

# Kathmandu Electric Vehicle Alliance

Prepared for

KEVA Secretariat under USAID/Nepal

Cooperative Agreement No: 367-A-00-02-00203-00 with PADCO, Inc;  
Washington, DC;

Final Report

## ANALYSIS OF HMG POLICIES AND REGULATIONS AFFECTING ELECTRICAL VEHICLES

*July 2003*

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Submitted by

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## EXECUTIVE SUMMARY

Pollution control, including air pollution through vehicular emission, has been a government priority at the policy level since 1992. Government strategies and action programs in subsequent plans and policy documents, however, have been very broad and limited mostly to formulation and implementation of vehicular emission standards particularly in the Kathmandu valley. Despite frequent attempts at framing environmental policies, strategies, and action programs, Nepal is yet to come up with a long-term national policy related to the control of vehicular air pollution. The regrettable situation today is that accumulated efforts over the years in this sector has only resulted in a build up of paper work with hardly any of the policy strategies, action plans and programs designed so far actually being translated into action.

The key legislations governing the control of vehicular emission are the Vehicle Transport Management Act (1993) and the Vehicle Transport Management Regulation (1997), Environmental Protection Act (1996) and Environmental Protection Rules (1997), Local Governance Act (1999), and the Fiscal Acts. The Industrial Enterprise Act (1993) has provisions for tax deduction for industries manufacturing goods and machinery for the reduction of pollution, and labels them as national priority industries.

The environmental legislations mentioned are very generic in nature, and describe general issues to be covered under the law, leaving all the provisions to be covered by Rules or Regulations and support guidelines under specific Acts. These supplementary Guidelines and Regulations under the Acts either remain to be approved or, if framed and passed, make no specific mention of the provisions required to prevent vehicular emission. Most of the legal provisions also either lack timely sector updates in accordance with other upcoming government policies, or consistent government policies and legislations for effective implementation and compliance.

The existing legal provisions have empowered four Ministries namely the Ministry of Population and Environment, Ministry of Labor and Transport Management, Ministry of Homes and Ministry of Finance and their line departments including local governments, to formulate and enforce vehicular pollution related policies, strategies, guidelines, standards, and action plans in their area of jurisdiction independently or in co-ordination. In spite of this, a periodic lack of co-ordinated action has resulted in duplication of activities, and conflicting interpretations of rules under the legal provisions.

While the promotion of pollution free vehicles has been repeatedly identified as a potential strategy for the reduction of vehicular emission, no mandates and targets, short or long term, have been specified at the policy level. Furthermore, the ambiguous nature of policies poses other obstacles to the favourable development of non-polluting vehicles. The term "pollution free vehicle" itself does not categorically indicate the overall pollution potential of vehicles; the lack of factual definition of what a pollution free vehicle is has in fact hindered the efficiency of many legal initiatives and implementation programs. As a result, existing policies and strategies promoting non-polluting vehicles have failed to take into account the environmental emission costs of such vehicles. In addition, the capital cost of imported fuel consumption by reduced emission vehicles is not accounted for by the current policies. In this light, the present policy of uniform custom subsidies and facilities like registration, roadworthiness certification, route and parking permits etc. for zero emission vehicles (EVs) and other low emission vehicles, is clearly not equitable environmentally.

There is no doubt that certain policy changes can bring about changes that increase the competitiveness and economic benefits of EVs. The recently recommended phasing out of polluting vehicles and replacement by EVs offers some long-term direct and indirect benefits. Of the direct benefits, the most noteworthy is the potential development of a national industry that will use Nepal's abundant water resources. Furthermore, amplified expansion of the EV industry would mean a reduction of petroleum imports, resulting in a positive contribution to

both the national current and capital accounts. The environmental benefit from increased use of EVs also offers a major benefit of local and ultimately global significance. Unfortunately these indirect benefits are usually not taken into account in the common market.

The necessity of implementing an assortment of policy measures directly correlated with the market economy is imperative in order to enable EVs to compete with other vehicles in direct economic terms. A subsidy and pollution taxing policy on the basis of environmental justice (polluters are made to pay and non-polluters are rewarded) is a viable option from among the alternatives offered by the existing policy. While these measures provide an edge in EV induction and marketing, complementary policies to support EVs are essential in order to reinforce the competitiveness of EVs in the open market. Judicious utilisation of the Environmental Tax collected from vehicles and fuels to promote EVs can help increase the competitiveness of EVs. Another factor to ensuring assertive EV induction and marketing would be to support the research and development of EVs to increase vehicle efficiency, reduce operation costs and provide soft loans and free parking.

In conclusion, protection policies are effective in the initial stages of marketing but without education and awareness building among the general mass, it can be counterproductive. Replacement policies, though they sound better, are sometimes very costly. Instead the provision to restrict registration of polluting vehicles could be as beneficial provided that compulsory retirement of vehicles after 10, 15 or 20 years of operation is implemented for all types of vehicles, at least in the public transport sector.

## **ACKNOWLEDGEMENTS**

We would like to express our gratitude to KEVA/WINROCK for entrusting us with the task of preparing the Report on Analysis of HMG Policies and Regulation Affecting Electrical Vehicles. Particular thanks are due to Mr. Bibek Chapagain, KEVA In-Country Coordinator, PADCO, Mr. Ratna Sansar Shrestha, FCA, Senior Advisor, Winrock International-Nepal, and Mr. Bikash Pandey, Winrock International, Nepal for providing the background information and other documents, which were of considerable help in the preparation of this paper.

We have benefited greatly from discussions on aspects of the Electrical Vehicles and related policies and opportunities with a number of eminent individuals, and officials in various capacities, among them Mr. Chiranjibi Gautam, Advisor ESPS/MOPE, who generously shared with us his ideas and opinions. We would also like to thank all the other individuals whose names are not mentioned here for their time and input.

## ABBREVIATIONS

ADB	Asian Development Bank
AFV	Alternative Fuel Vehicle
BEVC	Bagmati Electrical Vehicle Company
CLEAN	Clean Locomotive Entrepreneurs' Association of Nepal
CNG	Compressed Natural Gas
CO	Carbon-monoxide
DANIDA	Danish Development Agency
DHM	Department of Hydrology and Meteorology
DOTM	Department of Transport Management
EIA	Environmental Impact Assessment
ENPHO	Environment and Public Health Organisation
EPA	Environmental Protection Act
EPR	Environmental Protection Rules
ESPS	Environmental Sector Programme Support
EV	Electrical Vehicle
EVAN	Electrical Vehicle Association of Nepal
EVCO	Electrical Vehicle Company
EVDG	Electric Vehicle Development Group
EVMAN	Electrical Vehicle Manufacturers Association of Nepal
EVMAN	Electrical Vehicle Manufacturers Association of Nepal
FY	Fiscal Year
GHG	Green House Gases
Gm.	Gram
GREV	Green Electrical Vehicle Private Limited
GRI	Global Resources Institute
HLF	Himalayan Light Foundation
HMG/N	His Majesty's Government, Nepal
IEE	Initial Environmental Examination
IOC	Indian Oil Corporation
IUCN	The World Conservation Union
KEVA	Kathmandu Electric Vehicle Alliance
kg	Kilogram
KL	Kilo Litre
km	Kilo meter
KVVECP	Kathmandu Valley Vehicular Emission Control Program
KWh.	Kilo watt hour
LPG	Liquid Petroleum Gas

lt.	Litre
MPTS	Mass Public Transport Service
MOLTM	Ministry of Labour and Transport Management
MOPE	Ministry of Population and Environment
NEA	Nepal Electricity Authority
NEPAP	Nepal Environmental Policies and Action Plan
NESS	Nepal Environment and Scientific Services (Pvt) LTD
NEVCA	Nepal Electrical Vehicle Charging Association
NEVI	Nepal Electrical Vehicle Industry
NGO	Non-governmental Organisation
NO <sub>2</sub>	Nitrogen Oxides
NOC	Nepal Oil Corporation
NRs	Nepali currency Rupees
P&D	Promotion and Development
PADCO	Planning and Development Collaborative International
PARs	Policies, Acts, and Regulations
PM <sub>10</sub>	Particulate Matter less than 10 micrometer
PM <sub>2.5</sub>	Particulate Matter less than 2.5 micrometer
R&D	Research and Development
SDAN	Sustainable Development Agenda for Nepal
SO <sub>2</sub>	Sulphur dioxide
TOD	Time of Day
TOR	Terms of Reference
TSP	Total Suspended Particulate Matter
ug/m <sup>3</sup>	Microgram per cubic meter
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United State Agency for International Development
VAT	Value-added Tax
VTMA	Vehicular Transport Management Act
WHO	World Health Organisation
yr	Year

## TABLE OF CONTENT

	<u>Page Number</u>
EXECUTIVE SUMMARY.....	I
ACKNOWLEDGEMENTS.....	III
ABBREVIATIONS.....	IV
TABLE OF CONTENT .....	VI
1.0 INTRODUCTION.....	1
1.1. Background .....	1
1.2 Objectives of the Study.....	1
1.3 Scope of the Study .....	2
1.4 Study Methodology.....	2
1.5 Study Limitation .....	3
2.0 THE CONTEXT - WHY ELECTRICAL VEHICLES.....	3
3.0 ELECTRICAL/BATTERY-OPERATED VEHICLES IN NEPAL.....	4
4.0 REVIEW AND ANALYSIS OF GOVERNMENT POLICIES, STRATEGIES AND PRIORITIES .....	7
4.1 Review of Government Policies, Strategies and Priorities .....	7
4.2 Analysis of the Government Policies, Strategies and Priorities .....	11
5.0 REVIEW AND ANALYSIS OF THE LEGAL AND ADMINISTRATIVE FRAMEWORK.....	12
6.0 INCENTIVES FOR CLEANER VEHICLES IN SOME OTHER COUNTRIES.....	14
6.1 Incentives in Other Countries .....	14
6.2 Comparison with Nepal .....	16
7.0 ECONOMIC AND FINANCIAL COST BENEFIT ANALYSIS OF POLICY CHANGE.....	16
7.1 Policy Change Replacement of Petroleum/LPG Based Vehicles to Electrical Vehicles/or Elimination of Petroleum/LPG Based Vehicles .....	16
7.1.1 Savings from Imported Petroleum Products .....	17
7.1.2 Expenditure from the Import in the National Current/Capital Account.....	18
7.1.3 Use of National Indigenous Energy and Maximisation on the use of the Off Peak Electricity Energy which Otherwise is a National Loss.....	19
7.1.4 Local Employment Generation.....	20
7.1.5 Reduction of Emission, Particularly PM Fraction and Related Economic and Social Costs. ....	20
7.2 Policies Change in Electricity Tariff .....	21
7.3 Policy to Operate EVs only in some of the Priority Routes/Areas/Government/Institutions	23
7.4 Policy Change on Pollution Tax to Polluting Vehicles.....	23
7.5 Policy Change in Battery Procurement .....	24

7.6	Policy Change in Subsidies .....	25
7.7	Policy Change in Soft Loan and Parking Fees.....	26
7.8	Policy Change in R&D .....	26
7.9	Adverse Impacts of Policy Change Measures If Any .....	27
7.10	Conclusive Remarks.....	27
8.0	RECOMMENDATION FOR POLICY CHANGE.....	28
8.1	Basis for Specific Policy on Cleaner Vehicles .....	28
8.1.1	Environmental Basis .....	28
8.1.2	Impact of Pollution on Public Health and Economy .....	28
8.1.3	Economic Basis.....	28
8.1.4	National Development and Environmental Objectives.....	29
8.1.5	International Commitment.....	29
8.1.6	Inconsistency in Implementation of Policy .....	29
8.1.7	International Practices.....	29
8.1.8	Standards Enforcement Difficulties .....	30
8.1.9	Environmental Damage Cost not in Operational Cost .....	30
8.1.10	Environmental Responsibility of Central/Local Governments and Other Institution ...	30
8.2	Proposed Policy.....	30
8.2.1	Policy Objective.....	30
8.2.2	Policy Strategy .....	31
	REFERENCES .....	34

## Annexes

Annex - 1 Ambient Air Quality Status of Kathmandu Valley

Annex - 2 Route Permits, Name of the Routes and Number of Different Types of Mass  
Transport Vehicles in operation in Kathmandu Valley

Annex -3 Review of National Policy Documents

Annex - 4 Review of Legislation

Annex - 5 List of People Contacted

## **1.0 INTRODUCTION**

### **1.1. Background**

Rapid increase in vehicular traffic, poor traffic management, Nepal's fleet of sub-standard vehicles and low quality fuel, as well as ineffective control of emissions have been the major contributors to the country's escalating air pollution problem. As a result, negative health impacts to the residents of urban areas, along with the attendant problems of productivity loss and increased health expenses are on the rise. Those who suffer most from the impacts of air pollution are children, youth, and elderly people. In addition, poor air quality has also had an adverse impact on the economy through the negative impacts of pollution on tourism.

Given that air pollution is ever rising, it is high time the government formulates and implements a policy to abate pollution levels. A government policy that helps to mitigate vehicular emission pollution while simultaneously providing support to improve human health and increase government revenue would be ideal. In this regard, expansion of "clean", specifically zero emission vehicles in the city's transport system has the potential to improve the air quality

EVs are particularly suited to Nepal as they are largely locally assembled and their fabrication results in a substantial increase in employment at the local level. In addition, electric vehicles utilize nationally generated hydro-electricity as fuel, thereby reducing the nation's need for imported oil and foreign exchange expenditure. In the case of battery-powered EVs, the Nepal Electricity Authority (NEA) benefits even more by being able to sell currently wasted off-peak electricity to the electric vehicle charging stations.

