INSTITUTIONAL RESPONSES TO ELECTRIC VEHICLE PROMOTION IN NEPAL

Anil Baral, Ramesh Parajuli and Bimal Aryal

Introduction

Nepal has witnessed an encouraging growth of electric tempos in recent years. The Electric Vehicle (EV) industry which once was looked upon as a risky adventure has now established itself as a relatively strong and commercially-profitable industry. The proliferation of EVs has received wide attention from the international community. EVs which are unable to compete with conventional modes of transport in other parts of the world are doing well in Kathmandu. Though EVs were first introduced in Nepal in the 1970s when the trolley bus operation was started in Kathmandu with Chinese help, the real growth and diversification of EVs did not take place till 1993. In that year, under the Electric Transportation Program, the Global Resources Institute (GRI), with support from the United States Agency of International Development (USAID) introduced three-wheeler electric tempos in Nepal. There were two main reasons behind that initiative: to improve the deteriorating air quality of the Kathmandu valley (GRI n.d.) and to develop EVs as a profitable industry in Nepal (Baral *et al*. 1999:1). Improvement of the air quality of Kathmandu had become a necessity even by the early 1990s. At the same time, industries that used hydro-power, in which Nepal is said be to "rich", were also necessary for the country's development. Since 1993, the EV industry in Nepal has grown with about 600 vehicles plying the roads of Kathmandu by the end of May 2000. Different institutions—private, governmental, non-governmental (local and international)—have contributed to this growth in various ways. Challenges facing the industry—in the legislative, policy, infrastructure and technical fronts —have been overcome with varying degrees of success through the efforts of these institutions.

This paper describes the history of the growth of the EV industry in Nepal, and its current status, highlighting in particular the role of various participating institutions.[1] Drawing largely from information gathered

1 Though the term EV literally refers to all types of vehicles run by electric power, in this paper we refer to only the three-wheeler (or "tempo") electric tempo.

Studies in Nepali History and Society 5(1): 89-125 June 2000

during our participation in a EV research and advocacy project since November 1998, we argue that the involvement of the private sector, support from donor agencies and the advocacy work of non-governmental organizations (NGOs) have been crucial for the development of the EV industry in Nepal. We also indicate how the growth can be sustained. We argue that the nature of institutional arrangements rather than technological breakthroughs will determine the future of the EV industry in Nepal.

Growth of the Electrical Vehicle Industry in Nepal

The 1993 initiative of the GRI proposed to convert all diesel- or petrol-powered tempos into battery-powered electric tempos (Sherchan 1997).[2] The GRI began its project by converting eight diesel-run Vikram tempos into electric Safa tempos.[3] They were put into operation as part of a pilot project on evaluating the performance of EV operation in Nepal (Moulton and Cohen 1998). At the end of the GRI pilot project in early 1996, a group of Nepali professionals bought seven of the converted electric tempos (Baral *et al.* 1999:1). They soon developed expertise in EV production and started manufacturing electric tempos on their own. Starting from Nepal Electric Vehicle Industry (NEVI) in 1996, the number of EV manufacturers has increased to five.[4]

The period 1996-7 was a lag phase (see figure 1) as the manufacturers were still consolidating their knowledge in the operation of the GRI prototypes and their own prototype vehicles. Additionally, the technology was new to the public and there was not much of a demand for EVs. Besides, there were no mechanics or workshops to provide services to EVs (Moulton and Cohen 1998). The fares of EVs were also higher than those

---

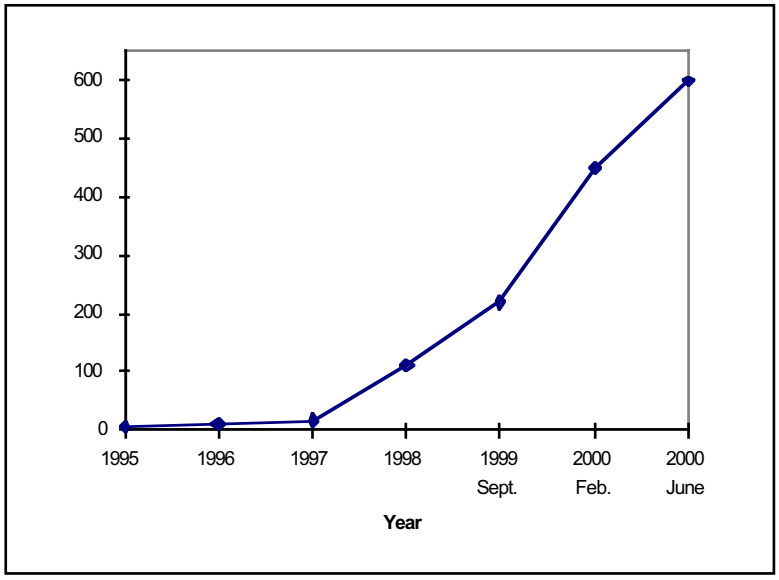
2 Before 1993 some efforts had already been made by a group of Nepali Engineers to run electric-powered vehicles in Nepal. Following India's transit embargo in 1989, this group of engineers, the Electric Vehicle Development Group, came up with this idea (Joshi 1999). The Group converted a Volkswagen into a battery-operated EV in 1992. This information was obtained from Girish Kharel, a member of the Group.

3 Since EVs do not emit any harmful air pollutants and are cleaner than gasoline vehicles, electric tempos were named Safa tempos. *Safa* in Nepali means "clean".

4 The five companies are: Nepal Electric Vehicle Industry (NEVI), Electric Vehicle Company (Pvt.) Ltd (EVCO), Green Valley Electro Mobile Pvt. Ltd, Green Electric Vehicle Pvt. Ltd, (GREV), and Bagmati Electric Vehicle Company. See below for details about the role of the private sector in the growth of EVs in Nepal.

of diesel Vikram tempos. The turning point came in 1998 when the number of manufacturers increased as did their production capacity. Contributing to this growth were rising awareness of the public on air pollution in Kathmandu and the benefits of using EVs, the reasonable price of EVs due to cheap labour costs and the economic incentives and infrastructural support from the government, and to some extent, the Danish International Development Agency (DANIDA). In 1999, concerted efforts from all quarters to banish diesel tempos from Kathmandu and to promote less polluting vehicles, i.e., EVs and Tuk-Tuks[5] through various financial schemes had their impact in the EV industry. At the end of 1999 industry leaders NEVI and EVCO were each manufacturing more than 20 EVs per month.

Figure 1
Year-wise Growth of EVs in Nepal



With the ban on diesel-powered tempos in effect from mid-September 1999, there was a sharp rise in demand for EVs. Within nine months after the ban, an additional 350 EVs entered the market, taking the total

5 In Nepal, Tuk-Tuks refer to three-wheelers powered by Liquefied Petroleum Gas (LPG). These Tuk-Tuks use LPG gas which is used for household cooking purpose. No separate gas stations for Tuk-Tuks are available in Nepal.

number to about 600. The demand has increased partly due to the shortage of vehicles in the valley but mostly due to the confidence of entrepreneurs in EVs. This confidence has come from the proven credibility of the EV manufacturers and, barring a few exceptions, the commercial success of the EV operations. After May 2000 the increasing trend of Safa tempos has slowed down. The decline in demand for Safa tempos is due to an excess number of Safa tempos in major routes in the valley, slow expansion of new routes for Safa tempos and limited efforts to expand the EV market outside Kathmandu valley. The major reasons however are the fear of stiff competition from microbuses, which are being imported into Nepal as substitutes for displaced diesel Vikram tempos and the government's decision to put a temporary ban on the registration of Safa tempos in June 2000.[6]

At the end of June 2000, the EV industry in Nepal can no longer be considered small both in terms of investment and the number of people employed in it. About 600 vehicles were already in the market by the end of June 2000. At the current figure, the investment for 600 electric tempos stands at over NRs 30 crore. There are 38 charging stations located in different parts of the Kathmandu valley that have been established at the cost of approximately NRs 3.8 crore. Therefore, the total investment in 600 electric vehicles and charging stations amounts to about NRs 34 crore.

In addition to direct economic benefits accrued from EV production and charging stations, there are a number of other benefits such as employment generation and cross-sectoral advantages. Employment generation itself is significant. The total number of jobs created in manufacturing, battery charging stations, charger manufacturing and installations and EV operation is about 750. The manufacturing sector employs 70 people (technical and labour), battery-charging stations provide 150 technical and labour-related jobs, and charging manufacturing and installations uses 25 people. About 600 jobs for drivers have been created. Many of the jobs in the EV industry are skilled ones. This employment figure will increase as more EVs are brought into the market.[7]

---

6 The government later revoked the temporary ban after intense pressure from environmentalists, NGOs and donor agencies.

7 This data is taken from a presentation by Bikash Pandey at an interaction programme entitled "EVs in the Next Millennium and the Experience of EVs in Nepal" on 8 December 1999 in Kathmandu.

Benefits are not only confined to the EV sector. For example, EV manufacturing encourages economic benefits and jobs in charger and transformer manufacturing and electricity generation. Since EVs are environmentally-friendly vehicles, their promotion results in air pollution reduction and is a potential boost to the tourism industry. A batch of 30 electric vehicles needs a 40-kVA power supply and generates NRs 800,000 in electricity annual revenue for Nepal Electricity Authority (NEA). This means that from 600 EVs, the annual revenue to NEA would be NRs 1.6 crore. Since most of the charging is carried out during off-peak hours, it will improve the load factor of the system and reduces wastage (Joshi 1999).

