STATE OF THE ELECTRIC VEHICLE MARKET

COMMERCIAL OPPORTUNITIES, CHALLENGES, AND RECOMMENDATIONS

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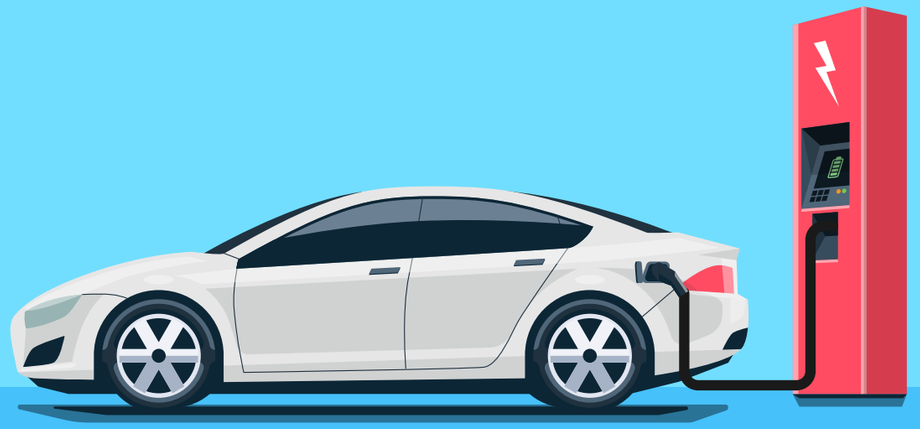
ELECTRIC VEHICLES ON THE RISE

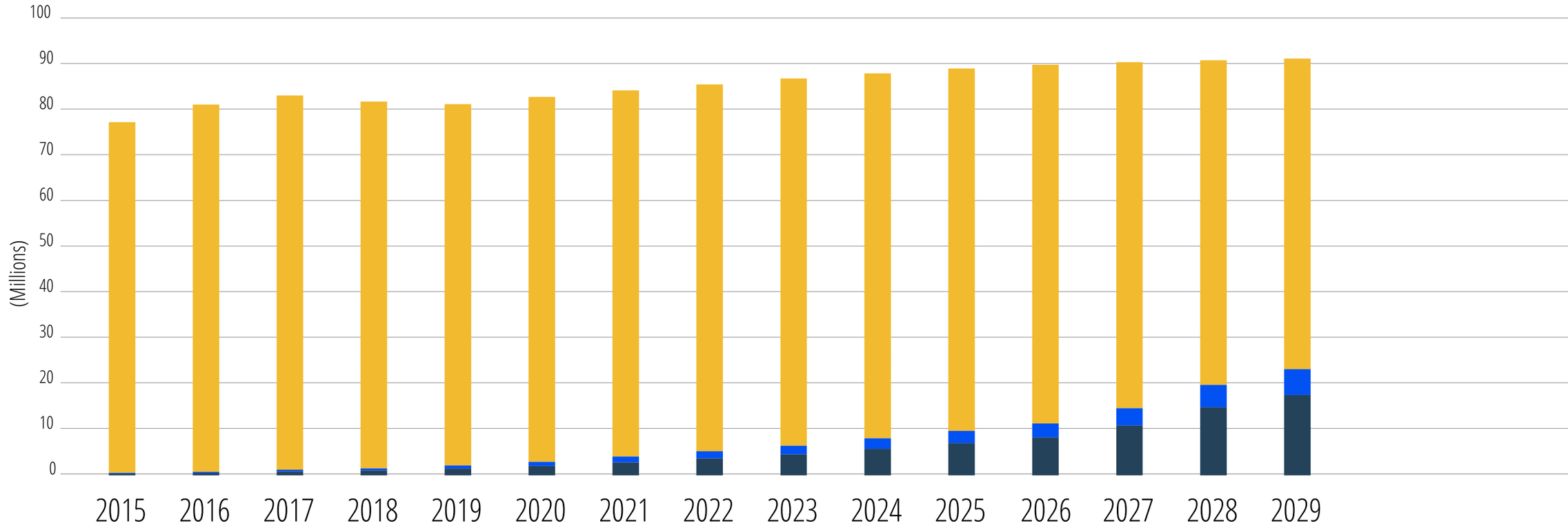
After decades as a high-cost, low-volume rounding error of global vehicle sales, electric powertrains are now in the ascendancy. Traditional Internal Combustion Engine (ICE) powertrains, diesels in particular, are no longer able to keep pace with the stringent roadmap for emissions requirements being laid down by governments around the world, so the penetration of Battery Electric Vehicle (BEV) sales is expected to grow from 1.3% in 2018 to 16.4% by 2029.

