EOS

Energy Storage Industry

BOUNDLESS
IMPACT RESEARCH & ANALYTICS

Climate Impact Profile
November 2020

Confidential

Company Description

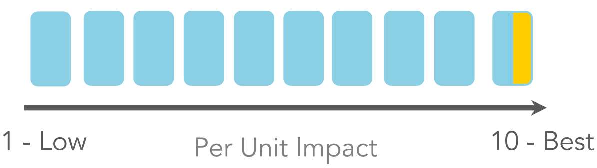
Eos Energy Storage is a New Jersey-based company that develops and manufactures grid-scale energy storage solutions using its Znyth battery technology. Using EOS' technology, utilities can rely on cleaner and a more efficient energy mix by storing excess energy produced during off peak hours and discharging the stored energy back to the grid during peak hours. The main environmental advantages of EOS' battery is its recyclability and avoidance of rare earth materials.

Headquarters	New Jersey, USA
Founded	2008 as Grid Storage Technologies.
Business model	Publicly Listed: EOSE:NASDAQ
Employees	70
Financial status	$171MM funded to date
Intellectual Property	14 patent families with over 140 patents pending, issued, or published in 33 countries
Website	https://eosenergystorage.com/

Alignment with SDGs

- Affordable and Clean Energy
- Industry, Innovation and Infrastructure
- Responsible Consumption and Production
- Climate Action

Climate Impact Score: 9.5/10



Boundless Analysis

- This profile compares the EOS battery against traditional battery chemistries such as Lithium-Ion, Lead-Acid, Sodium Sulfur and Vanadium Redox.
- The Climate Impact Score is based on per kWh impact for key performance indicators such as greenhouse gas (GHG) emissions, water footprint, energy intensity, and hazardous materials requirements. A high impact score reflects a better performance of the technology against competitors.
- Boundless scores EOS 9.5/10 per unit impact. The score rationale can be found in Appendix G.
- Measured per kWh over the lifetime of the battery, the EOS battery has a lower GHG impact and compares favorably against competing technologies for GHG, water, and solvent impacts, energy, as well as for the carbon payback time.
- Measured per kWh, the EOS battery has a positive carbon return on investment, assuming that storage capacity increases with renewable electricity on a 1:1 basis. Under this assumption, each 1MM $US invested in manufacturing capacity results in 39,620 tonnes of GHG reduction, equivalent to the carbon sequestered by 51,742 acres of U.S forest per year.
- The EOS battery is made of highly recyclable materials, is designed to last 5,000 cycles — equivalent to a 15 years calendar life — and is safe even in extreme temperature conditions.
- Due to the intermittent nature of non-conventional renewable energy sources like wind and solar, energy storage is a key component to increase the penetration of clean energy. With up to 80% efficiency in 100% depth of discharge applications, EOS presents a high efficiency solution for grid scale energy storage that allows a higher penetration of renewable energy to the grid.
- The Carbon Return on Purchase (CROP) shows that EOS's customers can realize significant GHG savings by installing the EOS battery, compared to Lithium-Ion, Lead-Acid, Sodium Sulfur, and Vanadium Redox batteries.

Management Team

- **Joe Mastrangelo, CEO,** has extensive experience leading diverse teams to develop and deploy commercial scale projects around the world. Prior to EOS, Joe was President and Chief Executive Officer of Gas Power Systems for GE Power. Originally from New York, Joe earned a Bachelor of Science in Finance from Clarkson University and an Associate of Science, Business Administration and Management from Westchester Community College.
- **Dr. Balakrishnan G. Iyer, CCO,** is a seasoned energy and utilities industry management professional, with deep experience driving business development for global conglomerates. Balki began his career at Schlumberger. He previously served as COO of renewable energy giant, Enel Green Power; and as VP, Business Development at General Electric, where he drove technology developments for renewable energy and smart grid. Balki has an Honorary Degree of Doctor of Science from his alma mater, Binghamton University, for his contributions to the fields of sustainable energy and inclusive education.
- **Daniel Friberg, SVP Engineering,** is responsible for system engineering and integration of Eos Aurora Battery System. Daniel has a strong technical background in battery integration, inverter technology, control systems and electrical engineering. He has more than 25 years of experience working for leading electrical engineering companies. He earned a BS in Mechanical Engineering from Jonkoping, Sweden 1990.
- **Nathan McCormick, SVP Operations,** served for nearly 20 years in senior manufacturing, demand management, and sourcing leadership positions at General Electric. While at GE, Nathan was responsible for all manufacturing activities for U.S.-built steam turbines and generators. He created a culture of competitiveness to improve product cost and productivity by using lean and digital tools along with effective capital investments. Nathan graduated Magna Cum Laude with a B.S. in Electrical Engineering from the University of Dayton, OH.
- **Francis Richey, Director Research & Development,** began his career as a Postdoctoral Research Scientist at Stanford University, leading a collaborative research effort between UC Berkeley and Stanford to investigate corrosion mechanisms in aqueous metal air batteries. His tenure at Eos began in 2015 as a Senior Battery Scientist and he now leads the research and development of the Eos battery. Francis holds 3 patents, has publications in Journal of the Electrochemical Society and Journal of American Chemical Society, and has presented at numerous electrochemical conferences on fuel cells, batteries, and capacitors.

