TABLE OF CONTENTS

RELATED SBD REPORTS

EV Charging & Infrastructure Guide – 217

This guide maps out the current landscape of EV charging and tracks its developments. In it, thorough insights into the key players and business models of this eco-system are provided. The strengths and weaknesses of different players are also highlighted to help plan and develop strong partnerships with them.

SUSTAINABLE

Sustainable

#224

V2G - Bi-Directional EV Energy Management Technologies

As EVs continue to grow in popularity and gain familiarity among mainstream automotive consumers, OEMs are equipping their latest models with new systems and features that extend or build on core EV capabilities. While these enhancements can already be seen in infotainment systems, bi-directional charging offers a new hardware-focused use case that is rapidly gaining momentum and becoming a new trend.

Bi-directional charging allows power from the EV battery to be distributed externally and supplied to large electrical appliances, other EVs, homes, buildings, back to the grid through utility providers, and to a broad spectrum of energy providers overall. As it becomes more widely available, bi-directional charging will spawn a new ecosystem of technologies, integrations and cross-industry partnerships that will together enhance and elevate the overall EV experience

In this report, our experts break down the various opportunities and challenges of bi-directional charging, including vehicle enablement and its integration with Home Energy Management Systems (HEMs). It also understands how bi-directional charging will support the development of virtual power plants while inspiring new collaborations between automakers, energy management providers, and key infrastructure players overall. Further insight into the potential of bi-directional charging is provided through a deep dive into EV bi-directional pilots and the latest commercial announcements.

COVERAGE

GLOBAL NA CHINA EUROPE

FREQUENCY

ANNUALLY QUARTERLY 1 ONE-OFF

PUBLICATION FORMAT

PDF POWERPOINT EXCEL ONLINE

PAGES

TBD

Request price

Key questions answered

- What are the in-market and upcoming OEM offers in the V2G and HEMs spaces?
- What bi-directional charging standards are emerging in each market which need to be considered?
- What technical issues should OEMs consider when designing V2X capability?
- How do IEEE 2030 .5, ISO 15118, and other protocols work with V2X and HEMS, and what does the future look like?

This research supports

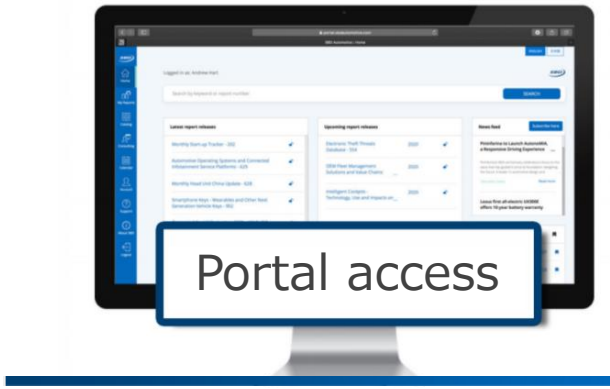
- Product Planners
- Marketing
- IT
- Engineering

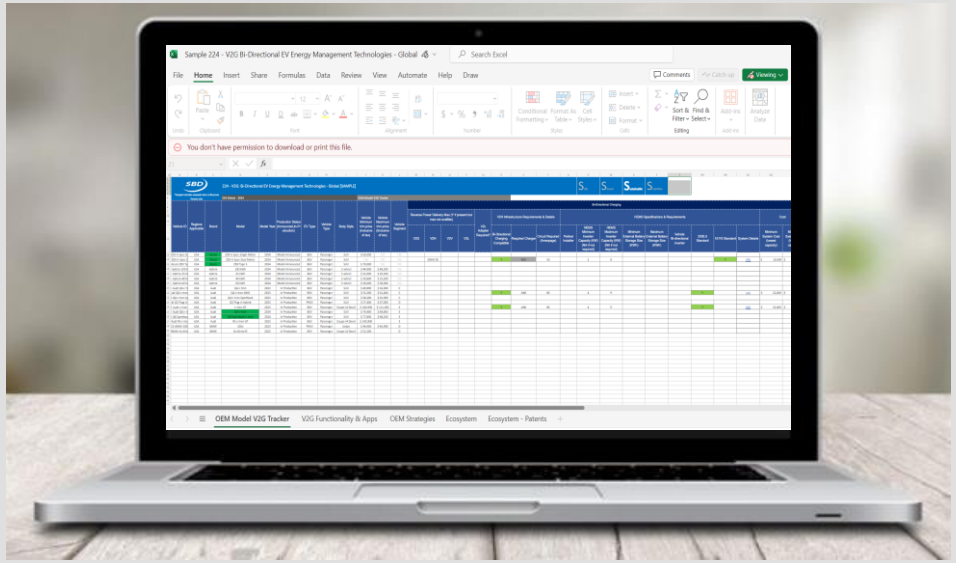
Do I have access?

