

# Business Plan of Tripureshwor Suryabinayak Trolley Bus System



Submitted to  
**Kathmandu Metropolitan City**

Submitted by

Kathmandu Electric  
Vehicle Alliance



(A program of USAID and Alliance Partners)  
**Alliance Partners: PADCO, Winrock International, City and County of San Francisco and  
Electric Drive Transportation Association**

Prepared by KEVA Secretariat under USAID/Nepal  
Cooperative Agreement No: 367-A-00-02-00203-00 with PADCO, Inc;  
Washington, DC

**March 2004**

## Preface

It would have been more than natural for Nepal to be extensively using fossil fuel in every walk of life, including the transport sector, if Nepal was sitting on fossil fuel mines. Unfortunately, that is not the case. On second thought, this is not as unfortunate as it may seem to be, because Nepal is bestowed with huge water resources, which do not cause any pollution, both local and global (in contrast with fossil fuel which is not only hazardous from a health perspective at the local level but has also been identified with causing global warming).

However, it is rather paradoxical that only a small proportion of Nepal's transport modes comprise of zero emission vehicles. This not only puts a strain on Nepal's foreign exchange reserve, but also afflicts adverse impacts on the local populace due to emission of pollutants. In this scenario, the closure in December 2001 of the only trolley bus service in Nepal is indeed a discouraging event. It has recently been reactivated to an extent by operation of a few trolley buses as of 15<sup>th</sup> September 2003 subsequent to handover, in trust, of the extant trolley bus system to Kathmandu Metropolitan City (KMC) and Bhaktapur and Madhyapur Thimi Municipalities under a Memorandum of Understanding (MoU) signed between HMG/N and the municipalities.

As the MoU envisaged operation of the system on a public private partnership basis, it was imperative to rope in the private sector for the purpose. With this in mind and at the request of KMC, on behalf of all three municipalities, this business plan has been prepared with Kathmandu Electric Vehicle Alliance (KEVA) support. KEVA is dedicated to increasing electric transport in Kathmandu valley and is very optimistic by this development. This business plan is of further appeal for KEVA because Winrock International, a KEVA alliance partner, is presently finalizing a pre-feasibility study on operating the trolley bus service on the Ring Road from the perspective of greenhouse gas abatement under the Asian Development Bank funded PREGA (Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement) project.

We earnestly hope that the trolley bus can be operated successfully from Tripureshwor in Kathmandu to Suryabinayak in Bhaktapur as a viable business proposition with financial sustainability under a public private partnership model. This will lead to replication of similar modes of transportation in many other places with associated benefits in terms of reduced pollution and eased strain on Nepal's hard currency reserve.

We thank KMC and its dynamic Mayor for the opportunity to prepare this document and also would like to thank HMG/N as well as the two other municipalities.

**Kathmandu Electric  
Vehicle Alliance**



March 2004

## **List of Abbreviations**

|                  |  |
|------------------|--|
| ADB              | Asian Development Bank   |
| BCR              | Benefit Cost Ratio   |
| CDM              | Clean Development Mechanism  |
| CEMAT            | Civil Electrical Mechanical Architectural and Transport                        |
| CEN              | Clean Energy Nepal   |
| CH <sub>4</sub>  | Methane  |
| COPD             | Chronic Obstructive Pulmonary Disease  |
| CO <sub>2</sub>  | Carbon dioxide   |
| DC               | Direct Current   |
| ENPHO            | Environment and Public Health Organization                                     |
| ESPS             | Environment Sector Programme Support   |
| EV               | Electric Vehicle   |
| FIRR             | Financial Internal Rate of Return  |
| FY               | Fiscal Year  |
| GHG              | Green House Gas  |
| HMG/N            | His Majesty's Government of Nepal  |
| JMB              | Joint Management Board   |
| KEVA             | Kathmandu Electric Vehicle Alliance  |
| KMC              | Kathmandu Metropolitan City  |
| MoU              | Memorandum of Understanding  |
| MoLTM            | Ministry of Labour and Transport Management                                    |
| NEA              | Nepal Electricity Authority  |
| NPV              | Net Present Value  |
| NTC              | Nepal Transport Corporation  |
| N <sub>2</sub> O | Nitrous Oxide  |
| PB P             | Pay Back Period  |
| PM <sub>10</sub> | Particulate Matter less than 10 micron   |
| PMT              | Professional Management Team   |
| PREGA            | Promotion of Renewable Energy, Energy Efficiency and Green House Gas Abatement |
| RCC              | Reinforced Concrete Cement   |
| RoI              | Return on Investment   |
| RoE              | Return on Equity   |
| USD              | United States Dollar   |
| WI               | Winrock International  |

## TABLE OF CONTENTS

|  |     |
|--|-----|
| Preface  | ii  |
| List of Abbreviations  | iii |
| Executive Summary  | 1   |
| 1. Introduction  | 3   |
| 2. Electric Trolley Bus Background                                     | 5   |
| 3. Existing Trolley Bus Infrastructure                                 | 7   |
| 3.1 Infrastructure (Buildings and Civil Structures)                    | 7   |
| 3.2 Traction Substation Equipment                                      | 7   |
| 3.3 Overhead DC power lines and networks                               | 7   |
| 3.4 Trolley buses  | 7   |
| 3.5 Equipment  | 7   |
| 3.6 Human Resources  | 7   |
| 4. Proposed Reactivation Model and Institutional Setup                 | 8   |
| 5. Proposed Business Plan  | 11  |
| 5.1 Scenario with Investment as Equity only                            | 11  |
| 5.1.1 Project Costs  | 11  |
| 5.1.2 Annual Operating Costs   | 12  |
| 5.1.3 Working Capital Requirements                                     | 13  |
| 5.1.4 Pay Back Period  | 14  |
| 5.1.5 Investment Plan  | 14  |
| 5.1.6 Projected Profit and Loss  | 15  |
| 5.1.7 Cash Flow Projection   | 16  |
| 5.1.8 Financial Indicators   | 17  |
| 5.2 Scenario with Investment as Equity and Loan                        | 18  |
| 5.2.1 Project Costs  | 18  |
| 5.2.2 Annual Operating Costs   | 19  |
| 5.2.3 Working Capital Requirements                                     | 20  |
| 5.2.4 Pay Back Period  | 21  |
| 5.2.5 Investment Plan  | 21  |
| 5.2.6 Projected Profit and Loss  | 22  |
| 5.2.7 Cash Flow Projection   | 23  |
| 5.2.8 Financial Indicators   | 24  |
| 6. Alternate Reactivation Model with New Trolley Buses                 | 25  |
| 7. Risk Sensitivity Analysis   | 28  |
| 7.1 Increase in Electricity Tariff                                     | 28  |
| 7.3 Capacity Utilization   | 28  |
| 7.4 Investment Pattern   | 30  |
| 7.5 Trolley Bus rehabilitation costs                                   | 30  |
| 7.6 Purchase of New Buses  | 30  |
| 7.7 Traffic congestion in the proposed route                           | 31  |
| 7.8 Competition with other vehicles                                    | 31  |
| 7.9 Total Rehabilitation Costs   | 32  |
| 7.10 Operating Costs   | 32  |
| 7.11 Revenue Collection  | 33  |
| 7.12 Possibilities of Trading Carbon Offset by Trolley Bus operation   | 33  |
| 8. Recommendations for HMG/N   | 34  |
| 9. Recommended Future Activities                                       | 36  |
| 10. Conclusion   | 37  |
| Annex  | 38  |
| 1. Risk Sensitivity Analysis Details (Equity Investment Scenario)      | 38  |
| 2. Risk Sensitivity Analysis Details (Equity-Loan Investment Scenario) | 41  |

## List of Tables

|  |    |
|--|----|
| Table 1: Annual Royalty  | 9  |
| Table 2: Summary of Financial Analysis*  | 10 |
| Table 3: Total Project Costs * ( <i>Investment as equity only</i> )                                      | 11 |
| Table 4: Annual Operating Costs – Fixed Costs * ( <i>Investment as equity only</i> )                     | 12 |
| Table 5: Annual Operating Costs – Variable Costs * ( <i>Investment as equity only</i> )                  | 13 |
| Table 6: Working Capital Requirements * ( <i>Investment as equity only</i> )                             | 13 |
| Table 7: Pay Back Period * ( <i>Investment as equity only</i> )  | 14 |
| Table 8: Investment Plan * ( <i>Investment as equity only</i> )  | 14 |
| Table 9: Projected Profit and Loss Statement (up to Year 10) * ( <i>Investment as equity only</i> )      | 15 |
| Table 10: Projected Profit and Loss Statement (Year 11 to 20) * ( <i>Investment as equity only</i> )     | 15 |
| Table 11: Cash Flow Projection (up to Year 10) * ( <i>Investment as equity only</i> )                    | 16 |
| Table 12: Cash Flow Projection (Year 11 to 20) * ( <i>Investment as equity only</i> )                    | 16 |
| Table 13: Financial Indicators * ( <i>Investment as equity only</i> )                                    | 17 |
| Table 14 : Total Project Costs * ( <i>Investment as equity and loan</i> )                                | 18 |
| Table 15 : Annual Operating Costs – Fixed Costs * ( <i>Investment as equity and loan</i> )               | 19 |
| Table 16: Annual Operating Costs – Variable Costs * ( <i>Investment as equity and loan</i> )             | 20 |
| Table 17: Working Capital Requirements * ( <i>Investment as equity and loan</i> )                        | 20 |
| Table 18: Pay Back Period * ( <i>Investment as equity and loan</i> )                                     | 21 |
| Table 19: Investment Plan * ( <i>Investment as equity and loan</i> )                                     | 21 |
| Table 20: Projected Profit and Loss Statement (up to Year 10) * ( <i>Investment as equity and loan</i> ) | 22 |
| Table 21: Projected Profit and Loss Statement (Year 11 to 20) * ( <i>Investment as equity and loan</i> ) | 22 |
| Table 22: Cash Flow Projection (up to Year 10) * ( <i>Investment as equity and loan</i> )                | 23 |
| Table 23: Cash Flow Projection (Year 11 to 20) * ( <i>Investment as equity and loan</i> )                | 23 |
| Table 24: Financial Indicators* ( <i>Investment as equity and loan</i> )                                 | 24 |

\*

---

\* The data in these tables are based on Final report study for revival of Kathmandu – Suryabinayak trolley bus system, CEMAT, June 2002. However, some alterations based on updated prices, fares, capacity utilization, etc. have been made which has caused some changes to the original numbers.

## Executive Summary

Since the past decade, registration of vehicles in the valley has been rising at an alarming rate. With fossil fuel burning vehicles accounting for almost half of the total PM<sub>10</sub> emissions today, switching to cleaner transport modes is becoming essential day by day. Trolley buses operating from Tripureshwor to Suryabinayak were the first clean vehicles to serve the valley commuters. However, in December 2001 the trolleybus service was discontinued due to continual losses. The continued losses were due to weak management.

This trolley bus service was reactivated in September 2003 after a MoU was signed between MoLTM and three municipalities (Kathmandu, Bhaktapur and Madhyapur Thimi). According to this MoU, HMG/N will hand over the trolley bus system to the three municipalities, in trust, leading to formation of a Joint Management Board (JMB) to manage and operate the trolley bus services. The MoU also states that the trolley bus services should be operated as a profit center and it (MoU) has the provision to involve the private sector and other municipalities, if necessary, to increase overall effectiveness of the system.

With the view of involving private sector for financially sustainable operation of the trolley bus system, another MoU was signed between KMC and KEVA on 19<sup>th</sup> December 2003 as an effort towards converting the system into a public private partnership venture. KEVA volunteered to compile a business plan for the venture. The business plan endorses formation of a public private partnership entity, which would include the three municipalities and private investors. This entity will formulate an executive board and a professional management team (PMT). The PMT will be assigned with the task to rehabilitate the system and manage & operate the services thereof. The MoU between the government and the municipalities also states that royalty will be paid to the HMG/N by the trolley bus services. The royalty amount will be based on a mutually agreed amount between the entity and the government.

The business plan prepared for this public private partnership venture is fundamentally based on a study commissioned by Winrock International/Nepal in June 2002 and undertaken by CEMAT Ltd. Some changes to the original study figures have been made due to changes in institutional setup, price of new trolley buses, capacity utilization assumptions, market inflation, etc. The projected operational span of the business venture is taken to be 20 years. The business plan has analyzed two different investment scenarios. The first scenario is equity only, where the total project cost is NRs. 40.05 million (NRs. 30.79 million for rehabilitation as fixed capital and NRs. 9.26 million as working capital). The second scenario is equity and loan, where the total project cost is NRs. 40.91 million (NRs. 30.79 million for rehabilitation as fixed capital and NRs. 10.12 million as working capital) and has excluded the depreciation of trolley bus property, as HMG/N will remain its sole owner. Assuming one full year is spent on rehabilitation works, only fixed capital investment is made in year 0 and the investment for working capital is made only in year 1. Twenty-two existing trolley buses have been recommended for the initial operation and two trolley buses recommended to be replaced every year from beginning of year five to the 15<sup>th</sup> year of operation (as the existing buses are antiquated) with new locally assembled trolley buses. The cost of the locally assembled buses is estimated to be NRs. 4.2 million per bus. The depreciation of these buses has been included at the annual rate of 10% from 6<sup>th</sup> year of

operation. Corporate tax is taken to be 21.5% in line with current figures. The service is assumed to operate at 80% (refer to page 22 footnote) of the average number of passenger riding the trolley bus is 1999. At this rate, the annual revenue is estimated at NRs. 45.62 million. For the financial scenario where investment is made as equity only, with annual operating cost calculated to be NRs. 32.19 million the annual gross operating profit will be NRs. 13.43 million. With these figures, for the projected twenty-year span, the analysis projects profit accumulated to be NRs. 148.22 million, cumulative cash flow to be NRs. 135.62 million and retained earnings to be NRs. 148.22 million. The payback period of total investments has been estimated to be 3.80 years. Similarly, with 12% discount rate, the financial analysis estimates Net Present Value (NPV) at the beginning of year 0 to be NRs. 10.38 million, Financial Internal Rate of Return (FIRR) to be 17.67%, Benefit Cost Ratio (BCR) to be 1.23 and return on investment/equity to be 22.02% (calculated with net profit at the end of year one). Similarly, for the financial scenario where investment is made as equity and loan, for the projected twenty-year span, the analysis projects profit accumulated to be NRs. 137.09 million, cumulative cash flow to be NRs. 103.02 million and retained earnings to be NRs. 137.09 million. The payback period of total investments has been estimated to be 7.79 years. Similarly, with 12% discount rate, the financial analysis estimates NPV at the beginning of year 0 to be NRs. 10.92 million, FIRR to be 22.47%, BCR to be 1.60, return on investment to be 17.48% and return on equity to be 36.48%(calculated with net profit at the end of year one).

All these financial indicators present a highly lucrative business venture with excellent returns on investment. It also displays a good opportunity to develop this urban clean transport system into a very profitable public private partnership venture especially in the prevailing highly liquid scenario with additional social values of contribution for better and healthier environment.

One limitation to the trolley bus rehabilitation based reactivation model can be unavailability of off-the-shelf spare parts. As the existing trolley buses are based on very old technologies, there is high chance of the spare parts for such trolley buses not being manufactured at present. This can require custom manufacturing of necessary spare parts which in turn can elevate the investment requirements beyond financial viability.

