SONA COMSTAR

Entering High Voltage Motor & Inverter Market

16 May 2023

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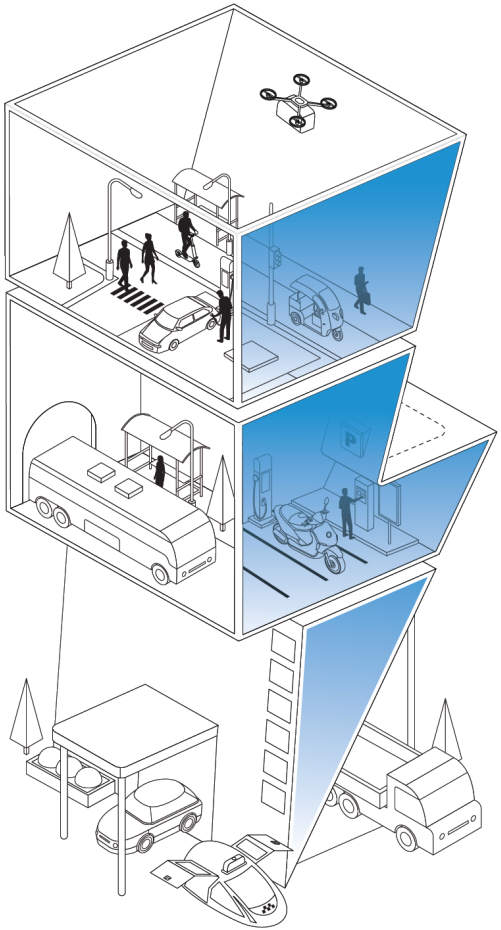
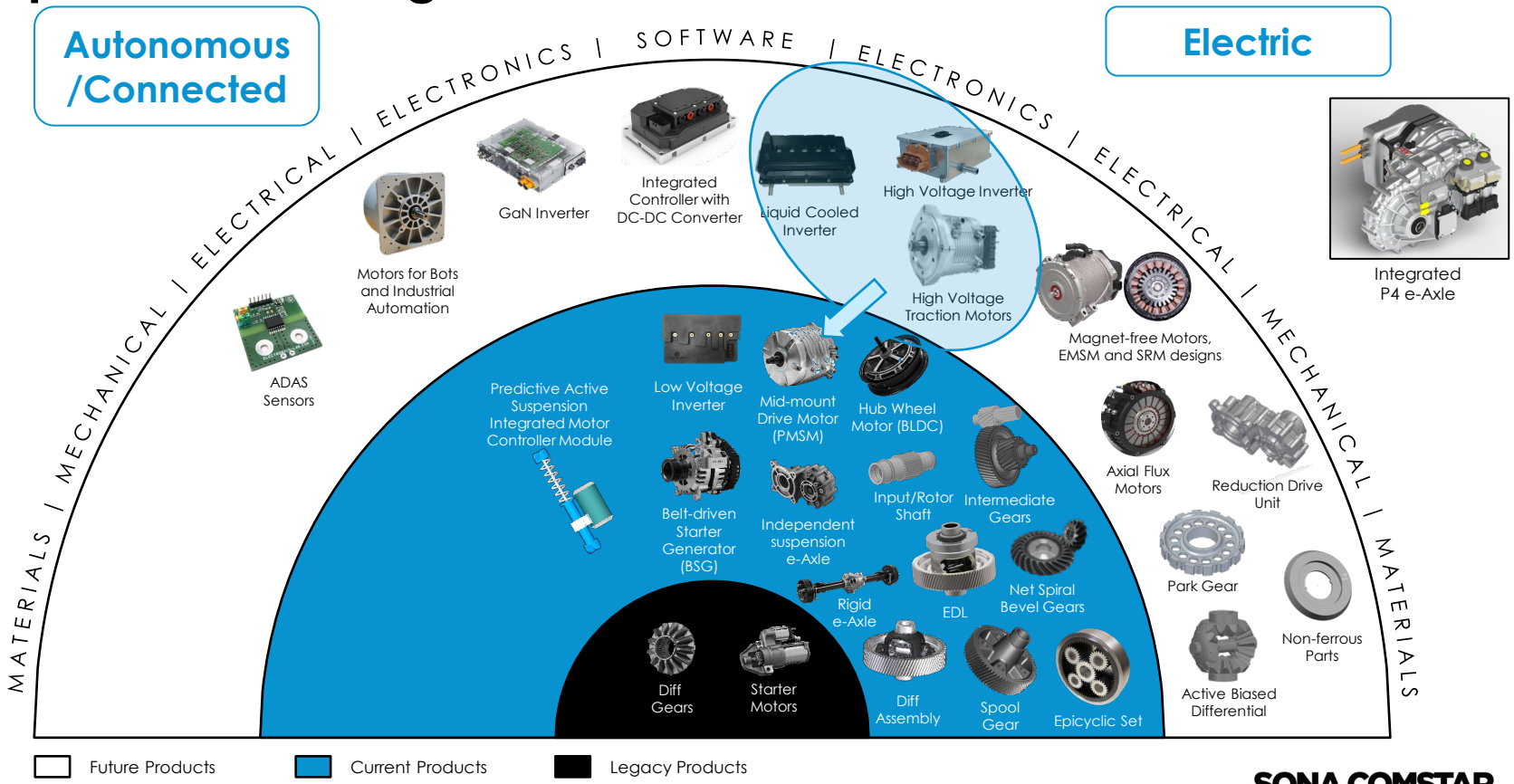
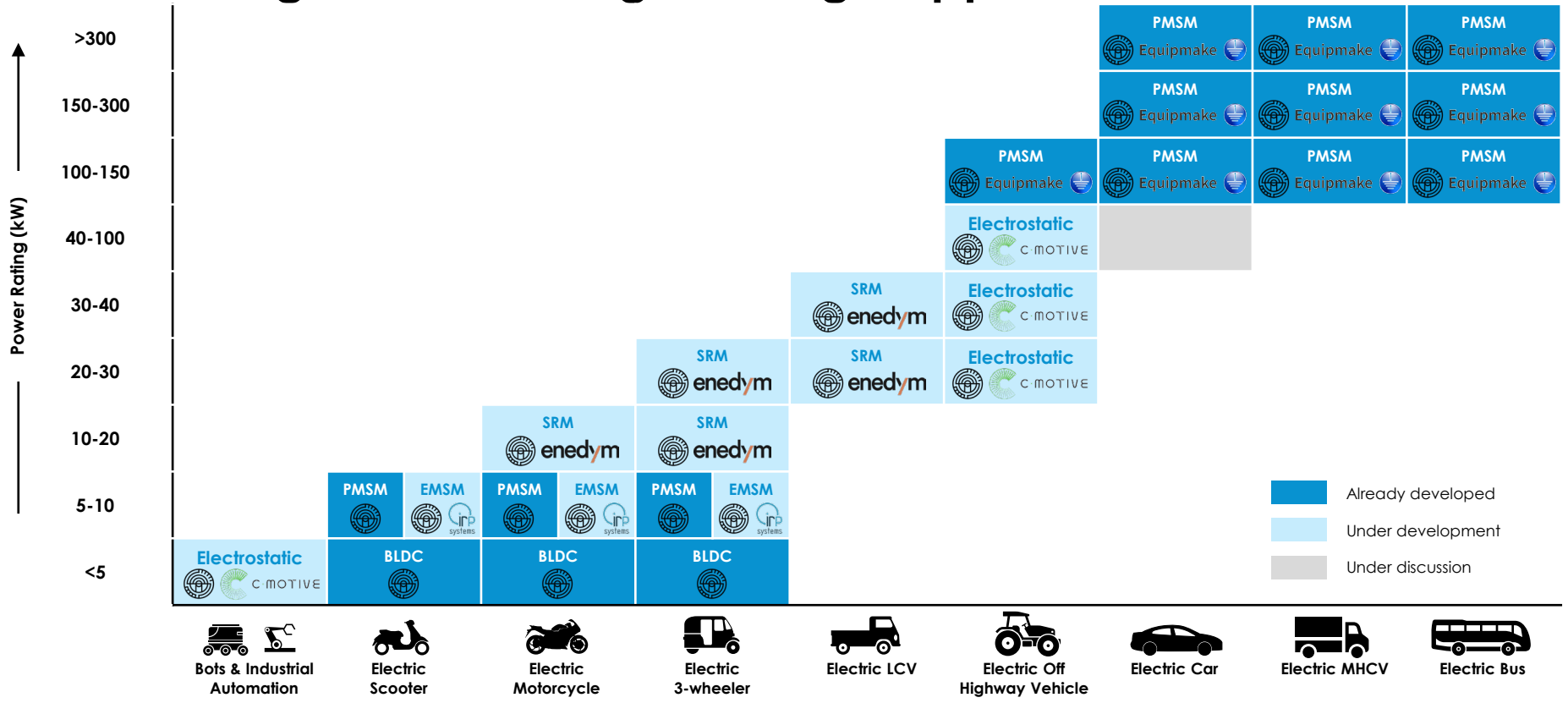