100+
Reports published per year

50k+
Slides of insights, forecasts & data

4,000+
# of auto professionals who access our reports





View Excel Data Sheet Sample

V2G - Bi-Directional EV Energy Management Technologies

For an in-depth model-level tech/feature/pricing data and pre-built dashboard showing OEM competitiveness

>10,000 datapoints

35+ OEMs covered

V2G/HEMS Hardware & Software covered

Click for Sample

SBD

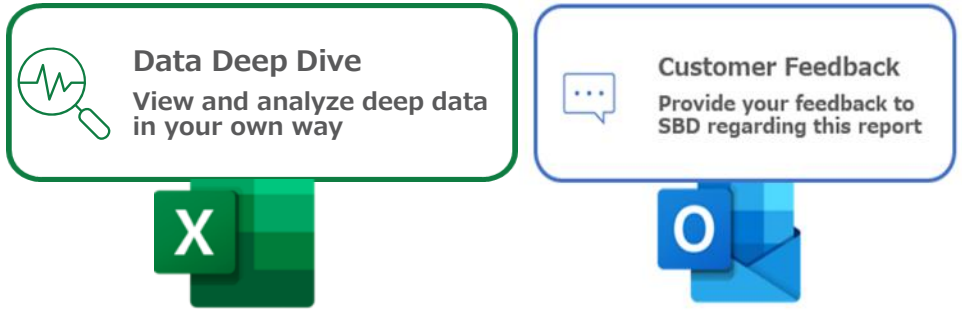
2024

224

V2G: Bi-Directional EV Energy Management Technologies

Contents Page

224 – V2G: Bi-Directional EV Energy Management Technologies



Introduction

Chapter Introduction

Electric vehicles are not only a critical user of electric power from homes, charging networks, and energy grids but are rapidly being designed to enable bi-directional power distribution back to buildings, homes, other EV vehicles, utility providers, as well as a broad spectrum of energy providers overall. This report breaks down the numerous opportunities and challenges of bi-directional charging including vehicle enablement, integration with Home Energy Management Systems (HEMs), and how bi-directional charging will enable virtual power plants and spark new collaborations with energy and infrastructure players overall. Through these considerations this report identifies the major drivers and barriers for the **six key OEM motivations for the Electric Vehicle**.

What are the key findings of this report?

- What are the in-market and upcoming OEM offers in the V2G and HEMS?
- What bi-directional charging standards are emerging in each market which need to be considered?
- What technical issues should OEMs consider when designing V2X capability?
- How do IEEE 2030.5, ISO 15118, and other protocols work with V2X and HEMS? What does the future look like?

Section	Content
Birds Eye View	An overview of the key findings from SBD's various Electric Vehicle, and adjacent reports
Executive Summary	Presents key highlights and conclusions from the report.
The Basics	What do you need to know about Bi-Directional EV Energy Management Technologies?
Analysis	Analysis of key trends identified in our research, including SBD insight on potential solutions
Summary Tables	Overview of each OEM's offerings and indicators on future activities through partnerships
Ecosystem	Offering, acquisition and patent insights for key non-OEM stakeholders
Future Outlook	Four OEM personas are considered against drivers and barriers into the future to understand when V2G benefits will be truly realized
Next Steps	Can SBD help you with any unanswered questions?

We Listened and Invested In Our V2G Report to Align to Your Goals

You Said...

"I sometimes struggle to relate conclusions from research reports to the Outcomes and KPIs that we are working towards..."

"I would like to see what has recently changed within a forecast or domain to help decide if any changes to strategy need to be made..."

