

GOVERNMENT OF PAKISTAN  
MINISTRY OF COMMUNICATIONS  
NATIONAL TRANSPORT RESEARCH CENTRE (NTRC)

388.41322

NTRC

2009

08758

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**PRIORITY RANKING OF  
AN ELECTRIC CABLE DRIVEN BUS  
IN THE URBAN PUBLIC TRANSPORT SYSTEM**

March, 2009

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## ELECTRIC CABLE DRIVEN BUS

### 1. Definition

An electric cable driven bus (also known as trolley bus, trolley coach, trackless trolley, trackless tram or simply trolley) is an electrically powered bus that draws its electricity from a network of charged overhead wires (which are generally suspended from roadside posts) using spring loaded trolley poles. Two poles are needed, so that one can draw down the live current to power the motor and the other can complete the circuit by carrying the neutral current back to the network. As the rubber tires on a bus do not conduct electricity, the neutral current cannot pass directly to the ground via the wheels unlike an electric tram (or streetcar) which can use its steel wheels to take the current to ground via the tramway rail (Annex).

### 2. Early Developments

The history of the trolleybus dates back to 29 April, 1882, when Dr. Ernst Werner von Siemens ran his "Elektromote" in a Berlin suburb. This experimental demonstration continued until 13 June, 1882, after which there was little progress in Europe. The next development was when Lombard Gerin operated an experimental line at the Paris Exhibition of 1900 after four years of trials. Max Schiemann made the biggest step when on 10 July 1901 the world's first passenger-carrying trolleybus operated at Bielathal (near Dresden), in Germany. Although the Bielathal system only operated until 1904, Schiemann had developed what is now the standard trolleybus electric current collection system.

Leeds and Bradford became the first cities to operate passenger-carrying trolleybuses in the United Kingdom on 20 June 1911. Bradford was also the last to operate trolleybuses in the UK, the system closing on 26 March 1972.

In the United States, some cities, led by the Brooklyn-Manhattan Transit Corporation (BMT – New York), subscribed to the all-four concepts of using buses, trolleybuses, trams (in US called streetcars or trolleys) and rapid transit subway and / or elevated lines (metros), as appropriate, for routes ranging from lightly-used to the heaviest trunk line.

3. Advantages of an Electric Cable Driven Bus

The advantages of an Electric Cable Driven Bus are as under:

1. Electric Cable Driven Buses are specially favoured in locations where electricity is abundant and cheap. Examples of this are the extensive trolleybus systems in Vancouver, Canada and Seattle, USA, both of which draw hydroelectric power from the Columbia River and other Pacific river systems. Seattle benefits doubly, with steep gradients near the Downtown waterfront and on Queen Anne, First, and Capitol Hills. San Francisco also operates its trolleybus system using hydro power from the city-owned Hetch Hetchy generating plant.
2. Electric Cable Driven buses are advantageous on hilly routes, as electric power is more effective than diesel for climbing steep hills. Cities especially those built in hills, have chosen trolleybuses over diesel buses because the electric motor can produce much more torque than a diesel engine. Moreover, the electric motor can be temporarily “overpowered”, that is, more than the normal power can be obtained for a short period of time, e.g. when climbing a steep hill.
3. The ‘rubber tires have better adhesion than trams’ steel wheels on steel rails, giving them better hill-climbing capacity and braking. Unlike rail vehicles (where side tracks are not available), an out-of-service vehicle

can be moved to the side of the road and its trolley poles disconnected, allowing other vehicles to pass. Additionally, because they are not tracked, trolleybuses can pull over to the curb as a diesel bus does, eliminating boarding islands in the street. Thus they have the capability to share the road infrastructure with other vehicular traffic.

