Electric Vehicles in India: Transformative Potential

Senior Advisor to the Ministry of Power, Professor Ashok Jhunjhunwala explains how India can and is moving towards a future away from oil-powered vehicles

India today is on the cusp of a vehicular revolution. The Government of India has envisaged that by 2030, India will shift gears from diesel and petrol-run vehicles to 100 per cent electric vehicles (EVs). The government's vision encompasses a dramatic reduction in the use of petrol/diesel, a reduction in India's carbon footprint but most of all, it envisages an eco-system of indigenous innovation that will accelerate manufacturing and make possible electric vehicles in product and price specifications that suit India's unique environment. The acceleration of domestic manufacturing is a natural, positive corollary.

The felt need to shift gears towards electric vehicles can be traced back to the report "India Leaps Ahead: Transformative Mobility Solution", produced by NITI Aayog in collaboration with the Rock Mountain Institute. The report estimated a saving of $60 billion in petrol and diesel costs for India. The National Electric Mobility Mission Plan 2020 underscores this priority further. If delivered, the mission has the potential to bring about a paradigm shift in the automotive and transportation industry in the country. According to the Ministry of Heavy Industry, this 'road to 2020' is a culmination of comprehensive collaborative planning for the promotion of hybrid and electric mobility in India. This is through a combination of policies aimed at gradually ensuring a vehicle population of about 6-7 million electric/hybrid vehicles in India by the year 2020, along with a certain level of indigenisation of technology to ensure India's global leadership in some vehicle segments.

> Two key factors favour the acceleration of EV adoption in India: vehicular energy efficiency and vehicular reliability, both of which are considerably higher than in conventional motor vehicles

Technically, two key factors favour the acceleration of EV adoption in India – vehicular energy efficiency and vehicular reliability. The energy efficiency of a conventional motor vehicle is a mere 17-21 per cent. In the case of electric vehicles, it is close to 90-95 per cent. On the count of reliability too, if manufactured right, electric vehicles have 25 moving parts as against a mammoth 2,000 moving parts in conventional motor vehicles.

Among the most pressing drivers of this shift is vehicular pollution in India. On that count, clearly, EVs win hands down given the lack of tail-pipe emission. Plainly,, the core fuel – power – will still need thermal sources like coal. The government's focus on 'clean coal' at one end and renewable sources of energy at the other must then go hand in hand with the EV strategy. Current government commitment to expand the share of renewables should see as much as 40 per cent of total energy coming from renewables by 2030. Renewable sources of energy, however, demand adequate storage given the dependence on nature. Here too, whilst it will take time, prices of storage are dropping dramatically. In time, this will aid the 'cleaner' nature of transportation at a key end of the supply chain.

IS INDIA READY?

Despite the clear advantages, achieving the lofty targets set could still prove to be a mammoth task for a developing country like India. Several obstacles and roadblocks could come in the way.

Electricity availability and distribution: Get this right

The first is on the count of the fuel itself. How will a country like India, with several pockets severely plagued with electricity deficiency, be able to achieve a 100 per cent adoption of electric vehicles? Counter intuitively, however, electricity production is not really an issue in India - thermal plants in the country operate at an average

59.6 per cent rate of efficiency. In fact, for all the noise surrounding electricity availability, it is in the distribution of electricity that India faces severe hurdles. Here again, EVs, whilst they will draw upon the existing grid, will not create huge overloads. Estimates suggest that full conversion of transport to electric vehicles would utilise only 15-20 per cent of total electricity generation. As an alternative measure, rooftop solar plants may also be installed in order to generate needed electricity – all of India's EV needs as planned would take up just 0.07 per cent of India's total geographical area.

THE MORE IMPORTANT QUESTION: IS INDIA'S INDUSTRY READY?

Subsidies – an 'ask' re-engineered

The world over, it is a common practice for governments to provide subsides on vehicles. To quantify, the number ranges somewhere between 30-40 per cent of the total vehicular cost. For instance, Tesla receives around $15,000-20,000 of subsidy per car in the United States, where there are three kinds of subsidies at play. The first is the US federal subsidy (around $12,000). The second is the state subsidy, which varies in the range of $4,000-5,000. The final component is a form of cross-subsidy, which involves tradable certificates, which are worth $4,300. In the case of pure electric vehicles, these certificates are tradable. India's fiscal position and the government's justified focus on fiscal consolidation do not leave room for this kind of outlay. India then needs to embrace a solution that will see industry accelerate and sustain EV production without the provision of subsidies.