"I want to know where we stand 'head-to-head' against the competition on major industry trends…."

"I can find it difficult to take actionable next steps on Guides without assessing the future direction of the industry..."

"It would be helpful to identify disruptive companies and start-ups to keep an eye for partnerships in the future..."

"I would like the topics to be more 'forward looking' to help with future planning and take advantage of enabling technologies."

We Did...

Added an **EV BIRDS-EYE VIEW** chapter with a high-level overview of all our EV reports.

Enhanced **CROSS-REFERENCING** with EV model data from our EV Guide and battery insights from our Battery Technology and Ecosystem Report.

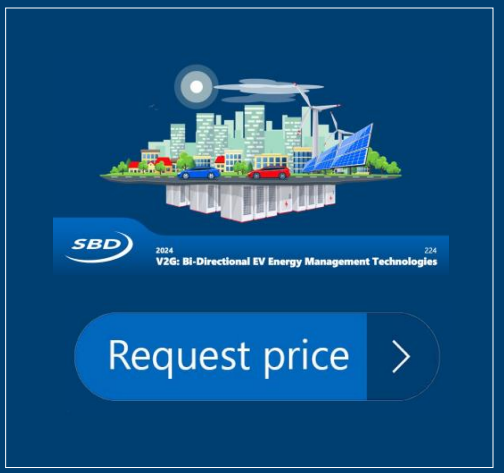
Introduced a **FUTURE OUTLOOK** chapter with motivations such as Increased EV Range, and its drivers and barriers over time.

More **DATA-DRIVEN ANALYSIS** through our Summary Table analysis, our dedicated Analysis chapter, and Executive Summary.

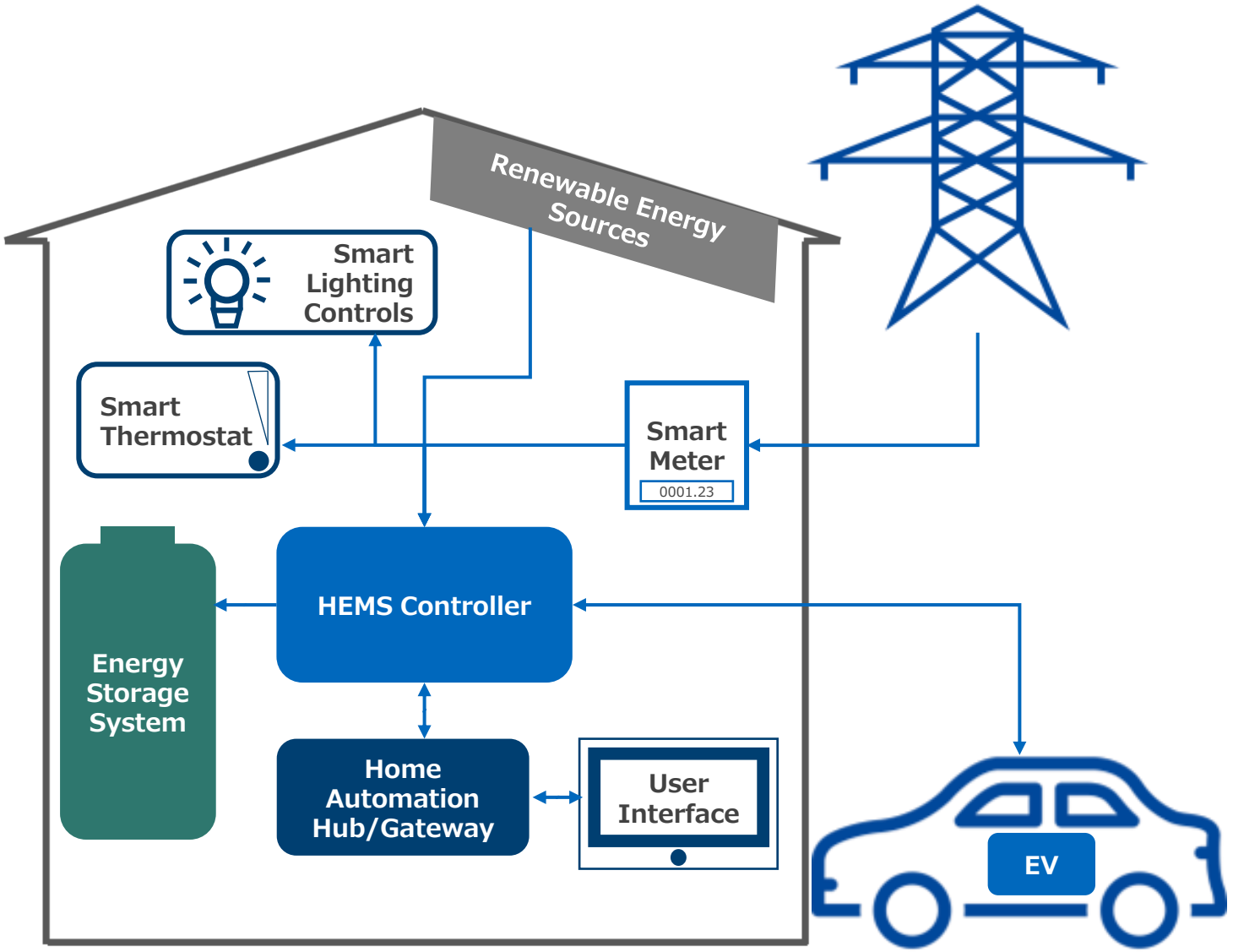
Created a **V2G OEM RANKING** and an **ECOSYSTEM** chapter with offering, acquisition and patent insights for key non-OEM stakeholders.

