

## Strategic priorities

# Technology and R&D focus

The automotive industry is currently experiencing two simultaneous revolutions: electrification and automation. These disruptions, like the decline of horse-drawn carriages in the early 20<sup>th</sup> century, are of a magnitude not seen in hundred years. While electrification is fostered by the concerns about global warming and regulations, automation of mobility is driven by the technology's societal benefits relating to safety, convenience, reliability, and equity. Sona Comstar's vision is to become a significant player in electric vehicles and autonomous and connected vehicles, offering integrated solutions to our global customers. Our R&D efforts are directed towards this goal.

We began preparing for these emerging trends in 2016 when we developed our advanced technology differential gears specifically for high-performance electric passenger vehicles. Since then, we have been investing massively in R&D and bringing to the market innovative products that exceed the expectations of our discerning customers.

### THE ELECTRIC REVOLUTION

In FY 2021-22, we have introduced two new products for the EV drivetrains: spool gear and epicyclic gear set. The introduction of these two products has extended our reach in the EV drivetrains' varying architectures.

As more carmakers introduce new electric vehicles, new architectures emerge. Depending on the specific application, design constraints, and manufacturing considerations, EV drivetrains have evolved into four different architectures. Where one motor drives two wheels, we need a mechanical differential to enable the wheels to turn at different speeds when the vehicle makes a turn. Where one motor drives a single wheel, we need a compact, high-efficiency gear reduction unit that is also quiet.



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**Kiran Manohar Deshmukh**  
Group CTO



Our final drive differential assemblies are already fitted in one- and two-motor configurations of mass-manufactured EVs. Spool gears and epicyclic geartrain developed by us offer the demanding features of electric vehicles. They find their relevance even in the absence of a mechanical differential. They also have a broader application in commercial vehicles' gearboxes and hub wheel reduction units.

While one- and two-motor architecture is likely to be the most prevalent configuration in the future, now we have solutions for every format of the electric drivetrain. Alternate architectures are more sophisticated and more expensive, and hence we also realise higher value per vehicle than with the differential assembly.

We will continue this journey and make more products to support the electrification of the drivetrain. We are developing high-performance, high-efficiency, and high-power-density motors of different types, with compatible liquid-cooled, state-of-the-art, high voltage inverters. We aim to leverage our core strengths and create a range of integrated electric drive units to meet the highly demanding requirements of electric passenger cars and commercial vehicles of all types.

### THE AUTOMATION REVOLUTION

Our hardware and software engineering, integration, and thermal management competencies have allowed us to expand our product range into the growing autonomous and connected space.

As automation moves to higher levels, many systems and sub-systems in the vehicle will get 'smarter' and need computing intelligence, in-situ memory, and closely integrated sensing and actuation functions. This presents many opportunities for suppliers who can and will integrate hardware and software to develop this new generation of automotive systems.

In FY 2021-22, we introduced Integrated Motor Controller Module (IMCM) for a predictive active suspension system that offers comfort and convenience to the occupants of a car. This futuristic suspension system with our IMCM senses every bump and speed breaker and independently responds to all external disturbances. The motor generates an exact counteracting force to mitigate the impact of uneven road surfaces so that the vehicle glides over all kinds of roads. This capability extends further to anticipating oncoming potholes or road disturbances through sophisticated geospatial software and reacts with lightning speed.

This new product has only been possible due to our extensive R&D on Belt Starter Generator (BSG), especially the thermal management and the software modules. Owning and controlling our primary technologies has given us the ability to keep iterating and innovating and finding multiple different applications and products for the same technology. Our IMCM with nearly two million lines of code is just one example of our abilities to integrate hardware and software—something that will keep gaining importance as vehicles and the systems inside them get increasingly more intelligent and more autonomous.

### NEW PARTNERSHIPS

We have recently partnered with three technology companies from three countries, each using a different core technology to develop magnet-less motors. We are co-developing an electrically magnetised synchronous machine (EMSM) with Israel's IRP Nexus that uses a patented power transfer module and no magnets. Our strategic partnership with Enedym Inc., the Canadian technology company incubated at the McMaster University in Ontario, aims to offer switched reluctance motors (SRMs) with advanced acoustic noise control. Finally, our partnership with C-Motive Technologies, a high-tech electric motor company based in Wisconsin, US, will harness electrostatic forces to build a motor through multiplicative gains in mechanical, electrical, and electrochemical innovations.

These initiatives of eliminating magnets from motors will provide us with the advantages of supply security, cost reduction, and product recyclability. Most of the world's rare earth magnets come from China. Dynamic geopolitical situations cause their prices to fluctuate dramatically and erratically. Further, the permanent magnets are difficult to isolate during the recycling process. Having a motor without magnets is an intelligent way of overcoming all these problems.

