### BATTERY SWAPPING MAY BE THE SOLUTION TO MAKING BATTERY OPERATED VEHICLES CHEAPER AND MORE ACCEPTABLE

# IIT-M centre charges up India for e-vehicles

Rajesh.C@timesgroup.com

Nestled in a nook inside the sprawling IIT campus, a team of engineers is working to find a comprehensive yet cheap solution for India's polluted mobility with e-vehicles.

The Centre for Battery Engineering and Electric Vehicles (C-BEEV), under professor Ashok Jhunjhunwala, has collaborated with several car and two/three-wheeler makers, battery manufacturers and motor makers to crack the e-vehicle market. "I expect significant breakthrough any time now," said Jhunjhunwala.

With the government thinktank Niti Aayog announcing plans for full electrification for three-wheelers by 2023 and two-wheelers with an engine capacity less than 150cc by 2025, the centre is turning out to be a beehive of activity. C-BEEV is working with Tata Motors, M&M, Ashok Leyland, Ampere, Lohia and Kinetic among original equipment manufacturers, with Amara Raja Batteries and Exide, on the battery front, and a few other companies for motors, he said.

Proposing a new solution — battery swapping — that will make capital costs cheaper, as batteries are the costliest part in the e-vehicle, the team says the concept is akin to the introduction of LPG in small cylinders in 1965 when the world chose expensive piped gas.

The problem is simple: Should we adopt the western style of strapping vehicles with large batteries and charge more or have smaller batteries and allow for battery swapping. "We are working on both. The alternative is not considered in nations where affordability is not a serious issue. Under the swap model, the vehicle weight is also reduced, enhancing the overall efficiency," he said.

When the battery runs out, instead of charging, it needs to be swapped at a place which has an inventory of charged batteries. This can be done in less than five minutes, the same time taken to refuel a vehicle at a gas station. Further, batteries may no longer be purchased reducing the capital cost of the vehicle. Instead, it is purchased by an "energy operator" who charges, swaps and leases out the battery to the user.

Battery exchange gives a taxi fleet two options: A small fixed battery that drives a particular range (of say 100km). The vehicle will also have a slot for additional battery, which the operator can use, should there be a long drive ahead. Study shows most private vehicles travel less than 95km a day. Second option is to lease the battery.

On the cost side, a conventional EV with a battery range for 300km would cost ₹14 lakh, while it would be ₹9 lakh under C-BEEV's model swapping model with limited powered battery. Without battery (leased from energy operators) the price would be down to ₹6.5 lakh. The operational expense (per km) for the conventional one with a full-range battery would be as cheap as ₹1.25 per km. In comparison, petrol-powered vehicles are ₹7 per km. EV with limited charge would cost ₹2.25 per km and one with leased battery would cost ₹4 per km.

There are issues though. Since the entire electric mobility concept is new, standardisation is difficult as each one wants to have control over what they do and own. "Over the next two years, everyone will start working towards standardising," Jhunjunwala said.

Pics: R Ramesh Shankar

**HUB OF IDEAS:** Differing capacities of battery being tested at the Centre for Battery Engineering and Electric Vehicles at IIT Madras; (right) an electric vehicle used for trial run at the campus


## 'Lobbies are preventing roll-out of technology'

Sindhu Hariharan & U Tejonmayam | TNN

At a time when government policies and subsidy frameworks for electric vehicles (EV) focus on large batteries and robust charging infrastructure, the Centre for Battery Engineering and Electric Vehicles (C-BEEV) at IIT Madras, under the guidance of veteran professor **Ashok Jhunjhunwala**, is testing out the technique of swapping batteries to help EVs go mainstream. In an interview, Jhunjhunwala says the government's goal of turning India into a 100% electric vehicle nation by 2030 is achievable, despite industry resistance and operational hiccups.


**■ Why is it important for India to go the EV way?**

India imports all its oil which significantly impacts our economy and trade balance. The idea is to find an alternative. Second, the country has 15 of the world's 20 most polluted cities, with increasing number of vehicles pollution is only going to rise further.

Further, battery prices have been falling, so mainstreaming of electric vehicles is inevitable. However, it is still more expensive than petrol vehicles. Other countries are trying to bring the cost down with subsidies, and we are trying to control it through innovations like battery swapping or smaller sized batteries.

**■ How can the country achieve maturity in the EV space?**

Worldwide, the culture is to use large batteries. For instance, Tesla gives a 500-km mileage on a single charge but the vehicle cost starts around $100,000. At this rate, only 0.2% of Indians can buy a Tesla. The only way we can achieve an affordable electric car is by making smaller batteries. At C-BEEV we are trying to do that and also give it range by adding the swapping feature. Whenever the battery drains out, it can be swapped with a charged one. If you have a two-wheeler with a 50-km range battery and you need to travel far, you can add a battery. It can be as simple as going to a petrol bunk.

**■ What are the challenges?**

The problem is that these things are not done internationally. Japan, Europe, China and the US work on high-end vehicles. We have to find our own solution. From a cost and distance standpoint, the Indian situation is different and we have to understand it.

The issue of standardisation is a big problem too. If you ask the government to do it, there's a risk of them favouring a particular methodology. We also don't want innovation to be stopped by standardisation. Let the industries do it independently. Once it emerges in the market, over time standardization will happen.

Our limitation is only in the mind. India has an advantage with its large consumer market. But, it has to be done as an entrepreneurial programme and not as a government one.

**■ But there is a strong opposition.**

Lobbies will always be at play. Some manufacturers don't want India to succeed as they will lose their stranglehold. The government should stick to its announcement on dates. The [auto] industry is trying to protect its existing business, which is natural, but they will change with time.

**■ Is the government's target for EVs achievable?**

The target of going electric by 2030 is definitely achievable. We are at an inflection point. Huge breakthroughs will happen now that the government is taking an initiative. There will be a few hiccups, but the direction is clear. New companies will come up and old ones will adjust.

**■ What is the push needed?**

The cost of materials like lithium, manganese, cobalt is the primary cost in EVs. If you take an old cellphone battery, you can recover 90% of these materials. All that we need is government direction and regulation. This means we don't have to be dependent on imports of lithium. There are more than 300 million used phones and if we can reuse them it is enough to get going. Every battery must be tracked and not wasted.

**Email your feedback to southpole.toi@timesgroup.com**

### POCKET-FRIENDLY GREEN RIDE

**Here is the approximate expense for e-vehicles with different battery options**

| | Conventional EV(with 300km battery range) | Without battery | With limited battery range of 100km |
|---|---|---|---|
| Electric vehicle cost | ₹14 lakh | ₹6.50 lakh | ₹9 lakh |
| Fast charging/ swapping time | 60 mins | 5 mins | 5 mins |
| Charging/swapping frequency for taxi | Rarely | 2 to 3 times a day | 1 or 2 times a day |
| Charging/swapping for personal vehicle | Rarely | Every day | Rarely |
| Running cost per km | ₹1.25/km | ₹4/km | 2.25/km |

**Cost per kilometre of a petrol vehicle ₹7**

Though non-polluting, these still have an environmental challenge. The batteries used in these cars, lithium ion, can be catastrophic if thrown away after use and not safely recycled. "Here is where we want the government to bring in a law. The owner of the battery should be responsible for it. Bar code it or provide cash incentives for battery recycling. Punish those who don't. This is an absolute must as battery recyclers can use the scrap," he said.

**REUSE, RECYCLE:** C-BEEV team member explains how battery swapping works