



#645d



User Experience

Vehicle UX Evaluation: Public Charging for EVs

The way in which key features are deployed within the vehicle can have a significant impact on how consumers perceive them. As such, deploying them in a manner that helps facilitate a satisfactory user experience is crucial to ensuring successful vehicle launches, while securing customer loyalty in the longer term.

In 2024, to support our best-selling, long-running, HMI UX Evaluation & Benchmarking report series, we launched the two-part UX Enabling Tech Series to more closely analyze the technological performance of various OEM aspects that deliver the biggest impacts on usability and the overall customer experience

For 2025, we will be releasing the next two entries in this series, with this edition focusing on public charging for EVs. Utilizing the vehicle models tested in our In-Car HMI UX Evaluation & Benchmarking Series, other models we have tested, and the overall usability study based on secondary data, the report will highlight the best user experiences offered by different EV charging services today and understand how they interact with the EV's connected features.

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RELATED SBD REPORTS



In-Car HMI UX Evaluation & Benchmarking – Summary – 635(23g)

SBD Automotive chose six cars to evaluate in 2023, based on two selection categories. New/interesting UX focuses on systems with to never-seen-before features or functionality, or the implementation of a solution that has previously been a challenge or pain-point for end-users. New mass-market UX includes vehicles in segments that are sold in high numbers and are entering a new generation of UI for that vehicle.

COVERAGE



FREQUENCY



PUBLICATION FORMAT



PAGES



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Key Benefits

- > Deep case studies of each navigation experience backed by objective testing data
- > Evaluate the technical and functional differences in the implementation of the selected features across the vehicles
- > Identify best practices and novel ways of delivering seamless user experiences across different use cases
- > Recommendations to enhance the customer experience for your own systems and technologies

This research supports

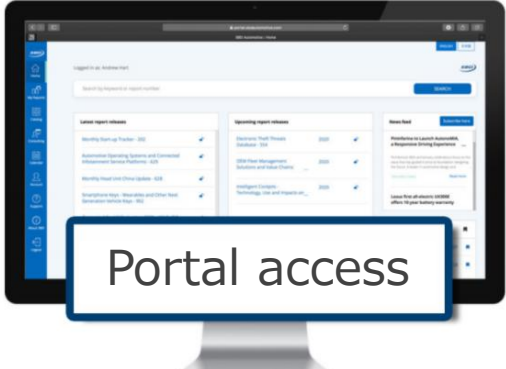


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November 2025

645d-25

UX Enabling Tech Series – Public Charging for EVs



Introduction

Introduction

Today, an increasing number of OEMs are equipping their latest models with innovative new technologies and connectivity features that work to elevate the user experience and extend it beyond the vehicle. For luxury and mass-market vehicles alike, the way that these features and systems are implemented and deployed plays a crucial role in enabling and delivering a satisfactory user experience. Public charging has become one of the most critical extensions of this experience outside the cabin. The shift to EVs has increased expectations around real-time information, reliability, pricing transparency, and seamless activation. As OEMs shift toward SDVs and deeper ecosystem integration, more of the charging journey is controlled by the automaker, meaning the quality of the charging experience can reflect directly on the brand and is capable of shaping long-term customer perception and loyalty.

SBD's 645d – Public Charging for EVs report, takes a deep dive into the features, functionality and user experience of public charging in Europe, the USA and China. Our usability experts consider good and poor examples, trends, and the future, by exploring how the ecosystem is likely to evolve in the coming five years, and help them to deliver **four key business outcomes of the public charging experience for automakers**:



| Layer | Section | Conclusion |
|-------------------|-------------------|---|
| STRATEGY & IMPACT | Executive Summary | High-level overview of features, functionality and trends along with key recommendations for creating future public charging experiences |
| LEARNING & ACTION | The Basics | Describes UX principles, unique challenges to charging, use cases and explains certain terms |
| | What's New? | New partnerships, the latest technology, new launches or announcements |
| | Analysis | Defines 13 pain points in public charging and provides in-depth analysis |
| CORE INSIGHTS | Best Practices | Provides insights into notable features and implementations from different OEMs, CPOs and other third-party providers, grouped into twenty categories |
| CONTEXT | Birds Eye View | An overview of the key topics that correlate with public charging |
| | Future Outlook | This section explores how public charging is likely to evolve and includes interviews with 3 industry experts |
| | Next Steps | Can SBD help you with any unanswered questions? |