The expansion of the EV industry may lead to the establishment of a battery recycling and manufacturing plant as used lead acid batteries need to be recycled to ensure that the benefits of zero-emission are not counteracted by health hazards from improper disposal of such batteries. Diesel Vikram tempo owners tried to counter EVs by pointing out that the lead from batteries used in EVs is far worse than the smoke from diesel Vikram tempos (Jana Ekta 1999). Nepal has a few and crude battery recycling plants which could upgrade their technology and capacity with a rise in the volume of used lead acid batteries. A study carried out by DANIDA (1998) indicates the willingness of some existing battery manufacturing companies in Nepal to establish a recycling plant for lead. The possibilities of job creation and economic opportunities from battery recycling and manufacturing will enhance the existing contribution of the EV industry to the Nepali economy.

Electric Vehicles and the Environment

As mentioned, the deteriorating air quality of the Kathmandu valley was one of the main factors behind the GRI's EV pilot project. The various EV stakeholders, NGOs, and international organizations have repeatedly used the statistics presented below for advocating non-polluting modes of transport.

With rapid urbanisation and increasing population, the air quality of Kathmandu valley has worsened over the last decade. It is attributed largely to the rising numbers of vehicles plying the streets of Kathmandu and to a smaller extent bad road conditions and industries (Devkota 1992). The vehicular growth is increasing at an alarming rate of 15 per cent per year (Rajbahak and Joshi 1993).

A study carried out in 13 spots in Kathmandu in 1998 by LEADERS Nepal, found that the suspended particulate matter (SPM) ($PM_{7.07}$) value

ranged from minimum 87.9 g/m3 to maximum 541.1 g/m^3 with a weighted average value of 246.05 g/m3 in the month of June (LEADERS Nepal 1999). In 1993, Karmacharya and Shrestha found that in eleven highly pollution-prone areas owing to high traffic activity, the total suspended particulate matter concentrations were exceptionally high (789-2258 g/m^3) as compared to the World Health Organization (WHO) guidelines for particulate matter (120 g/m^3) (quoted in Rawal 1997). In addition, potential air pollutants like NOx (oxides of nitrogen), SOx (oxides of sulphur), Pb (lead), CO (carbon monoxide) were above those given in the WHO guidelines in some of these stations. Air pollution is also aggravated by the rampant use of leaded, substandard and adulterated fuel, narrow streets, poor traffic management, the practice of importing old vehicles and generally poor vehicular maintenance (Rajbahak and Joshi 1993). Furthermore, the topography of the valley with its flat basin and surrounding high mountains creates a stable and stagnating pool of polluted air preventing diffusion beyond the surrounding hills. Temperature inversion over bowl-shaped Kathmandu valley worsens atmospheric pollution caused by dust, vehicular and industrial emissions. As a result Kathmandu City has been marked as one of the most polluted cities of the world in rank with others like Bangkok, Jakarta, and Mexico City. An estimate by Reuters news agency in 1995 showed the total emissions from Kathmandu valley to be 63,000 tons per year consisting of about 56,000 tons of carbon monoxide, 5000 tons of nitrogen oxides, 1000 tons of hydrocarbons and 840 tons of sulphur dioxide (Adhikari 1998). In the past eight years, the average traffic speed has been reduced from 25 km/hr to 7 km/hr which suggests that the vehicles now emit more than three times more pollution load than they did five years ago (Poudel 1998).

Cities like Nepalgunj and Biratnagar are no better. Out of seven stations in Biratnagar where LEADERS Nepal (LEADERS Nepal 1999:79) carried out suspended particulate matter ($PM_{7.07}$) measurements, not a single station could met WHO's SPM guideline values. In Nepalgunj, the results of air quality monitoring conducted in two consecutive dry seasons (1998 and 1999) demonstrated high SPM concentrations. Unlike in the Kathmandu valley, however, industries rather than vehicles are responsible for the higher concentrations of SPMs in Nepalgunj and Biratnagar (LEADERS Nepal 1999:79).

Though, the health hazards of various air pollutants have not been well-documented in Nepal, it can be inferred that such high levels of suspended particulate matter adversely affect the health of the population.

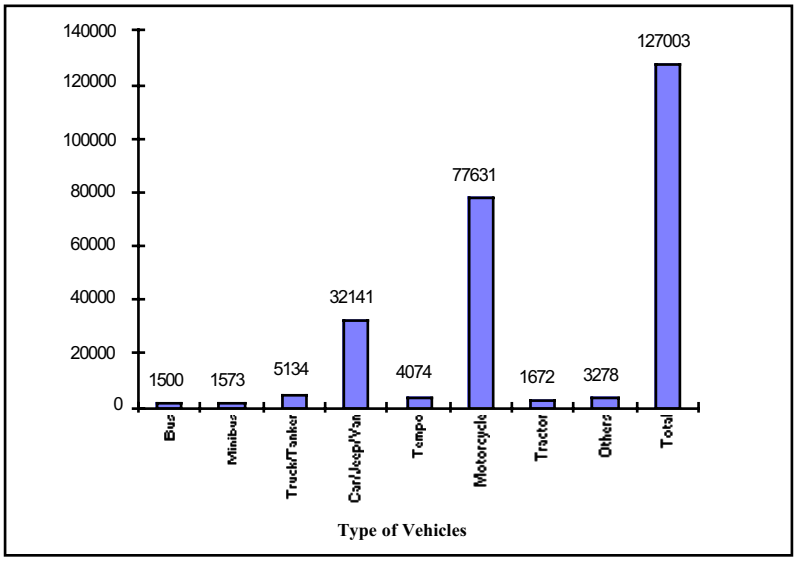
The effect is severe on older people and children. According to one estimate, air pollution in Kathmandu is causing approximately 394 cases of chronic bronchitis, 3,771 cases of bronchitis in children and 14,675 cases of asthma per year (Poudel 1998). Besides health problems, economic costs associated with air pollution are reflected in reduced productivity, degradation of physical capital and infrastructure, decline in tourist attraction and reduced foreign investors leading finally to retarded economic growth. According to one estimate, an increase in emission load due to traffic by 10 per cent would bring about health damages to the tune of US$ 75,000 while a reduction by a similar percentage would reduce the cost by US$ 44,000 (Arya 1996). To avoid these health and economic costs, it is imperative to devise and implement air pollution control strategies including the promotion of non-polluting modes of transport such as EVs.

EVs have a number of environmental benefits. First, EVs are zero emission vehicles. They do not emit any harmful air pollutants in the ambient air. Replacing the fuel-based vehicles by EVs would reduce the air pollution and improve the air quality. The benefits accrued from reduction in air pollution are the decrease in the incidence of air pollution-related diseases and hazards. This in turn will help the economy by improving productivity. EVs generate less noise as compared to diesel or petrol engines as they do not have internal combustion (IC) engines.

Even though no credible study has been carried out to substantiate that the air quality has improved after the banning of 640 diesel tempos in the Kathmandu valley, one can still feel the difference. The air looks relatively cleaner during the daytime in major traffic intersections. Since 640 diesel powered tempos constituted less than 1 per cent of the total vehicles in Kathmandu valley[8] (in comparison with the total 127,003 vehicles as given in figure 2), most of which are old and polluting, it would be naïve to think that the replacement of diesel tempos themselves would bring a substantial difference to the air quality situation in the valley.

8 Since most of the registered vehicles in Bagmati Zone are running in Kathmandu valley, the figures given in Figure 2 approximately equal the number of vehicles in Kathmandu valley.

Figure 2
Number of Vehicles Registered in Bagmati Zone (until March 1999)



Source: Department of Transport and Management

Before the ban on diesel tempos there were 640 diesel tempos, 710 petrol tempos (both six- and twelve-seater) and about 1,670 meter Bajaj tempos plying the streets of Kathmandu.[9] The total number of tempos excluding electric tempos and Tuk-Tuks in the Kathmandu valley was approximately 3,050, though the number of registered tempos was relatively higher, i.e. 4,074. As shown in Table 1, the average traffic coverage by all tempos in terms of number was approximately 13 per cent (excluding rickshaws and cycles).[10]

---

9 The meter tempo with a carrying capacity of 3 persons is the smallest tempo manufactured by Bajaj Co., India.

10 The figures given in the table 1 are obtained from 10-minute measurements only and therefore do not represent accurate average figures. However, these figures can be used to make approximate comparisons among various types of vehicles. Average traffic coverage refers to the average number of a specific type of vehicle passing through a particular spot at a given time. Even when the number of a particular vehicle is small, owing to high mobility as in the case of tempos, their average traffic coverage can be high.

Table 1
Traffic Volume in Kathmandu (10 minutes counts at various intersections) from 11 AM to 4.15 PM on 21 November 1997*

Sampling points	Motorcycle		Taxi/car/ jeep		Tempo		Truck/ bus/ Minibus		Others		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.
Putalisadak	279		152		45		6		1		483
City bus park	241		158		98		44		0		541
New Road gate	247		136		101		31		4		519
Thamel	95		84		37		2		0		218
Maharajgunj	54		43		8		29		4		138
New bus park	45		54		26		40		5		170
Balaju	162		105		49		50		7		373
Balkhu	91		73		27		61		7		259
Satdobato	79		59		28		49		2		217
Koteshwor	147		110		17		135		7		416
Airport	30		55		2		2		1		90
Chabahil	175		154		84		90		7		510
Total	1645		1183		522		539		45		3934
Average	137.08	41.8	98.6	30.07	43.5	13.3	45	13.7	3.8	1.15	327.8

*Excluding cycles/rickshaws

Source: Adapted from LEADERS Nepal 1998

Since the pollution load is directly proportional to the number and nature of vehicles, it can be safely assumed that the air pollution contribution by diesel tempos was not less than 10 per cent (on the lower side). Moreover, Vikram tempos which ran on diesel constituted one-fourth of the operating fleets of the tempos and were twice as polluting as the petrol ones. So the contribution to air pollution by all tempos can go well above 10 per cent. With this assumption, replacing all tempos by EVs would only reduce pollution by about 10 per cent. This contradicts the claim that "replacing all Vikram tempos by electric tempos could reduce vehicular air pollution by 25 per cent" (Kantipur 1998).