In this context, the Kathmandu Electric Vehicle Alliance's (KEVA) endeavour to promote EVs is commendable. KEVA is working to improve the air quality of Nepal in general and the Kathmandu Valley in particular, by promoting the extensive use of electric vehicles in both public and private transportation. KEVA promotes the use of three and four wheeler electric vehicles, which produce zero emissions as a positive intervention to reduce air pollution.

A larger role of EVs in the transportation sector will contribute towards the reduction of vehicular emission, which is a significant contributor of urban air pollution. The successful promotion of Electric Vehicles (EVs) however, depends primarily on favourable government policies.

This study report on "Analysis of HMG Policies and Regulations Affecting Electrical Vehicles" prepared by the Nepal Environmental and Scientific Services (P) Ltd. (NESS) for the KEVA, is a step toward providing policy and regulation recommendations to His Majesty's Government of Nepal for the constructive promotion of EVs.

### **1.2 Objectives of the Study**

The broad objective of the study is to analyse the existing government Policies, Acts, and Regulations (PARs) pertaining to the introduction and expansion of EVs in Nepal and to identify the key policy changes needed to make a positive impact on the promotion of EVs in Kathmandu.

### 1.3 Scope of the Study

The scope of the study was based on available information viz. HMG/N policies, acts and regulations to the transport sector focusing on electric vehicles and the available information published in research papers and reports with regard to EVs.

As stipulated in the Terms of Reference (TOR) the scope of study area was confined to the Kathmandu valley. The scope of work included but was not limited to the following:

1. List and provide a brief description of all HMG/N Policies, Acts, and Regulations (PAR) that affect the electric transportation sector, including but not limited to Trolley Buses and three-wheel Safa Tempos. This list should include customs duties, pollution tax, emissions standards including Euro classifications, route allocation, vehicle signage regulations (or lack thereof) and other PARs that apply to electric vehicles as well as to buses, mini-buses, microbuses and LPG tempos, which compete on the same routes as EVs.
2. Analyse those Policies and Regulations and identify changes that would have positive impacts on the promotion of EVs in Nepal, including public health, environmental and economic benefits and mandates. Also identify any adverse impacts might have on other industries or groups and thus oppose the change.
3. Provide an economic and financial cost-benefit analysis of these key policy changes. Illustrative areas included are:
  - Policies to promote R&D for EV vehicles;
  - Policies to promote local industries for EV support and infrastructure (vehicles, batteries);
  - Policies that affect battery access (purchase/loan);
  - Policies for EVs to access special electricity tariff set aside for the transportation sector and through Time of Day metering;
  - Policies to reduce costs and increase efficiency of EVs and supporting industry (taxes on competing vehicles, customs duties; pollution tax, soft loans, etc.);
  - Policy for conversion of petroleum-based vehicles to electric and/or elimination of petroleum-based vehicles;
  - Policies to assign service on certain routes and parts of the municipalities exclusively to EVs; and, municipal regulations for painting and advertising to clearly distinguish EVs from other vehicles.
4. Compare other policies and regulations in the region (India) that promote the development of EVs and clean air transportation alternatives.
5. Identify the highest priority policy changes for HMG/N to consider based on the analysis of regulations, possible changes and their impacts and the cost-benefit analysis.

### 1.4 Study Methodology

The study was fundamentally based on the review and assessment of His Majesty's Government policies and legislation related to air pollution in general and transport management in particular. The study relied heavily on the contents of published and unpublished secondary literature on EVs in Nepal to fully appreciate the problems and opportunities of the EV sector. Only limited first hand information has been collected in order to unravel some of the current issues in the sector. The informal meetings and discussions with the stakeholders in this sector have also been instrumental in streamlining some of the current issues.

## 1.5 Study Limitation

The reliance of the study on secondary information was a major limitation, particularly in the cost benefit analysis of policies. A number of discrepancies were noted in the secondary literatures; the team has tried to the utmost to rectify such discrepancies. However, time and resource constraints meant the study group occasionally had to compromise in the amendment of secondary data.

## 2.0 THE CONTEXT - WHY ELECTRICAL VEHICLES

Though the fraction of population living in the urban centres of Nepal is less than 15%, poor infrastructure, haphazard urban expansion and inadequate support services (including transportation) have made urban centres "pollution hot spots" comparable to the most polluted urban centres of the world. Pollution, particularly air pollution related to vehicular emissions, is increasing day-by-day; this is largely due to the presence of numerous old and ill-maintained vehicles. The combination of these ill-tuned vehicles with the profusely adulterated fuel sold here is polluting the air quality of urban centres beyond speculation. Another factor contributing to escalating air pollution is the fact that the number of vehicles in the urban areas is increasing at a pace of over 15% /annum, particularly in Kathmandu valley.

A case study of the Kathmandu Valley (*Annex - 1*) indicates an increase in vehicular exhaust related PM10 emission by about 74% in 2001 compared to 1993. Vehicular sector PM10 contribution to the total PM10 emission in Kathmandu valley has correspondingly increased from 12% in 1993 to about 28% in 2001.

Recent monitoring of PM10 and PM 2.5 in the city centre of Kathmandu, Lalitpur and Bhaktapur indicates PM10 and PM 2.5 levels to be well above WHO guideline values (*Annex - 1*) for all the days monitored (measured by a time series monitoring device). These PM data are extremely alarming, given the fact that an increase of the vehicular population will mean a proportional increase in the PM scenario.

Poorly maintained vehicles, adulterated fuels and weak enforcement of standards (vehicular emission and fuel quality) are the key factors influencing the increase in vehicular PM. The smaller the size of PM the more aerodynamic it is. The aerodynamic quality will allow it to remain airborne for a longer period of time. Furthermore, the smaller the size of PM, the greater the hazard to health is as these particles (because of their small size) can penetrate deep into the lungs. Therefore the smaller the size of PM the greater its economic and social costs particularly related to public health. More than 90% of vehicular PM are smaller than 2.5 micrometers. Therefore vehicular emissions are very harmful to public health.

The PM fraction of vehicular emission is directly related to the fuel used. Apart from EVs, all vehicles in Nepal run on fossil fuels. Petroleum, diesel and LPG gas are all imported commodities; these fuels expend more than 50% of the national development budget. It is clear that by consuming such fuels in the transport sector, the nation is not only diminishing its foreign currency reserve, but is also inflicting detrimental effects on public health through the resultant air pollution.

EVs are particularly suited to Nepal as Nepal has enormous potential for hydroelectricity generation. Vehicles using electrical energy do not emit pollutants and are zero emission vehicles. Besides, battery operated electrical vehicles provide an opportunity to store surplus electrical energy in the off peak hours and use later in the peak hours. This has the added advantage of utilising energy otherwise discharged. Currently Nepal has surplus electrical energy particularly in the off peak hours. Nepal's power generation is mostly based on run off the river hydroelectric power. Unfortunately, the Nepal Electric Authority (NEA) has not been able to fully utilize the electricity generated during off peak hours. Electrical vehicle could use NEA's off peak energy to provide clean transportation and thus mitigate urban air pollution. As this is a form of clean renewable energy, the use of hydroelectricity in the transport sector can mitigate air pollution, saving public expenditure on air pollution related health problems.

Instead of focusing only on control measures for the reduction of vehicular emissions (vehicular emission standards, vehicle standards, fuel quality standards etc.), preventative measures, such as elimination of air pollution as a whole, also needs to be considered. EVs stand to benefit the country by utilizing Nepal's indigenous hydroelectric energy. Furthermore, the positive effects on public health through mitigation of air pollution have the potential to save health care costs and contribute to the quality of life of Nepalis. EVs should be considered as one of the preventative options that can be effectively enforced and implemented. .

### 3.0 ELECTRICAL/BATTERY-OPERATED VEHICLES IN NEPAL

The first electrical transport to operate in the kingdom of Nepal dates back to the early 1960's. The Hetauda-Kathmandu Ropeway established under US assistance was used for the transportation of goods into and from the Kathmandu valley. HMG/N and the Peoples Republic of China's 1974 pact to introduce EVs as mass transport established the "Trolley Bus" in Nepal. The Trolley bus system along the 13-km route in the Kathmandu valley between Tripureswor and Surya-Binayak came into operation in 1977 with a fleet of 22 buses.

The 1989 -1990 trade embargo imposed by the Government of India on Nepal restricted the entry of fossil fuels into the country and conjured up the charm of developing vehicles run on the national energy source - hydro-electricity. The EV industry gained momentum after a group of enthusiastic engineers working as the Electric Vehicle Development Group (EVDG) to convert an old car into an EV. In 1992, the group successfully converted the car into an EV.

Following the EVDG success, Kathmandu Municipality requested USAID in 1993 to assist the municipality develop an electrical vehicle industry suitable to the Kathmandu valley. The Global Resources Institute (GRI) under the Electric Transportation Program for Kathmandu Valley began a program that aimed at developing EVs as a profitable industry in the transportation sector.

GRI conducted the initial R&D on a three-wheeler electrical vehicle. A total of 7 diesel fuelled Vikram tempos were converted into EVs and renamed "Safa Tempos". GRI tested and demonstrated the 7 Safa Tempos for about 6 months to gain experience regarding the performance and economy of EV operation in Nepal. Satisfied with the performance and economy of the Safa Tempos, GRI proposed a conversion program to replace all the diesel and petrol operated three wheelers in Kathmandu.

In early 1996, at the end of the GRI run pilot project,, a group of Nepali professionals and entrepreneurs bought the 7 EVs and soon developed expertise in EV production. By 1996 three EV manufacturers namely, Nepal Electrical Vehicle Industry (NEVI), Electrical Vehicle Company (EVCO) and Green Electrical Vehicle Private Limited (GREV) started production of Safa Tempos in the Kathmandu valley. The Finance Act 1996/1997, which had provisions for low import duty on the component of electric vehicles, promoted the EV manufacturers. By 1999 two additional EV manufacturing industries, namely Green Valley Electrical Vehicle (GVEV) and Bagmati Electrical Vehicle Company (BEVC) were also involved in EV production. In 1997, a contract between His Majesty's Government and the Royal Danish Government was signed to convert 100 diesel tempos into EVs within four years and to support the establishment of charging stations; this was a big encouragement to the EV industry. Unfortunately, the Danish conversion program could not be implemented as designed due to high conversion costs. However, the program succeeded in assisting the EV sector by providing soft loans (up to 70%) to establish two battery-charging stations in Lalitpur and also assisted MOPE in providing soft-loans to 48 entrepreneurs to purchase EVs. These 48 electrical vehicles are now serving various routes in Kathmandu Valley.

Since then, about 664 EVs (Safa Tempos) have been manufactured locally. Table 3.1 presents total number of EVs manufactured and sold by the EV industry from 1996 to 2002.

**Table 3.1: Total Number of EVs manufactured by EV Industries**

EV company	Total Sales
Nepal Electrical Vehicle Company	225
Electrical Vehicle company	282
Green Electrical Vehicle Pvt. Ltd.	80
Green Valley Electrical Vehicle	63
Bagmati Electrical Vehicle Company	14
Grand Total	664

Till 1999/2000, Nepal's EV industry was progressively gaining ground in the mass public transport services in Kathmandu and in some towns of the Terai – namely Biratnagar and Narayanganr (Bharatpur). But after 1999/2000, things took a different turn as clearly reflected in the sales record of EV manufacturers. Of the total number of EVs manufactured, 43% were manufactured before 1999/2000, 55% during 1999/2000 and only 2% after 1999/2000. The key reasons for this setback in the promotion of EVs (Safa Tempos) were:

- Lack of objectively defined policies for the promotion of Zero Emission vehicles
- MOPE's recommendation to provide a special customs tariff to owners of the banned Vikram Tempos toward the import of LPG/petrol/diesel minibuses. This tariff was almost on par with the special custom tariff extended towards the EV industry.
- Minimal attention on quality control of EVs and training of the charging station personnel and operators during the 1999/2000 boom period. This resulted in very short battery life.
- Indiscriminate route permission by the Transport Management Office to all kinds of vehicles without considering the environmental cost of polluting vehicles
- Fierce competition between EVs (Zero emission vehicle) and other polluting vehicles
- The comparatively high EV fares lead to passengers opting for other polluting vehicles instead
- Lack of government financial support for R&D in EVs to make them technically and economically viable
- Restrictions imposed on the registration of vehicles of that provide mass public transport. This included the EVs as well.
- Weak networking of EV manufacturing group, EV charger group and EV operators.

In spite of the above barriers, EVs (Safa Tempos) currently constitute about 13% of the mass public transport service of the Kathmandu valley (Table 3.2). This may be the highest percentage of battery-powered commuter electric vehicles in any urban centre in the world (Markus Eisenring, 2000). Safa Tempos of the Kathmandu valley provide services to over 3.5 million people in a year (Devtech, 2002, CEN 2002). The Safa Tempos are currently operational in 39 routes in the Kathmandu valley (*Annex - 2*). Some EVs are also being operated in the government and private sector (such as MOPE, Trans Himalayan Travels and Tours (Pt) Ltd Radio Sagarmatha, Royal Danish Embassy, Nepal Telecommunication Corporation etc). Despite the promising benefits offered by EVs, however, without adequate steps (policy and economic incentives), the future of Safa Tempos of Kathmandu valley is doubtful.