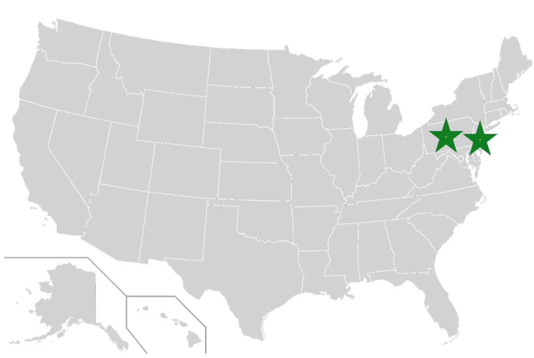
Technology

- EOS manufactures and deploys zinc hybrid batteries. Its battery is optimized for the 4+ hours discharge duration market, making it suitable for grid, industrial and commercial applications. The EOS battery can reach 80% efficiency in 100% depth of discharge and can last up to 5,000 cycles, which translates to 15 years of calendar life.
- EOS energy storage technology relies on its Znyth™ technology, employing materials that are non-rare earth or conflicted and widely available. The EOS battery materials are recyclable at the end of its life. With the exception of the electrolyte, all materials can be reclaimed and reused.
- The EOS battery is non-flammable even under extreme conditions, being able to operate between -20 °C (-4°F) and 45 °C (113°F) without need for HVAC. In contrast, Li-ion batteries commonly require HVAC for stationary applications, increasing the energy use during the battery operations.
- EOS is currently in the process to obtain UL safety certification for: UL 1972 "Standard for Safety, for Stationary Applications" and UL 9540A "Standard for Safety for Thermal Runaway".

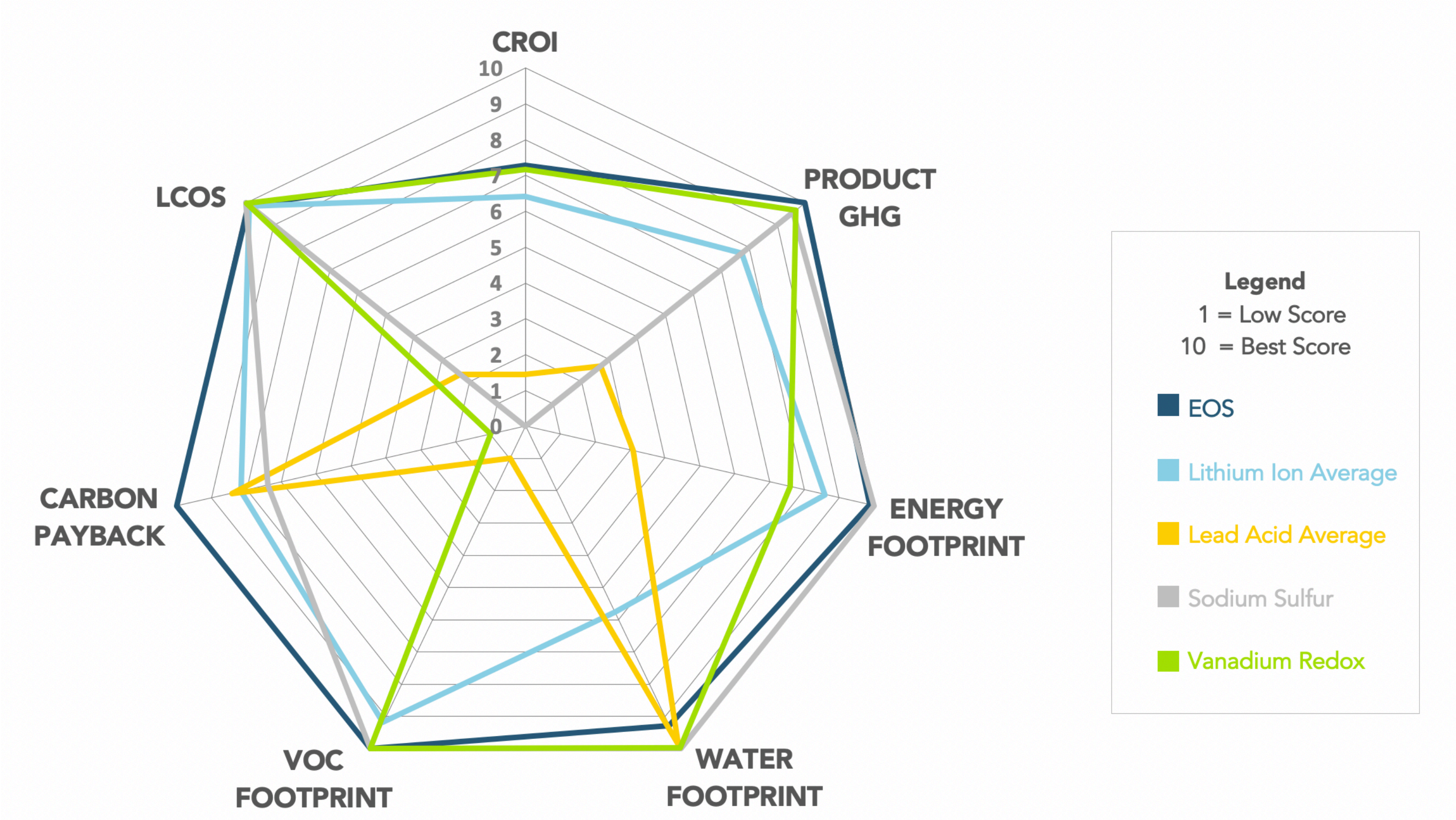
Operations

- EOS' headquarters is in New Jersey, while its manufacturing plant is in Pittsburgh, PA with a production capacity of 20,800 batteries per year.
- EOS already has several operational projects in the US, UK and India and in 2020 entered in an agreement with the Electric Reliability Council of Texas to supply 1GWh of standalone battery energy storage systems to International Electric Power, LLC for grid connected projects.
- During 2020 EOS entered into a definitive agreement to combine with B. Riley Principal Merger Corp II. This will result in EOS becoming a publicly listed company under the symbol "EOSE".

Current Operations



Benchmarking and Conclusions



The EOS battery GHG footprint per kWh of stored energy during its lifetime is significantly lower than Lithium-Ion (Li-Ion), Lead-Acid (PbA), Sodium Sulfur (NaS) and Vanadium Redox batteries. For every one-million dollars invested in EOS' battery production capacity, 39,620 tonnes of CO2e savings could be realized by enabling surplus renewable energy to enter the grid. 90.1% of the GHG footprint for the EOS battery is derived from the materials that compose the battery, and 65% of that impact comes from the electrolyte. Zinc is a relatively abundant material, five-times more abundant than lithium in the earth's crust, whilst Bromine is three times less abundant than lithium.