The EVs promotion should focus on developing markets for four-wheeler EVs as well to produce substitutes for existing old and highly-polluting four-wheelers like trucks, buses and minibuses. EVCO has made one four-wheeler (minibus type) with a 20-seater capacity. However, its economic feasibility has not yet been established. In any case, electric taxis may be feasible where travel distance is short and can be covered by a one-time-charge. For private uses too, owning EV cars may be feasible as long as they operate within the Kathmandu valley.

EVs are not pollution-free though they are emission-free. No product becomes environmentally-friendly unless its life-cycle is fully assessed and judged to be safe at every stage from its production to disposal. The EV batteries which chiefly consist of lead may pose threats to the environment if disposed off without proper treatment and management. The lead acid batteries' consumption (for EVs, gasoline vehicles and other applications) in Nepal was estimated to be about 2,000 tons in 1998 and it is likely to increase to around 3,700 tons by 2008 (DANIDA1998). The same report reveals that the amount of batteries to be scrapped was approximately 1,300 tons in 1998 and will increase to 2,200-3,100 tons by 2008.

Battery reuse and disposal can be managed in an environmentally-friendly manner. One way is to extend the life of a battery by employing it in solar power use and in vehicles for start up and lighting. The battery can also be used for emergency lighting systems. Globally, recycling the lead from the battery is common. Nepal does have the small and traditional types of lead recycling plants in Hetaunda and Biratnagar (Baral *et al.* 1999:20). The recycling facilities are very crude and not satisfactory. These local recycling plants need environmental, technical and economical upgrading so that health hazards to labourers and the surrounding environment can be minimized. The collection efficiency rate is reasonable (90-95 per cent) with a total loss of approximately 100 tons of lead per annum in Nepal (DANIDA 1998:5). If the leakage from the existing system of collection is to be improved, complete batteries need to be collected with their acid intact. The constituents should be separated only at the recycling plant. The problem emerges mainly from the uncontrolled disposal of acid from worn-out batteries as well as from lead dust generated by handling and transport of separated batteries (DANIDA 1998:5).

The existing collection system can be expanded to include EV batteries delivered to the lead recycling plants within the country or in India to make sure that the batteries are recycled properly. Taking into account the

willingness of the private sector to invest in battery recycling plants, a rise in the volume of lead acid batteries may lead to the establishment of new recycling plants within the country and thereby create more employment. The false notion that lead acid batteries from EVs are disposed off haphazardly has wide currency in Nepal. Since the resale value of lead acid batteries for EVs is higher than those used in conventional vehicles, it is highly unlikely that owners simply dump them in environmentally dangerous ways. In practice, EV batteries are collected along with batteries of other diesel and petrol vehicles from workshops and households by *kawaris*[11] and sold to retailers.

Institutional Responses to Promotion of Electric Vehicles

Various institutions — private sector, governmental organizations, national and international non-governmental organizations — have responded to the need to protect environment by formulating and enforcing environmental polices, providing incentives to environmentally-friendly vehicles, offering international financial and technical assistance, and lobbying to ban polluting vehicles. Here we described the contribution of these various actors to the growth of the EV industry in Nepal.

Private sector involvement

After the completion of the GRI's Electric Transportation Program, the private sector took initiatives for expanding the EV industry through manufacturing, expanding charging stations, charger manufacturing, and lobbying for electricity tariff concession for charging stations, import duty waiver and VAT exemption, and loading zones (places where EVs stop) for EVs.

While working as members of the research team of the GRI for EV manufacturing and operation, a few Nepali engineers and experts gained technical knowledge of EV manufacturing. This they later shared with other entrepreneurs (Baral *et al.* 1999:4). Since 1996, when the manufacturing of EVs first started, the number of manufacturing industries has grown to five (see table 2). All of these industries are start ups. The first EV industry, i.e., NEVI was established by the efforts of engineers. After some time, entrepreneurs who were once a part of NEVI went out to establish new EV industries. With the exception of EVCO where a few shareholders are from petrol and diesel vehicles businesses, all other companies are owned by entrepreneurs not belonging to the petrol or

11 *Kawārīs* collect used and thrown-away materials for recycling.

diesel vehicles business. The investments required for EV manufacturing industries have come mainly from the EV entrepreneurs themselves and partly as loans from the banks.

The manufacturing of electric tempos is done by assembling imported components of EVs from India and the US. The main body part, chassis, is imported from India, whereas electric components such as batteries, converters, motor controllers, fuel gauges, connector contacts and carbon brushes are imported from the US. Besides, the import of EVs (Bijlee) also began from India.[12]

Table 2
Growth of Manufacturers and Charging Stations

Year	No. of manufacturers*	No. of charging stations
1996	2	2
1997	2	4
1998	4	9
1999	5	15
May 2000	5	38

* It represents the number of manufacturers who have actually manufactured EVs. The number of registered manufactures is, however, higher.

In addition to private sector involvement in manufacturing, entrepreneurs are opening up new charging stations at various routes. They are altogether 38 charging stations in the valley. Some charging stations are run by EV manufacturers themselves, some are by individuals and some by groups consisting of both manufactures and EV operators. The existing charging stations can serve about 16 to 32 EVs per day. But many are running under-capacity as there are more charging stations in relation to the number of Safa tempos.

Before the entry of Nepali manufacturers into EV industry, the government did some exercises to encourage EV manufacturing in Nepal. In July 1996, the government reduced the duty and sales tax to 1 per cent for the chassis and other components of EVs (Moulton and Cohen 1998). Moreover, EV entrepreneurs also lobbied hard to get VAT exemption for

12 Dugar Brothers was the supplier of EVs named 'Bijlee' manufactured by Mahindra and Mahindra Co. India. As of 15 March 2000, there were 16 such Bijlees operating in the Kathmandu valley. Later on due to technical problems, Bijlees could not run and were subsequently withdrawn from the market by the supplier.

EVs on chassis and batteries. The GRI's project held a series of discussions with the government to provide incentives, privileges and regulations for Evs.

Initially, the EV industry was put under the industrial sector and therefore electricity tariffs for charging stations were high. But after the EV manufacturers' insistence[13] who at that time owned both manufacturing companies and charging stations, the government brought the EV industry under the transport sector. As the government had already subsidized electricity tariff for the transport sector when trolley buses began in operation in Nepal, the charging stations managed to get electricity at subsidized rate. Because of subsidized electricity tariff, it has been possible to operate EVs at a competitive fare. The cost per unit of charging is NRs 9.15 for EV operators. One set of batteries consumes around 13-15 units of electricity for one time charging. Depending upon the types of Trojan batteries (T-105 or T-125), a fully-charged set of batteries can drive an EV for 50-60 km (T-105) and 65-70 km (T-125). On an average, the cost of charging one set of batteries comes to around NRs 130. However, for charging stations the tariff per unit of electricity has been subsidized (NRs 4.10). In addition, charging stations pay a demand charge of 76 paise per unit of electricity. So on an average the charging station owner makes a profit of NRs 60-70 per set of batteries. The study carried out by Baral *et al*. (1999) recommends that for a charging station to become financially viable, it should be able to serve at least 16 or more EVs per day.

Related to charging stations, the issue of establishing a battery-leasing system has risen intermittently. The government of Nepal and the Royal Danish embassy had developed a project for EV promotion through the provision of financial assistance for establishing charging stations and battery banks.[14] The EV entrepreneurs were enthusiastic when they heard of such assistance. Though the project succeeded in providing soft loans

---

13 The government provided subsidies for EVs by bringing them under the transport sector at a time when there was a donor pressure to cut the subsidies in electricity. Moulton and Cohen's (1998) study shows that apart from entrepreneurs' pressure, donor agencies' interests might have played some role in the government's decision to grant subsidies to EV industry.

14 Battery banks operate by leasing batteries to EV operators and they have to pay back on a daily instalment basis. The preferable mode of operation is where charging stations assume the role of battery banks so that EV operators can pay the cost of charging and leasing at the same time thereby reducing administrative dealings.

to two entrepreneurs to establish charging stations, the idea of instituting battery banks could not materialize because of technical complications in determining the damage to the life of batteries.

Battery banks are necessary to secure the financial viability of the EV industry. Here the private sector can make a big difference. First, initial investment cost will be reduced from NRs 510,000 to 390,000 as EV customers no longer have to buy two sets of batteries (Baral *et al.* 1999:9). Secondly, leasing the batteries to consumers helps spread the cost and risks of early failure. EV operators have to pay only that amount that covers the daily leasing and charging of batteries. The study by Baral *et al.* (1999) estimated that the operator will have to pay approximately NRs 500 per day for two sets of battery charging and leasing. The battery-leasing programme is not a far-fetched idea. The French government has already conducted a battery-leasing programme with a view to promote EVs in France (Moulton and Cohen 1998). Nepali EV entrepreneurs will find it in their interest to work towards establishing battery banks.

Though the concept of battery banks is innovative, several problems need to be addressed before the private sector's involvement in battery bank can be facilitated. Batteries as sensitive components of EVs require careful handling and maintenance. There were cases where operators had become bankrupt partly due to the ignorance of operators and partly due to the negligence of drivers. Vehicle owners report that even those owners who have taken care of batteries have encountered problems in the successful running of EVs. Battery bank owners should monitor and decide the penalties for any damage to leased batteries. This is not so simple. An insurance system for batteries may work. Additionally, an innovative mechanism to prevent over-discharging has to be developed. Automatic cut-off after battery reaches the allowable discharge limit can be one solution. Because of these difficulties, donor agencies might have been reluctant to provide loans to entrepreneurs to establish battery banks. Therefore, a serious study on battery banks is required before bringing them into practice.