One of our top strategic priorities is to grow our EV revenue. We will accomplish this by expanding our traction motor offerings, addressing the entire range of EVs, spanning from below 5 kilowatts to above 300 kilowatts. Our other top priority is to serve the budding autonomous and connected space by expanding our product offerings to address this emerging field. We will realise both these objectives through our internal capabilities and partnerships with able technology companies from across the world Kiran Manohar Deshmukh Group CTO.

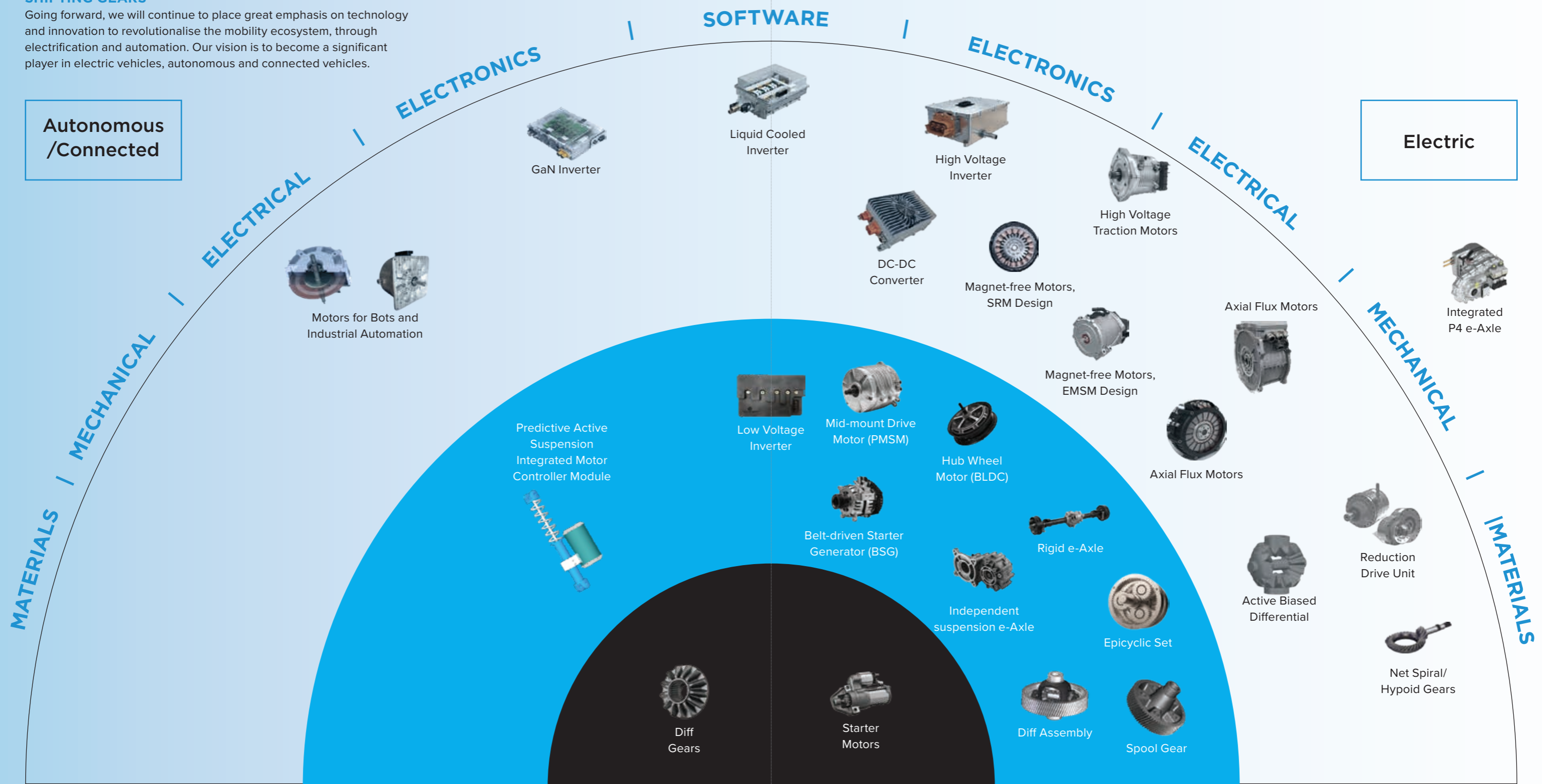
# Strategic priorities

## SHIFTING GEARS

Going forward, we will continue to place great emphasis on technology and innovation to revolutionise the mobility ecosystem, through electrification and automation. Our vision is to become a significant player in electric vehicles, autonomous and connected vehicles.

Autonomous /Connected

Electric



□ Future Products   ■ Current Products   ■ Legacy Products

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