ELECTRIC VEHICLE REVOLUTION:
ANOTHER SHIP THAT WILL BE MISSED BY PAKISTAN

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Background

Pakistan is very experienced in missing technology boats in time and repenting later, one more very attractive opportunity can also slip away unless we ENGINEERS TAKE AN ADVANCE NOTICE AND REACT TO CATCH THE TECHNOLOGY SHIP. Pakistan spent thirteen billion US Dollars on import of petroleum products during the year 2010. This expenditure is tremendous burden on foreign currency reserves that departs the country without directly adding to national economy. Major consumer of petroleum products are vehicles; therefore there is a requirement to develop new vehicles that have potential to reduce this drain on national exchequer. Most of the vehicles that are assembled in Pakistan, more specifically in Karachi Sindh, are made with imported assemblies from foreign countries as such industrial base as well as jobs related to manufacture of these assemblies are not available to Pakistani technicians & labor force. Most of capital earned by sale of hundreds of thousands of these vehicles are repatriated to the international owners of automobile companies. Whereas conversion of vehicles to CNG has created new drain on already strained reserves of natural gas while petroleum and CNG remain sources of pollution in cities, the adverse environmental impacts have to be addressed before they cause irreparable damage to the ecology in the country. There is therefore a requirement to reduce oil import bills, reduce repatriation of billions of dollars from sale of vehicles, enhance industrial base for manufacturing sub assemblies of vehicles, reduce stress on CNG consumption, reduce pollution in cities, provide hundreds of thousands of jobs, and reduce dependence on West. The current research article presents solution to this issue.

1. INTRODUCTION

The technologies involved in manufacturing in Electric Vehicles mainly include batteries, motors, drive transmission systems, brake system, steering system, vehicle lighting system, vehicle suspension system, wheels, tires and frame. Locally manufactured cars operating on petrol were introduced in Pakistani Market through Pakistan Automobile Corporation (PACO) a Government body. PACO was also tasked to ensure gradual deletion of components resulted in large indigenous manufacturing base in the country. That clearly highlights Public Sector Intervention in development of technologies backed by proper legislation. The presence of a dedicated Public Sector organization also resulted in confidence in sub contractors to fabricate components required by PACO indirectly resulting in influx of finances essential for development of any technology spread all over the country.

2. AUTOMOTIVE VEHICLE TECHNOLOGY BASE IN PAKISTAN

Most essential components of electric vehicle are batteries and motors and these are being manufactured on large scale by several manufacturers. Atlas, Exide (Chloride), Pakistan Accumulators (Volta) etc. All technologies associated with automobile manufacturing are available in Pakistan and are being used for providing maintenance support to existing vehicle fleet in all parts of the country. The infra structure for vehicle manufacturing can be seen by presence of large number of investors like Auto Air Conditioning Parts & Equipments Manufacturers; Auto Axles; Auto Body Fabricators; Auto Chassis; Auto Control Cables; Auto Electrical Parts; Auto Plastic Parts; Auto Radios & Stereos; Auto Rickshaw Manufacturers; Auto Safety Glasses; Auto Seat Fabrics; Auto Seat Manufacturers; Auto Spare Parts & Accessories Manufacturers; Auto Spare Parts Importers & Dealers; Auto Spring Leaves Manufacturers; Auto Starter Motors & Alternator Manufacturers; Auto Wheel Alignment & Balancing Computerized; Auto Wheel Alignment Equipment; Auto Wheel Rims Manufacturers; Automotive Consumable Products; Axle Components & Parts.

It can be safely determined that technology infra structure/ base exists in the country and it is only exploiting them through either a government body or a private sector investor friendly environment that they can be mobilized to form a cohesive team to convert Dream in to Reality.

3. CHANGE OF MINDSET

Whenever issue of vehicle manufacturing is highlighted mind directly jumps to high performance vehicles basically meant to meet the requirements of those who can afford luxury. The MINDSET has to be changed at the first instance; it is not fast cars that are being proposed at this stage, it is rather exploiting the low cost low performance section of auto rickshaw, black and yellow cabs, Vans, pickups, Auto rickshaws etc. The number of taxis & rickshaws registered in Sindh are shown in Figure-1 while motorcycles registered in Sindh are shown are shown in Figure-2. Both

show continuous increasing trend, specially motor cycles. Another example of Quetta city shows utilization pattern of Rickshaws as shown in Table-1.

