Project	Lithium-ion battery’s life cycle: safety risks and risk management at workplaces
Work package	WP1: EHS management. Framing the issue: identification of key aspects over the value chain
Task	T. 1.4 Overall picture of the Li-ion batteries
Responsible organisation	GAIKER
Authors	Leire García, Leire Barruetabeña, Isabel Rodríguez Llopis

Abstract

This task report is part of the research project "Lithium-ion battery's life cycle: safety risks and risk management at workplaces" and it summarizes the previous Task 1.1 and 1.3 reports' findings on overall picture of the Li-ion batteries.

The reports for Tasks 1.1 and T1.3 described the value chain of Li-ion batteries (LIBs) and the materials used for their production, and took the following aspects into account:

- Current use

- Reduction in amount of problematic Cobalt (Co)

- Energy density

- Cost.

The battery selected for the case study was NMC-811. This report presents the scheme of the selected case study.

Selection of case study

Figure 1 presents an overview of the existing and future LIBs.

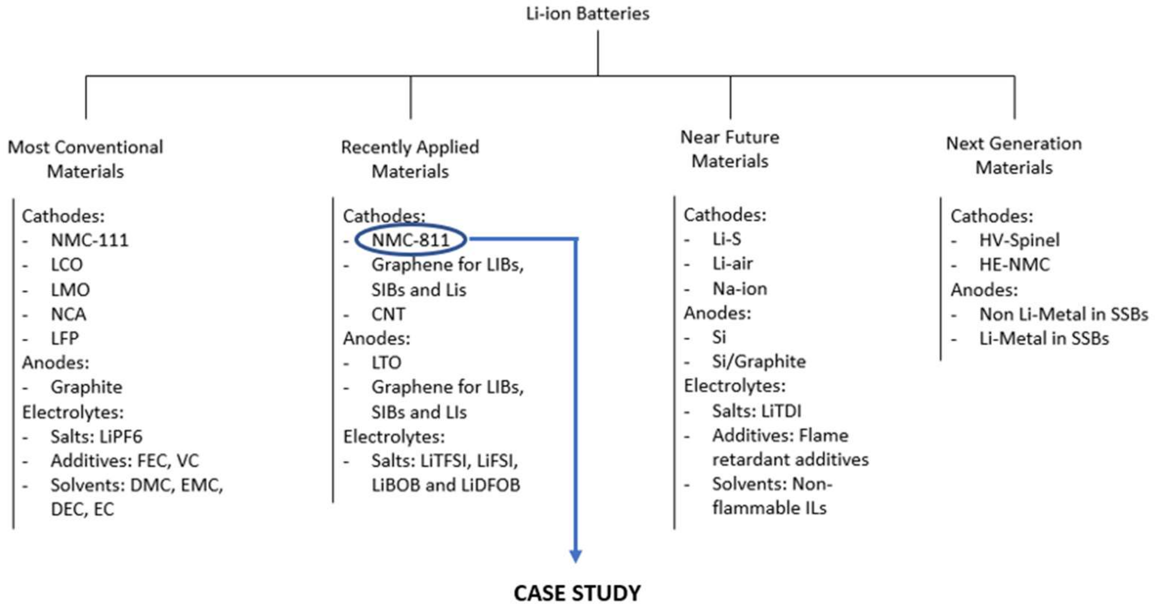

Figure 1. Li-Ion Batteries

The following criteria were used to select the case study in for this project:

- Current use
- Reduction of problematic chemicals
- Cost
- Energy density

The T.3.1 report reported the advantages and disadvantages of different types of batteries and NMC-811 was selected for the purpose of this project as it is an attractive alternative to most conventional LIBs, and is already used by the automotive industry as it enables reducing the amount of Co to 20% with an increase of Ni to 80%, achieving a higher energy density and a much lower battery cost. Compared to conventional NMC-111 technology, this battery has advantages such as higher energy density and lower problematic Co content.

The next figures present the general scheme of the NMC-811 battery (Figure 2), and include the materials involved, the applications, and the end-of-life or recycling phase of the selected case study. Table 1 summarizes the value chain in Finland and Spain together and the materials used.

