Life cycle assessment of batteries for underground mining

Batteries are increasingly used in society– from large-scale energy storage applications to electric vehicles and small electronic equipment. Also, vehicles in underground mining is shifting from operating on diesel to batteries. In addition to replacing diesel, this also reduces the electricity needed for underground ventilation of diesel fumes. Thus, mining companies can potentially reduce a variety of environmental burdens linked to diesel and electricity. At the same time, batteries require other materials and manufacturing and recycling processes connected to other types of environmental burdens. Also, batteries must be charged at the mining site. Since these sites are located all over the globe, some remotely without a power grid, the environmental implications of battery charging differ.

This master thesis aims at investigating and comparing the environmental burden of the conventional diesel-propelled vehicles and ventilation of underground mining with battery powered vehicles. A life cycle assessment should be conducted in which both options are investigated over their entire life cycle – from extraction of resources to recycling at end-of-life. Of special interest is to investigate the consequences of differences in electricity profiles at the mining sites – from national power grids based on coal to off-grid solar power.

The master's thesis is suggested by Epiroc and Chalmers in collaboration. Epiroc is one of the world-leading manufacturers of underground mining vehicles and a leader in battery electrification technology for underground mining (https://www.epirocgroup.com/en/media/corporate-press-releases/2018/20181114-epiroc-launches-new-generation-battery-driven-machines-for-sustainable-mining). The project is also linked to the research programme Mistra REES – resource effective and efficient solutions (https://mistrarees.se/home/), one of the major research initiatives on circular economy in Sweden.

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Time: January – May 2021

Suitable background: Industrial Ecology or Sustainable Energy Systems and completed course in Life Cycle Assessment