The water footprint of the EOS battery, including water requirement for raw materials, is 71% lower than the average water footprint of Lithium-Ion batteries. The water footprint of Lead-Acid batteries is on average 80% lower than the water footprint of the EOS battery and 97% lower on average than the water footprint of Lithium-Ion batteries. Also, unlike Lithium-Ion and Lead-Acid batteries, the EOS battery does not use regulated volatile organic compounds (VOC) during battery production.

The levelized product cost over the EOS battery lifetime is 95% lower on average than lead-acid batteries and 7% lower on average than that of Lithium-Ion batteries. The levelized product cost of the EOS battery is estimated to be similar to the cost of Sodium Sulfur and Vanadium Redox batteries. Levelized cost was estimated using EOS's reported production costs. Boundless financial analysis included calculating the long-term capital charge rate.

The Carbon Payback Time — the time that it takes for an EOS battery to offset its GHG footprint — for the EOS battery is two times faster than that for Lithium-Ion and Lead-Acid batteries and three times faster than Sodium Sulfur and Vanadium Redox batteries. Boundless also analyzed the GHG emissions that EOS' customers can avoid by installing their batteries. Customers purchasing EOS' batteries can avoid up to two times the GHG emissions compared to Lithium-Ion batteries and obtain up to 40% more savings compared to Sodium Sulfur and Vanadium Redox batteries.

Environmental Highlights

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

Material Use

EOS batteries use safe and abundant materials that mitigate battery hazards, such as flammability. One of the main materials used in the EOS battery, Zinc, is five times more abundant in the earth's crust than Lithium[1]. While lithium's reactivity with air and water creates an inherent fire hazard, the EOS battery is nonflammable. The EOS battery doesn't include any cobalt, mitigating human rights concerns with the procurement of cobalt in the Democratic Republic of Congo. The EOS battery manufacturing also requires no solvents, unlike the manufacturing process used for Lithium-Ion and Lead-Acid batteries. All EOS battery materials can be recycled at the end of its life, with the exception of the electrolyte.
Relevant code: SDG 12.

Greenhouse Gas Emissions

The production of the EOS battery has lower GHG emissions per kWh of stored and cycled energy during the lifetime of the battery than Lithium-Ion, Lead-Acid, Sodium Sulfur and Vanadium Redox storage technologies. The GHG emissions of the production of EOS cells are **0.02 kgCO2e per kWh**, or 3.5 kgCO2e per cell kilogram. On average, the EOS battery has a GHG footprint **84% lower than Li-Ion batteries**, 95% lower than Lead-Acid batteries, 51% lower than Sodium Sulfur batteries, and 45% lower than Vanadium Redox batteries (please refer to Appendix A). Savings are primarily driven by the materials that make up the batteries. Note that this analysis uses the 100- year GWP (Global Warming Potential). Using an alternative 20-year GWP assumption shows 31% higher emissions (0.03 kgCO2e per kWh stored and cycled during the life of the battery).
Relevant Code: SDG 13.

Clean Energy

Advanced energy storage is increasingly needed to transition the electricity grid, 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. With up to 80% efficiency in 100% depth of discharge applications, EOS presents a high efficiency solution for grid scale energy storage that will allow a higher penetration of renewable energy to the grid and to better manage load. The EOS battery is non-flammable even under extreme conditions, being able to operate between -20 °C (-4°F) and 45 °C (113°F) without need for HVACIn contrast to Li-Ion technology, EOS battery is non-flammable under extreme conditions without need for HVAC.
Relevant code: SDG 7.

Resiliency

EOS's modular system can be scaled up to provide reliable power to the grid or industrial facilities. EOS' technology enables the operations of reliable microgrids, and together with distributed renewable generation, can ensure a power source to critical load during outages for several hours.
Relevant Code: SDG 9.

(1) https://periodictable.com/Properties/A/CrustAbundance.v.html

Environmental Key Performance Indicators (EKPIs)

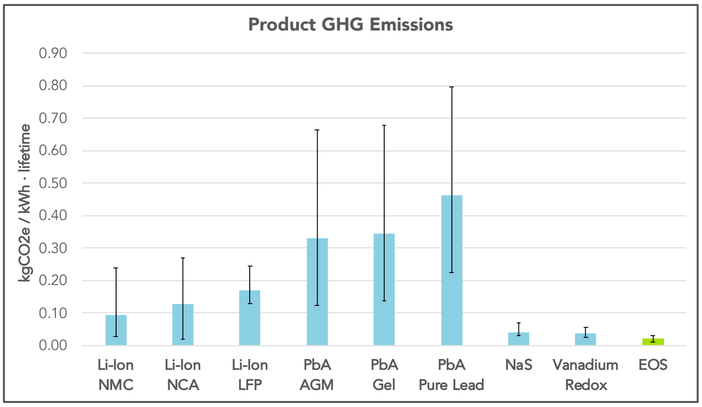
We evaluated the life-cycle inputs and impacts per kWh during the lifetime for the EOS battery, considering raw material production, procurement and battery cell fabrication. Results are normalized relative to one kWh of stored energy during the life of the battery and compared to Lithium-Ion, Lead-Acid, Sodium Sulfur and Vanadium Redox technologies. More specifically, Lead-Acid variants include Pure Lead (PbA Pure Lead), Absorbent Glass Mat (AGM), and Acid–Gel (PbA Gel), and Lithium-Ion variants include Nickel-Manganese-Cobalt (Li-Ion NMC), Nickel-Cobalt-Aluminum (Li-Ion NCA), and Iron-phosphate (Li-Ion LFP), Sodium Sulfur (NaS), and Vanadium Redox.).