4. Like other electric vehicles, electric cable driven buses are more environmentally friendly than fossil-fuel or hydrocarbon-based vehicles (petrol / gasoline, diesel, alcohol, etc.).
5. Centrally-produced power is more efficient, not bound to a specific fuel source and more amenable to pollution control as a single-source supply than are individual vehicles with their own engine that exhaust noxious gases and particulates at street level.
6. Electric Cable Driven Buses can generate electric power from kinetic energy while braking, a process known as regenerative braking.
7. Unlike buses or trams, electric buses are almost silent, lacking the noise of a diesel engine or wheels on rails. Early trolleybuses without these systems were quieter, and in the UK at least were often referred to as the "Silent Service".
8. With the introduction of hybrid design, electric cable driven bus is no longer tied to its overhead trolley wires. Increasingly system, such as Muni in San Francisco, TransLink in Vancouver, as well as Beijing's trolleybus operator, have circumvented this problem by installing battery packs on their trolleybuses to allow them to drive short to considerably long distances away from the wires.

9. The direct electric transmission used in electric cable driven buses is far more efficient (by a factor of two or more) than the conversion of energy into hydrogen, transportation and storage of the hydrogen and its conversion back into electricity by fuel cells.

4. **Disadvantages of an Electric Cable Driven Bus**

The disadvantages of an Electric Cable Driven Bus are as under:

1. Re-routings, temporary or permanent, are not usually readily available.
2. Dewirements sometimes occur, leaving the bus stranded without power. These events are, however, rare on systems with well-maintained overhead wire, hangers, fittings and "contact shoes".
3. Limitations in the erection of power lines limit the use of trolleybuses and further restrictions may also apply where taller vehicles may need to share the route, preventing installation of overhead lines.
4. An electric cable driven bus generally have high cost of their infrastructure as compared to the diesel bus.
5. These systems have been criticized for aesthetic reasons, with city residents complaining that the jumble of overhead wires is unsightly. Intersections often have a "webbed ceiling" appearance, due to multiple crossing and converging sets of line wires (Annex).
6. Electric buses produce very little noise compared with a diesel or petrol-engined vehicle and this makes them riskier for pedestrians and other motorists crossing roads. For this reasons, in Australia, these were known as "Whispering Death" or the "Silent Death".

5. **The Present Status**

As per a recent survey, out of 319 electric cable driven bus services introduced in various cities all over the world, mostly between the 1930s and 1950s, less than 154 are presently in operation. As an example, electric cable driven buses in UK, introduced in 1911 phased out in 1972. Similarly, in India, electric cable driven buses remained in operation between 1935 to 1962 in Dehli and 1962 to 1971 in Mumbai.

6. **The Priority Ranking of an Electric Cable Driven Bus in Pakistan**

In the context of urban transport in our major cities, Buses are the most basic form of 'mass transit'. These make the best use of the existing road infrastructure and are, therefore, the most cost effective and flexible mode capable of meeting most of the demand for urban transport at various levels of quality and quantity. Through better emission controls by adopting the higher tiers like that of Euro standards, Diesel buses should be able to provide environment friendly bus operation.

Amongst the 'source of power' in buses, prima-facie, the CNG buses may be the priority one choice from an environmental point of view depending on the availability of CNG and CNG Bus filling stations in the country.

As per the present scenario, share of hydel electricity has decreased from 58.1 per cent in 1978-79 to 29.9 per cent in 2007-08 with a corresponding increase in thermal generation from 41.2 per cent to 66.6 per cent. The problem of loadshedding, the unsightly 'Clutter' problem of overhead wires (specially in the context of Islamabad), security problem (with the overhead electric cables providing an easy target for acts of terrorism), activities like Basant etc which force power outages for the whole day, growing tendency of electricity theft using cable hooks, the priority ranking of an electric cable driven bus seems to be very low.

