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Vehicle-to-Grid Market Report by Solution Type (Electric Vehicle Supply Equipment (EVSE), Smart Meters, Home Energy Management (HEM) Systems, Software Solutions), Vehicle Type (Battery Electric Vehicle (BEV), Fuel Cell Electric Vehicle (FCEV), Plug-In Hybrid Electric Vehicle (PHEV)), Charging Type (Unidirectional Charging, Bidirectional Charging), Application (Peak Power Sales, Spinning Reserves, Base Load Power, and Others), and Region 2024-2032

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Abstracts

The global vehicle-to-grid market size reached US$ 3.4 Billion in 2023. Looking forward, IMARC Group expects the market to reach US$ 54.3 Billion by 2032, exhibiting a growth rate (CAGR) of 34.8% during 2024-2032. The market is being propelled by the increasing production and sales of electric vehicles (EVs), the rising demand for renewable energy integration, the introduction of advanced bi-directional charging infrastructure enabling bidirectional power flow, significant improvements in smart grid technology, government incentives for sustainable energy solutions.

Vehicle-to-Grid Market Analysis:

Major Market Drivers: The market is driven by the widespread adoption of EVs, necessitating efficient energy management systems. Moreover, government incentives and regulatory support promoting renewable energy and grid stability is acting as another growth-inducing factor. Technological innovations in smart grid infrastructure and energy storage solutions have enhanced V2G capabilities, further boosting the market growth. Besides this, the emerging need

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for sustainable and cost-efficient energy solutions is favoring the integration of V2G systems into existing power grids.

Key Market Trends: Some of the key trends in the V2G market involve the advent of advanced V2G technology that offer enhanced energy efficiency and grid stability. Moreover, the increasing partnerships between automakers, utility companies, and technology providers is facilitating large-scale V2G implementations. In addition, the incorporation of AI and ML in V2G systems has helped organizations optimize energy flow and usage, thereby favoring the market growth. Increasing investments in renewable energy sources and the push for smart city initiatives are also significant trends, driving the adoption of V2G solutions to balance energy supply and demand.

Geographical Trends: North America leads the V2G market due to its robust infrastructure for electric vehicles and advanced smart grid technologies. The region's strong regulatory support and substantial investments in renewable energy projects contribute to the market's growth. Furthermore, North America is home to major technology and automotive companies pioneering V2G innovations. The presence of large-scale pilot projects and collaborations between government, utilities, and private sectors also accelerate V2G adoption, ensuring the region's market leadership.

Competitive Landscape: Some of the major market players in the vehicle-to-grid industry include AC Propulsion Inc., Coritech Services Inc., DENSO Corporation, Enerdel Inc., ENGIE Group, EV Grid, Hitachi Ltd., Nissan Motor Company Ltd., NRG Energy Inc., and OVO Energy Ltd., among many others.

Challenges and Opportunities: Significant opportunities in the market include the potential for energy cost savings, enhanced grid stability, and the integration of renewable energy sources. The growing popularity of electric vehicles and advancements in energy storage technologies present significant growth prospects. However, challenges such as high initial costs, regulatory hurdles, and the need for extensive infrastructure development can impede market growth. Addressing cybersecurity concerns and ensuring seamless interoperability between different systems are also critical to the widespread adoption of V2G technology.

Vehicle-to-Grid Market Trends:

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Increasing Production and Sales of Electric Vehicles (EVs)

The surge in electric vehicle (EV) production and sales is significantly boosting the V2G market, driving remarkable growth and advancing the global shift towards cleaner and more sustainable energy solutions. According to Livemint, global electric vehicle (EV) sales have increased by approximately 30% annually over the past decade. Notably, 13 countries have surpassed 10% of new light-vehicle sales being electric. The International Energy Agency further reports that in 2023, electric car sales were 3.5 million higher than in 2022, marking a 35% year-on-year growth. Nearly 14 million new electric cars were registered worldwide in 2023, with battery electric cars comprising 70% of the electric car stock for that year. Growing consumer awareness and acceptance of EVs are also fostering a parallel trend for V2G systems. As consumers become more accustomed to EVs and their advantages, the V2G concept is gaining traction. Vehicle owners are increasingly comfortable with the idea of their car batteries serving dual purposes—both for driving and energy storage/transfer. This shift in consumer behavior and perception is driving the expansion of the V2G market.

