Environmental impact assessment of vanadium battery production

What is the environmental impact of a vanadium battery?
With the EPS weighting method,the greatest environmental impact of the vanadium battery originated from theproduction of polypropylene and constructional steel. For the lead-acid battery,lead extraction contributed most to the environmental impact,followed by polypropylene production.

Does a vanadium redox battery have an environmental impact?
The environmental impact of both the vanadium redox battery (vanadium battery) and the lead-acid battery for use in stationary applications has been evaluated using a life cycle assessment approach. In this study,the calculated environmental impact waslower for the vanadium battery than for the lead-acid one.

Why is a vanadium battery more energy efficient?
The net energy storage efficiency of the vanadium battery was greater due tolower energy losses during the life cycle. Favourable characteristics such as long cycle-life,good availability of resources and recycling ability justify the development and commercialisation of the vanadium battery.

How does a vanadium battery system work?
The mass of the vanadium battery system is mainly made up by water (48 wt.%). This water can be distilled and added to aconcentrated electrolyte at the site of use. The development of electrolyte with higher concentration can reduce the volume of the storage tanks and the space requirements for the installation.

Is a vanadium battery better than a lead-acid battery?
In this study,the vanadium battery was found to make less environmental impact and havehigher energy efficiencythan the lead-acid battery. Favourable characteristics such as long cycle-life,good availability of resources,and recycling ability justify the development and commercialisation of the vanadium battery. 7. Conclusions

Does a life cycle assessment affect the environmental impact of Ow batteries?
The present study focuses on using life cycle assessment to evaluate the environmental impact associated with the industrial-scale production of flow batteriesand the corresponding sensitivity to materials selection decisions.

In the present life cycle assessment (LCA) study, potential environmental impacts of a VFB are evaluated. The study is based on an in-depth technical analysis and electrochemical system design of megawatt-scale VFB. ...

In particular, vanadium redox flow batteries (VRFB) are well suited to provide modular and scalable energy storage due to favorable characteristics such as long cycle life, ...

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Environmental Impact (EI):As shown in Table 1, this paper references the methods developed by Graedel et al. and Manjong et al., using the Life Cycle Assessment (LCA) approach to evaluate the environmental impacts generated during the production of battery materials (Graedel et al., 2015; Manjong et al., 2023).

In particular, vanadium redox flow batteries (VRFB) are well suited to provide modular and scalable energy storage due to favorable characteristics such as long cycle life, easy scale-up, and good recyclability. However, there is a lack of detailed original studies on the potential environmental impacts of their production and operation. The ...

The environmental impact of both the vanadium redox battery (vanadium battery) and the lead-acid battery for use in stationary applications has been evaluated using a life cycle assessment approach. In this study, the calculated environmental impact was lower for the vanadium battery than for the lead-acid one. The net energy storage efficiency ...

The environmental impacts distribution of the three vanadium production processes were concentrated in the solid waste impact category (PI, PII, PIII: 98.68%, 98.40%, 98.40%) and the abiotic depletion potential impact category (PI, PII, PIII: 1.25%, 1.55%, 1.52%) (Table 3). The result for the sodium roasting production process exceeded that of the ...

The goal of this study is to conduct a detailed environmental impact assessment of flow battery production and to evaluate the sensitivity of the results to materials selection and system design choices. The battery production phase is comprised of raw mate-rials extraction, materials processing, component manufacturing,

Table 5.5 Results of environmental impact assessment of VRFB, using the ReCiPe midpoint (I), for the processes of assembly, USE, and EoL . Full size table. Figure 5.6 shows the results of this analysis. The use phase has the stronger contribution to each category of environmental impact investigated. On the other hand, Fig. 5.7 shows how the production ...

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The environmental impacts of batteries and particularly LIBs is an emergent topic that is closely related to the increase in the number of electric vehicles and the need for stationary energy storage systems. 27 The large amount of raw materials required to manufacture these batteries, including copper, cobalt and nickel, requires careful consideration to assess the ...

The production of three commercially available flow battery technologies is evaluated and compared on the basis of eight environmental impact categories, using primary data collected from battery ...

The investigation into the production of three flow batteries provides important guidance on potential

environmental impact associated with battery component manufacturing, upstream production activities, battery system designs, and materials selection choices, given state-of-the-art commercial technologies. In particular, the findings and ...

environmental impacts that occur during the production of the battery prototype and analyze possible scenarios that may be feasible solutions to implement and improve the environmental ...

Among the three flow battery chemistries, production of the vanadium- redox flow battery exhibited the highest impacts on six of the eight environmental indicators, various potential human health hazards, and per-energy-capacity material costs of $491/kWh

VRFB also has some other significant advantages, such as no toxicity by-products, environmental friendliness, high energy efficiency, and rapid response capability. Especially in large-scale...

The results demonstrated that the greatest environmental impact of the vanadium battery was originated from the production of steel and polypropylene. Further research is expected to be done to identify ...

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