The Material Constrain of the Energy and Climate Transition

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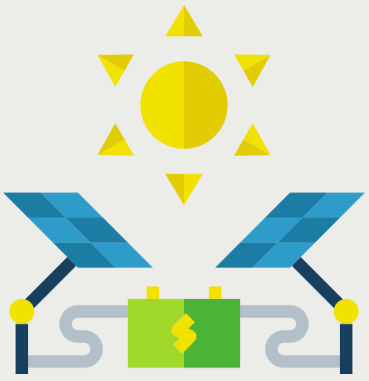
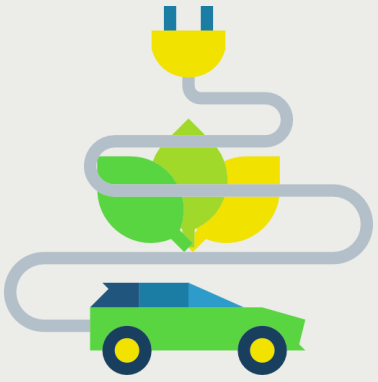
Background

To avert dangerous climate change, a transition to a **low carbon economy** is needed, in order to limit greenhouse gas (GHG) emissions. To achieve these goals, the global economy needs to be converted in a low carbon one, especially the energy and transport system.

For this transition, **green technologies** like wind turbine, solar photovoltaic or electrical vehicles (EVs) will be needed. However, these technologies are more metal intensive than traditional ones.

The concern about the so-called **energy-mineral nexus**, have arisen in recent years. This is because the green technologies require specific mineral resources, some of them considered **critical** because of the high-risk associated with their supply due to: geological scarcity, high concentration of producing countries and supply inelasticity drive by various by-product features.





Objective

The objectives of the PhD project are to analyze the supply chain of critical materials used in green technologies exploring the end of life and waste management processes considering future energy scenarios. The overall objectives can be achieved by four sub-objectives:

- To analyze future renewable energy scenarios at global, European, and Danish level
- To select one or more critical materials (e.g. lithium and cobalt used in lithium-ion batteries), and analyze the trade network, from raw materials, to intermediate products, final products, and scrap along the life cycle.
- Creation of a dynamic Material Flow – Multiregional Input-Output model to forecast the demand of the selected critical materials under different energy scenario
- To analyze the End of Life (EoL) management, in order to identify credible scenarios, potential and barriers for different EoL management options.

Methodology

Material Flow Analysis (MFA)

MFA is an analytical methodology that quantifies the material flow along its anthropogenic life cycle (from resource exploitation to intermediate products then to final products) in the predefined temporal and spatial boundary.

Multiregional input–output analysis (MRIO)

Contains comprehensive information on international trade and it can be used to trace materials through the global supply chain

Trade network analysis

Help to identify resource reallocation form primary production regions to final products destination.