Supportive Government Initiatives and Policies

Supportive government initiatives and policies drive the vehicle-to-grid industry by providing significant financial incentives, tax credits, and funding for infrastructure development. These measures lower the cost barriers for consumers and businesses, encouraging the adoption of V2G technology. Governments also set regulations and standards that promote renewable energy integration and grid stability, creating a favorable environment for V2G systems. Additionally, public investments in research and development help advance V2G technologies, making them more efficient and accessible, thereby accelerating market growth. For instance, in 2024, China’s National Development and Reform Commission (NDRC) issued an order to establish initial technical standards for integrating new energy vehicles into the grid by 2025. The report anticipates that new energy vehicles will form a significant part of the country’s new storage infrastructure by 2030. Additionally, the NDRC plans to launch over 50 pilot programs in regions with favorable conditions for vehicle-to-grid integration, including the Yangtze River Delta, the Pearl River Delta, Beijing, Sichuan, and Chongqing.

Adoption of Smart Grids

The widespread adoption of smart grids is significantly transforming and positively impacting the vehicle-to-grid (V2G) market. Smart grids excel in intelligently managing

energy supply and demand, thereby enhancing grid stability, reliability, and efficiency. V2G systems leverage this strength by serving as flexible energy resources. When connected to the smart grid, electric vehicles (EVs) can store surplus energy during low-demand periods and feed this energy back into the grid during peak demand times. This load-balancing capability significantly optimizes power distribution and helps prevent blackouts and power quality issues. Additionally, the widespread adoption of smart grids promotes the use of renewable energy sources, which is crucial for the success of V2G technology. According to the International Energy Agency (IEA), in 2022, investment in electricity grids increased by about 8%, driven by both advanced and emerging economies to support electrification and integrate renewable energy. The European Union plans to invest EUR 584 billion (USD 633 billion) by 2030, including EUR 400 billion for distribution grids. China announced USD 77 billion for 2023 and USD 329 billion over its 14th Five-Year Plan, totaling USD 442 billion. Japan introduced a YEN 20 trillion (USD 155 billion) fund for new grid technologies. India launched a USD 36.8 billion scheme for smart meters. The US DOE proposed a USD 10.5 billion program for grid upgrades. The World Bank promoted private investment in distributed renewable energy for Africa.

Vehicle-to-Grid Market Segmentation:

IMARC Group provides an analysis of the key trends in each segment of the market, along with forecasts at the global, regional, and country levels for 2024-2032. Our report has categorized the market based on solution type, vehicle type, charging type, and application.

Breakup by Solution Type:

Electric Vehicle Supply Equipment (EVSE)

Smart Meters

Home Energy Management (HEM) Systems

Software Solutions

Electric vehicle supply equipment (EVSE) dominates the market

The report has provided a detailed breakup and analysis of the market based on the

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solution type. This includes electric vehicle supply equipment (EVSE), smart meters, home energy management (HEM) systems, and software solutions. According to the report, electric vehicle supply equipment (EVSE) represented the largest segment.

Electric vehicle supply equipment (EVSE) is leading the vehicle-to-grid market size due to its essential role in facilitating bidirectional energy flow between EVs and the grid. EVSE provides the necessary infrastructure for efficient and safe charging and discharging of EV batteries. With advancements in smart grid technology and increased adoption of renewable energy sources, EVSE systems are crucial for optimizing energy distribution and enhancing grid stability. This capability makes EVSE a vital component in the integration of V2G solutions, promoting sustainable energy practices and grid reliability

Breakup by Vehicle Type:

Battery Electric Vehicle (BEV)

Fuel Cell Electric Vehicle (FCEV)

Plug-In Hybrid Electric Vehicle (PHEV)

Battery electric vehicle (BEV) hold the largest share in the market

A detailed breakup and analysis of the market based on the vehicle type have also been provided in the report. This includes battery electric vehicle (BEV), fuel cell electric vehicle (FCEV), and plug-in hybrid electric vehicle (PHEV). According to the report, battery electric vehicle (BEV) accounted for the largest market share.