**Table 3.2: EVs (Safa Tempos) in Relation to Other Vehicles in Mass Public Transport Service in Kathmandu Valley**

Type of Public Transport	Total Routes	No of Vehicle	% of vehicles
Bus and Mini Bus	21	1896	46.46
Microbus Ring Road and outside	4	207	5.07
Microbus Ring Road and inside	18	624	15.29
EVs	39	544	13.33
Tempo/LPG	41	528	12.94
Tempo/Petrol	36	282	6.91

Source: DOTM, 2003

Likewise, the promotion of other types of electrical transport is also bleak. Lack of policy commitment at the implementation level is a major setback and was instrumental in the closure of the Hetauda Ropeway in the late 1990's. Similarly, in 2001 the Trolley Bus Service between Bhaktapur and Kathmandu providing services to over 3.6 million people in a year

(CEN 2001) came to a halt due to the lack of political commitment to the government policy, mismanagement and political high handling of the Trolley Bus Management System. In spite of this, the success of privately operated Manakamana Ropeway in central Nepal still offers a ray of hope for the future of EVs. Encouraged by the prospects of EVs in Nepal, Trolley services have recently resumed in certain sections of the previous route. The local governments of Kathmandu, Bhaktapur and Lalitpur are inclined towards privatisation of the Kathmandu Trolley bus system and recommencement of operations in partnership with the private parties concerned. Route expansion in Ring Road and other feasible areas within the valley is also a possibility.

In such trying periods, Himalayan Light Foundation's (HLF), venture into the development of an electric four-wheeler bus in 2001 was encouraging news for the supporters of the EV industry. With support from the Climate Change Challenge Fund and the British Embassy, HLF planned to launch four vehicles to demonstrate its use and conduct further research on actual operation costs and technical performance of the bus. The aim of the project is to enable existing Nepal electric vehicle companies to take up the production of the electrical buses upon completion of the project so as to displace some older polluting vehicles in the Kathmandu Valley and other Nepali cities. Regrettably, lack of co-operation from the concerned HMG agencies has stalled the process preventing it from going ahead as designed. The main obstacles encountered were:

- Department of Transport Management (DoTM) held up the registration of vehicles in the pretext of alleged modification in the propose of the vehicle from that intended by the manufacturers, citing the Transport Management Act,
- Restriction on the import of second hand chassis from England to use for the Electric Bus, citing the provisions of the Finance Act

Delays in certifying battery operated cars as electric cars by MOPE and a subsequent change in Finance Act provisions by the Ministry of Finance have all made a direct impact on the promotion of electrical vehicles in the private sector. Five REVA cars imported to introduce electric cars in Kathmandu were unable to be cleared from customs as these cars were subjected to the same customs procedures as conventional polluting vehicles.

Despite inconsistencies both in the interpretation of government policy announcements and the lack of concerned government agencies' commitment to promote EVs over time, mounting pressure from the private sector, local NGO groups and donor agencies still provide hope for the growth of EVs in Nepal. The growing air pollution related to vehicular emission, infrastructure condition of Nepalese urban areas, mobility requirements and use of hydropower as fuel are the other factors that are conducive for the growth of the EVs in Nepal. Recent networking of key stakeholders in the EV sector such as Electrical Vehicle Manufacturers Association of Nepal (EVMAN), Nepal Electrical Vehicle Charging Association (NEVCA) and Clean Locomotive Entrepreneurs Association of Nepal (CLEAN) in a common platform called Electrical Vehicle Association of Nepal (EVAN), to promote EVs is a desirable first step in the right direction. EVAN is supported by the Danish government under the Environment Sector Programme Support (ESPS). The establishment of a Clean Vehicle Support Fund for technological improvements of EVs by ESPS has been a great source of encouragement to the EV industry. Similarly the Kathmandu Electrical Vehicle Alliance (KEVA) a USAID and Alliance Partners program could lead the EV movement in the right direction. Such support from INGOs will undoubtedly boost the EV movement in Nepal. Likewise, the recent air quality monitoring campaign initiated by MOPE to streamline government actions for the reduction of air pollution within the National Ambient Air Quality Standards is expected to open avenues for the promotion of the EV sector in at least the Kathmandu valley.

## 4.0 REVIEW AND ANALYSIS OF GOVERNMENT POLICIES, STRATEGIES AND PRIORITIES

### 4.1 Review of Government Policies, Strategies and Priorities

Nepal's government policies are based on Five Year Plans, which set the framework for the country's development strategy (*For details refer to policy in Annex - 3*). Nepal initiated planned development works in the mid-fifties with the introduction of the first Five-Year Development Plan (1956-61). Environmental issues were hardly reflected in the Planning Documents till 1980. However, it is in the Fourth Plan Period that the Trolley bus development linking Bhaktapur to Kathmandu in the Kathmandu valley was initiated, albeit without any specific mention about the promotion of clean vehicles for the reduction of air pollution.

The policy focus of the **6<sup>th</sup> and 7<sup>th</sup> plan (1980 - 1990)** was to integrate environmental concerns in the development process. Concerning the environmental sector, these documents emphasise the need of environmental impact assessment of development projects as per the policy suggestions of the National Conservation Strategy 1988. In the transport sector expansion and promotion of the trolley bus and electric trains have been emphasised but again without any specific targets and goals.

**The Eighth Plan Document (1992 - 1997)** in a separate Chapter "Environment and Resource Conservation" emphasised the need of a good environmental quality through control of environmental pollution. One of the objectives of the Eighth Plan was the formulation of air related pollution control management plans with supportive legal and institutional instruments. The plan policy emphasising decentralisation advocates participation of private and non-governmental organisations and argues for the incorporation of preventive (EIA and IEE) and curative measures (end of the pipe technologies) to curb the pollution problem at all levels.

Nepal Environmental Policies and Action Plan (NEPAP) (1993), a milestone in the national Environmental Policy of Nepal was endorsed in this plan period. NEPAP focuses on the utilisation of natural resources in a sustainable manner and the protection of environmental qualities. For the first time at policy level, it recognises the deteriorating air quality in many urban cities as having a social and economic cost on the population. However, the focus of the mitigation measures was limited only to improvement of fuel quality, fuel economy, vehicle maintenance, and formulation and implementation of vehicular emission standards. Use of hydropower, a natural resource of the country, and promotion of clean vehicles were not specifically mentioned in the action programs.

The National Plan of Action (NPA), 1996 – 2000, presented in the city summit (HABITAT II, 1996), identifies a number of activities for the improvement of the urban environment in Nepal. Urban environmental management was one of the key activities of the National Plan of Action and most of the targets set in this document were later incorporated in the 9<sup>th</sup> Plan document but without any effective implementation follow up.

The Vehicle Transport Management Act (1993), Vehicle Transport Management Rule (1994), Environmental Protection Act (1997) etc. were also enacted within the 8th plan period. This legislation, though progressive, makes no specific mention of the promotion of clean vehicles. The responsibilities for the promotion of environmentally friendly and minimally polluting vehicles in the urban areas were left to the executing agency officers, but without any specific guidelines (*Annex - 4*). The Transport Management Act and Rule did not differentiate between cleaner vehicles and other vehicles for the purpose of vehicle registration; roadworthiness tests, vehicle renewal and road permits particularly in relation to taxation provision (recurring annual tax).

For the reduction of vehicle emission, the legal documents empowered the executing agencies to formulate and implement environmental standards for vehicular emission and ambient air quality. Accordingly, under the Transport Management Act (1993) vehicular emission standards for petrol and diesel vehicles in Kathmandu valley were enforced.. Emission standards for LPG and other low polluting vehicles were not even formulated. This

lacuna in the law signified LPG vehicles as having the same status as zero emission vehicles. As a consequence, the Finance Act 1996/1997 treated low emission vehicles such as LPG fuelled vehicles on par EVs (battery operated three wheelers or Safa Tempos). Therefore LPG run vehicles and EVs enjoyed the same reduced customs tariff. It is noteworthy though that this Finance Act also included the provision of a pollution tax of NRs. 0.50/liter of diesel and petrol sold in Kathmandu. . While this is definitely a positive step in discouraging polluting vehicles, the pollution tax still remains to be implemented.

Although a clear vision at policy level had not been formulated, it is in this plan period that the successful Safa Tempo demonstration project assisted by USAID from 1994 - 1996 was initiated and executed. Despite its shortcomings, the Financial Act of 1996/1997 is a major instrument in the successful introduction of battery-operated vehicles in Nepal.

**The Ninth Plan (1997 -2002)** while endorsing environmental pollution as a serious problem at the policy level, stressed the need to initiate environmental programs by generating public participation and by implementing any existing legislations.. It further emphasized the need for the establishment and implementation of emission standards on air pollution. The policy also stressed the necessity to formulate appropriate short and long-term management plans to monitor pollution in different sectors. Implementation of the pollution standards through the establishment of voluntary and mandatory policies and elemental legal arrangements was also suggested.

As a complement to the environmental policy above, the 9<sup>th</sup> plan in the transport sector set a 20 year target for the promotion of electrical vehicles particularly the Trolley bus (Box-1) and electric trains. The sector policy emphasised the expansion of trolley bus services and battery operated vehicles in the Kathmandu valley in order to reduce air pollution. However, this ambitious plan remained only on paper. Another unfortunate incident of this plan period was that the government terminated Trolley bus services between Bhaktapur and Kathmandu.

**Box-1:  
Ninth Plan on Trolley Bus Service**

“Thirteen km long Kathmandu-Bhaktapur trolley bus service, the only trolley bus service of Nepal, will be extended to Kathmandu ring-road during the ninth plan period. Initiation of its privatization will be done. Detailed study will be done in order to extend the trolley bus service to Tripureshwor-Kirtipur, Thapathali-Patandhoka-Pulchok and Tripureswor-Maharajganj-Ringroad junction in Kathmandu Valley and necessary infrastructure will be constructed gradually to operate its services. Feasibility study will be done to operate trolley bus service in Biratnagar-Itahari-Dharan sector in the eastern region and Bhairahawa-Butwal sector in Western region and necessary infrastructure will be constructed.”

The Follow up NEPAP II (1998), in this plan period did not specifically identify activities and sub-activities related to “clean” or battery-operated vehicles. However, the key strategies identified by NEPAP II as conducive for the promotion of clean vehicles were: the need to develop and implement tools with partnership arrangements; promote environmental awareness, stakeholder participation and mobilise human resources (knowledge based and technical/scientific); provide additional incentives (financial and technical) to ensure participation of private and public sectors effectively; and enforce command and control instruments in combination with non regulatory measures. Regrettably, NEPAP II strategies have not materialized at the implementation level.

The National Transport Policy 2001, another policy document endorsed in the 9<sup>th</sup> plan, is focussed more on infrastructure development. It has made some key policy announcements for the promotion of clean vehicles (Box-2). Among clean vehicles, it prioritises solar, electric or gas operated buses, trams or cars in core city areas. Restrictions on noisy and polluting vehicles and the establishment of special emission standards in core city areas are some of the very promising policy initiatives recommended. Another policy also suggested here - reduced customs tariff for a limited period for pollution free vehicles- would help launch and market clean vehicles. This policy document, developed under the auspices of the Ministry of Physical Planning and Works, is currently under review by the Ministry of Labour and Transport Management before its full implementation. The Ministry has set up a special

committee for the revision process; the revised policy is expected to be disclosed within this fiscal year.

<b>Box-2: National Transport Policy 2058 Highlights</b>	
<b>POLICY</b>	<ul style="list-style-type: none"> <li>● Construction, repair and maintenance of the road infrastructures will be carried out keeping the traffic safety and environmental worthiness in view</li> <li>● Expansion of solar and electric vehicle services throughout the country</li> <li>● Improve accessibility of the general public as per the economic condition of the people to safe, reliable and pollution free public transport</li> <li>● Restrict foreign loan investment on the transport service, which is not economically feasible</li> </ul>
<b>TRANSPORT INFRASTRUCTURES</b>	<ul style="list-style-type: none"> <li>● To limit the traffic density and movement of vehicles within an acceptable level as per the land use and carrying capacity of cities</li> <li>● Arrangement of a separate bicycle lane in cities</li> <li>● Restrict operation of transport infrastructure and transport services likely to require subsidy from government</li> </ul>
<b>PUBLIC TRANSPORT VEHICLES</b>	<ul style="list-style-type: none"> <li>● To allow the running of public transport vehicles only on the basis of free competition</li> <li>● To reduce the load on roads, only vehicles with appropriate Axle Load System will be allowed to run</li> <li>● New vehicles will be required to get the roadworthiness certificate in five years and then in every two years</li> <li>● Complete ban on the import of older vehicles more than five years</li> <li>● The discarded batteries, Mobil, grease or other oily wastes to be disposed only in assigned places or following the prescribed procedures</li> <li>● To make public transport reliable, facilitating, pollution free, safe and inexpensive; standards will be developed for repair and maintenance and providing road permits</li> <li>● Vehicles made for particular purposes, will be allowed only for that purpose</li> </ul>
<b>FOR CITY AREA</b>	<ul style="list-style-type: none"> <li>● Ban of motorized vehicles in the core city areas</li> <li>● Priority to solar, electric or gas operated bus, tram, or motor</li> <li>● Not to allow increasing traffic density beyond a fixed degree. For this city parking system and control on ownership of vehicles will be introduced</li> <li>● Vehicles to be parked only in the assigned parking places</li> <li>● Restriction on operation of noise and air polluting vehicles. A separate standard will be introduced for core city areas</li> </ul>
<b>CUSTOM, TAX, ROYALTY</b>	<p>To promote private sector investment in the transport infrastructure development and promotion of pollution free vehicles, a tax and custom rebate will be provided for a certain duration</p>

A document entitled “Sustainable Development Agenda for Nepal (2002)”, an outcome of the 9th Plan policy initiative and only recently endorsed by the government, in chapters on Transport, Water and Energy, Protection of Atmosphere, and Pollution Control maintains a very supportive policy and programs for clean vehicle promotion (Box-3). The document policy stresses the use of clean electric energy in the transport sector for the reduction of air pollution and GHG emissions. Incorporation of the SDAN policy commitments in actual action plans and ultimate implementation, however, will be realized only in the future.

