – which begins in its own mine and ends with battery chemicals on one industrial site – is a unique and energy-efficient entity that provides customers with a transparent, traceable, and truly European battery chemicals production chain. Terrafame will start producing battery chemicals in early 2021 and the new production plant is one of the world's largest production lines for battery chemicals used in EV batteries. The carbon footprint of the nickel sulphate produced by the plant is more than 60% lower than the industry average.

Terrafame Ltd. was founded in 2015 and its production facilities are located in Sotkamo, Finland. In 2019, Terrafame's net sales amounted to EUR 310 million, and the company's industrial site employed approximately 1,500 people, of which around half were employees of its partner companies. [www.terrafame.com](http://www.terrafame.com)