With the expansion of EVs, the EV operators have also extended their routes. EVs are operating in Jamal-Bansbari, Royal Nepal Airlines Corporation (RNAC)-Lagankhel, RNAC-Chabahil-Tinchule and Jorpati, Baluwatar-Mangal Bazaar, and Kalanki-Sundhara. Not all the routes have been chosen on the basis of what is suitable for electric tempos (shorter routes with low speed area). In addition, choice of routes is constrained by the inadequate or virtual absence of charging stations along all the routes and bad road conditions. Apart from establishing adequate number of

charging stations along the various routes, improvements of road conditions should be given a priority. Initially, electric tempo operators had to face the hostility of diesel tempo drivers. Diesel tempo drivers perceived electric tempos as an immediate threat to their business and tried to drive them out of certain routes. The Kathmandu Post (1998) reported that "the drivers of Vikram tempos being unable to face the competition from EVs and commuters' preference towards the cleaner, quieter and environmentally friendly tempos threatened to smash the vehicles if electric tempos continued to ply the Maharajgunj route."

As in the case of other vehicles, smooth operation of EVs requires loading zones (EV stops). In the beginning, EV entrepreneurs had to face difficulties as they had not been provided with adequate loading zones. Later on, the government after strong lobbying from EV entrepreneurs yielded to their request and provided a loading zone for EVs in front of the Royal Nepal Airlines building in Kathmandu. After the expulsion of diesel tempos, a loading zone has been provided at Nagsthan for EVs operating in the Kalanki-Sundhara route. Similarly there are a number of loading zones at Chabahil, Tinchule, Lagankhel, Baluwatar, Balaju, and Mangal Bazaar.

Despite the efforts of EV entrepreneurs and public support in Kathmandu, the EV movement is not expanding as expected. Some of the problems that have appeared during the course of three years of EVs operation are:

1. Operators' inadequate know-how about battery maintenance and difficulty of life-cycle assessment.
2. Relatively long pay-back period due to high initial investment.
3. Inadequate charging stations at convenient locations.
4. Lack of battery leasing system.
5. Inadequate policies and their weak implementation thereby not creating a conducive environment for displacement of polluting vehicles and positive incentives for EVs promotion.
6. Lack of a single and authorized institution to regulate and monitor the EVs promotion and management of air quality.

Role of governmental institutions

Various government institutions have assisted in promoting environmentally-friendly vehicles such as EVs either by devising policies and laws or by providing financial incentives and physical support. The

main efforts of the government to promote EVs directly or indirectly are now described.

Availability of financing for EV manufacturing and owners

Nepal Rastra Bank which is the authorized regulatory and monitoring body of the banking sector in Nepal has included EVs in the priority sector. It has been made mandatory for all the government and joint venture banks to direct at least 12 per cent lending of the total loan portfolio to the projects assigned under the priority sector. This decision has undoubtedly helped to increase the volume of finance for EV- related activities and a number of EV entrepreneurs have benefitted from this programme. Government-owned banks like the Nepal Bank Ltd (NBL), Rastriya Banijya Bank (RBB) and the Agricultural Development Bank (AgDB) are assisting the EV entrepreneurs by providing loans for the purchase of EVs.

RBB until recently was providing 70 per cent of the loan at 14-16 per cent interest for the purchase of one EV per driver on the condition that a blue book[15] was deposited in the bank. Thirty per cent of the total price of an EV has to be paid by entrepreneurs. In addition, the customer had to indicate the routes where the EV would operate and present the EV in evidence before the RBB once a month. Normally under a hire-purchase management,[16] the banks levy an 18 per cent interest on the loan given to the customer. In the latest announcement by the bank in October 1999, the interest rate has been further reduced to 12.5 per cent (Himalaya Times 1999b). Recently, however, RBB has increased loan equity from 30 per cent to 50 per cent citing a growing insecurity in EV operation owing to competition from Tuk-Tuks and the possibility of the introduction of microbuses in Nepal. This may prevent low-income entrepreneurs who cannot provide 50 per cent equity from buying EVs .

If the customer cannot afford 50 per cent of the total price, a 100 per cent loan can be granted only with a collateral. In general, the subsidized interest rate is applicable only to the initial investment not exceeding NRs 2,000,000. The RBB can issue loans to all the EV customers provided they meet its criteria.

For the conversion of a Vikram tempo into an EV, the RBB provided 100 per cent lending at a 15 per cent interest against a collateral. It did not serve any customer since the customers declined to undergo conversion even at 5 per cent interest rate provided under a soft loan programme by

---

15 A blue book is the vehicle ownership certificate issued by the Department of Transport Management.

16 In hire-purchase, a certain portion of the price of an object to be purchased is paid by the individuals/firms/industries and the remaining loan is paid back in instalments that include interest rates.

the Danish International Development Agency (DANIDA). The details of this failure are discussed later.

Similarly, NBL has a programme to provide loans for 100 EVs for the fiscal year 2055-6 BS. Unlike RBB, the NBL grants only 50 per cent of the total loan with the deposit of a blue book. Because of this, no prospective customer has shown an interest in taking a loan from the NBL. The loan policy of AgDB for EVs is the same as that of the RBB, i.e. it charges an interest of 15-16 per cent. The executive board of AgDB in 1998 decided to provide loans to EV customers. It is going to invest on 35 EVs for the fiscal year 2055-56 v.s. (Baral *et al.* 1999:14).

Unlike the above-mentioned banks, finance companies and joint venture banks are not interested in granting loan to EVs customers as they are apprehensive of the financial viability of EVs. Moreover finance companies do not generally invest in the programme for which the loan return period exceeds two years and they charge higher interest rates at 20 per cent as compared to government banks.

No such subsidized loan programme exists so far for the manufacturers. Nepal Arab Bank Ltd and Nepal Bangladesh Bank have granted loans to some EV manufacturers at a 18 per cent interest.

Import duty and VAT concessions

In order to promote EVs in Nepal, the government has adopted certain measures to reduce the cost of production of EVs in order to give them a competitive edge in the market. It has also levied a marginal import duty of 1 per cent on the electric components of EVs as compared to 20 per cent for other electric goods. In addition, the Value Added Tax (VAT) Act 2054 has removed VAT on chassis and the battery, the main components of the EVs. A concession on import duty and VAT is beneficial to both the EV manufacturers and EV customers. The EV entrepreneurs however believe that VAT exemption only for chassis and batteries is a biased policy. They demand that VAT exemptions should also apply for other electronic components such as converters, motor controllers, fuel gauges, connector contacts, carbon brushes, battery accumulators and battery chargers which are costly. These electric components, currently imported to Nepal, are specialized which minimizes the possibility of their misuse. The apprehension of the government that these components could be misused if granted VAT exemptions is unfounded. If VAT is removed from the electronic components, the new price of electric tempos will be reduced by NRs 15,000. In addition, EVs are exempted from the transport vehicles tax which amounts to NRs 2,250 for diesel engines and

NRs. 1,500 for petrol engines per year as mentioned in the Economic Legislation 2055 v.s. (Baral *et al.* 1999:15).

Electricity tariff

The government has granted a subsidy on electricity tariff for charging stations to promote EVs. The normal electricity tariff is NRs 6.90 per unit and the subsidized tariff granted to charging stations is NRs 4.10 per unit. The electricity tariff is the same irrespective of the time of day. The EV owners demand a further discount for charging during the off-peak hours. The logic behind this demand is that electricity during off-peak hours is wasted. The use of electricity during the off-peak hours even at the discounted rate is revenue for the government. If a charging station owner sets up a time meter, the tariff is likely to be reduced slightly for the night-time electricity consumption. To have subsidized night-time tariff, the charging station has to get a line from the 11kV supply and set up its own transformer. Because of the costs associated with transformer installation, charging stations seem reluctant to install transformers and time meters.

Industrial enterprises act

The manufacturing industries dealing with energy efficiency and conservation, and pollution abatement have been declared 'nationally prioritized' industries and, therefore, EV manufacturing comes under the priority industries. According to the Industrial Enterprises Act, 2049 v.s., section 15 (e), EV manufacturing industries are entitled to a reduction of income tax of up to 50 per cent for a period of seven years beginning from the date of production. Moreover, sub-section (j) states that if a prioritized industry diversifies itself through reinvestment on the same industry, or expands the installed capacity by 25 per cent or more, modernizes its technology, or develops any aspect of the industry as an ancillary industry, it shall be entitled to 40 per cent deduction of the cost of the new additional fixed asset from its taxable income.[17]

Section 23 of the Finance Ordinance of 1994 has established a precedent for granting income tax deductions on expenditures that reduce air pollution. It states that, "In case any industry installs any pollution control system certified by technicians, it might deduct the expense in equal instalments in two years with the approval of the Department of Industry" (Baral *et al.* 1999:15). This provision is applicable to

17 Taken from the Industrial Enterprises Act, 2049 v.s. (1992).

conversion of a diesel engine into an electric engine. These provisions provide economic incentives and private sector investments in EV industries.

Transport management act

According to the Transport Management Act (2049 v.s.), the Department of Transport Management (DoTM) can prevent a vehicle from being registered if it fails to comply with emission standards (Baral *et al.* 1999:16). The vehicle might be prohibited from running if it is deemed harmful to human beings. However, no polluting vehicle except the diesel Vikram tempo has been prohibited from registration or operation. If strictly enforced, this Act may go a long way in driving out polluting vehicles from the valley and in paving the way for the promotion of EVs and other less-polluting vehicles.

