S Viswanathan

We can do it by 2030...

It is exhilarating to hear Dr Ashok Jhunjhunwala (AJ) of IIT-M that a paradigm shift to electric vehicles (EVs) is not just desirable but can certainly be done.

DELIVERING THE Dr. Y Nayudamma Memorial Lecture at the CLRI, AJ provided a development model for EVs tailored to the Indian conditions and different from the approaches of other more developed countries. True to his genius, AJ also provided an implementable roadmap over the short and medium terms.

A couple of years ago India announced a total switch to EV from 2030; but there was no visible activity on the ground. Except for the Mahindras which acquired the Reva Motors of Bengaluru, there was not much information on development works in progress. This contrasted with reports of hectic activity in China, Europe, and the US. Leading auto manufacturers like Toyota, General Motors, Ford, Volkswagen and Chinese manufacturers have been coming out with impressive plans on EVs. Particularly promising was the report from China forging ahead. EV two-wheelers seem to be ubiquitous in Chinese roads and the country gears to sell only EVs from 2025.

With the country depending on imports for more than 80 per cent of its petroleum requirement, India is in much greater need to switch to EVs. AJ pointed that out of the 20 most polluted cities in the world, 14 are in India. He also mentioned that EVs are four times more energy-efficient than petrol-driven vehicles and have 50 per cent less moving parts.

FOCUS ON AFFORDABILITY...

AJ pointed to the Indian conditions as different with two-wheelers, auto-rickshaws and e-rickshaws accounting for 84 per cent, buses for 3 per cent and economy cars 12 per cent of total vehicle population. India should attempt a leadership role in EVs. He said that unlike in the west hefty subsidies for the switchover are not possible. The focus must be on affordable cars. At present in the western model, the battery contributes to 50 per cent of the cost.

REDUCE BATTERY SIZE, GO FOR BATTERY SWAPS

AJ has a five-point agenda to reduce the battery size; without the range anxiety, opt for battery swaps instead of setting up expensive and elaborate charging centres, he said:

1) Split battery into a smaller size (1/3) and swap. No waiting time to charge battery, thus no public infrastructure.

2) Battery life severely affected by fast charging at 45 deg C.
   - The swapped battery can be charged in a conditioned environment and in two hours to maximise its life.

3) Separate vehicle business (without battery) and energy business (battery)
   - Capital cost is then similar to that for a petrol/diesel vehicle.
   - Operational cost same as petrol/diesel vehicle. With no subsidy but lower GST for three years.

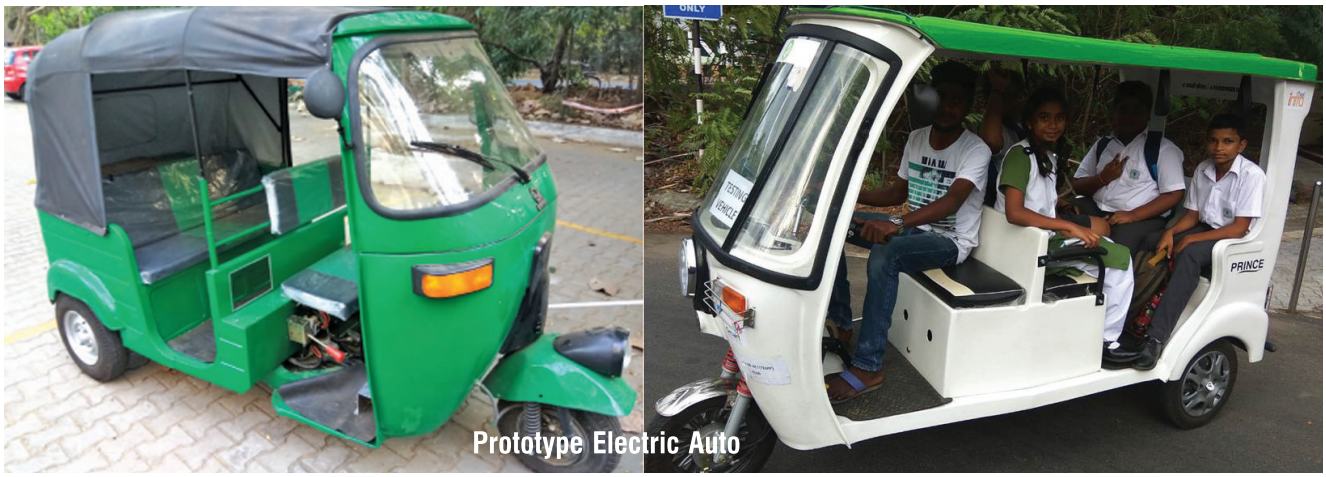
4) Higher efficiency Wh/km *vs* 9 km/litre of petrol) reduces battery size, weight and costs
   - For e-autos in last one year: from 70 to 80 Wh/km
   - E-buses: from 1600 Wh/km to 900 Wh/km

5) Drive volumes aided by public procurement. Batteries dominate the cost of an EV: Tesla the pioneer uses the battery with 540 km range
   - It also adds to the vehicle weight (lower energy efficiency). Smaller battery creates range anxiety

Suppose EVs have a small low-cost battery with limited range, it would make this affordable.

