

## **Analysis on Energy Scavenging From Roads**

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### **Abstract**

*In the present situation power becomes basic need for human life. Energy is responsible for major developments of any country's economy. Conventional energy sources generate most of the energy of today's world. But the population is increasing day by day and the conventional energy sources are diminishing. Moreover, these conventional energy sources are polluting and responsible for global warming. So, non-conventional sources are needed to be developed for power generation which are clean, environment friendly and sustainable. In this research we propose a renewable non-conventional energy source based on speed breaker mechanism. Our project is to enlighten the streets utilizing the jerking pressure which is wasted during the vehicles passes over speed breaker in roadside. We can tap the energy generated by moving vehicles and produce power by using the speed breaker as power generating unit. The kinetic energy of the moving vehicles can be converted into mechanical energy through rack and pinion mechanism and this mechanical energy will be converted to electrical energy using generator which will be used for lighting the street lights. Therefore, we have to investigate other types of renewable sources. The day-to-day increasing population and decreasing conventional sources for power generation, provides a need to think on non-conventional energy resources. Another major problem, which is becoming the exiting topic for today is the pollution. Power stations and automobiles are the major pollution producing places. So non-conventional power source is needed to reduce this problem. We proposed a nonconventional power generating system based on speed breaker mechanism which generate electricity without using any commercial fossil fuels, which is not producing any polluting products. In this paper, our aim is to conserve the kinetic energy which convert into electricity that gone wasted, while vehicles move.*

**Keywords:** Electricity, Roads

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### **I. Introduction**

India is the third largest producer of electricity in the world. India has a surplus power generation capacity but lacks adequate transmission and distribution infrastructure. India's electricity sector is dominated by fossil fuels, in particular coal, which during the 2018-19 fiscal year produced about three-quarters of the country's electricity. The government is making efforts to increase investment in renewable energy. The government's National Electricity Plan of 2018 states that the country does not need more non-renewable power plants in the utility sector until 2027, with the commissioning of 50,025 MW coal-based power plants under construction and addition of 275,000 MW total renewable power capacity after the retirement of nearly 48,000 MW old coal-fired plants. It is expected that non-fossil fuels generation contribution is likely to be around 44.7% of the total gross electricity generation by the year 2029 – 2030. therefore from now on India will be fully focused on the electricity generated from the renewable resources so as we can partially depend upon the non-renewable resources.

#### **1.1 Objective of the project**

The aim of the project is to generate electricity from the roads which causes no pollution the environment. Its just like every vehicles that moves through the roads can generate electric power The generation of electricity using roads is one of the easiest way as now-a -days everyone is having vehicle. It can be widely accepted at individual level because of its low production cost also it doesn't need any extra effort. Also the piezoelectric crystal which will convert the mechanical pressure in electric output will enhance the system output. Some main objectives are listed below

- To use a non-conventional source of energy to generate electricity.
- To generate electricity at low cost.

- To trap a readily available source of energy.
- To reduce load on the national grid.
- Saving the non-renewable resources of energy.
- Utilization of kinetic energy of the vehicle.
- Produce electricity at a lower cost.

### 1.2 Need for the project

As long as the time goes the cost of the fossil fuels which is used to generate electricity is keep on increasing such as coal, diesel engine generators, etc

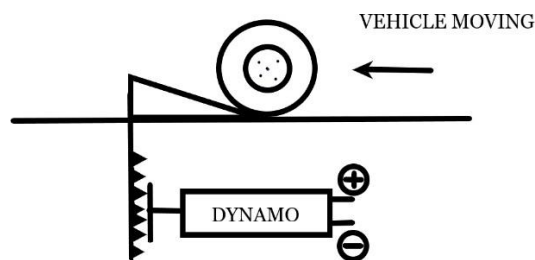
- The price of the non-conventional source of energy is keep on increasing
- These non-conventional sources releases a large amount of CO<sub>2</sub> which is harmful to the environment
- As the price of sources of power keep on increasing the price of electric power will also increase
- If we able to generate electric power from roads we can consume electric power at free of cost
- And then gradually dependence on non-conventional energy source will decrease

### 1.3 Scope of the project

The energy generated using speed breaker mechanism can be used to store in a batteries and can be used apart for various purposes. The work basically aims to produce free electricity with no fuel cost, no pollution andwith minimum requirement of space when the vehicle moves over the speed breaker, speed breaker reduces its speed. Its just like every vehicles that moves through the roads can generate electric power The generation of electricity using roads is one of the easiest way as now-a -days everyone is having vehicle. It can be widely accepted at individual level because of its low production cost also it doesn't need any extra effort, As these breakers have a little height it gains an increase in its potential energy. While moving, the vehicles possess some kinetic energy and it is being wasted. Electricity is the form of energy which is most widely used in nature. Electric power obtained from the conversion of other sources of energy, like coal, natural gas, oil, nuclear power and othernatural sources are called primary sources. This kinetic energy can be utilized to produce power by using a specialarrangement called power hump

