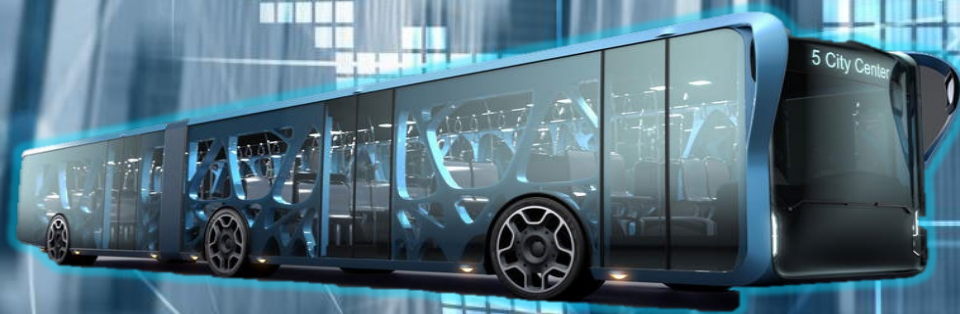


Frost & Sullivan's E-Bus Market Capability Document

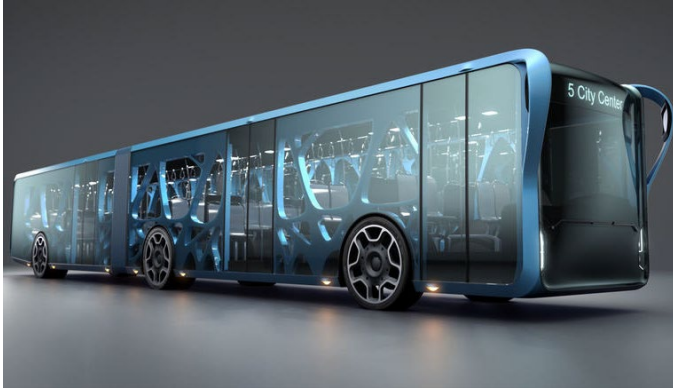
Thought leadership across e-bus ecosystem integrated through an end-to-end value proposition of consulting services.



*The Growth Pipeline™ Company
Powering clients to a future shaped by growth*

GLOBAL BUS MARKET – TRENDS OVERVIEW

Increasing ridership through seamless flexibility in switching between intermodal transport models, improving passenger connectivity, comfort & convenient features, and reducing emissions are key focus.