NOTES: Consistent with conventions within the financial sector, we use the Roman numeral "M" to denote "thousand" and "MM" for "millions."

Product GHG Intensity

GHG emissions were measured as CO2 equivalent per kWh of stored energy during the life of the battery.

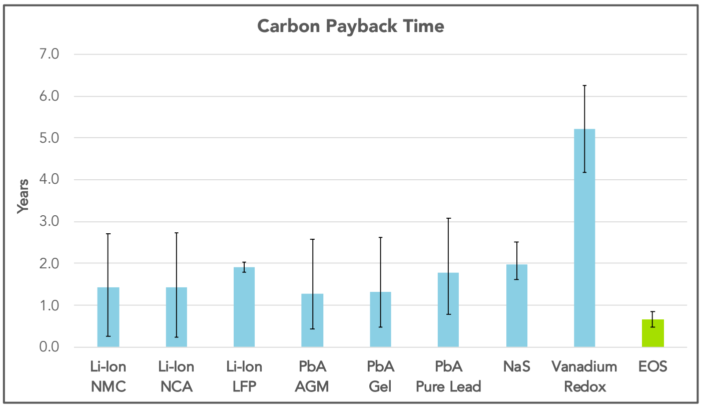
- GHG emissions for the EOS battery ranged from 253 to 444 kgCO2e per 100kg battery. This translates to an average of 0.02 kgCO2e per kWh of energy cycled during the life of the battery.
- The GHG intensity for PbA Gel and Pba Pure Lead was calculated starting with the GHG intensity of PbA AGM and replacing glass by fumed silica and recycled lead by virgin lead respectively.
- EOS' estimated GHG footprint is 84% lower than the GHG footprint of Li-Ion batteries, 95% lower than that of Lead-Acid batteries, 51% lower than that of Sodium Sulfur batteries, and 45% lower than that of Vanadium Redox batteries.



Carbon Payback Time

Time required for emissions savings from the product's use to offset the GHG of its production. All scenarios assume 300 cycles for every battery per year and that each kWh of stored energy (and associated losses) are supplied by non-emitting electricity and displace marginal U.S. grid electricity.

- The EOS battery takes between 0.5 and 0.8 years to offset the embedded GHG emissions due to its production, which is significantly lower than its competitors.
- The carbon payback time of Li-Ion batteries is on average 2.4 times longer than the carbon payback time of the EOS battery. The carbon payback time for Lead Acid and Sodium Sulfur is on average 2 times longer, and the carbon payback time for Vanadium Redox is 3 times longer than the carbon payback time of EOS.
- All other batteries report a carbon payback time in excess of one year.



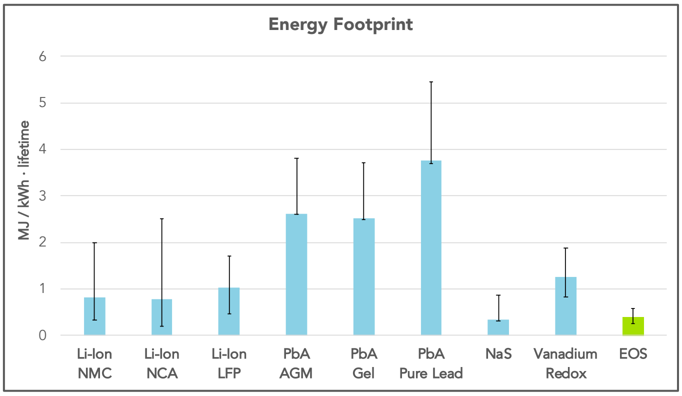
EKPIs continued

Calculations of environmental metrics used to determine climate impact benefit. NOTES: Consistent with conventions within the financial sector, we use the Roman numeral "M" to denote "thousand" and "MM" for "millions."

Energy Footprint

A measure of the energy input per kWh of energy stored during the life of the battery.

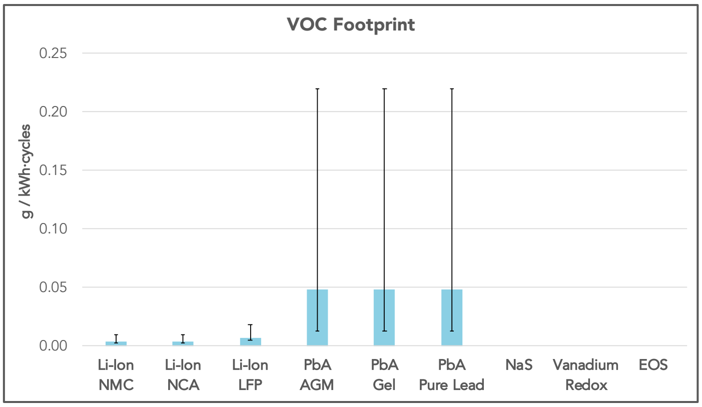
- The estimated energy footprint of the EOS battery ranged from 0.3 to 0.6 MJ per kWh cycled during the life of the battery.
- The energy intensity for PbA Gel and PbA Pure Lead was calculated starting with the energy intensity of PbA AGM and replacing glass by fumed silica and recycled lead by virgin lead, respectively.
- Energy intensity estimates for the EOS battery were 55% less than those for Li-Ion batteries, 86% less than those for Lead-Acid batteries, 69% lower than those for Vanadium Redox batteries and 14% higher than those for Sodium Sulfur batteries.



Solvent / VOC Footprint

A measure of the Volatile Organic Compounds (VOC) required for manufacturing per kWh stored and cycled during the life of the battery.

- The EOS battery uses no solvent, except for acetone, which is not regulated by the EPA as a volatile organic compound. Therefore, it was not considered.
- Average VOC footprint of Li-Ion batteries is 0.004 grams / kWh·lifetime.
- Average VOC footprint of Lead-Acid batteries is 0.05 grams / kWh·lifetime.
- Our independent expert review suggests that the values reported appear low for lithium-ion battery cathodes deposited via NMP solvent, because the typical solvent volume fraction may be approximately 30% and the cathode comprises a significant fraction (>1/3) of the cell[1].