### Methodology

Whenever a vehicle moves through this mechanism it gives the enough energy to rotate the wheel of the dynamo and this produces the electrical energy hence the kinetic energy of the moving vehicle is properly utilized for thegeneration of current



## II. Working principle

### 2.1 Mechanical to Electrical energy:

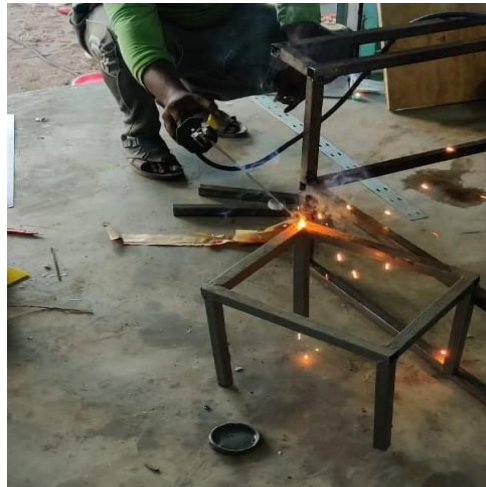
One rod with the dynamo is placed like a speed breaker. Dynamo means a generator that produces direct current with the use of a commutator. The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current through Faraday's law. A dynamo machine consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which tum within that field. Movement of vehicle just rotates the dynamo shaft and electricity is generated. This voltage is to be stored in the chargeable battery.

## III Material properties

### 3.1 mild steel

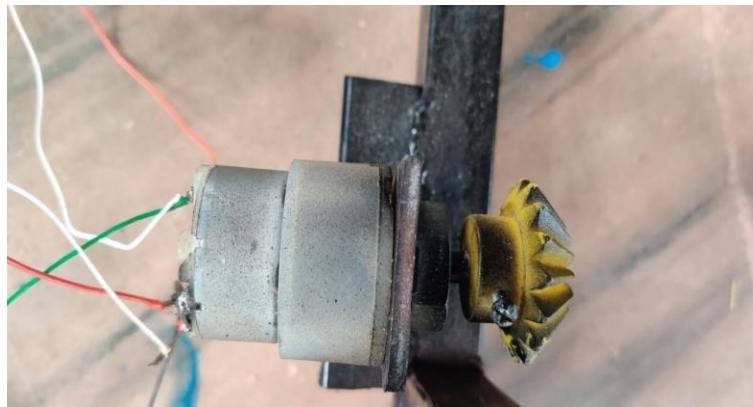
- Mild steel has a high tensile strength
- It has a high impact resistance since the material will hit by the vehicles this material is used
- It has a high resistance to temperature and humidity
- Good malleability with cold-forming possibilities.

- Good ductility and weldability



### 3.2 Dynamo and gear

- The function of the dynamo is to change mechanical energy into electricity
- It is connected with the gear which transfers the mechanical movement from the road to the dynamo
- The dynamo was originally designed by Nikola Tesla
- The dynamo works on the principle of electromagnetic induction
- Whenever the magnetic field linked with a coil changes, an induced emf is setup in coil.
- This principle is used to generate electricity in this project



### 3.3 Metal chain

- This chain is made up of plain carbon or metal alloy which prevents rusting
- This chain is attached to the rod which is in physical contact with the vehicles on the road
- On the other end it is connected to the gear which is attached to the dynamo
- Once the vehicle passes through the chain makes a up and down movement which produces the current from the dynamo
- To prevent the frictional heat this chain is lubricated periodically



### 3.4 Rack and pinion

- A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move, thereby translating the rotational motion of the pinion into the linear motion of the rack.
- For example, in a rack railway, the rotation of a pinion mounted on a locomotive or a railcar engages a rack between the rails and forces a train up a steep slope.
- For every pair of conjugate involute profile, there is a basic rack. This basic rack is the profile of the conjugate gear of infinite pitch radius. (i . e a toothed straight edge.)
- A generating rack is a rack outline used to indicate tooth details and dimensions for the design of a generating tool, such as a hob or a gear shaper cutter

## IV. Factors determining the choice of materials

The various factors which determine the choice of material are discussed below.

### 4.1 Properties:

The material selected must possess the necessary properties for the proposed application. The various requirements to be satisfied. Can be weight, surface finish, rigidity, ability to withstand environmental attack from chemicals, service life, reliability etc.

The following four types of principle properties of materials decisively affect their selection

- a. Physical
- b. Mechanical
- c. From manufacturing point of view
- d. Chemical

The various physical properties concerned are melting point, thermal Conductivity, specific heat, coefficient of thermal expansion, specific gravity, electrical conductivity, magnetic purposes etc. The various Mechanical properties Concerned are strength in tensile, Compressive shear, bending, torsional and buckling load, fatigue resistance, impact resistance, elastic limit, endurance limit, and modulus of elasticity, hardness, wear resistance and sliding properties.

