



Lithium-ion battery expansion environmental assessment



Overview

The LCA study of a small-scale factory by Ellingsen et al. (2014) was replicated and analyzed using both Ecoinvent v2.2 and v3.7.1 data (Fig. 2: Small-2.2 and Small-3.7, respectively). This modification of the background system resulted in an increase of the global warming impacts from about 140 to 185 kg CO₂-eq./kWh. The global warming impacts of small-scale and giga-scale LIB production are shown in Fig. 3. The Small-3.7 model coupled to the reference scenario and exclusively primary metals results in. Human (carcinogenic) toxicity impacts for the small-scale and giga-factory are shown in Fig. 5. The total amount of toxic emissions for the Small-3.7 model when coupled to the reference. A few environmental impacts such as ground level ozone formation, particulate matter formation, stratospheric ozone depletion, and ionizing. Acidification impacts for the small-scale and giga-factory are shown in Fig. 4. The acidification-related emissions in the Small-3.7 and Giga-3.7.



Article Content

A review of new technologies for lithium-ion battery treatment

A multidisciplinary approach combining materials science, chemistry, environmental engineering, and data science is crucial for overcoming challenges related to lithium-ion battery recycling. Collaboration between industry, academia, and government agencies will also play a crucial role in driving innovation and establishing standardized, efficient ...

Energy and environmental assessment of a traction lithium-ion battery ...

This article presents an environmental assessment of a lithium-ion traction battery for plug-in hybrid electric vehicles, characterized by a composite cathode material of lithium manganese oxide (LiMn_2O_4) and lithium nickel manganese cobalt oxide $\text{Li}(\text{Ni}_x\text{Co}_y\text{Mn}_{1-x-y})\text{O}_2$. Composite cathode material is an emerging technology that promises to combine the ...

Life Cycle Environmental Assessment of Lithium-Ion ...

The battery systems were investigated with a functional unit based on energy storage, and environmental impacts were analyzed using midpoint indicators. On a per-storage basis, the NiMH technology was found ...

Lithium-Ion Battery Recycling: Bridging Regulation ...

Lithium-Ion Battery Recycling: Bridging Regulation Implementation and Technological Innovations for Better Battery Sustainability ... the rapid expansion of electric vehicles is expected to lead to a 7-fold increase in the demand for LIBs by 2030. ... and the environmental impact assessment of low-carbon transportation technologies. References ...

Assessment of environmental impacts and circularity of lithium-ion ...

There is a wide range of information available on the environmental impacts of the lithium-ion battery lifecycle from different LCA studies. However, the complexity of the lithium-ion battery value chain and a wide variation in the composition and design, as well as lack of primary data for industrial scale, amongst other, has caused a wide variety in the reported values for carbon ...

Exploring the energy and environmental sustainability of ...

Currently, the large-scale implementation of advanced battery technologies is in its early stages, with most related research focusing only on material and battery performance evaluations (Sun et al., 2020) consequently, existing life cycle assessment (LCA) studies of Ni-rich LIBs have excluded or simplified the production stage of batteries due to data limitations.

A comparative assessment of value chain criticality of lithium-ion ...

Erratum: Life cycle environmental assessment of lithium-ion and nickel metal hydride batteries for plug-in hybrid and battery electric vehicles (Environmental Science & Technology (2011) 45 (4548–4554) DOI: 10.1021/es103607c)

Environmental impact assessment of lithium ion battery ...

The system boundary for conducting a Lithium-Ion battery Life Cycle Assessment (LCA) spans many stages of its lifespan. This includes raw material extraction and processing, which involves acquiring materials such as lithium and cobalt, manufacturing, which involves the production of battery components, transportation of materials and batteries ...

Environmental Impact Assessment in the Entire Life Cycle of ...

The present study offers a comprehensive overview of the environmental impacts of batteries from their production to use and recycling and the way forward to its ...

Estimating the environmental impacts of global lithium-ion battery ...

Here, we analyze the cradle-to-gate energy use and greenhouse gas emissions of current and future nickel-manganese-cobalt and lithium-iron-phosphate battery ...

Energy and environmental assessment of a traction ...

