

Proven concept

Steve Welch reports on meeting the challenge to develop a vehicle that balances performance, range, and cost of acquisition

David Hudson



The Tiago EV – on display at Cenex LCV 2017 – is the fruit of several years' work at Tata Motors European Technical Centre (TMETC). The car was developed at the Coventry facility and is aimed to target the nascent market for electric and hybrid vehicles in India.

David Hudson, Head of Propulsion and Innovation at TMETC, is responsible for teams covering both electric vehicle systems and internal

combustion engines. He explains that around 35 out of the facility's 260 members of staff are dedicated to low carbon propulsion technologies. "They are typically engineers with specialist responsibility for electric motor design and development, battery systems engineering, and whole vehicle packaging," he says. "The centre has been established for 12 years and through that time we've participated in large scale collaboratively funded LCV projects, including the 'CABLED' programme in the Midlands which looked at testing EVs for real world use and an InnovateUK project addressing the development of low cost auxiliary power units for EVs."

The Tiago EV builds on the technology behind the Bolt battery electric vehicle, a concept car unveiled by Tata Motors at the 2016 LCV event. Both vehicles are essentially 'conversion' EVs in which battery technology and an

electric drive system is packaged within a stripped down version of an existing internal combustion engine Tata model.

Whilst the Bolt EV was developed at TMETC as a proof of concept vehicle to demonstrate Tata's capability in batteries and electric driveline, the Tiago EV is a further step towards commercial availability in the future, initially in the Indian market. "The Tiago, one of our new generation vehicles, is an attempt to bring the cost of the system down into a more affordable range," comments Hudson. "One of the challenges we face with EVs in India is that the market is very cost sensitive and the uplift in price of an EV system (typically two or three times to cost of the base vehicle) can be a difficult pill to swallow."

Compared with the UK and parts of Europe, the electric vehicle market in India is very much in its infancy. EVs that are on the roads tend to be small, low-



powered quadricycle type vehicles akin to the G-Wiz. Market penetration of higher voltage EVs, such as the Nissan Leaf, is minimal.

Nevertheless, despite this low base, the Indian government has established some of the world's most ambitious targets for the adoption of electric vehicles with the energy minister Piyush Goyal saying earlier this year that by 2030 no petrol or diesel cars should be sold in the country (the UK government recently announced plans to phase out the sale of internal combustion engine vehicles by 2040). "Recent political developments in India have put significant emphasis on the development and deployment of zero emission vehicles," adds Hudson. "We are hoping that the products we are developing are going to reach market quite quickly and will actually move the game on from the EVs of limited performance to full range performance vehicles."

The challenge facing Tata is to develop a vehicle that hits a 'sweet spot' in terms of balancing performance, range, and cost of acquisition that will be acceptable to Indian buyers. In addition, the Indian market introduces certain extra complexities in the development of EVs, namely designing systems that will perform reliably in both extremely

high temperatures and the wet conditions of monsoon season.

Furthermore, as is the case in any market hoping to accelerate the adoption of electric vehicles, charging infrastructure is an important consideration. "Infrastructure in India is again very much in the early stages," comments Hudson. "There is not a public charging network yet. However, the government has indicated it is interested in participating in a similar roll out to many European countries."

Historically India has experienced difficulties around grid capacity, with demand occasionally exceeding supply. In recent years strategic investment has improved the robustness and reliability of the Indian grid, nevertheless, mass adoption of electric vehicles would place additional strain on an electricity network which, in places, remains old or badly maintained.

Hudson explains that Tata needs to be sensitive to potential charging limitations in its ongoing development of electric vehicles. "We're looking to minimize the amount of onboard energy storage and to ensure the battery size is such that it will charge at modest currents through an overnight period," he says. "We are not going to be fitting massive long range batteries because those could take several days

to charge in some of India's more restricted power areas."