Alternate model of introducing a fleet of 22 new trolley buses is also seen as viable option to reactivate the trolley bus services if spare parts for the existing trolley buses become unavailable. This model recommends purchase of 4 new trolley buses @ NRs. 5.5 million prior to the commencement of services. The remaining 18 buses will be granted to HMG by the donor country and HMG will lease these 18 trolley buses at an annual rent of 5% of purchase cost of 18 buses (depreciated each year at 10%). The lease rent will be paid up to 6<sup>th</sup> year of operation. It is assumed that the trolley buses will reach its salvage value after 60% depreciation. Under this assumption, the trolley buses will reach salvage value at the end of 6<sup>th</sup> year of operation. So, from the 7<sup>th</sup> year, it is recommended that the remaining 18 buses also be purchased from HMG at salvage value in yearly installment payment basis at 10% discount rate and over the period of 14 years (remaining years of the operational span of 20 years). This alternate model has tried to keep the financial investments and returns of the business very close to the previous reactivation model.

## 1. Introduction

The number of fossil fuel burning vehicles registered in the Kathmandu Valley has increased at an alarming rate in the past ten years. The disproportionate growth in the number of vehicles, rapid urbanization and inadequate road infrastructure has increased vehicular congestion on the roads. This has resulted in minimal driving speed and maximum obstructions, leading to longer commuting time and increased emissions of polluting gases. Numerous studies indicate that the increase in vehicles corresponds with severe air pollution and related health impacts in the Valley. Improper management of traffic flow and haphazard halting of vehicles to collect passengers etc. have also resulted in adding to the road congestion and increasing the time further.

Most modes of public transportation in Kathmandu are fossil fuel based. The buses and minibuses that most passengers commute on use diesel as fuel. After the closure of the trolley bus, there were 840 and 1680 buses and minibuses respectively operating on that particular route alone (at the time of the CEMAT survey). An added problem is that most vehicles in Kathmandu are old and poorly maintained. This, coupled with adulteration of fossil fuels, has resulted in poor vehicular performance and inefficient burning of fuels, thereby aggravating the already dangerous concentration of emissions. Even the vehicle emission testing and controlling system has not been adequately effective in minimizing the problem. As a result, air pollution levels in the urban centers of the valley measured in terms of micro-gram per cubic meter of PM<sub>10</sub> remains above the permissible level for more than 90 percent of days in a year. A study undertaken by MoPE/ESPS indicates that PM<sub>10</sub> emissions from vehicle exhausts have increased by more than four times between 1993 and 2001 and are responsible for 42 percent of the total PM<sub>10</sub> emission in the valley<sup>1</sup>.

This level of atmospheric pollution has triggered off a chain of related problems directly detrimental to valley residents, and ultimately to the Nepali population. The escalating environmental pollution has impacted the health of the valley residents adversely. Hospitals attribute the rising trend of lung related ailments to the valley's air pollution. There has been a corresponding increase of Chronic Obstructive Pulmonary Diseases (COPD) cases along with the increase in local air pollution and GHG emissions. As a result, the productivity of people has decreased and medical expenses have increased.

In addition to the obvious impacts on health, air pollution has other secondary yet significant effects. Acid formation due to high levels of sulphur and nitrous oxides in the air has shown signs of damaging historical heritage sites and artifacts, threatening Nepal's historical heritage, especially in Bhaktapur. Furthermore, air pollution induced lower visibility (mostly during the dry months) of the world renowned Himalayas and threat of pollution related health problems appears to be deterring tourists from visiting Kathmandu, the gateway to Nepal.

Another argument against fossil fuels is that for countless years the government has been draining a huge amount of hard currency in importing polluting fossil fuels for transportation, creating a hole in the national reserves.

---

<sup>1</sup> Health Impacts of Kathmandu's Air Pollution, CEN, ENPHO, September 2003

Needless to say, amalgamation of these various effects of air pollution has collectively contributed to the steady decline of the country's economic status.

Given the right approach, it is possible to reverse this vicious cycle. The rising trend of pollution and its associated problems needs to be addressed at the earliest by addressing the root causes of the problem. Studies indicate that exhaust from fossil fuel based transport systems is the single major contributor of air pollution in Nepal. Therefore, the introduction of clean vehicles to reduce tail pipe emissions possesses immense potential as an effective solution. Moreover, diversification of electric transportation is, without a doubt, the most appropriate means to make maximum use of country's natural resources.

While it is a matter of pride that, after Brazil, Nepal has the second largest hydropower potential in the world, it is a sad reality that not even one percent of the total economically feasible potential has been exploited so far. Even then, the electricity currently generated is spilled during the off peak hours in the dry season and most of the time during the wet season, causing the electricity tariff to increase to compensate for such spillage. Introducing electricity-based vehicles such as electric trolley buses, trains, ropeways, cable cars, battery-operated vehicles, etc. can utilize this spilled electricity to an extent, and as a result, make Kathmandu's air cleaner as well as boost both the national revenue and foreign exchange reserve.

Taking all the advantages offered by clean energy into consideration, the overall locomotive, environmental and economic status of Kathmandu Valley stands to benefit from the shift of public transportation systems from fossil fuel based to electricity based by inducing a positive impact on poverty reduction through employment generation, supporting the tourism sector, promoting environment protection and positive health impact etc.

## 2. Electric Trolley Bus Background

The first electric trolley bus system in Nepal was developed in 1975 with the grant assistance of NRs. 40 million from the Chinese government. From the commencement of the operation till 1989, the passenger traffic was in increasing trend with an annual growth rate of 15 percent. In 1989, the daily volume of passengers traveling by trolley buses was 19,094. In the same year, as high as 88.5 percent share of total passengers traveling by passenger service transport services operating in the route used trolley bus service. The passenger fare varied between NRs. 3 – 4 depending on the distance traveled, making it a cheap, dependable and clean mode of transportation. Nepal Transport Corporation (NTC) was established to operate the system. In 1997, the Chinese government again granted a supplementary fleet of 10 trolley buses with improved technology.

Even though electric trolley buses were a superior mode of transport with minimal adverse environmental impacts, overstaffing at NTC due to political instability/interference, inefficient management, weak revenue collection, improper maintenance of buses, lack of efficient strategies to increase commuters and lack of extension of routes, etc. gradually caused the system to lose efficiency. All of these factors caused the trolley bus services to operate at a financial loss. Over the years, the number of buses operating on the roads and the number of passengers per trip started to decline, while conversely the number of staff continued to increase. The accumulated trolley bus operational losses from Fiscal Year (FY) 1996/97 to FY 2001/02 were NRs. 42,773,242.4<sup>2</sup>. These losses were attributed to low vehicle availability and low revenue generation. The low level of availability was primarily the result of poor maintenance of buses. The low revenue generation was a result of low passenger fares in comparison to the fare of other buses and due to subcontracting of revenue collection to the drivers whereby the drivers remitted NRs. 425 and NRs. 475 respectively per trip for the old and new models of trolley buses (for FY 2053/54 and 2054/55 BS).

Hence, on November 30, 2001 HMG/N officially announced the adjournment of NTC with effect from December 16, 2001. While NTC's continued losses impelled the government to discontinue trolley services as of December 2001, NTC's Janakpur Railway and Truck-Container Service units were not affected and are still operational.

Winrock International, a KEVA alliance partner, supported a pre-feasibility study to explore the possibility of extending trolleybus services within the Kathmandu Valley through CEMAT Consultants in 1999. After the closure of the only trolleybus service in Nepal in December 2001, Winrock again commissioned CEMAT Consultants to conduct a study on the investments needed and the form of management suitable to reactivate and manage the trolleybus system effectively. The government acted on some of the recommendations of that report and from 1st September 2003, subsequent to handover of the trolley bus system jointly to the Kathmandu Metropolitan City (KMC) and Bhaktapur and Madhyapur Thimi Municipalities in trust, trolley services have been reactivated on a small portion of the previous route from Tripureshwor to Koteshwar with minimal maintenance and three buses.

The agreement between the Ministry of Labour and Transport Management and the three municipalities states that the three municipalities will rehabilitate and reactivate the trolley bus system service and operate it as a financially sustainable business

---

<sup>2</sup> Final Report study for revival of Kathmandu-Suryabinayak trolley bus system, CEMAT, June 2002

venture. The agreement also states that the three municipalities can involve the private sector in the operation and management of the Trolley Bus System. Due to the short route currently serviced, these buses haven't yet been able to attract enough passengers to even cover the operational and maintenance expenses in full. Lack of homework before reactivation and insufficient investment to repair damaged infrastructure has obstructed efficient operation of this once very profitable system.

Further revision of the operational strategies and expansion of services to Suryabinayak is anticipated to increase accessibility of a larger number of people to clean transportation and alleviate the overall atmospheric pollution in the valley.

### **3. Existing Trolley Bus Infrastructure**

The trolley bus system is operated by two identical traction stations situated in New Baneshwar and Thimi. Each traction station is connected to two different 11 kV high-tension feeders from two different Nepal Electricity Authority (NEA) sources to ensure uninterrupted supply of electricity. The traction stations are each equipped with two 780 kVA transformers and two 600 kW silicon rectifiers ensuring a 100% availability of power to the system at all times.

The 600 Volts DC rectifiers at the two substations feed the overhead trolley contact wires divided into six sections. There are 655 RCC poles supporting the 14-kilometer overhead feeder network.

The following information on the existing trolley bus infrastructure has been derived from the CEMAT study. Some data has also been updated according to the current situation.

#### **3.1 Infrastructure (Buildings and Civil Structures)**

- Main trolley bus depot at New Baneshwar consisting of an office complex, trolley bus parking area, maintenance garage, workshop area, stores, traffic section offices, water tanks, etc.
- Buildings for the traction station in the main depot at New Baneshwar and at Thimi.
- Terminal depots at Tripureshwor and Suryabinayak.

#### **3.2 Traction Substation Equipment**

- Two traction stations at Thimi and New Baneshwar.
- No technical problems in both traction stations
- The stations fully capable of powering 25 trolley buses with minor repair and maintenance.

#### **3.3 Overhead DC power lines and networks**

- Substantial damages have ensued as a result of shut down of services.
- Overhead copper wire lines have been snapped away substantially on the Kaushaltar - Thimi bazaar and Thimi – Suryabinayak routes.
- Further pilferage of copper wires is possible.

#### **3.4 Trolley buses**

- 5 trolley buses are already in operating condition and 5 are fit to operate immediately with minimum maintenance.
- 12 trolley buses can be made operational after some major repairs.

#### **3.5 Equipment**

- Workshop and other equipment are in general working condition.
- Two tower wagons used for line maintenance are not in working condition.

#### **3.6 Human Resources**

- 5 administrative staff (1 manager, 3 clerks, 1 peon)
- 29 technicians (17 for maintenance, 5 for substation, 7 square section)
- 5 drivers, 6 guards

#### **4. Proposed Reactivation Model and Institutional Setup**

The trolley bus system was reactivated on September 1, 2003. The Ministry of Labour and Transport Management (MoLTM) handed over the Trolley Bus System in trust to the three municipalities. MoLTM has signed a Memorandum of Understanding (MoU) with Kathmandu Metropolitan City and Madhyapur Thimi and Bhaktapur Municipalities. The MoU states that the three municipalities form a Joint Management Board (JMB) to manage and operate the trolley bus services. The MoU also provides latitude to the JMB to involve other municipalities and the private sector if necessary. The objective of re-operating the trolley bus services, as stated in the MoU, is to run it as a profit center with improved business strategies, to reduce the environmental pollution in the valley and to provide the public with a dependable and quality transport service. The MoU also entitles the expansion of the trolley bus services to other technically and financially feasible areas, as its working theme, apart from re-operation in the existing route.

Currently the three municipalities are operating the trolley bus system. This business plan proposes that the JMB will approach the private sector to initiate the formation of a public private partnership venture for the rehabilitation and operation of the trolley bus system. A new public private partnership entity (which will include the municipalities and private investors) will be incorporated and this entity will be assigned with the responsibility of putting together a management team for the rehabilitation and operation of trolley bus services.

The management team will be responsible for the operation of the trolley bus services and the Board of Directors, formed pursuant to relevant legislation, will guide the management in the rehabilitation and operation of the trolley bus system. The new public private partnership venture will be responsible for necessary investment to rehabilitate the trolley bus system and for bearing all costs related to the management and operation thereof. The proposed public private partnership entity will not be responsible for any old liabilities and dues that the previous trolley bus system owed to any government or non-government entity. The owner of the system, HMGN, shall be solely liable to pay such liabilities and dues. The composition and structure of the new public private partnership entity has not been discussed in this report as it will be up to the public and private investors to decide on how to compose and structure this partnership entity. However, an organizational structure of managers and employees of the proposed new trolley bus team has been presented in this business plan. This organizational structure has been used in the financial analysis. KEVA suggests that maximum public participation should be sought in the formation of the public private partnership entity by floating public shares. Public participation of one kind or another is also strongly recommended to ensure a sense of ownership of the trolley bus system among the public and users of the trolley services.

This model is based on the principle that the public private partnership entity will create a 'professional management team' to complete the rehabilitation of the existing system including trolley buses and the overhead system and to operate and manage the reactivated system. This business plan recommends the rehabilitation of 22 buses.

The public private partnership entity, in return for use of the vehicles, premises and equipment, will pay a **monthly/annual royalty to HMG/N as per a mutually agreed amount**. This plan envisages payment of royalty to HMG/N as follows:

**Table 1: Annual Royalty \***

| SN | Description of Royalty  | NRs. (Million) |
|----|---|----------------|
| 1  | Rent of Land  | 1.2            |
| 2  | Rent of Buildings   | 0.74           |
| 3  | Lease of existing trolley system, buses and equipment @ 5% of disposal value per annum. | 3.59           |
|    | Total   | 5.53           |

As the existing buses are now quite old, the financial analysis has provisions to replace 2 buses every year from the fifth year of operation. The cost of the new buses is estimated at approximately NRs. 4.2 million per bus when assembled locally with imported chassis from India and electromechanical parts from China (independently calculated by Winrock International/Nepal). The annual depreciation factor of these buses is fixed at 10% of the purchase cost, starting from the year after the purchase. As the CEMAT analysis proposed that HMG/N hand over all trolley assets to the three municipalities, the depreciation of the existing trolley bus assets was also included in the analysis. This business plan, however, is based on the MoU signed between MoLTM and the three municipalities. According to the MoU, the assets of the trolley bus services have been handed over to the municipalities as a trustee of HMG/N. Therefore, the trolley bus asset depreciation has not been accounted for in this business plan because HMG/N will remain the owner of trolley bus assets. This plan envisages, as mentioned above, payment of royalty to HMG/N, the owner, for the use of the system as proposed above. However, the depreciation of newly purchased trolley buses has been included, as the investors will have to pay for the procurement. Even though the business plan is fundamentally based on the CEMAT study, changes such as exclusion of depreciation of trolley bus assets, increased price of new locally assembled trolley buses (based on current information), changes in terminology used for capacity utilization assumptions, current bank interest rates etc. have resulted in some changes in the financial analysis.

\* The data in these tables are based on Final report study for revival of Kathmandu – Suryabinayak trolley bus system, CEMAT, June 2002. But some alterations based on updated prices, fares, capacity utilization, etc. have been made which has caused some changes to the original numbers.

The major indicators of this model on a 20-year analysis are presented below.