> Subsidies on electric vehicles are the most common way that governments the world over drive adoption. India's fiscal position does not allow this, so the solutions will have to come from elsewhere

Innovating for success: Energy efficiency…

The metric to measure energy efficiency of EVs is the watt-hour per kilometer (WhpK) of energy utilised. India's standards are weak on this count at the current juncture, standing at 75-80 WhpK for cars and a massive 1,600 WhpK for 12-metre long buses. Plainly, there is a pressing need for innovation and out-of-the-box thinking, but luckily, experts like Professor Ashok Jhunjhunwala bring precisely these qualities to their approach to the matter. He has stripped down every component of added cost (actual as well as during usage) to

identify areas of cost reduction and value creation. His exhortation of industry, then, is to improve:

- **Motor and physical body functioning** through using better motors more suited to India. Theoretically, this could lead to vehicular cost getting slashed by as much as 20 per cent, even as the cost of the motor might go up. Overall efficiencies including of batteries will override this easily. Quick analysis of a running vehicle reflected a motor at its most effective at 50 kmph and its worst at 25 kmph - the latter is the standard pace in India. Clearly then, motors set to overseas specifications (German or American of Chinese, where average speeds are much higher) will not suit the demands of the domestic environment. Better tyres, light-weighting and cleaner aero-dynamics will accelerate the savings further. Industry calculations and prototypes put in place since already reflect a downward swing from 80 WhpK to 40-50 WhpK for cars and from 1,600 to 900 for large buses. There is still a way to go but with these interventions, it is possible that the need for subsidies comes down from 40 per cent to 20 per cent, which can then be dealt with by innovating both product and operations in the battery and storage domain.
- **Storage.** The most expensive component of an electric vehicle is the stored power battery. Fortunately, the prices of batteries the world over have been declining steadily, and are expected to fall further in the future. Clearly, external dependence on other countries for a key fuel must be avoided. At the current juncture, technological leadership lies with the United States, Germany and China India from which India would need to import systems and sub-systems. No purpose is served – not of job creation, not of pricing and not of self-sufficiency.

> Industry must step away not only from its 'business as usual' mindset, but also from its instinct of 'compete or die'

Achieving a technological edge globally on this count is the fourth, higher aspiration. At the moment, India produces its own batteries - there are around 30 battery manufacturers in India, with Exide and Amara Raja being the most active on R&D spends in this area. With battery management systems (BMS), too, India has leapfrogged a number of other nations, including China. At present, however, the cells are still being imported from abroad. In order to circumvent this problem, India is now in talks with four of the foreign manufacturers with which India has agreements, to come and set up factories in India by 2019-20. Market opportunity itself should drive global industry towards India. (That said, cell-to-pack – which India does commendably - is also not just mere assembling. The pack is where the intelligence is because the vehicles require that every cell be monitored and examined carefully).

- **Battery charging options.** Both speed and scale of operations are impacted by the availability – or lack of – charging stations in an EV eco-system. Countries like Norway or Denmark have charging stations that use "fast charging technology". India must however think for itself – average temperatures beyond 40 degrees Celsius in the summer (and higher inside vehicles) nix this possibility. There is however a solution - "battery swapping", which involves industry innovation to split batteries into three equal parts and swapping them when required, i.e., substituting discharged batteries with fully charged back-ups. Another 20 percent cost saving can be achieved on this score alone.

...and new business models

Professor Jhunjhunwala's blueprint for success includes the creation of two different business streams – and thereby, the expansion of two different industry sectors. The cost of EVs would be dramatically reduced if vehicles were produced without batteries. Another industry altogether, one centred on battery provision (leasing) and service, would form the fuel component of the business – quite akin to the standard practice in conventional vehicles that use petrol/diesel. Driving volumes using public vehicles (get companies to buy vehicles in bulk and lease, buy batteries in bulk and set up energy businesses etc) could further reduce the dependence on subsidies.

All said then, if a perfect plan is adhered to – by industry through innovation and by government through facilitation in terms of needed infrastructure (parking/charging stations in massive bus depots etc), India could theoretically do without subsidies.

