

# Analysis of Hybrid Eco Friendly Auto Rail Control through Renewable Sources

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**Abstract** – This paper presents an analysis of hybrid auto rail control by using Hybrid Systems. Standalone hybrid railway vehicles combine two renewable energy sources. The conventional diesel prime mover is replaced with power derived from battery and super capacitor energy storage devices. These storage devices are discharged during high power demand, and may be recharged continuously through solar panel and wind energy system. The energy savings that is achievable through the adoption of these natural sources which are freely available in nature. Due to which railway transportation can be considered as Green transportation or Eco-Friendly transportation. The restricted nature of railway system presents opportunity for researchers for optimized design and various control strategies. In this paper discussed the architecture which is best solution if conventional supply is not available. Focus is on renewable energy options from the perspective of Indian Railways.

**Keywords** – Control strategies, green transportation, hybrid auto rail vehicle, renewable sources and storage devices.

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## 1. INTRODUCTION

Energy is prime issue of mankind. The requirement for energy is for heating, electricity, manufacturing, construction and transportation. Sustainable growth of the organization is in all depending on energy planning for the future. Similarly energy consumption has become increasingly important, as concern about the effects of economic growth. Now a days renewable fuel is preferred as sustainable development in transportation. These developments are development based on patterns of production and consumption that can be pursued into the future without degrading the human or natural environment.

Hybrid system used for railway uses more than one power source for vehicle propulsion. Hybrid architecture, system controlling, cost and maintainability are the major factors to be considered while designing the system. Storage medium include batteries and super capacitor have to design with optimal value as they have different operating characteristics and management of energy storage device is prime aspect of the system.

## 2. INDIAN RAILWAY

Indian railways, the premier transport organization of the country are the largest rail network in Asia and the world's second largest under one management. Indian Railways is a multi-gauge, multi-traction system covering the following:

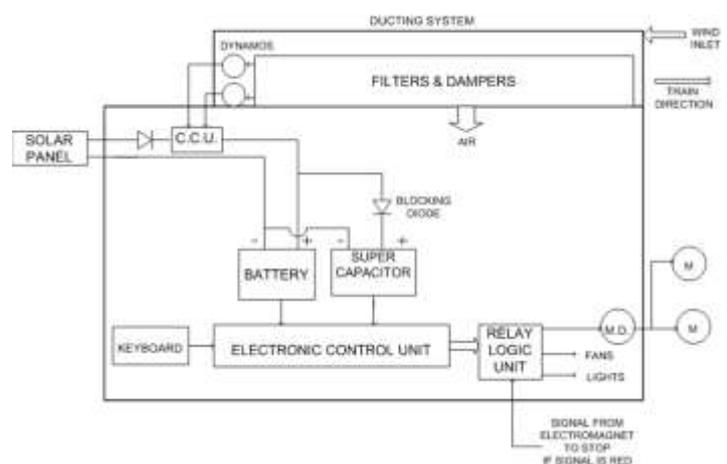
**Table 1. Multi-Gauges and Multi-Traction**

Track Kilometers	Broad Gauge (1676 mm)	Meter Gauge (1000 mm)	Narrow Gauge (762/610)	Total
	86,526	18,529	3,651	108,706
Route Electrified Kilometers	16,001	63,028		

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Other Interesting facts of Indian Railways are that an Indian railway runs around 11,000 trains every day, of which 7,000 are passenger trains.

## 3. SYSTEM ARCHITECTURE



**Fig.1 System Architecture**

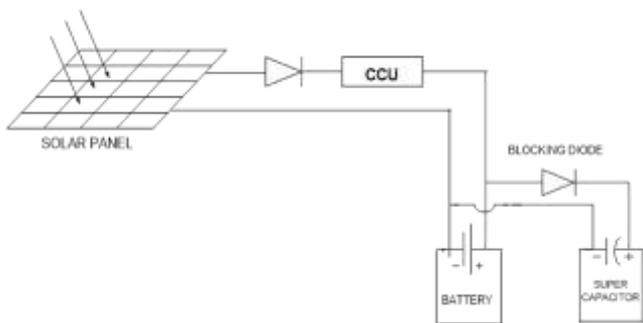
The basic principle of solar and wind hybrid train is to use sun and wind energy & store this energy in storage system. This system will store energy during sunshine and running condition.

Photovoltaic effect converts solar energy into electrical energy. Similarly wind energy convert kinetic energy into electrical energy.