Simultaneously, automakers are seeking to alleviate consumer fears around Electric Vehicle (EV) range by rapidly increasing battery capacity, using new battery technologies, such as silicon-dominant anodes and solid-state designs, to increase cell-level energy density from 250 Watt-Hours per Kilogram (Wh/kg) to more than 500 Wh/kg within the next 10 years.



Electric Vehicle Sales by Type

World Markets, Forecast: 2015 to 2029



(Source: ABI Research)

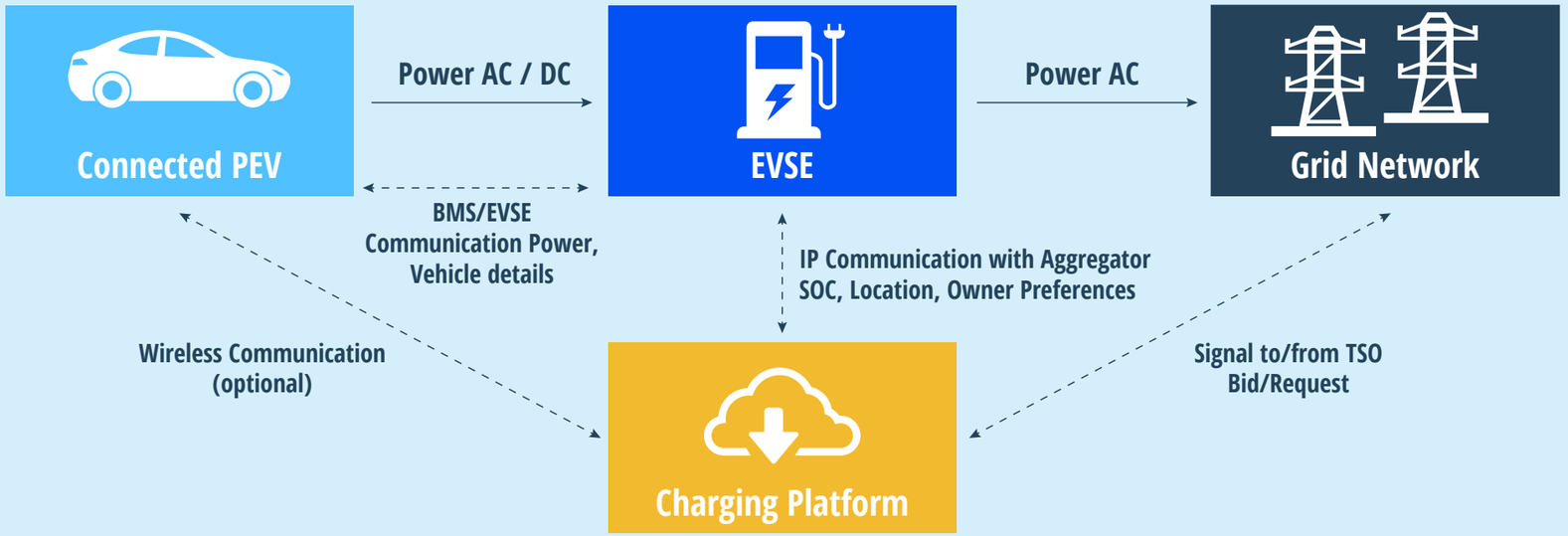
US$20 Billion
In Energy Sales by 2028

A CHALLENGE TO THE ENERGY INDUSTRY

The expected growth in EVs and the energy density of their batteries represents a considerable challenge to the energy industry, with energy demand for electric passenger vehicles expected to grow from 1,121 Gigawatt Hours (GWh) in 2018 to 19,141 gWH in 10 years. While this represents a potential of almost US$20 billion in energy sales by 2028, it also places extraordinary demands on national energy grids, with Transmission System Operators (TSOs) struggling to accommodate the on-boarding of BEVs due to the limitations in infrastructure at the last mile, particularly with line constraints, transformer limitations, and the syncing of renewable energy supply with usage.