Passenger comfort & convenience

Urbanization

Global harmonization of regulations

Intermodal flexibility

Connectivity & telematics

New business models

Driver and passenger safety

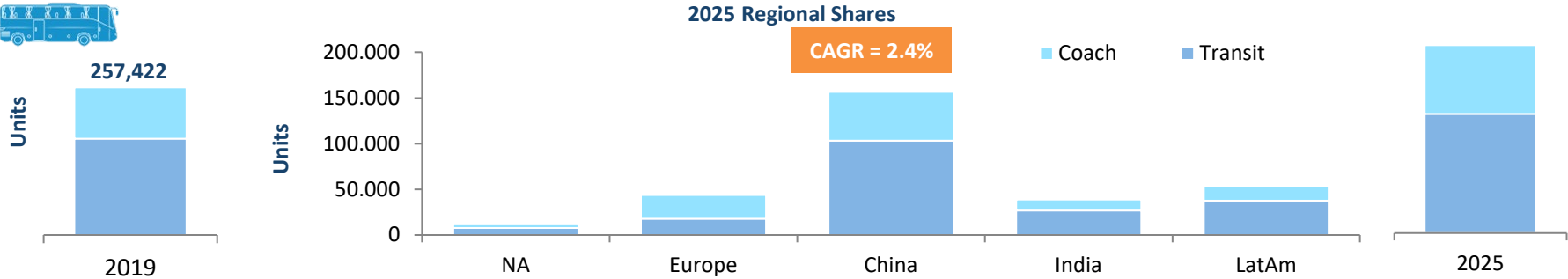
Autonomous driving

Electrification & advanced powertrains

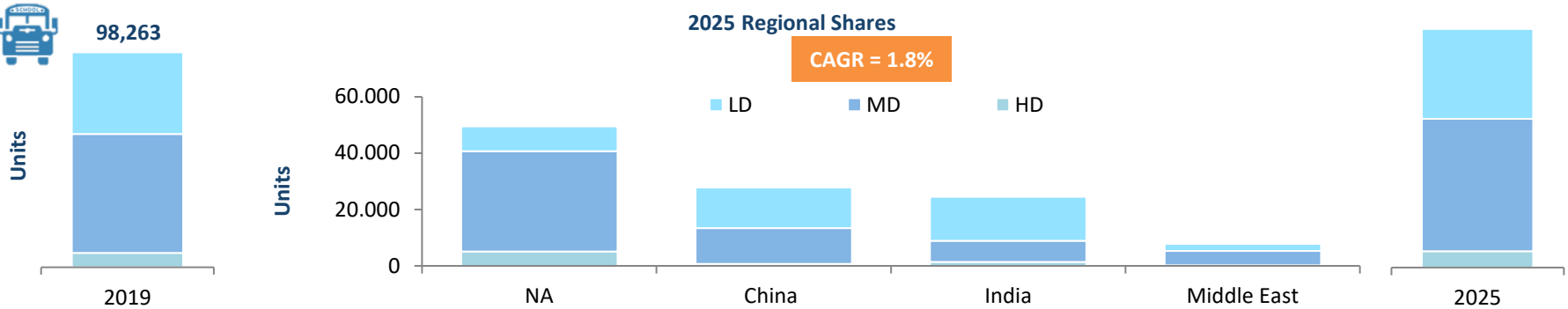
GLOBAL BUS MARKET FORECAST — TRANSIT, COACH AND SCHOOL BUS

Rapid urbanization, preference for safe transport model to aid school bus growth.
Transit bus segment emerge as early adopters of alternate powertrain including natural gas, battery electric and fuel cell with subsidies from government.

Global Bus Market Outlook: Transit Bus and Coach Unit Shipment, Global, 2019-2025



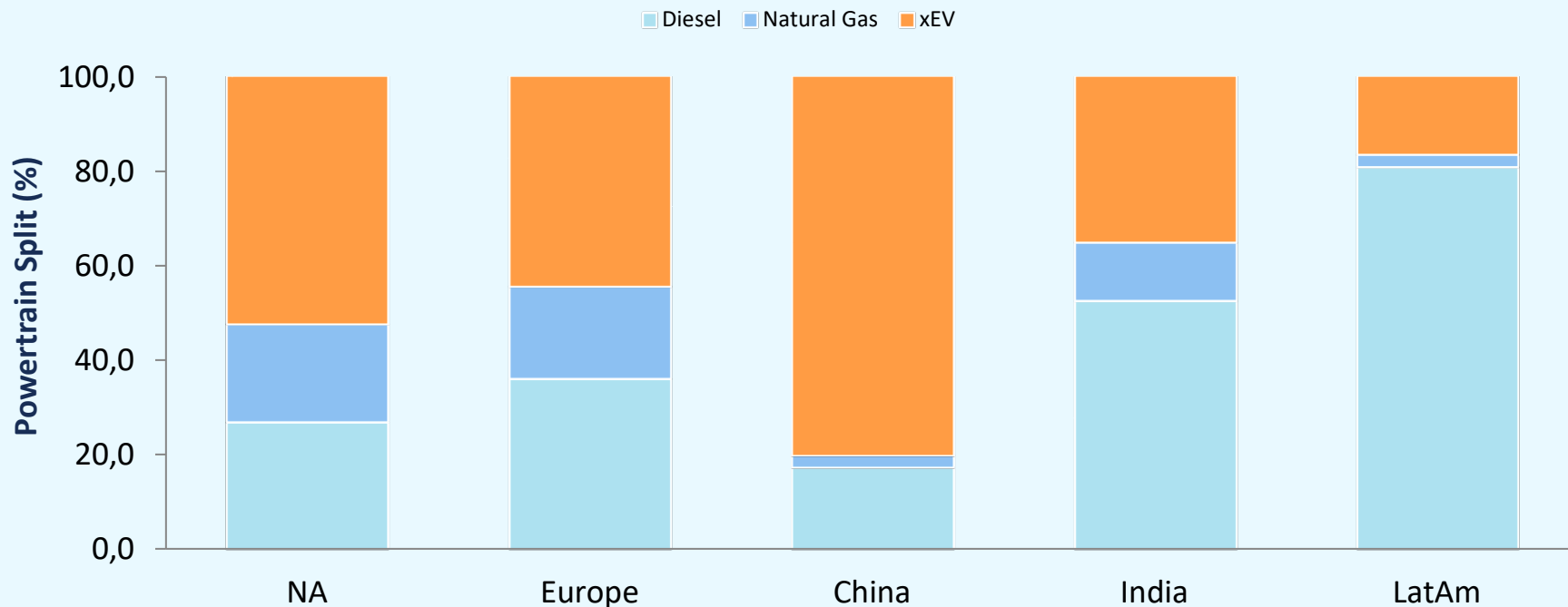
Global Bus Market Outlook: School Bus Unit Shipment, Global, 2019-2025