**Table 2: Summary of Financial Analysis\***

| SN | Description                                 | Unit           | (Investment as Equity only) Amount | (Investment as Loan & Equity) Amount |
|----|---|----------------|------------------------------------|--------------------------------------|
| 1  | Investment Structure                        | NRs. (Million) | 40.05                              | 40.91                                |
|    | <i>Fixed Capital</i>                        |                | 30.79                              | 30.79                                |
|    | <i>Working Capital</i>                      |                | 9.26                               | 10.12                                |
| 2  | Annual Operation Costs                      | NRs. (Million) | 32.19                              | 34.76                                |
|    | <i>Fixed Costs</i>                          |                | 13.93                              | 15.77                                |
|    | <i>Variable Costs</i>                       |                | 18.26                              | 18.99                                |
| 3  | Revenue at 80% capacity utilization         | NRs. (Million) | 45.62                              | 45.62                                |
| 4  | Profit before tax                           | NRs. (Million) | 13.43                              | 10.86                                |
| 5  | Profit after tax                            | NRs. (Million) | 10.54                              | 8.52                                 |
| 6  | Payback period                              | Years          | 3.80                               | 7.79                                 |
| 7  | NPV @ 12% discount rate                     | NRs. (Million) | 10.38                              | 10.92                                |
| 8  | FIRR  | %              | 17.67                              | 22.47                                |
| 9  | BCR @ 12% discount rate                     | -              | 1.23                               | 1.60                                 |
| 10 | Return on investment @ 1 <sup>st</sup> year | %              | 22.02                              | 17.48                                |
| 11 | Return on Equity @ 1 <sup>st</sup> year     | %              | 22.02                              | 36.48                                |

The business plan has accounted the insurance coverage for newly purchased fossil fuel vehicles, insurance of buildings and accident and hospitalization insurance for employees. However, since there is no existing policy for insuring trolley buses in Nepal, the trolley buses and their crew have not been included in the insurance scheme presented by this business plan. An alternative scheme of self insuring the trolley buses and the crew is suggested but has not been included in the financial analysis. Taking estimated costs of existing old and new trolley buses to be NRs. 1,000,000 and NRs. 2,000,000 respectively, the insurance scheme (as per other conventional fossil fueled buses) covering bus insurance, insurance for three bus-crews, terrorism insurance and also third party insurance rounds off to NRs. 605,650 per annum for the 12 old and 10 new trolley buses. In the absence of a trolley bus insurance policy, a self-insuring scheme for trolley buses can be instituted. Similarly, the yearly self-insurance premium will be NRs. 75,575 per bus for the new buses to be purchased from year 5.

The business plan has also put forward the proposed organizational structure for the trolley bus system. The organizational structure includes one general manager and three divisional managers for operations, administration & accounts and planning & technical divisions. These positions constitute the Professional Management Team. Furthermore, under the Administration and Accounts division, there are 3 staff in the store, 13 in the administration and 4 in the accounts sections. Under the technical division, there are 11 staff in the vehicle maintenance, 7 in the substation maintenance and 6 in the line maintenance sections. Similarly, under the operations division there are 26 drivers, 26 conductors and 4 administrative staff. The business plan proposes 104 staff members for the full functioning of trolley bus system along the existing route.

## 5. Proposed Business Plan

This business plan has been formulated with the view that the public private partnership entity will appoint a Professional Management Team (PMT) to operate the trolley bus system on lease for an initial period of 20 years. The PMT will rehabilitate the existing infrastructure and 22 (recommended number) trolley buses to operate on the 13 km Tripureshwor to Suryabinayak route. The costs for the rehabilitation of the infrastructure and buses, investment plan, projected income and expenditure, cash flow projection, pay back period and financial indicators (NPV, FIRR, BCR, Return on investment and equity) for the operation of the trolley bus system have all been included in this business plan.

### 5.1 Scenario with Investment as Equity only

Here, the total investment required for the rehabilitation and initial working capital generation is assumed to be made in equity only.

#### 5.1.1 Project Costs

The cost of reviving the trolley bus system to operate along the entire 13 km route involves added costs of rehabilitation of buildings, buses, power lines and overhead networks, procurement of different vehicles and equipment, purchase of spare parts, furnishing and generation of working capital for the initial year of operation.

The total project cost is expected to amount to NRs. 40.05 million with NRs. 30.79 million for rehabilitation purposes and NRs. 9.26 million as working capital for the first year.

**Table 3: Total Project Costs \* (Investment as equity only)**

| Particulars   | Amount in million (NRs.) |
|---|--------------------------|
| <b>Rehabilitation Costs &amp; Additional Investment</b> | <b>30.79</b>             |
| Building Rehabilitation                                 | 1.09                     |
| Rehabilitation of Trolley Buses                         | 7.33                     |
| DC Power Lines & Overhead Network                       | 4.72                     |
| Procurement of Tower Wagon                              | 2.50                     |
| Procurement of Service Truck                            | 1.60                     |
| Procurement of Light Car                                | 1.00                     |
| Procurement of 3 motorcycles                            | 0.45                     |
| Procurement of Light Pickup                             | 1.20                     |
| Procurement of Computer and Office Equipment            | 0.50                     |
| Purchase of Existing spare part stock                   | 3.40                     |
| Investment to order spares from China                   | 6.00                     |
| Furniture and Furnishing                                | 1.00                     |
| <b>Working Capital Requirements</b>                     | <b>9.26</b>              |
| <b>TOTAL</b>  | <b>40.05</b>             |

### 5.1.2 Annual Operating Costs

The annual cost of operating the trolley bus system in this model is expected to amount to NRs. 32.19 million. This includes fixed costs of NRs. 13.93 million and variable costs of NRs. 18.26 million.

#### a) Fixed Costs

This includes the cost of leasing and rent, salaries, overtime (OT) and perks, overhead expenses, repair & maintenance of buildings and office equipment and electricity demand charge.

**Table 4: Annual Operating Costs – Fixed Costs \* (Investment as equity only)**

| Description of works  | Amount in million (NRs.) |
|---|--------------------------|
| <b>I. FIXED COSTS</b>   | <b>13.93</b>             |
| <b>Leasing of trolley buses, substation equipment, RCC poles, traction wire</b> | <b>3.59</b>              |
| <b>Rent of office land, buildings, garage, etc.</b>                             | <b>1.94</b>              |
| <b>Indirect costs (Salary, OT &amp; perks)</b>                                  | <b>5.35</b>              |
| General Manager -1 @ Rs. 35000/month  | 0.42                     |
| Divisional Managers - 3 @ Rs. 20000/month                                       | 0.72                     |
| Admin/Account Officers - 2 @ Rs. 8000/month                                     | 0.19                     |
| Store I/C - 1 @ Rs. 6000/month  | 0.07                     |
| Office/Accounts Assistants - 2 @ Rs. 6000/month                                 | 0.14                     |
| Clerks - 4 @ 4000/month   | 0.19                     |
| Operation Assistants - 2 @ Rs. 4500/month                                       | 0.11                     |
| Foreman - 3 @ Rs. 6000/month  | 0.22                     |
| Senior Mechanical/Electrical Assistants - 6 @ Rs. 7500/month                    | 0.54                     |
| Mechanical/Electrical Helper - 8 @ Rs. 4000/month                               | 0.38                     |
| Ground Commander - 1 @ Rs. 7000/month   | 0.08                     |
| Guards - 10 @ Rs. 4500/month  | 0.54                     |
| Peon/Runner - 11 @ Rs. 3500/month   | 0.46                     |
| Driver(Heavy) - 2 @ Rs. 6000/month  | 0.14                     |
| Driver(Light) - 1 @ Rs. 5000/month  | 0.06                     |
| Perks & OT @ 25% of Total   | 1.07                     |
| <b>Office Overheads</b>   | <b>0.74</b>              |
| Stationery, Postage, Fax, Telephone, etc.                                       | 0.10                     |
| Audit and legal expenses  | 0.05                     |
| Transport   | 0.05                     |
| Publicity and promotion   | 0.05                     |
| Insurance @ 1% of cost of new vehicles  | 0.12                     |
| Employee Insurance  | 0.06                     |
| Building Insurance  | 0.02                     |
| Fixed electricity charges   | 0.30                     |
| <b>Repair and Maintenance</b>   | <b>0.29</b>              |
| Building and Civil works @ 3% of disposal value                                 | 0.21                     |
| Office equipment, furniture, fixtures @ 5%                                      | 0.08                     |
| <b>Electricity demand charge</b>  | <b>2.02</b>              |

**b) Variable Costs**

This includes costs of material inputs (electricity, lubricants and fuel), repair and maintenance of infrastructure and direct labor charges.

**Table 5: Annual Operating Costs – Variable Costs \* (Investment as equity only)**

| Description of works                     | Amount in million (NRs.) |
|--|--------------------------|
| <b>II. VARIABLE COSTS</b>                | <b>18.26</b>             |
| <b>Material Inputs</b>                   | <b>8.82</b>              |
| Electricity Consumption                  | 7.85                     |
| Consumption of Lubricants                | 0.82                     |
| Fuel (Petrol, Diesel, etc.)              | 0.15                     |
| <b>Repair and Maintenance</b>            | <b>5.39</b>              |
| Overhead wire, RCC Poles and substations | 0.65                     |
| Consumption of spare parts               | 3.09                     |
| Wear and tear of parts                   | 1.65                     |
| <b>Direct Labor</b>                      | <b>4.05</b>              |
| Drivers - 25 nos. @ NRs. 5,500/month     | 1.65                     |
| Conductors - 25 nos. @ NRs. 3,500/month  | 1.05                     |
| Perks & OT @ 50% of Total                | 1.35                     |
| <b>TOTAL</b>                             | <b>32.19</b>             |

**5.1.3 Working Capital Requirements**

With minimum days of coverage taken to be 60, the current assets will amount to NRs. 10.73 million and the current liabilities NRs. 1.47 million. Hence, the working capital requirements for Year 1 sums up to NRs. 9.26 million.

**Table 6: Working Capital Requirements \* (Investment as equity only)**

| Description                                    | Minimum Days of Coverage | Co-efficient Turnover | NRs. In Million |
|--|--------------------------|-----------------------|-----------------|
| Percentage of Ave. No. of Passengers (%)       |                          |                       | 80              |
| <b>A. Current Assets</b>                       |                          |                       | <b>10.73</b>    |
| Material Inputs                                | 60                       | 6                     | 1.47            |
| Accounts Receivable @ operating cost           | 60                       | 6                     | 5.36            |
| Cash in Hand (from D)                          |                          |                       | 3.89            |
| <b>B. Current Liabilities</b>                  |                          |                       | <b>1.47</b>     |
| Accounts payable @ Material Input              | 60                       | 6                     | 1.47            |
| <b>C. Working Capital Requirements (A - B)</b> |                          |                       | <b>9.26</b>     |
| Short Term Loan                                |                          |                       | 0.00            |
| Equity   |                          |                       | 9.26            |
| <b>D. Cash Requirements</b>                    | 60                       | 6                     | <b>3.89</b>     |
| I. Operating Cost                              |                          |                       | 32.19           |
| II. Material Inputs                            |                          |                       | 8.82            |
| III. I – II                                    |                          |                       | 23.37           |

### 5.1.4 Pay Back Period

Under this model of operation, the pay back period has been calculated to be 3.80 years.

**Table 7: Pay Back Period \* (Investment as equity only)**

(In Million NRs.)

| Year | Investment / Net Profit | Depreciation | Cost/Benefit           | Cumulative Benefit |
|------|-------------------------|--------------|------------------------|--------------------|
| 0    | (30.79) <sup>3</sup>    | 0            | 0                      |                    |
| 1    | 1.28 <sup>4</sup>       | 0.00         | 1.28                   | 1.28               |
| 2    | 10.54                   | 0.00         | 10.54                  | 11.83              |
| 3    | 10.54                   | 0.00         | 10.54                  | 22.37              |
| 4    | 10.54                   | 0.00         | 10.54                  | 32.91              |
| 5    | 2.14                    | 0.00         | 2.14                   | 35.06              |
| 6    | 1.48                    | 0.84         | 2.32                   | 37.38              |
| 7    | 0.82                    | 1.68         | 2.50                   | 39.89              |
| 8    | 0.17                    | 2.52         | 2.69                   | 42.57              |
| 9    | -0.49                   | 3.36         | 2.87                   | 45.44              |
| 10   | -1.15                   | 4.20         | 3.05                   | 48.48              |
|      |                         |              | <b>Pay Back Period</b> | <b>3.80</b>        |

### 5.1.5 Investment Plan

The following table gives the plan for putting together funds to invest for the proposed project based on the total costs outlined in the previous section. The total project cost of NRs. 40.05 is envisaged to be invested as equity. The costs for the rehabilitation will be met from equity of NRs. 30.79 million. Similarly, the costs for initial working capital will be met from equity of NRs. 9.26 million. It has been assumed that a full year (Year 0) will be required for the completion of rehabilitation works, so investment for rehabilitation works has been shown to be made only in Year 0. The investment for working capital is assumed to be needed from the beginning of Year 1, when the rehabilitation work is assumed to be completed and the operation of service will commence.

**Table 8: Investment Plan \* (Investment as equity only)**

| Description                     | Amount in millions (NRs) | Year of investment |
|---------------------------------|--------------------------|--------------------|
| <b>Fixed Capital Investment</b> | <b>30.79</b>             | <b>Year 0</b>      |
| Loan                            | 0                        |                    |
| Owner's Equity                  | 30.79                    |                    |
| <b>Initial Working Capital</b>  | <b>9.26</b>              | <b>Year 1</b>      |
| Loan                            | 0.00                     |                    |
| Owner's Equity                  | 9.26                     |                    |
| <b>Total Investment</b>         | <b>40.05</b>             |                    |
| Loan                            | 0                        |                    |
| Total Owner's Equity            | 40.05                    |                    |

<sup>3</sup> Equity Investment for rehabilitation works as fixed capital is made in Year 0.

<sup>4</sup> Equity investment for working capital is made in Year 1.

### 5.1.6 Projected Profit and Loss

Assuming that the average number of passengers per trip will be 80 percent of the average number of trolley bus passengers in 1999 (based on a CEMAT survey in 1999), the plan projects yearly revenue amounting to NRs. 45.62 million with average fare of NRs. 6 per passenger. A recent survey shows that the average fare in a local bus from the old bus park in Kathmandu to Suryabinayak is NRs. 9 and the minimum fare that has to be paid after boarding the bus in that route is NRs. 5. Assuming normal distribution, the average fare would be NRs. 7 per passenger. Taking into consideration that 88% commuters pay less than or equal to NRs. 7 and only 12% commuters pay above NRs. 7, the weighted average fare per passenger amounts to NRs. 6.50. Therefore, if the financial analysis is done with NRs. 6.50 as the average fare per passenger on the route, the annual revenue will be NRs. 49.42 million, which is NRs. 3.8 million more revenue than with the current rate. This, in turn, also improves the FIRR of the business venture. This is another indication that the financial analysis in this business plan has been done using conservative figures. Therefore, there are still areas to improve the profitability of this venture further.

With annual operating costs of NRs. 32.19 million, the gross operating profit will be NRs. 13.43 million per year. The annual depreciation value will amount to NRs. 0.84 million (at the rate of 10% of cost of two new buses per year from Year 6). This will add up as the number of buses replaced increases every year. Net profit after tax will be NRs. 10.54 million in the first year of operation. The accumulated profit is projected to reach NRs. 148.22 million at the end of the 20<sup>th</sup> year.

