Gelion Technologies

Energy Storage Industry

BOUNDLESS
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Climate Impact Profile
July 2021

Company Description

Gelion Technologies (Gelion) is an Australia-based company that develops advanced stationary and mobile battery technologies. Gelion has developed a non-flow zinc-bromide ($ZnBr_2$) battery for the stationary energy storage market which is affordable, safe, long-lasting, and recyclable. Gelion leverages existing lead-acid manufacturing infrastructure, techniques, and processes that allow scalability while maintaining low capital requirements. Its wide operating temperature range makes it suitable for harsh off-grid environments through to grid connected commercial and industrial applications, large-scale solar and wind farms, and utility deployments.

Headquarters	Sydney, Australia
Founded	2015
Business model	Proprietary Limited Company
Employees	24
Intellectual Property	9 Patents granted/pending
Website	https://www.gelion.com/

Alignment with the UN SDGs

Affordable and Clean Energy

Industry, Innovation, and Infrastructure

Responsible Consumption and Production

Climate Action

Climate Impact Score: 9.7/10

Boundless Analysis

- This profile compares Gelion's non-flow zinc-bromide ($ZnBr_2$) battery against traditional battery chemistries such as lithium-ion (Li-ion), lead-acid (PbA), sodium sulfur (NaS), and vanadium redox flow (VRF).
- The Climate Impact Score is based on per-kWh impact for key performance indicators such as Greenhouse Gas (GHG) Emissions, Water Footprint, Energy Footprint, and Carbon Return on Investment (CROI).
- Boundless scores Gelion 9.7/10 on its overall per-unit impact.
- Measured per kWh, the Gelion energy storage system has a low GHG Footprint and compares favorably against competing technologies for Water Footprint, VOC Footprint, as well as Carbon Payback Time.
- Measured per million dollars (USD) invested, the Gelion system has a positive CROI, assuming that its storage capacity increases renewable electricity penetration in the grid over its life. Under this assumption, each million dollars (USD) invested in manufacturing capacity results in two million metric tons of GHG reduction.
- Gelion's battery uses materials that are abundant, inexpensive, recyclable, and abuse-tolerant, resulting in environmental and commercial advantages of the battery over lead-acid and lithium-ion batteries.
- Advanced energy storage is increasingly needed to transition the electricity, transportation, buildings, and industrial sectors toward renewable energy resources. Environmentally safe batteries are a key factor in this transition.

Management Team

- Thomas Maschmeyer, Founder and Executive Chairman, a serial entrepreneur with four successful companies so far, and most recently awarded Australia's top honour in technology — the Prime Minister's Prize for Innovation (2020). He is ranked #15 in the list of most influential chemists during 2010 – 2020 globally. The founding Director of the University of Sydney's $150 million dollar (AUD) Nano Institute, Thomas is currently Professor of Chemistry, leading the University's Laboratory of Advanced Catalysis for Sustainability.
- Andrew Grimes, Chief Executive Officer, is a trained Chemical Engineer with over 25 years' experience in both technical and commercial roles. His early career was with large listed multinational companies including Shell, Nuplex and ICI, while more recently he was Group CEO of a multi-national specialty chemicals company. Andrew has completed a Masters of Sustainability at the University of Sydney.
- Nathan Coad, Chief Technology Officer, has an academic background in Mechanical Engineering and Energy Physics. Nathan started his career as a Fuel Cell Test Engineer and spent 10 years with ZBB Energy Corporation developing $ZnBr_2$ flow batteries. Nathan worked with Balance Utility Solutions integrating and installing industrial scale Li-ion energy storage systems.
- Stuart Rayner, GM Business Development, brings to Gelion over 20 years of global technology solution and professional services sales experience gained from IBM, Computer Associates (CA) and Ernst & Young. Previously, Stuart worked with Ignite Energy Resources and Licella commercialising novel waste to energy technologies with partners in Australia, Canada and the UK.

