

Kathmandu Electric Vehicle Alliance

KEVA Secretariat

C/o WINROCK INTERNATIONAL

103/68 Devkota Marg, Baneshwor

Kathmandu, Nepal

Final Report

ANALYSIS OF HMG POLICIES AND REGULATIONS

AFFECTING ELECTRICAL VEHICLES

July 2003

Submitted by

Nepal Environmental & Scientific Services [NESS] (P) Ltd.

GPO Box 7301, Jitjung Marga-26, Thapathali, Kathmandu, Nepal

Tel: 977 - 1 - 244989, 241001; Fax: 977 - 1 - 226028

E-mail: ness@mos.com.np; URL: <http://www.south-asia.com/environment>

EXECUTIVE SUMMARY

Pollution control including air pollution through vehicular emission is one of the priority areas of the government at the policy level since 1992. However, strategies and action programs in all the successive plan and policy documents are very broad and are mostly limited to formulation and implementation of vehicular emission standards particularly in Kathmandu valley. Despite the regular exercise in framing the environmental policies, strategies, and action programs, country is yet to come up with a long-term national policy in the control/reduction of air pollution from the vehicles. The sorry scenario of the efforts so far made is paper work only and a few of the policy strategies, action plans and programs designed so far have been translated into action.

Promotion of pollution free vehicles has been made repeatedly as one of the strategies for the reduction of vehicular emissions, but the policy has not specified any mandates and targets, short or long term. Again the term pollution free vehicles does not categorise vehicles as per their pollution potentials. This lack of objective definition of pollution free vehicles has confused the successive legal initiatives and implementation programs. Obviously policy and strategy failed to internalise the environmental emission costs of the polluting vehicles while promoting non-polluting vehicles. The current policy also failed to internalise the capital cost of the imported fuel consumption while promoting vehicles for emission control/reduction. The policy of equal treatment of the zero emission vehicles/transport with the other low emission vehicles/transport in custom subsidies, registration, roadworthiness certification, route permit, parking etc. is against the environmental equity principal.

The key legislation for the vehicular emission control/reduction is 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 provisions of tax deductions to industries, which manufactures goods and machines for the reduction of pollution as national priority industry.

These environmental legislation are of very generic nature and describes general issues to be covered under the law and leave all the provisions to be covered by Rules or Regulation and support guidelines under the Act. Guidelines and Regulation under the Act will either remain to be passed or if framed and passed remain silent on the provisions required to prevent vehicular emission in specific terms. Most of the legal provisions lack timely updates in accordance with upcoming new sector government policies or there is no uniformity in the government policies and legislation to be effective for implementation and compliance.

The existing legal provisions have empowered four ministries namely Ministry of Population and Environment, Ministry of Labour 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. Lack of co-ordinated action at times has resulted duplication of activities, and conflicting interpretations of rules under the legal provisions.

Changes in policies can make the EVs economically beneficial as well as competitive with the other vehicles. Major benefit from the EVs is the environmental benefit, which has a local as well as global significance. But in the common market these indirect benefits are hardly accounted.

The other benefit of the EV industry and EV vehicles is its potentials of development as national industry, which is based on the indigenous and clean hydroelectric energy. Besides, phasing out of the vehicles and replacement by suitable EVs has a positive contribution to national current account as well as national capital account. The major share of benefit occurs from the reduction of the import of petroleum fuel.

In this context, to make electrical vehicle competitive with the other vehicles in direct economic terms an array of policy measures, which has direct bearings with market economy, has to be implemented. A subsidy and pollution taxing policy on the basis of environmental justice (polluters pay and non-polluters rewarded) are among the lower hanging fruits of the available policy options.

These measures themselves does provide edge in the EVs marketing and introduction but essentially will not make EVs competitive in the open market. Complementary policies to support EVs are required. Judicious utilisation of the Environmental Tax collected from the vehicles and fuels for the promotion of EVs can only make EVs competitive. Support for R & D to increase vehicle efficiency and reduction of operation costs and provision of soft loans and free parking are the other factors that will make EVs marketing and introduction aggressive as well as competitive. Protection policies are helpful in the initial stages of marketing and introduction but without education and awareness building among the general mass, it can even be counterproductive.

Replacement policies though sound better are sometimes very costly. Instead provisions to restriction of polluting vehicles in upcoming registration could be beneficial provided compulsory retirement of vehicles after crossing 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, and Mr. Ratna Sansar Shrestha and Mr. Bikash Pandey, Winrock International, Nepal for providing with 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 like to thank each of those individuals for their time and their ideas, whose names are not mentioned here.

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
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
NO2	Nitrogen Oxides
NOC	Nepal Oil Corporation
NRs	Nepali currency Rupees
P&D	Promotion and Development
PARs	Policies, Acts, and Regulations
PM10	Particulate Matter less than 10 micrometer
PM2.5	Particulate Matter less than 2.5 micrometer
R&D	Research and Development
SDAN	Sustainable Development Agenda for Nepal
SO2	Sulphur dioxide

TOD	Time of Day
TOR	Terms of Reference
TSP	Total Suspended Particulate Matter
ug/m3	Microgram per cubic meter
UNFCCC	United Nations Framework for communication 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.....	1
1.4 Study Methodology	2
1.5 Study Limitation.....	2
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	6
4.1 Review of Government Policies, Strategies and Priorities	6
4.2 Analysis of the Government Policies, Strategies and Priorities	9
5.0 REVIEW AND ANALYSIS OF THE LEGAL AND ADMINISTRATIVE FRAMEWORK....	10
6.0 INCENTIVES FOR CLEANER VEHICLES IN SOME OTHER COUNTRIES	11
7.0 ECONOMIC AND FINANCIAL COST BENEFIT ANALYSIS OF POLICY CHANGE	13
7.1 Policy Change Replacement of Petroleum/LPG Based Vehicles to Electrical Vehicles/or Elimination of Petroleum/LPG Based Vehicles	13
7.1.1 Savings from Imported Petroleum Products	13
7.1.2 Expenditure from the Import in the National Current/Capital Account.....	14
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.....	15
7.1.4 Local Employment Generation.....	15
7.1.5 Reduction of Emission, Particularly PM Fraction and Related Economic and Social Costs.....	16
7.2 Policies Change in Electricity Tariff.....	17
7.3 Policy to Operate EVs only in Some of the Priority Routes / Areas / Government / Institutions	18
7.4 Policy Change on Pollution Tax to Polluting Vehicles	19
7.5 Policy Change in Battery Procurement.....	20
7.6 Policy Change in Subsidies	21
7.7 Policy Change in Soft Loan and Parking Fees.....	21
7.8 Policy Change in R&D	22
7.9 Conclusive Remarks.....	22
8.0 RECOMMENDATION FOR POLICY CHANGE	23

8.1	Basis for Specific Policy on Cleaner Vehicles	23
8.1.1	Environmental Basis	23
8.1.2	Impact of Pollution on Public Health and Economy.....	23
8.1.3	Economic Basis	24
8.1.4	National Development and Environmental Objectives	24
8.1.5	International Commitment	24
8.1.6	Inconsistency in Implementation of Policy.....	24
8.1.7	International Practices	25
8.1.8	Standards Enforcement Difficulties	25
8.1.9	Environmental Damage Cost not in Operational Cost.....	25
8.1.10	Environmental Responsibility of Central/Local Governments and Other Institution	25
8.2	Proposed Policy.....	25
8.2.1	Policy Objective.....	26
8.2.2	Policy Strategy	26
REFERENCES		29

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, fleet of sub-standard vehicles with low quality fuel in the street and ineffective control of emissions have been major contributors to air pollution in the Nepal. This has resulted in negative health impacts to the residents of urban areas, with the attendant problems of productivity loss and increased health expenses, as well as an adverse impact on the economy through the negative impacts of pollution on tourism.

It is high time to the government to formulate and implement a policy that support to abate level of air pollution. In this regard, apart from others the government should implement such a policy that helps to abate air pollution through vehicular emission vis-à-vis support to improve human health and increase government revenue. Clean modes of transportation, specifically, fleet of zero emission vehicles in the streets will greatly support to improve air quality level, which eventually will have catalytic impacts to boost tourism in the country.

EVs in Nepal are largely locally manufactured and their fabrication results in substantial increase in number of employment generation at the local level. In addition, electric vehicles use nationally generated hydro-electricity as fuel, thereby reducing the nation's need for imported oil and to save foreign exchange. In the case of battery-powered EVs, Nepal Electricity Authority benefits even more by being able to sell currently wasted off-peak electricity to the charging stations.

In this context, the Kathmandu Electric Vehicle Alliance (KEVA) efforts to promote the sector in Nepal are commendable. KEVA is working to improve the air quality of Nepal in general and 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.

The successful promotion of Electric Vehicles (EVs) depends strongly, however, on favourable government policies. Those who suffer most from the impacts of air pollution are children, youth, and the elderly people. At the same time, the tourism sector of Nepal along with other reasons is adversely affected due to poor air quality.

This study report on "Analysis of HMG Policies and Regulations Affecting Electrical Vehicles" is prepared by Nepal Environmental and Scientific Services (P) Ltd. for Kathmandu Electrical Vehicle Alliance (KEVA) is a step toward providing policy and regulation recommendations to His Majesty's Government of Nepal for the promotion of EVs. A larger role of EVs in transportation sector of Nepal will contribute toward the reduction of vehicular emission. Vehicular emission is a significant contributor of urban air pollution.

1.2 Objectives of the Study

The broad objective of the proposed 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 key policy changes that will have a positive impact on the promotion of EVs in Kathmandu.

1.3 Scope of the Study

The scope of the proposed study will be conducted based on available information viz. HMGN 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 the EVs.

As stipulated in the Terms of Reference (TOR) the scope of study area will be confined to Kathmandu valley and the scope of work will include but shall not be limited to the followings:

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, micro-buses 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 the changes 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 to be 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 batteries 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 basically based on the review and assessment of His Majesty's Government's policies, and legislation related to air pollution in general and transport management in particular. The study heavily relied on the contents of secondary literatures published and unpublished on the Electrical Vehicles of Nepal to understand the problems and opportunities of the EV sector. Only limited first hand information have been collected to unravel some of the current issues in the sector. The informal meeting and discussions with the stakeholders in this sector has been instrumental in streamlining some of the current issues.

1.5 Study Limitation

Dependency of the study on the secondary information is a major limitation, particularly in cost benefit analysis of the policies. A number of discrepancies were noted in the secondary literatures, however, the team has given effort to correct such discrepancies to the level possible. But due to time and resource constraints this was not always possible to the satisfaction of the study group and has to be compromised.

2.0 THE CONTEXT - WHY ELECTRICAL VEHICLES

Though the fraction of population living in the urban centre of Nepal are less than 15%, poor infrastructure, haphazard urban expansion without any planning and awful level of support services including transportation, has made the urban centre "pollution hot spots" comparable to the most polluted urban centre of the world. With regard to pollution, air pollution related to vehicular emission is increasing day-by-day due to dependency on the old and ill-maintained vehicle population. Use of the rampantly adulterated fuel by the ill-tuned vehicles is degrading the air quality of urban centre beyond speculation. Apart from this the number of vehicle is increasing at a pace of over 15% /annum in the urban areas, particularly in Kathmandu valley.

A case study of Kathmandu Valley (*Annex - 1*) indicate increase in vehicular exhaust related PM10 emission by about 74% in 2001 compared to 1993. Vehicular sector PM10 contribution to the total MP10 emission in Kathmandu valley has correspondingly increased from 12% in 1993 to about 28% in 2001.

Recent time series monitoring of PM10 and PM 2.5 in the city centre of Kathmandu, Lalitpur and Bhaktapur shows PM10 and PM 2.5 data well above WHO guideline value (*Annex - 1*) for all the monitoring days. These PM data are quite alarming and with the further increase of the vehicular population, the PM scenario will be worse than the present.

Poor vehicle conditions, adulterated fuels and weak enforcement of standards (vehicular emission and fuel quality) are the key factors that influence the increase in vehicular PM. The danger of the vehicular PM is its aerodynamic size. More than 90% of the vehicular PM has aerodynamic size of less than 2.5 micrometer. The smaller the aerodynamic size of PM the greater is its economic and social costs particularly related to public health.

The PM fraction of the vehicular emission has a direct relevance with the fuel type it uses. Most of the vehicles in Nepal run on the fossil fuels. The fossil fuel is an imported commodity and is one of the products, which is consuming more than 50% of national development budget. Thus by consuming fuels in the transport sector the nation is not only expending its foreign currency reserve but is also polluting its air resources with heavy toll on the public health.

For a country like Nepal, use of hydroelectricity in the transport sector will at least not pollute its air resources saving public expenditure in air pollution related health problems. Nepal has enormous potential for hydroelectricity generation. This is a clean form of renewable energy. The vehicles using electrical energy do not emit pollutants and are the zero emission vehicles. Besides, some of the electrical vehicles, provide opportunity to store electrical energy in the off peak hours and use later in the peak hours. This has the added advantage of utilising energy which otherwise is spilled. Currently Nepal has surplus electrical energy particularly in the off peak hours. Most of the power generation of Nepal is based on run off the river hydroelectric power. Therefore Nepal Electric Authority (NEA) has not been able to 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.

The old saying "Prevention is Better than Cure" could be applied in Nepal in the context of air pollution issues. Instead of focussing only on the control measures for the reduction of vehicular emissions (vehicular emission standards, vehicle standards, fuel quality standards etc.), it should also utilise the measure of elimination of air pollution. Electrical vehicles are preventive options, which could be effectively enforced, and operationalised. Nepalese urban infrastructures are quite suitable for the electrical vehicles and moreover it uses national indigenous hydroelectric energy. Its positive effects on the public health through prevention of air pollution are the other biggest contribution to the quality of life of the people besides savings on health care.

3.0 ELECTRICAL/BATTERY-OPERATED VEHICLES IN NEPAL

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

After a gap of 12 years in 1989, a group called the Electric Vehicle Development Group (EVDG) comprised of enthusiastic engineers started working on the conversion of old car into an EV. The trade embargo imposed by the Government of India was the reason to go for a vehicle which could run on the national energy source - hydro-electricity. In 1992, the group successfully converted the old car into EV.

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

GRI conducted initial R&D on the three wheeler electrical vehicle. A total of 7 diesel fuelled Vikram tempos were converted into electrical vehicles (EVs) and named as Safa Tempos. A demonstration of the EVs was done by GRI for about 6 months with the 7 Safa Tempos 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 three wheelers of Kathmandu (diesel and petrol operated).

At the end of the GRI run pilot project in early 1996, a group of Nepali professionals and entrepreneurs bought those EVs and they 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) came into production of EVs. The signing of contract between His Majesty's Government and the Royal Danish Government for the conversion of 100 diesel tempos into EVs within four years and for the support to the establishment of charging stations in 1997 also promoted the EV industry. This Danish conversion program could not be implemented as designed due to high cost of conversion. However, the program assisted the EV sector by providing soft loan (up to 70%) to establish two battery-charging stations in Lalitpur and to procure 48 EVs for private owners.

Since then to date about 664 EVs (Safa Tempos) were manufactured locally. Table 3.1 presents total number of EVs manufactured and sold by the EV industries between 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, EVs industry of Nepal was progressively gaining its ground in the mass public transport services in Kathmandu and in some towns of Terai - Biratnagar and Narayangarh

(Bharatpur). But after 1999/2000, it started losing its ground. The sales record of the EVs manufacturers clearly reflects the scenario. Of the total manufactured EVs 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 vehicle
- ❌ MOPE's recommendation to provide special custom tariff to the owners of the banned Vikram Tempos toward the import of LPG/petrol/diesel minibuses nearly at par with the special custom tariff extended towards the EV industries.
- ❌ Less attention on the quality control of EVs and training to the charging station personnel and operators during the boom period 1999/2000 leading to short battery life
- ❌ Indiscriminate route permission by the Transport Management Office to all kinds of vehicles without considering environmental cost of polluting vehicles
- ❌ Fierce competition between the EVs (Zero emission vehicle) with the other polluting vehicles
- ❌ Fare difference between the EVs and polluting vehicles (EVs fares were high) leading to reduction in passenger occupancy in the EVs
- ❌ Lack of financial support for R&D in EVs by the government to make them technically and economically viable
- ❌ Restriction on the registration of vehicles in the mass public transport including EVs in the Kathmandu valley
- ❌ Weak networking of the EVs manufacturing group, EVs charger group and EVs operators

Despite the above barriers, the EVs (Safa Tempos) currently constitute about 13% of the mass public transport service of Kathmandu valley (Table 3.2), which perhaps is the highest number of battery-powered commuter electric vehicles of any urban centre in the world (Markus Eisenring, 2000). Safa Tempos of Kathmandu valley provide services to over 3.5 million peoples in a year (Devtech, 2002, CEN 2002). The Safa Tempos are currently operated in 39 routes of Kathmandu valley (*Annex - 2*) and some of the 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) Without adequate steps (policy and economic incentives), the future of the Safa Tempos of Kathmandu valley is certainly not bright.

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

Promotion of other types of electrical transport system is also bleak. Lack of policy commitment at the implementation level is a major setback. As a result, the Hetauda Ropeway was closed in the later half of 1990's and 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. The reasons obviously were the lack of political commitment on the government policy, mismanagement and political high handling of Trolley Bus Management System. However, the success of privately operated Manakamana Ropeway in central Nepal is a ray of hope for the future. Efforts are being made to privatise the trolley bus system of Kathmandu and the local governments of Kathmandu, Bhaktapur and Lalitpur are inclined to initiate the reopening of Trolley Bus with partnership with the private parties and its expansion in ring road and other feasible areas within the valley.

In such difficult periods, initiation of Himalayan Light Foundation (HLF), for the development of an electric four-wheeler bus in 2001 was encouraging news for the people of Kathmandu. With the support from Climate Change Challenge Fund, British Embassy, HLF had planned to launch four vehicles to demonstrate its use and conduct further research on actual operation cost and

technical performance of the bus. The aim of the project is that existing Nepal electric vehicle companies will be able to take up the production of the vehicles when the project is completed in preparation of replacing some older polluting vehicles in the Kathmandu Valley and other Nepalese cities. But due to lack of co-operation from the concerned HMG agencies, it could not go ahead as designed. The main obstacle were:

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

Delays in certifying the battery operated cars as electric cars by MOPE and subsequent change in the Finance Act provisions by Ministry of Finance has a direct impact on the promotion of electrical vehicles in private sector. Five REVA cars imported for the purpose of demonstrating electric cars in Kathmandu were not cleared from the custom by the parties as these cars were treated more or less equivalent to the other polluting vehicles for the custom purpose.