Air pollution control laws and regulations

Nepal has no direct law for controlling environmental pollution, nor is there a specific and effective government policy to control pollution. However, there are many indirect laws relating to pollution control (Pant 1992). The Sixth Five Year Plan (1982-7) has called for the formulation of legislation to control air pollution. The Seventh Plan (1987-92) stressed the need for drafting national pollution standards. The Kathmandu Valley Development Authority Act 1988, section 20, contains a provision for pollution control but without any legally-enacted standards for monitoring air pollution, the implementation of rules has become rather arbitrary and ineffective (Pant 1992).

The government has instituted crude standards for vehicular emissions in 1994. The emissions standards expressed in terms of smoke and carbon monoxide are 65 HSU (Hatridge Smoke Unit) for diesel and 3 per cent carbon monoxide on petrol-driven vehicles (Arya 1996). It is reported that every two vehicles out of five fail the emission standards set by the DoTM but such non-complying vehicles are running without any hindrance (Poudel 1998). " It is because the transport policy of Kathmandu valley remains heavily influenced by some vested interest groups...from police officials to politicians and bureaucrats, all of them get a share from operators of polluting vehicles in one way or another" (Poudel 1998:16-21).

The Valley Traffic Police and the DoTM have delineated nine restricted areas where only vehicles which have passed the emission tests and carry green sticker are allowed to enter. These areas are King's Way, New Road,

Keshar Mahal-Thamel, Putali Sadak, all three Durbar Squares, Indrachowk-Thahiti, and the international airport.

Table 3
Vehicular Emission Standards

Petrol Engine	4-wheeler	(Up to 1980) 4.5% CO	(From 1981) 3% CO
	3-wheeler	(Up to 1991) 4.5% CO	(From 1992) 3% CO
Diesel Engine		(Up to 1994) 75 HSU (After 1995) 65 HSU	

Source: Traffic Police, Kathmandu

The vehicular standards for different production year and fuel type are given in table 3. The vehicular emission standards vary according to the type of fuel they use (petrol or diesel) and the production year of the vehicles. The year in parentheses represents the vehicle's year of manufacture. All rented vehicles are required to undergo emission tests once in every six months, while private/government or others are required to undergo them once in a year. It is evident from Table 3 that old vehicles are subject to relatively less stringent emission standards in comparison with new vehicles. Since 1995, when vehicular emission standards were introduced, 80,459 vehicles have been tested out of which only 55,099 vehicles have passed the emission standard. More than 25,000 vehicles in the city emit smoke beyond the prescribed limit (Poudel 1998). The traffic police imposes a nominal fine (Rs 25-200) on a polluting vehicle. This fine is not a disincentive. It is common to see the vehicles, which could in no way meet the standards, plying the restricted areas. A study team from Denmark found that traffic police is willing to enforce the emission test but due to the absence of trained personnel and inadequate test-equipment, the monitoring is not satisfactory (Bitsch *et al.* 1999).

The government also succumbs to lobbying from vested interests. In 1998, the Ministry of Population and Environment (MoPE) relaxed vehicular standards by increasing the permissible CO percentage from 3 to 4.5 for old petrol vehicles and 65 HSU to 75 HSU for old diesel vehicles. Needless to add, old vehicles are generally more polluting.

Recently, the MoPE introduced the Nepal Vehicle Mass Emission Standards (2056 v.s.) to tackle urban air pollution (Gorkhapatra 1999b). This standard, which is more or less similar to the Euro I standard as

adopted by European countries, is comprehensive.[18] All vehicles imported after 23 December 1999 must comply with the Nepal Vehicle Mass Emission Standard, 2056 v.s. In addition to this, the ministry has prohibited the sale of the government vehicles older than 20 years, allowing only those government-owned vehicles to run in the valley that meet the vehicular emission standards, providing quality fuels which meet the specifications of reference fuel used in Europe, providing unleaded petrol from 1 April 2000, establishing mobile laboratories to monitor the emissions of vehicles, and tightening the existing vehicular emission standards through incorporation of parameters like SOx and NOx.

Though the decision to impose the Nepal Vehicle Mass Emission Standard is a welcome step, it has failed to act on the MoPE's commitment to stick to its earlier pledges on certain points. Point ten of the notice allows the import and registration of Euro I two-stroke motorcycles[19] in all areas of Nepal except Kathmandu, Pokhara and Lumbini. Two-stroke motorcycles cannot meet Euro I standards, therefore, the provision allowing registration of Euro I two-stroke motorcycles is mystifying. If two stroke-motorcycles meet Euro I standards, then why are they prohibited in Kathmandu, Pokhara and Lumbini? Considering the inability to administer Euro I standards across Nepal, this provision leaves ample scope for dumping two-stroke motorcycles from India.[20] Similarly, point 22 of the notice is equally problematic. While it allows 99 per cent import duty waiver and VAT exemption for displaced diesel tempos owner to import petrol microbuses on the condition that they be later converted into compressed natural gas (CNG), liquefied petroleum gas (LPG), or liquefied natural gas (LNG) engine, it does not set the time frame and modalities for conversion. Also, the point 22 is silent on the conversion of petrol engines into EVs which gives the impression that the government is overlooking the EV industry.

---

18 Euro I is one of a series of standards implemented in the European Union to reduce vehicular emissions. Altogether, there are four standards known as Euro I, Euro II, Euro III, and Euro IV. The Euro I standard specifies allowable vehicle emission levels on active condition according to the vehicle type and weight. To be eligible for Euro I standard, a vehicle must pass types of tests and show conformity of production as specified by the standard. The European Union has already moved into the Euro II standard for light vehicles. By the year 2005, the European Union will have the Euro IV standard in place.

19 The government has already banned two-stroke motorcycles in Nepal from 30 August 1999.

20 Two-stroke motorcycles are already banned in various cities of India.

The vehicular emission standards in Kathmandu are based on a reductionist approach. They tackle the emission problem at a micro-level, i.e., at the vehicular level by restricting emission from each vehicle. They fail to address the problem at the ambient or macro-level. The problem with vehicular emission standards is that even though all vehicles may comply with the standards, the air pollution load, by virtue of a large number of vehicles at a given place such as during the rush hours, may build up beyond the allowable limit. Since vehicular emission standards cannot control the number of vehicles, the total quantity of emission may go unchecked. Ambient air quality standards need to be set in place in order to tackle air pollution. These standards will help in regulating the nature and number of vehicles introduced. Setting ambient air quality standards assists indirectly the promotion of less-polluting vehicles by discouraging polluting vehicles.

Environmental protection act

Though the Environmental Protection Act 1997 does not directly deal with promotion of EVs in particular, it contains provisions that, if fully enforced, will encourage alternative modes of transport. The Act deals with pollution control, initial environmental evaluation (IEE), and environmental impact assessment (EIA). For example section 7 of the Act dealing with prevention and control of pollution states that a person shall not cause pollution or allow pollution to be caused in a manner which is likely to have significant adverse impact on health or shall not emit, discharge sound, radioactive rays from any machine, industrial enterprise or any other place above the prescribed standards.[21] This provision alone if enforced strictly would drive out old and worn out vehicles and replace them with less polluting vehicles such as EVs.

Role of municipalities

When the resources, expertise and efforts of municipalities of the valley are closely evaluated, the Kathmandu Metropolitan City (KMC) emerges as a key player in air quality management and EV promotion. The other two municipalities viz. Lalitpur Sub Metropolitan City and Bhaktapur municipality have been following KMC's lead. The GRI's Electric Transportation Project was initiated at the request of the then deputy-mayor of Kathmandu Municipality, Navindra Raj Joshi. KMC brought out a work plan in 1999 to make Kathmandu valley free from

21 Taken from Environmental Protection Act, 1997.

polluting vehicles. The work plan envisaged permitting only complying vehicles within the Ring Road beginning from 5 June 2000. To accomplish this target, KMC along with other major stakeholders viz., Department of Transport Management, Ministry of Population and Environment, Traffic Police, and Lalitpur Sub-Metropolitan City reached an agreement of devising and executing a phase-wise removal of polluting vehicles from within the ring road.[22] Despite repeated efforts and lobbying by KMC, the plan could not meet the target. The DoTM kept the process in limbo. Ultimately, this grand scheme had to be substituted by the less effectual scheme of expelling diesel tempos out of Kathmandu valley.

The action plan entailed that first Lainchaur-Maharajgunj route would be made free from polluting vehicles (by early 1999) by enforcing vehicular emission standards followed by Lainchaur-Balaju-Samakhusi (by 5 June 1999), then Tripureshwor-Kalimati-Kalanki-Balkhu and Bafal routes (by October 1999), and finally Ratna Park-Chabahil and Maitighar-Tinkune routes (April 2000). The action plan had aimed to pronounce all the areas within the Ring Road as polluting vehicles restricted area from 5 June 2000. This plan involved a route-wise phasing out of polluting vehicles including diesel Vikram tempos. Driving out diesel tempos was much easier than pursuing a phase-wise removal of polluting vehicles. Had it succeeded, the government would have been spared from the allegation that only diesel tempos were targeted while ignoring the other polluting vehicles. It would have also given entrepreneurs enough time to get into the clean transportation industry and fill the void created by phasing out of polluting vehicles. The shortage after the ban on diesel tempos from the valley inconvenienced commuters. Since under phase-wise removal plan, all vehicles had to meet the vehicular emission requirements set by the government route-by-route, the over-all impact on air quality would have been more pronounced than it is after the expulsion of diesel tempos alone. The government, on other hand would have been spared from taking populist measure of granting VAT and import duty concessions to import Euro I standard at the cost of NRs 50 crore of revenue to the government as a compensation to the owners of displaced diesel tempos (Baral 1999). Critics argue that such incentives to Euro I microbuses were unnecessary when the government was not technically

22 The memorandum of understanding signed by the various government organizations (as mentioned above) and obtained by the authors from KMC clearly stated how a phased-out plan would work and the explicit commitment of signatories to enforce the plan in whatsoever way possible.

competent to deal with Euro I standards and when the country has an indigenous EV industry. By not capitalising on this opportunity to promote EVs, the government missed a rare opportunity to enhance the image gained after banning the diesel tempos.[23]

Although several central-level agencies such as Ministry of Population and Environment, Department of Road, Department of Transport Management, Traffic Police and Nepal Oil Corporation are involved in managing air quality in the valley, the KMC has ample scope to play a major role. KMC's strategy for clean air includes: (1) monitoring air quality, quality of fuel, vehicular emissions at various places in the valley, (2) building linkages between various organizations involved and the general public, (3) advocacy for cleaner vehicles (4) open space and urban forestry management, (5) transport management, and (6) generating public awareness. KMC officials argue that reducing subsidies on diesel will be helpful in discouraging diesel vehicles and in turn help promote environmentally-friendly vehicles but this action is unlikely to happen.