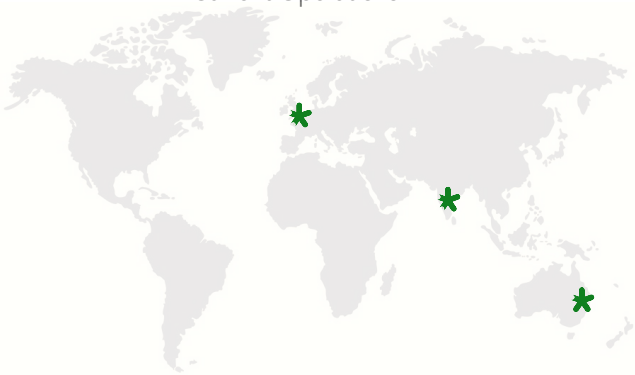
Technology

- Gelion uses a non-flow gel design. This recyclable design allows for a lower cost of storage through the battery's manufacturing, capex, and maintenance costs.
- The battery can cycle daily with 90% round trip efficiency and 100% depth of discharge, and it is able to operate at temperatures up to 50°C without the need for active cooling.
- Gelion's $ZnBr_2$ battery mitigates the need for conflict materials in its battery production, as zinc and bromine are inexpensive and abundant materials with minimal geographical or supply chain restrictions.
- Gelion's batteries have a high safety factor due to its $ZnBr_2$ chemistry acting as a fire retardant. This reduces the risk of thermal runaway and explosion.

Operations

- Gelion's headquarters is in Sydney, Australia.
- Gelion plans to focus on off-grid and grid-connected commercial and industrial applications initially. After achieving greater manufacturing scale, they will deploy their technology into grid-scale energy projects.
- Gelion's capital light manufacturing strategy lowers costs by partnering with existing lead acid battery companies in Australia and overseas and leveraging their ecosystem to produce the $ZnBr_2$ batteries.

Current Operations



Environmental Highlights

Summarized below are the most relevant impact categories and codes that refer to the United Nations' Sustainable Development Goals (SDGs). The associated metrics highlight the most important factors that explain how this technology impacts the environment.

Greenhouse Gas Emissions

The production of Gelion's energy storage system has a low GHG emissions per kWh of stored and cycled energy during the lifetime of the battery. The GHG emissions of the production of Gelion's battery are 0.029 kg CO_2e per kWh cycled during the life of the battery, or 9.9 kg CO_2e per kilogram of battery. On average, their system has a GHG Footprint 61% lower than Li-ion batteries, 85% lower than PbA batteries, 16% higher than NaS batteries, and 52% higher than VRF batteries. Savings are primarily driven by the materials that make up the batteries. Note that this analysis uses the 100-year Global Warming Potential (GWP). Using an alternative 20-year GWP horizon results in a 25% increase to Gelion's GHG (up to 0.033 kg CO_2e per kWh). Relevant Code: SDG 13.

Clean Energy

Advanced energy storage is increasingly needed to transition the electrical grid and the transportation, building, and industrial sectors toward renewable energy resources. To accommodate intermittent supply, renewable electricity integration requires utility-scale storage, as well as demand-side energy storage to better manage loads. The ability to deliver and support applications requiring 100% depth of discharge means Gelion's battery presents a potentially attractive solution for grid-scale energy storage that will allow for a higher penetration of renewable energy to the grid and perform better load management. Relevant code: SDG 7.

