

# ENERGY GENERATION FROM SPEED BREAKER BY RACK AND RATCHET MECHANISM

Hardial Singh<sup>1</sup>, Omprakash<sup>2</sup>

*Assistant professor, Department of Mechanical Engineering, Amity University Gurgaon*

## ABSTRACT

*This paper introduces useful concept of the present day scenario, Energy is a major need for human life. There is a need to develop non- conventional sources for Energy generation due to the reason that our conventional sources of Energy are getting scarcer by the day. Energy is the primary need for survival of all organisms in the universe. This paper includes how to utilize the energy which is wasted when the vehicles passes over a speed breaker. Lots of energy is generated when vehicle passes over it. We can tap the energy generated 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 of the shaft through rack and pinion mechanism. Then, this mechanical energy will be converted to electrical energy using generator which will be saved with the use of a battery. The energy we save during the day light can be used in the night time for lighting street lights. Therefore, by using this arrangement we can save lot of energy which can be used for the fulfilment of future demands.*

**Key Words:** *Speed breaker, renewable energy, electrical power, rack and ratchet mechanism*

## 1. INTRODUCTION

In the present scenario power becomes the major need for human life .The availability and its per capita consumptions are regarded as the index of national standard of living in the present day civilization. Energy is an important input in all the sectors of any countries economy. Energy crisis is due to two reasons, firstly the population of the world has been increased rapidly and secondly standard of living of human beings has increased. India is the country, which majorly suffers with lack of sufficient power generation. The availability of regular conventional fossil fuels will be the main sources for power generation, but there is a fear that they will get exhausted eventually by the next few decades. Therefore, we have to investigate some approximate, alternative, new sources for the power generation, which is not depleted by the very few years. Another major problem, which is becoming the exiting topic for today is the pollution. It suffers all the living organisms of all kinds as on the land, in aqua and in air. Power stations and automobiles are the major pollution producing places. Therefore, we have to investigate other types of renewable sources, which produce electricity without using any commercial fossil fuels, which is not producing any harmful products. There are already existing such systems using renewable energy such as solar wind), OTEC (ocean thermal energy conversions) etc..for power generation. The latest technology which is used to generate the power by such renewable energy” POWER HUMP”. The generated power can be used for the lamps, near the speed breakers. The present work an attempt has been made to fabricate a ramp, which can utilize the kinetic energy of vehicles in power generation. This type of ramp is best suited for the places where the speed breaker is a necessity. The places like Toll bridges or on vehicle parking stands are best for its utilization.

## 2. SCOPE OF THE PAPER

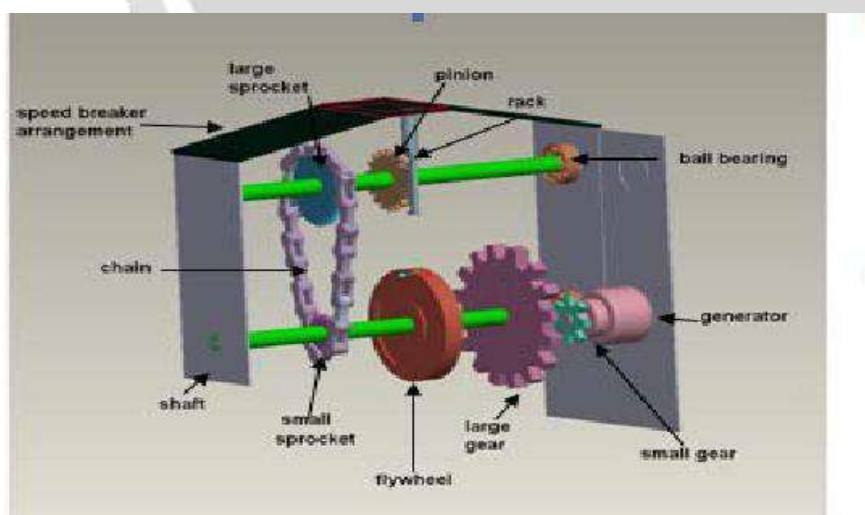
The utilization of the electrical energy is goon increasing with the growth of population. The United States of America (USA) is the world's second largest producer and consumer of electricity (Cecelski, B *et al*, 1979). It consumes about 20% of the world's supply of electricity. This is given by the US DOE Energy Information Administration/Electric Power Annual 2011. Total electrical energy consumption in 2011 was 4,138 Billion kWh (B kWh). Per capita consumption from the electrical grid in the same year was 13,187 kWh and is essentially the same as a decade ago-2001. Total Consumption in the peak year of 2007 was 4,184.5 B kWh up from 3,836 in 2000. The per capita average annual domestic electricity consumption in India in 2009 was 96 kWh in rural areas and 288 kWh in urban areas for those with access to electricity, in contrast to the world wide per capita annual average of 2600 kWh and 6200 kWh in the European Union(Goldemberg, J. *et al*. 1985). India's total domestic, agricultural and industrial per capita energy consumption estimate varies depending on the source. India currently suffers from a major shortage of electricity generation capacity, even though it is the world's fourth largest energy consumer after United States, China and Russia. The International Energy Agency