Engines in these rickshaws/ motorcycles can be quickly replaced with electric motors and batteries to get rid of air and noise pollution without causing major discomfort to the consumers. An example each of electric motor cycles and electric rickshaw is shown in Figure-3 that can be made base to *DEVELOP ELECTRIC RICKSHAWS, LOAD CARRIERS, TAXIS, MOTORCYCLES AND VANS IN PAKISTAN to reduce gas load shedding, reduce oil imports and pollution.* An all solar electric car developed by students at College of EME NUST is shown in Figure-4.

4. ELECTRIC VEHICLE CHARGING INFRA-STRUCTURE

Charging infra structure of electric vehicle will be similar to CNG charging station that have rapidly grown in all cities and across major highways of the country. Depending on the distance travelled in one charge, type of batteries, size of batteries, recharging rates of these batteries, charging stations will have different shapes and mechanisms to charge batteries. A solar battery charging station developed in Pakistan is shown in Figure-5 while a modern rapid electric vehicle charging station is shown in Figure-6. Another concept very familiar in Pakistan is to replace batteries with charged batteries as is the practice with LPG vehicles where LPG cylinders are replaced with filled cylinders as shown in Figure-7. These will be a common picture soon in Pakistan and an excellent business opportunity for electrical engineers to start designing such charging stations. All existing battery charging shops can be first to promote the concept as they have the capability, infra structure, necessary human resource and knowledge. With the passage of time each house may have its own charging system just like UPS.

5. LAW TO ENFORCE ELECTRIC VEHICLE PRODUCTION

Investment in manufacture of electric vehicles will be facilitated with the introduction of a law to enforce electric vehicle manufacturing in the country. Just like PACO an Electric Vehicle Development Authority has to be created with clear mandate to ensure manufacturing of certain percentage of vehicle every year as under:

(1) All components of Electric Cars will be completely manufactured in Sindh.

(2) Electric cars will be introduced beginning from the year 2015 in such a way that following minimum targets will be ensured as percentage of the total production of automobiles manufactured in that year:

YEAR	MINIMUM TARGET
2015-	10%
2016-	12%
2017-	14%
2018-	16%
2019-	18%
2020-	20%

6. FINANCING

The Government should offer following incentives to ensure continued support to entrepreneur in this sector:

(1) Banks be encouraged to provide loans to down streams industries on easy terms and conditions to enable them to build up their business;

(2) Micro credit banks be entrusted to develop schemes to provide electric vehicles on easy installments to customers;

(3) No provincial taxes be imposed on equipment, machinery and raw materials needed for the development, promotion and implementation of electric vehicle for a period of 5 years extendable to 10 years;

(4) HEC/ relevant provincial body be requested to specially allocate research grants to initiate the required training schemes;

(5) All subsidies provided for petroleum be shifted to subsidize the electric vehicles by the year 2015;

(6) Provincial Government to facilitate land for Charging Stations.

(7) No import or dumping of imported electric vehicles, their sub assemblies or components be allowed till the year 2020;

(8) Notwithstanding anything contained in the Income Tax law in force relating to income tax, the entire business of development of electric vehicle shall not be liable to pay any such tax on its income, capital profit and wealth for a period of five years.

7. FUNCTIONS OF THE AUTHORITY

The functions of the Authority shall be as under, namely: -

(1) To develop provincial strategy, policies and plans for introduction of indigenous electric vehicle to achieve the targets approved by Sindh Government;

(2) to act as a forum for evaluating, monitoring and certification of sub assemblies of electric vehicles directly or through expert groups;

(3) to act as a coordinating agency for complete culture development of electric vehicles introduction in Sindh;

(4) to facilitate the Bill by setting up pilot projects on its own or through joint venture or partnership with public or private entities in order to create awareness and motivation of the need to take such initiatives for the benefit of general public as well as by evaluating concepts and technologies from technical and financial perspective;

(5) making legislative proposals to enforce use of electric vehicle all over the country.