Despite many shortcomings, there are some achievements made in the 9<sup>th</sup> plan period. The Ministry of Population and Environment, in a drive to implement the pollution control provisions of the Environmental Protection Act and Rule, enforced a ban on 614 diesel-operated tempos in the Kathmandu valley. Further, MOPE put a restriction a on the import of second hand and reconditioned vehicles with the objective of importing low polluting vehicles and to prevent Nepal being the dumping ground for outdated technology vehicles. A total ban on the import of two stroke vehicles was enforced; compliance to the Nepal Vehicle Mass Emission Standard 2056 was made compulsory to import vehicles in Nepal; and monitoring of vehicle emission quality was imposed in Kathmandu.

The other step taken by the Ninth Plan was to prohibit vehicles of 20 years and older in the Kathmandu valley and restrict operation of two stroke vehicles in Kathmandu. Although an assortment of setbacks prevented this plan form being implemented as per the projected

plan, the Supreme Court has very recently ordered MOPE to implement the plan within two years.

Though MOPE's move to restrict polluting vehicles has been commendable, incentives to owners of polluting vehicle have not been favourable to clean vehicles in general and electrical/battery operated vehicles in particular. MOPE's actions connotes that the term "clean vehicles" applies to all vehicles comparatively cleaner than diesel operated tempos. This is clearly reflected in the custom incentives made by MOPE for diesel tempo operators affected by the ban on 2 stoke engines to import petrol/diesel/LPG vehicles through Finance Act 1999/2000. In fact, this policy not only rewarded the polluters but also hampered the promotion of electrical/battery-operated vehicles. Electrical/battery-operated vehicles were given custom incentives only a little higher than the polluting vehicles and were insufficient to promote marketing and operation of electrical/battery-operated vehicles in competition with other polluting vehicles.

The next Finance Act (2000/2001), however, revoked the incentives for other polluting vehicles including LPG operated vehicles. The Finance Act of 2002/2003 continued custom incentives of 1% of the import cost only to Safa Tempos (battery operated three wheelers) but not to battery operated four wheeler cars and buses. Customs duties for battery operated cars and buses were only 33% less than the normal custom duties. This finance policy is therefore limited to the promotion of only three wheeler battery operated Safa Tempos in the public transport service.

### Box-3

#### Clean Vehicle Promotion in SDAN: Transport; Water and Energy; and Protection of Atmosphere

##### Transport Sector

Although the focus is on road infrastructure development, attention is drawn to managing pollution. Pollution is linked to the increased number of vehicles, the condition of vehicles, poor road condition and the resultant congestion. Among the four major program areas identified is environmental sustainability. Here, focus is given to environmental impacts assessment of road infrastructure development and to developing an environmental code as well as economic measures (polluter pays principle) to control vehicular pollution.

##### Water and Energy Sector

Among the objectives defined for the sustainable development of the energy sector is a clause to "increase the use of the country's own renewable energy sources to at least match fossil fuel imports within a 20 year time frame."

One of the essential programs identified is "Policies favorable to renewable energy over fossil fuels": "There are a number of ways that HMG/N could demonstrate its support for the use of the country's own renewable energy over imported fossil fuels. The fastest growth in fossil fuel use is in the transportation sector. Electric trolley buses, trains, and battery-powered vehicles could all play a much larger role in the country's transportation sector than they do today. The government could remove the subsidy being provided on diesel and provide custom and VAT privileges on the importation of electric vehicles instead. The department of transportation should prioritize electric vehicles for public transportation in assigning routes on which they can run."

##### Protection of Atmosphere

##### **Action Agenda on Climate Change**

The Climate Change objectives include: control of GHG emissions, and maximize utilization of Nepal's huge clean hydropower source, GHG Emission Limitation has been identified as one of the Programs/activities essential to achieve this; the following activities have been specifically highlighted:

- Establishment of trolley bus facilities along the Kathmandu Valley Ring Road to limit fossil fuel consumption and utilize hydro electricity
- Feasibility study to introduce electric trains on long distances particularly in the Terai region
- Promotion of battery operated vehicles in the Valley and other major cities

##### **Air Pollution Control Action Agenda**

The primary objective of Air Pollution Control is improve the air quality of major urban centers by bringing the level of suspended particulates under control and maintaining the present level of other gaseous pollutants. To achieve this primary objective, the secondary objective includes: promotion of zero emission vehicles and environmentally sound vehicles to control the level of gaseous pollutants. Other secondary objectives- setting of national ambient air quality standard and emission standards; air quality monitoring networks; and the system of assessment of impact on health, physical, and economic damage of air pollution also supports the promotion of zero emission vehicles.

Among the essential programs/activities identified for correcting air pollution, the prominent ones are:

- Electric vehicles will be promoted with reduced night tariff of electricity

- Necessary infrastructure will be developed along the Kathmandu Ring-Road to operate trolley buses
- Economic incentives and disincentives will be introduced to replace old vehicles with more environmentally friendly vehicles
- Introduction of polluter pays principle including penalties for violators

A basic objective of the **10<sup>th</sup> Plan** (chapter "Population and Environmental Management") is to promote sustainable development by controlling pollution and amassing public participation in a campaign to create a clean and beautiful urban/rural environment. Setting up of air pollution standards and implementation and monitoring is one of the strategies suggested to combat pollution control/reduction. It emphasises the implementation of action programs that are conducive to the reduction of pollution and prioritises pollution control action programs including air.

Complementing the plan's pollution control policy, the document stresses the effective implementation of Sustainable Development Agenda for Nepal (2002) programs in the plan period. In a separate chapter "Labor and the Transport System" the plan makes a long term commitment to develop a sustainable, reliable, low-cost, safe, comfortable, pollution free and self-reliant transport system that contributes to overall economic, social, cultural, and tourism development. The key strategy adopted by the plan for pollution control is to enforce the Nepal Traffic Pollution Standard of 1999 (2056). Expansion of electric trains, trolley bus system and ropeways are the key priority programs identified by the plan document.

## 4.2 Analysis of Government Policies, Strategies and Priorities

Pollution control including air pollution through vehicular emission has been one of the priority areas of the government at the policy level since 1992. However, strategies and action programs in all the successive plans and policy documents have been very broad and mostly limited to formulation and implementation of vehicular emission standards particularly in the Kathmandu valley. Despite frequent attempts at framing environmental policies, strategies, and action programs, Nepal is yet to come up with a long-term national policy related to the control of vehicular air pollution. The regrettable situation today is that accumulated efforts over the years in this sector has only resulted in a build up of paper work with hardly any of the policy strategies, action plans and programs designed so far actually being translated into action.

While the promotion of pollution free vehicles has been repeatedly identified as a potential strategy for the reduction of vehicular emission, no mandates and targets, short or long term, have been specified at the policy level. Furthermore, the ambiguous nature of policies poses other obstacles to the favourable development of non-polluting vehicles. The term "pollution free vehicle" itself does not categorically indicate the overall pollution potential of vehicles; the lack of factual definition of what a pollution free vehicle is has in fact hindered the efficiency of many legal initiatives and implementation programs. The uniform dealing by the Finance Acts and the Department of Transport Management and Ministry of Population and Environment towards comparatively low polluting and zero emission vehicles is an example of such a policy setback. Such policies have in fact rewarded polluters instead of discouraging them. As a result, existing policies and strategies promoting non-polluting vehicles have failed to take into account the environmental emission costs of such vehicles.

In addition, the capital cost of imported fuel consumption by reduced emission vehicles is not accounted for by the current policies. Nepal has immense potential for hydropower development as a non-polluting and indigenous source of energy. Currently, the hydropower energy not used in off peak hours is discharged. Battery operated vehicles (safa tempos, cars and bus) have the capacity to store the off peak surplus energy and utilize it in the peak hours, providing a national benefit even at subsidised rates. The current policy failed to address this issue while promoting vehicles for emission control/reduction.

It is because of all these reasons that upcoming zero emission vehicles (electrical/ battery operated in Kathmandu) although offering an appreciable margin of environmental benefits, could not be adequately integrated into the market as well as due to technological and other

overhead costs despite successful demonstration and operation in the public mass transport system.

Promotion of a national industry is one of the broad policy objectives of all governments worldwide. There is potential for such industrial developments particularly related to the manufacturing of battery-operated vehicles in Nepal. In fact, most of the battery-operated vehicles in Nepal are assembled with the addition of a component of local value. Even the deep cycle lead acid batteries used by Safa Tempos are produced in Nepal (Kulayan battery Industry). There are some issues of quality related to both vehicles and batteries, but with the right initiatives to encourage research and development efforts by the private sector or the government, such industries could be established and enhanced according to national requirements. The current policy of vehicle promotion for emission control/reduction has not taken this issue with its supplementary potential for local employment opportunities and additional national revenues into account. .

Nepali urban centres are relatively small, with metropolitan areas spanning only some tens of kilometres. Poor infrastructure (narrow roads) in most cities restricts the mobility and speed of large vehicles. In the above context, battery operated three wheelers have an advantage over other vehicles both in terms of mobility and reduced emission pollution at the local level in the core city areas. Similarly, the Trolley bus, electrical trains and ropeways have a comparative advantage over other polluting vehicles within the city, in long distance transport, and in remote hill areas. In this light, the present policy of uniform custom subsidies and facilities like registration, roadworthiness certification, route permit, parking etc. for zero emission vehicles (EVs) and other low emission vehicles is clearly not environmentally equitable. The current policy failed to address this issue while promoting vehicles/transport for pollution control/reduction.

The current policy on decentralisation, awareness and public participation appears to be merely a cosmetic change. Promotion of electrical/battery-operated vehicles is clearly hindered by poor networking and lack of policy endorsed mandates and targets. There are no guidelines to indicate the correct strategies and action plans leading to effective implementation. The policy in general fails to address the lack of networking between stakeholders who have a clear vision of roles and responsibility sharing in terms of decision-making and program implementation.

Worldwide experience has illustrated that electrical/battery operated vehicles require a certain degree of policy protection for a certain duration in the form of restrictions, prioritisation of action, financial support for promotion and R&D, etc. for EV introduction and marketing in a new place. Moreover, identification of niche areas and the reservation of such areas for only zero emission vehicles is also required. Policy encouragement to local governments, institutions and private parties in the procurement and operation of zero emission vehicles could be a policy strategy in the promotion of electricity/battery-operated vehicles. Considering the narrow lanes and short distances within Kathmandu, the Kathmandu municipality can be encouraged to employ battery-operated vehicles for garbage collection. Similarly, certain lanes and historical spaces of archaeological and cultural significance in core urban areas can be allocated for only battery-operated vehicles. Nepal Electricity Authority (NEA), the institution responsible for the generation and distribution of electricity, can also be encouraged to take a lead role to replace its local fleets by electrical/battery-operated vehicles. Similar encouragement can be employed in tourist areas.

## **5.0 REVIEW AND ANALYSIS OF THE LEGAL AND ADMINISTRATIVE FRAMEWORK**

Since the early 1960s, HMG has enacted and enforced several pieces of sector legislation for the prevention of pollution. However only sector legislation developed after 1990 for the prevention of vehicular emission have provisions for the control/reduction of emissions.

The key legislations concerning control of vehicular emission are the Vehicle Transport Management Act (1993) and Vehicle Transport Management Regulation (1997), Environmental Protection Act (1996) and Environmental Protection Rules (1997), Local

Governance Act (1999), and the Fiscal Acts. The Industrial Enterprise Act (1993) has the provision of tax deductions for industries manufacturing goods and machinery for the reduction of pollution as a national priority industry. Detailed provisions of these legislative tools are presented in Annex-4 and the critical analysis is presented below.

The EPA and EPR do not permit any pollution beyond the prescribed standards. They authorize MOPE to give additional incentives for environment-friendly technologies, industries or services and also prohibit polluting technologies or services. MOPE has taken some steps to implement these provisions. Some noteworthy acts have been the prohibition of the highly polluting diesel tempos from the Kathmandu Valley in, 2056; the veto on the import of second-hand and reconditioned vehicles, and the proposed ban on two-stroke engine vehicles. The huge incentives, (99% custom waiver and VAT exemption) to diesel tempo owners to import microbuses were also made possible by exercising the provisions of these legal tools. However, the incentives provided to import microbuses to phase out the highly polluting tempos contradicted the very principle of “polluters should pay”; the mistake has been realized, however, and the provision to allow the import microbuses with 99% custom waiver and VAT exemption was removed in the subsequent fiscal acts. Later, the introduction of Nepal Vehicle Mass Emission Standard 2056 for vehicles to be imported into Nepal and the vehicle emission standards for functioning vehicles are good examples of the government’s initiative to discourage polluters. However, the lack of effective enforcement of the vehicle emission standards for functioning vehicles (the green sticker system) has resulted in numerous polluting vehicles even in the main streets of the capital. The Vehicle Transport and Management Act also insists on vehicular compliance with the emission standards in order to issue roadworthiness certificates. Non-compliance to the vehicle emission standards can result in suspension of registration and cancellation of route permits. No vehicle has been penalized using this provision so far. Under this act, non-polluting vehicles are to be given preference when allocating routes. Yet contrary to this, the ban on the registration of new public transport within the Ring Road was also enforced for EVs.

The Local Self-Governance Act authorizes local bodies (DDC, Municipalities, and VDCs) to take their own decisions for the protection of the environment. So far not a single municipality has taken the initiative to either promote cleaner vehicles or to discourage polluting vehicles. Even simple measures like allowing free parking for clean vehicles, allocating distinctive logos and colors to clean vehicles can be initiated by local bodies without any financial burden. Currently, all the Municipalities appear to be directing all their energy solely in the management of solid wastes.