**Table 9: Projected Profit and Loss Statement (up to Year 10) \* (Investment as equity only)**

(In million NRs)

| Operating year                           | 1               | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    |
|--|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Percentage of Ave. No. of Passengers (%) | 80 <sup>5</sup> | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    |
| Revenue Estimates                        | 45.62           | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 |
| Operating Cost                           | 32.19           | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 |
| Gross Operating Profit                   | 13.43           | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 |
| Depreciation                             | 0.00            | 0.00  | 0.00  | 0.00  | 0.00  | 0.84  | 1.68  | 2.52  | 3.36  | 4.20  |
| Profit before Tax                        | 13.43           | 13.43 | 13.43 | 13.43 | 13.43 | 12.59 | 11.75 | 10.91 | 10.07 | 9.23  |
| Corporate tax @ 21.5%                    | 2.89            | 2.89  | 2.89  | 2.89  | 2.89  | 2.71  | 2.53  | 2.35  | 2.17  | 1.98  |
| Net profit after tax                     | 10.54           | 10.54 | 10.54 | 10.54 | 10.54 | 9.88  | 9.22  | 8.57  | 7.91  | 7.25  |
| Accumulated profit                       | 10.54           | 21.09 | 31.63 | 42.17 | 52.72 | 62.60 | 71.83 | 80.39 | 88.30 | 95.54 |

**Table 10: Projected Profit and Loss Statement (Year 11 to 20) \* (Investment as equity only)**

(In million NRs)

| Operating year                           | 11     | 12     | 13     | 14     | 15     | 16     | 17     | 18     | 19     | 20     |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Percentage of Ave. No. of Passengers (%) | 80     | 80     | 80     | 80     | 80     | 80     | 80     | 80     | 80     | 80     |
| Revenue Estimates                        | 45.62  | 45.62  | 45.62  | 45.62  | 45.62  | 45.62  | 45.62  | 45.62  | 45.62  | 45.62  |
| Operating Cost                           | 32.19  | 32.19  | 32.19  | 32.19  | 32.19  | 32.19  | 32.19  | 32.19  | 32.19  | 32.19  |
| Gross Operating Profit                   | 13.43  | 13.43  | 13.43  | 13.43  | 13.43  | 13.43  | 13.43  | 13.43  | 13.43  | 13.43  |
| Depreciation                             | 5.04   | 5.88   | 6.72   | 7.56   | 8.40   | 8.40   | 7.56   | 6.72   | 5.88   | 5.04   |
| Profit before Tax                        | 8.39   | 7.55   | 6.71   | 5.87   | 5.03   | 5.03   | 5.87   | 6.71   | 7.55   | 8.39   |
| Corporate tax @ 21.5%                    | 1.80   | 1.62   | 1.44   | 1.26   | 1.08   | 1.08   | 1.26   | 1.44   | 1.62   | 1.80   |
| Net profit after tax                     | 6.59   | 5.93   | 5.27   | 4.61   | 3.95   | 3.95   | 4.61   | 5.27   | 5.93   | 6.59   |
| Accumulated profit                       | 102.13 | 108.06 | 113.32 | 117.93 | 121.88 | 125.83 | 130.44 | 135.71 | 141.64 | 148.22 |

<sup>5</sup> Based on a survey done by CEMAT in 1999, an average of 180 passengers traveled on a trolley bus per loop (to a destination and back). 22 trolley buses will operate making 8 loops per day. The assumption is that the buses will operate 300 days per year and the average fare will be NRs. 6 per passenger. Here, the analysis has assumed that the service will operate with 80% of the average passengers in the 1999 survey. Eighty percent would be 144 passengers commuting per loop. This is a conservative assumption.

### 5.1.7 Cash Flow Projection

A total of NRs. 30.79 million will be spent prior to the operation of the trolley bus system for rehabilitation works. In the first year of operation, a working capital of NRs. 9.26 million will be produced and a gross operating profit of NRs. 13.43 million collected, of which only NRs. 12.15 million will be spent generating positive cash flow from Year 1 itself. The cumulative cash flow at the end of Year 20 is projected to be NRs. 135.62 million.

**Table 11: Cash Flow Projection (up to Year 10) \* (Investment as equity only)**

(In million NRs)

| Operating Year                           | Constr. | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    |
|--|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Percentage of Ave. No. of Passengers (%) |         | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    |
| <b>Cash Inflow</b>                       |         |       |       |       |       |       |       |       |       |       |       |
| Equity in fixed capital                  | 30.79   |       |       |       |       |       |       |       |       |       |       |
| Equity in working capital                |         | 9.26  |       |       |       |       |       |       |       |       |       |
| Gross Operating Profit                   |         | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 |
| <b>Total Cash Inflow</b>                 | 30.79   | 22.69 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 |
| <b>Cash Outflow</b>                      |         |       |       |       |       |       |       |       |       |       |       |
| Capital Expenditure                      | 30.79   |       |       |       |       | 8.4   | 8.4   | 8.4   | 8.4   | 8.4   | 8.4   |
| Working Capital                          |         | 9.26  |       |       |       |       |       |       |       |       |       |
| Corporate Tax                            |         | 2.89  | 2.89  | 2.89  | 2.89  | 2.89  | 2.71  | 2.53  | 2.35  | 2.17  | 1.98  |
| <b>Total Cash Outflow</b>                | 30.79   | 12.15 | 2.89  | 2.89  | 2.89  | 11.29 | 11.11 | 10.93 | 10.75 | 10.57 | 10.38 |
| <b>Cash Flow</b>                         |         | 10.54 | 10.54 | 10.54 | 10.54 | 2.14  | 2.32  | 2.50  | 2.69  | 2.87  | 3.05  |
| <b>Cumulative Cash flow</b>              |         | 10.54 | 21.09 | 31.63 | 42.17 | 44.32 | 46.64 | 49.15 | 51.83 | 54.70 | 57.74 |

**Table 12: Cash Flow Projection (Year 11 to 20) \* (Investment as equity only)**

(In million NRs)

| Operating Year                           | 11    | 12    | 13    | 14    | 15    | 16    | 17     | 18     | 19     | 20     |
|--|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| Percentage of Ave. No. of Passengers (%) | 80    | 80    | 80    | 80    | 80    | 80    | 80     | 80     | 80     | 80     |
| <b>Cash Inflow</b>                       |       |       |       |       |       |       |        |        |        |        |
| Equity in fixed capital                  |       |       |       |       |       |       |        |        |        |        |
| Equity in working capital                |       |       |       |       |       |       |        |        |        |        |
| Gross Operating Profit                   | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43  | 13.43  | 13.43  | 13.43  |
| <b>Total Cash Inflow</b>                 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43  | 13.43  | 13.43  | 13.43  |
| <b>Cash Outflow</b>                      |       |       |       |       |       |       |        |        |        |        |
| Capital Expenditure                      | 8.4   | 8.4   | 8.4   | 8.4   | 8.4   |       |        |        |        |        |
| Working Capital                          |       |       |       |       |       |       |        |        |        |        |
| Corporate Tax                            | 1.80  | 1.62  | 1.44  | 1.26  | 1.08  | 1.08  | 1.26   | 1.44   | 1.62   | 1.80   |
| <b>Total Cash Outflow</b>                | 10.20 | 10.02 | 9.84  | 9.66  | 9.48  | 1.08  | 1.26   | 1.44   | 1.62   | 1.80   |
| <b>Cash Flow</b>                         | 3.23  | 3.41  | 3.59  | 3.77  | 3.95  | 12.35 | 12.17  | 11.99  | 11.81  | 11.63  |
| <b>Cumulative Cash flow</b>              | 60.97 | 64.38 | 67.96 | 71.73 | 75.68 | 88.03 | 100.20 | 112.19 | 124.00 | 135.62 |

### 5.1.8 Financial Indicators

The financial indicators show that the trolley bus system, if operated in this model, will operate very profitably. For the projected operational span of 20 years, the Net Present Value (NPV) at beginning of Year 0 is NRs. 10.38 million at a 12% discount rate. The Financial Internal Rate of Return (FIRR) indicates a very good return of 17.67%. Similarly, the Benefit Cost Ratio (BCR) value is 1.23 at a 12% discount rate. Furthermore, the returns on investment and equity at the end of 1<sup>st</sup> year of operation are 22.02% each as all investment is made in equity. For calculations of NPV, present time is taken as pre-investment period, i.e. at the beginning of Year 0. Each year number indicates the time at the end of that year. For example, NRs. 30.79 million invested in Year 0 indicates the total investment made by the end of Year 0.

**Table 13: Financial Indicators \* (Investment as equity only)**

(In million NRs)

| Year   | Gross Operating Profit | Investment/Tax     | Cost/Benefit  |
|--|------------------------|--------------------|---------------|
| 0  |                        | 30.79 <sup>6</sup> | (30.79)       |
| 1  | 13.43                  | 12.15 <sup>7</sup> | 1.28          |
| 2  | 13.43                  | 2.89               | 10.54         |
| 3  | 13.43                  | 2.89               | 10.54         |
| 4  | 13.43                  | 2.89               | 10.54         |
| 5  | 13.43                  | 11.29              | 2.14          |
| 6  | 13.43                  | 11.11              | 2.32          |
| 7  | 13.43                  | 10.93              | 2.50          |
| 8  | 13.43                  | 10.75              | 2.69          |
| 9  | 13.43                  | 10.57              | 2.87          |
| 10   | 13.43                  | 10.38              | 3.05          |
| 11   | 13.43                  | 10.20              | 3.23          |
| 12   | 13.43                  | 10.02              | 3.41          |
| 13   | 13.43                  | 9.84               | 3.59          |
| 14   | 13.43                  | 9.66               | 3.77          |
| 15   | 13.43                  | 9.48               | 3.95          |
| 16   | 13.43                  | 1.08               | 12.35         |
| 17   | 13.43                  | 1.26               | 12.17         |
| 18   | 13.43                  | 1.44               | 11.99         |
| 19   | 13.43                  | 1.62               | 11.81         |
| 20   | 13.43                  | 1.80               | 11.63         |
| <b>NPV @ 12% Discount rate (NRs. In million)</b> |                        |                    | <b>10.38</b>  |
| <b>FIRR</b>                                      |                        |                    | <b>17.67%</b> |
| <b>Benefit/Cost Ratio @ 12% Discount Rate</b>    |                        |                    | <b>1.23</b>   |
| <b>Return on Investment @ 1st year</b>           |                        |                    | <b>22.02%</b> |
| <b>Return on Equity @ 1st year</b>               |                        |                    | <b>22.02%</b> |

All financial indicators demonstrate that this scheme of operating the trolley bus system from Tripureshwor to Suryabinayak is financially viable and is a sustainable business proposition.

<sup>6</sup> At Year 0, investment worth NRs. 30.79 million will be made only for the rehabilitation of infrastructure and buses.

<sup>7</sup> At Year 1, investment worth NRs. 9.26 million will be made to generate working capital for 1<sup>st</sup> 60 days of operation of trolley bus services.

## 5.2 Scenario with Investment as Equity and Loan

Here the investment is assumed to be made as a mixture of equity and loan. For fixed capital investment, 50% is assumed to be made from term loan and 50% from equity. Similarly, for working capital investment, 60% is assumed to be made from short term loan and 40% from equity.

### 5.2.1 Project Costs

The total project cost will amount to NRs. 40.91 million with NRs. 30.79 million for rehabilitation purposes and NRs. 10.12 million as working capital for the first year.

**Table 14 : Total Project Costs \* (Investment as equity and loan)**

| <b>Particulars</b>                                      | <b>Amount in million (NRs)</b> |
|---|--------------------------------|
| <b>Rehabilitation Costs &amp; Additional Investment</b> | <b>30.79</b>                   |
| Building Rehabilitation                                 | 1.09                           |
| Rehabilitation of Trolley Buses                         | 7.33                           |
| DC Power Lines & Overhead Network                       | 4.72                           |
| Procurement of Tower Wagon                              | 2.50                           |
| Procurement of Service Truck                            | 1.60                           |
| Procurement of Light Car                                | 1.00                           |
| Procurement of 3 motorcycles                            | 0.45                           |
| Procurement of Light Pickup                             | 1.20                           |
| Procurement of Computer and Office Equipment            | 0.50                           |
| Purchase of Existing spare part stock                   | 3.40                           |
| Investment to order spares from China                   | 6.00                           |
| Furniture and Furnishing                                | 1.00                           |
| <b>Working Capital Requirements</b>                     | <b>10.12</b>                   |
|   |                                |
| <b>TOTAL</b>  | <b>40.91</b>                   |

## 5.2.2 Annual Operating Costs

The annual cost of operating the trolley bus system in this model is expected to amount to NRs. 34.76 million. This includes fixed costs of NRs. 15.77 million and variable costs of NRs. 18.99 million.

### a) Fixed Costs

This includes the cost of leasing and rent, salaries, overtime (OT) and perks, overhead expenses, repair & maintenance of buildings and office equipment and electricity demand charge.

**Table 15 : Annual Operating Costs – Fixed Costs \* (Investment as equity and loan)**

| Description of works  | Amount in million (NRs.) |
|---|--------------------------|
| <b>I. FIXED COSTS</b>   | <b>15.77</b>             |
| <b>Leasing of trolley buses, substation equipment, RCC poles, traction wire</b> | <b>3.59</b>              |
| <b>Rent of office land, buildings, garage, etc.</b>                             | <b>1.94</b>              |
| <b>Indirect costs (Salary, OT &amp; perks)</b>                                  | <b>5.35</b>              |
| General Manager -1 @ Rs. 35000/month  | 0.42                     |
| Divisional Managers - 3 @ Rs. 20000/month                                       | 0.72                     |
| Admin/Account Officers - 2 @ Rs. 8000/month                                     | 0.19                     |
| Store I/C - 1 @ Rs. 6000/month  | 0.07                     |
| Office/Accounts Assistants - 2 @ Rs. 6000/month                                 | 0.14                     |
| Clerks - 4 @ 4000/month   | 0.19                     |
| Operation Assistants - 2 @ Rs. 4500/month                                       | 0.11                     |
| Foreman - 3 @ Rs. 6000/month  | 0.22                     |
| Senior Mechanical/Electrical Assistants - 6 @ Rs. 7500/month                    | 0.54                     |
| Mechanical/Electrical Helper - 8 @ Rs. 4000/month                               | 0.38                     |
| Ground Commander - 1 @ Rs. 7000/month   | 0.08                     |
| Guards - 10 @ Rs. 4500/month  | 0.54                     |
| Peon/Runner - 11 @ Rs. 3500/month   | 0.46                     |
| Driver(Heavy) - 2 @ Rs. 6000/month  | 0.14                     |
| Driver(Light) - 1 @ Rs. 5000/month  | 0.06                     |
| Perks & OT @ 25% of Total   | 1.07                     |
| <b>Office Overheads</b>   | <b>0.74</b>              |
| Stationery, Postage, Fax, Telephone, etc.                                       | 0.10                     |
| Audit and legal expenses  | 0.05                     |
| Transport   | 0.05                     |
| Publicity and promotion   | 0.05                     |
| Insurance @ 1% of cost of new vehicles  | 0.12                     |
| Employee Insurance  | 0.06                     |
| Building Insurance  | 0.02                     |
| Fixed electricity charges   | 0.30                     |
| <b>Interest on Term Loan @ 12%</b>  | <b>1.85</b>              |
| <b>Repair and Maintenance</b>   | <b>0.29</b>              |
| Building and Civil works @ 3% of disposal value                                 | 0.21                     |
| Office equipment, furniture, fixtures @ 5%                                      | 0.08                     |
| <b>Electricity demand charge</b>  | <b>2.02</b>              |

**b) Variable Costs**

This includes costs of material inputs (electricity, lubricants and fuel), repair and maintenance of infrastructure and direct labor charges.