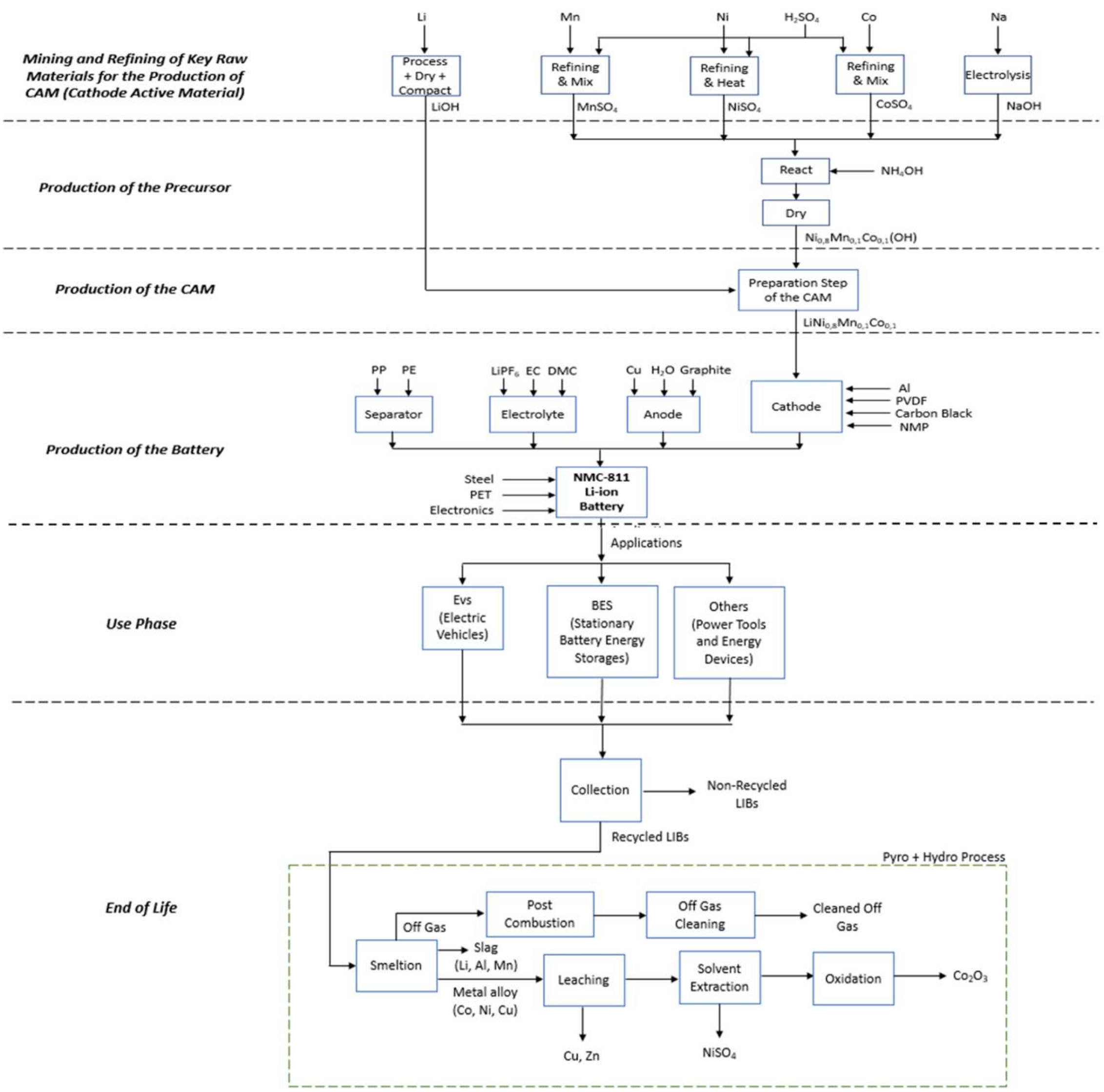

Figure 2. General scheme of selected case study

What materials are required? Value chain in Finland and Spain

Table 1. Value chain and materials used in Finland and Spain

	Finland		Spain	
Mining and Extraction of Raw Materials	Currently Cobalt Nickel Copper Phosphate(?) Manganese (?)	Future (?) Lithium	Currently Copper Aluminum	Future (?) Nickel Lithium
Production and Integration: *- Battery Chemical Production*	Currently NiSO4 CoSO4	Future (?) LiOH	Currently -	Future (?) LiOH
-pCAM and CAM production	Currently 1 pCAM pilot plant	Future (?) Several new projects announced for pCAM and CAM production factories	Currently -	Future (?) -
-Cell/Battery Production	Currently -	Future (?) -	Currently -	Future (?) Several projects announced for the production of batteries
-Battery Integration and End Users	Currently Several companies integrate LIBs in their products	Future (?) More companies may include LIBs	Currently Several companies integrate LIBs in their products	Future (?) More companies may include LIBs
Recycling and End of Life	Currently 2 Recycling factories	Future (?) -	Currently -	Future (?) One project announced to build a recycling factory