GLOBAL BUS MARKET FORECAST - 2030 POWERTRAIN TECHNOLOGY

China contributed 88.2% to the global electric bus unit shipment in 2020, but its share is expected to reduce to about 73% by 2030








Global Bus Market Outlook: Powertrain Technology Forecast, Global, 2030



Source: Frost & Sullivan

ELECTRIFICATION DRIVERS → GOVERNMENT SUBSIDIES

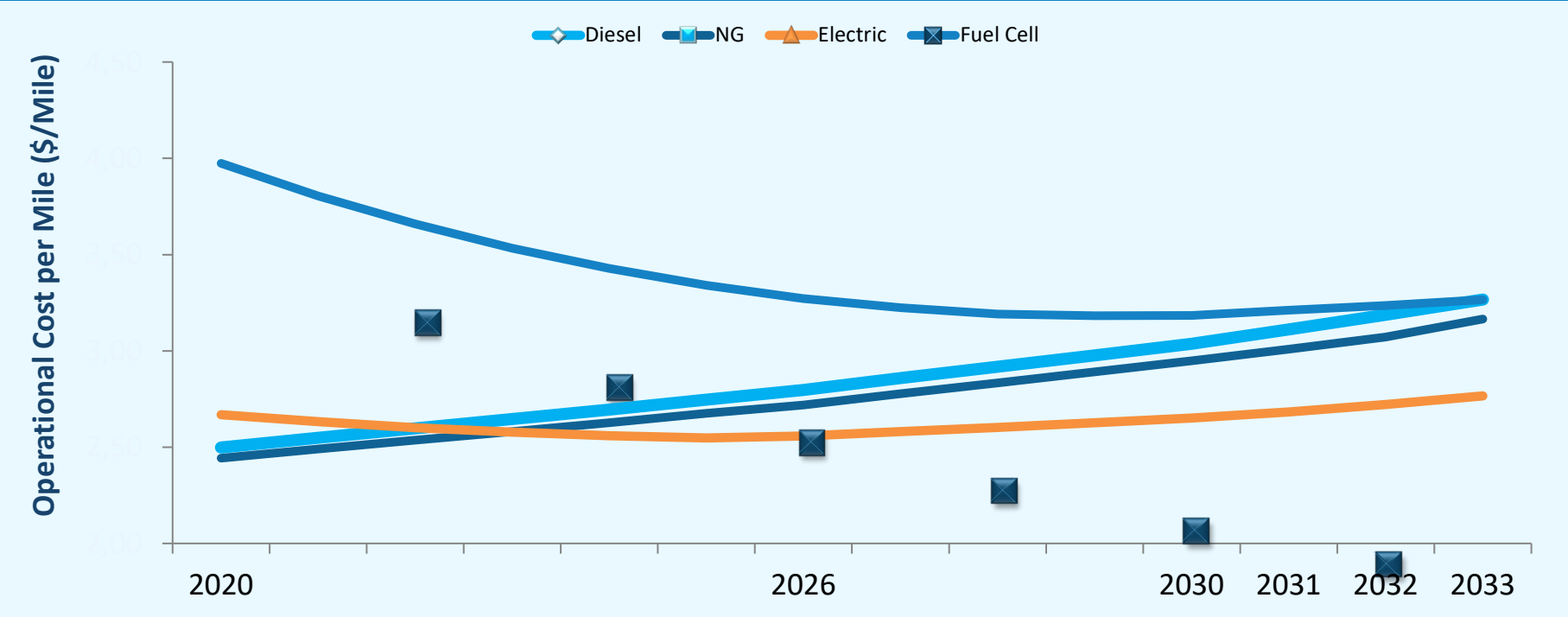
Subsidies drive the adoption of alternate powertrain in buses, across North America, Europe and China. F&S constantly track and monitor EV regulation for CV and Bus at country and city level as well as tenders and concessions for public transport.