Despite the inconsistencies both in the interpretation of government policy announcement and the commitment of the concerned government agencies to promote electrical vehicle over the time, there is hope for the growth of the EVs in Nepal due to growing pressure from the private sector, local NGO groups and the donor agencies. 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 the key stakeholders in 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 right beginning. EVAN has been supported by Danish government under Environment Sector Programme Support (ESPS). ESPS has established a Clean Vehicle Support Fund for technological improvements of EVs. This has been a source of encouragement to EV industry. This kings of supports from INGOs will help in the EV movement in Nepal. Similarly Kathmandu Electrical Vehicle Alliance (KEVA) a program of USAID and Alliance Partners could lead EV movement in Nepal further ahead in future. The recent air quality monitoring campaign initiated by MOPE to streamline the government actions for the reduction of air pollution within the National Ambient Air Quality Standards is hoped to open avenues for the promotion of EV sector at least in 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 policy is based on the five years plans, which sets the frameworks for the country's development strategy (*Refer for details of some policy in Annex - 3*). Nepal started its planned development works in mid-fifties with the introduction of 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 Trolley Bus development linking Bhaktapur to Kathmandu in Kathmandu valley was initiated without any specific mention on the promotion of cleaner vehicles for the reduction of air pollution.

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

The Eighth Plan Document (1992 - 1997) in a separate Chapter “Environment and Resource Conservation” emphasised on the need of good environmental quality through control of environmental pollution. One of the objectives of Eighth Plan was the formulation of air related pollution control management plans with supportive legal and institutional instruments. The plan policy emphasising the decentralisation advocated 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.

NEPAP (1993) a milestone in the national Environmental Policy of Nepal was endorsed in this plan period. It focuses on utilisation of natural resources in a sustainable manner and protection of environmental qualities. For the first time at policy level, it recognises the deteriorating air quality in many urban cities as having social and economic cost on population. However, the focus of the mitigation measures was limited to improvement of fuel quality, fuel economy, vehicle maintenance, and formulation and implementation of vehicular emission standards only. Use of hydropower, a natural resource of the country and promotion of cleaner vehicles were not mentioned specifically 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 9th 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. The legislation though progressive has no specific mention for the promotion of cleaner vehicles. The responsibilities for the promotion of environmental friendly and less polluting vehicles in the urban areas were rested upon the executing agency officers without any specific guidelines (*Annex - 4*). The Transport Management Act and Rule did not differentiate the cleaner vehicles and other vehicles for the purpose of vehicle registration; roadworthiness tests, vehicle renewal and road permit 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 are enforced, limiting to petrol and diesel vehicles of Kathmandu valley. Emission standards for LPG and other low polluting vehicles were not formulated. This lacuna in the law gave a clean cheat to the LPG vehicles as Zero emission vehicles. As a consequence, the Finance Act 1996/1997 treated low emission vehicles such as LPG at par with the electrical vehicle (battery operated three wheelers or Safa Tempos). Therefore LPG run vehicle and EV enjoyed the same reduced custom tariff. Provision of pollution tax of NRs. 0.50/liter of diesel and petrol sold in Kathmandu of this Finance Act was a positive step to discourage polluting vehicle. But the pollution tax has not been implemented till date.

Even without a clear vision at policy level, it is in this plan period that the successful Safa Tempos demonstration project assisted by USAID between 1994 - 1996 was initiated and executed. The financial act 1996/1997, despite its shortcomings is a major instrument in the successful introduction of battery-operated vehicles in Nepal.

The Ninth Plan (1997 -2002) while endorsing the environmental pollution as a serious problem at policy level, it stressed the need for initiating environmental programs by generating public participation and implementing existing legislation in order to enforce for national need. Further it emphasized on the establishment and implementation of emission standards on air pollution. The policy also stressed on the need and establishment of appropriate short and long-term management plans to check the pollution in different sectors and implementation of the pollution standards through the establishment of voluntary and mandatory policies and essential legal arrangements.

Complementing to the above environmental policy, the 9th plan in the transport sector, set a 20 years target for the promotion of electrical vehicles particularly trolley and electric trains. The

sector policy emphasised on the expansion of trolley bus services and battery operated vehicles in the Kathmandu valley to reduce air pollution. However, the transport sectors target of the 9th plan, remained in paper only. It is in this plan period that the operating trolley Bus Service between Bhaktapur and Kathmandu came into halt through the government decision.

The Follow up NEPAP II (1998), in this plan period did not specifically identify activities and sub-activities related to the cleaner or battery-operated vehicles. However, the key strategies identified by the NEPAP II such as: develop tools 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, were conducive for the promotion of the cleaner vehicles. Unfortunately no further action in tune with the NEPAP II strategies were perused at the implementation level.

The National Transport Policy 2001, the other policy document endorsed in the 9th plan is focussed more on the infrastructure development. However, it has made some key policy announcements for the promotion of cleaner vehicles. Among the cleaner vehicles it prioritise solar, electric or gas operated bus, tram or motor in core city areas. Restriction on the noisy and polluting vehicles and setting up of special emission standards in core city areas are very promising policy initiatives. Besides, reduced custom tariff for a limited period to pollution free vehicles is the other policy, which promote cleaner vehicle introduction and marketing. This policy document developed under the auspices of Ministry of Physical planning and Works is currently under review by the Ministry of Labour and Transport before its full implementation. The Ministry for its revision has set a special committee, which is likely to put forward its revision within this fiscal year.

Sustainable Development Agenda for Nepal (2002) document, 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 have very supportive policy and programs for clean vehicles promotion. The document policy focuses on use of clean electric energy in transport sector for the reduction of air pollution and GHG emissions. Incorporation of the above policy commitment of SDAN in the action plan and its implementation, however, will be realized only in future.

Despite many shortcomings, there are some achievements made in the 9th plan period. Ministry of Population and Environment in a drive to implement pollution control provisions of Environmental Protection Act and Rule put ban to over 614 diesel-operated tempos in Kathmandu valley. MOPE further put restriction on the import of second hand and reconditioned vehicles. Total ban is introduced on the import of two stroke vehicles. Nepal Vehicle Mass Emission Standard 2056 was made compulsory to import vehicles in Nepal and monitoring of vehicle emission quality was enforced in Kathmandu.

The other step taken by the Ninth Plan is to ban 20 years and old vehicles in Kathmandu valley and restriction for operation of two stroke vehicles in Kathmandu. This plan could not be implemented as per the projected plan due to various reasons. Very recently Supreme Court has ordered MOPE to implement the plan within two years.

Though MOPE's action on the restriction of polluting vehicles were commendable, incentives given to the affected polluting vehicle owners were not favourable to cleaner vehicles in general and electrical/battery operated vehicles in particular. MOPE's ground action shows the meaning of cleaner vehicles as limited to cleaner than the diesel operated tempos. This is clearly reflected in the custom incentives given by MOPE to the affected diesel tempo operators 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. The electrical/battery-operated vehicles were given custom incentives, which was little higher than the polluting vehicles and was not sufficient to promote marketing and operation of electrical/battery-operated vehicles in competition with the other polluting vehicles.

The next Finance Act 2000/2001, however, removed the incentives given to other polluting vehicles including LPG operated vehicles. But the Finance Act 2002/2003 continued custom

incentives of 1% of the import cost to only Safa Tempos (battery operated three wheelers) and not to the battery operated four wheeler cars and buses. Custom duties to the battery operated car and bus was 33% less of the normal custom duties. This finance policy, thus, limits the promotion of only three wheeler battery operated Safa Tempos in the public transport service.

The **draft 10th Plan** document (chapter "Population and Environmental Management") has one of the basic objectives of promoting 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 to combat pollution control/reduction. It emphasises on the implementation of action programs that are conducive to the reduction of pollution and give priority to pollution control action programs including air.

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

4.2 Analysis of the Government Policies, Strategies and Priorities

Pollution control including air pollution through vehicular emission is one of the priority areas of the government at the policy level since 1992. However, strategies and action programs in all the successive plan and policy documents are very broad and are mostly limited to formulation and implementation of vehicular emission standards particularly in Kathmandu valley. Despite the regular exercise in framing the environmental policies, strategies, and action programs, country is yet to come up with a long-term national policy in the control/reduction of air pollution from the vehicles. The sorry scenario of the efforts so far made is paper work only and a few of the policy strategies, action plans and programs designed so far have been translated into action that too half heart.

Promotion of pollution free vehicles has been made repeatedly as one of the strategies for the reduction of vehicular emissions, but the policy has not specified any mandates and targets, short or long term. Again the term pollution free vehicles do not categorise vehicles as per their pollution potentials. This lack of objective definition of pollution free vehicles has confused the successive legal initiatives and implementation programs. Equal treatment by Finance Acts and also by Department of Transport Management and Ministry of Population and Environment to the low polluting and zero emission vehicles is one of the examples of such policy setback. Obviously policy and strategy failed to internalise the environmental emission costs of the polluting vehicles while promoting such vehicles. Such policies in fact have rewarded polluters than discouraged them. It is because of this, upcoming zero emission vehicles (electrical/ battery operated in the context of Kathmandu) with appreciable environmental margin of benefit could not be introduced in the market as desired due to technological and other overhead costs despite successful demonstration and operation in the public mass transport system.

The current policy also failed to internalise the capital cost of the imported fuel consumption while promoting vehicles for emission control/reduction. Nepal has immense potential of hydropower development. Hydropower is a non-polluting and indigenous source of energy in the context of Nepal. Currently, in the off peak hours, the hydropower energy is not used and is spilled. Battery operated vehicles (safa tempos, cars and bus) as they could store the off peak wastage energy and use in the peak hours, could provide national benefit even at the subsidised rates. The current policy failed to address this issue while promoting vehicles for emission control/reduction.

Promotion of national industry is one of the broad policy objectives of all governments world-wide. There are potential of such industrial developments particularly related to the manufacturing of

battery-operated vehicles in Nepal. In fact, most of the battery-operated vehicles running in Nepal were assembled with some component of local value addition. It should be remembered that even deep cycle lead acid batteries used by the battery-operated Safa Tempos are under production in Nepal (Kulayan battery Industry). There are some quality issues related with both the vehicle and battery but with the right initiatives to encourage research and development efforts by the private sector or the government, such industries could have been established and improved upon according to the need of the nation. The current policy of vehicle promotion for emission control/reduction did not take into account of this issue, which also has potential of local employment opportunities and additional national revenues.

Urban centre of Nepal are small, and mobility within the urban areas is limited to only some tens of kilometres. Poor infrastructure (narrow roads) restricts the mobility and speed of large vehicles. In the above context, the battery operated three wheelers have advantage to other vehicles both in mobility and reduction of emission pollution at local level in the city core areas. Trolley bus, electrical trains and ropeways, similarly have advantage in areas with wide roads within city, long distance transport, and in the remote hill areas compared to the other polluting vehicles. However, current policy of equal treatment of the zero emission vehicles/transport with the other low emission vehicles/transport in custom tariff, registration, roadworthiness certification, route permit, parking etc. is against the environmental equity principal. The current policy failed to address this issue while promoting vehicles/transport for pollution control/reduction.

Current policy on decentralisation, awareness and public participation is merely cosmetic. There are no indicative guidelines on how they should be carried forward in strategies and action plans for effective implementation. The policy in general fails to address the lack of networking of the stakeholders, who have a clear vision of roles and responsibility sharing in terms of decision-making and program implementation. Promotion of electrical/battery-operated vehicles is the victim of this poor networking and lack of policy endorsed mandate and targets.

World-wide experience have shown that the electrical/battery operated vehicles/transport requires certain degree of policy protection in the form of restriction, priority setting, financial support for P&D and R&D, etc. for the introduction and marketing in a new place for a certain duration of time. Besides, it also requires identification of niche areas and reservation of such areas only for the zero emission vehicles. Policy encouragement to the local governments, institutions and the private parties in the procurement and operation of the zero emission vehicles could be one of the policy strategies in the promotion of electricity/battery-operated vehicles. In the context of Kathmandu, considering the narrow lanes and mobility distances, Kathmandu municipality should be encouraged to employ battery-operated vehicles for the collection of wastes. Similarly certain urban core areas lanes and historical places of archaeological and cultural significance could be allocated only for battery-operated vehicles. Nepal Electricity Authority, institution responsible for the generation and distribution of electricity, could be encouraged to take a lead role to replace its local fleets by the electrical/battery-operated vehicles. Similar encouragement can be employed in the areas where maximum numbers of tourist flock.

5.0 REVIEW AND ANALYSIS OF THE LEGAL AND ADMINISTRATIVE FRAMEWORK

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

The key legislation for the vehicular emission control/reduction are 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 (*Annex - 4*). The Industrial Enterprise Act (1993), has provisions of tax deductions to industries which manufactures goods and machines for the reduction of pollution as national priority industry.

These environmental legislation are of very generic nature and describe general issues to be covered under the law and leave all the provisions to be covered by Rules or Regulation and support guidelines under the Act. Guidelines and Regulation under the Act either remain to be passed or if framed and passed remain silent on the provisions required to prevent vehicular emission in specific terms (Annex - 4). Most of the legal provisions lack timely updates in accordance with upcoming new sector government policies or there is no uniformity in the government policies and legislation to be effective for implementation and compliance.

The existing legal provisions have empowered four ministries namely Ministry of Population and Environment, Ministry of Labour and Transport, Ministry of Home 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. Lack of co-ordinated action at times has resulted 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 the environmental matters. As this ministry is relatively younger than the other, there is an attitude of disregard to the ministry directives by the powerful ministries is a matter of serious concern. Besides, EPA provisions lack the co-operative operational model on how to integrate other institutions to meet the environmental objectives. Legally prerogative roles and responsibilities of the different ministries and departments need more clear 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 sectors and NGO sectors as crucial for the prevention of pollution at policy level (8th, 9th and 10th plan documents), the existing legal provisions are designed in such a way so as to keep the 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 sectors and NGO sectors to participate 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. Equal treatment to all the kinds of vehicles polluting and non-polluting for custom subsidies, VAT and other support mechanisms. Administrators of the Ministry of Finance in particular consider vehicle as the major revenue sources while forget the far outweighing social and economic cost of pollution borne by common mass.

The Traffic management office treatment to EVs in the route permits, Traffic police harassment to the EVs for parking and operations are some of the issues reflecting misuse of discretionary powers rested to these agencies without a spelled guideline. This lack of legal guidelines and legally resting of discretionary powers to executing administrators has been counterproductive for the promotion of EVs.

6.0 INCENTIVES FOR CLEANER VEHICLES IN SOME OTHER COUNTRIES

Considering that the automobiles are the major source of air pollution and also considering the growth in the demand of automobiles, governments all over the globe have taken policy steps to curb the air pollution in one side and meet the growing transport demand on the other side. First step in the direction was to improve the quality of automobile fuel in combination with improvement in the automobile combustion technology. Second step was development of technologies that help control pollutants prior to their release into the atmosphere. Although technology has succeeded in achieving drastic reductions in tailpipe emissions, the number of cars on the roads has dramatically increased and therefore the total air pollution from tail pipe emissions continues to be a concern.

Considering this, third and the most recent approach taken by many developed and developing countries is the development of cleaner vehicles, which utilises alternative cleaner fuels. An

Alternative Fuel Vehicle (AFV) is a vehicle that relies on energy other than petrol and diesel, and can either be zero-emission or lower emission. Governments and many automobile manufacturers of the developed countries, in a partnership arrangement guided by policy, have invested money, time, and manpower into the research of AFVs in order to satisfy both the consumer demands and environmental cleanliness. Consequently, research has led to significant development of AFVs.

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

United States of America

- ~~///~~ US government provides tax credit for EVs and hybrid electric vehicles
- ~~///~~ California state of USA 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 USA provide incentives for 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 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 will be either CNG or Battery Operated – Delhi
- ~~///~~ 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 the EV's is 16 %

7.0 ECONOMIC AND FINANCIAL COST BENEFIT ANALYSIS OF POLICY CHANGE

7.1 Policy Change Replacement of Petroleum/LPG Based Vehicles to Electrical Vehicles/or Elimination of Petroleum/LPG Based Vehicles

Direct economic benefit of replacement of the petrol/diesel/ LPG-based vehicles to the EVs is expected from:

- ☞ Savings from the imported petroleum product
- ☞ Use of National indigenous energy and maximisation on the use of the off peak electricity energy which otherwise is a national loss.
- ☞ Local employment generation
- ☞ Reduction of emission, particularly PM fraction and related economic and social costs.

7.1.1 Savings from Imported Petroleum Products

The fuel used by LPG/ petrol and diesel vehicles is the imported petroleum product, which Nepal procures through NOC using convertible currency. If, all these vehicles in the public transport services are replaced by EV under the Polluting Vehicle Retirement Program, direct saving of the convertible foreign currency from the national current account through savings from the import of petroleum product is presented in Table 7.1.

Table 7.1: Savings from the Petroleum Product 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/cyklinder
- ☞ 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)

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

Table: 7.2 Savings from the Petroleum Product 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 phased manner.

7.1.2 Expenditure from the Import in the National Current/Capital Account

The battery operated EVs require imported batteries for operation. Currently imported batteries from USA, according to operators and charging stations, run in average of 18 months. Two sets of batteries are required to operate one EV. The cost of 2 sets of battery 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 the battery import. Table 7.3 presents a comparison of expenditure from 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 EV is not accounted 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 EV is beneficial to LPG and Petrol 3-wheeler, but in the national current account it is only beneficial to petrol 3 wheeler.

Similarly, all of the vehicles are imported in completion or in part. This also burden on the national capital expenditure. Table 7.4 presents a comparison between LPG, Petrol and EV three wheelers. The EVs compared to other 3 wheelers has a less impact on the national capital account when the battery components are excluded.

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	385,000 (Excluding battery)	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 electrical energy for the charging of Batteries. Nearly 45% of the energy consumed by the charging station fall in the normal hours while 33.5% and 21.5% falls during the night hours (off peak hours) and peak hours respectively (Devtec, 2002). Currently NEA has not installed TOD meters and is billing the charging station at flat rate of NRs. 4.30/KWh. Considering that all the charging stations are paying their bills to NEA on flat rate, NEA is earning NRs. 41796 per EV vehicle per year (Table 7.5). Of the total amount billed by NEA about NRs 9767/vehicle/yr is the off peak energy which otherwise is loss to NEA.

Table 7.5: Income from Indigenous Energy Source use Including 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:

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. Rate for Peak, Off peak and normal hours is NRs. 4.8, 3.0, 4.25 respectively.

7.1.4 Local Employment Generation

At the current operational level, employment generation from different vehicle sector could not be assessed in right perspective. Currently existing EVs manufacturers are utilising their facilities as repair and maintenance shop or as charging stations. Such facilities are existing even for other vehicles. Therefore, employment in the sector looks more or less similar. However, one can argue that EVs charging stations has given employment to 2 to 3 employee per charging stations. The only difference in the fuel supplying stations and EVs charging station is that LPG and Petrol fuel dispensing station sale fuel at government administered price internalising the service costs in the fuel price, whereas EVs charging stations charge overhead cost on the top of actual electricity tariff which is about 117% of the actual electricity tariff.