We are adding High Voltage Traction Motors and Inverters to our product offerings



Note: *The product images shown are for illustration purposes only and may not be an exact representation of the products*

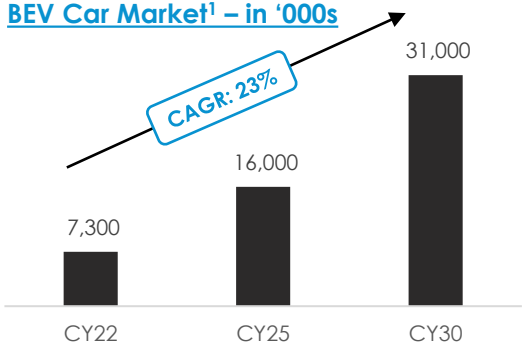
In partnership with Equipmake, we are covering all the major vehicle segments with high-voltage applications



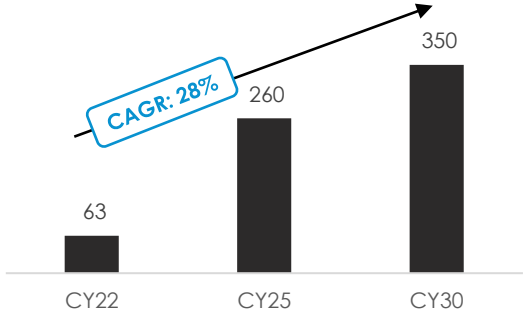
Both Global and Indian BEV markets with high-voltage applications have strong growth projections

GLOBAL

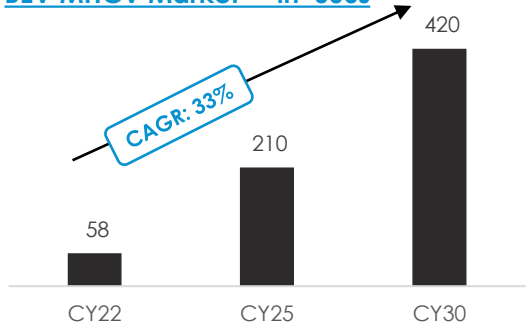
BEV Car Market[1] – in '000s



BEV Bus Market[1] – in '000s

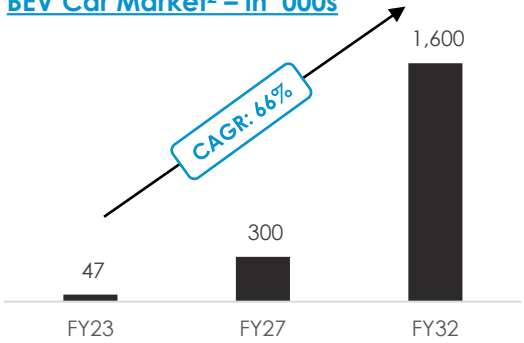


BEV MHCV Market[1] – in '000s

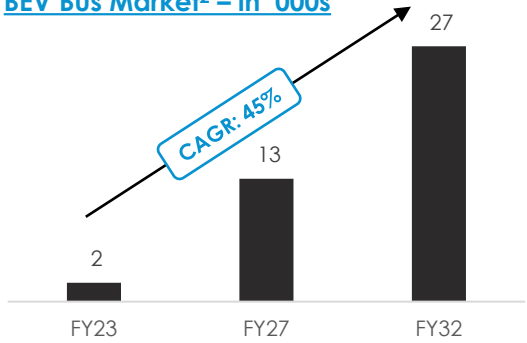


INDIA

BEV Car Market[2] – in '000s



BEV Bus Market[2] – in '000s



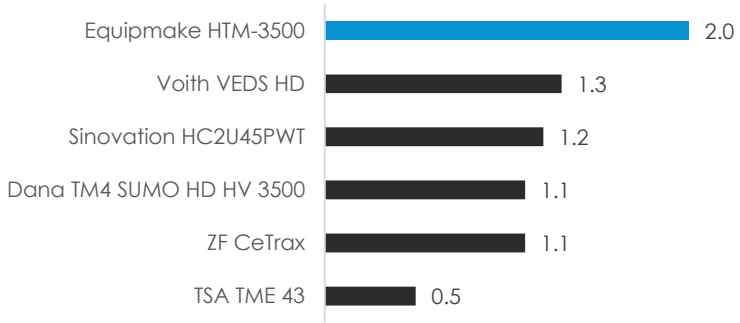
Data Sources:
1. IEA (2023), Global EV Data Explorer, IEA, Paris https://www.iea.org/data-and-statistics/data-tools/global-ev-data-explorer
2. CRISIL – Electric Vehicle Ecosystem Report