**Table 16: Annual Operating Costs – Variable Costs \* (Investment as equity and loan)**

|  |              |
|--|--------------|
| <b>II. VARIABLE COSTS</b>                | <b>18.99</b> |
| <b>Material Inputs</b>                   | <b>8.82</b>  |
| Electricity Consumption                  | 7.85         |
| Consumption of Lubricants                | 0.82         |
| Fuel (Petrol, Diesel, etc.)              | 0.15         |
| <b>Repair and Maintenance</b>            | <b>5.39</b>  |
| Overhead wire, RCC Poles and substations | 0.65         |
| Consumption of spare parts               | 3.09         |
| Wear and tear of parts                   | 1.65         |
| <b>Direct Labour</b>                     | <b>4.05</b>  |
| Drivers - 25 nos. @ Rs. 5500/month       | 1.65         |
| Conductors - 25 nos. @ Rs. 3500/month    | 1.05         |
| Perks & OT @ 50% of Total                | 1.35         |
| <b>Interest on Short Term Loan @ 12%</b> | <b>0.73</b>  |
| <b>TOTAL</b>                             | <b>34.76</b> |

**5.2.3 Working Capital Requirements**

With minimum days of coverage taken to be 60, the current assets will amount to NRs. 11.59 million and the current liabilities NRs. 1.47 million. Hence, the working capital requirements for Year 1 sums up to NRs. 10.12 million.

**Table 17: Working Capital Requirements \* (Investment as equity and loan)**

| Description                                    | Minimum Days of Coverage | Co-efficient Turnover | NRs. In Million |
|--|--------------------------|-----------------------|-----------------|
| Percentage of Ave. No. of Passengers (%)       |                          |                       | 80              |
| <b>A. Current Assets</b>                       |                          |                       | <b>11.59</b>    |
| Material Inputs                                | 60                       | 6                     | 1.47            |
| Accounts Receivable @ operating cost           | 60                       | 6                     | 5.79            |
| Cash in Hand (from D)                          |                          |                       | 4.32            |
| <b>B. Current Liabilities</b>                  |                          |                       | <b>1.47</b>     |
| Accounts payable @ Material Input              | 60                       | 6                     | 1.47            |
| <b>C. Working Capital Requirements (A - B)</b> |                          |                       | <b>10.12</b>    |
| Short Term Loan (60% of working capital)       |                          |                       | 6.07            |
| Equity (40% of Working Capital)                |                          |                       | 4.05            |
| <b>D. Cash Requirements</b>                    | <b>60</b>                | <b>6</b>              | <b>4.32</b>     |
| I. Operating Cost                              |                          |                       | 34.76           |
| II. Material Inputs                            |                          |                       | 8.82            |
| III. I - II                                    |                          |                       | 25.94           |

### 5.2.4 Pay Back Period

Under this model of operation, the pay back period has been calculated to be 7.79 years.

**Table 18: Pay Back Period \*** (Investment as equity and loan)

(In million NRs)

| Year | Investment / Net Profit | Depreciation | Cost/Benefit           | Cumulative Profit |
|------|-------------------------|--------------|------------------------|-------------------|
| 0    | 30.79                   | 0            | 0                      |                   |
| 1    | -1.60                   | 0.00         | -1.60                  | -1.60             |
| 2    | 8.69                    | 0.00         | 8.69                   | 7.10              |
| 3    | 8.89                    | 0.00         | 8.89                   | 15.99             |
| 4    | 9.10                    | 0.00         | 9.10                   | 25.09             |
| 5    | 0.95                    | 0.00         | 0.95                   | 26.04             |
| 6    | 0.56                    | 0.84         | 1.40                   | 27.44             |
| 7    | 0.05                    | 1.68         | 1.73                   | 29.16             |
| 8    | -0.45                   | 2.52         | 2.07                   | 31.23             |
| 9    | -0.93                   | 3.36         | 2.43                   | 33.67             |
| 10   | -1.38                   | 4.20         | 2.82                   | 36.48             |
|      |                         |              | <b>Pay Back Period</b> | <b>7.79</b>       |

### 5.2.5 Investment Plan

The following table gives the plan for putting together funds to invest for the proposed project based on the total costs outlined in previous sections. The total project cost of NRs. 40.91 is envisaged to be invested as equity and loan. The costs for the rehabilitation will be met from equity of NRs. 15.4 million (50%) and term loan of NRs. 15.4 million (50%) as fixed capital investment. Similarly, the costs for initial working capital will be met from equity of NRs. 4.05 million (40%) and short term loan of NRs. 6.07 million (60%) as working capital investment. It has been assumed that a full year (Year 0) will be required for the completion of rehabilitation works, so investment for rehabilitation works has shown to be made only in Year 0. The investment for working capital is assumed to be made only from the beginning of Year 1, when the rehabilitation work is assumed to be completed and the operation of service will commence.

**Table 19: Investment Plan \*** (Investment as equity and loan)

| Particulars                     | Amount in millions (NRs) | Assumed Interest Rate | Maturity Period | Investment Year |
|---------------------------------|--------------------------|-----------------------|-----------------|-----------------|
| <b>Fixed Capital Investment</b> | <b>30.79</b>             |                       |                 | Year 0          |
| Term Loan                       | 15.40                    | 12%                   | 10              |                 |
| Owner's Equity                  | 15.40                    |                       |                 |                 |
| <b>Initial Working Capital</b>  | <b>10.12</b>             |                       |                 | Year 1          |
| Short Term Loan                 | 6.07                     | 12%                   | 5               |                 |
| Owner's Equity                  | 4.05                     |                       |                 |                 |
| <b>Total Investment</b>         | <b>40.91</b>             |                       |                 |                 |
| Term Loan                       | 15.40                    |                       |                 |                 |
| Short Term Loan                 | 6.07                     |                       |                 |                 |
| Total Owner's Equity            | 19.44                    |                       |                 |                 |

### 5.2.6 Projected Profit and Loss

Assuming that the average number of passengers per trip will be 80 percent of the average number of trolley bus passengers in 1999 (based on a CEMAT survey in 1999), the plan projects yearly revenue amounting to NRs. 45.62 million with average fare of NRs 6.

With annual operating costs of NRs. 32.19 million, the gross operating profit will be NRs. 13.43 million per year. The annual depreciation value will amount to NRs. 0.84 million (at the rate of 10% of cost of two new buses per year from Year 6). This will add up as the number of buses replaced increases every year. Net profit after tax will be NRs. 8.52 million in the first year of operation. The accumulated profit is projected to reach NRs. 137.09 million at the end of the 20<sup>th</sup> year.

**Table 20: Projected Profit and Loss Statement (up to Year 10) \* (Investment as equity and loan)**

(In million NRs)

| Operating year                           | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Percentage of Ave. No. of Passengers (%) | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    |
| Revenue Estimates                        | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 | 45.62 |
| Operating Cost                           | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 | 32.19 |
| Gross Operating Profit                   | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 |
| Depreciation                             | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.84  | 1.68  | 2.52  | 3.36  | 4.20  |
| Financial Costs (Interests)              | 2.58  | 2.36  | 2.11  | 1.83  | 1.52  | 1.18  | 0.99  | 0.79  | 0.55  | 0.29  |
| Profit before Tax                        | 10.86 | 11.08 | 11.32 | 11.60 | 11.91 | 11.41 | 10.76 | 10.13 | 9.52  | 8.94  |
| Corporate tax @ 21.5%                    | 2.33  | 2.38  | 2.43  | 2.49  | 2.56  | 2.45  | 2.31  | 2.18  | 2.05  | 1.92  |
| Net profit after tax                     | 8.52  | 8.69  | 8.89  | 9.10  | 9.35  | 8.96  | 8.45  | 7.95  | 7.47  | 7.02  |
| Accumulated profit                       | 8.52  | 17.22 | 26.10 | 35.21 | 44.56 | 53.52 | 61.96 | 69.91 | 77.38 | 84.40 |

**Table 21: Projected Profit and Loss Statement (Year 11 to 20) \* (Investment as equity and loan)**

(In million NRs)

| Operating year                           | 11    | 12    | 13     | 14     | 15     | 16     | 17     | 18     | 19     | 20     |
|--|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| Percentage of Ave. No. of Passengers (%) | 80    | 80    | 80     | 80     | 80     | 80     | 80     | 80     | 80     | 80     |
| Revenue Estimates                        | 45.62 | 45.62 | 45.62  | 45.62  | 45.62  | 45.62  | 45.62  | 45.62  | 45.62  | 45.62  |
| Operating Cost                           | 32.19 | 32.19 | 32.19  | 32.19  | 32.19  | 32.19  | 32.19  | 32.19  | 32.19  | 32.19  |
| Gross Operating Profit                   | 13.43 | 13.43 | 13.43  | 13.43  | 13.43  | 13.43  | 13.43  | 13.43  | 13.43  | 13.43  |
| Depreciation                             | 5.04  | 5.88  | 6.72   | 7.56   | 8.40   | 8.40   | 7.56   | 6.72   | 5.88   | 5.04   |
| Financial Costs (Interests)              | 0.00  | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Profit before Tax                        | 8.39  | 7.55  | 6.71   | 5.87   | 5.03   | 5.03   | 5.87   | 6.71   | 7.55   | 8.39   |
| Corporate tax @ 21.5%                    | 1.80  | 1.62  | 1.44   | 1.26   | 1.08   | 1.08   | 1.26   | 1.44   | 1.62   | 1.80   |
| Net profit after tax                     | 6.59  | 5.93  | 5.27   | 4.61   | 3.95   | 3.95   | 4.61   | 5.27   | 5.93   | 6.59   |
| Accumulated profit                       | 90.99 | 96.92 | 102.19 | 106.80 | 110.75 | 114.70 | 119.31 | 124.57 | 130.50 | 137.09 |

### 5.2.7 Cash Flow Projection

A total of NRs. 30.79 million will be spent prior to the operation of the trolley bus system for rehabilitation works. In the first year of operation, a working capital of NRs. 10.12 million will be produced and a gross operating profit of NRs. 13.43 million collected, of which only NRs. 16.86 million will be spent generating positive cash flow from Year 1 itself. The cumulative cash flow at the end of Year 20 is projected to be NRs. 103.02 million.

**Table 22: Cash Flow Projection (up to Year 10) \* (Investment as equity and loan)**

(In million NRs)

| Operating Year                           | Constr. | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    |
|--|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Percentage of Ave. No. of Passengers (%) |         | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    |
| <b>Cash Inflow</b>                       |         |       |       |       |       |       |       |       |       |       |       |
| Equity in fixed capital                  | 15.40   |       |       |       |       |       |       |       |       |       |       |
| Equity in working capital                |         | 4.05  |       |       |       |       |       |       |       |       |       |
| Term Loan                                | 15.40   |       |       |       |       |       |       |       |       |       |       |
| Short Term Loan                          |         | 6.07  |       |       |       |       |       |       |       |       |       |
| Gross Operating Profit                   |         | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 |
| Total Cash Inflow                        | 30.79   | 23.55 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 |
| <b>Cash Outflow</b>                      |         |       |       |       |       |       |       |       |       |       |       |
| Capital Expenditure                      | 30.79   |       |       |       |       | 8.4   | 8.4   | 8.4   | 8.4   | 8.4   | 8.4   |
| Repayment to TL and interest             |         | 2.72  | 2.72  | 2.72  | 2.72  | 2.72  | 2.72  | 2.72  | 2.72  | 2.72  | 2.72  |
| Repayment to STL and interest            |         | 1.68  | 1.68  | 1.68  | 1.68  | 1.68  | 0     | 0     | 0     | 0     | 0     |
| Working Capital                          |         | 10.12 |       |       |       |       |       |       |       |       |       |
| Corporate Tax                            |         | 2.33  | 2.38  | 2.43  | 2.49  | 2.56  | 2.45  | 2.31  | 2.18  | 2.05  | 1.92  |
| Total Cash Outflow                       | 30.79   | 16.86 | 6.79  | 6.84  | 6.90  | 15.37 | 13.58 | 13.44 | 13.30 | 13.17 | 13.05 |
| Cash Flow                                |         | 6.69  | 6.64  | 6.59  | 6.53  | -1.94 | -0.15 | -0.01 | 0.13  | 0.26  | 0.38  |
| Cumulative Cashflow                      |         | 6.69  | 13.33 | 19.92 | 26.45 | 24.51 | 24.37 | 24.36 | 24.49 | 24.75 | 25.14 |

**Table 23: Cash Flow Projection (Year 11 to 20) \* (Investment as equity and loan)**

(In million NRs)

| Operating Year                           | Constr. | 11    | 12    | 13    | 14    | 15    | 16    | 17    | 18    | 19    | 20     |
|--|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Percentage of Ave. No. of Passengers (%) |         | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80    | 80     |
| <b>Cash Inflow</b>                       |         |       |       |       |       |       |       |       |       |       |        |
| Equity in fixed capital                  | 15.40   |       |       |       |       |       |       |       |       |       |        |
| Equity in working capital                |         |       |       |       |       |       |       |       |       |       |        |
| Term Loan                                | 15.40   |       |       |       |       |       |       |       |       |       |        |
| Short Term Loan                          |         |       |       |       |       |       |       |       |       |       |        |
| Gross Operating Profit                   |         | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43  |
| Total Cash Inflow                        | 30.79   | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43 | 13.43  |
| <b>Cash Outflow</b>                      |         |       |       |       |       |       |       |       |       |       |        |
| Capital Expenditure                      | 30.79   | 8.4   | 8.4   | 8.4   | 8.4   | 8.4   |       |       |       |       |        |
| Repayment to TL and interest             |         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0      |
| Repayment to STL and interest            |         | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0      |
| Working Capital                          |         |       |       |       |       |       |       |       |       |       |        |
| Corporate Tax                            |         | 1.80  | 1.62  | 1.44  | 1.26  | 1.08  | 1.08  | 1.26  | 1.44  | 1.62  | 1.80   |
| Total Cash Outflow                       | 30.79   | 10.20 | 10.02 | 9.84  | 9.66  | 9.48  | 1.08  | 1.26  | 1.44  | 1.62  | 1.80   |
| Cash Flow                                |         | 3.23  | 3.41  | 3.59  | 3.77  | 3.95  | 12.35 | 12.17 | 11.99 | 11.81 | 11.63  |
| Cumulative Cashflow                      |         | 28.36 | 31.77 | 35.36 | 39.13 | 43.08 | 55.43 | 67.60 | 79.59 | 91.40 | 103.02 |

### 5.2.8 Financial Indicators

The financial indicators show that the trolley bus system, if operated in this model, will be profitable. For the projected operational span of 20 years, the Net Present Value (NPV) of costs and benefits at the beginning of Year 0 is NRs. 10.92 million at a 12% discount rate. The Financial Internal Rate of Return (FIRR) indicates a very good return of 22.47%. Similarly, the Benefit Cost Ratio (BCR) value is 1.60 at a 12% discount rate. Furthermore, the return on investment at the end of 1<sup>st</sup> year of operation is 17.48% and return on equity at the end of 1<sup>st</sup> year of operation is 36.48%. For calculations of NPV, present time is taken as pre-investment period, i.e. at the beginning of Year 0. Each year number indicates the time at the end of that year. For example, NRs. 30.79 million invested in Year 0 indicates the total investment made by the end of Year 0.