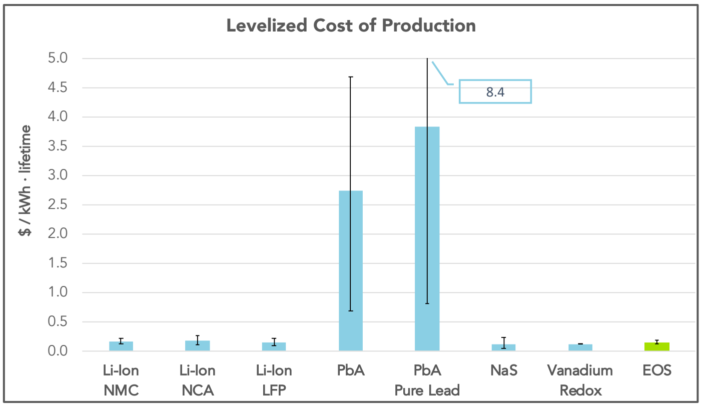
EKPIs continued

Calculations of environmental metrics used to determine climate impact benefit. NOTES: Consistent with conventions within the financial sector, we use the Roman numeral "M" to denote "thousand" and "MM" for "millions."

Levelized Cost of Production (LCOP)

Levelized cost was independently estimated using EOS's reported production costs. Boundless financial analysis included calculation of long-term capital charge rate.

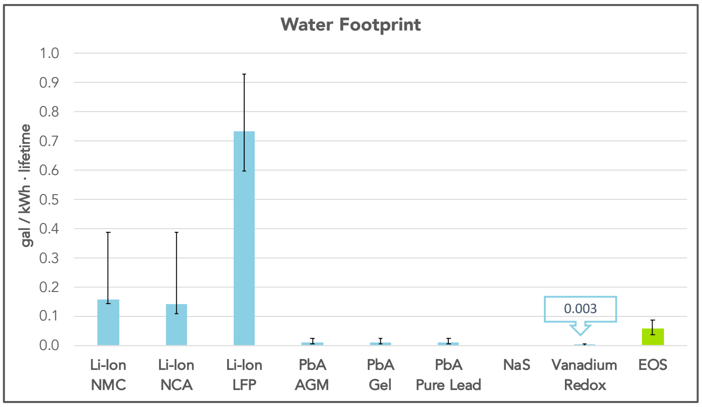
- EOS levelized cost ranges from $0.10 to $0.20 per kWh stored and cycled during a 4,000-cycle life of the battery. This estimate is based on EOS' current annual battery production rate and would likely be lower for future higher capacity production facilities. Detailed assumptions are compiled in Appendix F.
- The levelized cost of EOS is estimated to be 7% lower than the levelized cost of the Li-Ion battery.
- Costs for NaS and PbA are based on a 2014 analysis [1] and reviewed by an independent industry expert. Li-Ion pricing is dynamic and based on values reported by the industry expert.
- Average levelized cost of Lead-Acid is $3.3 /kWh, 22 times the cost of the EOS battery — in part due to a low 300 cycle battery life.
- LCOP estimates for alternative technologies are based on lifetime energy storage and would likely increase if all technologies were normalized based on 4 - hour discharge duration



Water Footprint

Water use per kWh of energy stored during the life of the battery as a result of raw material extraction and the manufacturing process of the batteries.

- The water footprint of the EOS battery ranges from 0.04 to 0.09 gallons per kWh and averages 0.06 gallons per kWh.
- The EOS battery requires 71% less water for material extraction and production than the average Lithium-Ion battery.
- Lead-Acid batteries have a low water footprint because of their high degree of recyclability and recycling infrastructure.



(1) Zakeri B and Syri S (2014) Electrical energy storage systems: A comparative life cycle cost analysis. Renewable and Sustainable Energy Reviews

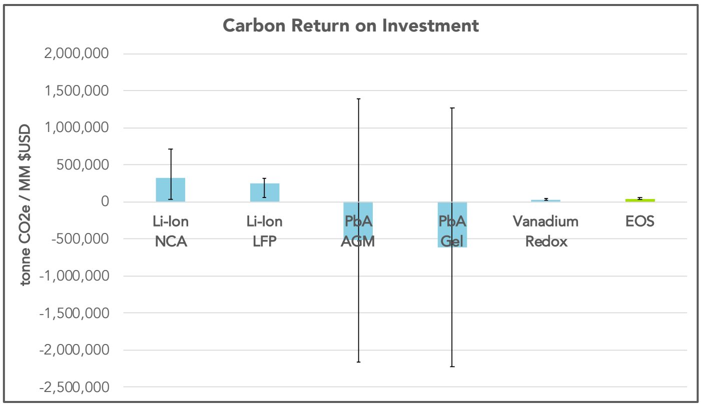
EKPIs continued

Calculations of environmental metrics used to determine climate impact benefit. NOTES: Consistent with conventions within the financial sector, we use the Roman numeral "M" to denote "thousand" and "MM" for "millions."

Carbon Return on Investment (CROI)

GHG avoided over manufacturing facility lifetime for each million dollars (USD) of equity investment. All scenarios assume that each kWh of stored energy (and associated losses) are supplied by non-emitting electricity and displaces marginal U.S. grid electricity.

- The CROI calculation assumes a baseline scenario of 20,800 cells production capacity per year and a 50% equity investment for EOS and competitors.
- Technology specific assumptions for energy storage and depth of discharge were used to compare alternatives on an energy basis.
- EOS has an estimated CROI of 39,620 tonnes of CO2 avoided for each million-dollar investment. EOS' CROI is 86% lower, on average, than the CROI of Li-Ion batteries due to the incredible scale of Giga-factory production.
- The EOS battery has a positive carbon return across the entire scenario range, whereas the Lithium-Ion and Lead-Acid ranges resulted in negative CROI (net increase in emissions) due to its lower estimated life.