8. CONCLUSION

An Electric Vehicle offers all the above advantages and can be developed and truly indigenized in a short span of time that will provide business opportunities to Pakistani investors, industrialists and jobs to designers, engineers, technicians, and labor; Complete manufacture of these vehicles in Pakistan in general and Sindh in particular, will ensure that all funds are kept in circulation in the economy of the Province;

Electric Vehicles are powered by and operate with the help of batteries that are being manufactured locally; Electric power is transmitted to wheels through electric motors that are being manufactured locally; Body and super structure, suspension systems, tires, tubes are already being manufactured locally; Electrical and electronic circuitry can be designed and developed locally; In all, these vehicles can be manufactured for light and medium size as well as for load carriers; Indigenization will keep prices at affordable limits while addressing all quarters of life and there use will reduce direct air pollution in cities.

Just like CNG stations these vehicles will be charged through Charging Stations using electricity generated through much more efficient power plants, these vehicles can also be charged using solar, wind and other renewable energy technologies specially in remote locations;

9. RECOMMENDATION

The Institution of Engineers along with Sindh Assembly have responsibility to provide guidance to the province and the nation to develop a technology that meets all above components of technology and infra structure support. As implementation of this proposal is envisaged to require a continuous prolonged effort and funds, it needs to have an appropriate organization to ensure its implementation in true spirit of indigenous manufacture. A Bill should therefore be proposed to the Government of Sindh to ensure all issues are addressed and legislation is available for smooth Introduction of Electric Vehicles in Sindh.

10. REFERENCES

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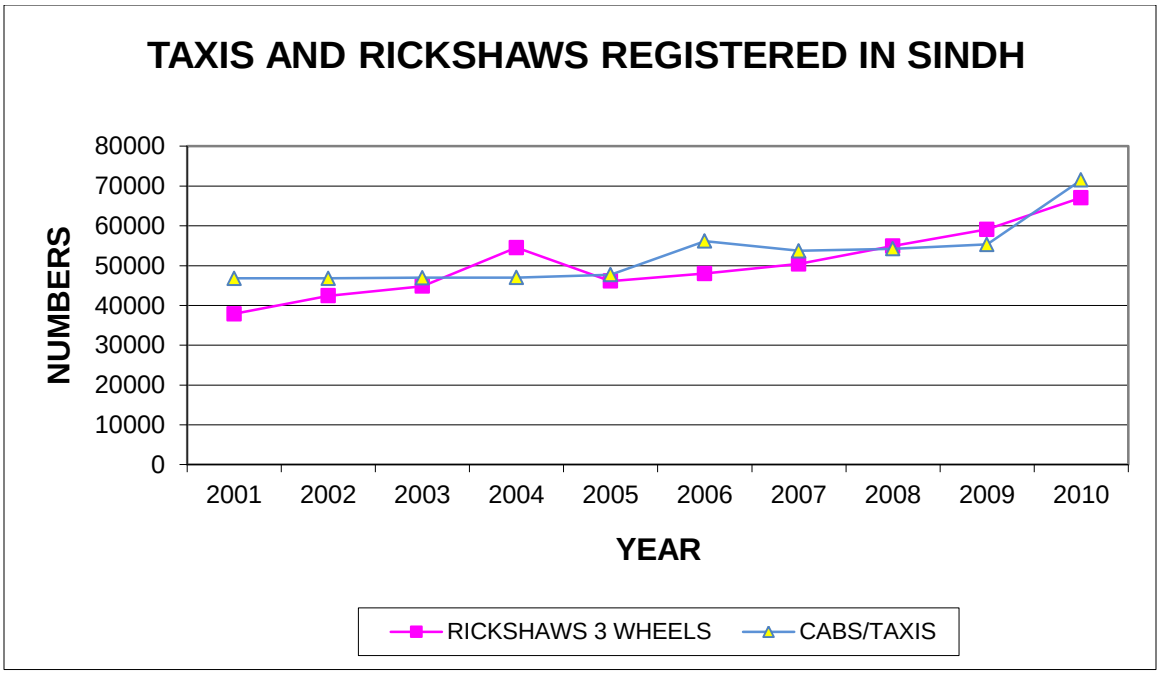