China		The Chinese Government updated its subsidy program in 2020; it encapsulates all battery electric vehicles and plug-in hybrid vehicles and is extended until 2022.
India		The government has increased the budget allocation for FAME-II by 8 times, compared to FAME-I. The primary focus is to increase localization and domestic manufacturing. The policy states that to be eligible for the upfront incentives, OEMs have to ensure at least 40% localization for buses
USA		Under Low or No Emission Vehicle Program – 5339 U.S. Department of Transportation's ok(USDOT) Federal Transit Administration (FTA) announced \$129,956,625 in 2020 for 41 projects in 40 states and District of Columbia . The eligible projects included purchase or lease of hydrogen and battery-electric buses, and charging infrastructure related investments. In 2021
Chile		National Electromobility Strategy's goal is to electrify 100% of the public transportation fleet in the capital by 2040 and the rest of the country by 2050.
Germany		€1.2 billion for fleet modernization program to switch to alternative drive systems until end of 2021. German ministry for the environment (BMUB) has now allowed bus operator to claim upto 80% of cost of investment provided they acquire 5 or more all electric buses. The investment includes charging infrastructure, training and new service centers
UK		UK government all electric bus town scheme will fund 75% of cost differential between a zero-emission bus and a standard conventional diesel bus and 75% of CapEx for charging infrastructure. Initially 50 million pounds budget is allocated for the scheme.
Sweden		Public transportation authorities buying new electric buses can receive a premium of maximum 20% of the purchase price of the electric bus. The premium must not be higher than the difference in price of the electric bus and that of the corresponding diesel bus. Private companies buying new electric buses can receive a premium of 40% on the price differential over diesel bus

OPERATIONAL COST/MILE (\$/MILE)—DIESEL, ELECTRIC, NG, FUEL CELL

A lower battery price for the electric and higher fuel price for diesel buses work in favor of electric buses, making them the best alternative fuel in terms of operational cost/mile.

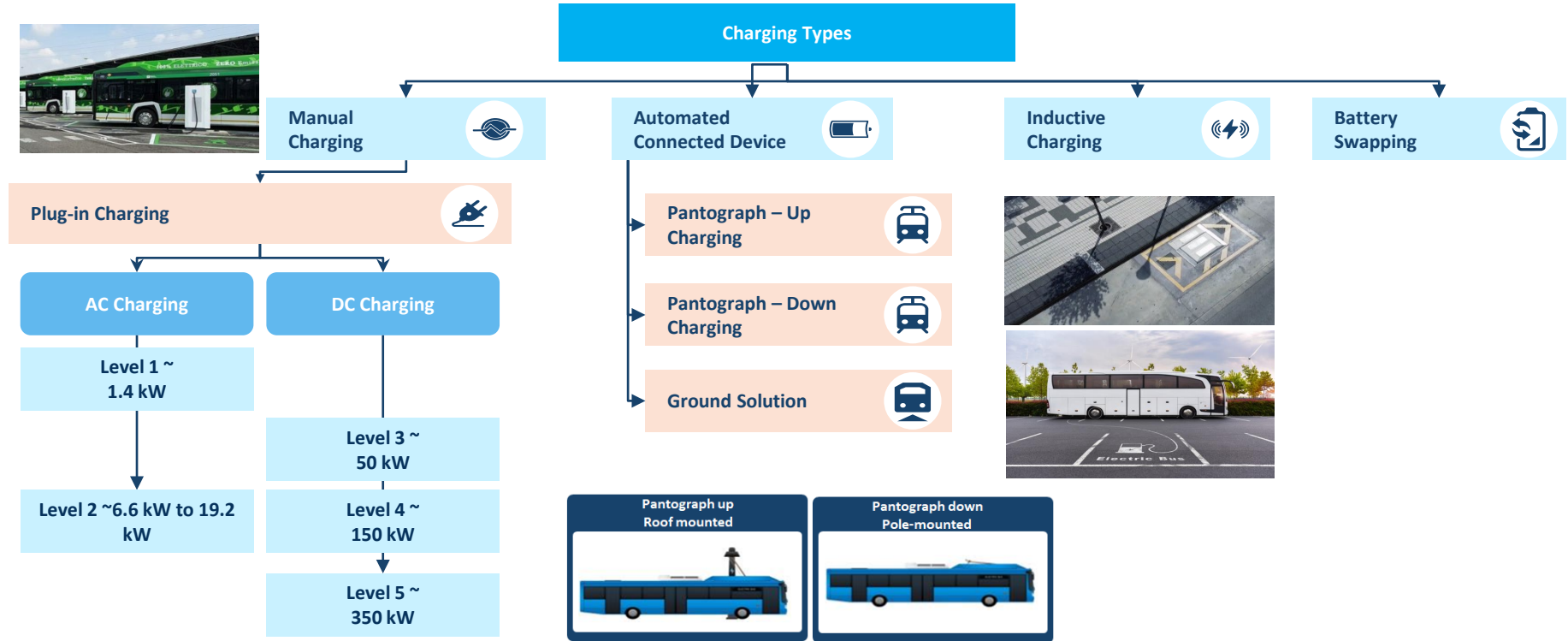
Global Bus Market: Operational Cost Forecast per Mile, NA, 2020–2033