Given the right kind of promotion to EV in Nepal, there are potentials that the EV manufacturing could be developed as indigenous industry of Nepal and has potentials for employment to Nepali youths. The actual figures in terms of number of employment and the payments to the employee by the EV manufacturing industries, 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 regular basis.

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

World-wide experience is that the vehicular emissions have a linear relationship with the economic and social costs. In the context of Nepal and Kathmandu in particular, vehicular emission is a major contributing factor related to the public health and related economic and social costs. Since other pollutants are within the prescribed limits of WHO guidelines, only PM fraction has been evaluated to account the likely economic and social costs in relation to the vehicular emission potentials of the public sector vehicles of Bagmati zone. Table 7.6 presents the PM potentials and related economic and social costs in simplest terms. Government expenditure on health services (preventive and curative) and on the health infrastructure are additional costs, which are not accounted in the table 7.6, presented below.

Table 7.6: Economic and Social Costs of the Public Sector Transport Vehicles of Bagmati Zone from 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 Ale 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 EVs the above costs are the environmental margin of benefit which otherwise are borne by the society at large.

Polluting Vehicle Retirement Program should be built on the ground of environmental benefit as well as on the savings in the national capital account by the reduction of petroleum product import. While enforcing replacement program, carrying capacity of the vehicles should be given due consideration. Replacing a high carrying capacity vehicle by low carrying capacity vehicle will not only increase road congestion but also hamper the services. Polluting tempos and Microbuses could be replaced by the Safa Tempo EVs, But Minibus and Bus could only be replaced by equal carrying capacity EV Bus or by Trolley Bus where infrastructure development potential exists.

Further, replacement program should not give benefit to the polluters in direct economic terms. Only 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 the right kind of EVs in the same route of operation. Subsidies to the affected parties should be equal to other parties operating in this sector.

7.2 Policies Change in Electricity Tariff

Table 7.7 presents the total operation costs of EVs and other vehicles. The EVs operation costs are higher compared to the other vehicles. The reason behind is the higher battery costs in addition to electricity tariff.

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 the benefits gained by NEA and charging stations and 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 benefit of NRs. 3402/vehicle/yr. Currently charging station charge in average NRs. 4.7/KWh for the charging of battery to cover up fixed costs and operation costs including profits. In actuality EVs pay NRs. 9/KWh of energy consumption to the charging station.

If the current NEA tariffs for peak, night (off peak) and normal hours are changed 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), the electrical vehicle will have to pay NRs.7.67/KWh against 9/KWH. This will help in the reduction of running cost of EVs from NRs 5.98 to 5.59. There will be very marginal decrease in the total running costs of EVs in this scenario.

Normally charging of deep cycle lead-acid battery sets require about 10 hours. Off peak energy time of NEA is only 7 hours. Complete charging of the battery is not possible only in off peak hours and it will have to extend on either side. Considering that the 100% time of off peak hour energy is stored and 30% of the energy required will have to be stored from either normal or peak hour. Assuming that 1 hours time is used from peak hour, 7 hours from off peak hours and 2 hours from normal hours the cost of electricity charging is presented in Table 7.8 for both the current and proposed tariff.

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

Parameter	EVs electricity consumption on 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 available off peak electrical energy (i.e. 7 hours) in the current tariff rates with TOD meter, running cost will decrease by only 4.34%. With the change in electricity tariff rates, as proposed and utilising 100% of available off peak hour electrical energy with TOD meter, running cost will decrease by about 12%. The overhead costs of Charging stations is a major factor that inhibits running cost reductions significantly.

Provided NEA facilitates charging at the changed tariff rates itself or through agents, running costs of EVs/kilometre decreases significantly amounting to 35.62%.

One could argue that NEA also need investment and other overhead costs for the development and operation of charging station. The question is valid, but NEA while developing hydropower and its transmission systems is inflicting environmental damage to the society in a variety of ways, though not directly in air pollution. One of the way to compensate social environmental costs of NEA 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 EVs only in Some of the Priority Routes / Areas / Government / Institutions

In the mass transport sector, owing to the route permits in every route for all kinds of mass transport vehicles, EVs are getting a tougher competition (Annex 2). Projected average occupancy rate of EVs is about 98 % (Devtec 2002). The maximum is 186% and minimum 76%. If all the EVs in all the routes in the present fares are taken into consideration, with an average occupancy rate of 120%, EVs could meet the total operation cost without profit. As the operation cost depends directly with the distance travelled, in the present fares, the occupation percentiles to meet the operational cost vary with the route. In some routes EVs could meet their operational costs even at 76% of seat occupation, whereas in some routes 240% of seat occupation is needed.

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

The other policy to fix the fares in proportion with the distance travelled will be beneficial to EVs. Current practice of flat rate application in all routes is not practical. However, fares should be in competition with the other public transportation vehicles plying in the same route.

A policy to restrict operation of other vehicles except EVs in historical, archaeological, tourist as well as cultural places on the ground of environmental cleanliness gives a holistic meaning for the promotion of EVs in general. Such actions will promote people to acquire family EV vehicles in the private sectors as well including tourism industries.

Government and institutions play a major role in the promotion of EVs in a number of ways. Persons heading these sectors are the leaders of the society and general public tries to be like them. Encouragement by the policy to the heads of these sectors gives a different meaning in the public acceptance of EVs. Besides, central and local governments can employ EV vehicles for the pickup and drop of their employees within the urban areas. Local Governments and institutions could even use EVs effectively in some of the use sectors such as local garbage collection, local maintenance vehicles for NEA, NTC, NWSC etc. These are the benefits to EVs but not directly in terms of costs.

7.4 Policy Change on Pollution Tax to Polluting Vehicles

Pollution tax on the petrol and diesel consumed in the Kathmandu valley was one of the Financial policy announcement since 1996. The applied rate was flat (NRs. 0.50/lt) and did not take into consideration of the polluting character of the fuel. This policy is still in the paper, but its implementation was never realised.

Provided the policy was implemented, 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 is a quite substantial amount, which 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. If this was implemented with the soul and spirit, EVs would have taken a long leap by now. Late but not never, this policy should be implemented for the promotion of EVs, however, modalities of pollution taxing could be different and should be based on environmental justice.

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

Various options of pollution taxing can be forwarded. First option could be taxing on the fuel but with a difference in the pollution tax rates. Because petrol is definitely a cleaner fuels than diesel and should have tax reduction than the diesel. Present announcement of flat rate for both diesel and petrol is not environmentally justifying. Even LPG should be taxed for pollution.

The second option could be sharing the pollution tax between vehicle and the fuel. The vehicle as per their pollution potential are taxed every year which is added to the present yearly vehicle tax and correspondingly, pollution tax in the fuel sold is lowered.

The third option is to tax the vehicle only according to their pollution potential yearly.

Of the three options, the second option seems better for it discourages directly polluting vehicles as well as polluting fuels.

Collection of pollution tax alone is not going to help EVs. What is required is the use of the collected Pollution Tax Fund in the promotion of EVs in its entirety so that the EVs are made cost effective and cost efficient. A policy to use this Pollution Tax Fund money for the development and promotion of EVs and its infrastructure will only take EVs ahead in future.

7.5 Policy Change in Battery Procurement

Battery component is responsible for the higher running cost of EVs. Contribution of battery in the running cost and in the operation cost is 39.39% and 20.53% respectively (Table 7.7).

TROZAN lead-acid battery imported from USA has an average life of about 18 months only. Every 18 months battery component requires replacement by new sets. Current market price of one sets of battery costs NRs. 65000. Costs included in the battery are import cost, 1% custom duty, and about 10% profit.

On the top of this, batteries access in the Nepali market is not always assured. Last year number of EVs went out of operation because of the unavailability of batteries in the local market.

To make EVs competitive with the other cleaner vehicles the cost of battery as well as its accessibility in the local market is essential. There is very little space for the cost reduction of imported batteries except subsidies in the import costs, which is most unlikely.

The only option is to promote the local battery industry for the cost reductions. Kulayan Battery Industry located at Biratnagar, Nepal is also manufacturing deep cycle lead acid batteries. The life of the battery so far tested has given an effective life span of 9 to 12 months. The cost of the local battery is about 26.2% less. The difference in the cost/km between the local and imported battery 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 marketing edge over the local in the present conditions. However, there are ample of opportunities for the development of Kulayan batteries to operation levels of the 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 purpose. Besides, subsidies and VAT to the Kulayan on the import of raw materials and sales of the manufactured batteries, the cost of batteries could be brought down substantially.

Considering that the Kulayan is given development opportunities through government pollution tax fund, the cost of the development will not be internalised in the battery cost and it shall remain as of today (ie. NRs 96000 for two sets of batteries). There will be nearly 12% reduction in the running cost (Table 7.10). Further, if VAT to the current price of the battery is exempted, the cost of the battery will be NRs. 87273 and the corresponding reduction in the running cost will be nearly 15% than the present, which is substantial but still not competitive with the 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 a right kind of policy guideline, Kulayan Battery Industry could be developed for the recycling of the used batteries. Battery operated EV sector is often blamed for battery pollution, though at present it contributes less than 15% of the wastage battery.

7.6 Policy Change in Subsidies

Current exemptions given are on the custom duties, VAT, and yearly vehicle Tax for EVs three wheelers. The EVs in private sector and EV bus were given some subsidies in the import cost only. Whereas in the past, LPG three wheelers, and even diesel and LPG microbus were given subsidies in the custom duties and VAT, which were nearly equivalent to EV three wheelers. This policy change without objectivity in giving subsidies, have made EVs less competitive as compared to the other types of vehicles.

Policy should consider the pollution potentials and associated economic and social costs while fixing Tax and duties and the subsidies to the vehicles so that the costs of pollution are internalised in the vehicle and the EVs could become competitive both in the public and private sector vehicles. Table 7.11 presents a simplified pollution potentials of the current mass transport vehicles in terms of costs related to PM emissions. This could be taken as a guideline for internalising the pollution costs and scheme for subsidies to the cleaner 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

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

Similarly, if the parking fees are waived for the EVs, 1.7% of the operational cost/km will decrease. Such a policy change in the soft loan and parking together decreases operational cost/km by about 11%, which is substantial.

To implement the above propositions Pollution Tax Fund could be utilised. A certain portion of the fund every year could be marked for the above purpose.

7.8 Policy Change in R&D

There have been very little efforts from the government and private sectors in the R&D of the EVs particularly three wheeler Safa Tempos after the initial research and development by GRI in 1994/96. One of the reasons of decline in EVs manufacturing and sales after 2000 is related with the lack of R&D support in increasing the vehicle efficiency particularly in relation to safety measures to prevent discharge of batteries, improvements in the vehicle mechanical and electrical 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.

EV manufacturing sector, currently is an assembly industry with only about 18% value addition. Given adequate R&D support, the manufacturing sector can grow up as an industry with gradual value addition as well as technological improvements. Both are conducive for the promotion of EVs of not only Safa Tempo but also for the Cars, Bus and Trolley Bus. In the present situation, the sector already investing more than NRs. 450,000,000, investment in R&D by itself is not possible. Government and other environmental groups concerned with the increasing air pollution should support the manufacturing industries for R&D or technological transfer to make these 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.

Current EVs maintenance and labour cost and wear and tear of tyres component /km running cost is 63% higher than LPG 3 wheeler and 43% higher than petrol 3 wheelers. Adequate R&D could reduce this cost to make EVs competitiveness with other vehicles. The saving of cost of regular breakdown, which puts the vehicle out of operation, is the other major benefit.

Uncertainty of the battery life is one of the major economic risk 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 of old and new batteries to make a set, leaving discharged battery for long time etc. (Markus Eisenring, 2000). To increase certainty of the battery life there is a need for educating both chargers and drivers. R&D for the development of cost-effective safety tools such as speed limiter device, current limiter device etc. could ensure the life of the battery.

The battery operated EV sector has a number of R&D opportunities in the electrical, and mechanical parts of EVs. Besides, opportunities also exist in the type of battery itself to make the EVs most efficient and cost effective.

A portion of Pollution Tax Fund need to be diverted for the R&D activities of the battery operated EVs so as to make them cost effective and cost efficient.

7.9 Conclusive Remarks

Changes in policies as illustrated above can make the EVs economically beneficial as well as competitive with the other vehicles. Major benefit from the EVs is the environmental benefit, which has a local as well as global significance. But in the common market these indirect benefits are hardly accounted.

In this context, to make electrical vehicle competitive with the other vehicles in direct economic terms an array of policy measures, which has direct bearings with market economy, has to be

implemented. A subsidy and pollution taxing policy in the basis of environmental justice (polluters pay and non-polluters rewarded) are among the lower hanging fruits of the available policy options. These measures themselves does provide edge in the EVs marketing and introduction but essentially will not make EVs competitive in the open market. Complementary policies to support EVs are required. Judicious utilisation of the Environmental Tax collected from the vehicles and fuels for the promotion of EVs can only make EVs competitive. Support for R & D to increase vehicle efficiency and reduction of operation costs and provision of soft loans and free parking are the other factors that will make EVs marketing and introduction aggressive as well as competitive. Protection policies are helpful in the initial stages of marketing and introduction but without education and awareness building among the general mass, it can even be counterproductive.

Replacement policies though sound better are sometimes very costly. Instead provisions to restriction of polluting vehicles in upcoming registration could be beneficial provided compulsory retirement of vehicles after crossing 10, 15 or 20 years of operation is implemented for all types of vehicles at least in the public transport sector.

Above all, use of indigenous hydropower energy in the transport sector should be the priority policy focus in the promotion of cleaner vehicles. With such a policy drive the battery operated vehicles is expected to get 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 the EVs and making them competitive with the other polluting vehicles.

8.0 RECOMMENDATION FOR POLICY CHANGE

8.1 Basis for Specific Policy on Cleaner Vehicles

Although HMG/N many policy documents and legislation tools favours cleaner vehicles in paper, in practice the spirit of these documents are not realised. Therefore, Nepal needs a specific policy on cleaner vehicles promotion, and for the purpose the basis for such initiation is highlighted here.

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 related with the increasing numbers of vehicles
- ✍ Assessment of air quality over the decade show that major concern is on particulate pollution particularly the respirable particulate matter (PM10 and PM2.5) well above the WHO guideline most of the time in the year of which vehicle exhaust is the major contributor
- ✍ Vehicle exhaust is also responsible for many toxic pollutants having much more serious health impact over the time, of which there are no set limits set even by WHO
- ✍ Oxides of Nitrogen and Ozone will keep increasing with more fuels burned in vehicles, difficult pollutants to control even in developed countries

8.1.2 Impact of Pollution on Public Health and Economy

- ✍ Air pollution has began to show the impact on human health in major urban cities and there is a need to further carry out investigation with toxic pollutants and related health impact
- ✍ Air pollution related health problems have direct impact on the national account for developing health institutions and curing the diseases
- ✍ Heath problems directly reduces the working days of people and hence the national productivity
- ✍ Tourism industry, one of the main source of foreign currency, is seriously hampered over the years, among others pollution of major cities is one of the concern

8.1.3 Economic Basis

- ✂ Import of petroleum products drains out significant amount of convertible foreign currency every year and 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 and transport sector being the major consumer of petroleum products must be targeted to be the major consumer of electricity
- ✂ Besides petroleum products, import of vehicles also drains out huge amount of foreign currency, thus there is a need to develop national industry based upon the national resources, electrical vehicles manufacturing industry has the potentials for development attracting foreign direct investment and providing job opportunities to Nepalese citizen
- ✂ Increasing population, the enhanced economic status of population, and the changing behaviour of people demands more vehicles and the current growth rate of almost 15% of vehicle registration is there to remain and grow further.

8.1.4 National Development and Environmental Objectives

- ✂ Policy objectives clearly focuses on the development of national industries (manufacturing and service) based on the indigenous resources for the overall economic and social development of nation
- ✂ Environmental policy objectives are based on maintaining the quality of environmental characteristics and protecting the human life
- ✂ Policy objectives prioritise the co-ordinating efforts of all the development partners in maximising the use of natural resources in a sustainable manner for the well being of citizen
- ✂ National policy documents has the objectives of promoting environment friendly industries, technologies with incentives and also adopts of policy of polluters should pay principles

8.1.5 International Commitment

- ✂ Nepal is the party to UNFCCC and being a vulnerable country likely to have severe impact of climate change need to develop policies that reduces GHG emissions and create conducive environment for attracting foreign investments through the financial mechanisms of the Kyoto Protocol

8.1.6 Inconsistency in Implementation of Policy

- ✂ Industrial enterprises act does not put EV manufacturing industry in the category of nationally prioritised industries category
- ✂ Financial incentives provided by Fiscal Acts and Environmental Protection Acts to LPG and Petrol operated vehicles equal or even more than the EV is against the 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)
- ✂ Fiscal incentives provided for phasing out of diesel tempos is against the principle of polluters should pay principle (diesel tempos could not comply the vehicle emission standard instead each got over a million rupees incentives as against market price of approximately 100,000 rupees)
- ✂ Ban of registration of EV inside the ring road together with other public transport vehicles is opposite of the National Transport Policy and even against the provisions of VTMA
- ✂ DOTM not giving priority in allocating routes to EVs is also against the legal mandate of VTMA, i.e. based upon the roadworthiness of the vehicles of which the vehicle emission is fixed as one of the major criteria
- ✂ Indecision of MOPE on two chassis imported purely for R&D purposes for the development of four wheeler electrical bus is just opposite of national policy and spirit of EPA and EPR

- ✂ The attitude of decision-makers in Ministry of Finance towards the five REVA cars is the violation of the provisions of the Fiscal Act. And changing of the provisions in the next fiscal act looks like that it is brought to block the import of these zero emission vehicles
- ✂ The clause of EPA/EPR on additional incentives to environment friendly industries, technologies, and equipment have never been used in favour of EVs to date
- ✂ Lack of commitment of government in implementing the decisions made by themselves (decision made on phasing out of 20 years old vehicles and two stroke three wheelers is pending for almost three years)

8.1.7 International Practices

- ✂ In many countries zero emission vehicles enjoys custom, tax, parking, and host of other economic incentives such free charging, reduced electrical tariff, also even in the cost of the vehicles
- ✂ In many countries vehicles and fuels are taxed according to environmental damages
- ✂ In many countries there are phasing out programs of polluting vehicles to be replaced by targeted cleaner vehicles
- ✂ In many countries government and even the private sector allocate 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 in the long run requires adequate repair and maintenance for the compliance and this requires effective monitoring administration and so is the case with import of high quality fuel and quality control. In underdeveloped country like Nepal emission elimination technology prevails over the emission reduction/control technology

8.1.9 Environmental Damage Cost not in Operational Cost

- ✂ 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. For the environmental justice, pollution tax to the polluters is not on practice.