Although KMC first articulated the need of alternative modes of transport in Kathmandu valley, its direct involvement in EVs promotion is not significant. KMC's role in air quality management assumes significance following the enactment of the Decentralization Act as it has rendered more autonomy to local bodies to devise plans and execute them. Despite municipalities' unchallenged authority and rights on paper, KMC has been unable to exercise its full rights. From the KMC's point of view, there is a negative aspect to the Act. Municipalities have been relieved from the responsibility of collecting octroi and road taxes which were sources of revenue for them. Without this source, municipalities face a financial constraint which they strongly resent. The political inclinations of local bodies and their alignments with the centre make for incomplete autonomy. Interventions are common. The KMC, nonetheless, can lobby directly for air quality improvement and indirectly for EV promotion. The KMC holds the right over open spaces within the municipality area. It can make arrangements for parking spaces for EVs by consulting the Department of Transport Management and Traffic police.

---

23 Bikash Pandey, Director, Renewable Energy Program Support Office (REPSO)-Nepal, Winrock International made this argument in an interaction programme on "Euro I and Micro Bus" organized by Martin Chautari on 28 September, 1999 in Kathmandu.

Participation of NGOs in EVs Promotion

Non-governmental Organizations (NGOs) in Nepal have grown at an unprecedented rate in the last ten to fifteen years. However, their involvement in the promotion of environmentally-friendly vehicles directly or indirectly through clean air campaign is recent. From 1992 to 1997, NGOs efforts were restricted to monitoring of air quality and awareness-building against polluting vehicles. The GRI's initiative to introduce electric tempos in the market encouraged NGOs to press for expansion and diversification of environmentally-safe vehicles. In this period some NGOs which have, among others, the objective of promoting environmentally-friendly vehicles came into existence (e.g., Center for Renewable Energy, Alternative Energy Promotion Center, LEADERS Nepal, Center for Social Research and Development under the banner of Martin Chautari).[24]

As the number of EVs and Tuk-Tuks began to increase after 1997, the activities of a number of NGOs intensified in the direction of driving out polluting vehicles and promoting Alternative Fuel Vehicles (AFVs). Most of the NGOs focussed their strategies on expelling diesel-powered Vikram tempos. Notable among them were Abhiyan Group and the Explore Nepal Group. A few NGOs like the Center for Renewable Energy and Alternative Energy Promotion Center concentrated on research and development of renewable energies rather than on public campaigns. Meanwhile, Martin Chautari carried out a public awareness programme against polluting vehicles. It is to be recalled that it was mainly through extensive coverage of news in various print media that the government's decision to allow the registration of new gasoline tempos in Kathmandu could be revoked (The Kathmandu Post 1999b). Had this decision not been reversed, it would have put to rest all hopes of driving polluting vehicles out and keeping Kathmandu valley clean. After revocation of the decision to allow import of gasoline tempos, Martin Chautari along with LEADERS Nepal and the Nepal Forum of Environmental Journalists (NEFEJ) organized a seminar to highlight the controversies surrounding the tempo scandal and future direction of transport system in Kathmandu valley. Explore Nepal and LEADERS Nepal conducted a signature campaign against polluting vehicles and for strong air quality monitoring involving school and college students.

---

24 The authors have been involved in an electric vehicle promotion project conducted by Martin Chautari, as part of a Center for Social Research and Development initiative.

Though the activities launched by various NGOs were scattered and often duplicated, they built up public pressure for the government to execute its polluting vehicle removal plan and resist efforts by Vikram tempos drivers to thwart the ban on diesel tempos. Legal suits against notorious diesel Vikram tempos were filed in the supreme court on behalf of the NGOs like Explore Nepal Group (Gorkhapatra 1999a) and Pro-public. The activists of the Explore Nepal Group and Abhiyan held rallies to boycott diesel tempos. Some activists tried to stop diesel tempos from operating in Dilli Bazaar and Baneshwor routes and the police had to resort to a lathi charge (Mahanagar 1999). This followed similar boycotts in areas like Anamnagar and Kalikasthan (Aajako Samachar Patra 1999 and Himalaya Times 1999a:8). All these intensified efforts finally culminated in the government prohibiting diesel tempos from running in Kathmandu (The Kathmandu Post 1999a:8) and providing a compensation package for displaced diesel tempo owners. The compensation package included 75 per cent (for diesel engines) and 99 per cent (for petrol engines) import duty concessions and VAT exemptions for the import of Euro I standard microbuses. Though the majority of NGOs and KMC demanded a step-wise removal of polluting vehicles including the diesel tempos, this decision was hailed as a good step towards reducing air pollution and promoting environmentally-friendly vehicles.

The ban on diesel tempos was a boon for the EV industry. The demand for electric tempos soared dramatically and within three months of ban, about 105 new EVs have been added to the existing fleet. This was further helped by DANIDA's soft loan programme through the MoPE to 48 entrepreneurs.[25] After the ban, the efforts of NGOs to press for a phase-wise removal of polluting vehicles have diminished and their attention has shifted to information dissemination and promotion of Alternative Fuel Vehicles.

As the number of EVs started to reach around 550, the traffic police office in Kathmandu complained that Safa tempos were creating traffic jams because of their slow speeds. The vehicle dealers who were looking for the right moment to introduce microbuses in the valley began attacking EVs by spreading misinformation about Safa tempo batteries.

---

25 There were more than 1,000 applicants for soft loans. Because of the overwhelming number of applicants, it was not possible to provide loans to all applicants. Therefore, MoPE set certain criteria to select the eligible candidates. A few of those selected could not get loans because they were unable to provide 35 per cent of the total price of electric tempos as down payment.

Subsequently, the Department of Transport Management banned Safa tempos along with other vehicles on the assumption that the number of vehicles was in excess of the carrying capacity of roads within the valley. Nowhere in the world have environmentally friendly public transport systems been banned. This shows the vulnerability of the government to various pressure groups. Fortunately, with awareness campaigns about Safa tempo batteries and their management and intense lobbying from various environmental NGOs, EV manufacturers, and donor agencies, the government was forced to withdraw its decision to ban registration of new Safa tempos in the second week of June 2000.

With varying degrees of resources and skill, NGOs working in the field of air pollution control and EVs promotion have shown that NGOs can reach the sectors not served by other agencies, mobilize local people, resources and build up momentum and pressure towards change, provide low costs solutions, create innovations and facilitate networks of diverse organizations involved in environmental issues.

Role of International Institutions

The involvement of international institutions in the EV sector can be traced to 1993 when the Electric Transportation Program supported by USAID came into existence. The USAID's involvement paved the way for the participation of the private sector. In terms of money involved in EV industry, the contribution of the private sector to the EV industry (approximately NRs 34 crore) has now overtaken that of the USAID and DANIDA combined (approximately NRs 6 crore).

The contribution of foreign aid to development has always been debated. Dixit (1997) has criticized foreign aid for eroding local and national initiatives and making every development effort dependent entirely upon foreign resources. Foreign aid has not helped to improve the living standards of the average Nepali. A part of the problem lies in the fact that more than 80 per cent aid comes in the form of loans. Incompetent Nepali bureaucrats accept conditionalities associated with aid without careful review and judgement (Dixit 1997). Clean Locomotive Entrepreneurs Association Nepal (CLEAN) does not seem to be in favour of international assistance for the promotion of EVs (Baral *et al.* 1999). CLEAN's position is that donors take away whatever money they invest and make us always dependent on them for both money and technical expertise. They state that mobilising the internal resources with the active involvement of the government and EV owners and manufacturers will be effective.

However, this idea is not wholly practical. In resource-scarce Nepal international assistance is needed for projects like the promotion of EVs. Donor agencies can play an important role in technology transfer, research and development activities and in carrying out training programmes in relation to EVs. Since institutions depend on the people, professional expertise (both administrative and technical) is indispensable. International agencies can contribute to a large extent through education and training programmes in AFVs. Rather than donor agencies determining if and how technology is implemented, local stakeholders should be involved in decision-making so that their indigenous knowledge and expertise can be utilized. The history of the failure of Vikram conversion (as discussed later) should be kept in mind. The government needs to streamline the conditionalities of donor agencies keeping in view the interests of labour in an industry or its role in helping industries to tide over the problems created by the conditionalities of donor-funded projects.

Though international assistance has not proved successful on the scale expected, the EV sector is different. Foreign involvement has worked well in areas of upgrading skills and technology transfer. EV promotion, though a small project, has benefited both through technology transfer by USAID through GRI's research and development and by DANIDA'S promotional activities. The EV project was successful because of the establishment of a linkage between international assistance and the private sector whereby resources and expertise could be funnelled directly into the private sector.