Note: All figures are rounded. The base year is 2020 Source: Frost & Sullivan

E-BUS CHARGING INFRASTRUCTURE & TECHNOLOGIES

Pantograph charging is seeing higher adoption among Transit e-Buses because they allow quicker charging time and the use of smaller batteries that could lower bus acquisition cost.



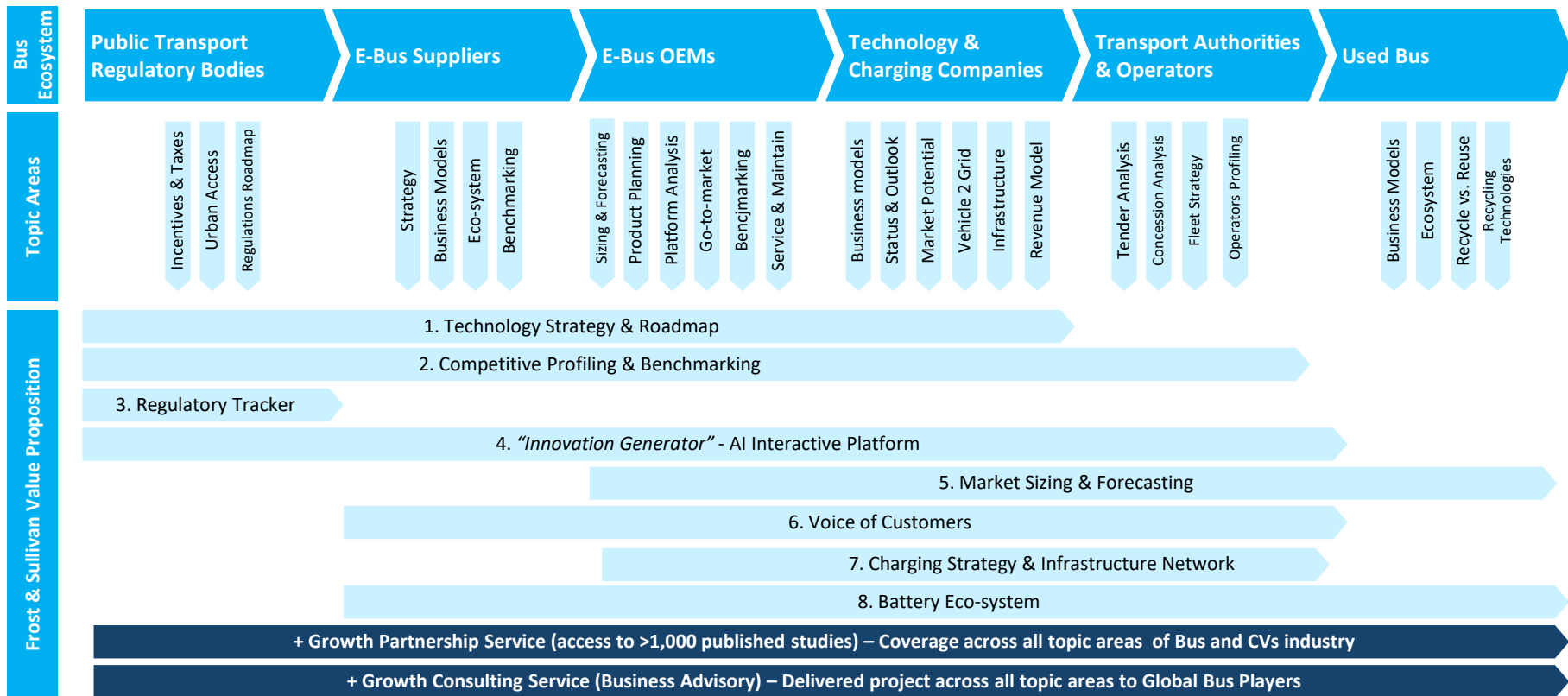
Note: Dynamic Conductive Charging for trolley buses exists in the market