Pushed boundaries to add the disruptive **NEW TITLE** V2G: Bi-Directional EV Energy Management Technologies

Example slides from the report



The role of HEMS in V2X



Highlights

- The additional component of bi-directional charging with V2H is the Home Energy Management System (HEMS). The system provides an interfaces to optimize the energy consumption within a household, controlling also energy storage and maximizing cost-reduction, self-sufficiency, and minimizing emissions. This is achieved through monitoring and control of distributed energy resources (DERs) like photovoltaic (PV) panels, heating, dynamic tariffs, and EVs through bidirectional charging.
- The V2H system can contribute to cost savings through peak shaving, time-of-use (TOU) optimization, energy arbitrage, optimized self-consumption, and excess energy storage.
- While V2G is not necessary, if enabled it can make possible also a range of ancillary grid services.
- As of now one of the main factors holding back the deployment of V2G-capable HEMS in houses is its significant additional cost over a V1G system. With the average cost in the US ranging between $10,000 and $11,000, it is estimated that the difference in cost with a unidirectional HEMS can reach $8,000-9,000.
- Similar systems can also be deployed to enable V2B with price ranges that increase significantly over the ones for private use.

Grid reliability

Practical requirements

- Using a battery electric vehicle to improve grid reliability will likely be on a case-by-case basis, rather than broad coordination across towns. It requires a willingness of users to relinquish charging autonomy.
- Coordination. Large numbers of battery electric vehicles carrying out uncoordinated charging into the grid would affect power system stability.
- At a national level, connection to the energy grid requires communication, measurement and control systems to be in place.

Example of use case

- In Taiwan, Nuvve are helping to improve the reliability of micro grids.
- The project is a 95 EV hub that is capable of power management between the grid and electric vehicles.

Notable Players

NUVVE

Nuvve is a V2G aggregator. They supply charging stations and software for EV fleets.

newmotion charge smart

Newmotion chargers have cloud control compatibility which gives fast charge and discharge response times.

Assessment of use case

Region	Population affected by power outages (estimated, 2021)
USA	~ 10 million
China	~ 98 million
Taiwan	~ 11.7 million
South Africa (load shedding)	~ 3.7 million

Region	Power outage duration (average)
UK	~ 151 minutes (2023)
USA	~ 250 minutes (2016)

- Grid reliability as a use case is more likely to be applied in situations where the electricity supply from the national grid has failed. This is more likely to happen in unforeseeable circumstances, for example natural disasters.
- In some markets, outages in electricity are common and necessary for the national infrastructure. Electric vehicles could be useful for maintaining power for a house or business.
- It should be noted that countries with poor grid reliability are unlikely to have the capacity to support electric vehicles, so using electric vehicles to support the grid is unlikely to be possible.