8.1.10 Environmental Responsibility of Central/Local Governments and Other Institution

- ✂ Institutional leadership in procuring and running the zero emission vehicles goes 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 not taking into consideration the institutional responsibilities of environmental protection

8.2 Proposed Policy

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

The Ministry of Population and Environment as lead agency on the 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 initiatives 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 competitive transport sector prioritising based on the indigenous clean energy resources of nation.

The immediate/secondary objectives are:

- ✍ To bring the deteriorating urban ambient air quality to the acceptable level with minimum adverse impact on human health
- ✍ To make the transport system easily accessible, affordable and comfortable to general public
- ✍ To establish national co-ordinating mechanism to develop adequate infrastructure facilities conducive for the promotion of different modes of cleaner vehicles as per the local and regional conditions
- ✍ To create 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 private and non governmental sector in the decision making as well as implementation processes
- ✍ To introduce market based instruments based upon the environmental cost and benefits in the transport sector
- ✍ To create public awareness in the protection of environment
- ✍ To create networking of the stakeholders involved in the cleaner vehicles

8.2.2 Policy Strategy

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

Air quality Assessment and Public Awareness

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

- ✍ Establishment of ambient air quality monitoring network system focusing pollutants of health concern in major urban cities of Nepal in partnership with central/local governments, academic institutions, private and non-governmental research institutions
- ✍ Develop source inventories and establish system of regular updating of such inventories including transport sector with age, technology, type and fuel of vehicles
- ✍ Establish mechanism to continuously assess the impact of air pollution on human health and economy involving health institutions and environmental research institutions
- ✍ Build partnership with mass media to regularly inform citizen on the status of air quality and its potential impact
- ✍ Based upon the air quality and its impact on human health, set national ambient air quality standard and develop institutional mechanism for periodic review and modification of 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 current level of PM10 and PM2.5 in Kathmandu Valley, it is required to declare it as 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 centre)

Classification of Cleaner Vehicles

In order to design and implement fiscal and non-fiscal incentives, it is most important to classify the vehicles with the degree of cleanliness of vehicles

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

National Priority on Infrastructure Development

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

- ✍ Establishment of east-west electric railway service within twenty years
- ✍ Establishment of Trolley Bus service between Bhirahawa and Lumbini within next five years
- ✍ Rehabilitation of existing trolley bus system of Bhaktapur-Tripureswor and expansion of the service in the ring-road of Kathmandu Valley within next five years
- ✍ Infrastructure development in the outskirts of Kathmandu Valley for the running of electric train or trolley bus service within fifteen years
- ✍ Linking of major cities of Terai by trolley bus services within twenty years (Biratnagar-Dharan, Butwal-Bhairahawa, etc)
- ✍ Trolley bus service linking major tourist centre in Pokhara within 10 years
- ✍ Roadway services in the hilly areas

Classification of Roads and City Areas

In order to promote the different types of cleaner vehicles as per the road infrastructure and characteristics of city areas, classification of roads and urban centre based upon

- ✍ Heavy traffic areas
- ✍ Core city areas where maximum flow of people in the roads together with vehicles
- ✍ Roads with lanes capacity/ Highway
- ✍ Historic, religious and tourist areas

Polluting Vehicle Retirement Program

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

- ✍ Target vehicle emission monitoring programs on vehicles that are major sources of particulate pollutants- the old diesel buses, trucks, minibuses and the two stroke three wheelers, which could hardly comply with the prevailing vehicle emission standards
- ✍ Target vehicle emission monitoring programs on vehicles without the 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 of old polluting buses
- ✍ Replacement of 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 scrapping incentives

Establishment of Cleaner Vehicle Fund/Pollution Tax Fund and use of the fund for the promotion of cleaner vehicles

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

- ✍ Fixing of pollution tax on the fuel as per their emission character
- ✍ Fixing of pollution tax on vehicles (on annual basis based on the damage cost calculated)
- ✍ Contribution from government's Environmental Fund annually
- ✍ Contribution from donor agencies (like the support of DANIDA already established Clean Vehicle Promotion Fund)
- ✍ Contribution from utilities institutions (like NEA with provisions made on EIA itself)
- ✍ Levying 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 for 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 EV as public transport
- ✍ Tax credit for electric cars
- ✍ Free parking for electrical vehicles
- ✍ No income tax for EV manufacturing industries at least for ten years
- ✍ No income tax for EV battery manufacturing industry at least for ten years
- ✍ Industries manufacturing EV or parts for EV to be included in the nationally prioritised industries to enjoy the prevailing facilities

Establishment of Charging Centre

- ✍ Encourage NEA to establish charging stations in major cities charging the cost of actual energy consumption
- ✍ Support from the Cleaner Vehicle Fund/Pollution Tax Fund to private charging stations to reduce the cost of charging

REFERENCES

1. 10th Plan Document, National Planning Commission
2. 6th Plan Document, National Planning Commission
3. 7th Plan Document, National Planning Commission
4. 8th Plan Document, National Planning Commission
5. 9th Plan Document, National Planning Commission
6. Addresses of Chinese Companies and Institutions involved in Electric Vehicles, and exhibiting at EVS 16, held in Beijing China, 10/12/1999-- 10/15/1999
7. Alternative Fuel Vehicles and Phase-out Program, By Anil Baral
8. Amann, C. A. "Technical options for energy conservation and controlling environmental impact in highway vehicles". *Int. J. of Vehicle Design*. Vol. 14, 59-77.
9. Anil Baral, 2000. Bottlenecks in EVs promotion in Nepal,
10. Anil K. Raut , ///Why Electric Vehicles should be promoted in Kathmandu valley?
11. Bangladesh: Reducing Emissions from Baby-Taxis in Dhaka , Joint UNDP/World Bank Energy Sector Management Assistance Programme, (ESMAP), January 2002
12. B.B. Ale, 2001. A Report on Transport Management, submitted to MOPE
13. Battery Frequently Asked Questions,
<http://www.geocities.com/CapeCanaveral/Lab/8679/battery.html>
14. Carlos A. De La Paz, Gerardo Martinez, Andres Morin, and Laurel Schaidler , 2001. The Future of Solar And Electrical Vehicles
15. Conceptual Considerations for Future EV's in Nepal, By Markus Eisenring
16. Devtec Nepal P. Ltd. 2002. Current Status Survey of Three Wheeler Electrical Vehicles (Safa Tempo) of Kathmandu Valley and Appraisal Study of Operating the Electrical Vehicles of Some Sub-metropolitan Cities of Nepal.
17. Dr. B. Sengupta , 2001. Vehicular Pollution Control in India Technical & Non-Technical Measure Policy, Paper Presented at Regional Workshop on Transport Sector Inspection & Maintenance Policy in Asia Organised by ESCAP/UN(DESA) in Bangkok during 10-12 Dec'2001.
18. Electric Drive Transportation Association, 2003 Goals and Objectives
19. Electrical Vehicles in Kathmandu, Clean Energy Nepal Fact Sheet # 3, 2002
20. Environmental Protection Act, 2053
21. Environmental Protection Rule , 2054
22. Fiscal Bill, HMG, 2053/54
23. Fiscal Bill, HMG, 2054/55
24. Fiscal Bill, HMG, 2055/56
25. Fiscal Bill, HMG, 2057/58
26. Fiscal Bill, HMG, 2057/58
27. Fiscal Bill, HMG, 2058/59
28. Growth of EVs in Nepal, By Anil Baral
29. ICIMOD, 2000. State of Environment Report : Nepal, Strengthening Environment Assessment and Monitoring Capability in Nepal.
30. Improving Air Quality in Metropolitan Mexico City an Economic Valuation * The Mexico Air Quality Management Team, World Bank, 2002
31. Industrial Enterprise Act, 2049
32. International Energy Agency, 2002. Deployment Strategies for Hybrid, Electric and Alternative Fuel Vehicles, A Report of the IEA Project Deployment strategies for Hybrid, Electric and Alternative Fuel Vehicles.
33. Markus Eisenring , 2000. Assistance to the Electrical Vehicle Sector in Nepal Report on ,Short Term Consulting in Kathmandu June 19th to July 19th 2000 For the Swiss Development Corporation (SDC)
34. Markus Eisenring , 2000. Measures to Prolong Battery Life and How to Treat Batteries
35. Martin Chautari, 1999. Bottleneck in the Proliferation of Electrical Vehicle in Nepal,
36. Maureen L. Cropper, Nathalie B. Simon, Anna Alberini, and P.K. Sharma, 2000The Health Effects of Air Pollution in Delhi, India.
37. Motor Vehicle Pollution In Australia, Supplementary Report No. 1, LPG In-Service Vehicle Emissions Study, prepared by the NSW Environment Protection Authority May 1997
38. National Conservation Strategy, IUCN, 1987

39. National Transport Policy 2058
40. Nepal Environmental Policy and Action Plan 1993
41. Nepal Environmental Policy and Action Plan, 1998
42. O'Brien, W. (1993). "Electric Vehicles (EVs): A Look Behind the Scenes". *IEEE AES Systems Magazine*. May, 38-41.
43. Oman, H. (1993) "8th Annual Battery Conference on advances and Applications". *IEEE AES Systems Magazine*. May, 2-5.
44. Oman, H. and S. Gross. (1995) "Electric-Vehicles Batteries". *IEEE AES Systems Magazine*. Feb. 1995.
45. Rajnish Sharma,, 2001. Vikram EV, Senior Sub-Editor, Hindustan Times, Lucknow, India
46. South Asia Urban Air Quality Management Briefing Note No. , UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
47. South Asia Urban Air Quality Management Briefing Note No. 1, Vehicular Air Pollution: Setting Priorities, UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
48. South Asia Urban Air Quality Management Briefing Note No. 10, Tackling Diesel Emissions from In-use Vehicles, UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP);
49. South Asia Urban Air Quality Management Briefing Note No. 11, Health Impacts of Outdoor Air Pollution; UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
50. South Asia Urban Air Quality Management Briefing Note No. 12, Economic Valuation of the Health Benefits of Reduction in Air Pollution; UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
51. South Asia Urban Air Quality Management Briefing Note No. 13, The Science of Health Impacts of Particulate Matter; UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
52. South Asia Urban Air Quality Management Briefing Note No. 2, International Experience with CNG Vehicles; UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
53. South Asia Urban Air Quality Management Briefing Note No. 3, How Can Urban Bus Policy Reduce Air Pollution? UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
54. South Asia Urban Air Quality Management Briefing Note No. 5, Impact of Better Traffic Management UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
55. South Asia Urban Air Quality Management Briefing Note No. 6, Urban Planning and Air Quality, UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
56. South Asia Urban Air Quality Management Briefing Note No. 7, Catching Gasoline and Diesel Adulteration, UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
57. South Asia Urban Air Quality Management Briefing Note No. 9, Making Vehicle Emissions Inspection Effective — Learning from Experience in India; UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP).
58. Sudha Menon PUNE, Nov. 30, 2001. Scooters India into pollution-free vehicles,
59. *The ABCs of AFVs--A guide to alternative fuel vehicles*. 33-39.
60. Trojan Battery Company, <http://www.trojanbattery.com/>
61. Vehicle Transport Management Act, 2049
62. Vehicle Transport Management Regulation, 2054
63. World Bank 2001. Review of Past and On-going Work on Urban Air Quality in India.
64. World Bank Group, Private Sector and Infrastructure Network, Note Number 254, public Policy for private sector, Leapfrogging Technology, 2003.<http://rru.worldbank.org/Viewpoint/index.asp>
65. World Bank, 1996. URBAIR, Kathmandu Valley Report.
66. World Bank, 2001. Review of Past and On-going Work on Urban Air Quality in India.

Annex – 1: Ambient Air Quality Status of Kathmandu Valley

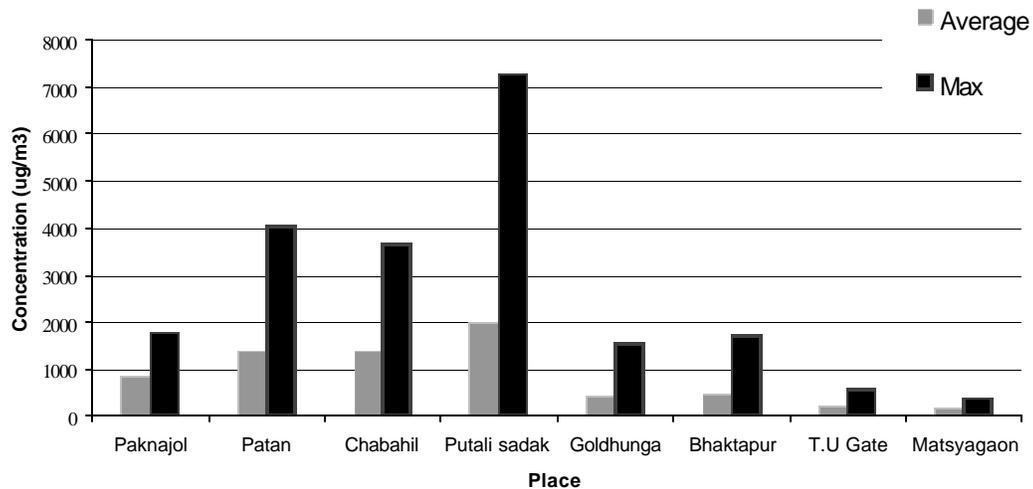
1. Kathmandu Valley - Topography, Climate and Population

Kathmandu Valley located between 27°37'30" N and 27°45'0" N latitude, and 85°15'0" E and 85°22'30" E longitude is about 1300 meter above m.s.l with the area of about 340 sq.km. The valley has the bowl-like structure surrounded by high hills and the altitude from the valley floor vary between 500 meter and 1400 meter. It lies between the Himalayas in the north and the Mahabharat range in the south. The prominent boundary features of the valley are Phulchowki Hill (3132m) in South West, Shivapuri (2713m) in North, Chapa Devi (2400m) in South West and Nagarjun (2100m) in West.

A temperate climate prevails in Kathmandu valley. The mean annual temperature in the Kathmandu Valley is 18 °C. The coldest month is January with a mean temperature of 10 °C. The warmest months are July and August, with an average temperature of 24 °C. The valley has an annual rainfall of 1400 mm. The wettest month is July with an average rainfall of about 370 mm. November and December are the driest months, the average rainfall is less than 6mm (URBAIR-Kathmandu Valley Report, 1997).

Kathmandu Valley being the economic and administrative center of Nepal is experiencing a very high population growth rate over the decades. According to the population census carried out in 1981 the population was 766345, which increased to 1105379 in 1991 census, with the annual growth rate of 4.2 %. The population census data for 2001 reveals that there are 1656951 people in the Kathmandu Valley by the end of 2001, with the annual growth rate of 4.9% per annum. In the present trend of population growth rate in Kathmandu Valley, it is estimated to reach 2104685 by the end of 2006 and 3395799 by the end of 2016. The population density of Kathmandu valley was 852 people per sq. km in 1981 and 1230 people per sq. km in 1991, which has reached 1843 people / sq. km in 2001. The population of Kathmandu Valley for 1991, 2001 and projection for coming 15 years presented in the figure below (ESPS, 2003).

Average and Maximum TSP Concentration at Major Spots Kathmandu Valley, 2001



2. Kathmandu Valley: Air Quality Status

The concern over the air quality of Kathmandu Valley started only in early 90s and the information on the routinely monitored results are very limited. However, there have been many campaign air

quality monitoring works carried out by many NGOs, private laboratory and the government institutions over the last decade which clearly indicate that the air of Kathmandu Valley is heavily polluted particularly with the particulate pollutants. Among the various studies carried out over the decade include: IUCN 1992, ENPHO 1993, KVVECP (NESS Pvt Ltd.) 1993, ENPHO 1993, ADB/MOPE 1999, NESS 1999. In addition to these, Department of Hydrology and Meteorology (DHM) started measuring TSP on a more continuous basis since 1993 and continued till 1996. The various air pollutants measured during these period primarily focuses on TSP, PM₁₀, NO₂, SO₂, and CO. Although not directly comparative with WHO guidelines on an annual averages basis, these results show that Kathmandu is experiencing increasing trend over these pollutants, particularly with alarming rate in terms of particulate pollutants which is found significantly higher compare to WHO guideline values. Gaseous pollutants are found within the WHO prescribed values.

All these studies have been very instrumental in launching a special project on "Air Quality Management of Kathmandu Valley" in the Ministry of Population and Environment with DANIDA financial and technical assistance in 2001. One of the main working areas of this project is to establish a Permanent Air Quality Monitoring Network System in Kathmandu Valley with the objective of collecting routinely database on various air pollutants. In order to facilitate the design of the monitoring network system, the project has started monitoring of TSP and PM₁₀ in seven different locations of the Valley in January 2001 on a three-hour basis. ENPHO was involved in the monitoring works by the project while Soil Test and NESS also participated in doing parallel monitoring. The annual averages of TSP and PM₁₀ concentration of 3-hour monitoring results for the year 2001 are presented in Figure 2 and Figure 3 (ESPS, 2003).

Roadside monitoring in Putalisadak even recorded a highest concentration of 7285 ug/m³ of TSP and the average concentration of TSP in the same station over the year is also significantly high, 1993 ug/m³. The annual averages for 2001 of 1363 ug/m³, 1364 ug/m³, and 830ug/m³ at Chabhil, Patan, and Paknajol respectively are also significantly are high compared to the proposed national standard of 230 ug/m³ (24 hr-average). Even the Machhegaun identified as a valley background station also recorded the highest concentration of 357 ug/m³ and the average concentration of 154 ug/m³ for the same year clearly indicate that the whole Kathmandu Valley is heavily polluted in terms of Total Suspended Particulate (ESPS, 2003).

Similarly, the maximum concentration of PM₁₀ of 1336 ug/m³ was observed at Chabhil while the maximum annual average concentration of 415 ug/m³ was measured at Putalisadak. Annual average concentration of PM₁₀ measured in other monitoring stations are 209 ug/m³ at Paknajol, 286 at Patan, 289 at Chabhil, 120 ug/m³ at Bhaktapur, 87 ug/m³ at Kirtipur and 72 ug/m³ at Matsyagau (ESPS, 2003).

All the above mentioned annual average values of 3-hr basis which represent the peak traffic hours can not be directly compared to WHO annual prescribed values or the proposed national standard of 120 ug/m³ (24-hr average).