FROST & SULLIVAN GLOBAL BUS MARKET CAPABILITIES

F&S CAPABILITY ACROSS BUS ECO-SYSTEM

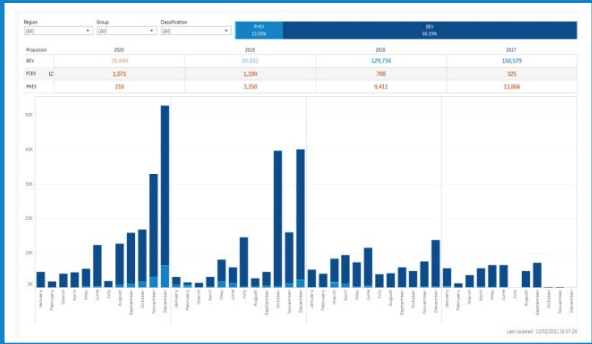
Thought leadership across bus ecosystem integrated through an end-to-end engagement offering with increasing focus on **electrification**.



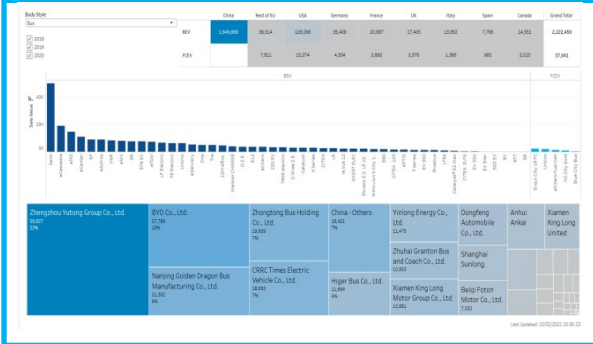
INNOVATION GENERATOR PLATFORM: VISUALISATIONS

Platform Screenshots and Analysis

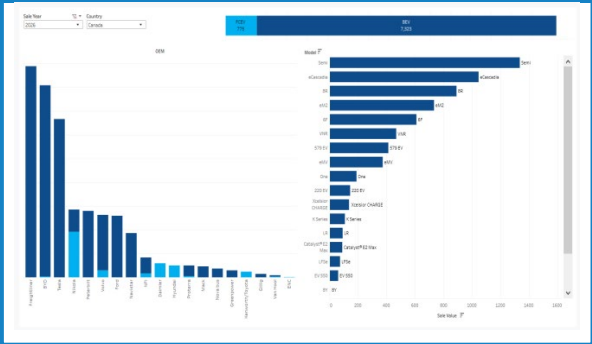
Electric Commercial Vehicles: Historic Sales by OEM



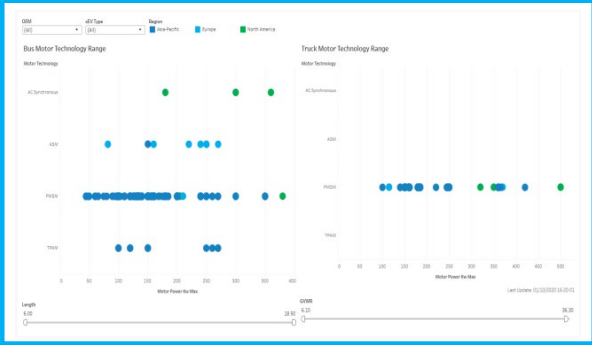
Electric Commercial Vehicles: Sales by Model