645d – UX Enabling Tech Series – Public Charging for EVs

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- Importance of charging experience
- UX and customer pain points
- Convenience and seamless experience
- Transparency and level of information
- Guidance and education
- Safety concerns and vandalism
- Industry interviews
- Conclusions and recommendations
- Highlights in delivering OEM outcomes

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- Overview user experience pain points
- Insight from SBD:HERE Survey
- In-depth analysis of UX pain points

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- Audi
- BMW
- BYD
- Ford
- Li Auto
- Mercedes-Benz
- NIO
- Renault
- Polestar
- Porsche
- Rivian
- Tesla
- Volvo

- VW
- Xpeng
- Several CPOs

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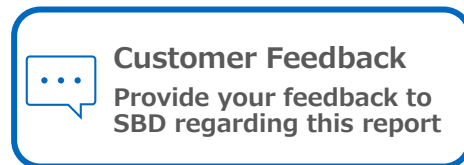
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Example slides from the report

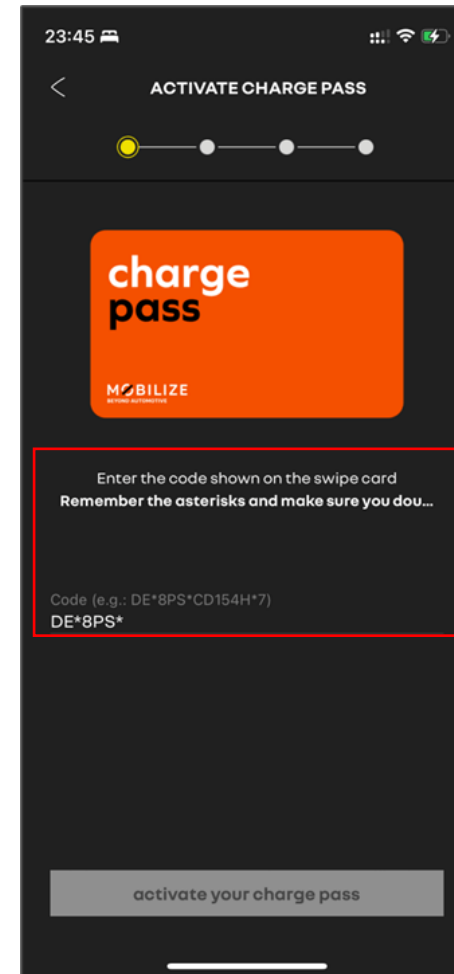
This block is a screenshot of a report slide. At the top, there is a photograph of a silver electric sedan parked at a charging station. Below the photo is a dark blue banner containing the SBD logo on the left, the text 'November 2025' in the center, and '6454-25' on the right. Underneath the banner, the text 'UX Enabling Tech Series - Public Charging for EVs' is displayed. At the bottom of the slide is a large, rounded rectangular button with a blue gradient and the text 'Request price' followed by a white right-pointing chevron symbol.



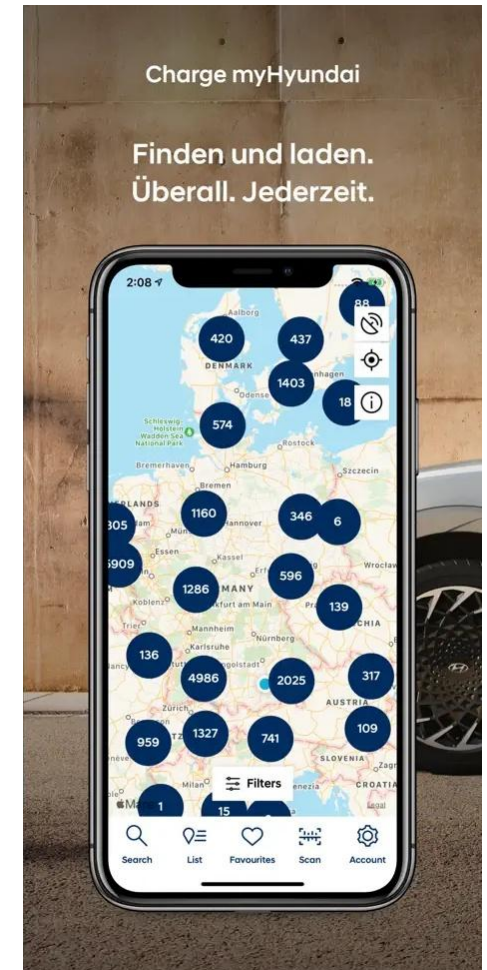
Major pain points exist across the charging experience