The ask then is of industry – first to step away from a 'business as usual' mindset and second, from the instinct of 'compete or die'. This change is potentially transformative for the nation at large. Industry will have to step forward to run R&D, to innovate, to think once again, like start-ups (many great ideas to the Ministry were in fact provided by start-ups active in this space), and re-engineer both processes and products as illustrated above. A start-up came up with the idea of recycling batteries from multiple sources where a technology will save

90 per cent of the lithium in batteries; a key raw material that India must import. Such ideation is the need of the hour on so many elements. Just as the impossible was re-thought on the count of motors and batteries, there remain many other milestones to tackle. Industry has now realised both viability and the fact that EV production would not entail an escalation of costs; in fact, it could lead to major savings and cost cutting. Equally, a major change like this must see collaboration across industry and not competition. A new path demands collaboration among pioneers. The fruits of this endeavor are multifarious.

THE ROAD AHEAD

Public vehicles will lead the charge

In terms of the roadmap ahead, India needs to envisage target-specific plans for each segment of vehicles. The beginning will be made by public vehicles where the government has the capacity to run interventions as needed. The focus is on:

- **Three-wheelers.** 50 vehicle, battery and sub-system manufacturers, aggregators and businesses have been contacted to enable the launching of 50,000 high quality e-rickshaws by the end of this year. Many Indian companies have sighted the opportunity and taken up the challenge. Put together, the fillip to industry is huge – the order itself will be to the tune of Rs 30-40,000 crores. A target of 1-3 million has been set for the next 18 months. Battery charging could happen through swapping, with a plan to set up 200 locations in a city.
- **City buses.** A target of 10,000 electrically-powered buses on the roads over the course of the next 15 months (starting January 2018) has been set. Most city buses make 8-10trips every day and travel not more than 30 km per trip. The race is on to produce batteries with a 500-km range and an option of swapping at trip-terminal points.
- **Four-wheeler taxis.** On average, taxis in India's metros ply around 200 km in a day. Whilst the total cost of ownership of EVs is comparable to today's petrol vehicle costs, the need of the hour is to increase an e-Taxi's range from 110-160 km by July 2018. A combination of fixed plus swappable batteries is a prospective plan. Taxi aggregators like Ola and Uber are coming in to play a role as demand drivers and user test cases.
- **Standardised public chargers** for each of the above that will enable scale are an important pre-requisite, which in turn, demand a business case. At the current juncture, Professor Jhunjhunwala's plans include working predominantly with NTPC and PGCIL on charging-cum-swapping vehicles in order to ensure 100 per cent reliability of electricity. Private companies will join as the entire exercise accelerates.

Clearly, these are calculations on paper and on prototypes thus far. Pilot test cases will determine the operational efficacy of these plans and there may well be an unknown upside as much as any downside. The government's thinking encompasses the entire vehicle eco-system; each kind will have its own requirements. Small vehicles for example - two/three/four wheelers - could use available chargers - Bharat Chargers AC-001 (for slow charging) and DC-001 (for faster charging) may be put to use. At Rs 1-1.5 lacs per charger, the cost is not prohibitive. In turn, a new service industry that will charge vehicles at a fee akin to STD PCOs, will spring up in response where both charging and swapping would be possible. Hypothetically, any shop with a rack can put up 25 batteries. Buses should be able to charge at depots and cars at parking lots, which must be equipped with chargers. The intent of the government is to launch in twelve cities as a prototype.

> Businesses will need to innovate massively, and also 'think' again like start-ups, re-engineering their processes and also their products. This will mean, among other things, looking at every component of added cost that goes into an EV

Looking forward, the emphasis should on building volumes in these early adopters in order to then also enable personal vehicles to take off and bring other vehicles such as long-distance buses and tempos into the purview.

Implementation of this transformation in a complex, densely populated country still in the early stages of its infrastructure build out will see teething troubles. Working out the economics of the EV industry is however the first, badly needed step to follow through on this vision. And that step has been taken. It now remains for industry and government to collaborate and continue to engage, solving one challenge after another - and for India's consumer, at the end of it all, to benefit – from cleaner air and cheaper transportation – in the very least. ■

This article is based on discussions of The India CEO and CFO Forum with Senior Advisor to the Ministry of Power, Professor Ashok Jhunjhunwala