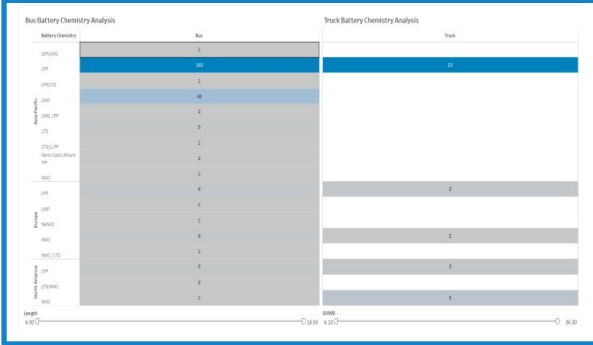
Electric Commercial Vehicles : Forecast by OEM



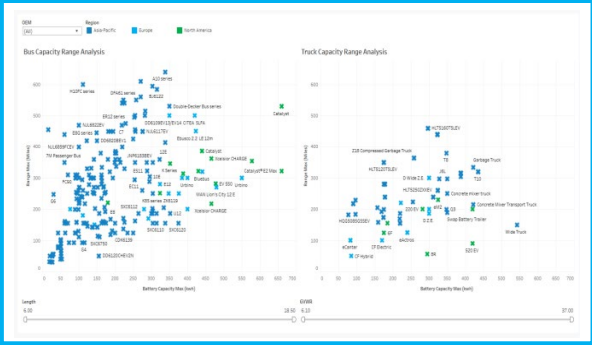
Electric Commercial Vehicles: Power Rating by Motor Type



Electric Commercial Vehicles: Battery Chemistry by OEM



EV Charging Infrastructure Analysis



E-BUS CAPABILITY - WHY SHOULD YOU PARTNER WITH FROST & SULLIVAN?

Frost & Sullivan can leverage experience with multiple commercial and electric vehicles related studies & engagements across the value chain

FROST & SULLIVAN

Public Transport Market
Sizing, Forecasting &
Opportunities Identification
in Europe G5 Countries

**EUROPEAN COMMERCIAL VEHICLE
MANUFACTURER**

FROST & SULLIVAN

European E-Bus Market
Analysis & Battery-as-a-
Service Strategy
Development

**ASIAN INDUSTRIAL
CONGLOMERATE**

FROST & SULLIVAN

Analysis of Global OEM
Electric Bus Strategy and
User Feedback on Electric
Bus

**CHINESE COMMERCIAL VEHICLE
MANUFACTURER**

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Global Public Transport
Market analysis, Partners
Scouting a Go-to-market
Strategy Definition

**GLOBAL
INFRASTRUCTURE MANUFACTURER &
CHARGING OPERATOR**

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Evaluation of the potential
EV battery pack in selective
transportation including
commercial vehicles

JAPANESE CONGLOMERATE

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Strategic assessment of the
battery electric applications
in the material handling
equipment market

EUROPEAN BATTERY MANUFACTURER

FROST & SULLIVAN

EV battery recycling
opportunities in Europe: Key
players and opportunities

**JAPANESE CV
MANUFACTURER**

FROST & SULLIVAN

EV battery market analysis to
help the client understand &
quantify key market trends
within Electrification

TIER 1 SUPPLIER

Note: Additional case studies in the Appendix

BUS CAPABILITY - LIST OF RESEARCH STUDIES ON BUS & E-BUS MARKET

Planned Bus Research Titles-2022

2022 Prediction of Global Coach and Bus Growth Outlook
Growth Opportunities in ASEAN Bus Market
Growth Opportunities in LATAM Bus Market
Growth Opportunities in Russia Bus Market
Growth Opportunities in Turkey Bus Market
Growth Opportunities in India Bus Market
Growth Opportunities of Electric Bus Charging Infrastructure - NA and EU
Growth Opportunities of Fuel Cell in Buses and Coaches
Global School Bus Market Growth Opportunities
Growth Opportunities in Global Connected Transit Bus & Coach Market

Existing Bus Research Titles

2021 Predictions of Global Transit Bus Growth Outlook
Global Connected School Bus Market
Global Electric Transit Bus and Coach Market, 2030
Global School Bus Market Analysis, Forecast to 2025
Global Electric Bus Market Opportunity Analysis, 2017–2025
Global Bus Rapid Transit System (BRT)
Global Hybrid-Electric Trucks and Buses – Technology Uptake Overview
Strategic Analysis of Global CNG/LNG Truck and Bus Markets
HD Transit Bus Market Global Analysis

Source: Frost & Sullivan

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