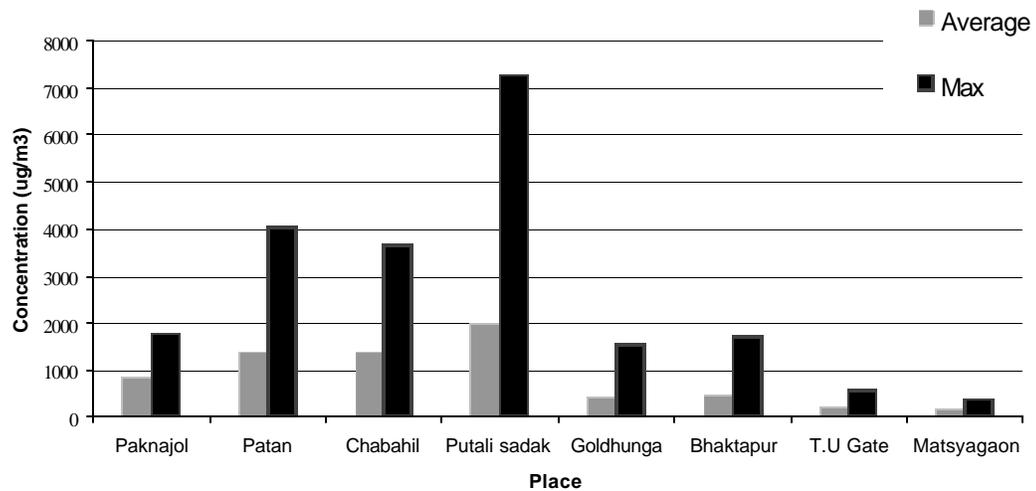
MOPE/ESPS established the permanent monitoring network in late 2002 in six different locations of Kathmandu Valley. Of these six stations, stations at Putalisadak and Patan are the traffic stations, stations at Thamel is a traffic/residential, Bhaktapur and Kirtipur are the urban background stations, and the station at Matsyagau is the valley background station. MOPE/ESPS recently presented the results of this monitoring network in a training cum workshop organized for the assessment of the results. At the moment, the focus is on PM₁₀ and the results since Novemebr 2002 are published. More recently, the secretary of MOPE organized the press conference and disseminated the results to general public. The results disseminated by MOPE also include the campaign monitoring carried out in Bhaktapur on PM_{2.5}. This is the first time that results on PM_{2.5} are measured in Kathmandu Valley. The monthly average values of PM₁₀ at all the six stations measured on the 24-hr average basis and the comparative study on PM₁₀ and PM_{2.5} at Bhaktapur are presented in Figure 4 and Figure 5 respectively (ESPS, 2003).

MOPE/ESPS has also published the results of benzene concentration in the ambient air monitored in the above mentioned monitoring sites. The results of Jan/Feb, 2002 and Feb/March, 2003 are presented in Figure 6. During a period of 1 year, the concentration of benzene in the heavy traffic areas has reduced significantly, from 66 ug/m³ to 17ug/m³ in Putalisadak, and from 44 ug/m³ to 14

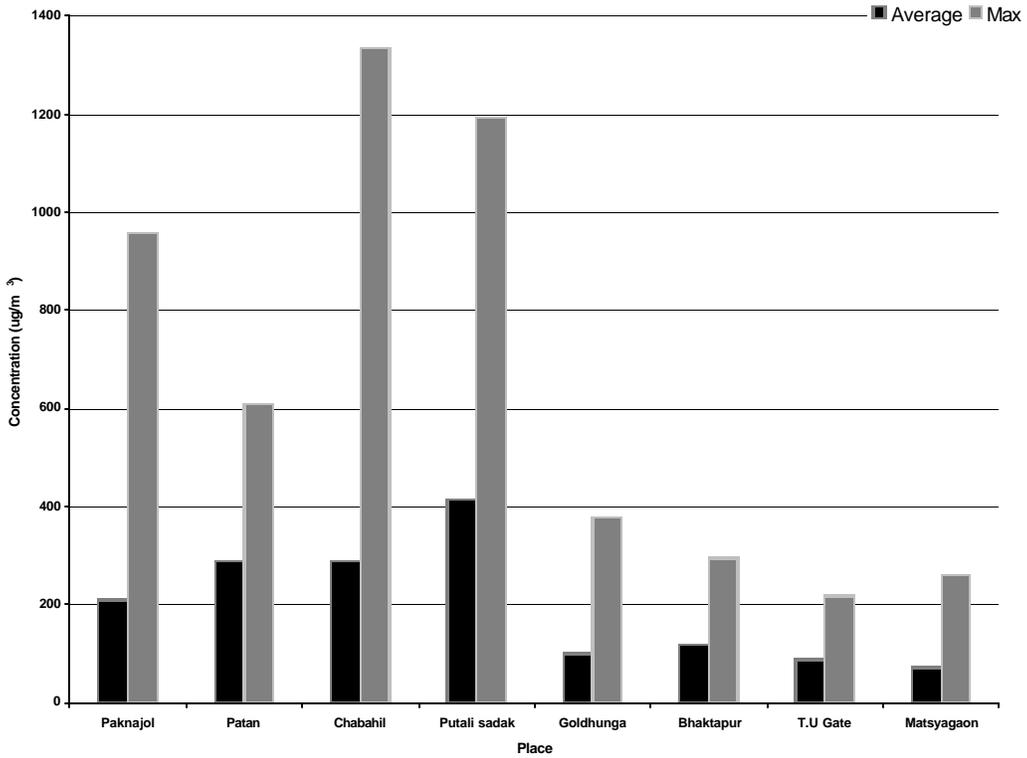
ug/m³ in Patan. The comparative study of 2002 and 2003 in Thamel and Bhaktapur is 30 ug/m³ and 11 ug/m³, 14 ug/m³ and 9 ug/m³ respectively. While in Kirpur and Matsyagau the average concentration for these periods have remained almost the same around 4 ug/m³ and 3 ug/m³ respectively. These days there are no safe limits prescribed by WHO for benzen, however it was 5-20 ug/m³ maximum earlier.

The results of ambient air quality monitoring of Kathmandu Valley clearly shows that the valley is highly polluted in terms of particulate pollutants. The very high concentration of PM10 and PM2.5 is of great concern from the human health point of view. The high percentage of PM2.5 of almost 60-70% of PM10 indicate that the fossil fuel combustion in vehicles and industries are the major contributors. Similarly the trend seen in the benzene concentration at heavy traffic areas also indicate that it is directly related with the benzene content in gasoline supplied by NOC. It is learnt from NOC that the gasoline which used to be around 5% benzene content one year earlier is now less than 3 % benzene content.

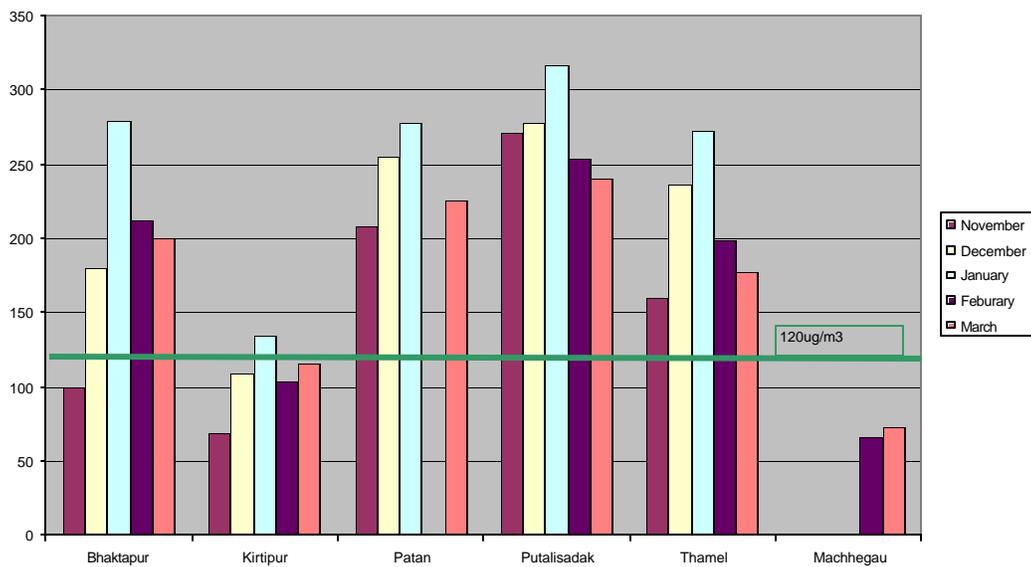
Average and Maximum TSP Concentration at Major Spots Kathamandu Valley, 2001



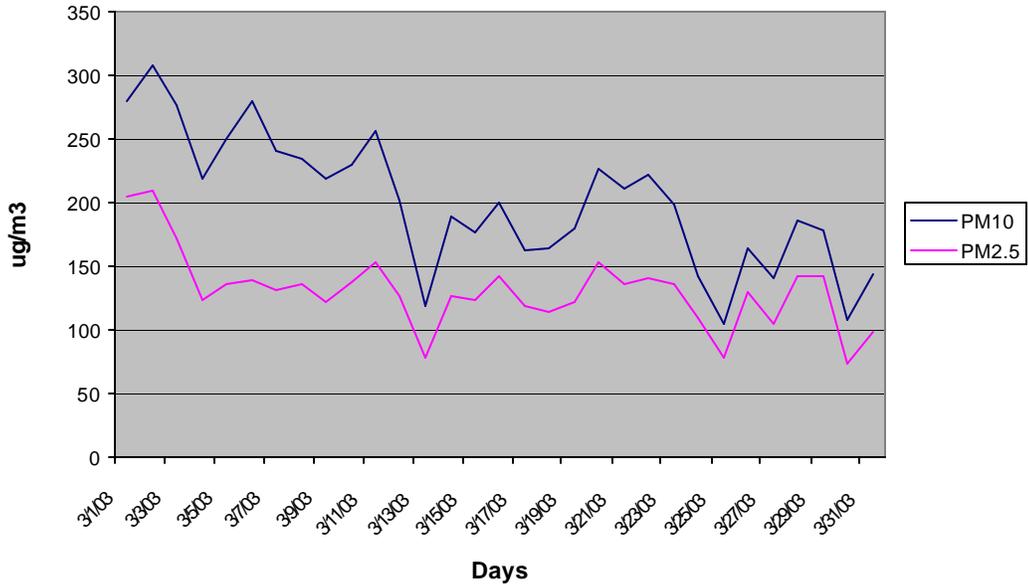
Average and Maximum PM10 Concentration at Major Spots in Kathmandu Valley, 2001



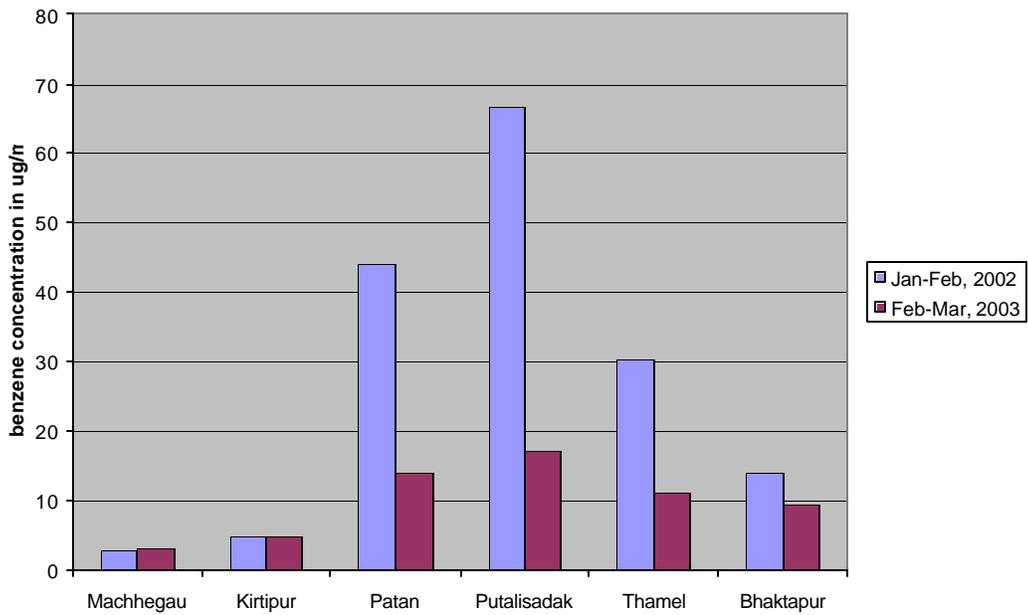
Monthly Average Concentrations of PM10 in Kathmandu Valley (Oct,2002-March, 2003)



Daily Comparison of PM10 and PM2.5 at Bhaktapur (March, 2003)



Benzene Monitoring Results of Jan/Feb 2002 and Feb/March 2003



3. Emission Inventory

There have been very limited studies on the inventory of air pollutants sources. The URBAIR Report has estimated the total emissions of some of the pollutants particularly focusing on TSP and PM10. Also estimates of SO₂, NO₂, CO and CO₂ been made focusing on particular sources. The URBAIR study takes the base year for 1993. In 2002, MOPE/ESPS has developed the update of the URBAIR study for the base year 2001. The findings of URBAIR and MOPE/ESPS are presented in Table 1 and Table 2 respectively.

As the two tables show that the identified sources of air pollutants in the Kathmandu Valley are vehicular exhausts, the road resuspension, the brick manufacturing industries, the Himal Cement Factory, domestic fuel combustion, and the refuse burning. The latest study also mentions the industrial boilers. Looking into the changing scenario of sources, there is a decline in the production of bricks and the number of brick industries in operation. The total number of brick kilns in 1993 are 135 while in 2001 the number has decreased to 116. Similarly the production of bricks has gone down from 361 million pieces to 344 million pieces from 1993 to 2001. Another major source of air pollutants identified is the Himal Cement Factory and the annual production of this factory also has gone down significantly over the years. While it was 63392 tons per year in 1992/93 and went down to 36129 tons/year in 2000/2001. In between these years, the annual production was in decreasing trend, and now the factory is closed since late 2001.

As against the industrial sources, all other sources are in increasing trend with increase in the population in the valley. There have been significant increase in the vehicle numbers over the year. As this study primarily relates with the transport sector, focus is given to this sector also. The annual increase in the vehicle number over the years and the projection for coming years based on the recent growth rate is presented in the following figure.

Trend over vehicular growth in Bagmati Zone

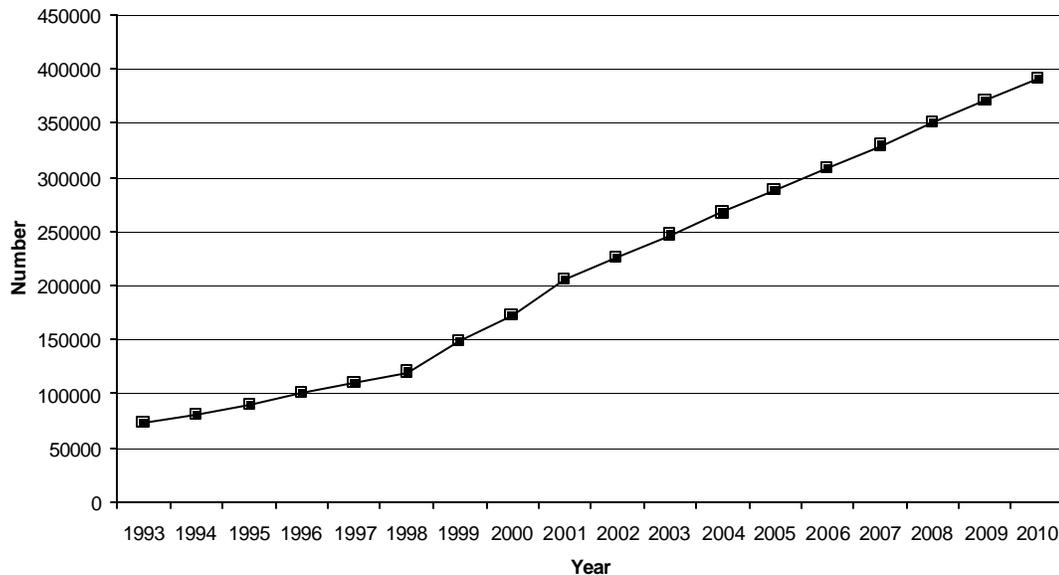


Table 1: Estimated Emissions from Air Pollution Sources in Kathmandu Valley, 1992/93 (URBAIR, 1996)

Sources of Emissions		TSP	PM10	S02
Vehicles				
Gasoline	Car/Taxi	38.4	-	-
	TC	67.5	-	4.2 - 105 ¹
	MS	107.5	-	-
Diesel	Jeep	68.4	-	-
	Minibuses	22.5	-	-
	Buses	45.0	-	78-390 ¹
	Trucks	114	-	-
	Tractors	21.6	-	-
	TC	85.8	-	-
Sum vehicle exhaust		570	570	82-495 ¹
Sum Resuspension from roads		1530	-400	
Energy/Industry Sector Fuel Combustion				
Industrial / commercial (excluding bricks and cement)	Fuelwood	61.9	31	
	Coal	48.0	24	172
	Charcoal	20.0	10	
	HSD	1.8	2	
	LDO/FO			
	Kerosene/LPG	0.1		
	Agri Residue	450.0	225	
Sum Industrial/Commercial		582.0	292	
Domestic	Fuelwood	1832.0	916	
	Agri-residue	454.0	227	
	Animal waste	30.0	15	
	Kerosene/LPG	2.3	2.3	
	Charcoal	10.0	5	
Sum Domestic		2328.0	1165	
Industrial Process	Brick Industry			
	Bulls Trench	5000	1250	4.8-4465 ²
	Chinese	180	45	
	Sum Brick	5180	1295	
	Himal Cement sum stack	-2000	-400	615
	Himal Cement diffuse dust	-4000	-400	
Other				
Sum Refuse burning		385	190	
Sum Construction		-	-	
Total		16565	4712	

- 1 High value: Based on max. allowable S content
Low value: Based on actual S content, according to IOC limited certificates
- 2 NESS (1995); Estimates based on different methodologies.

Table 2: Total Annual Emissions in Kathmandu valley,(tons/yr), 2001

	TSP	PM10	SO2	Nox	CO	CO2
1. Transport Sector						
Diesel						
Bus	270	270		897		
Minibus	100.4	100.4		869.7		
Trucks/Tankers	644.1	644.1		2791.1		
Tractor	31.68	31.68		49.28		
Gasoline						
Car/Jeep/Van	244.04	244.04		3294.5		
3 wheelers	80	80		1.12		
2 wheelers	868.8	868.8		12.16		
<i>Total vehicular exhaust</i>	2175.97	2175.97	0	8034.38		
<i>Total road resuspension</i>	7008.01	1822.08				
2. Industrial Sector						
Himal Cement						
<i>Total Himal Cement</i>	2348.43	1828.16				
Brick Kilns						
Bull's Trench	6493.21	1623.3	4177.16	813.37	820.27	
Chinese	83.28	64.78	55.52	23.59	37.01	13880.1
<i>Total Brick Kilns</i>	6576.49	1688.0	4232.68	836.96	857.28	13880.1
3. Refuse Burning	687.68	339.56				
4. Boilers	28.25	15.34				
Total	18824.88	7869.23	4232.68	8871.34	857.28	13880.1

Source: MOPE/ESPS

Note: this estimate is based on the number of vehicles registered in Bagmati Zone and not on the actual number of vehicles running in Kathmandu Valley.