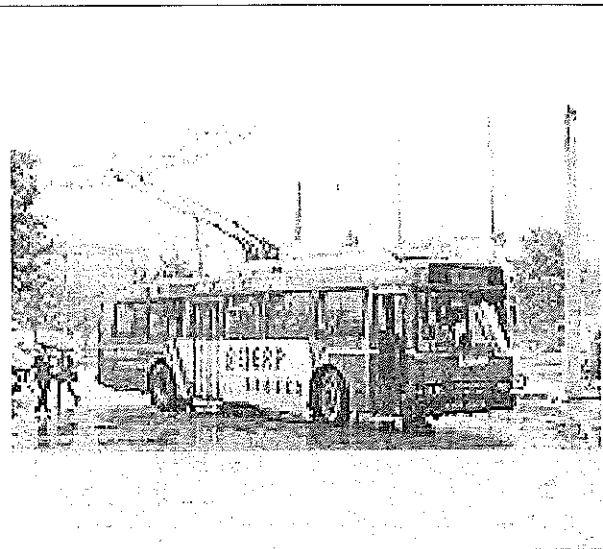
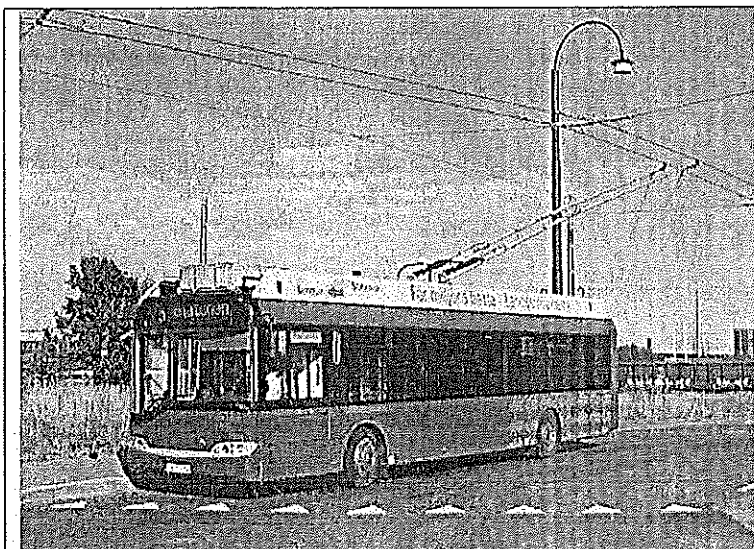
It may be mentioned that in the whole analysis, a distinction between a 'high quality bus' and a 'high quality bus service' is essential. An air-conditioned bus may be a 'high quality bus' but this does not automatically qualify it as a 'high quality bus service'. The ultimate focus in an urban bus transport system should be on a 'high quality bus service' for which a 'package approach' is necessary. The various factors which need to be considered may include safety and security; operations in private sector / private-public partnership etc, provision of terminal facilities by the Development Authority / local body; other incentives to ensure reasonable profitability and hence sustainability; affordable fare structures; service quality parameters like scheduled and frequent service, minimum stoppage times, seat by seat travel; availability of 3S (Sales, Service and Spare parts); adequately trained manpower including technicians and drivers, etc. Adoption of restraint measures on congestion – causing vehicles like personal modes of transport (car, motorcycles etc) and other adequate measures to ensure modal shift in favour of public bus transport to ensure a reasonable load factor will be the essential components for a realistic analysis.

#### 7. The Way Forward

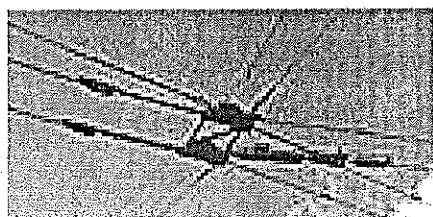
For an assessment of quantified priority ranking based on a comprehensive analysis, detailed techno-economic (including assessment of environment friendliness) and a financial feasibility study may be necessary for which the following course of action may be considered:

- (1) Although Electric Cable Driven Buses have very little scope specially in the context of Islamabad, it may be included as one of the options in the mass transit study of Islamabad / Rawalpindi being carried out by the CDA.
- (2) Comprehensive techno-economic, environmental and financial analysis of diesel versus electric traction being carried out as part of on-going study of the Ministry of Railways under the ADB assistance should quantify the potential of electric traction in the current and foreseeable future.





**Electric Cable Driven Bus**



**Unsightly Jumble of Overhead Wires**

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