The various properties concerned from the manufacturing point of view are,

- Cast ability
- Weld ability
- Surface properties
- Shrinkage
- Deep drawing etc.

### 4.2 Manufacturing case:

Sometimes the demand for lowest possible manufacturing cost or surface qualities obtainable by the application of suitable coating substances may demand the use of special materials.

### 4.3 Quality Required:

This generally affects the manufacturing process and ultimately the material. For example, it would never be desirable to go casting of a less number of components which can be fabricated much more economically by welding or hand forging the steel.

### 4.4 Availability of Material:

Some materials may be scarce or in short supply. It then becomes obligatory for the designer to use some other material which though may not be a perfect substitute for the material designed. the delivery of materials and the delivery date of product should also be kept in mind.

### 4.5 Space consideration:

Sometimes high strength materials have to be selected because the forces involved are high and space limitations are there.

### 4.6 Cost:

As in any other problem, in selection of material the cost of material plays an important part and should not be ignored

## V. Construction And Operation

When the vehicle comes on the speed breaker, because of its weight, the top portion of the speed breaker moves downwards and the shaft consisting of the U portion rotates in a particular direction. Due to this rotation of the shaft, the sprocket will rotate and the rotational energy from one shaft is transferred to the other shaft with the help of chain drive mechanism. This rotates the gear on the bottom shaft, which in turn will help to rotate the gear placed on the motor. This rotation of the gear starts the generator and generates electricity which

can be stored in the battery and can be converted to A.C. current using inverter



## VI. Result

- In this project we use a dynamo that releases a small amount of energy
- The current produced through this generator is enough to glow two LEDs of 20mA each
- Each vehicle moving through this generator produces a current of 40mA
- Considering a busy road in which this generator is placed and an average of 1000 vehicles pass through it and a current of about 40,000 mA is being saved
- This 40 watts / volts is hardly enough to glow a street lamp for at least 5 hours



### 6.1 Features Of This Project

- Generation of electricity at low cost.
- Operating cost is less.
- Stored electricity can be used for other purposes.
- Convert the totally waste energy in some useful work.
- For government economic consideration.
- Saving the other energy resources. It can also work at night as we have provided a storage battery.
- It can generate electricity in forward as well as in reverse direction.
- Light in weight.

### 6.2 Future scope

- Such speed breakers can be designed for heavy vehicles, thus increasing input torque and ultimately output of generator.
- More suitable and compact mechanisms to enhance efficiency.

- A survey on the energy consumption in India had published a pathetic report that 85,000 villages in India do not still have electricity.
- Supply of power in most of the country is poor. Hence more research and development of technologies are needed in this field.
- This energy can be used for the lights on the either-sides of the roads and thus power that is consumed by these lights can be utilized to send power to these villages.
- It may also be used for light vehicle also.

### **6.3 Advantages**

We had constructed the material which is enough to produce a voltage of 40 watts/volts per day if it is hit by 1000 vehicles. This apparatus we constructed is suitable for the vehicles lesser than 250kg that is this apparatus is only for the two wheelers. As the dynamo used in this material is capable of producing low voltage only for producing higher voltage higher sized dynamo is required. This project is economically safe and producing no green house gases and generates electricity. Regular maintenance of the material is required since it is made of iron it should be protected from the rust and others. Roads and highways in India are provided with speed breaker to control the speed of traffic in congested areas. This energy loss on speed breakers can be utilized for useful purposes. This is of compact in size. Less Maintenance is enough. Quite running and smooth operation is achieved. Higher efficiency. Full efficient positive displacement. Effective working principle. Power generation with low cost and using non-conventional energy sources which will help us to conserve the conventional energy sources to meet the future demand. By using this method, electricity will be generated throughout the year without depending on other factors. Easy for maintenance and no fuel transportation problem. Pollution free power generation. Less floor area required and no obstruction to traffic. No need of manpower during power generation.

### **VII. Conclusion**

In the coming days, demand for electricity will be very high as it is increasing every day, speed breaker power generator will prove a great boom to the world in the Future. The Aim of this research is to introduce another innovative method of green power generation in order to contribute toward developing the world by enriching it with utilization of available resources in more useful manner.

Any country, especially Nigeria and other developing nations, can only develop when there is steady and available power supply for its citizens and not by getting breakdown in middle course of time or unreliable power sources. Now time has come for using these types of Innovative ideas and it should be brought into practice. It is suggested that further developments should be done to minimize above mentioned challenges.

This research can also be modified by using camshaft and pulley stem or concepts of fluid mechanics can be used instead of gears, so as to minimize the inherent complexities and difficulties. By using the concept of power generation new ideas should be introduced which would help in reduction of friction and increase the efficiency of the generators.

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