**Table 24: Financial Indicators\*** (Investment as equity and loan)

| (In million NRs)                                |                        |                               |               |
|---|------------------------|-------------------------------|---------------|
| Year  | Gross Operating Profit | Investment/Tax/loan repayment | Cost/Benefit  |
| 0   | 0                      | 15.40                         | (15.40)       |
| 1   | 13.43                  | 10.79                         | 2.64          |
| 2   | 13.43                  | 6.79                          | 6.64          |
| 3   | 13.43                  | 6.84                          | 6.59          |
| 4   | 13.43                  | 6.90                          | 6.53          |
| 5   | 13.43                  | 15.37                         | -1.94         |
| 6   | 13.43                  | 13.58                         | -0.15         |
| 7   | 13.43                  | 13.44                         | -0.01         |
| 8   | 13.43                  | 13.30                         | 0.13          |
| 9   | 13.43                  | 13.17                         | 0.26          |
| 10  | 13.43                  | 13.05                         | 0.38          |
| 11  | 13.43                  | 10.20                         | 3.23          |
| 12  | 13.43                  | 10.02                         | 3.41          |
| 13  | 13.43                  | 9.84                          | 3.59          |
| 14  | 13.43                  | 9.66                          | 3.77          |
| 15  | 13.43                  | 9.48                          | 3.95          |
| 16  | 13.43                  | 1.08                          | 12.35         |
| 17  | 13.43                  | 1.26                          | 12.17         |
| 18  | 13.43                  | 1.44                          | 11.99         |
| 19  | 13.43                  | 1.62                          | 11.81         |
| 20  | 13.43                  | 1.80                          | 11.63         |
| <b>NPV @ 12% Discount rate (Rs. In million)</b> |                        |                               | <b>10.92</b>  |
| <b>FIRR</b>                                     |                        |                               | <b>22.47%</b> |
| <b>Benefit/Cost Ratio @ 12% Discount Rate</b>   |                        |                               | <b>1.60</b>   |
| <b>Return on Investment @ 1st year</b>          |                        |                               | <b>17.48%</b> |
| <b>Return on Equity @ 1st year</b>              |                        |                               | <b>36.48%</b> |

## 6. Alternate Reactivation Model with New Trolley Buses

The idea of reactivating trolley bus service in this business plan has been conceptualized with the following prioritized assumptions,

- The first priority has been given to rehabilitation of a fleet of 22 trolley buses from the existing trolley buses. Necessary rehabilitation of the infrastructure will be done to reactivate the trolley bus services for the entire traction system. The spare parts necessary for the repair and maintenance will be available from the existing stock and additionally by import from China.
- As, these trolley buses are very old, provisions have been made to replace two old trolley buses by new trolley buses starting from the fifth year of operation.
- While replacing the old buses, priority has been given to locally assembled trolley buses with imported chassis from India and electro-mechanical accessories from China.

As such, the reactivation model mentioned in the business plan have been put forward with the assumption that the existing fleet of trolley buses can be rehabilitated with existing and imported spare parts, resulting in heavy reliance on reconditioned buses for the successful reactivation of the system.

However, the limitations to this reactivation model are,

- These trolley buses were imported from China a long time ago. The technology of these buses is very old and could be obsolete.
- In such situation, it is very likely that the spare parts for the rehabilitation of the trolley buses may not be available as off-the-shelf items. This would lead to a serious problem in repairing these buses to make them operational again.
- As the business plan heavily depends on rehabilitated buses to start operation and two buses per year get replaced only from the 5<sup>th</sup> year of operation, inability to rehabilitate these buses will lead to dysfunction of the proposed business plan right from the beginning.
- Moreover, importing custom made spare parts can increase the rehabilitation costs hugely and also become a barrier to the sustainability of the system.

Hence, keeping in mind that such situation can prevail with unavailability of spare parts, another model has also been proposed where the reactivation of the trolley bus services will be carried out with a completely new fleet of trolley buses. However, this model requires strong support from the government, in terms of approaching the donor countries for funds to import new trolley buses.

Following are the general assumptions for this model,

- 22 new trolley buses will be brought into operation from year 1.
- Out of these 22 trolley buses the business entity will purchase 4 buses at the rate of NRs. 5.5 million per bus at full payment prior to the commencement of operation.

- The remaining 18 buses will be provided, in grant, to HMG by the donor country, and the HMG will lease these 18 new buses to the business entity with an annual rent of 5% of purchase cost of 18 buses (depreciation will be deducted annually to determine the rent amount).
- The new trolley buses will be depreciated at an annual rate of 10%. After 60% depreciation the salvage value of the buses will be attained. That is, from the 7<sup>th</sup> year there will be no further depreciation of these buses.
- After the buses have reached their salvage value, i.e. from 7<sup>th</sup> year of operation, the business entity will purchase the remaining 18 buses from the HMG in installment basis at 10% discount rate within 14 consecutive years.
- All other financial and operational assumptions made in the previous reactivation model of the business plan will remain the same.

The major differences between the previous model and this alternate reactivation model are that,

- Instead of investing in reconditioning of existing trolley buses, it is proposed that four new trolley buses are purchased. *This slightly increases upfront investment.*
- Instead of paying lease rent for the 22 reconditioned buses, it is proposed to pay lease rent for the 18 new trolley buses. *This slightly increases lease rent in the initial years and subsequently lowers ROI, ROE and profits calculated at the end of year 1.*
- Instead of purchasing 2 new locally assembled trolley buses from 5<sup>th</sup> year of operation to replace 2 old buses every year, it is proposed to buy the 18 buses from the government at their salvage value (40% of purchase cost; 60% depreciated by the end of year 6) starting from year 7 through installment payments calculated at 10% discount rate over the remaining period of the operational span i.e. 14 years. *This reduces total expense on trolley bus purchase.*

The number of trolley buses to be purchased at the beginning of operation has been quantified such that the amount of investment to be made at the beginning doesn't differ outrageously with that of previous model. This alternate model has tried to keep most of the financial indicators (importantly the pay back period and FIRR) close to the previous respective investment scenarios so that the financial presentation of the business plan is not significantly altered. However, with a slight increase in the total investment amount and a higher amount of lease rent of trolley buses to be paid in the initial years, the Return on Investment and Equity and profits calculated at the end of year 1 is less than what it was in the previous. But the cash flows, all throughout the operational span of 20 years, are positive with FIRR almost equal to the previous scenarios.

Similar to the previous model the scenarios of making total investment have been analyzed a) as total equity and b) as 50% equity and 50% loan.

Comparative table of financial analysis between old & new trolley bus based models (Total Equity Scenario)

| SN | Description                                 | Unit           | (Old Trolley Buses) Amount | (New Trolley Buses) Amount |
|----|---|----------------|----------------------------|----------------------------|
| 1  | Investment Structure                        | NRs. (Million) | 40.05                      | 44.75                      |
|    | <i>Fixed Capital</i>                        |                | 30.79                      | 36.06                      |
|    | <i>Working Capital</i>                      |                | 9.26                       | 8.69                       |
| 2  | Annual Operation Costs                      | NRs. (Million) | 32.19                      | 30.48                      |
|    | <i>Fixed Costs</i>                          |                | 13.93                      | 12.22                      |
|    | <i>Variable Costs</i>                       |                | 18.26                      | 18.26                      |
| 3  | Revenue @ 80% avg. passenger capacity       | NRs. (Million) | 45.62                      | 45.62                      |
| 4  | Profit before tax                           | NRs. (Million) | 13.43                      | 7.99                       |
| 5  | Profit after tax                            | NRs. (Million) | 10.54                      | 6.27                       |
| 6  | Payback period                              | Years          | 3.80                       | 4.85                       |
| 7  | NPV @ 12% discount rate                     | NRs. (Million) | 10.38                      | 12.50                      |
| 8  | FIRR  | %              | 17.67                      | 17.61                      |
| 9  | BCR @ 12% discount rate                     | -              | 1.23                       | 1.24                       |
| 10 | Return on investment @ 1 <sup>st</sup> year | %              | 22.02                      | 11.64                      |
| 11 | Return on Equity @ 1 <sup>st</sup> year     | %              | 22.02                      | 11.64                      |

Comparative table of financial analysis between old & new trolley bus based models (50% Equity, 50% Loan Scenario)

| SN | Description                                 | Unit           | (Old Trolley Buses) Amount | (New Trolley Buses) Amount |
|----|---|----------------|----------------------------|----------------------------|
| 1  | Investment Structure                        | NRs. (Million) | 40.91                      | 45.59                      |
|    | <i>Fixed Capital</i>                        |                | 30.79                      | 36.06                      |
|    | <i>Working Capital</i>                      |                | 10.12                      | 9.53                       |
| 2  | Annual Operation Costs                      | NRs. (Million) | 34.76                      | 33.01                      |
|    | <i>Fixed Costs</i>                          |                | 15.77                      | 14.06                      |
|    | <i>Variable Costs</i>                       |                | 18.99                      | 18.95                      |
| 3  | Revenue @ 80% avg. passenger capacity       | NRs. (Million) | 45.62                      | 45.62                      |
| 4  | Profit before tax                           | NRs. (Million) | 10.86                      | 5.14                       |
| 5  | Profit after tax                            | NRs. (Million) | 8.52                       | 4.04                       |
| 6  | Payback period                              | Years          | 7.79                       | 5.91                       |
| 7  | NPV @ 12% discount rate                     | NRs. (Million) | 10.92                      | 15.42                      |
| 8  | FIRR  | %              | 22.47                      | 23.24                      |
| 9  | BCR @ 12% discount rate                     | -              | 1.60                       | 1.75                       |
| 10 | Return on investment @ 1 <sup>st</sup> year | %              | 17.48                      | 7.37                       |
| 11 | Return on Equity @ 1 <sup>st</sup> year     | %              | 36.48                      | 15.28                      |

## **7. Risk Sensitivity Analysis**

### **7.1 Increase in Electricity Tariff**

The government's 2003 Budget Speech stated that a concessionary electricity tariff rate will be provided for electric vehicles. According to NEA sources in the recent context, even though the electricity tariff is bound to increase in the near future for general consumers, the EV tariff is very unlikely to increase. In contrary, it is more likely to drop. Therefore, it is safe to make a financial analysis taking into account the current electricity tariff for EV operations, which will be a conservative figure at the time of implementation. As the costs associated with electricity consumption comprises the major part of the material input costs, the decrease in electricity tariff for EVs can cause substantial improvement in the profitability of the trolley bus system. The increase in costs of other materials, such as lubricants and fossil fuels will not affect the financial strength of the trolley bus system as consumption of these is very minimal. On the contrary, this can actually improve its competitiveness with other fossil fuel burning vehicles that may have to hike passenger fares due to increased fuel prices. This would place trolley bus services at a unique advantage. The trolley bus services could increase the passenger fare along with the rest of the transportation services and increase revenue generation without experiencing the increase in operational cost. Alternatively, the trolley would not increase the passenger fares, making it more competitive and therefore an attractive cheaper alternative for passengers. For the equity investment scenario, the increase in electricity tariff up to 16% will still return 13.99% FIRR and for equity-loan investment scenario, the increase in electricity tariff up to 21% will still return 13.77% FIRR with discounted BCR above 1 in both cases. This reflects the business plan's safety even with an increase in the electricity tariff. The degree of safety is further improved, as an EV electricity tariff hike is very unlikely. (See Annex 1(a) and 2(a) for details)

### **7.2 Load Shedding Possibilities**

Load shedding usually occurs during peak electricity demand hours (i.e. usually in the evening); the peak operation time of trolley buses are during office hours and in the daytime and not within the peak electricity demand hours. Therefore, even though load shedding may occur, it will not hamper the trolley bus operations substantially. Furthermore, load shedding is usually implemented in different areas of Kathmandu Valley on different days. The trolley bus over head network is energized from two different NEA sources at two traction stations, there is a very rare possibility of load shedding occurring on both sources simultaneously. For these two reasons load shedding cannot be taken as a serious potential threat in the smooth operation of the trolley bus service.

### **7.3 Capacity Utilization**

In the operation model followed in this business plan, 100 percent capacity utilization of the trolley bus system infers to:

- a) Operation of 22 rehabilitated buses,
- b) Each bus doing 8 round trips per day (calculated according to total operation time and time required per trip),
- c) Buses operating 300 days per year (incidental closures, electricity problems, etc.),

- d) 180 passengers commuting on the bus per round trip (as per average passengers traveling per trip before the closure in December 2001),
- e) Average fare per passenger taken as NRs. 6, which is very conservative as the actual fare on the route varies from (NRs. 5 to 9) according to the distance traveled.

Three cases of risk sensitivity analysis involving capacity utilization can be made.

***Case I: Number of passengers traveling per trip***

The 2002 CEMAT study showed that, on average, 180 passengers traveled by trolley buses per round trip before the closure of services in December 2001. The financial analysis in this business plan has taken 180 passengers per trip as the full passenger capacity. With 180 passengers commuting per trip, the annual revenue (at 100% capacity utilization as mentioned above) will be NRs. 57.02 million, giving 35.01% (loan scenario) and 40.71% (equity scenario) return on total investment at the end of year one itself. However, to make the financial scenario more conservative and safe, only 80% of the average number of passengers per trip, i.e. 144 passengers traveling per trip, has been accounted to make financial calculations. Even at this rate, the annual revenue will be NRs.45.62 million, with 17.48% (loan scenario) and 22.02% (equity scenario) of total investment returning by the end of Year 1.

***Case II: Number of operating days per year***

The business plan has accounted that the trolley buses will operate 300 days a year. This indicates that trolley buses will not operate for 20% of days a year (i.e. 65 days) which is a highly unrealistic and conservative assumption as any business entity will try its best to operate trolley services throughout the year. Even the assumption that the trolley buses will not operate for 10% of days a year (35 days) will be conservative. With this assumption, buses will be operational for 330 days a year, which will increase the annual revenue by NRs. 4.56 million. This also illustrates that the business plan has been prepared with conservative assumptions with ample scope for improving the revenues and thus the profitability.

***Case III: Bus fare per passenger***

Average bus fare per passenger traveling on a trolley bus along the proposed route has been taken as NRs. 6 for the financial analysis in the business plan. A recent survey conducted to acknowledge the average fare being charged by diesel buses along the route (Ratna Park to Suryabinayak) has revealed a range of NRs. 5 to 9, depending on the distance traveled. If normal distribution in distances traveled by passengers was to be assumed, then the average fare should be NRs. 7. However, to be on the safe side, if we take a weighted average by assuming 80% of passengers paying fares equal to NRs 5 & 6 and 20% of passengers paying fare equal to NRs. 7 – 9, the average fare should be NRs. 6.5. This indicates that NRs. 6.5 would still be a very conservative average fare. With this increase to the average bus fare per passenger, the annual revenue increases by almost NRs. 4 million.

#### **7.4 Investment Pattern**

Investment can be made as equity alone or as a combination of equity and loan borrowed from financial institutions. The first scenario suggests making investments as equity only as the amount to be invested is relatively small and the FIRR (17.67%) is very good. The interest rate provided for savings in banks is considerably low, which can prompt the investors to make the entire investment as equity.

Obviously, if the investment is made as a mixture of equity and loan, the FIRR improves, but the overall investment amount and annual operating cost increases because of loan and interest repayment, which ultimately increases the payback period.

#### **7.5 Trolley Bus rehabilitation costs**

After the closure of trolley bus services in December 2001, CEMAT Ltd. undertook a study to estimate the cost of reactivating the service with different institutional setups. As a process, they also estimated the cost of rehabilitating the existing trolley buses. The rehabilitation costs of these buses have been calculated by examining each bus individually. The study reveals the status of different components of each bus. So, as the costs of rehabilitating these buses have been calculated in depth, there is a very low chance of estimated costs misleading the overall financial analysis. Moreover, even if the trolley bus rehabilitation costs are inflated by 30%, the financial indicators would remain attractive. Moreover, even if the trolley bus rehabilitation costs are inflated by 50%, the financial indicators will still remain very good with the FIRR being 15.49% and 18.41% in equity only and equity-loan investment scenarios respectively. (See Annex 1(b) and 2(b) for details).

#### **7.6 Purchase of New Buses**

The business plan has accounted for the purchase of two new buses to replace the old buses from Year 5 to 15. The plan has also explored the possibility of assembling the buses locally with chassis imported from India and electromechanical accessories from China. According to the CEMAT study, the cost of new trolley buses imported from China is estimated at NRs. 5.5 million. CEMAT estimates locally assembled trolley buses in the above mentioned process to cost NRs. 2.5 million. However, a similar estimate recently carried out by Winrock International/Nepal estimates a cost of NRs. 4.2 million. To be on the safe side, the business plan has considered the conservative number. Furthermore, the Industrial Enterprises Act 2049 has declared manufacturing industries dealing with energy efficiency and conservation and pollution abatement as "Nationally Prioritized" industries, and is entitled up to 50% rebate on income tax for 7 years from the date of production. Assembly of trolley buses should be given these facilities as an incentive.