The emissions have increased significantly as shown by the comparison in the *Table 1 and Table 2.. Figure 7 and 8* highlights the percentage contribution of TSP and PM10 from various sources for the year 2001. In terms of TSP contribution, road resuspension is the biggest contributor with 37.2 % of the total followed by Brick Kilns and HIMAL Cement Factory with 34.9% and 12.5% respectively. In terms of PM10 contribution, vehicular exhaust is the major contributor with 28% followed by road resuspension (23%), HIMAL Cement (23%) and brick kilns (22%).

Figure 7: TSP Contribution form Various Sources in Kathmandu Valley, 2001

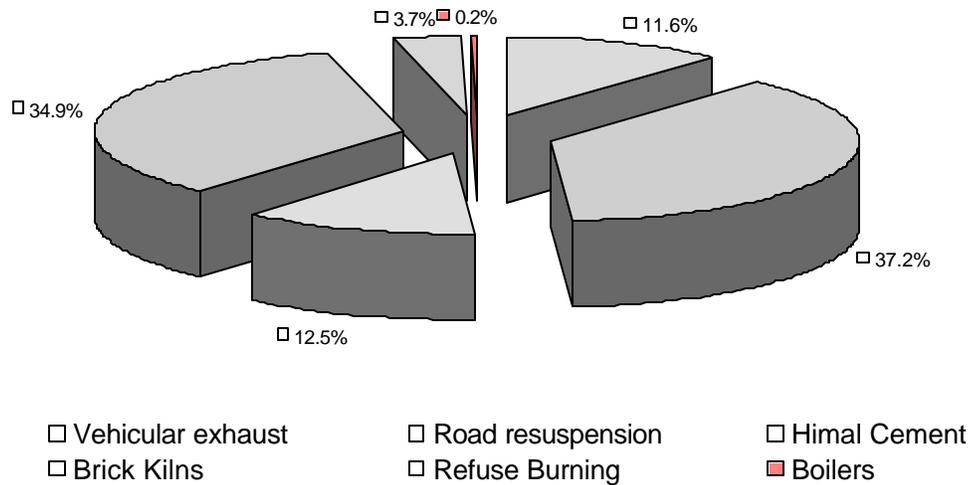
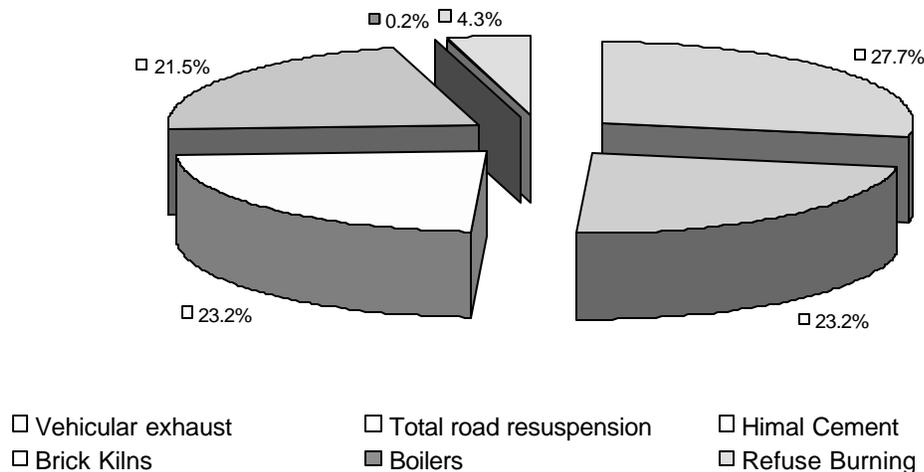


Figure 8: PM10 Contribution form various Sources in Kathmandu Valley, 2001



If we look into the number of vehicles registered in the Bagmati Zone, it has reached 171678 by 2000/2001 from 72037 in 1993, with the average growth rate of 15.3 %per year. Amongst the various categories of vehicles the maximum growth rate.21.8 % is for motorcycles followed by buses with 13.3 %. With the present rate of vehicular growth, the vehicular number is expected to reach around 400,000 by the end of 2010.

The increase in the vehicle numbers has direct impact on the demand of the petroleum products. The consumption of POL products increased from 181571 KL in 1996/97 to 209702.4 KL in 2001/2002.

The increased usage of petroleum products results with increased vehicular pollution. As compared to PM10 contribution of vehicles of 570 tons/year in 1993, the contribution of vehicular exhaust has almost increased by four fold in 2001. Considering the prevailing road conditions in the valley and the reduced vehicle km/hour speed, it is a major concern for policy makers. Further, the very high concentration of PM2.5 in the ambient air of Kathmandu Valley further demands more serious measures to be taken to curb the vehicular pollution in the valley. With increase in urban population and economic status of people in urban centers, the demand of more vehicles is there to increase. This results in more population exposed to increased pollution level resulting in more damage in terms of human health and economic cost. All these demand a long-term strategy in the transport sector development that focuses both on meeting demand and in the mean time reducing the pollution or at-least not allowing the increase of vehicular exhausts.

Annex - 2:
Route Permits, Name of the Route and Numbers of Different Types of Mass Transport Vehicles in Operation in Kathmandu

Gas Tempo (After DOTM, 2003)

SN	Route	No. of Gas tempo
1.	RNAC - Lagankhel	41
2.	RNAC - Mangal Bazar [Lagankhel]	20
3.	RNAC - Lagankhel - Satdobato	4
4.	RNAC - Lagankhel Tikathali	6
5.	RNAC - Mahalaxmisthan	1
6.	Lagankhel - Sunakothe	13
7.	Lagankhel - Kalanki	2
8.	RNAC - Budanilkatha	23
9.	RNAC - Hattigauda	19
10.	RNAC - Jorpati - Aarubari	53
11.	RNAC - Kadabari - Pepsicola	45
12.	RNAC - Kadabari - Pepsicola (Putalisadak)	4
13.	RNAC - Apanga Hospital	5
14.	RNAC - Kalanki	31
15.	RNAC - Taukhel	1
16.	RNAC - Chovar	5
17.	RNAC - Taidaha	9
18.	RNAC - Naicap - Sahisgate	11
19.	Naicap - Thapathali - Sahidgate	40
20.	Satdobato - Koteswor - Maitighar - Satdobato	39
21.	Kalanki - Lagankhel - Koteswor - Thapathali - tripureswor - Kalanki	2
22.	Gopikrishna - Gaushala - Satdobato	2
23.	RNAC - kalopul	2
24.	Balkhu - Kalimati - Thapathali - Jamal - Maharajgang	1
25.	Guarkhu - Koteswor - tripureswor - Balkhu - Ratnapark - Guarkhu	6
26.	RNAC - Bhatekako pul	3
27.	Aarubari (Jorpati) - Chabahil - Balaju - Balkhu	6
28.	Kalanki - Kaushaltar	27
29.	Kaushaltar -Makalu Chowk	5
30.	RNAC - Kalo pul - Sifal - Gopikrishna - Sahidgate - Tripureswor	4
31.	Putalisadak - Ghantaghar - Ranipokhari - Jamal	7
32.	Koteswor - Sahidgate - Tripureswor - Balkhu - Satdobato - Dhobighat - Koteswor	1
33.	Tilganga - Naya Baneshwor - Sahidgate - Tripureswor - Kalanki	1
34.	Kausaltar - Balkhu	2
35.	Dungeaada - Kalanki - Maharajgang - Aarubari (Jorpati)	10
36.	Satdobato - Koteswor - Gaushala - Chabahil - Aapang Hospital	1
37.	Aarubari - Sanothimi	1
38.	Gopikrishna - Koteswor - Sahidgate	28
39.	Guna Cinema - Koteswor - Sinamangal - Putalisadak - Kumari - Ratnapark - Naya Bazar - Shova Bagawati - Jamal - Gaushala - Purano Baneshwor - Sinamangal	39
40.	Mandikatar - Bhatbatani - Darbarmarg - Sahidgate - Jamal	5
41.	Pepsicola - Chabahil - Narayangopalchowk	3
Total		528

Petrol Tempo (After DOTM, 2003)

SN	Route	No. of Petrol tempo
1.	Ratnapark - Lagankhel	1
2.	Jamal - Maharajung Chakrapath	13
3.	Jamal - Maharajung	42
4.	Jamal - Balaju	12
5.	Jamal - Samakhusi	18
6.	Jamal - Basundhara	16
7.	Jamal - Bishalnagar	11
8.	Jamal - Sinamangal	9
9.	RNAC - Minbhavan	7
10.	RNAC - Dhumbarahi Capal Karkhana	12
11.	RNAC - Maharajung Chakrapath Basundhara	6
12.	RNAC - Basbari	7
13.	RNAC Budanilkanth	1
14.	RNAC - Samakhusi	1
15.	RNAC - Tangal	1
16.	RNAC - Chabahil - Jorpati - Gokarna - Dachindhoka	3
17.	RNAC - Jorpati	3
18.	Ranipokhari - Maharajung Chakrapath	1
19.	Ranipokhari - Bishalnagar	1
20.	Naya Baneshwor - Chabahil - Teaching Hospital - Gokarna - Maharajung	57
21.	Naya Baneshwor - Teaching Hospital	15
22.	Sundhara - Naya Buspark	2
23.	RNAC - Banustali	1
24.	RNAC - Golfutar	1
25.	RNAC - Dhumbarahi	11
26.	RNAC - Kalanki	10
27.	RNAC - Balkhu	7
28.	Sahidgate - Balkhu	4
29.	Sahidgate - Bhimsengola, Minbhavan	2
30.	RNAC - Naicap	1
31.	Kalanki - Maharajung	1
32.	Kalanki - Lagankhel	1
33.	Balkhu - Naya Baneshwor	1
34.	Balkhu - Kausalatar	1
35.	Lagankhel - Luu	1
36.	Satdobato - Koteswor, Naya Baneshwor - Maitighar - Jawalakhel - Lagankhel Satdobato	1
Total		282

Safa tempo (After DOTM, 2003)

SN	Route	No. of Safa tempo
1.	RNAC - Hattigauda	6
2.	RNAC - Lagankhel	22
3.	RNAC - Kalanki Sitapaila	14
4.	RNAC - Balaju, Baneshitali	11
5.	Sundhara - Sinamangal	33
6.	RNAC - Samakhusi, Gongabu [Naya Buspark]	11
7.	Sundhara - Mangal Bazar [Lagankhel]	3
8.	Baluwatar - RNAC - Mangal Bazar - RNAC - Dumbarahi	1
9.	RNAC - Maharajung - Golfutar - RNAC - Chabahil - Jorpatii	1
10.	Baluwatar - Putalisadak - Mangal bazar	11
11.	Sundhara - Lagankhel - Koteshwor - Maitighar	127
12.	RNAC Aanamnagar - Baneshwor Pipalbot	18
13.	Sundhara - Mangal Bazar - Guarko	11
14.	Satdobato - Koteshwor - Maitighar - Jawalakhel - Lagankhel	1
15.	Sundhara - Sanepa - Lagankhel	2
16.	Sahidgate -Thache	1
17.	Lagankhel - Thache	1
18.	Satdobato -Chapagau	3
19.	RNAC - Kalanki	18
20.	RNAC - Naikap	2
21.	RNAC -Chhauni, Sitapaila	4
22.	RNAC - Balaju	3
23.	RNAC - Samakhusi	2
24.	Kausaltar - Kalanki	2
25.	Kaushaltar - kalimati	2
26.	Kaushaltar - Balkhu	2
27.	Kaushaltar - Makalu Chowk	4
28.	Dachindhoka - Apanga - Teaching	16
29.	Jorpati - Purano Baneshwor - Singha Darbar southgate	4
30.	RNAC - Mahankal	4
31.	RNAC - Tincule	46
32.	RNAC - Jorpati	55
33.	RNAC - Gokarna	1
34.	Tincule - Narayantar - Aapanga Hospital - Chabahil - Maharajung	7
35.	RNAC - Narayantar	3
36.	Sundhara - Chabahil - Laharajung - Lagankhel	1
37.	Lagankhel - Sangrila - Kupondol	1
38.	RNAC - Dhumbarahi	33
39.	RNAC - Golfutar	57
Total		544

Microbus

Microbus white letter in Black Plate (After DOTM, 2003)

SN		Route Name	Microbus white letter in black plate
1.	Jorpati	Jorpati - Baudha - Chabahil - Purano Baneshwor - Maiti devi - Dilli Bazar - Putali Sadak - Sahidgate - Ratnapark - Jamal - Gyaneshwor - Chabahil - Baudha - Jorpati	84
		Jorpati - Chabahil - Maiti devi - Putali Sadak - Sahidgate- Ratnapark - Kamal Pokhari - Gyaneshwor - Maiti devi - Chabahil - Maharajung - Balaju - Shwaymbhu - Same route to Jorpati	12
		Jorpati - Chabahil - Gaushala - Koteswor - Satdobato - Lagankhel - Sahidgate - Ratnapark - Gyaneshwor - Maiti devi - Purano Baneshwor - Gaushala - Ratnapark - Gyneshwor - Maiti devi - Purano Baneshwor - Gaushala - Chabahil - Gaushala	9
		Jorpati - Chabahil - Maharajung - Kalanki - Balkhu - Same Route to Jorpati	2
2.	Godavari	Godavari - Lagankhel - Jawalakhel - Kupondol - Singha Darbar - Sahidgate - Ratnapark - Singha Darbar - Thapathali - Jawalakhel - Lagankhel - Godavari	12
		Godavari - Lagankhel - Jawalakhel - Kupondol - Singha Darbar - Sahidgate - Tripureswor - Kupondol - Jawalakhel - Satdobato - Koteswor - Gaushala - Chabahil - Balaju - Kalanki - Balkhu - Satdobato - Godavari	6
3.	Chabapokhari	Chabapokhari - Patan Hospital - Jawalakhel - Pulchowk - Kupondol - Thapathali - Singha Darbar - Sundhara - Ratnapark - Singha Darbar - Pulchowk - Jawalakhel - Patan Hospital - Chabapokhari	19
		Chabapokhari - Lagankhel - Jawalakhel - Singha Darbar - Sahidgate - Ratnapark - Tripureswor - Kupondol - Pulchowk - Jawalakhel - Lagankhel - Satdobato - Balkhu - Kalanki - Return ti same route	7
		Chabapokhari - Lagankhel - Satdobato - Koteswor - Gaushala - Chabahil - Maharajung - Balaju - Kalanki - Balkhu - Chabapokhari	10
4.	Lagankhel	Lagankhel - Koteswor - Gaushala - Chabahil - Gaushala - Koteswor - Satdobato - Lagankhel - Jawalakhel - Pulchowk - Singha Darbar - Sahidgate - Ratnapark- return to same route	20
		Lagankhel - Jawalakhel - Pulchowk - Kupondol - Thapathali - Singha Darbar - Sundhara - Ratnapark - Singha Darbar - Thapathali -Kupondol - Lagankhel	33
		Lagankhel - Guarko - Mangal Bazar- Jawalakhel - Singha Darbar - Sahidgate - Ratnapark return to same route	8
5.	Balkhu	Balkhu - Kalanki - Balaju - Maharajung - Chabahil - Gaushala - Purano Baneshwor - Maiti Devi - Putalisadak - Sahidgate - Kalimati - Balkhu	3
		Balkhu - Kalanki - Balaju - Maharajung - Chakrapath Balaju - Kalanki - Balkhu	3
		Balkhu - Kalanki - Kalimati - Thapathali - Naya Baneshwor - Koteswor - Naya Baneshwor - Maitighar - Sahidgate - Tripureswor - Kalimati - Sialteemod - Kalanki - Balkhu	3
6.	Kritipur	Kritipur - Kalimati - Thapathali - Singhadarbar - Sahidgate - Kalimati - Kritipur	18
7.	Gurjudhara	Gurjudhara - Naikap - Kalanki - Kalimati - Tripureswor - Thapathali - Singhadarbar - Sahidgate - Tripureswor - Kalimati - Kalanki - Naikap - Gurjudhara	35
8.	Budhanilkant ha	Budhanilkantha - Maharajung - Lajimpat - Kesarmahal - Darbarmarg - Tidharapathshala - Ghantaghar - Ratnapark - ranipokhari - Rastriyanachghar - kesarmahal - Maharajung -Budhanilkantha	65
9.	Kapan	Kapan – saraswatinagar – Chabahil – Gaushala – Dilibazar – Ghantaghar – Ratnapark – Jamal – Maitidevi – Chabahil - Jorpati – Saraswatinagar – Kapan	38