The EV charging experience is shaped by a mix of digital and physical touchpoints, but several recurring pain points continue to limit ease of use and driver confidence. These issues can be grouped into four key categories:

- **Access & Account Management:** Lengthy sign-up processes and poor contract management tools make it difficult for users to set up or adapt charging services. Basic tasks like viewing conditions or deleting contracts can be unnecessarily complicated.
- **Transparency & Information:** Users can face unclear or inconsistent pricing structures, limited filtering options when searching for stations, and poor visibility of charging session summaries. In many cases, guidance is unclear or missing altogether, making it harder to understand processes or features.
- **Reliability & Efficiency:** Users still encounter broken or unavailable stations, long delays due to slow charging, and fragmented digital ecosystems that require switching between multiple apps for planning, authentication, and payment. Depending on the vehicle, some users have to use separate CPO apps for each charging station.
- **Physical Experience & Safety:** Even when a station is located and functional, the physical environment can cause frustration. Many sites lack roofs, clear signage, or space for larger vehicles such as caravans. Stolen cables have become a problem, while poor lighting or remote industrial locations create safety concerns, particularly for women and other vulnerable users.



Renault: A physical card is required to use the Mobilize charging network and to enable P&C



Hyundai offers two apps for charging-related functions. Users need to constantly switch between both apps to get the full experience.



The ecosystem that supports Plug & Charge

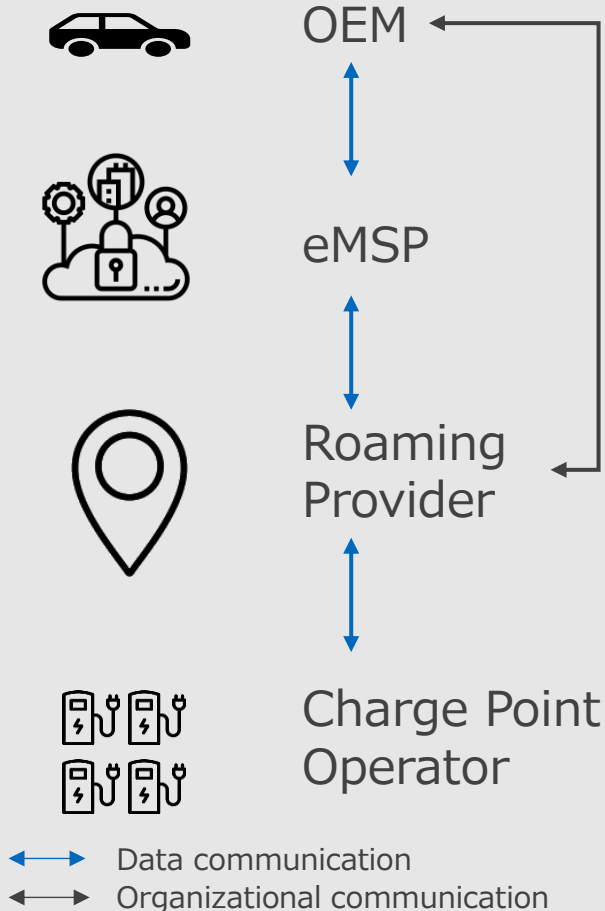
Roaming provider

Roaming allows EV owners to charge on third-party networks. It may allow a user of a charging network to use other charging networks. The roaming provider market is currently relatively small: Hubject has a significant lead and very few competitors exist, two examples being Gireve and e-clearing.net.

Standards

ISO 15118-2 is the current standard specifying the communication protocol between EVs and EV supply equipment. It specifies authentication, billing, and authorization protocols. ISO 15118-20 is the updated version of ISO 15118-2 and is being implemented gradually. It provides an extended set of features and functionalities to enhance interoperability, including higher levels of communication security and bidirectional power transfer capabilities.