Equipmake is one of the few high-voltage motor makers and their motors are amongst the best in the world in power density

HTM - 3500

Power	: 400 kW
Torque	: 3,500 Nm
Speed	: 3,500 rpm
Weight	: 195 kg
Size	: 540 mm (dia) x 251 mm (w) x 607 mm (h)
Configuration	: Single or Coupled
Inverter	: With or without Inverter
Application	: Electric Buses and HCVs

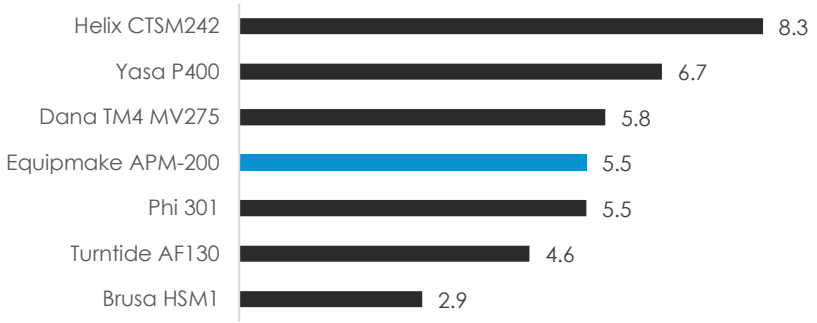
Power Density Comparison[1]



APM - 200

Power	: 220 kW
Torque	: 450 Nm
Speed	: 10,000 rpm
Weight	: 40 kg
Size	: 318 mm (dia) x 247 mm (l)
Configuration	: Single or Coupled
Inverter	: With or without integrated inverter and/or gearbox
Application	: Electric Cars, MCVs and Tractors

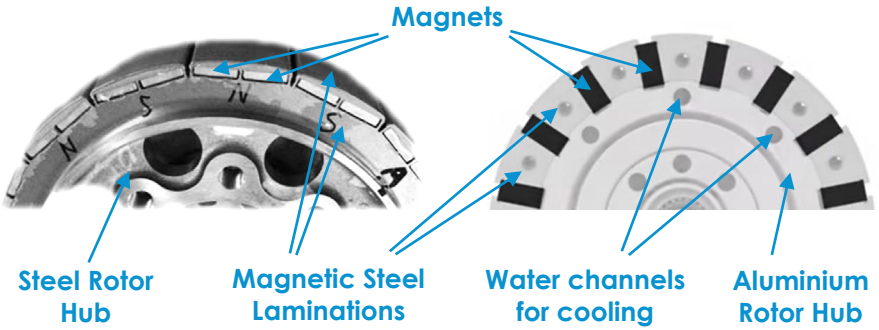
Power Density Comparison[1]



Data Sources: 1. Company Websites of the respective motor makers, website links available in the appendix; Company Analysis

Equipmake's spoke motor architecture is a proven technology which is validated on road

Conventional Architecture vs Spoke Motor Architecture



Advantages of Spoke Architecture and Patented Rotor Design

Aluminium Rotor Hub	Non-magnetic and cost-effective for manufacturing
Effective Rotor Cooling	Integrated water channels for cooling; Increases specific performance; Can use low-cost magnets
Concentrated Winding	Automated winding process for low-cost stator manufacturing
Effective Use of Magnets	Reduction in magnet material results in high torque density and low magnet cost

Tested and Delivered this technology to multiple customers

First Group (UK)	Repowered 12 buses for First Bus; Secured another order for repower of a double-deck bus
London Routemaster	Launch of customer trials of an Equipmake converted fully-electric London Routemaster
Emergency One (UK)	Delivered bespoke EV drivetrains for Emergency One Fire Trucks; Secured further orders from them
Agrale (Argentina)	Zero-emission powertrain fitted bus completed pre-service trails and started in-service trials in Nov-22
European Electric Hypercar	Long-term contract to supply ASIL-D compliant motor drive inverter