Dialogue with Trolley Bus Unit technicians has revealed that the existing manpower is capable of assembling all electromechanical parts of the bus. If appropriate chassis are imported from India and electromechanical components are imported from China, these technicians can assemble the electromechanical parts and the body can be

manufactured locally. This prospect has enabled the possibility of purchasing locally assembled trolley buses. This would decrease the trolley bus cost by NRs. 1.3 million even at a conservative estimate. Even if the trolley buses are to be imported from China at the rate of NRs. 5.5 million per bus from the 5th year of operation, the FIRR will still be good, revealing good returns.

In case of total equity investment, since the return on investment is above 20% at the end of Year 1, the cumulative cash flow at the end of 1<sup>st</sup> year itself is good enough to procure two buses a year. This will however increase the pay back period of equity investment to over 10 years and the benefit cost ratio will fall below 1. In case of equity-loan mixed investment, since the annual cash flow is lower due to loan repayment, purchase of new trolley buses in the initial years can cause serious financial problems with low FIRR and a lengthy pay back period. With good repair and maintenance, it is safe to assume that the existing buses can operate for at least the initial four years. This assumption makes investments safe with better financial status.

### **7.7 Traffic congestion in the proposed route**

The traffic congestion in the Kathmandu Suryabinayak route is a common problem for all vehicles. This is a limitation for the business plan, as it is out of any business entity's control. Advocating for better policies to reduce congestion must be done so that HMG/N will take some steps towards alleviating the problem. Widening of the road to reduce congestion is not possible within 10 years. Moreover, the widening of the road will cause the trolley bus infrastructure to be dismantled and reassembled, which will increase the costs further. The cost of widening the road must also include the cost of rehabilitating the trolley bus overhead infrastructure. A good option will be to prioritize vehicles operating on the route based on the registration date and the environmental, economical and quality of service benefits provided by vehicles. Since trolley buses can currently operate only on this route, they must be given the highest priority for operation. Newly added vehicles that have the option of operating in other routes can be scaled down. Also acknowledging the future increase in traffic due to Banepa Bardibash highway, a bypass route for vehicles crossing the valley boundaries is recommended.

### **7.8 Competition with other vehicles**

The competition with other vehicles on the route is obvious. However, it must be noted that the number of commuters has also increased correspondingly along with the increase in the number of vehicles operating on the route. Here again, competition between trolley buses and other vehicles can be reduced to some extent by prioritizing trolleys. Since trolley buses have been operating along the route for 30 years and are currently able to operate on that route alone, they should be given more priority over other newer vehicles. Trolley buses should also be given a higher priority as they are zero emission vehicles and provide both economical and environmental benefits. Taking all these aspects into consideration, HMG/N should take steps to prioritize trolley buses on the route by restricting operation of new and polluting vehicles. This will reduce the competition with other vehicles substantially. The comparatively low fares ( as a result of reduced electricity tariff for EVs while gas prices are gradually increasing) and higher quality service (environmental and health benefits) offered by

trolley buses to commuters is also expected to reduce competition from other vehicles to some extent.

### **7.9 Total Rehabilitation Costs**

The estimated cost for rehabilitation works prior to the commencement of operation is NRs. 30.79 million. This is proposed to be invested in Year 1 as 100% equity in equity investment scenario and as 50% loan and 50% equity in equity-loan investment scenario. As the cost of rehabilitation works is susceptible to change with market price variations, risk analysis has been performed to assess the extent of safety. For equity investment scenario, 22% increase in costs will still give 13.96% FIRR with discounted BCR above 1. Similarly, for equity-loan investment scenario, 30% increase in costs will still give 14.10% FIRR with discounted BCR above 1. This shows that the business venture is safe even with a substantial increase in rehabilitation work costs. (See Annex 1(c) and 2 (c) for details).

### **7.10 Operating Costs**

As operating costs also play a vital role in guiding a business venture towards profitability, it becomes essential to assess the safety limits of operating costs to ensure the profitability of the venture. In case of the proposed capacity utilization, the safety margin hovers around a 4% increase in operating costs in both investment scenarios with a FIRR close to 14%.

It has to be accounted for here that the number of days the trolley buses operate in a year has been assumed to be 300 in the proposed capacity utilization. It has already been stated in the capacity utilization section that this assumption is very conservative. So, if we assume that buses operate for 340 days a year, the operating costs can be increased up to 21% in both investment scenarios with FIRR around 14%. This shows that, even if all trolley buses are dysfunctional for 25 days a year, the business venture can still be profitable with 21% increase in annual operating costs.

Two major areas of operating costs involve cost of spare parts and direct labor costs, both of which are variable. The cost inflation in these areas can affect the business venture's profitability, so the degree of safety must be assessed. (See Annex 1(d) and 2(d) for details).

#### **a) Spare Part costs**

Risk sensitivity analysis reveals that the business venture will remain profitable even when the cost of spare parts are inflated by 30% in case of the equity investment scenario with FIRR standing at 14.87%, and by 50% in the equity-loan investment scenario with FIRR standing strong at 14.07%. In both cases the discounted BCR remains above 1.

#### **b) Direct Labor costs**

The FIRR remains at 14.01% for the equity investment scenario and 13.70% for equity-loan investment scenario, even when the costs associated with direct labor is inflated by

30%. Even with very conservative capacity utilization assumptions made for the financial analysis, the margin of safety here is quite substantial.

### 7.11 Revenue Collection

The amount of revenue collected is the most sensitive part of all business ventures. Here also, this part is vitally responsible for the profitability of the system. Under the proposed capacity utilization, the revenue collection can only drop safely by 3% in equity investment scenario and by 3.5% in the equity-loan investment scenario.

But at this stage, where revenue collection is very sensitive to the profitability of the system, we must recapitulate the conservative assumptions made in the proposed capacity utilization. Firstly, the trolley buses are assumed to operate only 300 days a year. Secondly, the average passenger fare is taken to be NRs. 6 only. Both these assumptions are excessively conservative. Assuming that the buses will not operate for 25 days a year i.e. operates for 340 days a year, then the percentage by which the revenue collection can safely drop will soar up to 14% for equity investment scenario and 15% for equity-loan investment scenario with FIRR values around 14%. Adding to this, if the average passenger fare is taken to be NRs. 6.5 (which is the weighted average at a conservative estimate) the safe revenue drop percentage further hikes to 20% for equity investment scenario and 21.5% for equity-loan investment scenario, again with FIRR close to 14%.

While the drop in revenue collection is very sensitive to assumption of utilizing the current capacity, these assumptions are excessively conservative and the revised aforementioned assumptions for operating days and average passenger fare seem to be more realistic with the real-time practices. This is expected to build confidence in the investors that even the drop in revenue collection by 20% does not hamper the profitability of the business venture. (See Annex 1(e) and 2(e) for details).

### 7.12 Possibilities of Trading Carbon Offset by Trolley Bus operation

The Clean Development Mechanism (CDM) is a mechanism within the Kyoto Protocol that allows industrialized Annex I countries to implement projects that reduce emissions in non-Annex I countries (developing countries) and get credits for meeting their commitments to reduce emissions. Trolley buses are a clean mode of transportation. Therefore, the carbon offset by trolley bus services can be traded in the global market to obtain additional funds. The operation of trolley buses will replace the diesel buses that emit polluting gases like carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). These gases are harmful to the environment. Operation of trolley buses reduces consumption of fossil fuels a) by displacing operation of an equivalent number of diesel buses and b) by reducing the trips made by fossil fuel transportation from the Nepal-India border to Kathmandu.

Even when we take into account only the three major polluting emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, the operation of 22 trolley buses commuting 62500 km per year per bus (26 km per trip, 8 trips per day, 300 days a year) can offset 1467.76 tons of CO<sub>2</sub> equivalent annually. This means at the end of the project span (20 years), with the same number of buses plying along the same 26 km route, the total CO<sub>2</sub> equivalent offset will be 29355.16 tons. Calculations on carbon offset are based on assumptions made by the PREGA report compiled by WI Nepal.

If this amount can be traded in the international market through CDM and other possible mechanisms even at the rate of US\$ 10 per ton of CO<sub>2</sub>eq. offset, US\$ 14677.60 (NRs. 1.08 million @ 1USD = 73.24 NRs.) can be collected to the benefit of the trolley bus. This ultimately adds to the profitability of the system and will also earn an international tag of being environment friendly. This will enable the collection of approximately NRs. 20 million over the project span.

## **8. Recommendations for HMG/N**

It is recommended that His majesty's Government of Nepal (HMG/N) should take the following initiatives for the sustainable promotion of trolley buses and other EV industries.

### **a) Prioritization of Trolley buses**

- Trolley buses have been operating along the Kathmandu Suryabinayak route for the past 30 years. On the basis of 'first come first serve' rule, trolley buses get the highest priority to operate on the route.
- Trolley buses are zero emission vehicles. They are beneficial to the environment and contribute in reducing air pollution related health hazards. This means that the promotion of EVs will help to reduce Kathmandu's air pollution problem and better related health and economical aspects.
- Tourists prefer clean vehicles to get to tourist places in Bhaktapur.
- Trolley buses use indigenous hydroelectricity as fuel. This reduces dependency on polluting fossil fuel imports and also makes transportation cheaper and more dependable.

### **b) Widening of roads**

- Roads along the trolley bus route should be widened to accommodate the number of vehicles plying to reduce congestion and traffic jams.
- The cost of restructuring the trolley bus overhead infrastructure should be included while widening the road.

### **c) Decrease in electricity tariff for EVs**

- Even though the government has been positive about giving electricity tariff concessions for EV operation, further decrease in electricity tariff is recommended to promote the EV industry and boost the profitability of trolley bus operation.

### **d) Expansion of trolley bus routes**

- The government should play a vital role in attracting donors to build infrastructures for the expansion of trolley buses in various routes of Kathmandu and Nepal. This will make the transportation sector more dependable, sustainable and environment friendly.

### **e) Trolley Industry income tax rebate**

- Industrial Enterprises Act 2049 has declared manufacturing industries dealing with energy efficiency and conservation and pollution abatement as "Nationally Prioritized" industries, entitled up to 50% rebate on income tax for 7 years from the date of production. Assembly of trolley buses should be given these facilities as an incentive.

### **f) Better policies to reduce road congestions**

- The Government should take steps to decrease congestion on the proposed route by controlling route permits. Policies must be developed to give priority of route permits to cleaner vehicles. Vehicles that have obtained route permits at latter dates and are also responsible for increasing the congestion should be displaced to other routes. Issuing of new route permits along the route must be suspended except for cleaner vehicles. Traffic flow must be improved by imparting regulations that discourage haphazard stoppages to collect passengers. Collection of passengers must be allowed only at stops with adequate space for stoppage.

**g) Alternative bypass highway**

- Considering the future increase in traffic that cannot be accommodated by the present capacity of roads due to operation of Banepa-Bardibash highway, construction of an alternate route (highway) that connects Kathmandu with Suryabinak is recommended. All vehicles crossing the valley must use this route. This will decrease the unnecessary traffic congestion along the present route due to out-of-valley transiting vehicles (mostly big diesel buses), ease traffic flow and ultimately promote transit vehicles plying between Kathmandu and Bhaktapur.

## **9. Recommended Future Activities**

### **9.1 Discussion with Key Stakeholders**

After the business plan is finalized, a discussion with the current trolley bus system stakeholders should be carried out. This discussion should center on the official acknowledgement and approval of the business plan and structuring and planning of the subsequent steps in forming a public private partnership entity for the rehabilitation and future operation and management of the trolley bus system.

### **9.2 Discussion with potential private parties**

A meeting must be organized with interested potential private investors to present and discuss the business plan.

### **9.3 Preparation of bidding document and agreement papers**

After discussions with private investors, the process of preparing for the bidding of investments to be made by the private investors must be started. Necessary setups and announcements must be made through different media.

### **9.4 Bidding process**

After the announcements are made, bids will be received from interested investors. Then through a transparent process, the private investors must be selected according to the criteria fixed for the bidding process and the amount proposed.

### **9.5 Transfer of responsibilities**

After the bidding process is completed, investors selected and necessary funds collected, the process of selecting the board of directors of the new public private partnership entity and establishment of the professional management team must be initiated. Then the responsibilities should be transferred to the directors based on hierarchy and responsibility of rehabilitation, operation and management works by the professional management team.

## 10. Conclusion

The problem of air pollution exacerbated by fossil fuel burning vehicles has called for an urgent need to introduce cleaner vehicles in the Kathmandu Valley. A good initiative of operating the trolley bus service from Tripureshwor to Suryabinayak, which had been contributing for cleaner air quality for over 20 years, was shut down due to inefficient management and constant political interference, resulting in heavy losses. In retrospection, lack of good management, overstaffing, political interference, lack of business promotion strategies, lack of good revenue generation schemes, lack of monitoring, inadequate maintenance, etc. have contributed to the demise of the once highly profitable trolley bus system.

The financial analysis shows that the complete reactivation of this clean transport system under a public private partnership venture under an efficient management will be financially sustainable. Presently, rehabilitation of some dislodged infrastructure and vehicles can enable immediate operation of 22 trolley buses along the route. For the projected operational span of 20 years, in case of total equity investment scenario, the financial analysis has projected FIRR, BCR, payback period and NPV to be 17.67%, 1.23, 3.80 years and NRs. 10.38 million respectively. In case of loan and equity investment scenario, the FIRR has been projected to be 22.47%, BCR 1.60, payback period to be 7.79 years and NPV to be NRs. 10.92 million. All these indicate a viable proposition that would be very sound and highly profitable.

In conclusion, reactivation of the Tripureshwor–Suryabinayak electric trolley bus system will yield definite environmental and financial benefits. A larger role of electric trolley buses will reduce the reliance on imported oil and thus help the national reserves. If managed well this could be a profitable venture for private sector investors as well. A successful public private partnership venture in public transportation will be a model that can be replicated in other areas and cities in Nepal. Hence, a successful reactivation of the Tripureshwor – Suryabinayak electric trolley bus system would contribute towards larger and more efficient urban mass transit systems in Kathmandu and other cities. This would help in the overall development and improvement of a clean public transportation system in Kathmandu, and other cities in Nepal.

