



Building the
Web 3 Economy



ELECTRIC VEHICLE RECHARGEABLE BATTERY STATE OF HEALTH DATA VALUE CHAIN MAPPING

MOBI SOH002/VM/2023 VERSION 1.3

DRIVES Program

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EXECUTIVE SUMMARY

According to Open Data Watch, “Data value chain provides a framework through which to visualize the life cycle of data, from defining a need to using them for impact... Finding high-value uses and creating a process to transform raw data into actionable information is the essence of the data value chain.”

Electric Vehicle Battery State of Health (SOH) data is of interest to many different stakeholders in the value chain. This analysis maps various stakeholders engaged in collection, publication, uptake, and other activities related to the SOH information. It describes those activities along with interfaces by which stakeholders share data. Interfaces include contracts and other legal mechanisms, consents provided by SOH data providers, usage restrictions, and privacy requirements.

LIST OF ACRONYMS

BMS	:	Battery Management System
EV	:	Electric Vehicle
OEM	:	Original Equipment Manufacturer
SOH	:	State of Health

GLOSSARY OF TERMS

This section contains the definitions of all technical and specific terms used throughout this document.

Battery: Any source of electrical energy generated by direct conversion of chemical energy and consisting of one or more non-rechargeable or rechargeable battery cells or groups of them.

Battery State of Health (SOH): Ratio of total maximum capacity (in kWh) at any given time over beginning of life capacity (or rated capacity). The SOH deteriorates over long periods of usage impacting the battery’s overall performance.

Battery Management System (BMS): A battery management system manages a battery pack and monitors the operating state of modules and cells, calculates and reports various performance data, and balances the performance of individual cells and modules.

OBJECTIVE OF THIS DOCUMENT

A decentralized mechanism has the potential to instill trust without sacrificing the accuracy or timeliness of the SOH data, thereby directly adding value to the data moving through the value chain.

Electric Vehicle Battery State of Health (SOH) data is of interest to different stakeholders in the electric vehicle value chain. This analysis mapped stakeholders engaged in the collection, publication, and uptake, and hence the impact of the battery SOH data on the stakeholders in the value chain. The mapping describes the impact on the value of SOH information due to reporting attributes, accuracy, and timeliness.

Trust must be maintained in order for the data value chain to function. Therefore, the stakeholders must verify data accuracy and ensure timeliness. This presents a strong incentive for the stakeholders to coordinate. A decentralized mechanism has the potential to instill that trust without sacrificing the accuracy or timeliness of the SOH data. By providing all the guarantees of data security, accuracy, and timeliness at a reduced cost, such a decentralized mechanism can directly add value to the data moving through the overall value chain.

STAKEHOLDERS OF THE SOH DATA

Stakeholders of SOH data span across a wide range of sectors, all of whom play critical roles in producing, verifying, or utilizing SOH data.

Stakeholders of SOH data include individuals and entities that (1) produce algorithms to estimate SOH, (2) perform laboratory tests to determine or verify SOH, and (3) consume SOH data for various commercial and non-commercial purposes.

This analysis mapped the following stakeholders:

- » Electric Vehicle (EV) Manufacturers
- » Tier N Battery Manufacturers
- » EV Owners/Fleets
- » Governments, Regulators, and Policymakers
- » Insurers of EV Owners
- » Lenders to EV Owners and Dealers
- » EV Dealers and Repair Shops
- » Battery Recycling and Repurposing Companies
- » Battery Swapping Companies
- » Battery Analytics Platforms
- » Battery Testing Companies



ACTIVITIES IN THE SOH DATA VALUE CHAIN

In this stage, stakeholders establish the process for collecting SOH data from other stakeholders. This involves processing data to ensure they are correctly recorded, classified, and stored in formats that allow further use.

Collection

Collection of SOH data is the first stage in the value chain. In this stage, stakeholders establish the process for collecting SOH data from other stakeholders. This involves processing data to ensure they are correctly recorded, classified, and stored in formats that allow further use. For the purposes of this analysis, assume that the SOH data are either directly stored in the battery management system (BMS) or stored in such a way that the stakeholders can derive SOH by using analytical models over attributes stored in the BMS. SOH data can then be transmitted to stakeholders via wireless communication (e.g., cellular connection, Bluetooth) and/or wired connections.

This analysis assumes that once an EV is sold to an individual or a company, then the SOH data associated with the EV battery are only accessible by the buyer, who may then also consent to give access to third parties. This analysis also assumes hereon that there are no prevalent standards, specifications, and best practices on how the SOH data should be shared between the stakeholders.

Once data has been collected by a stakeholder, the data and all accompanying metadata must be published in such a way that intended users can access them.

Publication

Publication is the second stage of the value chain. Once data has been collected by a stakeholder, the data and the accompanying metadata must be published in such a way that the intended users can access them. The publication stage involves three activities: (1) providing the SOH data to the user with appropriate documentation in online and offline formats; and (2) analyzing data to extract useful information.

Stakeholders may publish the data for internal or external use. Stakeholders such as vehicle owners, insurers, and lenders typically will not publish the data externally and instead consume it for internal business purposes. For example, insurers may aggregate the SOH data they receive from different EV models and evaluate this data to influence underwriting decisions. Government regulators may, on the other hand, publish SOH information about particular vehicle makes/models and how SOH deteriorates over time for those vehicles based on empirical data collected over time.

In this stage, the stakeholders utilize the SOH data without the need for cleaning or alterations and instead focus on generating immediate value from the data.