Equipmake has a strong pedigree and history of innovation

Ian Foley

Founder & Managing Director

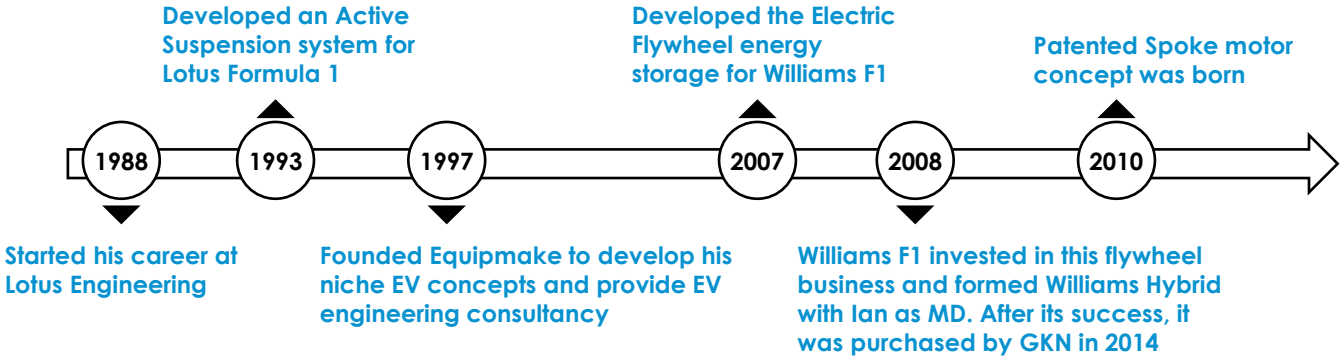
A highly-experienced engineer who has worked in global motorsport at the highest level – from Le Mans to Formula 1

>20 years

of experience in developing and integrating industry-leading innovative electric powertrains

70 employees

allowing Equipmake to continue innovating and developing new products



Since then Equipmake has developed various motors and inverters and validated their technology with multiple electric bus makers and a leading European electric hypercar player

Scope and Terms of our Licensing Agreement with Equipmake

Products Covered	EV Powertrains with power output between 100 kW to 440 kW • HTM 3500 motor and inverter, and its variants • APM 200 motor and inverter, and its variants
Target Applications	• Electric passenger cars • Electric passenger buses • Electric commercial vehicles • Electric off-highway vehicles including tractors
Scope of Design, Sales & Manufacturing	• Equipmake will provide the validated design of the products • Sona Comstar has exclusive rights to sell these products in the licensed territory of India, Thailand, and select South Asian markets • Sona Comstar will manufacture the products in India and supply them to its customers in the licensed territory and to Equipmake for other markets
License Fee & Royalty	• One-time fee for each motor • Variable royalty payment
Target SOP	• Production is targeted to start in 2025

Appendix

Data Sources for Motor Specs for Power Density Calculations

1. Voith VEDS HD - https://voith.com/corp-en/drives-transmissions/voith-electrical-drive-system.html https://d2euiryrvxi8z1.cloudfront.net/asset/445934742530/4d5e2414c0d9405f69e0ec1f1715fe32/vt2533-english.pdf
2. Sinovation HC2U45PWT-MRA - https://www.sinovation-ev.com/12m-coach-platform
3. Dana TM4 SUMO HD HV3500-9p - https://www.danatm4.com/wp-content/uploads/2019/04/TM4-SUMO-HD_Dana-TM4.pdf
4. ZF CeTrax - https://www.zf.com/public/org/Product-Datasheet_CeTrax_EN_78313.pdf
5. TSA ROAD-Motor TME 43-33-6 - https://www.tsa.at/tsa_referenzen/solaris-trollino-metrostyle-for-salzburg/
6. Helix CTSM242-LV - https://ehelix.com/products/ctsm242-electric-motor/
7. Yasa P400 - https://www.yasa.com/wp-content/uploads/2018/01/YASA_P400_Product_Sheet.pdf
8. Dana TM4 MV275 - https://www.danatm4.com/products/electric-motors/mv275/
9. Phi 301 - https://www.phi-power.com/wp-content/uploads/2018/01/Phi301-Spec_Sheet-V1.2.pdf
10. Turntide AF130 - https://turntide.com/wp-content/uploads/2022/10/Tradeshow-Component-Datasheets.pdf
11. Brusa HSM1-10.18.22 - https://www.brusa.biz/wp-content/uploads/2021/08/101_Datasheet_EN_HSM1-10.18.22.pdf