Incentives are generally provided through the Fiscal Acts. The general practice is that recommendations of the line ministries to the Ministry of Finance are implemented through the fiscal acts. Though it initiated the establishment of incentives for clean vehicles, the Fiscal Act of 2053 failed to distinguish zero-polluting vehicles from other comparatively less polluting vehicles, labelling all electrical, battery or gas operated vehicles as “Safa Tempos” and allocating uniform custom subsidies and facilities to all three (Box-4). However, pressure from NGOs and environmental groups lobbying for the removal of import tax exemption for LPG vehicles resulted in the duty exemption for LPG vehicles being repealed the following year. However, since 2057 only the electrical or battery operated vehicles are recognized as Safa-Tempo; gas operated vehicles are in an equal category with petrol operated vehicles.

#### **Box-4:**

##### **Incentives for electrical, gas and battery operated vehicles in Fiscal Act 2053**

- 1% custom duty on the import of Chassis or Chassis with engine and parts for tempo and exemption of sales tax (imported by industries to manufacture the tempo).
- Other vehicles apart from tempos are subject to a 5% customs duty and exemption of sales tax on the import of chassis or chassis with engine, motor, accumulator, battery, battery charger and other parts (imported by industries to manufacture)
- Vehicles (transport and goods) powered only by electricity, battery and gas are subject to a 10% customs duties and sales tax exemption
- Tempos (petrol and diesel) registered in Transport Management Offices, are allowed to import equipments at 1% customs and exempt from sales tax if wishing to convert to battery.
- This act also introduces the pollution tax of 50 paisa on a liter of petrol and diesel to be sold in the Kathmandu Valley

These environmental legislations are of a very generic nature and describe the general issues to be covered under the law, leaving all the provisions to be covered by Rules or Regulations and support guidelines under the Act. Guidelines and Regulations under the Act either remain to be passed or if framed and passed, make no mention in specific terms of the provisions required to prevent vehicular emission (Annex - 4). Most of the legal provisions also either lack timely sector updates in accordance with other upcoming government policies, or consistent government policies and legislations for effective implementation and compliance.

The existing legal provisions have empowered four ministries namely the Ministry of Population and Environment, the Ministry of Labour and Transport, the Ministry of Home and the Ministry of Finance and their line departments including local governments, to formulate and enforce vehicular pollution related policies, strategies, guidelines, standards, and action plans in their area of jurisdiction either independently or in co-ordination. In spite of this, a periodic lack of co-ordinated action has resulted in duplication of activities, and conflicting interpretations of rules under the legal provisions.

The Environmental Protection Act 1997, to some extent, has established the Ministry of Population and Environment as the higher authority in environmental matters. As this ministry has been established relatively recently compared to other ministries, certain domineering ministries have tended to disregard the ministry directives as a matter of little importance. Moreover, the EPA provisions lack the co-operative operational model to indicate integration with other institutions to meet the environmental objectives. Legally prerogative roles and responsibilities of the different ministries and departments need clearer definitions in the matter of environmental concern. In this context, the existing vehicular emission related environmental legislation needs streamlining as per the roles and responsibilities of the sister ministries, line departments and local governments.

Despite the recognition of the private and NGO sectors as crucial for the prevention of pollution at policy level (8<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup> plan documents), the existing legal provisions are designed to retain government control on the matter. Old-fashioned command and control approaches still persist in the legal provisions, and legally there is very little space for the private sector and NGOs to participate in and co-ordinate pollution prevention activities.

The other issue of concern is the lack of political commitment in the administration of vehicular pollution related legal provisions. The present policy of uniform custom subsidies and facilities like registration, roadworthiness certification, route permit, parking, VAT and other support mechanisms for all the kinds of vehicles polluting and non-polluting clearly not equitable environmentally. Administrators of the Ministry of Finance in particular consider vehicles to be major sources of revenue, overlooking the social and economic costs of pollution.

This lack of legal guidelines and the ensuing legal latency of discretionary powers to executing administrators have been counterproductive for the promotion of EVs. The hassles EVs face in the Traffic Management Office regarding route permits, and the harassment by Traffic police about parking and operations reflect the misuse of discretionary powers bestowed on these agencies without any denoted guidelines.

## **6.0 INCENTIVES FOR CLEANER VEHICLES IN SOME OTHER COUNTRIES**

### **6.1 Incentives in Other Countries**

Considering that automobiles are the major source of air pollution and the escalating demand for automobiles, governments all over the globe have made policy level changes to curb air pollution while fulfilling the growing demand for transport. The first step in this direction is to improve the quality of automobile fuel as well as automobile combustion technology. The second step is to develop technologies that control pollutants prior to their release into the

atmosphere. Although technology breakthroughs have succeeded in achieving radical reductions in tailpipe emissions, the simultaneous increase in the production of cars means that air pollution from tail pipe emissions continues to be a matter of serious concern.

Considering this, a third and most recent approach adopted by many developed and developing countries is the development of clean vehicles utilizing alternative clean fuels. An Alternative Fuel Vehicle (AFV) is a vehicle that relies on an energy source other than petrol or diesel, and can either be zero-emission or lower emission. Many governments and automobile manufacturers from developed countries, in partnerships guided by policy, have invested money, time, and manpower into the research of AFVs in order to fulfil both consumer demands and environmental cleanliness. Consequently, extensive research has resulted in significant development of AFVs.

As these newly developed AFV technologies are expensive, some governments (Federal Government of California, USA) have even mandated manufactures to manufacture and market a certain percentage of AVF. To promote the marketing of these vehicles, certain governments have offered a number of monetary and non-monetary incentives to the buyers of the AFV vehicles. Some examples of the incentives given to EVs by selected governments are listed below:

#### United States of America

- US government provides tax credit for EVs and hybrid electric vehicles
- The state of California has the Zero Emission Vehicle Incentive Program, which provides up to \$ 3000 per year for three years towards the purchase or lease of EVs
- Los Angeles Dept of Water and Power provides discount of \$ 0.036/ kWh for electricity used to recharge EVs during off-peak time periods
- Pacific Gas and Electric offers a discount rate of between \$0.044/kWh and \$0.051/kWh for recharging batteries.
- Many cities in the USA provide incentives for the installation of EV charging stations
- Los Angeles Airport offers free parking and charging for EVs

#### Japan

- The government of Japan provides an amount equal to 50% of the difference in cost between electric vehicles and regular automobiles

#### France

- The French Government provides a subsidy of \$ 8000 for the purchase of electric vehicles, and the French Electric company provides a further subsidy of \$ 4000 for charging the vehicles

#### Italy

- In the city of Milan in Italy, in order to reduce pollution in the city, the Italian Government only permits electric vehicles, bicycles and motorcycles fitted with catalytic converter in the streets of the city between 8.00 AM to 8.00 PM

#### Denmark

- Electric vehicles can be imported without paying the import registration fee of up to 180% of the price of the vehicle.

- Denmark also provides EVs with a total waiving of the fuel consumption tax that is imposed on petrol and diesel vehicles.
- EVs can park free of cost all over Copenhagen
- Free charging of EVs is provided at several EV specific parking places in Copenhagen.

### India

- New autos and taxis to be registered in Delhi will be either CNG or Battery Operated
- Replacement of Pre-1990 autos and taxis with new subsidised vehicles using clean fuels in Delhi
- All buses to switch over to CNG or other clean fuels in Delhi
- Scooters India Ltd (SIL) is being assisted by the Ministry of Non- Conventional Energy of India for the development of EVs
- Scooters India with the assistance of state governments and subsidies provided by the Ministry of conventional Energy has manufactured and supplied EVs in Lucknow, Agra, New Delhi, Jaipur and Ahmedabad
- In Pune, Mumbai, and Nagpur, the EVs are being promoted by the local governments to replace the petrol and diesel operated 6 seater 3 - wheelers.
- A central subsidy of Rs 75,000 to all purchasers of EVs by Government institutions, Public Departments, Educational Institutions, Hospitals, NGO's (This scheme is currently not available to individual customers)
- 80 % depreciation allowed in the 1st year of purchase for all EVs purchasers
- Sales tax (VAT) has been exempted in the following states Karnataka Delhi, Rajasthan Goa
- Road tax has been exempted in Karnataka, Delhi, Pondicherry, Andhra Pradesh, Goa, Rajasthan
- The excise duty for EV's is 16 %

## **6.2 Comparison with Nepal**

As compared to the incentives mentioned above for the promotion of clean vehicles in many parts of the world, Nepal only has limited incentives regarding customs duty and tax (Box 4). The major incentive for EVs in Nepal is the minimal 1% customs duty for electrical vehicle parts and Value Added Tax exemption. There is a clear lack of coordination between various institutions in designing incentive packages for the promotion of clean vehicles. The concepts of allocation of clean vehicle only routes, electricity tariff subsidies free charging stations in public places, free parking for zero emission vehicles, free route permits for clean vehicles, preferences for parking clean vehicles are not practiced in Nepal though they are basic facilities in many countries. A strong leading institution committed to improving the air quality and capable of effectively implementing policies is needed to take the lead role in bringing all the concerned governmental institutions together to introduce all these indirect incentives here in Nepal.

## **7.0 ECONOMIC AND FINANCIAL COST BENEFIT ANALYSIS OF POLICY CHANGE**

### **7.1 Policy Change to Replace Petroleum/LPG Based Vehicles with Electrical Vehicles/or Elimination of Petroleum/LPG Based Vehicles**

A direct economic benefit is expected by replacing petrol/diesel/ LPG-based vehicles with EVs:

- Savings from reduced import of petroleum products
- Use of the National indigenous energy and maximum use of off peak electrical energy, which is otherwise a national deficit.
- Generation of local employment
- Reduction of emission, particularly the PM fraction and its related economic and social costs.

### **7.1.1 Savings from Imported Petroleum Products**

LPG/ petrol and diesel vehicles rely on imported petroleum products, which Nepal procures through NOC using convertible currency. By replacing fossil fuel public transport vehicles with EVs, as granted in the Polluting Vehicle Retirement Program, Nepal can make direct savings of convertible foreign currency from the national current account through savings from the import of petroleum products (presented in Table 7.1).

**Table 7.1: Savings from import of Petroleum Products by the Replacement of Polluting Vehicles in the Mass Public Transport Service of Bagmati Zone in the National Current Account**

Vehicle Type	No of vehicles	Import Fuel cost/km/vehicle (NRs)	Average distance covered by vehicle/yr (km)	Total saving/yr (Nrs.)
Bus - MPTS	1858	6.71	39600	493,700,328
Minibus -MPTS	2172	4.47	37125	360,440,685
micro bus LPG -MPTS	387	2.27	37125	32,613,941
Micro bus diesel -MPTS	480	2.68	37125	47,757,600
Petrol Tempo Taxi	3645	2.24	32340	264,049,632
Petrol Tempo - MPTS	282	2.24	32340	20,428,531
LPG -MPTS	528	2.05	32340	35,004,816
Total Savings/yr				1,253,995,533

Note:

- Taxi Cars are not accounted
- Vehicle Number Data - DOTM (2059)
- Cost of imported Petroleum Product - NOC (2060): NRs for petrol, diesel and LPG is 26.84/lt, 26.97/lt and LPG 410/cylinder
- Average annual distance covered - Ale 2001
- Consumption of fuel/km from the field survey NESS 2002 (consumption of fuel: Bus - 4km/lt, Minibus - 6km/lt, Micro Bus - 10km/lt, Petrol Tempo - 12km/lt, LPG Microbus - 180km/cylinder, LPG Tempo - 200km/cylinder)

The expected savings in the current market price is presented in Table 7.2

**Table: 7.2 Savings from Petroleum Products by the Replacement of Polluting Vehicles in the Mass Public Transport Service of Bagmati Zone in the Current Market Price**

Vehicle Type	No of vehicles	Market Fuel cost/km/vehicle (NRs)	Average distance covered by vehicle/yr (km)	Total saving/yr (Nrs.)
Bus - MPTS	1858	7.75	39600	570,220,200
Minibus -MPTS	2172	5.16	37125	416,079,180
Micro bus LPG -MPTS	387	3.88	37125	55,873,125
Micro bus diesel -MPTS	480	3.1	37125	55,242,000
Petrol Tempo Taxi	3645	4.5	32340	530,456,850
Petrol Tempo - MPTS	282	4.5	32340	41,039,460
LPG -MPTS	528	3.5	32340	59,764,320
Total Savings/yr				1,728,675,135

Note:

- Taxi Cars are not accounted
- Vehicle Number Data - DOTM (2059)
- Cost of Petroleum Product - NOC (2060) : NRs for petrol, diesel and LPG is 54/lt, 31.5/lt and LPG 700/cylinder
- Average annual distance covered - Ale 2001
- Consumption of fuel/km from the field survey NESS 2002 (consumption of fuel: Bus - 4km/lt, Minibus - 6km/lt, Micro Bus - 10km/lt, Petrol Tempo - 12km/lt, LPG Microbus - 180km/cylinder, LPG Tempo - 200km/cylinder)
- MPTS - Mass public Transport service

Replacement of all the mass public transport system is not possible at once. The decision-makers will have to plan Polluting Vehicle Retirement Program and Replacement of such vehicles by EVs in a gradual phased manner.

### 7.1.2 Expenditure from Import to the National Current/Capital Account

Battery operated EVs require two sets of imported batteries for operation. According to operators and charging stations, the current lot of USA imported batteries are functional for an average of 18 months. The cost of 2 sets of batteries at the market price is NRs. 130000.00. About NRs. 14000.00 is obtained as salvage value after 18 months. Thus annually one EV operation consumes about NRs. 77333.00, which is equivalent to Nrs.69454.54 if one considers the yearly expenditure from the national current account.

Certainly with the replacement of polluting vehicles by EVs, there will be an increase in the expenditure from the national current account for battery import. Table 7.3 presents a comparison of expenditure from the national current account for the import of fuel/battery for LPG, Petrol and EV three wheelers.