Battery electric vehicles (BEVs) hold the largest share in the vehicle-to-grid market analysis due to their large battery capacities, which provide significant energy storage potential. This allows BEVs to effectively store and discharge energy back to the grid, balancing supply and demand. Additionally, the increasing adoption of BEVs, driven by advancements in battery technology, government incentives, and growing environmental concerns, enhances their dominance in the V2G market. Their ability to support grid stability and integrate renewable energy sources further bolsters their market share. According to the IEA's annual outlook report, it is projected that by 2035, battery-electric and plug-in hybrid vehicles (BEVs/PHEVs) will comprise up to two-thirds of global automobile sales. This year, sales of these vehicles have surged by over 20%,

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reaching 17 million from just under 14 million in 2023. The analysis predicts that by 2030, nearly one in three cars on Chinese roads and almost one in five in the US and EU will be electric, based on current policy settings. Moreover, as per an article published on Electric Autonomy in May 2024, in Canada, 130,000 battery electric vehicles (BEVs) were sold in 2023, marking a 35 per cent increase over 2022 sales.

Breakup by Charging Type:

Unidirectional Charging

Bidirectional Charging

Bidirectional charging holds the biggest share of the market

A detailed breakup and analysis of the market based on the charging type have also been provided in the report. This includes unidirectional charging and bidirectional charging. According to the report, bidirectional charging accounted for the largest market share.

Bidirectional charging holds the largest vehicle-to-grid market share because it enables electric vehicles (EVs) to both draw power from and supply power to the grid. This capability allows EVs to act as mobile energy storage units, providing flexibility in energy management and enhancing grid stability. It supports the integration of renewable energy sources by storing excess energy during low demand and releasing it during peak periods. Additionally, bidirectional charging can help reduce electricity costs for consumers and generate revenue, further driving its adoption. For instance, in June 2023, Renault announced its plans to introduce bidirectional charging with the all-electric Renault 5, set to be the first Renault vehicle equipped with this technology. The V2G service will launch with the Renault 5 in France and Germany in 2024, followed by the UK in 2025. This initiative is coordinated through Renault's mobility brand, Mobilize.

Breakup by Application:

Peak Power Sales

Spinning Reserves

Base Load Power

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Others

Peak power sales hold the maximum share in the market

A detailed breakup and analysis of the market based on the application have also been provided in the report. This includes peak power sales, spinning reserves, base load power, and others. According to the report, peak power sales accounted for the largest market share.

Peak power sales hold the maximum share in the vehicle-to-grid market because they provide a lucrative revenue stream for EV owners and utility companies. During peak demand periods, the grid requires additional power, and EVs can supply this energy stored in their batteries, earning owners' compensation for their contribution. This practice enhances grid stability and efficiency, reduces reliance on traditional power plants, and supports the integration of renewable energy sources. The economic incentives and grid benefits make peak power sales a dominant factor in the V2G market. For instance, in February 2024, Nissan Motor Co., Ltd. announced the launch of the Nissan Energy Share service in Japan to enhance the value of electric vehicles (EVs). This service uses advanced energy management technology to control EV battery charging and discharging, targeting companies and municipal governments. It offers load shifting through smart charging, peak shaving by managing discharge during high demand, efficient use of renewable energy by integrating with solar panels, and coordinating charging schedule by employing bidirectional charging technology, aiding businesses in achieving renewable energy goals.

Breakup by Region:

North America

United States

Canada

Asia-Pacific

China

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Japan

India

South Korea

Australia

Indonesia

Others

Europe

Germany

France

United Kingdom

Italy

Spain

Russia

Others

Latin America

Brazil

Mexico

Others

Middle East and Africa

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North America exhibits a clear dominance, accounting for the largest vehicle-to-grid market share

The report has also provided a comprehensive analysis of all the major regional markets, which include North America (the United States and Canada); Asia Pacific (China, Japan, India, South Korea, Australia, Indonesia, and others); Europe (Germany, France, the United Kingdom, Italy, Spain, Russia, and others); Latin America (Brazil, Mexico, and others); and the Middle East and Africa. According to the report, North America represented the largest market.

