Electric Vehicle Design Initiatives in India & some Case Studies

Abstract: The growing environmental consciousness and seeing the adverse effects of climate change, the governments in India are supporting initiatives for development of eco-friendly mobility solutions including electric vehicles. To offset the disadvantages of electric vehicles regarding range, weight and charging time, efforts have to be made to orient the use of electric vehicles to niche situations and niche markets where these limitations can be leveraged by design. Confined spaces like airports, industrial campuses, gated communities lend themselves easily to vehicle electrification. When the technology does not offer major physical constraints as in electric vehicles in comparison to the traditional vehicles, design criteria will have to be predominantly use oriented - psycho-physiological, cultural, contextual and environmental. The phenomenon / aesthetics of electric vehicles can be and should be quite different.

Keywords: Urban renewal, leveraged by design, vehicle electrification, Research-shy companies, physically pliable technologies, unique formal language

1. Policy

With the growing environmental consciousness and seeing the adverse effects of climate change, the Government of India and the governments of various Indian states are supporting many initiatives for the development of eco-friendly technologies, which can reduce the carbon footprint emanating from India. Regulation has become one of the prime factors driving this change. Energy audits have been made mandatory in large consumer units from March 2007. An energy-labeling programme for appliances was launched in 2006 and comparative star-based labeling has also been introduced. Recent signing of the agreement in Copenhagen on Climate Change, India is committed to pursue this policy aggressively Programme of Urban Renewal of the Government of India insists on energy efficiency, and increasing the use of cheaper lawmakers are offered to urban transport authorities. The National Solar Mission will promote the use of solar energy for power generation and other applications. Even Indian industry has taken up these issues seriously. Energy efficiency has become the top most agenda for Indian companies as well. Big automobile companies are developing electric vehicle technologies and/or buying smaller electric vehicle companies to prepare for the future. One such example is Mahindra & Mahindra recently bought Reva Electric car company from Bangalore.

2. The Challenge

Although first electricity driven car was driven in 1880s, it lost the race to gasoline-powered vehicles due to the deficiencies of range, weight and time of charging. Despite having great strides in technology in more than hundred years, the electric vehicle suffers from some problems even now. What is however encouraging is that serious thought is being given to address these issues. What we see often is that all vehicles running in the airport for ferrying passengers to and from the terminal could be electric vehicles. One can argue that aeroplanes obviate the need for such traffic. But then aeroplanes in the context of developing countries like India are available only in a few large cities. The rest is still dependent on gas guzzling. Carbon Dioxide emitting buses for ferrying millions of passengers across the airports all over the country. Although it seems obvious that we should have "electric ferry buses" on the airports, but I have not even seen one electric bus on any Indian airport, despite paying so much lip-service to pollution and carbon footprint by government, media and civil society. Not only buses, but all the vehicles at the airport could be electricity driven, which can include airport tow tractor, baggage and food trolley tow trucks, maintenance runabouts, crew vehicles etc. It could be a small but a very important beginning.

3. Strategy

As a strategy to make the electrical vehicles acceptable and usable, efforts can be made to design and orient the use of specialized electric vehicles to niche situations and markets, where these vehicles can have an edge over petrol driven conventional vehicles. This needs to be understood well. If the limitations of the electric driven vehicles are clearly defined, special vehicles can be developed. Special applications / special situations can become viable and common-place, thereby relieving the pressures on oil, environment (pollution), heat & carbon footprint.

The limitation of range can be understood, let us identify areas where range of a vehicle is not important. One such example is the airport. Airports have become an essential infrastructure of a city however small. Airports are highly traffic and surface vehicle intensive and therefore one of the most polluted area of a cityscapes. The phenomenon / aesthetics of electric vehicles can be and should be quite different.

4. Case 1

One case study was developed through a project for the Design of electric aircraft tow tractor. An aircraft tow tractor tows the aircraft from the runways to the farman or apron, and back. Presently it is a high fuel guzzling and polluting vehicle, which can include aircraft tow tractor, baggage and food trolley tow trucks, maintenance runabouts, crew vehicles etc. It could be a small but a very important beginning.

5. Education & Research

A New Masters and Doctoral level program was started from last year for education and research into ‘mobility’ and vehicle design issues at the Industrial Design Centre, IIT Bombay, to create a body of specialist vehicle designers, who can address the problems of future mobility in the country, and also to develop the research culture in this discipline. Special emphasis is given to eco-friendly vehicle design and research. Light weighting is a very important criterion for electric vehicles, to make them run cheaper and lighter. Another problem is that the wheels of a small electric vehicles are undertaken for situations like campuses, gated communities, industrial areas etc. But these electric vehicles are not necessary for transport and smaller ones are enough. Research is being conducted on lightweighting of these vehicles in ₹10 millions. Manufacturing of these is under consumption further. Integrated single unit reinforced plastic bodies for 2-wheelers and 4-wheelers are built and tested to achieve this objective. By designing ‘single-seat mini electric scooter’ and similar small vehicles, examples were created, and prototypes were developed to prove the concepts. These concepts can be adopted and developed by ‘research-shy’ companies for manufacture and marketing.

6. Design Integration

Integrating computer and communication technologies with electric vehicle can become a big driver for development. One such example can be the development of autonomous road trains, small tourist destination / architectural landmarks which are sensitive to pollution from high traffic during the season. Pollution free transport seems to be an imperative need. A project is being undertaken at IIT Bombay to develop a mobility facility at Elephant Island, a small tourist spot near Mumbai, for tourists who visit the ancient caves there. An autonomous mini road train running on battery bank charged through solar panels and following a ‘tour line’ is being contemplated. Besides being a facility for tourists, it offers an additional means of livelihood to the local community who are dependent on tourism. It is to be showcased as a prototype for mobility solution in small towns particularly the tourist towns.

7. Water in Pot Model

Traditionally the form or physiognomy of a product is dictated by the shape of the component, material linkages and their physical interference or fit. The emerging technologies are fluid in character, and therefore physically pliable. There is very little or no physical constraint of form. Water, like electric, can offer many fold advantages, which will be difficult to understand, compared to traditional products. The scope of design for electric vehicles is enormous, as it has to have weight (added through battery pack, particularly the newer polymer batteries are flexible and pliable). We have had similar difficulties in the past, for example, to get charged. The structure of this vehicle need not be complex. It could be as simple as a trolley with a trunk. In other words, the vehicle could be converted into advantage in this situation. It is to be showcased as a prototype for mobility solution in small towns particularly the tourist towns.

8. Unique Formal Language

Electric vehicles do not need the space for voluminous internal combustion engines or bulky gears. The prime movers in electric cars are built into the wheels, the battery pack, particularly the newer polymer batteries are flexible and pliable, and can be configured according to the availability of spaces and spread, and yet the electric vehicle simply looks like a sedan, or SUVs and even with ‘air vents’ in the front. The physiognomy of electric vehicles can be and should be quite different. What we see today in the USA and Europe is that Industrial Designers and stylists are struggling hard to invent a new formal language, which depicts the uniqueness of this breed of products. We have had similar difficulties in the past, when cars were made like horse buggies, and first TV’s were made to look like radios. With so much interest and so many people inspired to work in this area, discovery of a new identity / aesthetic breakthroughs for electric vehicles are not far off, as new conceptual breakthroughs are invariably driven by the development of new technologies which I believe have fairly matured and moved to post ‘failure stage’. The attempts in this direction are worth watching.

References:

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