In Nepal, USAID and DANIDA have helped the promotion of EVs in various ways. USAID provided the grant to GRI for a feasibility study as well as for the development of the prototypes of EVs. During the course of the GRI project, a handful of diesel tempos were converted into EVs and run successfully. Apart from EV demonstrations, the GRI worked with various government agencies to find incentives and physical support for EVs. As the GRI wanted to make EVs commercially viable, it held discussion with transport associations, chambers of commerce, banks, businesses and potential investment groups (Moulton and Cohen 1998). DANIDA initiated its involvement through Vikram tempo conversions. Initially DANIDA had set a fund of NRs 400 million for the promotion of EVs in 1997. Due to bureaucratic delays and government indifference, the fund was reduced to 25 million. DANIDA targetted the conversion of about 100 Vikram into EVs through soft loan programme in collaboration with the government. For various reasons not a single Vikram tempo could be converted into an EV. The failure of Vikram conversion into electric

tempos demonstrates that any project with international assistance without an understanding of technical, economic and social problems can be a failure.

Several reasons accounted for the conversion failure, the main being the absence of strict legal action to drive out old and highly polluting vehicles including diesel Vikram tempos from the streets of Kathmandu. Financial considerations played their part. Despite the ban on registration of new gasoline three-wheelers, the market price of Vikram tempos did not fall. Vikram tempos were financially better placed than EVs. This prevented the Vikram tempo owners from taking up the burden of loans and eventually getting lesser profits. The cost of conversion was about NRs 2-3 lakhs. The chassis of the Vikram tempo is not as strong as that of the EVs currently in operation. The passenger-carrying capacity of a converted Vikram tempo would not be the same as that of an EV. This meant a further monetary loss in comparison with three-wheeler EVs which can carry up to 11 passengers. The EV at that time demanded about NRs 220 per day for charging two sets of batteries whereas a Vikram tempo could get away with NRs 135 for fuel.

Another aspect concerned the financial security for drivers. Drivers would have to be laid off for a month while the Vikram tempo underwent conversion. Since tempo owners seemed reluctant to pay wages to their drivers in the interim, drivers themselves were against conversion.

After the failure of the Vikram conversion project, DANIDA began to fund EVs directly and to help develop infrastructure for EVs.[26] DANIDA allocated a total of NRs 80 lakhs to establish charging stations. Under this programme, two industries Green Electric Vehicle Ltd. and Green Valley Electro Mobile Company were given loans to install charging stations. Additionally, as mentioned, under the Electric Vehicle Promotion Program, DANIDA provided soft loans at 5 per cent interest to 48 entrepreneurs to buy new EVs. The loans covered 65 per cent of the total investment and the rest was to be borne by the entrepreneurs themselves (Kantipur 1999). Such projects may impede the purchasing trend in EVs as entrepreneurs wait for similar assistance, whether it is forthcoming or not.

DANIDA has also trained workers from different manufacturing companies and drivers on EV battery management. DANIDA has recently

---

26 The electric vehicle promotion project under MoPE posted an advertisement in *The Kathmandu Post*, 25 May 1998 inviting proposals for the establishment of charging stations and battery banks from interested entrepreneurs. This project was supported by DANIDA.

started an ambitious five year environment sector support program (ESPS) to improve the urban environment in Nepal. The programme aims to also promote EVs in Nepal. Its strategies include forming an association of EV stakeholders, instituting an EV fund to support development of improved prototypes (both two- and three-wheelers), initiate and support local production of EV chassis, environmental, technical and economical upgrading of local lead acid recycling plants (DANIDA 1999). Despite these efforts, DANIDA's progress and responses especially in execution of EVs promotion project have been slow.

Lessons Learnt from the Experience of EVs Promotion

It took eight years for the government to prohibit the operation of diesel Vikram tempos in Kathmandu after it stopped registering new diesel Vikram tempos. The introduction of electric tempos and Tuk-Tuks and an intensified "Vikram Out" campaign in the past one year by a number of NGOs like Martin Chautari, Explore Nepal, LEADERS Nepal and Abhiyan Group resulted in ousting Vikram tempos and paving the way for the promotion of EVs. The demand for EVs has more than trebled after the Vikram tempos' expulsion. Constant public pressure of the kind which led to the ban on Vikram tempos and the provision of incentives for EVs is crucial for sustaining change. The government has realized that environmental quality and pollution control (air pollution in particular) are not luxuries meant only for developed countries since even in developing countries deferred pollution control expenditures can accumulate to unmanageable amounts.

The EV industry is now multi-crore and has already provided jobs to about 745 people. This implies that the protection of the environment need not conflict with economic growth. Appropriate urban infrastructure is affordable. The other lesson of Nepal's EVs is that reducing air pollution does not require major technological breakthroughs or expensive equipment.

In developing countries like Nepal, creating demand-driven initiatives for Alternative Fuel Vehicles through grassroots advocacy is important. It is evident that the government alone can not enforce environmentally-friendly policies such as implementing strict emission standards, penalizing polluting vehicles, and providing incentives unless it has been forced into doing so. NGOs play a vital role by mobilizing people and demanding improvements both in terms of policy formulation and implementation.

Gender equality can be furthered by encouraging women to participate as drivers or as owner of vehicles and charging stations. New technology can help redefine gender roles. There are already about fifteen EV women drivers and several others have received driving training from Safa tempo driving institutes. Martin Chautari has been involved in facilitating the involvement of women in EV operation through information dissemination to NGOs working in the field of women empowerment and by assisting the establishment of a new training institute.[27]

The implementation of the Nepal Vehicle Mass Emission Standard, 2056 v.s. will be facilitated by a smooth working relationship between the government (MoPE and other ministries) and NGOs. The NGOs can provide feedback on what types of standards are economically and socially feasible and what measures will result in cleaner air. After the official announcement of the Nepal Vehicle Mass Emission Standard, 2056 v.s., Martin Chautari pointed out the discrepancies in the standard and suggested amendments. NGOs can act as intermediaries between the government and the target group. They can help the EV industry negotiate with government agencies to obtain access to basic infrastructures and services for EVs and other less-polluting vehicles. NGOs can provide technical advice to and help in coordinating small-scale environmental projects to promote cleaner modes of transport.

As discussed, international institutions produced a visible impact by introducing EV technology and demonstrating that low cost EVs are appropriate for Nepal not only to reduce pollution but also as a source of income-generation. The low costs of production encouraged private investment and profit. The international institutions' involvement in EVs promotion has been confined to technology transfer (research, development and training) and financial assistance. The growth of the market has ensured that the EV industry can sustain itself on private sector initiatives. The catalytic role of international assistance to initiate sustainable development projects cannot be denied.

The private sector has had the lead role in the expansion of the EV industry. Though, its involvement in the EV industry has not as much been spurred by its potential to combat pollution as by its seemingly good economic prospects, the private sector is capitalizing on the clean image of electric vehicles. In a country where state-owned transport

27 With the assistance of Martin Chautari, Samuhik Sewa has established a Safa tempo driving training institute . Samuhik Sewa is a cooperative which operates a fleet of 10 Safa tempos.

services are suffering, the private sector involvement in the EV sector indicates that it may emerge as a sustainable industry. The participation of entrepreneurs as manufactures, operators, charging manufacturers is gradually increasing. From all accounts, the EV industry represents a growing industry in Nepal. EV entrepreneurs have created a conducive atmosphere for further investments by urging the government to grant import duty concessions and VAT waivers, concessions on electricity tariffs and loading zones, and by organizing themselves to resist the onslaught of diesel Vikram tempo operators.

Government efforts in EVs promotion still remain fragmented. Different bodies have rules and policies that affect EVs in one way or the other. For example, emission tests are conducted by the Traffic Police, the routes are determined by the DoTM, taxes and import polices for EVs are made by the Ministry of Finance. Legally they should all come under one act. A long-term integrated one-window policy bringing in all the concerned government departments, the manufacturing industry, EV operators, and donor agencies needs to be formulated.

In contrast to state-owned trolley bus service which has become financially bankrupt, electric tempos are potentially a financially-viable private institution. The state-owned trolley bus service has been unable to pay electricity tariffs to the government or salaries to its staff. The Nepal Transport Corporation (NTC) has been operating the trolley bus system ever since its commissioning in 1977. The state-owned trolley bus sector, even after more than two decades of operation, has neither expanded nor is even financially sustainable. Technology-wise the trolley bus is far superior to electric tempos. Due to inefficient management, low efficiency of operation, corruption, inflexible regulations, low fares, leakages and the lack of incentive to collect revenues for the state-owned institution, trolley buses are running into a loss. The NTC has faced a loss of NRs 6.7 million during the fiscal year 2054-55 v.s. "Whereas the operational revenue from trolley bus operation is only NRs 16.87 per km, the operational expenditures are NRs 27.2 per km of vehicle operation"(CEMAT 1999). NTC is surviving on state support and subsidy.