- Example: 100/50 km range for e-car/e-scooter. Enough within cities for 90 per cent of the days.
- Use only nighttime slow-charging that would maximise battery life.

Dr Ashok Jhunjhunwala, Lead, TeNet, IIT-M



Prototype Electric Auto

FOR LONGER DISTANCES...

When one needs to drive longer distances (only for 10 per cent of days), use a Range Extender battery to overcome range anxiety

- Swap-in second (swappable) battery doubling the range at a petrol pump (3 to 5 minutes)
- Swap the swappable battery again for still longer range (300 km or 400 km)

STRATEGY FOR EV BATTERIES...

AJ talked of the strategy for EV batteries. This consists of three segments:

1) **Battery pack development:** the thermal design, mechanical design and battery management system to get the best out of the low-cost cell as largely ready. Some 15 companies are engaged in the cell to pack manufacturing even in 2017. These account for 30 to 35 per cent of value addition.
2) **Battery cell development:** this may call for joint ventures with external tie-ups and will account for 30 per cent value addition. Cell manufacturing can start in 2019-20.
3) **Battery material development:** There has been great progress with battery recycling (urban mining); this will account for 40 per cent value addition.

- AJ pointed to India having little of lithium, manganese or cobalt. So battery recycling to recover 95 per cent of Li and Co and 93 per cent of Ni and Mn and 90 per cent graphite.
- India could import used batteries and become the urban-mining capital of the world for Li-Ion battery materials. These require scaling up.

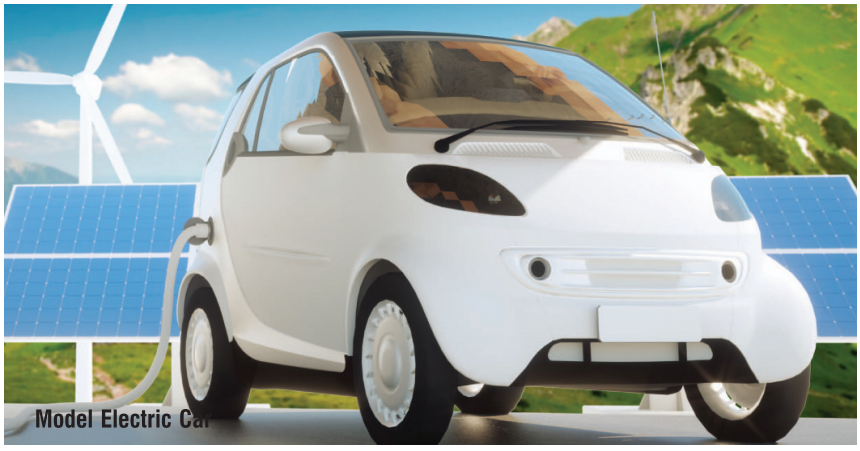
The focus should be on generating demand designing of appropriate policies.

At the IIT-M RP Chennai Demo 2019 an auto rickshaw, a scooter and small car pilots with battery swapping were displayed.

AJ said that electric three-wheeler with battery swapping will scale up soon.

In regard to two-wheelers that account for 78 per cent of all vehicles, EV would make the maximum impact and would require some innovation to scale up. (China has already succeeded in switching to electric two-wheelers in large numbers). Buses would still take time to scale. Battery swapping will emerge in 2019.

AJ also predicts the first signs of scaling of four wheelers by the end of 2019. By then, battery pack manufacture will start scaling up and battery recycling would encourage urban mining. AJ stressed the need to act fast as otherwise we should face the flooding of imports of EVs, batteries and end up in over-dependence on imports as experienced in petroleum products and solar PV cells.



Model Electric Car

There are welcome signs of the Centre funding a switch to electric buses for urban transportation. But these involve sizeable subsidies. AJ's model appears tailored to Indian needs and conditions.

Piyush Goyal as Minister of Power got AJ to shift to Delhi as an Advisor in the Power Ministry. This seems to have helped AJ shift focus from telecom and agriculture to EVs! His return to Chennai is a big help in working out the bolts and nuts of this futuristic mode of transportation. ■