Great Wall Motors

Overview

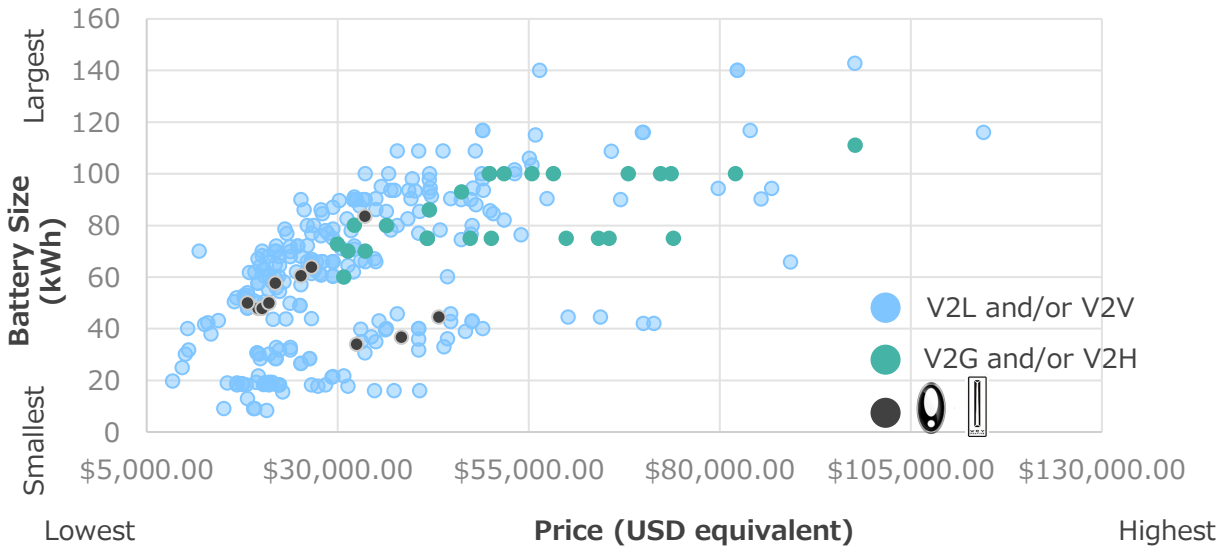
Great Wall Motors founded in 1984 in China is one of the very few brands which have really good global presence. The company has four brands under them including the two EV brands Ora and Wey. Although the company doesn't have vehicles with V2G technology in their lineup, they are researching in V2G technology.

Compatibility and connection type

Brand	Model	V2G	V2H	V2V	V2L
Ora	es11, Ballet Cat				3.3kW
Ora	Lightening Cat			Y	6kW
Wey	Mocha PHEV, Bluemountain PHEV				3.3kW

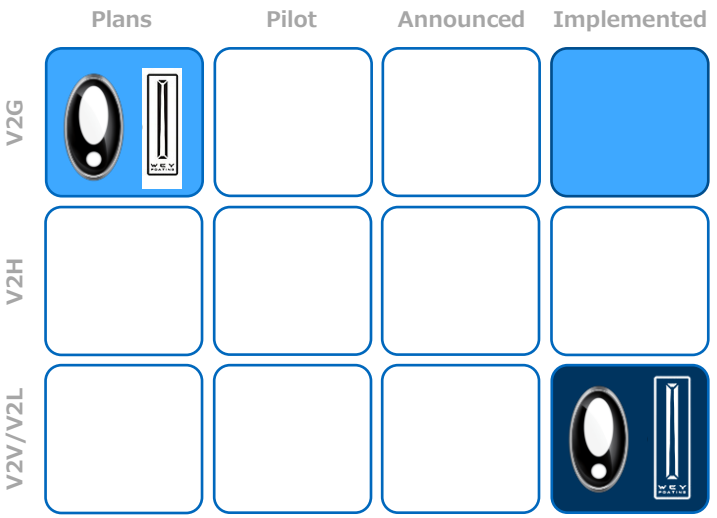
Type 1	Type 2	CHAdeMO	CCS	GB/T AC	GB/T DC	ChaoJi	NACS
				✓	✓		

Model Position



Highlights and OEM Position

- In April 2021, State Grid Corporation of China and Great Wall Motors installed 50 units of 15kW direct current V2G charging stations at Baoding Great Wall Automobile Industrial Park to demonstrate V2G capability.
- This puts them close to the forefront in the competition of bi-directional charging capability among OEMs in China.