Charging ecosystem



RFID cards

Currently various back up payment options are put in place. In Europe, these payments are mostly made with an RFID card, though in the USA it's mostly by credit card. In other markets it can vary. With time, old forms of payment may be replaced but, if the industry wants to have a solution for every charging station, it may be important to retain these kinds of payment solutions as options.

White label eMSP

Electromobility Service Providers (eMSPs) are primarily responsible for setting up a consumer-facing charging network. This activity has led to a variety of business models to emerge. For example, OEMs can have their own eMSP, like Ford, use a third party eMSP, like Audi, or have a joint venture with other OEMs, like IONNA.



Charging station ratings and data collection

Best Practice

Access to reliable, transparent information on charging stations is important for a good charging experience. Transparent ratings and real user feedback reduce uncertainty and increase confidence, helping drivers to avoid frustrating delays and unreliable chargers.

BMW:

- European BMW drivers benefit from enhanced charging data through a partnership with Parkopedia. It integrates into the My BMW app and IVI/vehicle navigation systems and supports users in selecting a suitable charging station.
- Includes user-submitted ratings for charging locations.

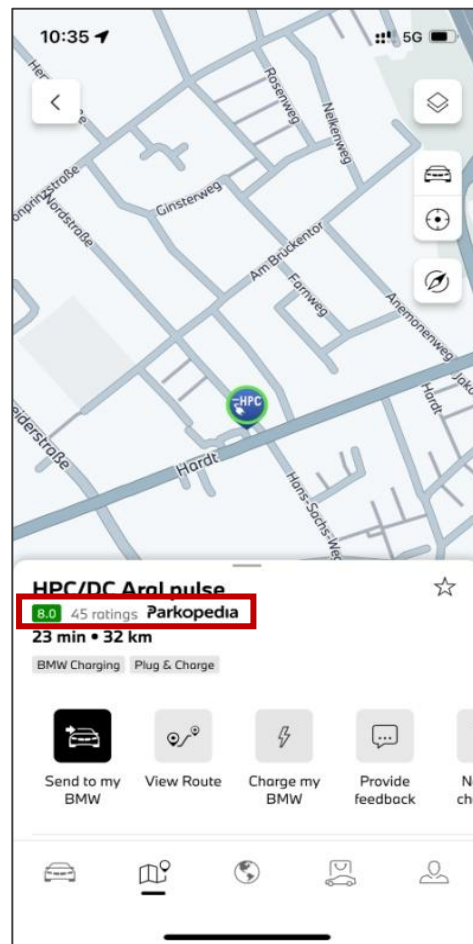
Rivian

- Rivian implemented an objective data driven rating score for individual charging stations. The score is based on actual plug-in data from the fleet of Rivian vehicles.
- The vehicle logs data such as the average top speed, payment success and overall charge session success.
- Within the app and the IVI, low-scoring charging stations can be filtered out.

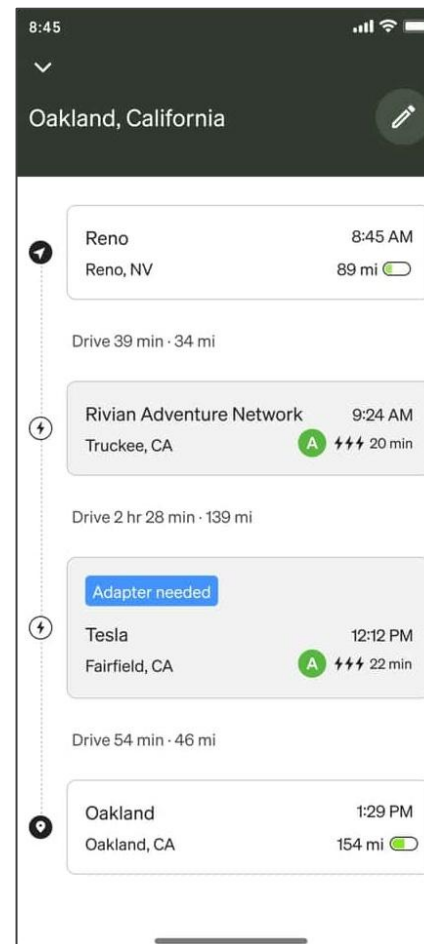
We Charge

- Users can rate charging stations with star ratings, view feedback from other drivers, and make better-informed decisions.