## Annex

### 1. Risk Sensitivity Analysis Details (Equity Investment Scenario)

#### a) Electricity Tariff

|        | Electricity tariff per unit (NRs.) |          |          |          |
|--------|------------------------------------|----------|----------|----------|
|        | Current                            | 10% incr | 20% incr | 16% incr |
| Amount | 4.3                                | 4.73     | 5.16     | 4.99     |
| FIRR   | 17.67%                             | 15.37%   | 13.07%   | 13.99%   |
| PB P   | 3.80                               | 4.31     | 6.84     | 5.65     |
| BCR    | 1.23                               | 1.09     | 0.96     | 1.01     |
| NPV    | 10.38                              | 6.17     | 1.95     | 3.64     |
| RoI    | 22.02%                             | 20.67%   | 19.34%   | 19.87%   |
| RoE    | 22.02%                             | 20.67%   | 19.34%   | 19.87%   |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

#### b) Trolley Bus Rehabilitation Costs

|        | Cost of bus rehabilitation (Mil. NRs) |          |          |          |
|--------|---------------------------------------|----------|----------|----------|
|        | Current                               | 10% incr | 20% incr | 50% incr |
| Amount | 7.33                                  | 8.06     | 8.79     | 11.00    |
| FIRR   | 17.67%                                | 17.19%   | 16.74%   | 15.49%   |
| PB P   | 3.80                                  | 3.87     | 3.94     | 4.72     |
| BCR    | 1.23                                  | 1.20     | 1.17     | 1.10     |
| NPV    | 10.38                                 | 9.73     | 9.07     | 7.11     |
| RoI    | 22.02%                                | 21.60%   | 21.20%   | 20.09%   |
| RoE    | 22.02%                                | 21.60%   | 21.20%   | 20.09%   |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

#### c) Total Rehabilitation Costs

|        | Total Rehab cost p.a. in mil. NRs. |          |          |          |
|--------|------------------------------------|----------|----------|----------|
|        | Current                            | 10% incr | 20% incr | 22% incr |
| Amount | 30.79                              | 33.87    | 36.95    | 37.56    |
| FIRR   | 17.67%                             | 15.81%   | 14.24%   | 13.96%   |
| PB P   | 3.80                               | 4.45     | 5.82     | 6.07     |
| BCR    | 1.23                               | 1.12     | 1.03     | 1.01     |
| NPV    | 10.38                              | 7.63     | 4.88     | 4.33     |
| RoI    | 22.02%                             | 20.37%   | 18.96%   | 18.70%   |
| RoE    | 22.02%                             | 20.37%   | 18.96%   | 18.70%   |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

d) Operating Costs

| <b>Operating Costs p.a. in mil. NRs.</b> |         |           |           |           |
|--|---------|-----------|-----------|-----------|
|  | Current | 2.5% incr | 3.5% incr | 4.5% incr |
| Amount                                   | 32.19   | 32.99     | 33.32     | 33.64     |
| FIRR                                     | 17.67%  | 15.24%    | 14.27%    | 13.31%    |
| PB P                                     | 3.80    | 4.45      | 5.37      | 6.52      |
| BCR                                      | 1.23    | 1.09      | 1.03      | 0.97      |
| NPV                                      | 10.38   | 5.96      | 4.18      | 2.41      |
| RoI                                      | 22.02%  | 20.58%    | 20.01%    | 19.45%    |
| RoE                                      | 22.02%  | 20.58%    | 20.01%    | 19.45%    |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

| <b>Operating Costs p.a. in mil. NRs.</b> |         |          |          |            |
|--|---------|----------|----------|------------|
|  | Current | 10% incr | 20% incr | 21.5% incr |
| Amount                                   | 32.19   | 35.41    | 38.63    | 39.11      |
| FIRR                                     | 34.35%  | 24.90%   | 15.55%   | 14.16%     |
| PB P                                     | 2.61    | 3.22     | 4.61     | 5.80       |
| BCR                                      | 2.26    | 1.69     | 1.11     | 1.03       |
| NPV                                      | 42.23   | 24.52    | 6.81     | 4.16       |
| RoI                                      | 31.99%  | 26.13%   | 20.52%   | 19.70%     |
| RoE                                      | 31.99%  | 26.13%   | 20.52%   | 19.70%     |

Assuming trolley bus operating days a year to be 340 and average passenger fare equal to NRs. 6.

| <b>Spare Parts p.a. in mil. NRs.</b> |         |          |          |          |
|--------------------------------------|---------|----------|----------|----------|
|                                      | Current | 10% incr | 20% incr | 30% incr |
| Amount                               | 3.09    | 3.40     | 3.71     | 4.02     |
| FIRR                                 | 17.67%  | 16.73%   | 15.80%   | 14.87%   |
| PB P                                 | 3.80    | 3.90     | 4.02     | 4.78     |
| BCR                                  | 1.23    | 1.17     | 1.12     | 1.06     |
| NPV                                  | 10.38   | 8.68     | 6.98     | 5.28     |
| RoI                                  | 22.02%  | 21.46%   | 20.91%   | 20.37%   |
| RoE                                  | 22.02%  | 21.46%   | 20.91%   | 20.37%   |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

| <b>Direct Labour p.a. in mil. NRs.</b> |         |          |          |          |
|--|---------|----------|----------|----------|
|  | Current | 10% incr | 20% incr | 30% incr |
| Amount                                 | 4.05    | 4.455    | 4.86     | 5.265    |
| FIRR                                   | 17.67%  | 16.44%   | 15.23%   | 14.01%   |
| PB P                                   | 3.80    | 3.93     | 4.46     | 5.66     |
| BCR                                    | 1.23    | 1.16     | 1.09     | 1.01     |
| NPV                                    | 10.38   | 8.15     | 5.93     | 3.70     |
| RoI                                    | 22.02%  | 21.29%   | 20.57%   | 19.86%   |
| RoE                                    | 22.02%  | 21.29%   | 20.57%   | 19.86%   |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

e) Revenue Collection

| <b>Revenue collected p.a. in mil. NRs.</b> |         |           |         |           |
|--|---------|-----------|---------|-----------|
|  | Current | 2.5% decr | 3% decr | 3.5% decr |
| Amount                                     | 45.62   | 44.48     | 43.34   | 44.02     |
| FIRR                                       | 17.67%  | 14.42%    | 13.77%  | 13.11%    |
| PB P                                       | 3.80    | 5.15      | 5.89    | 6.75      |
| BCR  | 1.23    | 1.04      | 1.00    | 0.96      |
| NPV  | 10.38   | 4.41      | 3.22    | 2.02      |
| RoI  | 22.02%  | 20.15%    | 19.77%  | 19.40%    |
| RoE  | 22.02%  | 20.15%    | 19.77%  | 19.40%    |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

| <b>Revenue collected p.a. in mil. NRs.</b> |         |          |            |          |
|--|---------|----------|------------|----------|
|  | Current | 10% decr | 12.5% decr | 14% decr |
| Amount                                     | 51.7    | 46.53    | 45.24      | 42.2     |
| FIRR                                       | 34.35%  | 20.24%   | 16.59%     | 14.38%   |
| PB P                                       | 2.61    | 3.56     | 3.91       | 5.19     |
| BCR  | 2.26    | 1.39     | 1.17       | 1.03     |
| NPV  | 42.23   | 15.16    | 8.39       | 4.33     |
| RoI  | 31.99%  | 23.51%   | 21.39%     | 20.12%   |
| RoE  | 31.99%  | 23.51%   | 21.39%     | 20.12%   |

Assuming trolley bus operating days a year to be 340 and average passenger fare equal to NRs. 6.

| <b>Revenue collected p.a. in mil. NRs.</b> |         |          |          |          |
|--|---------|----------|----------|----------|
|  | Current | 10% decr | 15% decr | 20% decr |
| Amount                                     | 56.01   | 50.41    | 47.61    | 44.81    |
| FIRR                                       | 45.58%  | 30.89%   | 23.24%   | 15.36%   |
| PB P                                       | 2.14    | 2.80     | 3.31     | 4.28     |
| BCR  | 3.00    | 2.04     | 1.57     | 1.09     |
| NPV  | 64.78   | 35.46    | 20.80    | 6.14     |
| RoI  | 39.05%  | 29.87%   | 25.28%   | 20.69%   |
| RoE  | 39.05%  | 29.87%   | 25.28%   | 20.69%   |

Assuming trolley bus operating days a year to be 340 and average passenger fare equal to NRs. 6.5.

## 2. Risk Sensitivity Analysis Details (Equity-Loan Investment Scenario)

### a) Electricity Tariff

|        | <b>Electricity tariff p.u.*</b> |          |          |          |
|--------|---------------------------------|----------|----------|----------|
|        | Current                         | 10% incr | 20% incr | 21% incr |
| Amount | 4.3                             | 4.73     | 5.16     | 5.20     |
| FIRR   | 22.47%                          | 18.12%   | 14.15%   | 13.77%   |
| PB P   | 7.79                            | 10.24    | 13.17    | 13.50    |
| BCR    | 1.60                            | 1.33     | 1.05     | 1.03     |
| NPV    | 10.92                           | 6.70     | 2.48     | 2.06     |
| RoI    | 17.48%                          | 16.16%   | 14.84%   | 14.71%   |
| RoE    | 36.48%                          | 33.73%   | 31.00%   | 30.72%   |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

### b) Trolley Bus Rehabilitation Costs

|        | <b>Cost of bus rehabilitation (Mil. Rs)</b> |          |          |          |
|--------|---|----------|----------|----------|
|        | Current                                     | 10% incr | 20% incr | 50% incr |
| Amount | 7.33  | 8.07     | 8.8      | 11.00    |
| FIRR   | 22.47%                                      | 21.55%   | 20.69%   | 18.41%   |
| PB P   | 7.79  | 8.21     | 8.60     | 9.67     |
| BCR    | 1.60  | 1.55     | 1.49     | 1.35     |
| NPV    | 10.92                                       | 10.30    | 9.68     | 7.82     |
| RoI    | 17.48%                                      | 17.09%   | 16.71%   | 15.65%   |
| RoE    | 36.48%                                      | 35.63%   | 34.81%   | 32.54%   |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

### c) Total Rehabilitation Costs

|        | <b>Total Rehab cost p.a. in mil. NRs.</b> |          |          |          |
|--------|---|----------|----------|----------|
|        | Current                                   | 10% incr | 20% incr | 30% incr |
| Amount | 30.79                                     | 33.87    | 36.95    | 40.03    |
| FIRR   | 22.47%                                    | 18.98%   | 16.27%   | 14.10%   |
| PB P   | 7.79                                      | 9.40     | 10.72    | 11.91    |
| BCR    | 1.60                                      | 1.38     | 1.20     | 1.05     |
| NPV    | 10.92                                     | 8.32     | 5.71     | 3.11     |
| RoI    | 17.48%                                    | 15.92%   | 14.58%   | 13.40%   |
| RoE    | 36.48%                                    | 33.12%   | 30.24%   | 27.74%   |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

d) Operating Costs

|        | <b>Operating Costs p.a. in mil. NRs.*</b> |           |           |           |
|--------|---|-----------|-----------|-----------|
|        | Current                                   | 2.5% incr | 3.5% incr | 4.5% incr |
| Amount | 34.76                                     | 35.63     | 35.98     | 36.32     |
| FIRR   | 22.47%                                    | 17.52%    | 15.71%    | 13.96%    |
| PB P   | 7.79                                      | 10.59     | 11.85     | 13.27     |
| BCR    | 1.60                                      | 1.29      | 1.17      | 1.04      |
| NPV    | 10.92                                     | 6.11      | 4.21      | 2.28      |
| RoI    | 17.48%                                    | 15.95%    | 15.34%    | 14.74%    |
| RoE    | 36.48%                                    | 33.31%    | 32.06%    | 30.81%    |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

|        | <b>Operating Costs p.a. in mil. NRs.</b> |          |          |          |
|--------|--|----------|----------|----------|
|        | Current                                  | 10% incr | 20% incr | 21% incr |
| Amount | 34.94                                    | 38.43    | 41.93    | 42.45    |
| FIRR   | 54.60%                                   | 35.46%   | 15.52%   | 13.85%   |
| PB P   | 3.07                                     | 3.90     | 11.63    | 12.95    |
| BCR    | 3.59                                     | 2.42     | 1.17     | 1.04     |
| NPV    | 41.48                                    | 23.56    | 4.25     | 2.29     |
| RoI    | 26.95%                                   | 21.02%   | 15.02%   | 14.43%   |
| RoE    | 56.25%                                   | 44.03%   | 31.58%   | 30.35%   |

Assuming trolley bus operating days a year to be 340 and average passenger fare equal to NRs. 6.

|        | <b>Spare Parts p.a. in mil. NRs.</b> |          |          |          |
|--------|--------------------------------------|----------|----------|----------|
|        | Current                              | 10% incr | 20% incr | 50% incr |
| Amount | 3.09                                 | 3.40     | 3.71     | 4.64     |
| FIRR   | 22.47%                               | 20.66%   | 18.90%   | 14.07%   |
| PB P   | 7.79                                 | 8.74     | 9.75     | 13.18    |
| BCR    | 1.60                                 | 1.49     | 1.38     | 1.05     |
| NPV    | 10.92                                | 9.22     | 7.51     | 2.41     |
| RoI    | 17.48%                               | 16.94%   | 16.39%   | 14.78%   |
| RoE    | 36.48%                               | 35.35%   | 34.23%   | 30.88%   |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

|        | <b>Direct Labour p.a. in mil. NRs.</b> |          |          |          |
|--------|--|----------|----------|----------|
|        | Current                                | 10% incr | 20% incr | 30% incr |
| Amount | 4.05                                   | 4.46     | 4.86     | 5.67     |
| FIRR   | 22.47%                                 | 20.10%   | 17.86%   | 13.70%   |
| PB P   | 7.79                                   | 9.06     | 10.38    | 13.51    |
| BCR    | 1.60                                   | 1.46     | 1.31     | 1.02     |
| NPV    | 10.92                                  | 8.68     | 6.46     | 1.99     |
| RoI    | 17.48%                                 | 16.77%   | 16.06%   | 14.64%   |
| RoE    | 36.48%                                 | 35.00%   | 33.54%   | 30.61%   |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

e) Revenue Collection

| Revenue collected p.a. in mil. NRs. |         |           |         |           |
|-------------------------------------|---------|-----------|---------|-----------|
|                                     | Current | 2.5% decr | 3% decr | 3.5% decr |
| Amount                              | 45.62   | 44.48     | 44.25   | 44.02     |
| FIRR                                | 22.47%  | 16.45%    | 15.33%  | 14.24%    |
| PB P                                | 7.79    | 11.37     | 12.22   | 13.15     |
| BCR                                 | 1.60    | 1.21      | 1.14    | 1.06      |
| NPV                                 | 10.92   | 4.95      | 3.76    | 2.56      |
| RoI                                 | 17.48%  | 15.65%    | 15.28%  | 14.91%    |
| RoE                                 | 36.48%  | 32.65%    | 31.88%  | 31.11%    |

Assuming trolley bus operating days a year to be 300 and average passenger fare equal to NRs. 6.

| Revenue collected p.a. in mil. NRs. |         |          |            |          |
|-------------------------------------|---------|----------|------------|----------|
|                                     | Current | 10% decr | 12.5% decr | 15% decr |
| Amount                              | 51.7    | 46.53    | 45.24      | 43.95    |
| FIRR                                | 54.60%  | 27.57%   | 20.39%     | 13.88%   |
| PB P                                | 3.07    | 5.56     | 8.91       | 13.47    |
| BCR                                 | 3.59    | 1.91     | 1.47       | 1.03     |
| NPV                                 | 41.48   | 15.66    | 8.93       | 2.16     |
| RoI                                 | 26.95%  | 18.94%   | 16.87%     | 14.79%   |
| RoE                                 | 56.25%  | 39.53%   | 35.20%     | 30.86%   |

Assuming trolley bus operating days a year to be 340 and average passenger fare equal to NRs. 6.

| Revenue collected p.a. in mil. NRs. |         |          |          |            |
|-------------------------------------|---------|----------|----------|------------|
|                                     | Current | 10% decr | 15% decr | 21.5% decr |
| Amount                              | 56.01   | 50.41    | 47.61    | 44.81      |
| FIRR                                | 79.89%  | 30.89%   | 33.89%   | 13.99%     |
| PB P                                | 2.43    | 2.80     | 3.95     | 13.38      |
| BCR                                 | 5.14    | 2.04     | 2.28     | 1.04       |
| NPV                                 | 65.32   | 35.46    | 21.34    | 2.28       |
| RoI                                 | 34.22%  | 29.87%   | 20.69%   | 14.82%     |
| RoE                                 | 71.40%  | 29.87%   | 43.17%   | 30.93%     |

Assuming trolley bus operating days a year to be 340 and average passenger fare equal to NRs. 6.5.