

Tata: Indica EV to launch in Europe

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Tata's electric version of Indica, which is a converted ICE car, is set to be launched in Norway, Denmark and UK in 2011

The Indica Vista EV is Tata Motors' entrant into the full electric vehicle (EV) arena. The car is an EV conversion of the

latest incarnation of Tata's spark ignition Indica model – the Vista – which was launched in Mumbai in August 2008. This is a good choice for a donor vehicle because the current, larger Indica is a complete redesign of the previous model and better suited to the global market.

The electric Indica Vista has a range of 200km and gets fully-charged in eight hours. The EV can attain a maximum speed of 110kph. It accelerates from zero to 60 in nine seconds. Mr. Prakash M. Telang, Managing Director, India Operations, Tata Motors, told Hybrid-EV that once development has been completed, probably in 2010, the company will embark upon a feasibility study to determine demand for EVs in the domestic market. "[The car] will be launched in Norway, Denmark and the UK in 12 to 14 months. We're evaluating the option of an Indian launch, but are still not sure if the EVs are the best option for the country," Telang said.

The selection of Norway and Denmark as the starting point for Tata's EV marketing is not surprising. Norway's tax on ICE vehicles is high and so EV prices end up being comparable. The same is true to some extent for Denmark. As for the Indian market, the most likely influence on Tata's launch decision is price. The Indian market is very price sensitive and EVs come with a premium price tag – perhaps as much as twice the ICE price – the difference being mainly due to the cost of the EV's expensive batteries.

No prices have been announced for the European version of the vehicle. But some Spanish sources in mid-2009 quoted a price tag of €25,862 (about \$37,500), subsidised down to €24,000 (\$34,800) by the government. This is about twice the price of the ICE powered vehicle in the US and a premium of about 70% over the ICE price in Spain and the UK. But pricing decisions must be announced soon. At the 10th Indian Auto Expo in January 2010, Tata Motors confirmed that the Indica Vista EV would be launched this year.

Tata is supplying 25 of the 110 vehicles in the UK's largest trial of low emission vehicles, the CABLED Project. The trials project, supported by the UK-government, entails deployment of 110 EVs on the road in an urban area of the UK West Midlands. During the trials, Birmingham's Aston University will collect usage data on the cars. The cars will be used by drivers selected from the area's population – as opposed to engineers who are usually involved in the development of the car.

The OEM's European operations include Tata Motors European Technical Centre plc (TMETC), a 100% owned subsidiary. TMETC is based at the Warwick University near the Jaguar Land Rover plant in Coventry. The centre employs a staff of 190.

In October 2008, TMETC acquired a 50.3% share of Norwegian EV specialist Miljø Grenland/Innovasjon and subsequently increased it to 72%.

Where to manufacture

The production location of the vehicle has been a topic of considerable negotiation in the past year. In September 2009, the technical centre of Tata Motors in Europe received £10m in loan under the UK government's Automotive Assistance Programme (AAP). The loan will support development of the Indica Vista EV in the UK. But the TMETC loan became embroiled in a separate request by Tata for £500m (US\$813.00) of UK government support for JLR following a drop in sales due to the recession.

The UK government's measured response and unattractive terms compelled Tata to turn down the government's offer. The company believes it can secure funding at better terms from private financial institutions.

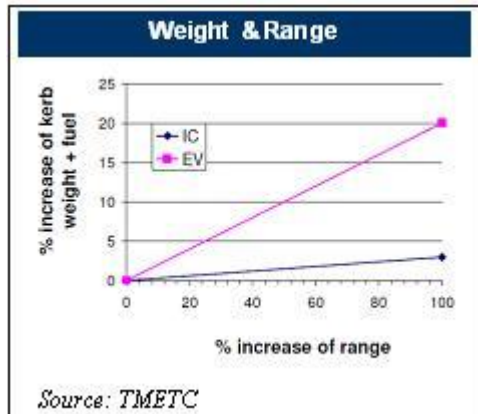
Recent reports say the Indica Vista EV will be assembled in Norway with SKDs brought from India, confirming reports from the May 2009 EVS24 symposium where Miljø Grenland CEO Bjørn Nenseth said: "Our aim is to have [the car] on the road, in serial production, in the first quarter of next year." He also confirmed that the cars will be shipped from India as gliders and fitted with TM4 drivetrains and SuperPolymer lithium batteries made under license from Electrovaya. Nenseth also said that Miljø expects to turn out about 1,000 cars in 2010 and as many as 5,000 in 2011. The ultimate capacity of the plant is expected to be about 5,000 EVs per year.