Fig 1. Growth trend of Taxis and Rickshaws registered in Sindh

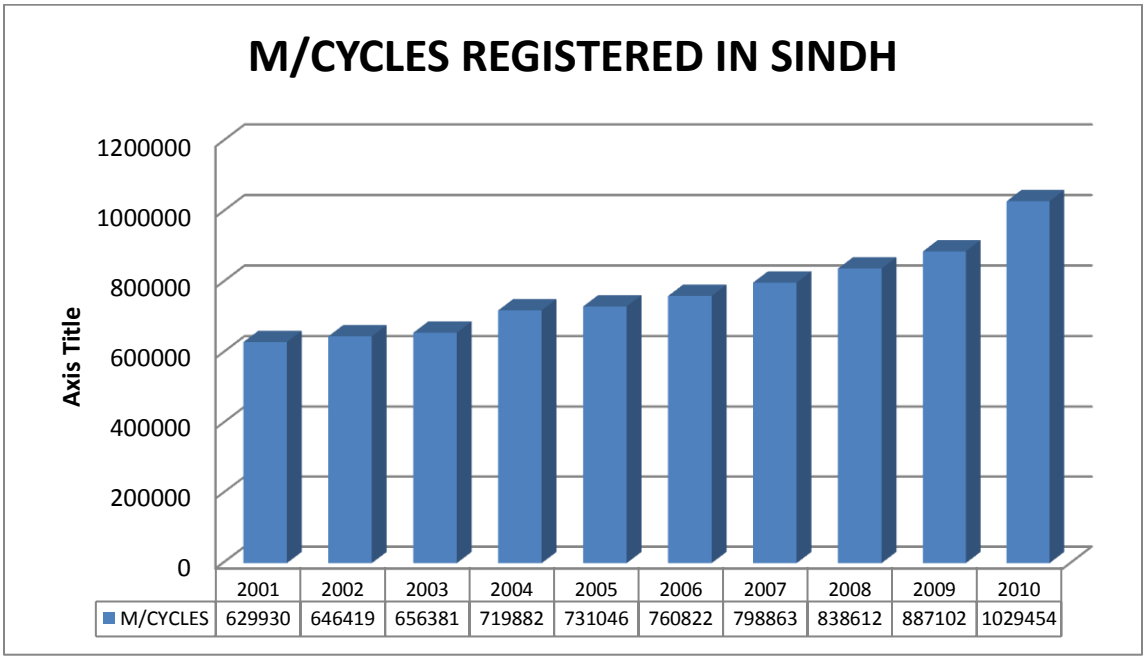

Fig 2. Growth trend of Motor cycles registered in Sindh

Fig 3. Electric car with solar trickle charging with an electric motorcycle

Research was Partially Funded by Volta Battery

Fig 4. Solar car designed by students at Solar systems lab, College of EME, NUST that can be improved for auto rickshaws

Views of solar battery charging station at College of EME in the year 1998

Fig 5. Several views of Solar Battery Charging Station in Rawalpindi

Fig 6. A modern electric Vehicle rapid charging station

Fig 7. An electric Vehicle charging station replacing batteries with charged ones

Table 1. Position of auto rickshaws in Quetta

Item	Quantity
No of Auto Rickshaws in Quetta	6,000
Average Daily Running:	200 km
Max run in one stretch	20 km
Average run in a stretch:	7 km
Average Time between stops	20 mins
Maximum Speed:	40 km/hr
Average Speed:	30 km/hr
Average no of Passengers:	4
Weight of Passengers:	180 Kg
Weight of three batteries:	105 Kg
Weight of Rickshaw:	200 Kg
Weight of Electric Motors:	100 kg
Size of batteries (10X10X8)	30X30X8 in
Capacity of batteries: (100 AH):	300 AH