

# Study, Development & Modifications of Series Hybrid Electro-Petroleum Bicycle.

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**Abstract** – India is still a developing country. There is no availability of electricity throughout the country for all 24hrs of a day. Series Hybrid Electro Petroleum Bicycle is basically electric bicycle which needs plug-ins to charge the battery. Due to the electricity issues this SHEPB is not suitable to use throughout the India. We made a modification to overcome these problems. We have been design a system which works by using human effort. This human power is gives to the crankshaft of an Engine to start it. We added pedal system attached to the crankshaft by means of belt drive. These pedals are directly attached to the driven wheel by using chain sprocket mechanism. An alternator is attached to the crankshaft of an engine and battery is connected to the battery which is used to store the charge and to utilize it to drive the motor. This modified SHEPB works on the principle of conservation of energy. We convert the human power to the mechanical power and then mechanical energy is stored in the form of electrical energy by using battery. Then further this stored electrical energy is gets converted to do mechanical work by using motor. The engine is used to drive the vehicle till battery gets fully charged. There is no any such vehicle is exists in Indian market till today.

**Key Words:** Hybrid Vehicle, Existing Model, SHEPB-Modifications, SHEPB- Principle.

## Abbreviations:

SHEPB- Series Hybrid Electro-Petroleum Bicycle

PHEV – Plug-In Hybrid Electric Vehicle

CDI – Capacitor Discharge Ignition

BLDC – Brushless Direct Current

## 1. INTRODUCTION

The hybrid system is any which works by using two or more distinct fuels for its working. Let us consider an example of submarine, it uses diesel as a fuel when it is at surface. And it uses battery power when it is submerged. There are various types of hybrid systems. In this paper we are going to focus over the Series Hybrid Electrical Petroleum Bicycle.

### 1.1 Concept of SHEPB

Series Hybrid Electrical Petroleum Bicycle system is a type of hybrid system, in which a bicycle works by using electricity until battery get discharged and then generator gets started

to charge the battery and also to keep vehicle in running condition during the journey. This vehicle is mostly electric vehicle which also have a plug-ins provided for the charging of battery by providing supply. This may be called as Plug in hybrid electric vehicles (PHEV). These consists the batteries having extended capacity. PHEV runs on battery throughout the journey, but at the end of journey, it shifts to engine to overcome the possibility of overcharging. Basically PHEV requires less mechanical linkages, so the system becomes easy and simple.

### 1.2 Modifications in Existing model

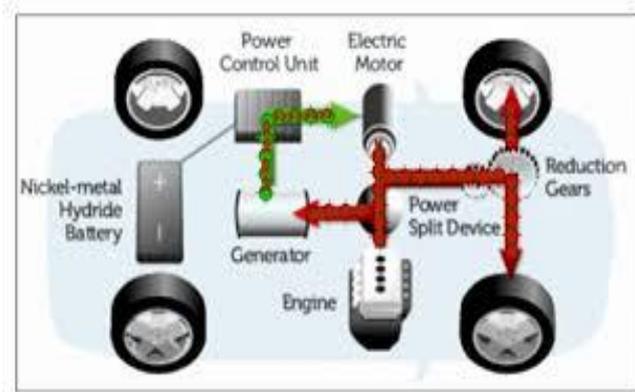
As we all know that the India is still developing country and in India the electricity is easily not available as per the requirement. For Plug-in Hybrid Electric Vehicles the battery charging is done by using electrical supply to the system. As an unavailability of electricity is major obstacle for this system. So to overcome this problem, we have added a trend in this system. For providing an initial torque or moment to the bike, we added pedals to it. These are connected to crankshaft and rear wheel of a bike by means of chain and sprocket. We also provided an alternator at the connected to the crankshaft to generate electricity. This generated electricity gets stored in battery and the process gets controlled by using control unit. Motor of specific specification is then attached to the rear wheel of a vehicle to obtain the final output.

## 2. METHODOLOGY

### 2.1 Problem Definition

Generally “Series Hybrid Electric Petroleum Bicycles” are plug in hybrid electric vehicles (PHEV). These are basically electric vehicles. On considering the India’s best electric vehicles, on an average all the vehicles need to charge for 6 to 8 hours to recharge the battery. And after this charging these vehicles provide an economy of 70 to 80 kilometers per charge. These vehicles took so much time for charging and performance is not so well. The output power is also not much suitable for heavy and long journey. In India, there is also unavailability of infrastructure for electric vehicles cause very limited use of electric bikes in India. Hence in India, the electric vehicle is mostly preferred for city and small journey modes.

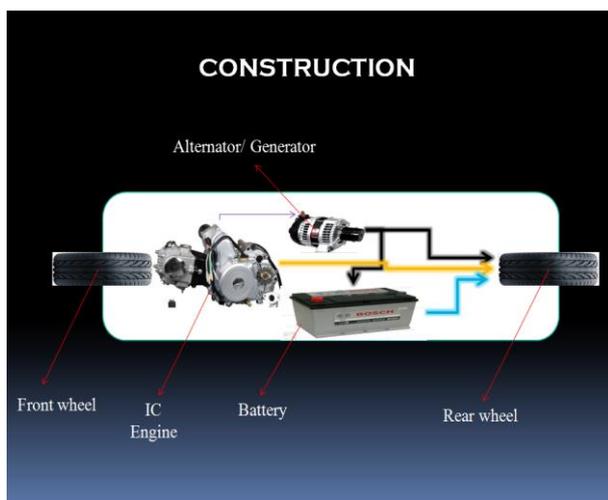
## 2.2 Concept



**Fig-1:** Concept of Hybrid Vehicle

We are going to use a concept of electric petroleum vehicle to drive the SHEPB. This car uses battery power to start the vehicle. Which reduces the fuel consumption result in improves efficiency of a vehicle. During the running condition of vehicle, at cruising this hybrid car uses only engine power because of at constant speed engine gives higher efficiency, simultaneously the kinetic energy of vehicle used to charge battery. During acceleration we use both of engine and battery power to achieve higher output power. And finally at deceleration the total kinetic energy of a vehicle gets converted in to electric energy to charge the battery. This phenomenon is known as "Regenerative braking system".

