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Generation of Electrical Power using Bicycle Pedal

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Abstract- **It is known that the supplies of fossil fuels are limited and their utilization as energy source causes environmental degradation due to unfinished ignition when used as energy source, in addition to this as the world population increase the order for energy sources increases, so the issue of a steady replacement of fossil fuels with renewable energy source is of major consideration for most countries. Renewable power generation system is currently preferred for clean power generation. With ongoing revolution in the generation, electricity is generated at small level by using bicycle pedal. Bicycle is the main mode of transportation for many Indian villagers. Most of these villages are un-electrified. Power generated by pedaling can be converted from mechanical to electrical energy by using either dynamo or alternator.**

Keywords- **Bicycle, Pedal, MATLAB Simulink, Rectifier, Inverter, Generator**

I. INTRODUCTION

India is the second most popular nation in the world. Like many other countries where agriculture is the main activity, biomass and other non – commercial fuels constitute around 40% of energy requirements in India. Around 85.49% of Indian villages are electrified [1]. People use bicycles as the main medium of transportation in villages. In addition in cities, where most people use exercise bikes, the energy can be productively used to power electronic gadgets, which require less power. In India, many of the villages are still without electricity and most of them use bicycle as their medium of transportation. In such places, our system will be of great help. Charging of the battery can be done by a layman by just connecting the circuit to the output of the dynamo which is connected to the bicycle. This would charge the NiMH batteries.

World is a storehouse of energy. And according to energy conversion law, energy neither be created nor be destroyed but can be transformed from one form to another. But we are wasting resources that can produce energy as if they are limited. Humans are able to generate approximately 150W of power while riding bicycle. However, this power goes waste without any use. If this is making use of this energy, would be able to power many electronic devices. A dynamo or an alternator can be used for harvesting the energy generated by a cycle rider while riding. We can charge mobile phones or a small lighting device with the power. Not only in bicycle but also in alternator bikes, cars and exercise bikes use this principle [2].

With reference to the report statistics, "No. of Towns and Villages Electrified in India", Ministry of Statistics and Program Implementation, India, it can be seen that even after 65 year of independence 17.7% of India is still in dark during nights. All of the 5161 towns in India are electrified, i.e. cent percent in the case of towns. However, in India villages are more than towns and development of India I only possible by the development of those villages, out of 593732 village in India only 488439 villages are electrified, i.e. 105293 villages are un-electrified. Andhra Pradesh, Goa, Kerala, Punjab, Tamil Nadu, Haryana, and Delhi are the few of the stated that are where less than 60% of the villages are electrified, the worst situation is in Jharkhand where only 31.1% villages are electrified. The consumption of electricity in the country is increasing the rate of 10% per year. The energy usage has been increasing through year,

but there has been no sufficient increase in the production. In the case of electricity, this leads to load shedding and increase in prices [3].

Fig.1Charging batteries using bicycle pedal

II. PRINCIPLE OF OPERATION OF ALTERNATOR

Rotating a coil within a magnetic field induces a voltage at the coil terminals, which allows powering a load connected to these terminals. If the coil rotates at constant speed within a uniform magnetic field, an AC voltage with zero mean value is induced at its terminals. The periodic change of the voltage polarity is due to the change of the position of the coil relatively to the magnetic poles. The amplitude of the voltage depends on the magnetic field strength and the rotation speed. This is the principle of operation of alternator [4-5].