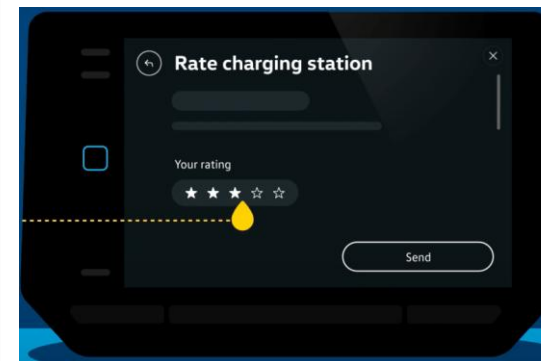
By providing ratings and transparent data, these systems help drivers save time and reduce uncertainty when charging. It is recommended that OEMs integrate similar rating features to enhance the overall user experience.



Rating of a charging station in the My BMW app.



Rivian's scoring (A to F) of charging stations.

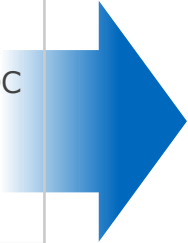


With the We Charge app users can rate charging stations and send direct feedback to the OEM.

Compliance with standards is pivotal for V2G development

Main Standards

| | |
|----------------------------|--|
| <p>ISO 15118-20</p> | <p>Necessary for reliable and future-proof grid communication making AC and DC smart charging and V2G more convenient and secure</p> |
| <p>IEEE 1547</p> | <p>It standardizes DERs (like EVs) performance capabilities to enable power systems to integrate them as assets that can support the grid and ultimately save costs through simplification</p> |
| <p>SAE J3400</p> | <p>Specific to the US, it standardizes charging connectors for AC and DC charging making it more user friendly and cheaper and easier also to install</p> |
| <p>OCPP</p> | <p>Enables standard communication that is scalable, provides real-time data on charging remotely, and eliminates complexity for better consistency</p> |



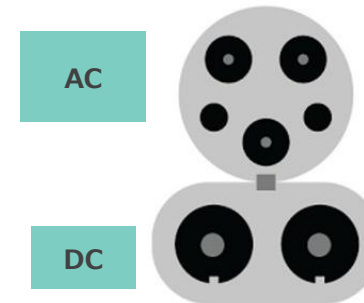
An important development example

SAE J3400 standard defining the **North American Charging Standard (NACS)** specifications brings several advantages.

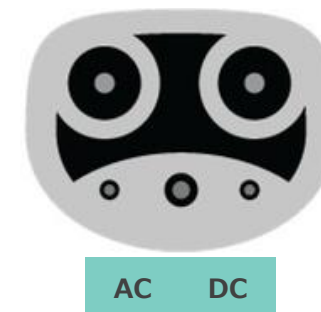
- **User-friendly**
- **Cost-effective**
- **Combining AC and DC in a single plug.**
- Tesla is currently the only one using NACS, but several OEMs are adopting it



CSS Type 1



NACS



The key regulations covering DERs and grid's **communication, safety, interoperability, hardware interface, grid integration and cybersecurity** are developing.



HEMS, V2G & Future of Smart Vehicle Charging Guide

This report breaks down the various opportunities and challenges of bi-directional charging, including vehicle enablement and different integrations

[Learn more](#) ➔



Development of new battery technologies

Ongoing advances in battery technology are significant for electric vehicle uptake, because they determine range, charging speed, safety, and the overall cost and sustainability of EVs. The pace of development is accelerating, as battery manufacturers and OEMs race to deliver next-generation solutions.

- **Solid-State Batteries:** Solid-state designs are moving closer to deployment, promising nearly double the energy density and improved safety compared to liquid-electrolyte lithium-ion. CATL has emerged as one of the most advanced players in this field, with significant R&D investment and clear signals that it may be among the first to bring solid-state cells into high-volume production. Ongoing trials and anticipated mass production by Xiaomi, General Motors, and LG Energy Solutions could mark a significant turning point for the EV industry. The technology could enable ranges over 700 to 1,000 km and deliver charging from 10% to 80% in under 10 minutes.

Notable news: In October 2025, Chery Automobile announced an all-solid-state battery module, which should enable ranges between 1,300 and 1,500 km.