estimates India needs an investment of at least \$135 billion to provide universal access of electricity to its population. India is population growing country; therefore the utilization of electrical energy will also increase (Reddy, S 1990; Reddy, A K N *et al*, 1994). There are number of resources for the production of electric energy but all are commercially high. It is essential to produce the electrical energy with the existing natural resources. In this process, the production of electrical energy with the sun (solar energy) is one. But the investment cost is more. Similarly, the cost of production of electrical energy with wind, tide etc., is high. Therefore the proposed concept with simple arrangement. Hence more research and development and commercialization of technologies are needed in this field. India, unlike the top developed countries has very poor roads. Talking about a particular road itself includes a number of speed breakers. By just placing a unit like the “Power Generation Unit from Speed Breakers”, so much of energy can be tapped. This energy can be used for the lights on the either sides of the roads and thus much power that is consumed by these lights can be utilized to send power to these villages .

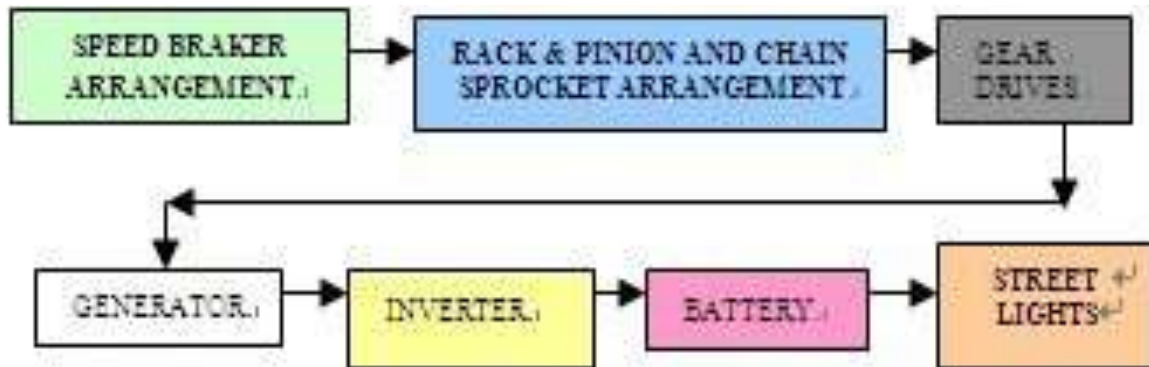
### 3. WORKING PRINCIPLE

While moving, the vehicles possess some kinetic energy and it is being wasted. This kinetic energy can be utilized to produce power by using a special arrangement called POWER HUMP. It is an Electro-Mechanical unit. It utilizes both mechanical technologies and electrical techniques for the power generation and its storage. POWER HUMP is a dome like device likely to be speed breaker. Whenever the vehicle is allowed to pass over the dome it gets pressed downwards then the springs are attached to the dome is compressed and the rack which is attached to the bottom of the dome moves downward in reciprocating motion. Since the rack has teeth connected to gears, there exists conversion of reciprocating motion of rack into rotary motion of gears but the two gears rotate in opposite direction. A flywheel is mounted on the shaft whose function is to regulate the fluctuation in the energy and to make the energy uniform. So that the shafts will rotate with certain R.P.M. these shafts are connected through a belt drive to the dynamos, which converts the mechanical energy into electrical energy. The conversion will be proportional to traffic density. Whenever an armature rotates between the magnetic fields of south and north poles, an E.M.F is induced in it. So, for inducing the E.M.F. armature coil has to rotate, for rotating this armature it is connected to a long shaft. By rotating same e.m.f is induced, for this rotation kinetic energy of moving vehicles is utilized. The power is generated in both the directions; to convert this power into one way, a special component is used called zener diode for continuous supply. All this mechanism can be housed under the dome, like speed breaker, which is called HUMP. The electrical output can be improved by arranging these POWER HUMPS in series. This generated power can be amplified and stored by using different electrical devices.

#### A. CONSTRUCTIONAL DETAILS:



**B. BLOCK DIAGRAM :**



**4. POWER CALCULATIONS:**

Let us consider,

The mass of a vehicle moving over the speed breaker =250Kg (Approximately)

Height of speed brake =10 cm

Work done=Force x Distance

Here,

Force=Weight of the Body=250 Kg x 9.81 =2452.5 N

Distance travelled by the body = Height of the speed brake =10 m

Output power=Work done/Sec= (2452.5 x 0.10)/60 =4.0875 Watts (For One pushing force)

Power developed for 1 vehicle passing over the speed

Breaker arrangement for one minute= 4.0875 watts

Power developed for 60 minutes (1 hr) =245.25 watts

Power developed for 24 hours=5.866 Kw

This power is sufficient to burn four street lights in the roads in the night time.