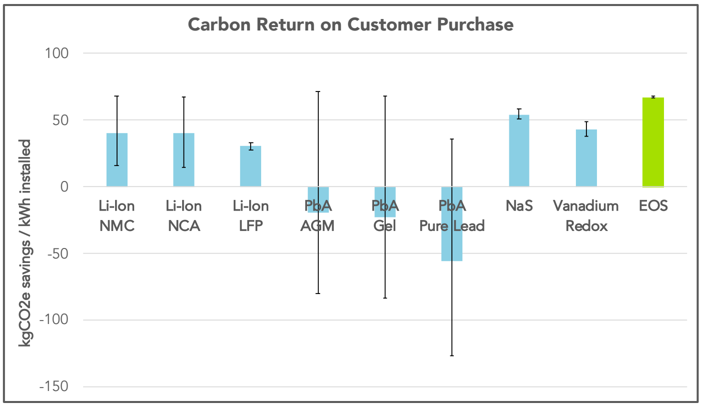
Greenhouse Gas Emission benefits for EOS Customers

Calculation of environmental metric as seen from a EOS customer perspective.

Carbon Return on Customer Purchase

A measure of the greenhouse gases avoided by EOS's customers per kWh of customer energy storage. Each kWh of stored energy (and associated losses) are assumed to be supplied by non-emitting electricity and displaces marginal U.S. grid electricity.

- The Carbon Return on Purchase (CROP) shows that EOS' customers can realize significant GHG savings by investing in the EOS battery, compared to buying either Li-Ion or Lead-Acid batteries.
- EOS' CROP ranges from 66 to 68 kgCO2e per kWh energy storage. Customers purchasing the EOS battery can save up to 2 times more GHG emissions compared to Li-Ion batteries.
- Technology specific assumptions for energy storage and depth of discharge were used to compare alternatives on an energy basis.



(1) JL Sullivan and L Gaines (2010) A Review of Battery Life-Cycle Analysis: State of Knowledge and Critical Needs. Center for Transportation
Research, Argonne National Laboratory.

APPENDIX A: Methodology

Key Goals

Key goals of this analysis were to:

1. Examine environmental performance in conjunction with financial data to arrive at environmental and hybrid environmental-financial metrics for EOS' storage technology versus existing technologies.

2. Provide equitable comparisons among relevant alternative technologies.

3. Incorporate a variety of methodological considerations that are relevant to the energy storage industry and which were expected to bear upon the results.

To ensure that these key goals were reached, an independent industry expert reviewed the study and assumptions to ensure that the methodology was coherent with industry standards. The expert review and commentary notes are provided in Appendix D.

Methodology

To address the first goal, Boundless researched the material, energy, and performance characteristics for EOS' energy storage technology, based on detailed information provided by EOS that describes the material components and energy inputs. At the core of the methodology is a life-cycle assessment (LCA) model for a kWh of stored energy on the EOS battery. The functional unit (FU) of this LCA was a kWh of stored energy, such that embodied energy and emissions are estimated for the battery production. We used SimaPro v9.0.0.41 and employed the IPCC 2013 methodology when calculating life-cycle impacts of material and energy systems not described elsewhere in the literature. The complete set of detailed calculations, impact assessment factors, assumptions, and references are available as Supporting Information (SI) upon request.

Each metric compares EOS' technology against alternative technologies. Metric construction for industry alternatives relies on comparisons, for which we relied on scientific literature, industry reports, white papers, as well as assumptions provided by the industry expert. The impact metrics are reported graphically using bar charts to illustrate a baseline result value, along with sensitivity bars reflecting a range of possible result values around deployment scenarios and key variables.

Research Approach

- Followed a life-cycle analysis approach and leveraged professional LCA software/data and scientific literature.
- Investigated non-GHG metrics, including water footprint and minerals use.
- Accounted for emissions offsets occurring from hypothetical marginal electricity system impact assuming energy storage facilitated renewable generation by a 1:1 ratio.
- Identified sources of uncertainty and quantified their impact on results.
- Included important financial and operational variables to estimate the cost of production.

APPENDIX B: List of Metrics

EKPI	Unit of Measure	Description
Energy Intensity	MJ / kWh · lifetime	A measure of the energy input per kWh of stored energy during the lifetime of the battery.
GHG Intensity	kgCO2e / kWh · lifetime	A measure of the greenhouse gas impact per kWh of stored energy during the lifetime of the battery.
Levelized Cost of Production	$ / kWh	The levelized unit-cost of battery production in terms of storage capacity.
Water Footprint	Gallons / kWh · lifetime	A measure of the water use per kWh of stored energy during the lifetime of the battery.
Solvent / VOC Footprint	mg / kWh	A measure of the VOC avoided by using water-based manufacturing, measured per kWh of stored energy.
Carbon Return on Investment	kgCO2e saved / $1M investment	A measure of the climate impact (positive or negative) of each $M dollars (USD) investment.
Carbon Payback Time	Years	A measure of the time that it takes for a product's use to offset the GHG of its production.
Carbon Return on Purchase	kgCO2e / kWh Installed	A measure of the greenhouse gases avoided by customers per kWh of customer energy storage.

