

TATA TECHNOLOGIES

## eMO-C, A New eMO Variant

*electric MObility - Commercial: Phase two of the eMO engineering study, another industry first by an India-based engineering services company*

### Overview

In January 2012, when Tata Technologies launched its electric MObility (eMO) EV study at the North American International Auto Show in Detroit, Kevin Fisher, President – Tata Technologies Vehicle Programs Development (VPD) group said "This study is the first in a series of thought-provoking concepts to showcase our capabilities across the current, and future, automotive landscape."

In March 2013, Tata Technologies introduces the second **in** its series of engineering studies building upon the eMO solution. This solution is aimed at the commercial market, often populated with inefficient vehicles that no longer serve the fuel-efficiency demanded by fleet customers.

### Continuing the eMO Story

While working on the original eMO, Tata Technologies recognized a potential white space in the commercial vehicle market, and planned on revisiting this after the eMO study release. In 2012, the company began to explore the potential of utilizing eMO learning and engineering solutions to this potential white space. The answer is a well-structured variant on the eMO platform that compliments the eMO business plan.

The development team considered a range of concepts, but to practice business-responsibility, Tata Technologies settled on an eMO-based variant, to maximize the planned investment of the original eMO study.

Additionally, the development team wanted to further highlight the company's focus on sustainability, as well as utilize its global experience, knowledge, capacity and innovation across its entire product and process development cycle.

"We studied the global commercial market, analyzing the competition and emerging technology trends, and evolved the eMO to produce a compelling, best-in-class concept," said Fisher. "We then looked at our eMO design and focused on maximizing shared content. We ended up sharing 70% of the base vehicle, which meant we could produce a unique commercial variant with innovation and technologies that would bring an attractive value proposition to this market segment."

## **Product and Market Definition**

Tata Technologies undertook a careful study of relevant data on the global commercial vehicle market, industry trends, and what markets could be served by this type of vehicle. Results showed that currently, there are few vehicles of this size in North America, but there is growing demand. Additionally, in European markets, where this size vehicle is more common, commercial EV efficiencies have competitive advantage over Internal Combustion Engine (ICE) solutions.

The development team also found that vehicles of this size and cargo capacity potentially have the scope to serve the commercial needs of small business entrepreneurs as well as large fleet owners. For fleet customers, Tata Technologies

offers multiple driving ranges with three battery sizes to better match established short-, medium- or long-range delivery routes. Currently, smaller and shorter routes (hub-and-spoke distribution model) being served by larger, older vehicles are extremely fuel inefficient and have very high maintenance costs. For example, many fleet service companies use and maintain vehicles from a defunct company (Grumman LLV), based on a truck platform no longer in production.

This engineering study covered many facets, concentrating on performance, price, and – most importantly – total cost of ownership (TCO). Tata Technologies compared its eMO-C against current and future competitive ICE, hybrid and EV vehicles; to ensure it offers value for money, while not compromising style, comfort, practicality, fuel-efficiency and environmental friendliness – the essence of eMO.

### **Finding the ‘Right Balance’**

As with the value proposition of the original eMO concept, Tata Technologies managed the design, engineering, and production processes to find the right balance for this commercial vehicle in three critical areas:

1. **Low Vehicle Cost of Ownership** – eMO-C’s tailored design enables the lowest overall cost of ownership with price per mile of less than 2 cents – the most critical success factor in the commercial market. "Our research showed that overall, majority of commercial vehicles in the market are actually oversized and over-specified for their daily use," said Fisher.
2. **Powertrain Technology** – Utilizing the eMO Technology, Tata Technologies factored the powertrain to suit three driving ranges, so that the owner/operators can

purchase to their plans. "Our objective was to find the right size and functionality for this type of EV, with configurable range, without reducing daily usability. Tailoring MSRP allows further reduction to the total cost of ownership," Fisher added.

3. **Innovative and Usable Interior Space.** – Again, with an emphasis on architectural design functionality, Tata Technologies incorporated features that would enhance interior cargo storage as well as ease access capabilities. The unique eMO-C "Lift & Slide" rear hatch eases loading and unloading. "Our research also led to a focus on a 'new commercial urban EV' with an emphasis on optimization of usable interior space – and access to it," Fisher said.

### **Vehicle Architecture and Innovative Design Features**

Ultimately, the Tata Technologies development team determined it came down to the vehicle architecture. After reviewing the eMO package the company made some minor, but significant, changes which the development team believes led to the right content for this urban commercial solution.