**Table 7.3: Comparison of Expenditure for Fuel/Battery from National Current Account for LPG, Petrol and EV Three Wheelers.**

Parameters	LPG costs/yr (NRs.)	Petrol costs/yr (NRs)	EV costs/yr (NRs)
Cost of fuel/battery at current market price/vehicle annually	113,190	145,530	77333.00
Cost of fuel/battery at national current account/vehicle annually	66,297	72,441	69454.54

Note: Electricity consumption by EVs is not accounted for in the above calculations, as it is not an imported fuel. 10% benefit on the sale of battery by supplier

In the current market price, EVs have an advantage over LPG and Petrol 3-wheelers, but in the national current account only over petrol 3 wheelers.

Similarly, all the vehicles are imported either fully assembled or in parts. This also places a burden on the national capital expenditure. Table 7.4 presents a comparison between LPG, petrol and EV three wheelers. With the exclusion of the battery components, EVs make minimal impact on the national capital account compared to other 3 wheelers.

**Table 7.4: Comparison of expenditure for import of vehicle and vehicle parts from national capital account for LPG, Petrol and EV three wheelers**

Vehicle type	Total cost on a vehicle In NRs	Total imported cost of a vehicle In NRs	Total local component NRs.	Impact on BOP NRs.
LPG	535,000	421611.19	46000	421611.19
Petrol operated	750,000	401,658	0	401,658
EVs (Excluding battery)	385,000	339,000	46,000	339,000

### 7.1.3 Use of National Indigenous Energy and Maximisation on the use of the Off Peak Electricity Energy which Otherwise is a National Loss.

EVs utilise hydropower energy to charge batteries. Charging stations utilize nearly 45% of the energy in normal hours; 33.5% at night (off peak hours) and 21.5% in peak hours (Devtec, 2002). At present, NEA has not installed TOD meters and is billing charging stations at the flat rate of NRs. 4.30/KWh. Considering that all the charging stations are paying a flat rate to the NEA, the NEA is earning NRs. 41796 per EV per year (Table 7.5). Of the total amount billed by NEA, about NRs 9767/vehicle/yr is the off peak energy which is otherwise a loss for the NEA.

**Table 7.5: Income from Use of Indigenous and Off Peak Energy**

Number of EVs KTM - PMTS	EVs electricity Consumption on KWh/day/vehicle	Annual consumption of electricity/vehicle 27 days/month (KWh)	Charging station income/vehicle/yr @9.00/KWh (NRs.)	Total Charging Station Income (NRs)	Total NEA Income/ Vehicle/yr @4.30/KWh (NRs)	NEA Total annual income (NRs)	Total Off peak energy used (NRs)
544	30	9,720	87,480	47,589,120	41,796	22,737,024	5,314,118

Note:

- The off peak energy price is calculated based on the TOD basis, while for NEA and Charging station income flat rate of NRs. 4.30 is used. The rates for Peak, Off peak and Normal hours are NRs. 4.8, 3.0, 4.25 respectively.

### 7.1.4 Local Employment Generation

At the current operational level, the employment generation from various vehicle sectors could not be assessed as desired. Currently the existing EV manufacturers are utilising their facilities as repair and maintenance shops or as charging stations. As similar facilities are found for other vehicles as well, employment in the EV sector appears to be no different from other sectors. However, EV charging stations employ at least 2 to 3 employees per charging station. The only difference between the fuel supplying stations and EV charging station is that LPG and Petrol dispensing stations sell fuel at the government administered price, internalising the service costs in the fuel price, whereas EV charging stations charge an overhead cost to the actual electricity tariff which is about 117% of the actual electricity tariff.

Given the appropriate kind of EV promotion in Nepal, the potential of manufacturing EVs as an indigenous industry and generating a new avenue of employment carries great hope. The actual figures in terms of the number and payments to employees by the EV manufacturing industry, however, will be determined by the number of vehicles manufactured per year. In the boom period of 1999/2000, it was reported that an EV manufacturing company employed as many as 50 persons on a regular basis.

### 7.1.5 Reduction of Emission, Particularly PM Fraction and Related Economic and Social Costs.

Global experiences indicate that vehicular emissions have a linear relationship with economic and social costs. Vehicular emission is a major contributing factor related to public health and related economic and social costs in Nepal, particularly in Kathmandu. Since other pollutants are within the prescribed limits of WHO guidelines, only the PM fraction has been evaluated to account for any economic and social costs in relation to the vehicular emission potential of public sector vehicles in the Bagmati zone. Table 7.6 presents the PM potential and related economic and social costs in the simplest terms. Government expenditure on health services (preventive and curative) and on health infrastructure are additional costs not accounted for in Table 7.6, below.

**Table 7.6: Economic and Social Costs to Bagmati Zone by Public Sector Transport due to Vehicular PM**

Vehicle type	Total Number in Bagmati	Average distance coverage/yr (km)	Emission factor gm/km	Economic and social cost/kg of PM (NRs)	Total emission /yr/vehicle (kg)	Economic and social costs/ vehicle /yr	Total economic and social cost/yr
Bus - MPTS	1858	39600	3	517.07	119	61428	114,133,068
Minibus -MPTS	2172	37125	2	517.07	74	38392	83,388,396
micro bus LPG - MPTS	387	37125	0.067	517.07	2	1286	463,013
Micro bus diesel -MPTS	480	37125	1.2	517.07	45	23035	12,669,508
Tempo Taxi	3645	32340	0.5	517.07	16	8361	30,475,917
Tempo - MPTS	282	32340	0.5	517.07	16	8361	2,357,808
LPG -MPTS	528	32340	0.067	517.07	2	1120	591,559
Total economic and social costs /yr							244,079,269

**Note:**

- Taxi Cars are not accounted
- Vehicle Number Data - DOTM (2059)
- Average distance covered after Aie 2001
- Emission Factor adopted from Urbair (1996)
- Cost of PM/Kg adopted from Urbair (1996) and adjusted to current exchange rate.

Provided the polluting vehicles are phased out under the Polluting Vehicle-Retiring program, and are supplemented by functional EVs, the costs presented above are the environmental margin of benefits that the society at large stands to benefit from.

The Polluting Vehicle Retirement Program should be built on the foundations of environmental benefit and potential savings in the national capital account through the reduction of petroleum imports. The haulage capacity of the EVs needs to be given due consideration while enforcing the replacement program. Replacing a high haulage vehicle with a low one will not only increase road congestion but also hamper services. Polluting tempos and minibuses can be replaced with EV Safa Tempos, but Minibuses and Buses can only be replaced by an EV or Trolley Bus of an equal haulage capacity, subject to the infrastructure development potential.

Furthermore, the replacement program should not award benefits to polluters in direct economic terms. Only the salvage value of the vehicles to be replaced should be paid to the polluters. However, individuals or parties affected by the replacement programs should be given priority in procuring and operating EVs suitable to specific routes. Subsidies to the affected parties should also be uniform with that provided to other parties operating in this sector.

## 7.2 Policy Change in the Electricity Tariff

Table 7.7 presents the total operation cost of EVs and other vehicles. Due to the combination of high battery costs and the current electricity tariff, EV operation costs are higher compared to other vehicles.

**Table 7.7: Operation Costs of the vehicles**

Vehicle Type	Running Cost/km					Time and overhead costs/km	Total operation cost /km
	Fuel or electricity/km	Battery/km	Maintenance part and labor/km	Wear and tear of Tier/km	Total Running cost/km		
Safa Tempo (EV)	2.70	2.39	0.72	0.17	5.98	5.66	11.64
LPG-three wheeler	3.50	0	0.23	0.10	3.83	3.72	7.55
Petrol three wheeler	4.50	0	0.41	0.10	5.01	4.17	9.18
Diesel microbus	3.10	0	0.24	0.16	3.50	8.60	12.10
LPG Microbus	3.88	0	0.19	0.13	4.20	6.70	10.90

Note:

- Fuel and battery cost in the running cost based on field survey (*Cost of Petroleum Product - NOC (2060): NRs for petrol, diesel and LPG is 54/lt, 31.5/lt and LPG 700/cylinder; Consumption of fuel/km from the field survey NESS 2002 (consumption of fuel: Bus - 4km/lt, Minibus - 6km/lt, Micro Bus - 10km/lt, Petrol Tempo - 12km/lt, LPG Microbus - 180km/cylinder, LPG Tempo - 200km/cylinder) Other costs as per Devtec 2002*)
- Time costs and overhead costs as per Devtec 2002.

Table 7.5 presents the current scenario and benefits gained by NEA and the charging stations as well as the corresponding costs to EVs. If the TOD meters are installed, in the prevailing electricity consumption pattern of charging stations (Devtec 2002), they will have to pay in average NRs. 3.95/KWh to NEA against 4.30/KWH, which amounts to NRs. 38394/vehicle/yr. This means that the charging station will make a profit of NRs. 3402/vehicle/yr. Presently, charging stations make an average NRs. 4.7/KWh charging batteries to cover up fixed costs and operation costs including profits. In actuality EVs pay NRs. 9/KWh of energy consumption to charging stations.

If the current NEA tariffs for peak, night (off peak) and normal hours are modified at the rate of NRs. 7.1, 1 and 2.5 respectively, and the charging stations overhead of NRs.4.7/KWh remains the same, in the prevailing energy consumption pattern of charging stations (Devtec 2002), EVs will have to pay NRs.7.67/KWh against 9/KWH. This will help reduce EV

operational costs from NRs 5.98 to 5.59. This scenario entails a marginal decrease in the total operational cost of EVs.

Deep cycle lead-acid battery sets generally need to be charged for about 10 hours. The NEA has an off peak energy period of only 7 hours; since this period is insufficient to fully charge the batteries, the charging time has to be stretched out before and after off peak hours. In this respect, 100% of the off peak energy is stored and an additional 30% of the energy required has to be stored from either normal or peak hours. The cost of charging with the assumption of an hour in peak hours, 7 hours in off peak hours and 2 hours from normal hours is presented in Table 7.8 for both the current and proposed tariffs.

**Table 7.8: Cost of Electricity in the Current and Proposed Tariff Context Utilising 100% Energy from Off Peak Hours.**

Parameter	EVs electricity consumption KWh/day/vehicle	Annual consumption of electricity/vehicle 27 days/month (KWh)	Charging station income/Vehicle/yr (NRs.)	Total NEA Income/Vehicle/yr (NRs)	Total Off peak energy used/vehicle/yr (NRs)	Running cost of EV/km (NRs)	Difference in Running cost from the current running cost/km (NRs)
Current tariff rate adding charging stations overhead	30	9,720	79023.60	33339.60	20412	5.72	0.26 (4.34%)
Proposed tariff rate adding charging station overhead	30	9720	64245.20	18565.20	6804	5.26	0.72 (12.04%)
Proposed tariff rate directly by NEA	30	9720	0	18565.20	6804	3.85	2.13 (35.62%)

*Note: Electricity Consumption estimates as per Devtec 2002, and average annual distance coverage as per Ale 2001*

Utilising 100% of the available off peak electrical energy (i.e. 7 hours) at the current tariff rates with TOD meter, the operational cost shows an inclination to decrease by only 4.34%. With the proposed change in electricity tariff rates and with 100% utilization of off peak electrical energy with TOD meter, the operational costs are expected to decrease by about 12%. The overhead cost of charging stations is a major factor in inhibiting a significant reduction of operational costs.

Provided NEA facilitates EV charging at the modified tariff either by itself or through agents, operational costs of EVs/kilometre decreases significantly amounting to 35.62%.

While the assertion that NEA could benefit from investment and other overhead costs for the development and operation of charging station is valid, it is also true that while developing hydropower and its transmission systems, NEA inflicts an assortment of damages environmentally to society, though not directly in air pollution. One of the ways to compensate social environmental costs of NEA's infrastructure development could be to promote EVs for the environmental betterment of the society at large. Costs for such programs could even be internalised in the project development costs of NEA and Environmental Impact Assessment studies should include such options to internalise the costs.

### 7.3 Policy to Operate only EVs in some Priority Routes/Areas/Government/Institutions

EVs face tough competition in the mass transport sector owing to permits allowing all kinds of mass transport vehicles in all routes (Annex 2). The projected average occupancy rate of EVs is about 98 % (Devtec 2002), with a maximum of 186% and minimum of 76%. Taking all EVs on all routes at the present fares into consideration, an average occupancy rate of 120% would enable EVs to just meet the total operation costs without a profit. As the operation cost depends directly on the distance travelled, at the present fares, the occupation percentile to meet the operational costs varies with specific routes. In some routes EVs could meet their operational costs even with 76% seat occupancy, whereas in others 240% seat occupancy is needed.

In this context, a policy of permitting only EVs in some routes will help increase the seat occupancy rate to over 150% making EVs profitable even alongside the prevailing subsidies, battery costs, and electricity tariffs.

The other policy proposed to fix fares in proportion to the distance travelled, will be beneficial to EVs. The current practice of a flat rate for all routes is not practical. However, fares should be able to compete with other public transportation plying the same route.

A policy to restrict operation of other vehicles except EVs in historical, archaeological, tourist as well as cultural places on the grounds of environmental cleanliness gives a holistic meaning for the promotion of EVs in general. Such actions may precipitate the public to acquire family EV vehicles in the private sector as well as in the tourism industries.

Governments and institutions play a major role in the promotion of EVs in a number of ways. As persons heading these sectors are perceived as leaders of society, the general public tends to emulate them. Policy endorsement by the heads of these is expected to substantiate public acceptance of EVs. In addition, central and local governments can employ EVs for the pickup and drop of their employees within urban areas. Local Governments and institutions could even use EVs effectively in some service sectors such as local garbage collection, local maintenance vehicles for NEA, NTC, NWSC etc.