This article presents an environmental assessment of a lithium-ion traction battery for plug-in hybrid electric vehicles, characterized by a composite cathode material of lithium manganese oxide ...

Assessment of environmental impacts and circularity of lithium-ion ...

In this report, three different circularity indicator tools (MCI, Circulytics and CTI) are presented shortly based on their capability to support or complement environmental impact assessment, ...

Environmental trade-offs across cascading lithium-ion battery ...

Purpose The purpose of this study was to analyze the environmental trade-offs of cascading reuse of electric vehicle (EV) lithium-ion batteries (LIBs) in stationary energy storage at automotive end-of-life. **Methods** Two systems were jointly analyzed to address the consideration of stakeholder groups corresponding to both first (EV) and second life ...

Chemical hazard assessment toward safer electrolytes for lithium-ion ...

Integrated Environmental Assessment and Management published by Wiley Periodicals LLC on behalf of Society of Environmental Toxicology & Chemistry (SETAC). **Key Points.** Chemical hazard assessment was conducted for 103 electrolyte chemicals, categorized into seven groups, used in lithium-ion batteries.

Review of lithium-ion batteries" supply-chain in ...

Review of lithium-ion batteries'' supply-chain in Europe: Material flow analysis and environmental assessment March 2024 Journal of Environmental Management 358:120758

Liu Master Theses Life Cycle Assessment of a Lithium-Ion Battery ...

This thesis assessed the life-cycle environmental impact of a lithium-ion battery pack intended for energy storage applications. A model of the battery pack was made in the life-cycle assessment-tool, openLCA. The environmental impact assessment was conducted with the life-cycle impact assessment methods recommended in the Batteries Product

Evaluating the sustainability of a pilot-scale spent lithium-ion ...

Environmental life cycle implications of upscaling lithium-ion battery production Int. J. Life Cycle Assess., 26 (2021), pp. 2024 - 2039, 10.1007/s11367-021-01976-0 View in Scopus Google Scholar

Life cycle assessment of high capacity molybdenum disulfide lithium-ion ...

This study presents a comprehensive life cycle assessment (LCA) on a potential next-generation lithium ion battery (LIB) with molybdenum disulfide (MoS₂) anode and Nickel-Cobalt-Manganese oxide (NMC) cathode. The NMC-MoS₂ battery is configured with 49.4 kWh capacity enabling a 320 km driving range for a mid-sized EV. In this study, the MoS₂ anode ...

Life cycle environmental impact assessment for battery-powered ...

To analyze the comprehensive environmental impact, 11 lithium-ion battery packs composed of different materials were selected as the research object. By introducing ...

Environmental Impact Assessment in the Entire Life Cycle of ...

The growing demand for lithium-ion batteries (LIBs) in smartphones, electric vehicles (EVs), and other energy storage devices should be correlated with their ...

A review of lithium-ion battery state of health and remaining ...

A review of lithium-ion battery state of health and remaining useful life estimation methods based on bibliometric analysis ... extreme learning machine, variational mode decomposition, long short-term memory neural networks, health status assessment, gated recurrent unit, lithium-ion power batteries, electrochemical impedance spectroscopy ...

Life cycle assessment of a lithium-ion battery with a silicon ...

Life cycle assessment of a lithium-ion battery with a silicon anode for electric vehicles. ... the main drawback of silicon is its large volume expansion during cycling (up to 400 %), decreasing cell performance ... Life cycle environmental assessment of lithium-ion and nickel metal hydride batteries for plug-in hybrid and battery electric ...

Life cycle assessment of lithium-ion batteries and vanadium ...

Contribution of lithium-ion battery (LIB) and vanadium redox flow battery (VRB) components to the overall life cycle environmental impacts, along with life cycle phases of the LIB-based renewable energy storage systems (LRES) and VRB-based renewable energy storage system (VRES) resulting in significant impacts.

Life cycle assessment of lithium-based batteries: Review of ...

Life cycle assessment (LCA) of lithium-oxygen Li-O_2 battery showed that the system had a lower environmental impact compared to the conventional NMC-G battery, with ...