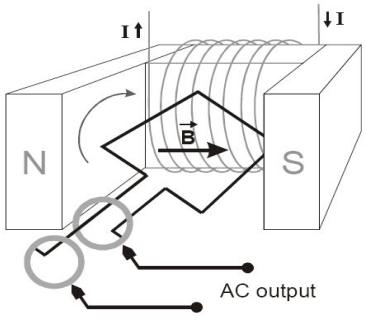

Fig. 2 Principle of operation of single phase alternator

III. POWER LEVELS

The power levels that a human being can produce through pedaling depend on how strong the peddler is and on how long he or she to pedal. If the task to be powered will continue for hours at a time, 75 watts mechanical power is generally considered the limit for large, healthy no-athlete. A healthy athletic person of the same build might produce up to twice this amount. A person who is smaller and less well nourished, but not till, would produce less; the estimate for such a person should probably be 50 watt for the same kind of power production over an extended period. The graph in figure 3 showed various record limits for pedaling under optimum condition. The meaning of these curves is that any point on a curve indicated the maximum time that the appropriate class of person could maintain the given average power level.

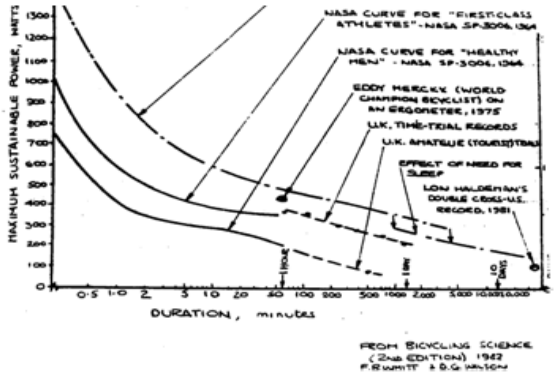

Fig.3 Human Power Output Pedaling

Power levels are also directly related to the environment of the person doing the pedaling. To be able to continue pedaling over an extended period, a person must be able to keep cool whether because the ambient temperature is low enough or because there is adequate breeze.

IV. MATLAB MODEL AND RESULTS

A model of the pedal power generator with permanent magnet synchronous generator was built up using MATLAB simulink shown in figure 4. In this model,

turbine and shaft is using as dynamo which is connected to generator, which is connected to load through IGBT based PWM inverter.

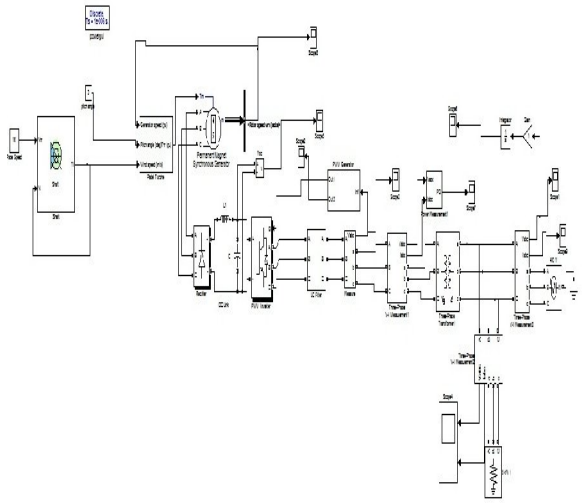

Fig.4 MATLAB Simulation Model of Pedal Power Generator

A. Results at pedal speed 12 rotations per second

The output results are shown, when pedal speed is 12 rotations per second.