SN		Route Name	Microbus white letter in black plate
10	Dhashindhola	Dhashindhoka – Jorpati – Chabahil – Gaushala – Purano Baneshwor – Putalisadak - Ratnapark – Jawalakhel – Lagankhel – Bhadrakali – Ratnapark – Putalisadak – Maitidevi – Purano Baneshwor – Gaushala – Chabahil - Jorpati – Dhashindhoka	9
		Dhashindhoka – Jorpati – Chabahil – Purano Baneshwor – Dillibazar – Putalisadak - Pradarsanimarg – Sahidgate – Ratnapark – Jamal – Kamalpokhari – Gyaneshwor – Maitidevi – Gaushala – Chabahil - Jorpati – Chabahil – Maharajung – Balaju – Syambhu – Kalanki – Balkhu same route to return Dhashindhoka	3
11	Tokhadovan	Tokhadovan – Gongavu – Naya Buspark – Samakhusi – Kharibot – Majuhiti – Samkhusi – Lainchour – Galphutar – Jamal – Ghantaghar – Ratnapark – Jamal – Lainchour Same route to return	31
12	Chakrapath	Chakrapath – Balaju – Sorakhutte – Lainchour – Ghantaghar – Sahidgate – Jamal – Kesarmahal – Balaju – Tamel – Samakhusi – Chakrapath	17
13	Balaju	Balaju – Sorakhutte – Jamal – Ghantaghar – Sahidgate – Ratnapark – Jamal – Sorakhutte – Balaju – Syambhu	11
14	Kalanki	Kalanki – Balaju – Maharajung – Chabahil – Gaushala – Airport – Koteswor – Satdobato – Lagankhel – Kalanki – Kalimati – Tripureswor – Sahidgate – Ratnapark – Sahidgate – Kalanki	15
		Kalanki – Balaju – Maharajung – Chabahil – Gaushala – Airport – Koteswor – Satdobato – Lagankhel – Kalanki – Kalimati – Tripureswor – Sahidgate – Ratnapark – Sahidgate – Ratnapark – Gaushala – Ratnapark – Sahidgate – Kalanki	8
		Kalanki – Balaju – Maharajung – Chabahil – Gaushala – Airport – Koteswor – Satdobato - Lagankhel – Kalanki	19
		Kalanki – Lagankhel – Thapathali – Sahidgate – Singhadarbar – Naya Baneshwor – Koteswor – Maharajung – Kalanki	11
		Kalanki – Balkhu – Satdobato - Lagankhel – Naya Buspark return to same route	8
		Kalanki – Satdobato - Lagankhel – Satdobato – Koteswor – Gaushala – Chabahil – Kalanki – Kalimati – Tripureswor – Ratnapark – Jamal – Ghantaghar – Sahidgate – Tripureswor – Kalanki	9
		Kalanki – Kalimati – Tripureswor – Thapathali – Naya Baneshwor – Koteswor – Naya Baneshwor – Maitighar – Singha darbar Sahidgate – Tripureswor – Kalimati – Kalanki	45
15	Seuchatar	Seuchatar – Kalanki – Kalimati – Ratnapark – Sahidgate – Tripureswor return to same route	6
16	Syambhu	Syambhu – Kalanki – Kalimati – Thapathali – Naya Baneshwor – Koteswor – Singha Darbar – Sahidgate – Tripureswor – Syambhu	17
		Syambhu – Chakrapath – balaju – Chakrapath – Soharakutte – Lainchour – Kesarmahal – Jamal – Ghantaghar – Sahidgate – Jamal – Soharakutte – Balaju – Syambhu Chakrapath	8
17	Sitapaila	Sitapaila – Balaju – satdobato – Lagankhel – Satdobato – Koteswor – Gaushala – Chabahil – Budha – Gaushala – Gaurko – Satdobato – Lagankhel – Jawalakhel – Thapathali – Singha darbar – Sahidgate – Ratnapark return to same route	7
		Sitapaila – Kalanki – Balkhu – Satdobato – Lagankhel – Chabapokhari return to same route	5
18	Naya Buspark	Naya Buspark – Syambhu – Kalanki – Kalimati – Tripureswor – Thapathali – Singhadarbar – Sahidgate – Ratnapark – Sahidgate – Ratnapark	8
		Total	624

Microbus Black Letter in White Plate (After DOTM, 2003)

SN		Route Name	Microbus Black letter in White plate
1.	Balkhu	Balkhu - Kalanki - syambju - Gongabu - Maharajung - Chabahil - Gaushala - Airport - Koteswor - satdobato - Aakantakuna - Balkhu	19
2.	Mulpani	Mulpani - Chabahil - Budha - Narayangopal chowk - Syambhu - Kalanki - Balkhu - Bairabchour - Gokarna - Jorpati - Chabahil - Gaushala - Airport - Satdobato return to same route	83
3.	Satdobato	Satdobato - Koteswor - Gaushala - Maharajung - Balaju - Kalanki - Balkhu - Satdobato	81
4.	Budhanilkantha	Budhanilkantha - Narayangopalchowk - Chabahil - Gaushala - Koteswor - Satdobato return to same route	24
Total			207

Bus / Mini Bus

SN	Route	No. of Bus/Minibus
1.	Ratnapark to Lagankhel	261
2.	Ratnapark to BKT	342
3.	Ratnapark to Sakhu	51
4.	Ratnapark to Budhanilkantha	60
5.	Ratnapark to Kritipur	78
6.	Ratnapark to Balaju	61
7.	Ratnapark to Naya Bus Park	133
8.	Ratnapark to Dashin	25
9.	Ratnapark to Thankot	82
10.	Ratnapark to KTM Valley	130
11.	Ratnapark to Jorpati	161
12.	Ratnapark to Sundarijal	43
13.	Lagankhel ringroad	215
14.	Nayabuspark -Maharajung-Jamal-Ratnapark - Kalanki -Nayabuspark	66
15.	Nayabuspark-Jamal-Mahendrasalik-KrishnaPauroti -Gyneshwor-Siphal-Kapan-Hathisar	33
16.	Patan Dhoka -Lainchuor-Tangal-Purano Buspark	44
17.	Matatritha -Kalanki -Rabibhavan -Kalimati - Jamal - Bhadrakali -Singhadarbar - Naya Baneshwor-Tinkune-Koteswor-Guaeko -Sadobato-Balkhu-Kalanki - Naikap -Gurjudhara - Matatritha	20
18.	Gopikrishna-Maharajung- Teaching - Baluwatar - Naxal - Jaya Nepal - Putalisadak -Singha Durbar - naya Baneshwor -Koteswor - return to same route	52
19.	Balkhu-Aakantakune-Jawalkhel-Thapathali-Maitighar-Naya Baneshwor - Tinkune -Koteswor - Thapathali -Tripureshwar-Kalimati - Balkhu	32
20.	Purono Naikap-Khadka Gau - Kalanki - Kalimati -Ratnapark	5
21.	Machhegau -Naikap-Kalanki-Kalimati-Tripureswar - Ratnapark - Matatritha-Naya busparkKoteswor- Guarko - Satdobato - Aakantakune	2
		1896

Year Wise Vehicle Population in Bagmati Zone

SN	Vehicle Type	1993/94	1994-95	1995-96	1996-97	1997-98	1998-99	2000	2001	2002
1	Bus	792	958	1045	1163	1298	1403	1632	-	1858
2	Minibus	1352	1388	1430	1468	1500	1527	1610	-	2172
3	Trunk/Tanker	3343	3781	4113	4483	4759	4811	5295	-	6274
4	Car/Jeep/Van	20748	22640	24248	27153	28915	30919	0	-	43409
5	Three wheeler automobile	3844	3844	3844	3844	3925	4262	4778	-	5073
6	Two Wheeler automobile	37774	43506	49299	58029	64142	71612	94217	-	1E+05
7	Tractor	1623	1635	1670	1672	1672	1672	1672	-	1673
9	Others	2561	2678	3012	3020	3278	3311	3332	-	3356
	Total	72037	80430	88661	100832	109489	119517	112536	0	2E+05

Vehicular Registration Number Annual Registered Vehicles

Fiscal Year	Year	Car/Jeep /Van	Bus	Minibus	Truck/Tanker	Tractor	Motorcycle	Tempo	Other	Total
046/47	1989/90	23050	2489	1464	7969	6169	32776	2359	102	76378
047/48	1990/91	1893	458	226	800	788	4954	856	1549	11524
048/49	1991/92	2115	413	148	1524	548	8154	1207	358	14467
049/50	1992/93	2266	606	185	1491	262	7608	62	381	12861
050/51	1993/94	3049	1168	77	1740	1396	8653	154	372	16609
051/52	1994/95	3043	850	83	1629	1814	9401	241	353	17414
052/53	1995/96	5261	486	82	1151	2183	13855	117	58	23193
053/54	1996/97	2993	608	175	907	1257	12633	185	352	19110
054/55	1997/98	4139	899	130	1291	1265	12306	344	51	20425
055/56	1998/99	2507	872	19	978	2248	17090	388	37	24139
056/57	1999/2000	3647	494	122	829	2542	19755	789	102	28280
057/58	2000/2001	5152	1203	250	1271	3519	29291	232	77	40995
058/59	1990/2002	4374	868	475	1798	3189	38522	248	86	49560
Grand Total		63489	11414	3436	23378	27180	214998	7182	3878	354955

Vehicular Registration Number, Till : 2057 ASHADH

Office	Bus	Minibus	Truck /Tanker	Tempo	Motorcycle	Tractor	Other	Total
Bagmati	1632	1610	5295	4778	94217	1672	3332	112536
Narayani	4832	428	9662	1107	15581	6412	60	38082
Koshi	957	167	1338	249	8437	4140	22	15310
Lumbini	313	184	1236	281	10211	1960	156	14341
Gandaki	527	202	701	0	7298	653	22	9403
Janakpur	182	18	381	37	3024	1560	71	5273
Bheri	189	34	470	132	3205	1124	16	5170
Seti	238	35	416	18	1849	439	5	3000
Mechi	94	16	250	9	1267	640	3	2279
Sagarmat	95	5	319	37	1140	1291	2	2889
Rapti	161	6	181	43	477	285	0	1153
Mahakali	123	6	97	11	448	296	6	987
Total	9343	2711	20346	6702	147154	20472	3695	210423

Source: Department of Transport Management, 2003.

Annex – 3: Review of National Policy Documents

This annex provides key points of the relevant policy documents only and is not an exhaustive review of all the policy documents.

1. Ninth FY Plan (1997-2002)

Concepts, Strategies and Targets of Long-Term Development of Ninth Plan:

Transport Sector:

Target for 20 years include “Ropeways and cable cars will be installed in remote areas and tourists spots. The construction of electric railway line along Mechi-Mahakali will be given priority. Electric railway will be constructed along the outskirts of Kathmandu Valley. The use of circular electric railway will be started and use of trolley buses and electric battery operated vehicles will be expanded in order to lessen the pollution in the Kathmandu Valley.”

The review of the eight plan shows that ten new more trolley buses were added during that period.

One of the priority areas of the ninth plan include: controlling vehicle induced pollution.

The ninth plan under the heading of other means of transport specifically focuses 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 Tripureswor-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 Traffic and Transport Management section under the transport specifically focuses on vehicular pollution control. The planned activities for the ninth plan are regular vehicle emission test and on the spot vehicular pollution monitoring. Production, development and operation of zero emission vehicles will be encouraged.

Development of Infrastructure- Electricity Development:

The background on the heading highlights “ non polluting natural fuel (hydropower) can replace other polluting fuel (petroleum, gas and coal) and helps to save foreign currency and reduce the level of air pollution”.

The objectives of the plan in electricity development include: “to develop hydropower in a least effective way so as to meet the energy demand from agriculture, industry, transportation, domestic, commercial and other sector”

2. Review of Tenth Plan (2003-2008)

10th Plan has main objective of the Traffic and Transport System Sector is to make the traffic and transport system systematic and sound by making transport service reliable, safe, pollution free, and service-oriented, and to increase the quality of the transport service.

The long-term concept of the transport sector development in the 10th Plan is to develop the sustainable, reliable, low-cost, safe, comfortable, pollution free and self-reliant transport system that contributes to the overall economic, social, cultural, tourism and so on development in the kingdom of Nepal.

One of the strategy of the 10th Plan is to effectively enforce the Nepal Traffic Pollution Standard of 1999 (2056) in order to reduce the pollution due to traffic.

Policies and action policies have focussed to make transport services safe, reliable, pollution free and qualitative thus increasing the quality of services. In the Kathmandu valley efforts to reduce the pollution adopting various means of controlling the pollution caused by traffic has a specific mention. Besides, one of the action program has targeted for the expansion of Trolley Bus System.

3. Review of National Conservation Strategy (1988)

In 1988, the National Conservation Strategy (NCS) was formulated. NCS, as indicated during the Eighth Plan, recognises that in order to meet the basic needs of the Nepalese people substantial development activity must be undertaken. Such development will cover a wide range of projects.

The NCS provides that:

- ~~///~~ An Assessment and Review Office (ARO) will be established, and it will be responsible for socio-economic and environmental assessment,
- ~~///~~ The proponent of a development project or industrial activity that may have significant detrimental social and or environmental impacts must prepare and file with ARO a statement concerning the potential socio-economic and environmental effects of the proposed development. The impact statement must be prepared in accordance with the guidelines provided by ARO, and
- ~~///~~ A review process that is open to both government and non-government participants and consistent with government's policy concerning public participation will consider the proponent's socio-economic and environmental impact statement.

4. Review of National Plan of Action (1996)

In 1996, National Plan of Action was prepared for the United Nations Conference on Human Settlement (HABITAT I, Turkey 3-14 June, 1996). The National Plan of Action identified prior issues, formulated a plan of action for a period of years 1996-2000 and identified key areas for international co-operation and assistance. The plan identified several priorities relating to urban environmental planning and management, including development of water and air pollution control and monitoring, land use planning and enforcement, urban basic service, and related institutional capacity building.

5. Review of NEPAP (1993)

NEPAP has identified the eight aims and policies:

- ~~///~~ To efficiently manage natural and physical resources
- ~~///~~ To balance and coordinate developmental efforts and environmental conservation in order to meet the basic needs of the Nepalese people in a sustainable manner
- ~~///~~ To manage, develop, and conserve natural, cultural, physical, and heritage resources, keeping in view the social, economic, and cultural needs and potentialities of the present and future generations
- ~~///~~ To identify and mitigate to the greatest extent possible the adverse environmental impacts caused, or likely to be caused, by human action and development projects
- ~~///~~ To utilize, manage, develop, conserve, and recycle natural and physical resources in a manner that is not detrimental to their ability to yield long-term benefits
- ~~///~~ To formulate and implement special protection and conservation policies and plans to safeguard important national heritage resources such as rare wildlife species, plants, biodiversity, genetic pools, environmentally sensitive areas, and manmade heritage sites of aesthetic and cultural significance
- ~~///~~ To formulate acts and laws pertaining to various environmental issues as the needs arises and to carry out timely reform of existing legislations
- ~~///~~ To develop institutions for the effective implementation of environmental laws and policies

Looking into the above policy statements, the utilization of the natural resources in a sustainable manner and the protection of the environmental qualities, mitigating the adverse impacts caused by human actions, formulations of policies and acts as the needs arises can be directly related to the promotion of the clean vehicles in Nepal. These policy statements also directly supports the development of specific policy and provide guidance to encourage clean technologies with legal supports.

It recognizes that the deteriorating quality of air in many urban areas is imposing significant social and economic costs on population. It relates with the high incidence of respiratory diseases raises health costs and results in lower level of productivity.

The document said that “in urban areas, haphazard growth of settlements and industrial establishments and a dramatic increase in the number of vehicles have worsened air pollution,”

Under this heading “vehicular pollution” has been highlighted. The focus is given on import of quality vehicles, quality fuels, better roads, introducing standards for vehicles, review of pricing structure of petroleum products to avoid fuel adulteration, and more emphasis is given on proper repair and maintenance of vehicles. The need for standards and monitoring mechanism is highlighted. The sad part is that there is no mention of the then running trolley bus as a no smoke vehicles and need to promote such ones. In the mitigating of adverse impact, this NEPAP does not give emphasis on promoting electrical vehicles. However there are many issues mentioned that discourages the polluting ones and hence open room for clean ones. In the identified action program also promotion of electrical vehicles is missing.

6. Review of National Transport Policy 2058

This policy document has mention of cleaner or non-polluting vehicles in the following sections

Background

In the urban areas road infrastructure and vehicle management should be done with due consideration to the environment.

Preamble

This policy has been formulated in order to promote the transportation services in the remotest areas of Nepal with minimum resources as soon as possible, to make the existing transport infrastructure more reliable and to establish an environmental friendly transportation system in the rural and urban areas with the international standard transport system of foreign countries.

Objectives

The primary objective of the National Transport Policy 2058 is to aid in the social, economic, cultural and tourism development of the nation through the extension of far reaching, reliable, low cost, safe, comfortable and self reliant transport system.

Policy

- ~~///~~ The construction and repair and maintenance of the road infrastructures will be carried out keeping in view of the traffic safety and environmental worthiness
- ~~///~~ Expansion of the service of solar and electric vehicles throughout the country
- ~~///~~ To make the public transport safe, reliable, facilitating, pollution free and easily accessible to general public as per the economic condition of people
- ~~///~~ No foreign loan investment on the transport service, which is not economically feasible

Transport Infrastructures

- /// To limit the traffic density and movement of vehicles within the acceptable level as per the land use and carrying capacity of cities
- /// Arrangement of a separate bicycle lane in cities
- /// Not to run the transport infrastructure and transport service likely to require subsidy from government

Public Transport Vehicles

- /// To allow the running of public transport vehicles only on the basis of free competition
- /// To reduce the load on roads, only the vehicles with appropriate Axle Load System will be allowed to run
- /// New vehicles will be required to get the roadworthiness certificate in five years and then in every two years
- /// Complete ban on import of older vehicles more than five years
- /// The discarded batteries, Mobil, grease or other oily wastes to be disposed only on assigned places or following the prescribed procedures
- /// To make the public transport reliable, facilitating, pollution free, safe and less expensive; standards will be developed for repair and maintenance and providing road permits
- /// The vehicle, which was made for particular purposes, will be allowed only for that purposes

For City Area

- /// Ban of motorized vehicles in the core city areas
- /// Priority to solar, electric or gas operated bus, tram, or motor
- /// Not to allow to increase the traffic density from a fixed density. For this city parking system and control on ownership of vehicles will be introduced
- /// Vehicles to be parked only on the assigned parking places
- /// Restriction on the running of noise and air polluting vehicles. A separate standard will be introduced for core city areas

Custom, Tax, Royalty

- /// To promote the private sector investment in the transport infrastructure development and promotion of pollution free vehicles, tax and custom rebate will be provided for certain duration

7. Review of SDAN (a recent document of government prepared in 2002 and still in the draft stage)

Three chapters of SDAN are found directly related: Transport; Water and Energy; and Protection of Atmosphere. The review is focused on these three chapters only.

Transport:

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

Water and Energy:

On the basis for future action, one of the basis for identified future action is "policies favorable to renewable energy over fossil fuels". The emphasis is given to encourage the use of renewable energy to curtail the growth of fossil fuel imports and it is stressed that government policy needs to support these opportunities.

Among the objectives defined for the sustainable development of energy sector, include “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 identified essential programs 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 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 fuel and provide custom and VAT privileges on the importation of electric vehicles. The department of transportation should provide priority to electric vehicles for public transportation on assigning routes on which they can run.” The promotion of time-of-day meters is also given emphasis to maximize the off-peak use of electricity.

Protection of Atmosphere:

Climate Change, Protection of Ozone Layer, and Air Pollution Control falls under the heading of Protection of Atmosphere.

Among the objectives on Climate Change include: control of GHG emissions, and maximize utilization of nations huge clean hydropower energy source. In order to achieve the, the identified essential programs/activities include GHG Emission Limitation. Under this the identified activities are:

- ~~///~~ Establishment of trolley bus facilities in the ring road of Kathmandu Valley to limit the fossil fuel consumption and utilize hydro electricity
- ~~///~~ Feasibility study to introduce electric trains on long distances particularly in the Terai region
- ~~///~~ Promotion of batteryoperated vehicles in the valley and other major cities

On the Air Pollution Control, the primary objective set is improve the air quality of major urban centers by bringing down the level of suspended particulate 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; the air quality monitoring networks; and the system of assessment of impact on health, physical, and economic damage of air pollution also support the promotion of zero emission vehicles.