Developing the Indica Vista EV

Developing an EV from an ICE engine vehicle typically has to do with compromises in a number of key attributes such as ride, handling, interior space, build quality, safety and performance, says Dr Valerie Self, Senior Technical Specialist at TMETC, who worked on the Indica Vista EV.

"Interior space has been a particular problem. [But in our case], the Vista EV... has been particularly engineered to try and overcome some of these disadvantages," she told Hybrid-EV. Reports say the Tata EV will have power windows, power steering, air conditioning and central locking. This seems unlikely for the first round of vehicles to go on road. Such features place a high power demand on the vehicle's electrical systems – not a problem in an ICE vehicle, but in an EV they represent a considerable engineering challenge if a satisfactory operating range is to be maintained.

"One of the most challenging issues we're finding is how to set targets and how to make the product



attractive enough for a customer to purchase, balancing the trade-off between particular attributes. In reality, this depends upon the chosen mission for the product. For example, should this be a fully capable vehicle with minimum compromise that is comparable to an IC engined vehicle? If so, the target should be set using the normal strategy for competitive benchmarking. Or should the vehicle be targeted more towards niche applications? In this case, benchmarking may need to be against unconventional benchmarks such as alternative transport," says Dr Self.

The trade-off between range and weight also posed a challenge in the development of the EV. The graph (on the left) shows that adding extra battery weight increases the mass of the vehicle by a higher percentage than adding extra fuel tank capacity.

In an IC Vista, the petrol tank represents about 3% of the total curb weight. "So if you want to increase the range by 100%, it means increasing the curb weight by 3%. On the other hand, for the EV, the batteries represent about 20% of the weight of the vehicle. So if you want to increase the range, you would need to increase the curb weight of the vehicle by about 20% (not taking into account the implications of increasing weight on range)," Dr Self said.

Having said that, because there is an implication of increasing the weight, the increase in range is only about 90%. Another issue which Tata's EV designers are taking into account (and which applies to all EVs) is the capability of the electric motor. Performance targets need to be set not just for peak and continuous operation but also for the intermittent required performance of the motor. As Dr Self points out

"In order to know that you have correctly sized the motor, you need to decide on how much hill climbing you might need, how much overtaking capacity, and whether this is going to be continuous or intermittent."

Setting targets for both range and performance means that compromises have to be made. And for all the OEMs and their EV designers, deciding on what compromises customers are prepared to accept and what compromises they might not deal with in a finished vehicle, is a crucial activity. Time will tell whether Tata is able to achieve the right level of balance between performance, range and vehicle features.

Supplying to the Tata EV

The Indica Vista EV uses motors supplied by TM4 – a subsidiary of Hydro-Quebec. The motors use inverted rotor topology for maximum torque density. The motor has maximum power output of 120kW (37kW continuous) and 170Nm peak torque (60Nm continuous). The unit weighs 26kg, and has a maximum 4.6kW/kg power-to-weight ratio. The motor has a target of 96% efficiency at normal speed.

The Indica Vista complete electric drive system has an integrated power distribution unit and motor controller, and weighs 71kg.

One goal of TMETC's designers was to package the Indica Vista electric drive system within the envelope of an ICE base vehicle powertrain. They also wanted to package the battery in a way that minimises loss of interior space in a car. To meet these goals, the batteries are placed in slim packs under the floor to maximise space in the cabin and the electric motor sits under the bonnet and drives the front wheels as in the ICE-powered Indica.

In October 2008, Canadian battery supplier ElectroVaya joined hands with TMETC and Miljø Grenland to manufacture lithium-ion SuperPolymer batteries for the Indica EV. ElectroVaya became a 6% shareholder as part of the deal which also involved setting up a battery manufacturing plant in Norway.

Until the plant is ready for operations, Tata lined up a second supplier, Korean company Energy Innovation Group (EIG) to deal with immediate battery needs in November 2009.

The EIG contract envisions supply of up to two million large format cells and associated parts and services between 2010 and 2012. These cells will be ePLB C020 cells with a $\text{Li}[\text{NiCoMn}]\text{O}_2$ -based cathode and graphite-based anode and are optimized for applications in plug-in HEVs. According to EIG, the cells' specific energy is 175Wh/kg with an energy density of 370Wh/L.