## 2.3 Construction/Components



**Fig -2:** Construction of Modified SHEPB

The construction of modified SHEPB consists of various components which we have mentioned below with their specifications.

### Engine:



**Fig-3:** Engine

Mode of Engine- Two Stroke, Single Cylinder SI Engine  
Capacity- 60 CC  
Rated Power- 2.5KW@5000 RPM  
Fuel type-Petrol  
Ignition mode- CDI  
Compression ratio- 6:1.

### Battery:



**Fig-4:** Battery

Voltage - 12V  
Capacity - 24 AH  
Type - Zinc Ion Battery

### Alternator:



**Fig-5:** Alternator

System Voltage - 12 V  
Maximum Speed - 13500 RPM  
Manufacturer - TVS Lucas

**Motor:**

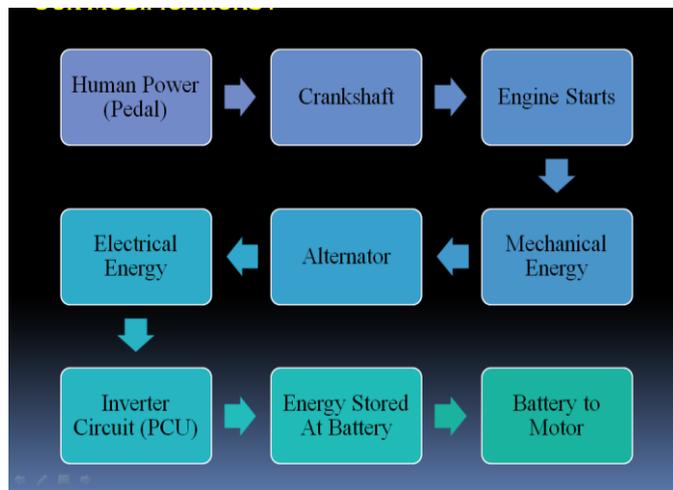


**Fig-6:** Motor Coupled with rear wheel

Type – BLDC Geared motor.  
 Operating Voltage – 12V  
 Output Capacity – 250W

**2.4 Working**

This modified SHEPB works on the principle of conservation of energy. In this system the human efforts get stored in the form of electric charge in capacitor & used to start the engine which generates mechanical energy. By adding drives, this mechanical energy gets stored in the form of electrical energy in battery by means of alternator. As the engine has CDI (Capacitor Discharge Ignition) system for starting an engine. In which the power or charge generated by pedaling get stored in the capacitor. During the ignition, this capacitor gets discharged to generate a spark.



**Fig-7:** Process flow chart of Modified SHEPB

After starting an engine, the rotational energy of crankshaft is used to run an alternator. This alternator is then connected to the battery by using inverter circuit. This inverter circuit is worked as power control unit. It restricts the overcharging of battery and also helps to improve reliability of battery. The output motor is connected to rear wheel hub. The battery and motor are connected to each other by electric wiring. When battery gets fully charged,

inverter circuit automatically shut offs a supply from alternator to stop charging. When we are using engine power to drive the vehicle at that time motor is not connected to rear wheel. That is the motor is stationery. When battery gets fully charged, we shut offs an engine by cutting fuel and vehicle drives with the help of battery power.

**2.5 Comparison between Electric bike & Modified SHEPB:**

Sr. No	Parameter	Electric Bike	Modified SHEPB	Conclusion
1	Charging Type	Plug-ins	Alternator	Alternator gives similar power to charge the battery.
2	Fuel Mode	Electric Battery	Electric Battery + Petroleum+ Human power (For Starting torque)	Uses more than single fuel, since it is hybrid bike.
3	Efficiency	Generally 60-70 km per charge.	Higher efficiency due to the double fuel system from both petroleum & electrical battery.	Modified SHEPB is more Efficient
4	Charging time	6 to 8 hrs when vehicle is stationery.	Can charge during running conditions.	Due to the alternator battery can easily charged.
5	Output Power	Motor Power (Generally 250W)	Engine Power (2.5 KW) & Motor Power (250W)	High power due to duel power system.
6	Cost	Comparatively less	Slightly high	Additional cost of Mechanical Elements
7	Top speed	Less	High	Combined efforts of Engine & Motor results in high speed
8	Maintenance	Less	More	More elements in assembly.
9	Weight	Less	High	Additional weight of components like Engine & Alternator

10	Load carrying capacity	Less	High	Due to High power
11	Emission	No	Present	Emissions due to Engine
12	Environmental effects	Eco-friendly	No	Emission causes pollution

### 3. CONCLUSIONS

The modifications made in regular series hybrid electric petroleum bicycle result in the improved efficiency. It also provides high output power with both electric as well as engine power. It overcomes all the problems regarding to the electric bike. It is useful in long journeys due to auto battery recharging system. A good torque is available due to the high rotations at engine and battery too. It has only single drawback that, it requires human efforts for starting a bike only. It also has a wide scope in future studies. It is less polluting with respect to petroleum vehicle but deliver same or more power than petroleum vehicles.

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