The strategy, according to Hudson, is to not give buyers "more EV than they need to use". By keeping specifications modest and focussing on modular electric drivetrains within vehicles, Tata hopes to achieve accessible pricing. "Rather than have every vehicle we wish to make into an EV use a completely separate solution, we are trying to combine technologies so that we have a modular architecture for electric drive systems," continues Hudson. "With fundamental building blocks within the drivetrain we can collect as much volume as possible onto a single solution in an effort to bring selling price of vehicle down to a reasonable level."

Looking beyond the Tata brand to the future of EVs more broadly, Hudson believes that vehicle development will follow two paths: conversion vehicles and optimized vehicles. "What we might call conversion vehicles are those where the electric drivetrain is one choice of many: you can choose a conventional gasoline engine, some degree of hybridization, or something that is fully electric," he says. "Conversion vehicles have a lot of attractions because as the vehicle is in production at high volume, as long as





you don't modify too many of the parts, you can end up with the conversion being not much more than the cost of the components you add."

He continues: "From there you move to a more optimized vehicle that might involve something more aerodynamically sophisticated or designed for very low rolling resistance of ultra light weight. The challenge with this type of vehicle is that you have to pay for everything with only your EV volume. That might be OK in a mature market but in India it would be foolish to jump into a space where we would have to build tens of thousands of EVs having never sold one before."

Another significant theme in the future of EVs is their parallel development alongside connected and autonomous vehicles. TMETC is a participant in the UK's Centre for Connected and Autonomous Vehicles development programme and is part of the UK Autodrive consortium alongside Ford and Jaguar Land Rover, trialing automated vehicle technology. "We see connected and autonomous vehicles being a contributor to low carbon transport in the future," says Hudson.

"An obvious connection is that EVs are straightforward to control so an EV is a very attractive base platform to transfer to autonomous driving."

Alongside the development of low emission and autonomous vehicle technologies, a shift in consumer attitudes to cars and driving is likely. Firstly, increasing volume of EV production allied to government initiatives penalizing the use of petrol or diesel cars will make EVs more appealing from a cost perspective. Furthermore, the nature of driving is changing. "As trends towards urbanization and mega-cities continue across the globe, roads will become more and more precious as they become more crowded," reflects Hudson. "A high performance internal combustion engine vehicle capable of sustained journeys at 70 miles-per-hour and covering hundreds of miles a day is not something an average family is going to need all the time. The EV becomes a much more practical choice: we believe there is a future for an urban EV that has a maximum range in the 100km bracket because for typical families that might suffice for

three or four days of driving. For times when you need longer journeys there are alternatives."

Hudson jokes that through his four decades in the automotive industry he has witnessed a "good deal of crystal ball gazing". Nevertheless, he maintains that keeping an open mind is crucial in the pursuit of true innovation. "We are employed to find solutions that aren't yet being demanded by customers," he says. "What about the speculation as to how autonomous vehicles will look in the future? What if you remove the restraints we are typically given as engineers or styling designers? If those don't apply anymore how does that impact the appearance, form, and proportions of the vehicle?"

"How long will it be before we see radical vehicles on the road?" he asks. "Perhaps with the internal combustion engine there are certain rules you can't break, but with electric vehicles we have the chance to change all that because the components are different and the thermal efficiency of the vehicle is so much greater."

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Tata Tiago EV concept

Tata Motors European Technical Centre PLC (TMETC) marks a further milestone in its pioneering research and product development into electric vehicles (EVs) launching the Tata Tiago EV concept

The Tata Tiago EV concept is a battery-electric variant of the Tata Tiago hatchback launched in 2016 in the Indian market by parent company Tata Motors.

The Tata Tiago EV utilises a liquid-cooled 85 kW drive motor developing 200 Nm of torque driving the front wheels through a single speed gearbox.



Based in Coventry, TMETC provides research and development services principally for parent company Tata Motors but also for selected partners in the automotive industry

TMETC's engineering departments encompass every aspect of vehicle engineering and are continuously updated through training and development programmes

The TMETC design studio, one of three global Tata Motors design centres, plays a pivotal role in the creation of design concepts for future Tata Motors passenger vehicles

Come and see TMETC at stand SP-19 to book in for your ride and drive in the Tata Tiago EV concept or visit www.tmetc.com for more information

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