Uptake

In this stage, the stakeholders utilize the SOH data without the need for cleaning or alterations and instead focus on generating immediate value from the data. This stage involves three activities: (1) connecting the SOH data to users; (2) incentivizing users to incorporate SOH data into the decision-making process; and (3) influencing them to value data. For example, vehicle manufacturers may connect and engage with vehicle owners by providing the battery SOH, indicating upcoming battery maintenance needs, and incentivizing better charging and discharging activities to prolong the battery SOH.

Vehicle manufacturers may use aggregated SOH data to assess defects in battery design.

Vehicle manufacturers may also use the SOH data gathered from multiple vehicles to assess defects in the current battery design.

Impact

In the impact stage, stakeholders use the SOH data to advance their bottom-line goals and objectives.

In the impact stage, stakeholders use the SOH data to advance their bottom-line goals and objectives. This is the final stage in the value chain and offers the largest value-add for stakeholders. Manufacturers may assess SOH data to influence decisions regarding battery design, engineering, and manufacturing processes, which may have a substantial effect on future revenue and brand impact.

STAKEHOLDER INTERFACES

This section describes interfaces between the stakeholders used to exchange the SOH data. Interfaces are actions stakeholders must perform before, during, and after sending and receiving data.

This section describes interfaces between the stakeholders used to exchange the SOH data. Interfaces are actions stakeholders must perform before, during, and after sending and receiving data. Interfaces form a basis for the exchange of SOH data and can be contractual in nature.

Data Exchange Contracts

There must exist contractual relations related to the exchange of SOH data between two legal entities.

Because SOH data is exchanged between two legal entities, there must exist contractual relations between the entities on the basis of which the data exchange occurs. For example, a vehicle manufacturer may enter into a contract with a vehicle owner to provide value-added services for a fee to provide timely notification of changes in battery SOH. Such a contract must stipulate terms and conditions regarding the usage of SOH data by vehicle manufacturers when this data is provided by vehicle owners. Figure 1 shows a potential model for SOH data flow.

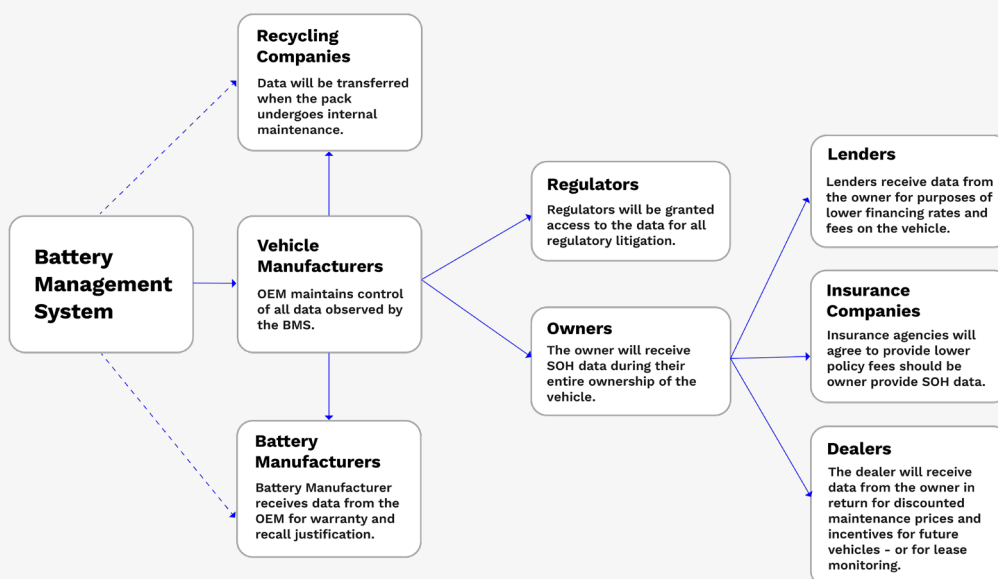


Figure 1. Downstream flow of battery SOH data.

Legal Consent of Use

Legal consent of use outlines terms and conditions by which stakeholders must share/use/consume battery state of health data.

Legal consent of use outlines terms and conditions by which stakeholders must consume battery state of health data. It defines usage restrictions and limitations imposed by a stakeholder to another before sharing the SOH data. For example, the vehicle manufacturer of the EVs may put restrictions on how the vehicle owners can use the SOH data and attach liability and limits for such use. Each stakeholder relationship may have varying levels of data consent.

Transmission Methods

The intent of this section is to define potential mediums of data transmission between stakeholders.

This section describes methods of data transmission between stakeholders. The intent of this section is not to prescribe any specific transmission technologies such as HTTP, FTP, etc., as those will be determined by the stakeholders themselves. Rather, the intent is to define potential mediums of data transmission between the stakeholders. For example, SOH data can be transferred from the vehicle manufacturer to the EV owner using various wireless mediums such as cellular connection.

Usage Restrictions

Usage restrictions define what data can be utilized between two stakeholders that have established a contractual agreement to share SOH data.

Usage restrictions define what data can be utilized between two stakeholders that have established a contractual agreement to share SOH data. This means certain variables or information may only be allowed use for analysis, inspection, maintenance, or financial purposes. For example, vehicle owners may restrict insurers from reselling or sharing their SOH data with a third party. Alternatively, data owners may allow insurers to share the data with a third party in order to correctly assess insurance premiums.



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