- **Silicon Anode:** Silicon-anode could be an improvement for conventional lithium-ion cells that enables longer range and faster charging. Tesla and Rivian have signaled moves towards this technology; however, significant physical challenges remain, and it is expected that the technology is not near commercialization.
- **Lithium-Sulfur:** Lithium-sulfur offers up to 2x higher energy density than lithium-ion, which means longer driving range without increasing battery weight. Lyten (backed by Stellantis) aims for commercialization by 2028. Generally, it is expected that widespread commercialization will take several years.

Leading-edge battery advancements are powering the next wave of EVs, with solid-state batteries and next-gen chemistries on the horizon. These breakthroughs will soon deliver longer ranges, faster charging, and lower costs, making electric mobility more accessible and likely increasing EV adoption.

6 Industry takes a step ahead in battery technology: In the news

- The ongoing trials and anticipated mass production of solid-state batteries by Xiaomi, General Motors, and LG Energy Solutions could mark a significant turning point for the EV industry.
- These batteries could transform electric vehicles by offering higher energy density for longer ranges, enhanced safety with solid electrolytes, and quicker charging capabilities.

| | | |
|--|---|---|
| <div style="background-color: #0056b3; color: white; padding: 5px; font-weight: bold; font-size: 0.9em;"> Factorial Factorial </div> <p style="font-size: 0.8em; margin: 0;">Factorial unveils Gammatron AI platform for battery production</p> <ul style="list-style-type: none"> • Gammatron is an AI-powered digital twin simulation platform designed to accelerate the development of next-generation batteries, especially solid-state batteries, by improving the prediction, validation, and optimization of battery performance. • It is compatible with both solid-state and traditional lithium-ion battery systems. • Factorial is collaborating with Mercedes-Benz, Stellantis, Hyundai, and Kia, to enhance solid-state battery technology. • It provides simple prediction by showing engineers how design and material changes can lead to longer life and enhanced performance. • In partnership with Stellantis, it doubled battery life cycle through protocol tuning and accelerated performance forecasting, without altering cell chemistry. | <div style="text-align: center; margin-bottom: 5px;">  <p style="font-size: 0.8em; margin: 0;"><i>Gammatron, AI-Enabled Digital Twin Platform</i></p> </div> <div style="text-align: center; margin-bottom: 5px;">  <p style="font-size: 0.8em; margin: 0;"><i>Xiaomi new solid-state battery</i></p> </div> | <div style="background-color: #0056b3; color: white; padding: 5px; font-weight: bold; font-size: 0.9em;"> mi </div> <p style="font-size: 0.8em; margin: 0;">Xiaomi registers patent for solid-state battery</p> <ul style="list-style-type: none"> • Xiaomi has registered a patent for a type of solid-state battery technology. The patent describes a layered electrode structure that enhances both ion conductivity and energy density. • The battery is designed to enable a driving range of over 1,200 km (CLTC) and supports fast charging, which can deliver up to 800 km of range in 10 minutes. • Replacing the liquid electrolyte with solid materials enhances energy density, safety, and thermal stability compared to traditional lithium-ion cells. • The technology is compatible with existing lithium battery production lines, indicating potential for mass production. • In this patent, Xiaomi could eventually integrate in-house solid-state batteries into its EVs, reducing dependence on third-party suppliers such as CATL and BYD. |
| <div style="background-color: #0056b3; color: white; padding: 5px; font-weight: bold; font-size: 0.9em;"> GM LG </div> <p style="font-size: 0.8em; margin: 0;">GM and LG Energy Solution to pioneer LMR battery cell technology</p> <ul style="list-style-type: none"> • GM and LG Energy Solution will commercialize lithium manganese-rich (LMR) prismatic battery cells for future GM electric trucks and full-size SUVs. • The commercial production of LMR prismatic cells in the U.S. will begin in 2028, with pre-production starting at an LG Energy Solution facility by late 2027. • The final design will be validated at GM's Battery Cell Development Center in Michigan, which will open in early 2027, and at the LG facility. • It has been claimed that the new LMR prismatic battery cell offers 33% higher energy density compared to the top-performing LFP-based cells. This advancement has the potential to achieve over 400 miles of range in an electric truck, while also providing significant cost savings compared to current high-nickel options. | | |

[SBD's Quarterly Wrap-Up – Q2 2025](#) presents the newest developments in battery technology.



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