Ford Europe & USA

Overview

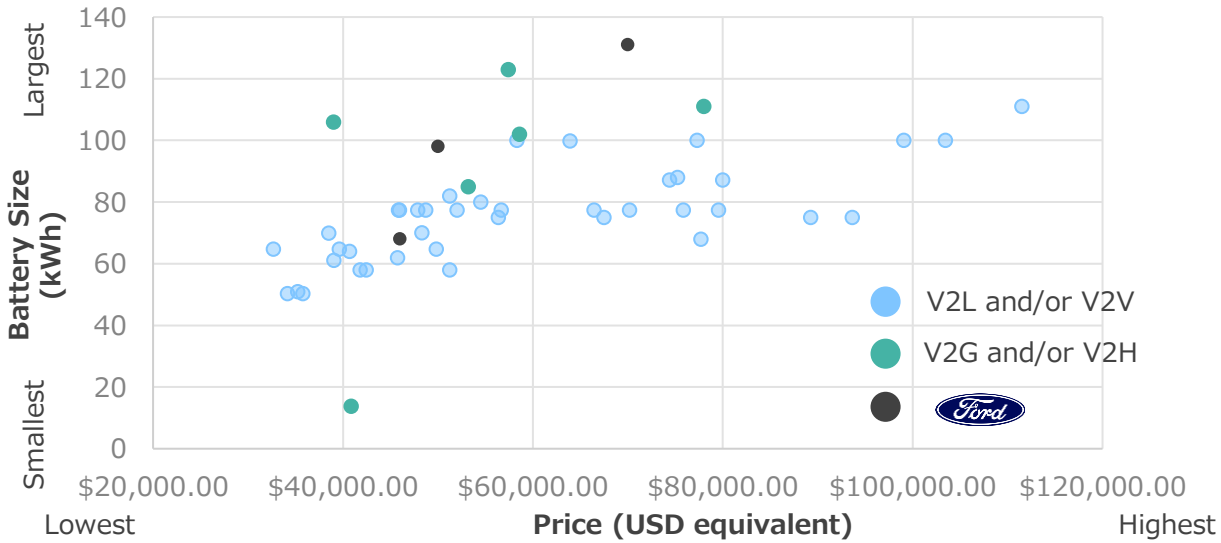
Ford is actively working on V2G technology by forming partnership companies and conducting pilot projects. Ford was one of the first brands to bring V2H technology to consumers in the US. This means that some of their vehicles are already bi-directional charging capable which gives them an advantage to implement V2G technology.

Compatibility and connection type

Brand	Model	V2G	V2H	V2V	V2L	Region
Ford	E-Transit				Y	Europe
Ford	Tourneo Custom				2.3kW	Europe
Ford	E-Transit				2.3kW	USA
Ford	F-150 Lightning	Y	9.6kW		9.6kW	USA

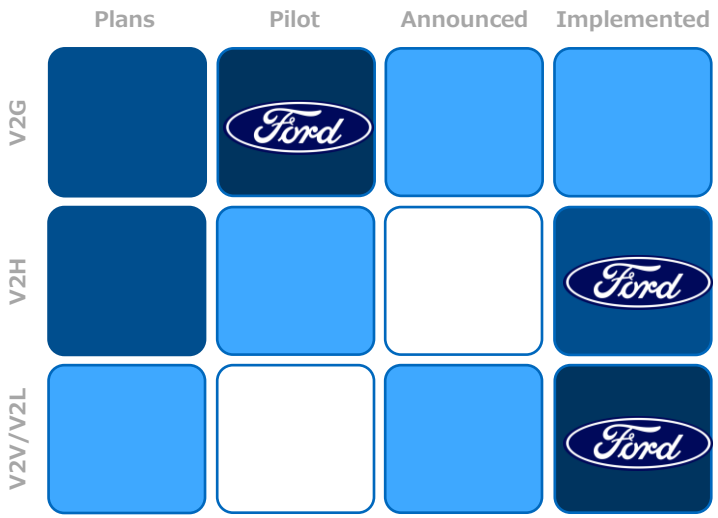
Type 1	Type 2	CHAdeMO	CCS	GB/T AC	GB/T DC	ChaoJi	NACS
✓			✓				

Model Position



Highlights and OEM Position

- It appears that V2G and all other bi-directional charging capabilities are important factors for their future electrification strategy.
- Ford hasn't made any official announcements when they will bring V2G to their customers. Some of their vehicles already have bi-directional capability and Ford is now focusing on factors required for V2G outside the vehicle.