These policy recommendations if implemented would provide direct financial assistance to the EV industry. The policies recommendations listed below can effectively promote EVs, though not directly in terms of costs.

### 7.4 Policy Change of Pollution Tax to Polluting Vehicles

The introduction of a pollution tax on the petrol and diesel consumed in the Kathmandu valley has been a financial policy recommendation since 1996. The rate applied was flat (NRs. 0.50/lt) and did not take into consideration the polluting character of the fuel. As its implementation was never realised, this policy is still only on paper.

Provided the policy had been implemented, the collection of pollution tax to date from the consumption of petrol and diesel in Kathmandu would have amounted to NRs. 635,068,500 (Table 7.9). This substantial amount could have been utilised in R&D, soft loan, parking, polluting vehicle retirement program with replacement by EVs and infrastructure development for EVs in a number of ways. Had the activities proposed above been duly implemented, there is no doubt EVs would have taken a long leap forward by now. To augment the advantages of the policy, however, various modalities of taxing pollution based on the principle of environmental justice need to be developed.

**Table 7.9: Estimated Pollution Tax since 1996 from the Petrol and Diesel Consumption in Kathmandu Valley**

Fiscal Year	Petrol			Diesel			Total pollution tax collection of petrol and diesel (NRs.)
	Total import Nepal (KL)	Total consumption in Kathmandu (KL)	Annual Pollution Tax collection (NRs)	Total import Nepal (KL)	Total consumption in Kathmandu (KL)	Annual Pollution Tax collection (NRs)	
1996/97	44709	26825.4	13412700	257910	154746	77373000	90,785,700
1997/98	46939	28163.4	14081700	300604	180362.4	90181200	104,262,900
1998/99	49994	29996.4	14998200	315780	189468	94734000	109,732,200
1999/2000	55589	33353.4	16676700	310561	186336.6	93168300	109,845,000
2000/01	59245	35547	17773500	326060	195636	97818000	115,591,500
2001/02	63271	37962.6	18981300	286233	171739.8	85869900	104,851,200
Total	319747	191848.2	95924100	1797148	1078288.8	539144400	635,068,500

Note:

*Import records from NOC*

*Consumption in Kathmandu valley is taken as 60% of total import (personal communication NOC)*

*Pollution Tax NRs. 0.50/lt of petrol and diesel*

There are various options of taxing pollution. A first option could be to tax the fuel used depending on comparative pollution rates. As petrol is definitely a cleaner fuel than diesel, it would be liable to pay less tax than diesel. The present declaration of a flat taxation rate for both diesel and petrol is not justified environmentally. In this context, even the comparatively low polluting LPG vehicles should be taxed.

A second option could be to distribute the pollution tax between the vehicle and the fuel used. In this case vehicles would be taxed annually according to their pollution potential; this would be added to the present yearly vehicle tax, resulting in a corresponding lowering of the pollution tax in the fuel sold.

A third option could be to impose an annual tax only on vehicles according to their pollution potential.

Of the three options, the second option seems the most viable as it discourages both directly polluting vehicles and polluting fuels simultaneously.

The collection of pollution tax alone is not going to facilitate the EV sector in Nepal. What is required is the use of the collected Pollution Tax Fund in the promotion of EVs in its entirety so that EVs are made cost effective and cost efficient. Only a policy to use this Pollution Tax Fund for the development and promotion of EVs and related infrastructure will take EVs ahead in future.

## 7.5 Policy Change in Battery Procurement

The high running cost of EVs is due to the battery component. Batteries are accountable for 39.39% of the running cost and 20.53% of the operation cost of EVs (Table 7.7).

TROZAN lead-acid batteries are imported from the USA and have an average life of about 18 months only. Every 18 months, the batteries need to be replaced by a new set. The current market price of one set of battery costs NRs. 65000. The import costs, 1% custom duty, and about 10% profit are included in the price.

An added problem is that these batteries are not always accessible in the Nepali market. Last year a number of EVs went out of operation due to a shortage of batteries in the local market.

To make EVs competitive with other clean vehicles, the battery costs and accessibility in the local market is essential. Unfortunately, there is very little space for the cost reduction of imported batteries except for subsidies in the import costs, which is most unlikely.

The only viable option for cost reductions would be to promote the local battery industry. Kulayan Battery Industry, located at Biratnagar, Nepal, manufactures deep cycle lead acid batteries. The batteries tested so far suggest an effective life span of 9 to 12 months. The cost of the local battery is about 26.2% less than the imported batteries. The difference in the cost/km between local and imported batteries is only NRs. 0.14 (imported battery cost/km is NRs. 2.39 and local battery cost/km is NRs. 2.53). Certainly, the imported batteries have a marketing edge over the local ones in the present conditions. However, there are ample opportunities for the development of Kulayan batteries to match the operation levels of imported batteries. Given R&D support or technological transfer opportunities to the Kulayan this is achievable. A certain portion of funds collected by pollution taxing on vehicle and fuel can be used annually for such purposes. Besides, subsidies and VAT exemption to Kulayan batteries on the import of raw materials and sales of the manufactured batteries can help to bring down the cost of batteries substantially.

Should Kulayan batteries be given development opportunities through a government pollution tax fund, the development costs will not be internalised in the battery costs and will remain as of today (i.e. NRs 96000 for two sets of batteries). There will be nearly a 12% reduction of running costs (Table 7.10). Further, if VAT to the current price of the battery is exempted, the battery costs will be reduced further to NRs. 87273; the corresponding reduction in the running costs will make it nearly 15% lower than the present costs. This is a substantial improvement, but still does not make EVs competitive with other vehicles.

**Table 7.10: Improvement of Kulayan Battery at par with Imported Batteries**

Battery / 2 set (NRs)	Average life time (Months)	Annual cost /vehicle (NRs.)	Salvage value (NRs)	Total cost/km (NRs)	Reduction in running cost/km (%)
96000	18 months	64000	14000	1.69	11.70% (NRs. 0.70)
87273	18 months	58182	14000	1.51	14.71% (NRs.0.88)

*Note: Cost of Battery as per field survey and Devtec 2002*

Given the right kind of policy guideline, the Kulayan Battery Industry could also be developed for the recycling of used batteries. The battery operated EV sector is often blamed for battery pollution, though at present it is accountable for less than 15% of the battery wastage.

## 7.6 Policy Change in Subsidies

The exemptions currently available to EVs relate to custom duties, VAT, and yearly vehicle tax for EV three wheelers. Only EVs in the private sector and EV buses were allocated subsidies for import costs. In contrast, previously LPG three wheelers, and even diesel and LPG microbus were allocated subsidies in custom duties and VAT, making them nearly equivalent to EV three wheelers. Such policy changes disregard of specific details while allocating subsidies have made EVs less competitive than other types of vehicles.

Policies need to take the pollution potentials and associated economic and social costs into consideration while fixing vehicle tax, duties and subsidies so that pollution costs are internalised in the vehicles and to enable EVs to compete with both public and private sector vehicles. Table 7.11 presents the basic pollution potentials of the currently operational mass transport vehicles in terms of costs related to PM emissions. This could be taken as a guideline for internalising the pollution costs and to develop subsidy schemes for clean vehicles.

**Table 7.11: Comparison of Pollution Potentials of different types of vehicles**

Vehicle Type	Emission cost/km (NRs)	Emission cost/head/km (NRs.)
Bus - MPTS	1.55	0.03
Minibus -MPTS	1.03	0.041
micro bus LPG -MPTS	0.03	0.002
Micro bus diesel -MPTS	0.62	0.041
Tempo - MPTS	0.25	0.03
Tempo - Taxi (petrol)	0.25	0.08
LPG -MPTS	0.03	0.0025
EVs	0	0

Note:

- Average distance covered after Ale 2001
- Emission Factor adopted from Urbair (1996)
- Cost of PM/Kg adopted from Urbair (1996) and adjusted to current exchange rate.
- Vehicle carrying capacity (LPG and Petrol Tempos - 12, Micro Bus - 15, Mini Bus - 25, Bus 40 and Petrol Tempo Taxi - 3

## 7.7 Policy Change in Soft Loan and Parking Fees

The current interest rate for loans in the EV sector is 12% (Devtec, 2002). The corresponding interest per/km is NRs. 1.88, accounting for 16 % of the total operational costs. Provided soft loans are given to EV operators through government funds at a 5% interest rate, the operational costs per/km could be reduced by 9.2%.

Similarly, if parking fees for EVs are waived, 1.7% of the operational cost/km will decrease. Such changes in the soft loan and parking policies together help reduce the operational cost/km by a substantial 11%.

The Pollution Tax Fund could be utilised to implement the above propositions. A certain portion of the fund could be set aside every year for the above purpose.

## 7.8 Policy Change in R&D

Following the initial research and development by GRI in 1994/96, there has been very little supplementary effort from the government and private sector in the R&D of the EVs, particularly three-wheeler Safa Tempos. One of the reasons behind the decline in EV manufacture and sales after 2000 is related to the lack of R&D support in increasing vehicle efficiency, particularly in relation to safety measures to prevent discharge of batteries, improvements in mechanical and electrical vehicle parts such as shock absorbers, wheel rims, tyres, brake system, differential, oil seals in gear box, DC motor, the motor controller, DC – DC converters etc.

The EV manufacturing sector is currently an assembly industry with only about 18% value addition. Given adequate R&D support, the manufacturing sector has the potential to grow as an industry with gradual value addition as well as technological improvements. Both are conducive for the promotion of EVs, not only Safa Tempos, but also for cars, buses and the Trolley Bus. In the present situation, the EV industry has invested more than NRs. 450,000,000. Additional investment in R&D by the EV industry is not unlike at this point. The government and other environmental groups concerned about the increasing air pollution should support the manufacturing industries for R&D or technological transfer to make EVs more efficient and suitable to local conditions. Teaching/research institutions should be encouraged for R&D in the EV sector by allocating minimum required funds.

The current EV maintenance and labor costs and the running costs of tyre wear and tear /km is 63% higher than for LPG 3 wheeler and 43% higher than petrol 3 wheelers. Adequate R&D could reduce this cost to make EVs competitive with other vehicles. An additional major benefit of this would be to save the cost of regular breakdowns that put the vehicle out of operation..

Uncertainty of battery life is one of the major economic risks of battery-operated vehicles. Battery life depends upon a number of factors such as discharging of battery to levels above 80%, drawing of high currents from the battery during operation (currents higher than 100 A shorten the battery life), improper charging of batteries, use of ordinary water in the place of distilled water, mixing old and new batteries to make a set, leaving discharged batteries for long periods etc. (Markus Eisenring, 2000). To increase certainty of battery life, there is a need to educate both the chargers and drivers. R&D for the development of cost-effective safety tools such as speed limiter devices, current limiter devices etc. could ensure the optimum life of the battery.

A portion of the Pollution Tax Fund needs to be diverted for the R&D activities of battery operated EVs so as to make them cost effective and cost efficient. The battery operated EV sector has a number of R&D opportunities in the electrical and mechanical parts of EVs. Additional opportunities also exist in exploring the type of battery itself to make EVs most efficient and cost effective.

## **7.9 Adverse Impacts of Policy Change Measures If Any**

All the measures recommended above are liable to inflict very limited adverse impacts on other sectors. The reduced electricity tariff may seem to have an adverse impact, but in reality the use of wasted energy will generate additional income for the NEA. Introduction of a pollution tax on polluting vehicles will definitely increase the operational cost of these vehicles but these measures are also recommended based on the basic polluters pay principle. Subsidies for clean vehicles will have direct impact on revenue generation but if no vehicles are imported without subsidies, then there is no adverse impact as well. Free parking for clean vehicles will have a direct impact for municipalities, but this is a very nominal loss compared to the economic and social benefits of reduced pollution. Allocation of specific routes for clean vehicles only will definitely limit the market for other types of vehicles. However, these vehicles can be shifted to long routes to reduce any adverse impacts. In conclusion, only minimal adverse impacts of any importance are anticipated due to the proposed policy changes for the promotion of clean vehicles in Nepal.

## **7.10 Conclusive Remarks**

Changes in policies, as illustrated above, can make EVs economically beneficial as well as competitive with other vehicles. A major benefit of EVs is the environmental benefit, which is of a local and ultimately a global significance. Unfortunately these indirect benefits are hardly accounted for in the common market.

In this context, to make EVs competitive with other vehicles in direct economic terms, an array of policy measures having a direct bearing on the market economy have to be implemented. A subsidy and pollution taxing policy on the basis of environmental justice (polluters pay and non-polluters rewarded) are among the most appealing of the available policy options. These measures themselves do provide an edge in EVs marketing and introduction but essentially will not make EVs competitive in the open market. For this, complementary policies to support EVs are required. Only the judicious utilisation of the Environmental Tax collected from all vehicles and fuels for the promotion of EVs can help make EVs competitive. Other factors that can boost the marketing and competitiveness of EVs would be to support R & D to increase vehicle efficiency and to reduce operational costs and provide soft loans and free parking. Protection policies are effective in the initial stages of marketing but without education and awareness building among the general mass, it can be counterproductive.

Above all, use of indigenous hydropower energy in the transport sector should be the priority policy focus in the promotion of clean vehicles. Such policies enable battery operated vehicles to acquire maximum advantage as they can store off peak energy which otherwise has no

economic value. On this ground the tariff rates could be brought down, substantially lowering the total operation cost of EVs and making them competitive with other polluting vehicles.

## **8.0 RECOMMENDATION FOR POLICY CHANGE**

### **8.1 Basis for Specific Policy on Cleaner Vehicles**

The financial and economic cost benefit analysis presented in Section 7 singularly points to the fact that the promotion of EVs is economically and financially beneficial. It has a direct monetary benefit and has an indirect benefit on the quality of life of the people and the environment. Although HMG/N through many policy documents and legislation tools gives priority to clean vehicles on paper, the spirit of these documents is not realised in practice. As a result, Nepal needs a specific policy on clean vehicle promotion. The basis for such an initiation is highlighted below.