On the other hand, since the EV industry is run by the private sector, entrepreneurs want to sustain it for their own interests through applications of various strategies such as production of EVs at competitive prices, proper care of vehicle and proper battery maintenance, quality service to commuters and good financial management. The long-term sustainability of the EV industry is also in the interest of

environment protection. This shows that the nature of institutional set-up can affect the long-term viability of a technology irrespective of its status. This does not necessarily lead to the conclusion that state-owned systems would not be financially viable. It is possible that with serious management restructuring and financing, the state sector may as well become sustainable.[28]

Future Direction

Barring trolley buses, EVs in Nepal mainly represent electric tempos. Entrepreneurs in Nepal are focussing on three-wheelers rather than on four-wheelers. The reason is these three-wheelers were originally developed to substitute the fossil fuel tempos. Though the battery-run four-wheelers are expensive to build, manufacturers in Nepal should bear in mind that manufacturing electric tempos cannot alone sustain themselves in the future. For example, the demand for electric tempos is sure to dwindle after the demand created after Vikram tempos' expulsion is filled. Attempts must now be made to expand the market for three-wheelers outside the valley. There is scope for introducing EVs in towns like Pokhara[29] and Lumbini where gasoline tempos like Bajaj and Vikram are banned and in towns in the Tarai. Biratnagar already has a few Safa tempos which provide public transport and carry solid waste. Besides, Green Electric Vehicle (Pvt.) Ltd. operates four Safa tempos in the Lumbini area. Some project offices of INGOs/NGOs in these areas can be persuaded to run EVs for transporting people and mail. This will have a demonstration effect and create a market.

Industries should also develop four-wheelers running on alternative fuels. This requires research and development. As in the case of electric tempos which began operating after a few years of research, manufacturers need technical assistance and financial support from international communities. The government can give incentives to four-wheelers and facilitate technology transfer. Here again NGOs can help devise policies favouring four-wheelers, and to create public awareness on the advantages of using such four-wheelers.

---

28 The issue of the sustainability of the state sector, itself an important area of discussion is beyond the scope of this paper.

29 The hotel association of Nepal-Pokhara announced that they did not want to see any kind of three-wheelers (including electric tempos) entering Pokhara as these might create problems like traffic jams (Gorkhapatra 2000).

Kathmandu and other towns in Nepal are unlike many Asian cities where due to rapid urbanization, growing income levels, and constraints imposed by current transport infrastructure on economic growth, large-scale investments for mass-transit systems such as light-rail, metros are urgently required. Neither the economy nor institutional capacity can afford such mass-transit systems at present. The government must be sure that the type of institution governing a particular technology can sustain it. The government's priority should be on promoting and diversifying low-cost, environmentally-friendly transport systems rather than undertaking ambitious mass-transit systems.

The ineffective implementation of environmental laws and regulations is obstructing the promotion of environmentally-friendly vehicles. Human and financial resources for policy implementation, monitoring and enforcement are insufficient. Expenditures on environmental administration are miserably low as compared to those of other developing countries.[30]

There are two ways of reducing pollution from the transport sector. One is to reduce emission per vehicle through a mixed set of instruments including taxes on fuels, polluting vehicles and parking; incentives and regulations affecting polluting vehicles and traffic management. The other is to promote environmentally-friendly vehicles through economic incentives and infrastructure support. Simultaneously implementing both will be the most effective way. In Nepal while the government is, to some extent, favoring the EVs, a simultaneous disincentive for polluting vehicles does not exist.

The use of EVs is likely to swell in Nepal as emission standards become tougher, concern about air quality grows, and as more fleet operators and individuals appreciate the economic, environmental and public-relation advantages of using EVs. Considering the regulatory environment, technological change, resource infusion, and the upgraded priority level, the EVs market represents significant opportunities in Nepal as in other countries. At the same time this market also represents substantial risk, especially in view of the technology requirements, the resource needs and constraints, and the moving target of government regulations (Baral 1999).

---

30 Less than 0.05 per cent of total budget was set aside for the MoPE for the fiscal year 2056-57 v.s. (1999-2000).

Acknowledgements

The research and advocacy project on which this paper is based was done through Martin Chautari with financial support provided by Renewable Energy Program Support Office (REPSO) of Winrock International. We thank Bikash Pandey and Ratna Sansar Shrestha of REPSO, Surendra Raj Devkota, Pratyoush Onta, Rama Parajuli and various other individuals associated with the EV industry in Nepal for the help they have extended us. Substantive editorial comments on earlier drafts of this paper by Mary Des Chene, Bikash Pandey, Pratyoush Onta and Bela Malik have helped us to bring this paper to the present form. However we alone are responsible for any errors.

References

Aajako Samacharpatra. 1999. Kalaṁkisthānmā pani Tempo Rokine. 2 July, p. 2.

Adhikari, A. P. 1998. *Urban Environmental Planning in Nepal: Analysis, Policies and Proposals*. Kathmandu: The World Conservation Union (IUCN).

Arya, R. C. 1996. Air Pollution and Transport. *Environment* 1(1): 33-43.

Baral, A. 1999. After Saying Goodbye to Diesel… *The Kathmandu Post*, 26 September, p. 4.

Baral, A., R. Parajuli, and B. Aryal. 1999. *Bottlenecks in the Proliferation of Electric Vehicles in Nepal*. Report submitted on behalf of Martin Chautari to Renewable Energy Program Support Office-Nepal, Winrock International, Kathmandu.

Bitsch, H., L. Neilsen, and O. S. Johannsen. 1999. Debriefing Note on Data Collecting and Technical Assistance Program for Safa Tempo submitted to Ministry of Foreign Affairs-Nepal/DANIDA.

CEMAT Consultants (P.) Ltd., 1999. Pre-Feasibility Study for Extending Trolley Bus Services within Kathmandu Valley. A Report submitted to Renewable Energy Program Support Office Nepal Winrock International, Kathmandu.

Cohen, M. 1993. An Electric Transportation Program for the Kathmandu Valley: An Environmental Solution. Kathmandu: World Bank URBAIR Conference, 1-3 December.

DANIDA. 1998. *Study on Environmental Impacts of Rechargeable Batteries in Relation to DANIDA Financed Projects on Electric Vehicles and Solar Energy in Nepal*. DANIDA/Ministry of Foreign Affairs, Nepal.

DANIDA. 1999. Debriefing Note submitted in relation to the preparation of "Support to Air Quality Management in Kathmandu Valley Brief Component Description", The Environment Sector Program Support, DANIDA/HMG-Nepal, 26 November.

Devkota, S. R. 1992. Energy Utilization and Air Pollution in Kathmandu Valley, Nepal. MS Thesis, Environmental Engineering Division, Asian Institute of Technology.

Dixit, K. M. 1997. Foreign Aid in Nepal: No Bang for the Buck. *Studies in Nepali History and Society* 2(1): 173-86.

Gorkhapatra. 1999a. Vikram Tempo mā Rok Lagāuna Riṭ Dāyar. 11 May, p. 12.

Gorkhapatra. 1999b. Janasankhyā tathā Vātavaraṇ Mantrālayako Atyanta Jarūrī Sucanā. 26 December, p. 8.

Gorkhapatra. 2000.Tinpāṅgre Tempo ko Birodh.13 February, p. 2.

GRI. n.d. Electric Vehicle Demonstration Project. A Proposal submitted by Global Resources Institute.

Himalaya Times. 1999a. Anāmnagar bāṭa pani Vikram Tempo Lakheṭine, 9 July,
p. 8.

Himalaya Times. 1999b. Praduṣaṇ Mukta Sawārīmā Byājdar Ghaṭāiyeko Sucanā. 7 October, p. 1.

HMG/MoPE. 1998. *State of the Environment, Nepal*. Kathmandu: HMG, Ministry of Environment and Population.

Jana Ekta Weekly. 1999. Tempo ko Bicmā Juhārī. 12 April, p. 1.

Joshi, K. R. 1999. NEVI and Development of EV Industry in Nepal. Paper presented at a talk programme on "Safa Tempo: Clean Transportation for Tourism Promotion," Kathmandu, 23 September.

Kantipur. 1998. Rājdhānīmā Praduṣaṇ Ghaṭauna Sakriya Dātrisaṁsthāharu Sarkārī Byabahār Bāṭa Hatotsāhī. 1 November, p. 2.

Kantipur. 1999. Advertisement by Electric Vehicle Promotion Project (MoPE) regarding soft loans to buy electric tempos. 6 August.

LEADERS Nepal. 1998. *A Citizens Report on Air Pollution in Kathmandu: Children's Health at Risk*. Kathmandu: LEADERS Nepal.

LEADERS Nepal. 1999. C*itizens Report '99: Air Pollution in the Face of Urbanization*. Kathmandu: LEADERS Nepal.

Mahanagar.1999. Vikram Tempo Birodhī Ra Samarthak Bica Ṭhauṭhaumā Jhaḍap. 14 April, p. 1.

Ministry of Industry. 1992. *Industrial Enterprises Act*. Kathmandu: Ministry of Industry.

Ministry of Population and Environment. 1997. *Environment Protection Act, 1997*. Kathmandu: HMG.

Moulton, P., and Marilyn Cohen. 1998. Promoting Electric Vehicles in the Developing World. A paper presented at the International Electric Vehicle Conference, San Jose, Costa Rica.

Pant, A. P. 1992. Pollution Control: National and Transnational. *Proceedings of the International Conference on Environment and Law*, 6-8 March, Kathmandu.

Poudel. K.,1998. Choking under Smoke. *Spotlight* 18(21): 16-21.

Rajbahak, H.L. and K. M. Joshi. 1993. Kathmandu Valley Vehicular Transportation and Emission Problems. Paper presented in Urban Air Quality Management Workshop, 1-2 December, Kathmandu.

Rawal, Deepashree. 1997. Plants, Air Pollution Checking Agent in Kathmandu. *The Kathmandu Post*, 13 July, p. 4.

Sherchan, B. M. 1997. Kathmandu—the Shangri-La for Electric Vehicles! *The Kathmandu Post*, 28 May, p. 4.

The Kathmandu Post. 1998. Vikram Drives Out Safa. 8 May, p. 2.

The Kathmandu Post. 1999a. Ban on Vikram Tempos Flayed. 27 July, p. 8.

The Kathmandu Post. 1999b. Decision on 3-wheeler Revoked. 9 February, p. 1.