Ten major challenges for sustainable lithium-ion batteries

Following the rapid expansion of electric vehicles (EVs), the market share of lithium-ion batteries (LIBs) has increased exponentially and is expected to continue growing, reaching 4.7 TWh by 2030 as projected by McKinsey. 1 As the energy grid transitions to renewables and heavy vehicles like trucks and buses increasingly rely on rechargeable ...

An In-Depth Life Cycle Assessment (LCA) of ...

There is an unmet need for a detailed life cycle assessment (LCA) of BESS with lithium-ion batteries being the most promising one. This study conducts a rigorous and ...

An investigation on expansion behavior of lithium ion battery ...

Fig. 2 (a) illustrates the description of the concept to model battery at cell level and the expansion phenomenon. The battery level is the actual three-dimensional model involves the cell, positive tab, and negative tab to investigate the thermal and expansion behavior, as well as thermal stress.

Environmental impact assessment of lithium ion battery ...

Request PDF | Environmental impact assessment of lithium ion battery employing cradle to grave | The purpose of this study is to calculate the characterized, normalized, and weighted factors for ...

Environmental performance of a multi-energy liquid air energy ...

Among different and commercially available battery types, Li-ion battery is the leading option in terms of energy density, lifetime expectancy and the use of less environmentally intensive materials ; in addition to this, Li-ion battery withstand higher depth of discharge and can reach significantly high roundtrip efficiency [, [43 ...

Environmental Sustainability Assessment ...

With the rapid increase in production of lithium-ion batteries (LIBs) and environmental issues arising around the world, cathode materials, as the key component of all LIBs, ...

A brief survey on heat generation in lithium-ion battery ...

6 Conclusions. This review collects various studies on the origin and management of heat generation in lithium-ion batteries (LIBs). It identifies factors such as internal resistance, electrochemical reactions, side reactions, and external factors like overcharging and high temperatures as contributors to heat generation.

Lithium-ion batteries and the transition to electric vehicles ...

Here we use the material flow analysis method to quantify the future material demand for lithium-ion batteries and the prospective life cycle assessment method to quantify future emissions of battery production. Further combined with battery technology modelling, future energy storage potential of EV batteries is evaluated.

Environmental life cycle assessment of recycling technologies for ...

Life Cycle Assessment (LCA) is a systemic tool for evaluating the environmental impact related to goods and services. It includes technical surveys of all product life cycle stages, from material acquisition and manufacturing to use and end-of-life(Nordelöf et al., 2014).With regard to the battery, the LCA is one of the most effective ways of exploring the resource and ...

Environmental Assessment of Lithium ...

This review analyzed the literature data about the global warming potential (GWP) of the lithium-ion battery (LIB) lifecycle, e.g., raw material mining, production, use, and end of life. The literature ...

Life cycle assessment of a lithium-ion battery vehicle pack

Life cycle assessment of a lithium-ion battery vehicle pack Linda Ager-Wick Ellingsen, Guillaume Majeau-Bettez, Bhawna Singh, Akhilesh K. Srivastava, Lars Ole Valøen, Anders Hammer Strømman

Life cycle assessment of lithium-based batteries: Review of ...

The lithium-ion battery pack with NMC cathode and lithium metal anode (NMC-Li) is recognized as the most environmentally friendly new LIB based on 1 kWh storage capacity, with a cycle life approaching or surpassing lithium-ion battery pack with NMC cathode and graphite anode (NMC-C). ... Life cycle environmental assessment of lithium-ion and ...

Environmental Assessment of Lithium-Ion Battery Lifecycle and of ...

This review analyzed the literature data about the global warming potential (GWP) of the lithium-ion battery (LIB) lifecycle, e.g., raw material mining, production, use, and end of life.

Environmental impact analysis of potassium-ion batteries based ...

Batteries, not only a core component of new energy vehicles, but also widely used in large-scale energy storage scenarios, are playing an increasingly important role in achieving the 1.5 °C target set by the Paris Agreement (Greening et al., 2023; Arbabzadeh et al., 2019; Zhang et al., 2023; UNFCCC, 2015; Widjaja et al., 2023). Since the commercialization of ...

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