#### **8.1.1 Environmental Basis**

- Ambient air quality of major cities in Nepal is deteriorating over time and the trend of such deterioration is increasing day by day
- The trend of air quality deterioration is directly proportional to the increase in vehicles
- Assessment of air quality over the past decade shows that the major concern is particulate pollution, particularly inhale able particulate matter (PM10 and PM2.5) which is well above the WHO guideline most times of the year. Vehicle exhaust is the major culprit here
- Vehicle exhaust is also responsible for many toxic pollutants having much more serious long term health impacts, of which there are no set limits set even by the WHO
- Oxides of Nitrogen and Ozone will keep increasing with the increase in fuels burned in more vehicles; these pollutants are difficult to control even in developed countries

#### **8.1.2 Impact of Pollution on Public Health and Economy**

- Air pollution has began to reflect on human health in major urban cities and there is a need to carry out further investigation with toxic pollutants and related health impacts
- Air pollution related health problems directly impact the national account for developing health institutions and curing diseases
- Health problems can directly reduce the number of working days and hence the national productivity
- The tourism industry, a major source of foreign currency has been seriously hampered over the years - this is partly due to pollution in major cities

#### **8.1.3 Economic Basis**

- Import of petroleum products drains out significant amounts of convertible foreign currency every year; this is increasing day by day
- Hydropower development is envisaged as the main engine of sustainable development in Nepal
- Hydropower development is directly linked with the major sector development for the consumption of generated power; the transport sector, being the major consumer of petroleum products, must be targeted to be the major consumer of electricity
- Besides petroleum products, the import of vehicles also drains out huge amounts of foreign currency. Thus by developing a national industry based upon the available natural resources, an EV manufacturing industry promises immense potential for development by attracting direct foreign investment and providing job opportunities to Nepali citizens
- Today's growing population, improved standards of living and demands for better access to transportation has led to an almost 15% increase in vehicle registration. This number is expected to increase with time.

### **8.1.4 National Development and Environmental Objectives**

- Policy objectives are focused on the development of national industries (manufacturing and service) based on indigenous resources for the overall economic and social development of the nation
- Environmental policy objectives are based on maintaining the quality of environmental characteristics and protecting human life
- Policy objectives prioritise the co-ordinated efforts of all the development partners in maximising the use of natural resources in a sustainable manner for the well being of all citizens
- National policy documents have the objective of promoting environment friendly industries, technologies with incentives and also adopt the policy of polluters should pay principle

### **8.1.5 International Commitment**

- Nepal is a member of UNFCCC, and as a vulnerable country, likely to bear a severe impact of climate change. Nepal needs to develop policies that reduce GHG emissions and create a conducive environment for attracting foreign investments through the financial mechanisms of the Kyoto Protocol

### **8.1.6 Inconsistency in Implementation of Policy**

- The Industrial Enterprises Act does not place the EV manufacturing industry in the category of nationally prioritised industries
- The financial incentives provided by the Fiscal and Environmental Protection Acts to LPG and Petrol operated vehicles are on par with or even exceed those to EVs; this is against national and environmental policy documents (Fiscal Acts 2053 to 2055 provided equal incentives to EV and Gas operated vehicles; while in 2056 the decision of MOPE based on EPA to provide only 1% custom and no VAT to EURO-I petrol microbus and LPG microbus and ignoring of 10% custom on EVs for import)
- The fiscal incentives provided to phase out diesel tempos are against the polluters should pay principle (diesel tempos could not comply with the vehicle emission standards and were phased out with compensation of over a million Rupees per vehicle against the market price of approximately 100,000 Rupees).
- The ban on registration of EVs inside the Ring Road in sync with the ban enforced on other public transport contradicts the National Transport Policy as well as the provisions of Vehicular Transport Management Act (VTMA)
- DoTM (Department of Transport and Management) not prioritising EVs in allocating routes is also against the VTMA's legal mandate i.e. vehicle emission is fixed as one of the major criteria in verifying the roadworthiness of vehicles
- MOPE's inability to support the import of two chassis purely for R&D purposes for the development of a four wheeler electrical bus contradicts the national policy and spirit of EPA and EPR
- The attitude of decision-makers in the Ministry of Finance towards the five REVA cars violates the provisions of the Fiscal Act. Modification of the allocated provisions in the subsequent fiscal act suggests that these changes were made specifically to block the import of these zero emission vehicles
- An additional EPA/EPR clause providing supplementary incentives to environment friendly industries, technologies, and equipment has to date never been used in favour of EVs
- Lack of government commitment in implementing their own decisions (the proposed phasing out of 20 year old vehicles and two stroke three wheelers has been pending for almost three years)

### **8.1.7 International Practices**

- In many countries zero emission vehicles enjoy customs, tax and parking exemptions as well as a host of other economic incentives such as free charging, reduced electrical tariff, even reduced vehicle costs
- In many countries vehicles and fuels are taxed according to environmental damages

- In many countries there are phasing out programs in which polluting vehicles are replaced by targeted cleaner vehicles
- In many countries the government and even the private sector allocates resources for R&D and P&D programs for the development and marketing of zero emission vehicles

### **8.1.8 Standards Enforcement Difficulties**

- Import of vehicles with stringent emission standards requires adequate repair and maintenance in the long run for compliance; this requires effective monitoring and administration as is the case with the import and quality control of high quality fuel. In an underdeveloped country like Nepal, emission elimination technology prevails over emission reduction/control technology

### **8.1.9 Environmental Damage Cost not in Operational Cost**

- The prevailing national legislation does not take into account the environmental damage cost while determining the tax, custom duties, and subsidies to vehicles and vehicular fuels. The environmental justice based pollution tax payable by polluters is not in practice.

### **8.1.10 Environmental Responsibility of Central/Local Governments and Other Institutions**

- Institutional leadership in procuring and running zero emission vehicles goes a long way in the promotion of such vehicles - which is absent in Nepal (central/local governments and public institutions could utilise EVs as pick up and drop vehicles for their employees, use of EVs for specific jobs such as collection of garbage, repair and maintenance of electrical and telecom services etc)
- Service institutions are not taking into consideration the institutional responsibilities of environmental protection

## **8.2 Proposed Policy**

Based upon the identified basis for specific policy formulation in the context of air pollution, the following policy changes are recommended for the promotion of zero emission/ cleaner vehicles in the national policies, strategies and priorities, legal and administrative framework, and the status of zero emission/cleaner vehicles Nepal.

The Ministry of Population and Environment as the lead agency in environmental matters in co-ordination with the Ministry of Labour and Transport, (particularly the Department of Transport Management) Ministry of Health, Ministry of Finance and Local Governments, should take the initiative for the proposed policy changes in consultation with vehicle operators, dealers, manufacturers, NGOs and Civil Societies.

### **8.2.1 Policy Objective**

The long-term/primary objective of the cleaner vehicle promotion policy is to develop an environment friendly and competitive transport sector prioritising the indigenous clean energy resources of the nation.

The immediate/secondary objectives are:

- To bring the deteriorating urban ambient air quality to acceptable levels having minimum adverse impact on human health
- To make the transport system easily accessible, affordable and comfortable to the general public
- To establish a national co-ordinating mechanism to develop adequate infrastructure facilities conducive to the promotion of different modes of cleaner vehicles as per local and regional conditions
- To create an investment friendly environment to attract national and foreign capital in the development of infrastructure facilities for the promotion of different categories of cleaner transport services

- To maximise the participation of the private and non governmental sector in decision making as well as implementation processes
- To introduce market based instruments based upon environmental costs and benefits in the transport sector
- To create public awareness of the need to protect the environment
- To create networking of stakeholders involved in cleaner vehicles

### **8.2.2 Policy Strategy**

In order to achieve the long-term and immediate objectives, the policy strategies proposed are as follows:

#### **Air quality Assessment and Public Awareness**

As seen in many developed countries, genuine understanding of the environmental situation and its potential impacts on human health and economy has triggered government commitment towards the promotion of cleaner vehicles with pressure from environmentally aware citizens. In order to create this situation in Nepal, the cleaner vehicle promotion policy needs to address the following issues:

- Establishment of an ambient air quality monitoring network system focusing on pollutants hazardous to health in major urban areas of Nepal in partnership with central/local governments, academic institutions, private and non-governmental research institutions
- Develop source inventories and establish a system of regular updating of such inventories including the transport sector with the age, technology, type and fuel of specific vehicles
- Establish a mechanism to continuously assess the impact of air pollution on human health and economy involving health institutions and environmental research institutions
- Build a partnership with the mass media to regularly inform citizens about the status of air quality and its potential impacts
- Based upon the air quality and its impact on human health, set a national ambient air quality standard and develop institutional mechanisms for periodic review and modification of these standards.

#### **Declaration of Air Pollution Control Area and Environmentally Sensitive Areas**

Declaration of air pollution control areas where the air quality is well above the national ambient air quality standard (for example with the current level of PM10 and PM2.5, Kathmandu Valley would be required to declared a air pollution control area)

- Declaration of environmentally sensitive areas to maintain and enhance their historic, social, religious, economic and archaeological importance (for example, Lumbini Area, Bhaktapur Darbar, Patan Darbar, Basantpur Darbar, for their historic significance, Pokhara and Thamel as tourism centres)

### **Classification of Cleaner Vehicles**

In order to design and implement fiscal and non-fiscal incentives, it is important to classify vehicles according to their degree of cleanliness:

- Zero-emission vehicles (vehicles having no exhaust emission and based on clean energy like hydro electricity)
- Ultra low emission vehicles (hybrid vehicles running on hydro electricity in urban centres and high quality petroleum products in highways etc)
- Low emission vehicles (vehicles based on cleaner fuels like CNG (Compressed Natural Gas) and other identified clean fuels)

### **National Priority on Infrastructure Development**

Looking into the huge potential of hydro-electricity generation in Nepal and the steady flow of significant amounts of foreign currency on the import of petroleum products every year, the development of infrastructure for electricity based transport system must be included in the nation's highest prioritised development programs.

- Establishment of an East-West electric railway service within twenty years
- Establishment of Trolley bus services between Bhirahawa and Lumbini within the next five years
- Rehabilitation of the existing Trolley bus system between Bhaktapur-Tripureswor and expansion of service in the Kathmandu Valley Ring-Road within the next five years
- Infrastructure development in the outskirts of the Kathmandu Valley for the operation of electric trains or Trolley buses within fifteen years
- Linking of major cities of the Terai by Trolley bus services within twenty years (Biratnagar-Dharan, Butwal-Bhairahawa, etc)
- A Trolley bus service linking the major tourist centres in Pokhara within 10 years
- Ropeway services in the hilly areas of the country

### **Classification of Roads and City Areas**

In order to promote various types of clean vehicles as per the road infrastructure and city features, a systematic classification of roads and urban centres is required based upon:

- Heavy traffic areas
- Core city areas of maximum pedestrian and vehicle usage
- Multiple lane roads and highways
- Historic, religious and touristy areas

### **Polluting Vehicle Retirement Program**

A compulsory Vehicle Retirement Program in at least the Public Transport Service is should be initiated. At the initial phase, such programs should be based on environmental grounds, taking into account the air quality status and the pollution contribution of various categories of vehicles As per the prevailing situation, the following policy measures are justified on environmental grounds:

- Target vehicle emission monitoring programs on vehicles that are the major sources of particulate pollutants - old diesel buses, trucks, minibuses and two stroke three wheelers that barely meet the prevailing vehicle emission standards
- Target vehicle emission monitoring programs on vehicles without pollution control devices
- Focus on replacement of old buses and minibuses in the Ring-Road and wider roads with trolley bus services
- Import of EV buses as replacement for old polluting buses
- Replacement of all two stroke three wheeler tempos (12 seaters) with only electric three wheelers
- Phasing out of the two-stroke three wheeler taxi tempos with scraping incentives

- Five-year phasing out program of LPG operated three wheelers with scraping incentives

#### **Establishment and use of a Clean Vehicle Fund/Pollution Tax Fund for the promotion of cleaner vehicles**

In order to support the Polluting Vehicle Retirement Program in the initial stage and to support air quality monitoring and assessment, R&D activities on clean vehicles, establishment of free parking areas, incentives in the interest rates, etc the establishment of a Clean Vehicle Fund/Pollution Tax Fund with income from following areas is imperative.

- Establishment of a pollution tax on fuels according to their emission character
- Establishment of a pollution tax on vehicles (on annual basis based on the damage cost calculated)
- An annual contribution from the government's Environmental Fund
- Contribution from donor agencies (DANIDA support has helped establish the Clean Vehicle Promotion Fund)
- Contribution from utilities institutions (like NEA with provisions made on EIA itself)
- Levying a 1% additional custom on import of petrol, diesel and LPG vehicles

#### **Special Routes for Clean Vehicles and Preference to Cleaner Vehicles for Replacement**

- Assign special EV routes based upon the strategies recommend above
- Preference to EVs to replace the routes of two-stroke three wheelers, and LPG three wheelers in the initial vehicle retirement program

#### **Fiscal Incentives**

- Interest subsidy for purchasing of EVs as public transport
- Tax credit for electric cars
- Free parking for electrical vehicles
- No income tax for EV manufacturing industries for at least ten years
- No income tax for EV battery manufacturing industry for at least ten years
- Industries manufacturing EV or EV parts to be included and benefit from the prevailing facilities as a nationally prioritised industries

#### **Establishment of Charging Centres**

- Encourage NEA to establish charging stations in major cities at the actual energy consumption tariffs
- Support from the Clean Vehicle Fund/Pollution Tax Fund to private charging stations to reduce charging costs

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