North America dominates the market due to several factors. The region's strong focus on reducing greenhouse gas emissions and combating climate change drives significant investments in V2G technology. The increasing adoption of electric vehicles (EVs) contributes to this trend, as EVs reduce reliance on fossil fuels and lower harmful vehicular emissions. Government initiatives, including incentives, tax credits, and policies promoting EVs and clean energy, further propel market growth. Additionally, advancements in smart grid infrastructure enhance the integration and efficiency of V2G systems, supporting the market's expansion. These factors collectively position North America as a leader in the V2G market, fostering sustainable energy practices and technological innovation.

For instance, in September 2023, BMW Group, Ford Motor Company (F), and American Honda Motor Company (HMC) collaborated to establish ChargeScape, a new entity designed to bridge the gap between utilities, automakers, and electric vehicle (EV) owners. Leveraging extensive cross-industry research on the Open Vehicle-Grid Integration Platform (OVGIP), ChargeScape aims to create a unified, cost-effective platform to maximize the potential of EV technology through managed energy services. The initiative also seeks to offer financial benefits to EV owners via grid services, including reduced electricity costs during low-demand periods and the ability to participate in vehicle-to-grid energy sharing.

Competitive Landscape:

> The market research report has also provided a comprehensive analysis of the competitive landscape in the market. Detailed profiles of all major companies have also been provided. Some of the major market players in the vehicle-to-grid industry include AC Propulsion Inc., Coritech Services Inc., DENSO Corporation, Enerdel Inc., ENGIE Group, EV Grid, Hitachi Ltd., Nissan Motor Company Ltd., NRG Energy Inc., and OVO Energy Ltd.

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(Please note that this is only a partial list of the key players, and the complete list is provided in the report.)

Leading companies in the vehicle-to-grid (V2G) market are heavily investing in research and development to enhance the efficiency, scalability, and performance of V2G systems. They focus on improving bidirectional charging technology, optimizing battery management systems, and developing advanced communication protocols to ensure seamless integration with smart grids. Additionally, top firms are collaborating with electric vehicle (EV) manufacturers, utilities, and other stakeholders to build a robust V2G ecosystem. These companies are also expanding the deployment of V2G-enabled charging stations at strategic locations to support a larger number of EVs and facilitate broader participation in V2G programs. Integrating V2G systems with renewable energy sources like solar and wind power is a key focus, enhancing the sustainability of these systems. Furthermore, they are actively educating consumers on the benefits of V2G technology and its critical role in promoting a cleaner and more sustainable energy system.

For instance, in June 2024, Toyota Motor North America and local energy utility Pepco are collaborating on vehicle-to-grid (V2G) research in Maryland, utilizing the Toyota bZ4X battery electric vehicle (BEV). This initiative aims to explore bidirectional power flow technology, enabling BEV owners to not only charge their vehicles but also send power back to the local grid. The V2G technology promises enhanced energy reliability, integration of renewables, and potential reductions in electricity costs. Additionally, the collaboration seeks to understand EV owners' charging habits and vehicle usage to facilitate the widespread adoption of V2G technology.

Vehicle-to-Grid Market News:

In March 2023, OVO Energy Ltd. announced the launch of 'Charge Anytime,' a smart charging electric vehicle plan that can charge EVs automatically during off-peak energy usage periods.

In June 2023, ENGIE Group announced the launch of its new brand named ENGIE Vianeo, which aims to develop 12,000 electric charge points in France

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for cars and heavy goods vehicles by 2025.

In May 2023, DENSO Corporation announced its collaboration with United Semiconductor Japan CO., Ltd (USJC) to produce insulated gate bipolar transistors (IGBT) for expanding the electric vehicle market.

Key Questions Answered in This Report

1. What was the size of the global vehicle-to-grid market in 2023?

2. What is the expected growth rate of the global vehicle-to-grid market during 2024-2032?

3. What has been the impact of COVID-19 on the global vehicle-to-grid market?

4. What are the key factors driving the global vehicle-to-grid market?

5. What is the breakup of the global vehicle-to-grid market based on the solution type?

6. What is the breakup of the global vehicle-to-grid market based on the vehicle type?

7. What is the breakup of the global vehicle-to-grid market based on charging type?

8. What is the breakup of the global vehicle-to-grid market based on the application?

9. What are the key regions in the global vehicle-to-grid market?

10. Who are the key players/companies in the global vehicle-to-grid market?

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