- eMO-C retains the overall wheelbase from eMO, so it's still easy to maneuver and park.
- The small increase in overall footprint led to an impressive 53 cubic feet of cargo space, which also provides space for 8-foot long packages, and configurable storage solutions with bins and racks.
- Cost is further minimized with seating for only one (the driver), maximizing the interior cargo space

- More cost minimization was realized by the eliminating the rear doors. This also produced ample space for customized graphic livery and client branding.
- Retained are the unique front-end product design features from the eMO, like shorter overhangs, and the flush profile windshield to cowl, giving a more uninterrupted aerodynamic profile, with the wipers parked at the A-pillars.
- eMO-C maintains all-round visibility, with the panoramic windshield and with selective use of low-mass polycarbonate glazing.
- Delivery-specific operator's needs are allowed for, with at-hand solutions and comfortable seating.
- The eMO-C overall structure incorporates the same steel safety cage as eMO. It has been engineered using extensive CAE global simulation knowledge within the company, to meet the current safety standards and regulations in all major markets worldwide.
- Recyclability – as with the eMO, the carryover front fascia and front doors, along with the new rear fascia, are recycled panels with mold-in color.
- The unique 'Lift & Slide' rear hatch is a feature that offers easier loading and unloading. It does not intrude on interior space, and can be used in all loading situations. The development team dubbed it 'Lift & Slide' because it consists of a one-piece polycarbonate hatch, which pivots similar to a traditional hatch, then slides in tracks integrated in the exterior roof cargo system. This enables uncompromised use of the interior space, and enables the users to back up to confined spaces, but still load cargo easily.

All of these features made it possible for our e-MO-C study to concentrate on cost management. Based on three variable driving ranges, the estimated MSRP would range from \$15,750 (50-mile range) to \$23,750 (150-mile range); without any federal or state government incentives. This includes a disruptive price per mile of less than 2 cents, which is 93% more efficient than the current Grumman LLV, at 22.4 cents.

### **Green in Every Way**

The eMO-C carries over the powertrain of the eMO — a unique liquid-cooled, dual-motor, front-wheel-drive system coupled with an air-cooled, high-energy/density battery system. However, the eMO-C architecture is modified so that it can be tailored for 50-, 100- or 150-mile range packages; providing the unique selling proposition of the vehicle. eMO-C also has a top speed of 65 miles per hour.

The suspension incorporates an independent front lower A arm and MacPherson struts. The rear suspension has a semi-trailing link with separate mounting shock absorbers and springs. Braking is regenerative with ABS and electronic stability control. Steering is provided by an electric power-assisted rack-and-pinion system.

"As with the eMO, the eMO-C variant would be produced with the same manufacturing methods, so it would enjoy the same overall reduced carbon footprint of manufacturing, assembly and all associated processes. A small assembly footprint methodology drove our manufacturing solution," said Fisher. "This eliminates the traditional body shop and paint process and uses as many 'green' product materials and processes as possible."

## Summary

"The eMO project symbolizes the coming of age of Indian automotive engineering," said Warren Harris, Tata Technologies President and Global COO at the study's launch in 2012. "It's a tangible example of the capability of Tata Technologies to deliver a full vehicle."

Fisher noted eMO-C demonstrates that, while eMO was a "first" for an Indian engineering services company it was not an "only" as ongoing automotive innovation continues from the original study. eMO-C further reflects the unique multidimensional approach of Tata Technologies, its innovation DNA, and its intimate understanding of the demands of both developed and developing markets.

"We believe the eMO-C engineering study shows a pragmatic, innovative and cost-feasible solution for daily-use electric vehicles in a new urban commercial environment," said Fisher. "And we also believe there is an emerging market for a vehicle demonstrating this intelligent combination of price, performance, function, safety, and environmental responsibility."

Is there more to come?

"With this second study, we believe we have again demonstrated a thought-provoking concept, addressing a market segment with significant white space. There are always new directions where technology and innovation can take us. We will continue to look for ways and areas to become 'better and better'," Fisher said

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## **BETTER AND BETTER: It's Our Way of Life.**

Through more than two decades of providing pragmatic solutions to the world's most successful automakers, Tata Technologies has developed a reputation for capability and innovation. In 2010, the company formed the Vehicle Programs and Development (VPD) group, which serves client organizations worldwide from its four automotive centers of excellence – Detroit, Coventry, Pune and Stuttgart

. "We have the talent, ideas, and ability to anticipate client and market needs. We're ready to help our current and future clients rise to meet their next global challenges," said Fisher.

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