**5. EXPERIMENTAL INVESTIGATION**

The experimental investigation is performed by placing the speed breaker arrangement in a pit with a depth of 90 Cm. Vehicles move over the speed breaker arrangement and the voltage generated is measured by a multimeter and the various readings are plotted in a graph. The graphs are drawn for various parameters as shown below

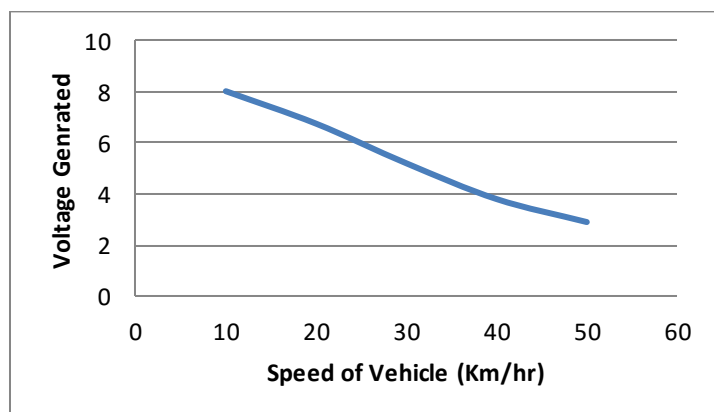
1. Voltage generated (Vs) speed of vehicle
2. Voltage generated (Vs) Load

**A. VOLTAGE GENERATED (VS) SPEED OF VEHICLE:**

READINGS: (TABLE 1)

1. LOAD = 270 Kg (Vehicle load + man weight)

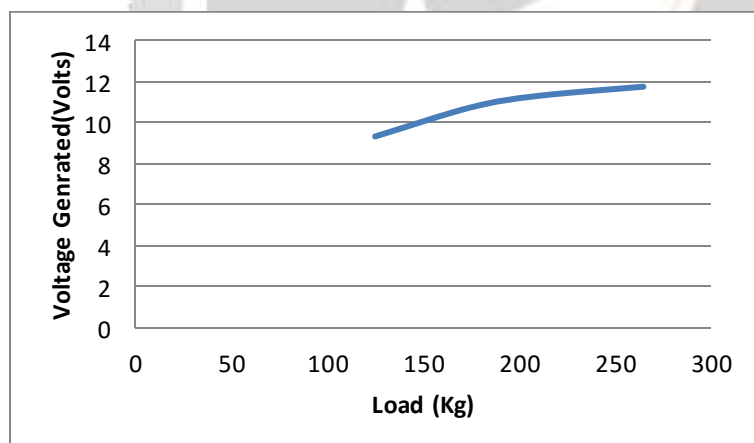
Speed of vehicle (Km/hr)	Voltage generated (Volts)
10	8.02
20	7.5
30	5.2
40	4.8
50	3.1



**B. VOLTAGE GENERATED (VS) LOAD:**

Speed of vehicle=10km/hr

Load(Kgs)	Voltage Generated(V)
65	8.43
125	9.32
175	10.74
210	11.30
265	11.75



**6.CONCLUSION**

This method has many advantages such as Power generation does not require any fuel input, Running cost is very less, this is a non-conventional form of energy and therefore very useful in the present scenario of energy crisis. Electricity plays a very important role in our life”. Due to population explosion, the current power generation has become insufficient to fulfil our requirements. In coming days, this will prove a great boon to the world, since it will save a lot of electricity of power plants that gets wasted in illuminating the street lights .

**REFERENCES**

- [1] Cecelski, B, Dunkerley, J, Ramsay, W (1979) Household Energy and the Poor in the Third World. Resources for the Future, Washington, DC
- [2] Goldemberg, J. et al., Basic needs and much more with one kilowatt per capita. *Ambio*, 1985, 14, 190–200.
- [3] Reddy, S (1990) The energy sector of the metropolis of Bangalore. Ph.D. thesis. Department of Management Studies, Indian Institute of Science, Bangalore, India
- [4] Reddy, A K N and Reddy, B 5 (1994) Substitution of energy carriers for cooking in Bangalore. *Energy* /9, 561—572.
- [5] Sharma.P.C, 2003, Non-conventional power plants, Public printing service, New Delhi.
- [6] Principles of renewable energy systems, Sharma.P.C, 2003,
- [7] Non-conventional power plants Mukherjee.D Chakrabarti.S, 2005,
- [8] Fundamentals of renewable energy systems, New Age international limited publishers, New Delhi.
- [9] Non-conventional power engineering, Public printing service, New Delhi.