V1G and V2G diffusion can favor EV demand

Gen 4.0 Benefit 1 — EV Demand Increase

Provide a more compelling financial offering for EV customers

	2024	2025	2026	2027	2028
Established Premium Medium Volumes High Margins High Legacy	Use brand status to educate and engage with the public Market fragmentation			Establishing partnerships and collaborating in common projects to establish standardization	Maintain leadership role, and expand the offering with subscription services and a strong ecosystem
Disrupter Through start-up or resetting for BEV have leapt straight to Vehicle 3.0 but some struggle to deliver the full value	Take advantage of the extensive expertise and/or established partnerships bringing in partners willing to invest in V2G development while demand is still relatively limited		Focus on more promising use cases for V2G adoption and		Bring well-defined value propositions to V2X applications and drive more customers focusing initially on commercial and fleet solutions and services
High Volume High Volumes Low Margins High Legacy	Focus on V1G limit battery degradation or optimize it through scheduling and public education		Gradually introduce affordable V2g solutions		Deliver a strong value proposition for energy arbitrage and time shifting for price-sensitive clients
Chinese New Entrant High Volumes Medium Margins High Legacy	Resources and reduced partnership potential compared to more established companies	Leverage a more dynamic environment to focus on the most promising use cases more ease in new software releases thanks to different organization			Improved visibility over established competitors bringing further distinction and making the brand more unique

Outcome | Barriers | Solutions

Explore our V2G data in our accompanying Data Deep Dive

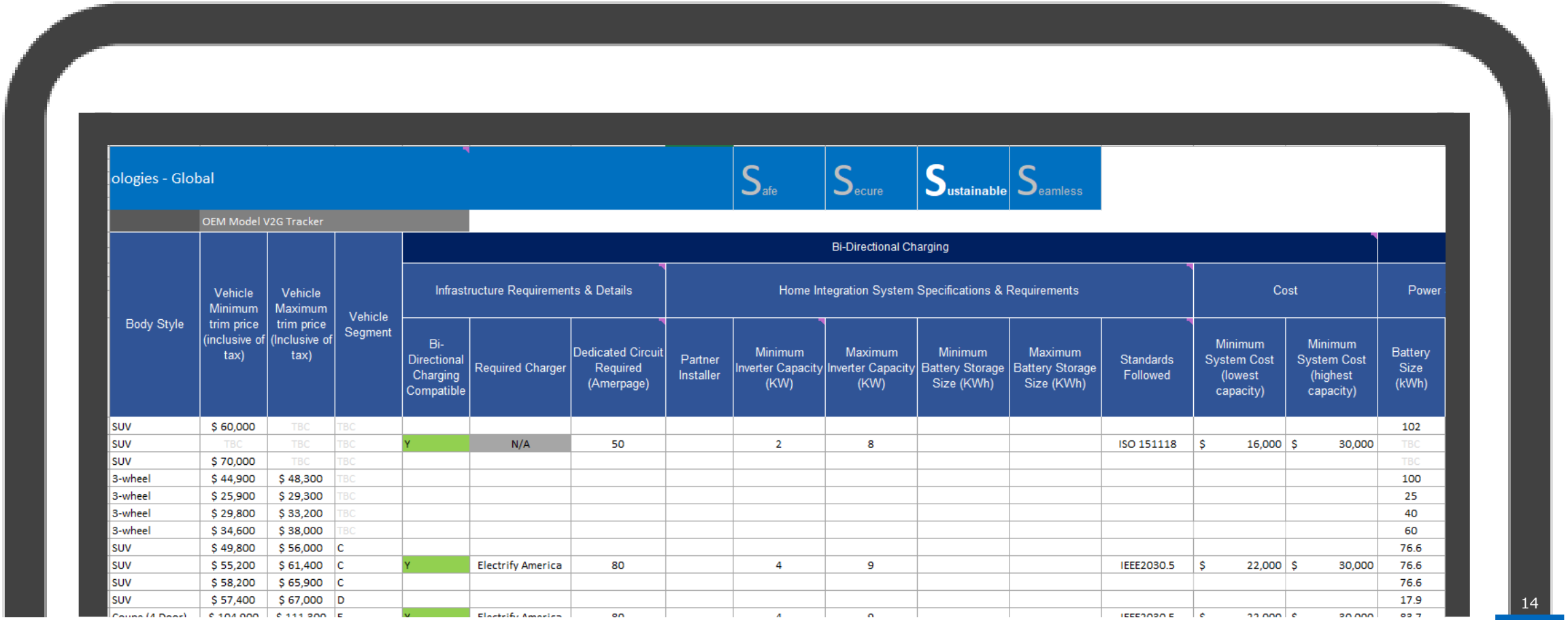
This guide gives an overview of the key activities being carried out by OEM groups and their partnerships