The storage system are used for lighting, fan operation & to drive the motors which serves here as an engine and run the train.

**4. VARIOUS APPLICATIONS PROVIDED IN SYSTEM**

**4.1 Solar energy storage**

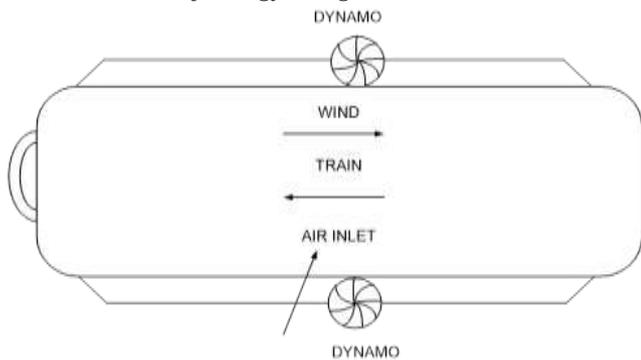


**Fig.2 Solar energy storage in battery and super capacitor in proposed traction system.**

In this diagram battery & super capacitor get charged through energy generated by solar panel. It contains CCU (charged control unit) which limits the battery from overcharging & discharging.

Blocking diodes are connected to restrict the reverse current from battery and super capacitors which further protect solar panel.

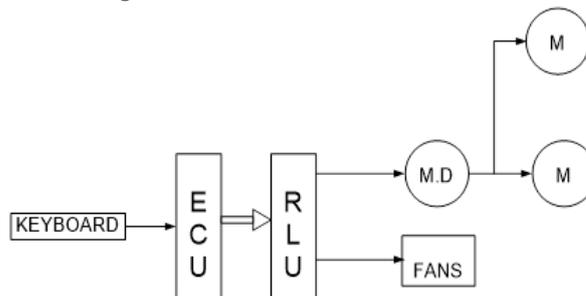
**4.2 Conservation of energy using WECS**



**Fig. 3 Application of wind for generation & conservation of energy in proposed system.**

It consists of dynamo inside the ducting which is attached to both sides of the rail. As train moves, the outside air enters in rail through duct system. This system consist of electrostatic filters , which remove moisture & dust from outside air and fresh air get inside the rail. The dynamo get rotates due to air and generates electricity which further supplied to charged control unit. The logic circuits cut of the supply of fans inside the rail as the dynamo get rotates.

**4.3 Controlling Circuit**



**Fig. 4 Control circuit through keyboard for proposed system**

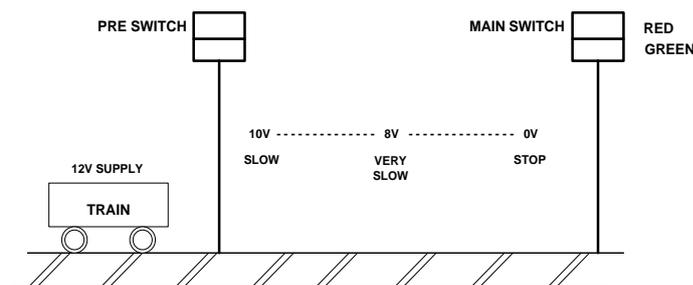
This circuit consists of Keyboard, ECU (electronic control unit) & RLU (relay logic unit).

The purpose of keyboard is to give the command for controlling of train such as start-stop, forward-reverse.

ECU is a generic term that controls one or more of the electrical system in a transport vehicle.

RLU provide control signal to Motor Drive (M.D)

**4.3 SignalControlling**



**Fig. 5 Automatic signal controlling using electromagnetic sensors**

This system helps to protect the train from accidents due to improper visualization of signals in foggy weather.

It consists of two switches pre switch and main switch. As the train passes through pre switch and if the signal is red the supply to the motor which is couple to wheels get automatically goes on decreasing. At main switch, it gets reaches to zero and train get stop.

**CONCLUSION**

The proposed hybrid vehicle use solar and wind energy as source of power to drive the motor and other applications. Motor power is transmitted to the wheels and the vehicle to move. Similarly other application and controlling can be done with efficient way. The solar powered trains are use at a very low scale, at present. Due to some constraints in the natural resources, they have been around for about few years only. This is wide area for researchers to develop the technology by

considering cost, feasibility, controlling and acceptability by the user in context with railways. So conclusion is that the challenge lies in making it a viable means of green transport.

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