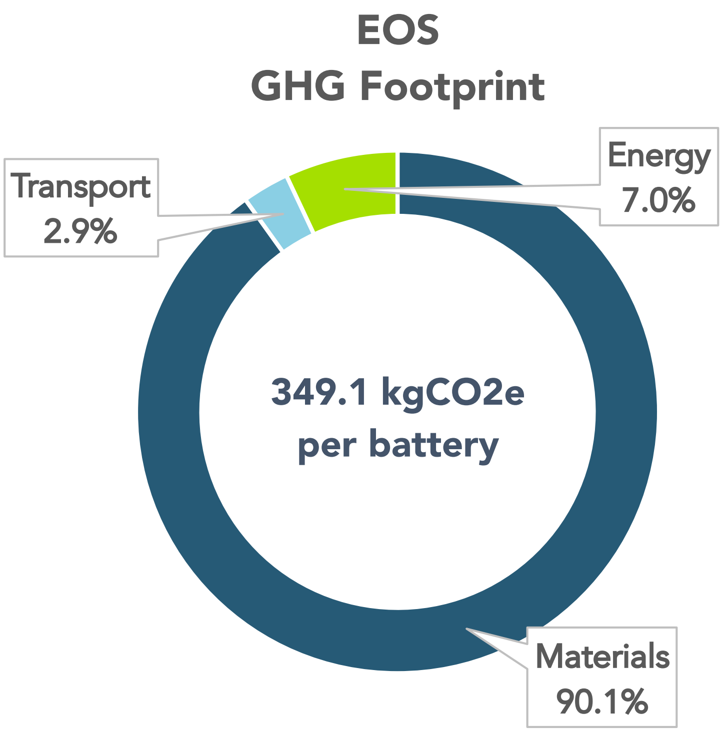
Appendix C: Summary of Life Cycle Product Inventory

Greenhouse gas (GHG) emissions associated with the production of one EOS battery, measured as kilogram of CO2 equivalent per kg.

The estimated GHG emissions associated with the production of EOS battery are:

- 349.1 kgCO2e/battery
- 3.8 kgCO2e / kg
- 0.02 kgCO2e / kWh · lifetime

Transportation reflects transportation of material inputs to the production facility.



APPENDIX D: Independent Expert Review

Independent Industry Expert

Kent J. Griffith holds a PhD in battery materials from the University of Cambridge, United Kingdom. He has ten years of experience in electrochemical and battery research and development. Kent is also the founder and CTO of a start-up company commercializing efficient, fast charging and high-power lithium-ion batteries based on new, patent-protected electrode materials. His experience in technical subfields includes cathode and anode chemistry, solid electrolytes for all solid-state batteries, nickel-rich NMC degradation and protection, fast charging battery applications, high power chemistries and electrode formulation, characterization and specification of batteries for individual applications (e.g. energy density, safety, power, variable temperature operation), mineralogy, materials synthesis and recycling.

Kent previously served as an industry expert for Boundless, reviewing and providing guidance for assessments of the following technologies: zinc-manganese battery, a nickel-zinc battery, and silicon anodes for lithium-ion batteries.

Summary of Expert Review

The broad environmental context for this technology is that by enabling the storage of intermittent low-carbon energy, batteries can reduce the need for carbon-intensive on-demand energy generation. The climate assessment report by Boundless Impact Research and Analytics is based on a comprehensive analysis of the EOS zinc–bromine energy storage technology. The climate impacts of the raw materials, transport, and manufacturing were compared against relevant electrochemical energy storage alternatives for greenhouse gas emissions, water consumption, energy usage, and volatile organic compound emissions. The EOS battery has a low environmental impact per kg of battery, but this is partially offset by its low energy density. Where the EOS battery can significantly increase the environmental benefits of intermittent clean energy storage is through its long-life span. The long cycle life delivered by the EOS battery means that it may outlast competing technologies and avoid the need for replacement.

The water-based nature of the EOS battery means that it is non-flammable, avoiding a residual safety concern for large-scale lithium-ion batteries that contain flammable solvents. Another factor to consider is that several major lithium-ion battery components appear on the Department of the Interiors list of minerals deemed critical to U.S. national security and the economy. These include lithium, natural graphite, cobalt, and manganese. On the other hand, the major components of the EOS battery—zinc and bromine—are not classified on the list of critical minerals.

The EOS battery is a fundamentally different technology from the lithium-ion battery and is designed specifically for large-scale energy storage. Other technologies in this space include (vanadium) redox flow and a variety of liquid or molten batteries. Lithium-ion batteries, on the other hand, are better known for their function as the power source for small portable electronics and electric vehicles. While many of the materials used in a lithium-ion battery are invariant with size, the manufacturing and electrical and thermal management will vary considerably. The way the battery is used—the duty cycle—can significantly impact its cycle life and efficiency. Thus, care must be taken to consider the specific requirements of an application, because this may influence not only the environmental impact of a particular battery choice, but whether that technology can meet the requisite demands. To generalize beyond an individual application, the Boundless Impact report uses grid-relevant assumptions for each energy storage solution.

In summary, the EOS battery has a short carbon payback time and can contribute to a cleaner and lower carbon energy landscape. The EOS battery is best suited for stationary applications that are not constricted by energy density. Its long cycle life provides favorable environmental impacts and convenience. The use of non-flammable components offers safety benefits.

APPENDIX E: Global Warming Potentials

How Global Warming Potential Scenarios highlight the importance of investing in Emission Reduction Technologies

The methane impact from emissions depends on which Global Warming Potential (GWP) is used. GWP is a metric measuring how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide. The larger methane molecule provides a warming potential that is 28-36X that of CO_2 in a 100-year timeframe. (That is, over 100 years, methane traps 28 times more heat per mass unit than carbon dioxide). The lifespan of methane in the atmosphere, however, was estimated at 9.6 years, while that of CO_2 is much longer (estimated from 20-200 years). In the shorter 20-year timeframe, methane's impact would, therefore, be 84-87X that of CO_2, and the GHG savings for all landfill technologies would be greater. Investment in methane reduction using this shorter timeframe increases the return for investment by a factor of 2.2-3X. The 20-year timeframe is especially important when considering critical climate change mitigation efforts needed over the next two decades.