It is accompanied by an associated database with a more exhaustive data set.

Click for Sample

How can the accompanying spreadsheet help you go deeper?

- View OEM by OEM offerings
- Identify announced partnerships

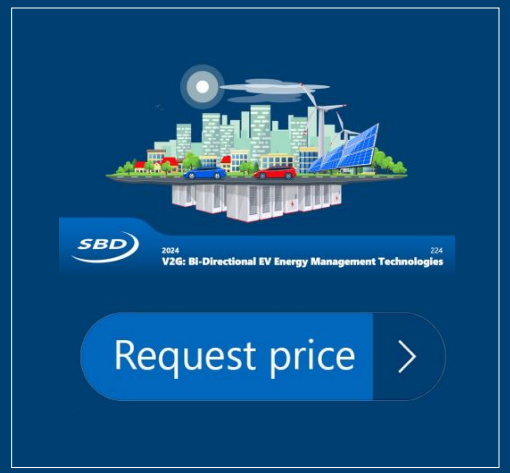


ologies - Global | Safe | Secure | Sustainable | Seamless

OEM Model V2G Tracker

Body Style	Vehicle Minimum trim price (inclusive of tax)	Vehicle Maximum trim price (Inclusive of tax)	Vehicle Segment	Bi-Directional Charging											
				Infrastructure Requirements & Details			Home Integration System Specifications & Requirements						Cost		Power
				Bi-Directional Charging Compatible	Required Charger	Dedicated Circuit Required (Amerpage)	Partner Installer	Minimum Inverter Capacity (KW)	Maximum Inverter Capacity (KW)	Minimum Battery Storage Size (KWh)	Maximum Battery Storage Size (KWh)	Standards Followed	Minimum System Cost (lowest capacity)	Minimum System Cost (highest capacity)	Battery Size (kWh)
SUV	$ 60,000	TBC	TBC												102
SUV	TBC	TBC	TBC	Y	N/A	50		2	8			ISO 151118	$ 16,000	$ 30,000	TBC
SUV	$ 70,000	TBC	TBC												TBC
3-wheel	$ 44,900	$ 48,300	TBC												100
3-wheel	$ 25,900	$ 29,300	TBC												25
3-wheel	$ 29,800	$ 33,200	TBC												40
3-wheel	$ 34,600	$ 38,000	TBC												60
SUV	$ 49,800	$ 56,000	C												76.6
SUV	$ 55,200	$ 61,400	C	Y	Electrify America	80		4	9			IEEE2030.5	$ 22,000	$ 30,000	76.6
SUV	$ 58,200	$ 65,900	C												76.6
SUV	$ 57,400	$ 67,000	D												17.9
Coupe (4 Door)	$ 104,900	$ 111,300	E	Y	Electrify America	80		4	9			IEEE2030.5	$ 22,000	$ 30,000	88.7

Request the price



Contact SBD Automotive

Do you have any questions?

If you have any questions or feedback about this research report or SBD Automotive's consulting services, you can email us at info@sbdautomotive.com or discuss with your local account manager below.

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