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

- ~~///~~ Electric vehicles will be promoted with reduced night tariff of electricity
- ~~///~~ Necessary infrastructure will be developed in ring-road of Kathmandu to run trolley buses
- ~~///~~ Economic incentives and disincentives will be introduced to replace old vehicles with more environment friendly vehicles
- ~~///~~ Introduction of polluter pays principle including penalties for violators

Annex - 4 Review of Legislation

1. Review of Environment Protection Act, 1997 and Environment Protection Rules, 1997

The EPA's focus is on minimizing the environmental degradation in order to protect human beings and ecosystem, proper use and management of natural resources, and integration of environment into economic development process.

This act has provisions on prevention and control of pollution. Nobody will be allowed to create pollution contrary to prescribed standards.

Specific Provisions

Section 7 of the Act " Prevention and Control of Pollution" has following provisions related to prevention and control of pollution.

1. Nobody shall create pollution in such a manner as to cause significant adverse impacts on the environment or likely to be hazardous to public life and people's health, or dispose or cause to be disposed sound, heat radioactive rays and wastes from any mechanical devices, industrial enterprises, or other places contrary to the prescribed standards.

The Act define wastes and disposal as under:

"Wastes" means the liquid, solid, gas, slurry, smoke, dust, radiated element or substance or similar other materials disposed in a manner to degrade the environment.

"Disposal" means the act of emission, storage, or disposal of sound, heat or wastes

2. If it appears that anyone has carried out any act contrary to sub-section (1) and caused significant adverse impacts on the environment, the concerned agency may prescribed necessary terms in regard thereto or may prohibit the carrying out of such an act.
3. If it appears that the use of any types of substance, fuel tools or device has caused or is likely to cause significant adverse impacts on the environment, the Ministry may, by a notification in the Nepal Gazette, forbid the use of such substance, fuel, tools or device.

Section 8 of the Act has made provision of the appointment of Environmental Inspector to carryout the acts of the mitigation, avoidance or control of pollution through inspection, examination, fines and prohibition of pollution actions.

Section 15 of the Act has made provision to provide additional concessions and facilities to encourage any industry, enterprise, technology or process which causes positive impacts on environment protection, by publishing a notification in the Nepal Gazette.

Section 23 of the Act has empowered HMG to frame and implement necessary guidelines under the act for environmental protection.

Section 24 of the Act has empowered HMG to frame necessary rules related to Pollution standards including air and emissions for the prevention and control of pollution

Chapter 3, rule 15 of EPR prohibits emission of noise, heat, radio-active material and waste from any mechanical means, industrial establishment or any other place in contravention of the standards prescribed by the Ministry by notification published in the Gazette.

2. Review of Vehicle and Transport Management Act 2049 and Regulation 2054

The act is promulgated to prevent vehicle accidents, compensate the affected ones from accidents, establishment of insurance system, and make the transport service capable and effective ensuring the service is easily accessible to general public.

This is the prevailing legal system that governs the overall management aspects of the transport system in the country. This act classifies the vehicles in terms of weight and capacity, ownership basis and also the type of service intended to provide.

According to act every vehicles in the country have to be registered and the owners have to get the registration certificate.

Specific Provisions

Roadworthiness Certificate (Section 17 and 23)

This is made compulsory and it must be attached in the vehicles all the time. To get the certificate, the vehicles have to comply the prescribed standard comprising of the following areas:

- ?? Mechanical conditions of the vehicle
- ?? Vehicle length, width, height, construction, or look
- ?? Exhaust emission
- ?? Time limit for the running

Right to Refuse Registration of a Vehicle (Section 24 and 40)

If the vehicle applied for registration does not comply the standards prescribed under the roadworthiness certificate heading, the department or the concerned authority has the right to refuse the registration of the vehicle. However, the reasons must be made known to the applicant.

Need of Prior Permission to Change Specification (Section 39)

Without the prior approval of the authorized officers, the owners are not allowed to change the color, seating capacity, look, engine and chassis of the vehicle. However, the approval will not be granted if the change is intended to change the model/construction specifications of the manufacturer.

This provision is significantly important here that if somebody wants to change a diesel or petrol vehicle to a CNG/LPG/Electric vehicle, it will not be possible if this provision is not changed.

Right to Withheld the Vehicle Registration Certificate (Section 40):

If the vehicle condition is found unsuitable for public safety, department has the authority to withheld the certificate till the vehicle is repaired again to comply with the roadworthiness standard. *This also requires that the vehicles must comply with the prescribed vehicle emission standard.*

Provisions on Transport Management (Section 74, 75, 78 and 93)

- ?? Department has the authority to fix the road for the running of the public transport system.
- ?? Without having the road permission, no public transport can be run.
- ?? Vehicle owner have to apply for the road permission to run the public transport and have to fulfill among others the roadworthiness test

Refusal for route permits on pollution ground (Section 82, and 118)

The authority in consultation with management committee has the authority to refuse the road permit on the ground of pollution on a particular area or road. This is significantly important that department can only allocate specific routes to zero emission vehicles or less polluting vehicles on this ground within this legal tool.

Work, Duty and Responsibility of the Department of Transport Management (Section 153)

- ?? Formulation and implementation of Transport Policy
- ?? Issue directives to the concerned for the Transport management
- ?? Issue directives to the goods transporters based on the priority of goods
- ?? Identification of Public Transport Routes and fixing of the transport fares
- ?? Management of traffic signals at public places as per International practice
- ?? Decide upon the vehicle speed, load, and number of passenger in a vehicle
- ?? Formulate standards for the examination of mechanical, look and other specifications
- ?? Decide upon the examination procedures and examination subjects for drivers
- ?? Other actions related to the transport management strengthening.

Transport Management Committee (Section 154)

To ensure the systematic running of the public transport in every region/area, a transport management committee is formed, comprising of the following representatives:

- Chief District Officer (having office of department)- chairman
- Chief, District Police Office- member
- One representative of transport entrepreneurs- member
- One representative of transport labors- member
- Chief, Office of Transport Management- member secretary

This committee only has the supportive role. This committee only looks whether the public transport vehicles have all the required permits or not, whether they are providing the required service or not and can recommend department for necessary action. Regarding the route permits, this committee can only recommend to the department.

Appointment of a Transport Inspector

Government can appoint the transport inspector to monitor whether the public transport vehicles are complying with all the prescribed requirements as per the act. The responsibilities include to check the roadworthiness conditions including emission standard, seating capacity, having the certificates or not, check on speed limits etc

Permission Required to have Testing Center, Auto-Industry and Workshop

Prior to establish the training center for driving, automobile manufacturing industry or assembling industry, workshop, it is required to take the permission of the department. It is significantly important to develop criteria for having standard workshops and monitor them.

Transport Service on Competitive Basis

There is a restriction on running transport service on rotation basis (syndicate system not allowed). However, for public comfort, it can be done with permission from transport management committee.

Rule 4 of the regulation has made provisions for registration fees of the vehicles as under:

Vehicle Registration Fees

Vehicle Classification	Types of vehicle	Registration charge
Heavy Vehicle	Private	600
Medum Vehilce	Private	400
Light Vehicle (car/jeep/pickup/ Tempo/ power trailer	Private	300
Motorcylce/Scooter etc.	Private	300
Heavy Vehicle	Public	1200
Medum Vehilce	Public	800
Light Vehicle (car/jeep/pickup/ Tempo/ power trailer	Public	600
Motorcylce/Scooter etc.	Public	200

Note: For Tourist and corporation vehilce registration charge will be as per public vehicles

Rule 8 of the Regulation has made provisions of registration renewal charges as under:

SN	Vehicle Classification	Types of vehicle	Registration Renewal Charge
1.	Heavy Vehicle	Private	150
2.	Medum Vehilce	Private	100
3.	Light Vehicle (car/jeep/pickup/ Tempo/ power trailer	Private	75
4.	Motorcylce/Scooter etc.	Private	25
5.	Heavy Vehicle	Public	300
6.	Medum Vehilce	Public	200
7.	Light Vehicle (car/jeep/pickup/ Tempo/ power trailer	Public	150
8.	Motorcylce/Scooter etc.	Public	50

Note: For Tourist and corporation vehilce registration charge will be as per public vehicles

Rule 15 of Regulation has classified the Public Transport Vehicle as under:

1. Bus - Between 26 to 56 seat including driver
2. Mini - Bus - Between 15 to 25 seat including driver
3. Jeep/ Van/ Pickup/ Micro-bus - Maximum 14 seat including driver
4. Car Taxi - Maximum 5 seat including driver
5. Tempo - maximum 12 seat including driver
6. Motorcycle/ Scooter - maximum 2 seat including driver

Rule 30 and 34 of the Regulation has made a provision of fees for route permits and renewal fees of the route permits to the public transport as under:

- ?? Heavy and medium Bus and Mini Bus - 1500.00 for four months
- ?? Light Vehicles - 200 for four months

Rule 39 of the Regulation has made provisions for fees for exam pass of the vehicles as under:

- ?? Heavy vehicle - 50.00 every 6 months
- ?? Medium vehicle - 30.00 every 6 month
- ?? Light vehicle - 20.00 every six months

Vehicle Emission Standards for Green Stickers

Since October 23, 2000

Petrol operated vehicles

S.No.	Types of vehicles	CO% by volume	HC (ppm)
1	Four Wheelers 1980 or older	4.5	1000
2	Four Wheelers 1981 onwards	3	1000
3	Two-wheelers (two-stroke)	4.5	7800
4	Two-wheelers (four-stroke)	4.5	7800
5	Three-wheelers	4.5	7800

Gas Operated vehicles

S.No.	Types of vehicles	CO% by volume	HC (ppm)
1	Four-wheelers vehicles	3	1000
2	Three wheelers vehicles	3	7800

Diesel Operated Vehicles

S.N.	Types of vehicles	HSU
1	Older than 1994 A.D	75
2	1995 A.D onwards	65

Source: MOPE

3. Review of Industrial Enterprises Act 2049

The manufacturing industries dealing with energy efficiency and conservation, and pollution abatement have been declared 'nationally prioritized' industries. EV manufacturing as a rule comes under the priority industries. According to Industrial Enterprises Act, 2049 BS, Article 15 (e), EV manufacturing industries are entitled up to 50% discount from taxable income for a period of 7 years beginning from the date of production. Moreover, sub-article (j) has made a provision for additional benefit to the prioritized industries. It states that if a prioritized industry diversifies itself through reinvestment on the same industry, or expands the installed capacity by 25 % or more, modernizes its technology, or develops any aspect of the industry as ancillary industry, it shall be entitled to 40% deduction of the cost of the new additional fixed asset from its taxable income.

4. Review of Local Governance Act 2055

This act provides more autonomy to District Development Committees, Municipalities and Village Development Committees. Section 25 of the Act provides the functions, rights and duties of the local governments including environmental protection. The term environmental protection is broadly used which can also be used for the restriction of polluting vehicles in the context of environmental protection.

5. Review of Financial Acts

In order to evaluate the economic incentives provided through the financial acts in the promotion of clean vehicles in Nepal, the financial acts from 2051/52 to the recent one 2059/2060 are reviewed.

Section 23 of the Finance Act 2051 (1994) has established precedent for granting income tax deductions for expenditures to reduce air pollution. It states that "In case any industry installs any pollution control system certified by technicians, it may deduct the expense in equal installments in two years with the approval of the Department of Industry". This provision is applicable to conversion of diesel engine into an electric engine. These provisions provide economic incentives and attract the private sector to come forward and invest on EV industries.

As Nepal is primarily a vehicle importing country and vehicles being the major source of revenue generation for the country, the incentives are provided in terms of customs, sales taxes/VAT, waive in special taxes, waive in local taxes, reduced rate on vehicle taxes.

Financial Act 2053

Special Provision on Electrical, Gas or Battery Operated Three Wheelers: These vehicles all are categorized as Safa Tempo.

- ?? Only 1% custom 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 than the tempo, the custom will be 5% and no sales tax on the import of chassis or chassis with engine, motor, accumulator, battery, battery charger and other parts (imported by industries to manufacture)
- ?? Whole Vehicles (transport and goods) powered by only electricity, battery and gas : the custom is only 10% and on sales tax

- ?? Tempos (petrol and diesel) registered in Transport Management Offices, if wanted to convert to battery, the owners are allowed to import equipments only on 1% custom and no sales tax.
- ?? This act also introduces the pollution tax of 50 paise on a liter of petrol and diesel to be sold in Kathmandu Valley

Financial Act 2054

- ?? Continued the same provisions of Financial Act 2053

Financial Act 2055

- ?? Continued the same provisions of Financial Act 2054

Financial Act 2056

- ?? Continued the same provisions on the import of chassis and parts for the production of tempo, and also the provisions on conversion continued
- ?? In the import of whole vehicle, the facilities continued only for the vehicles operated by only electricity
- ?? Vehicles to be operated by Gas will have only 50% reduction in the custom

Incentives to Replacement of Diesel and Petrol Tempos

- ?? Fiscal Act 2056 introduced special provision for the replacement of diesel and petrol operated vehicles from Kathmandu Valley
- ?? If the owner of the diesel and petrol tempos cancel the registration of such vehicles or transfer registration from Kathmandu Valley to operated in other places and imports public transport vehicles from 10 to 15 seat capacities to be run only in Kathmandu Valley will get 75% custom duty reduction in the import of such vehicles. If such vehicles are of EURO-I standard, then such vehicles will get additional 10% custom reduction. There will be no custom on the import of catalytic converter.

Additional Incentives by MOPE in the Provisions of Financial Act 2056

- ?? Ministry of Population and Environment on 2056-5-14 ban the running of diesel operated tempos in Kathmandu Valley effective by the Ashwin 2056 (cabinet level decision) and provided 99% custom reduction and no VAT on the import of EURO-I petrol only operated minibuses of 10-15 seats.
- ?? The incentives provided by Fiscal Act 2056 remained the same for diesel minibuses.
- ?? MOPE again in 2056-11-8 added that minibuses to be converted to LPG, a very low polluting fuels, will enjoy the 99% custom reduction and no VAT even if they do not comply with EURO-I standard. If the owner had only one diesel tempo, he was allowed to import one, if such owner had more than one diesel tempos then he was allowed to import one for two vehicles.
- ?? MOPE also banned the import of second hand and reconditioned vehicles, two stroke engine vehicles

Financial Act 2057

- ?? Incentives provided to electrical vehicles remained the same
- ?? Incentives to gas operated vehicles were removed in this fiscal act
- ?? Provisions of Nepal Vehicle Mass Emission Standard, 2056 were made compulsory to import vehicles in Nepal
- ?? Ban on import of second hand and reconditioned vehicles and two-stroke engine vehicles continued (special provisions were made to import second hand vehicles by diplomats only)

?? Pollution tax on diesel and petrol to be sold in Kathmandu Valley continued since 2053

Financial Act 2058

- ?? Continued incentives of Fiscal Act 2057
- ?? In the process of implementation of Fiscal Act 2058 on the import of whole vehicles on electricity run only vehicles surfaced in the import of four RIVA cars, Department of Custom questioned that battery operated vehicles does not fall within the provisions of electricity operated only vehicles. DOC asked MOPE for clarification and MOPE took almost six months to clarify the issue- at last defining the battery operated vehicles as electricity operated vehicles
- ?? Because of the ban on the import of second hand vehicles and parts, two chassis imported by Himalayan Light Foundation are still lying in customs. As per the provisions of Fiscal Act, MOPE has been given the authority to recommend on the import of second hand or used equipments and parts.
- ?? Continued pollution tax on petrol and diesel

Financial Act 2059

- ?? Continued the incentives for electric vehicles parts to be imported by manufacturers
- ?? Changed the incentives for whole vehicles import: three wheelers enjoyed the same provisions while other vehicles only enjoyed 33% reduction in the custom
- ?? Provisions of electricity or battery operated vehicles introduced
- ?? Provisions on pollution tax on petrol and diesel fuel continued

The details of taxes on various types of vehicles and incentives provided in this act are summed up in the following table.

Tax and Duties for Public Transports in Fiscal Act 2059

Particulars	Bus	Mini Bus	Car/Jeep/Van	Mini/Mico	Tempo	Tempo	Evs 3 wheeler	Evs other
	Petrol/diesel	Petrol/diesel	Petrol/diesel	LPG	Petrol	LPG	Battery	Battery
Custom Duty	25%	40%	130%	80%	80%	80%	10%	less 33%
<i>Spare parts engine and chesis</i>	25%	40%	130%	80%	80%	80%	1%	5%
<i>Body parts</i>	15%	15%	15%	15%	15%	15%	1%	5%
Special Duty	3%	10%	10%	10%	10%	10%		3%
Local Development Tax	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	0%	1.50%
VAT*	10%	10%	10%	10%	10%	10%	0%	0%
Yearly income Tax	1500	1500	1200	1200	850	850	850	850
Yearly Vehicle Tax	11500/12700	7400/8700	3400/4700	3400/4700	1600	1600	Exmpted	Exempted
Pollution Tax	Additional 10% for each year for vehicle older than 15 years						x	x
Registration	1200	800		600	600	600	600	600
Yearly Registration Renewal	300	200		150	150	150	150	150
Registration in Municipality	500	300		200	200	200	200	200
Yearly Registration Renewal in Municipality	500	300		200	200	200	200	200
Vehicular inspection fee paid every six month	100	60		40	40	40	40	40
Road permit paid every four months	290	290		200	200	200	200	200
Insurance**	1% vehicle cost	1% vehicle cost		1% vehicle cost				

* VAT is applied after adding custom, special duty and local development tax

** insurance of the passenger @ 100/person depending upon the seat

Annex – 5: List of People Contacted

1. Mr..Ashok Pandey, EVAN
2. Mr. Lal Bahadur Ghising , Chairman, EVAN
3. Mr. Sarad Adhikari, Under Secretary, DOTM
4. Mr. Bhusan Tuladhar, Executive Director, Clean Energy Nepal
5. Mr. Man Bahadur Gurung, Vehicle owner (Diesel Micro Buses)
6. Mr. Surendra Tandukar –Vehicle Owner (Petrol tempos)
7. Mr. Sagar Aryal- Vehicle Owner (LPG Micro Buses)
8. Mr. Bikash Pandey - Winrock
9. Mr. Ratna Sansar Shrestha - Winrock
10. Mr. Bibek Chapagain - KEVA/Winrock
11. Mr. Chiranjibi Gautam - ESPS/MOPE
12. Mr. Nara Bahadur K.C. - LPG tempo owner
13. Mr. Shanta Ram Pokhrel, DOTM