APPENDIX F: Levelized Cost of Storage

The Levelized Cost of Product (LCOP) measures lifetime costs of levelized battery manufacturing divided by lifetime battery production, measured in storage capacity. Levelized cost allows the comparison of different technologies of unequal life spans, project size, different capital costs, risks, return, and capacities. EOS' current annual production rate is 20,800 cells per year. LCOP was calculated as follow:

$$LCOS = \frac{\sum_{t=1}^{n} \frac{I_t + Lt + M_t}{(1+r)^t}}{\sum_{t=1}^{n} Pt} = \frac{Present\ Value\ of\ Cost}{Total\ Production}$$

Where:

I_t: Capital Investment in year t
M_t: Material cost in year t
Lt: Operating and Maintenance expenditures in year t
P_t: Production (kWh storage capacity) in year t
r: Discount rate
n: Life of the system

APPENDIX G: Score Rationale

Climate Impact Score

The climate impact value is a number (1=worse to 10=best). This number represents an overall indicator of a company's climate impact performance against its most relevant industry competitors. The value is obtained by comparing the average of each resulting EKPIs for the company against its competitors. The score for each metric can be read from the summary Spider Chart of the profile for each product. The EKPIs are developed and displayed in the detailed graphs for both the target company and the competing companies.

EOS has a generally advantageous performance when compared to its competitors. For example, EOS' technology has a lower GHG Footprint than its competitors, but a slightly higher Water Footprint than its lead-acid, sodium sulfur and vanadium competitors. Using a formulaic comparison to measure relative performance across all EKPIs, EOS' technology scored a 9.5 out of 10 on its climate performance.

APPENDIX H: Report Development Team

Paul Meier, Director of Climate Impact
Paul has worked with industry, government and public interest groups on energy and environmental issues since 1995. His efforts have focused extensively on the use of energy systems modeling to support decision-making. Paul has led multi-disciplinary research efforts to evaluate energy alternatives at the national, regional, and state levels and spanning electricity, transportation, and building energy sectors. From 2006 – 2016, Paul served as a Scientist and Energy Institute Director at the University of Wisconsin-Madison. From 2016 – 2018 he served as Director of Engineering for Blumont Engineering Solutions. He currently serves as an Adjunct Professor at the Center for Sustainability and Global Environment at the University of Wisconsin - Madison. Paul has environmental engineering degrees from Purdue University and Clemson University and earned his Doctorate from the Nelson Institute for Environmental Studies at the UW - Madison. He is a licensed professional engineer.

Fernanda Avila Swinburn, Research Analyst
Fernanda graduated from Columbia University in 2018 with a Master's degree in Sustainability Management and a focus on renewable energy, sustainability strategies, data analysis, and life cycle assessment. Prior to Columbia, she graduated from Universidad de Chile with a master's degree in Electrical Engineering. Fernanda has experience modeling demand side management systems for micro-grids and renewable resources forecasting. Her work on these topics was recognized with the first place of the Eco-Logicas Monograph competition, given by the "Instituto para o Desenvolvimento de Energias Alternativas na America Latina". She has worked as a consultant performing energy price projection and the modeling of power purchase agreements for developers and financial institutions. She also has experience developing sustainability strategies and life cycle assessment for organizations in different sectors, such as a music festival, a foundry plant, and a coffee roasting company.

Andreas van Giezen, M.S., Research Analyst
Andreas graduated from Delft University of Technology (TU Delft) in The Netherlands in 2018 with a Master's degree in Management of Technology, focusing on Infrastructure & Environmental Governance. He received a special annotation with his degree for his thesis work focusing on sustainable development of technologies. Prior to TU Delft, he graduated from Inholland University of Applied Sciences with a Bachelors degree in Aeronautical Engineering. Andreas interned for research & development projects at universities in both the Netherlands and China and won a nationwide contest for engineering students active in the energy industry in the Netherlands. He was previously employed at an international engineering consultancy firm, researching the social and technical impacts of ultra-deep geothermal energy projects. Andreas also has experience with academic research on ocean plastic collection logistics.

Michele Demers, Founder, CEO
Boundless Founder and CEO Michele Demers has 20 years of experience as a philanthropy executive, strategist, and social entrepreneur. She is Founder and CEO of Boundless Impact Investing, a market intelligence platform that provides high-quality, objective, and actionable research and tools to family offices and private investors interested in maximizing the social and environmental impact of their investments. From 2010-2013, she was Vice President at Foundation Source where she built a knowledge platform on best practices in philanthropy that was used by a network of 1200 family foundations. From 2007-2008, Michele was the Director of Communications for Humanity United. She has been involved in the successful development of more than two-dozen philanthropic and nonprofit start-ups, including her own, Tattersall Consulting, from 2002 to 2007. Michele is regularly called upon for her innovative thinking about impact investing and social enterprise. She is a graduate of Pennsylvania State University and has a Master's in International Relations and Communications from Boston University.

Jack Cederroth, Director of Operations
Jack is an accomplished global operations and platform management leader with more than thirty years' experience in the Financial Services and Financial Technology arena. During that time, he has worked extensively creating, implementing, and supporting enterprise-wide data and analytics platforms and services for the investment community. He is versed and trained in Lean Six Sigma techniques and principles. Prior to joining Boundless, he was the Global Head of Operations at S&P's Securities Evaluation business unit where he established and led a twenty-four-by-seven follow the sun customer support model for their enterprise reference data and evaluation feed products. As a member of the leadership team, he helped define the strategy for the sale and subsequent integration of the entity to ICE Data Services. Jack believes that effectively creating strategic alliances with partners, leaders internally and at client organizations is the key to successful business initiatives. He is a graduate of Fordham University with a B.S. in Finance.

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About Boundless Impact Research & Analytics

Driven by the latest research by independent industry and academic experts, Boundless Impact offers analysis, market trends, and evidence of best practices in a growing number of emerging sectors that address major social and environmental challenges. We are an advanced consulting firm that enables investors to connect with industry leaders and peers for expert analysis, diverse perspectives, and real-time collaboration. Our investor education and expert advisory services offer proprietary access to both subject-matter experts and other impact investors.

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