Resiliency

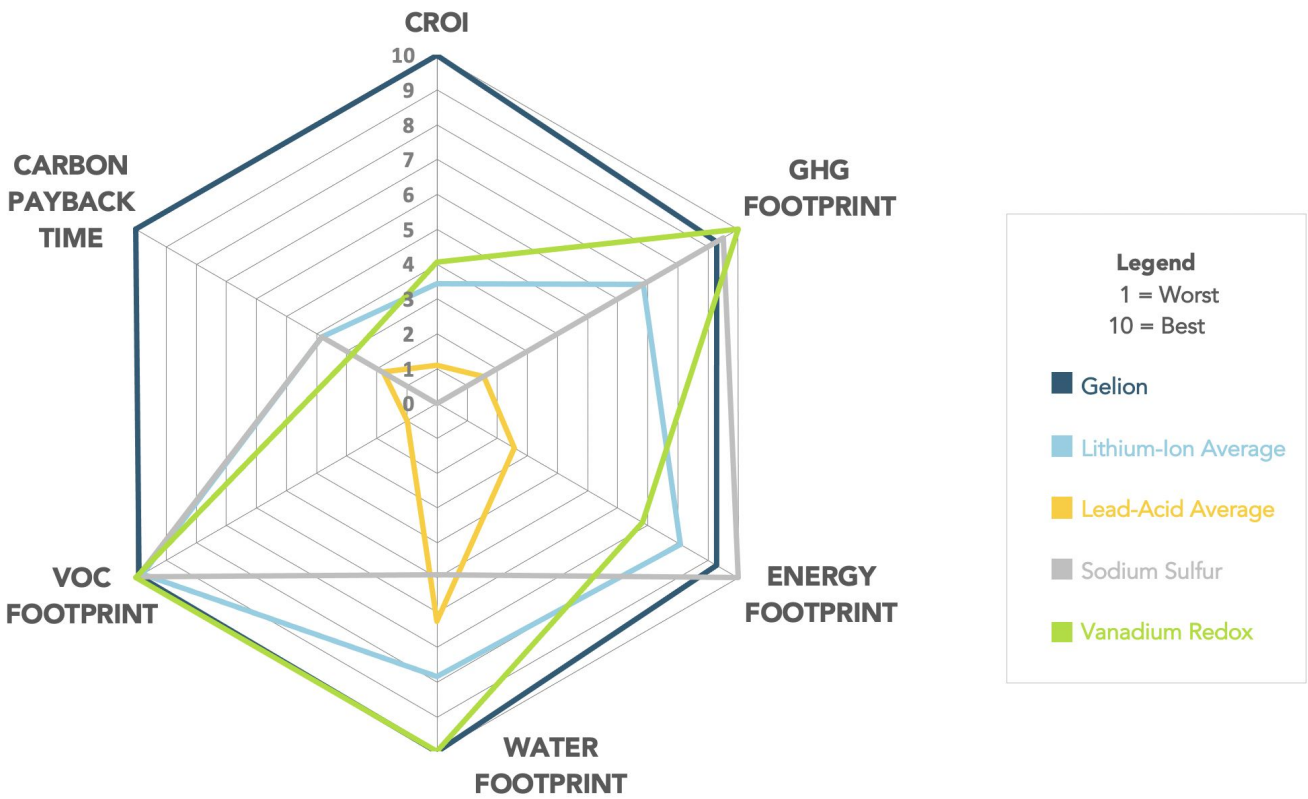
Energy storage systems are designed to provide reliable power to businesses and residences. Gelion's low cost of manufacturing and ability to operate with high cycling rates enables it to be used in environments where the market increasingly demands intermittent renewable energy. Relevant Code: SDG 9.

Material Use

Gelion uses materials that are more abundant and safer than materials common to other battery technologies. One of the main materials used in Gelion's battery, zinc, is twelve times more abundant in the current world's minerals reserves than lithium and twenty-two times more abundant in terms of identified resources.[1] While lithium's reactivity creates an inherent risk of thermal runaway, Gelion's $ZnBr_2$ chemistry is safe because it acts as a fire retardant. Competing batteries, such as some lithium-ion batteries, require the use of cobalt. The majority of the world's cobalt is produced in the Democratic Republic of the Congo, where significant human rights concerns have been documented. Gelion's battery also completely avoids the global health concerns of lead exposure. Relevant code: SDG 12.

(1) https://pubs.usgs.gov/periodicals/mcs2021/mcs2021.pdf

Benchmarking and Conclusions



For every 1 million dollars (USD) invested in Gelion, 2.3 million metric tons of greenhouse gas emissions (CO_2e) could be reduced by enabling surplus renewable energy to enter the grid. Gelion's GHG Footprint per kWh of stored energy during its lifetime is significantly lower than that of Li-ion and PbA batteries. The biggest contributor to the GHG footprint of the Gelion battery are its terminals and connectors, which represent 38% of the total GHG Footprint. The Carbon Payback Time, the time that it takes for the Gelion battery to offset its GHG Footprint, is 2.4 times faster than Li-Ion batteries, PbA batteries, NaS batteries, and VRF batteries.

The Water Footprint of Gelion's battery, including water requirements for raw materials, is 78% lower than the average Water Footprint of Li-Ion batteries, and 75% lower than the Water Footprint of PbA batteries. The Water Footprint of vanadium redox flow (VRF) batteries is similar to that of Gelion's battery.

A core material of Gelion's battery chemistry, zinc, is twelve times more abundant than lithium in the world's mineral reserves and twenty-two times more abundant in terms of identified resources. The $ZnBr_2$ chemistry acts as a fire retardant, increasing the safety and resiliency of the battery and preventing thermal runaway in high temperature conditions. The battery's ability to tolerate multiple 100% depth of discharge cycles and long cycle life would make it an attractive option for grid-scale energy storage that will allow a higher penetration of renewable energy to the grid and better load management.

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