A SMART OPPORTUNITY FOR TRANSMISSION SYSTEM OPERATORS

These factors have opened up a market opportunity for smart energy management companies to support TSOs in the onboarding of EVs, incentivizing consumers via rewards and revenue sharing to encourage charging during off-peak hours. Potential benefits include helping TSOs to strategically improve last-mile infrastructure without impeding EV adoption and helping energy retailers to better predict energy demand in order to avoid demand charges.



Beyond the core smart charging opportunity, numerous use cases can be exploited via bidirectional energy flow between the EV and the grid, commonly referred to as Vehicle-to-Grid (V2G). As well as receiving energy from the grid, vehicles can act as generators, providing energy back to the grid in order to fulfil a number of use cases. One such opportunity is energy arbitrage, in which energy is purchased and stored in the vehicle when demand is low, before being sold back to the grid when demand is higher.

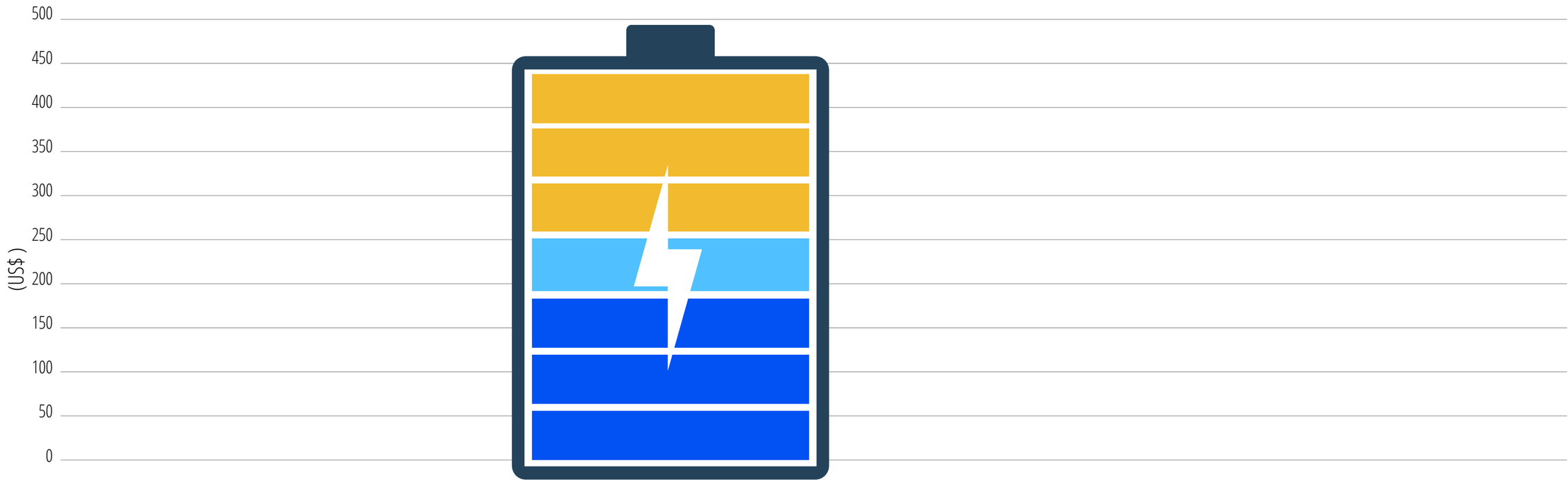
Beyond the core arbitrage opportunities, the growing fleet of EVs could deliver ancillary services, such as frequency control, in which energy stored in EVs can be used in bilateral trading models to ensure that the frequency of power produced is within the safe operating limits of the grid network frequency. A trial in Denmark carried out by Nuvve found that a Nissan e-NV200 electric van could generate US$2,086 per year through frequency control.

Overall, ABI Research expects that even conservative adoption of smart charging and V2G services could see energy suppliers more than double their total revenue beyond the core energy sales opportunity.

An ABI Research economic feasibility analysis found that a typical consumer could save up to US$272 on their annual energy bills by engaging in V2G arbitrage (assuming 10,000 miles driven per year, 90% charging efficiency, and a 75 Kilowatt Hour (kWh) battery).

Total Value to Energy Suppliers per Vehicle per Year

Typical Scenario: 2019



(Source: ABI Research)

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