1. Rotor speed

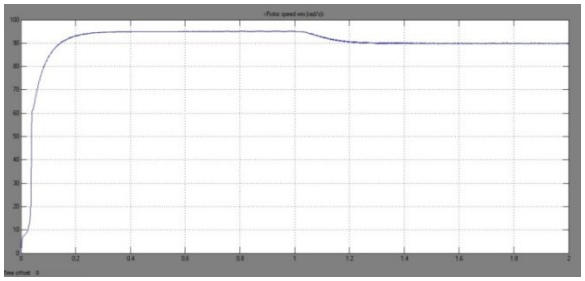

Fig. 5 Rotor speed at pedal speed 12 rotations per second

2. Rectifier Voltage

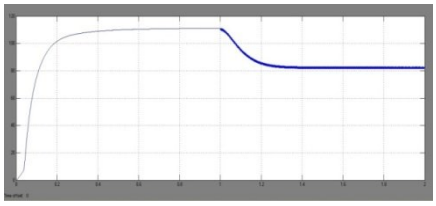

Fig. 6 Rectifier voltage at pedal speed 12 rotations per second

3. Inverter Voltage

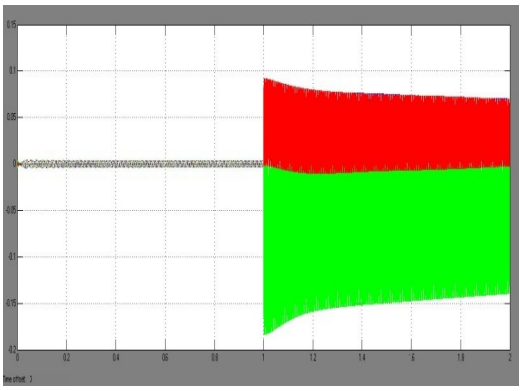

Fig. 7 Inverter voltage at pedal speed 12 rotations per second

4. Output Voltage

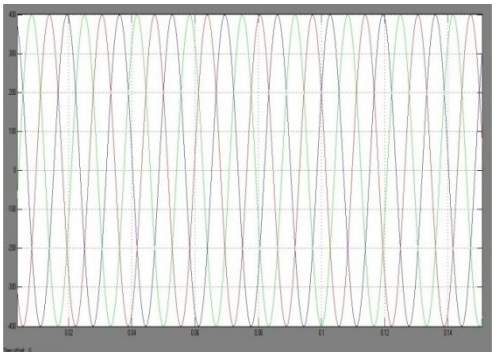

Fig. 8 Voltage output at pedal speed 12 rotations per second

5. Output Current

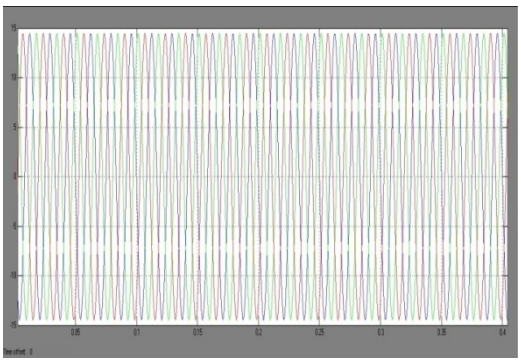

Fig. 9 Current output at pedal speed 12 rotations per second

6. Flux

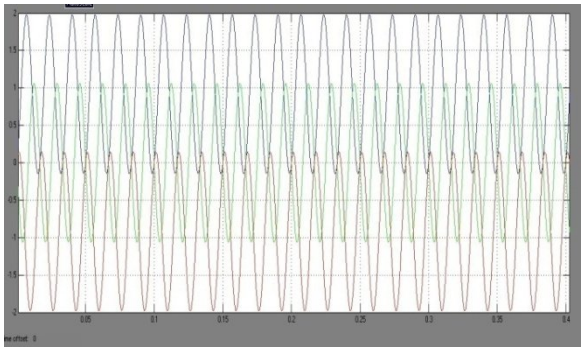

Fig. 10 Flux at pedal speed 12 rotations per second

B. Results at pedal speed 16 rotations per second

When pedal speed s 16 rotations per second, the results are following

1. Rotor Speed

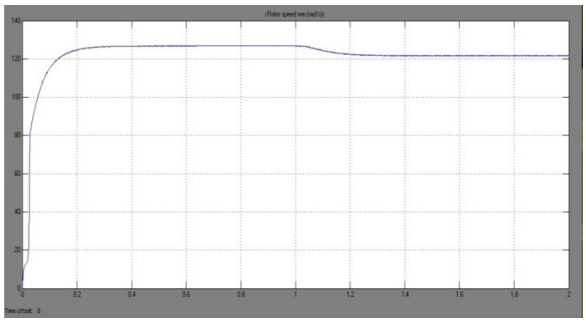

Fig.11 Rotor speed at pedal speed 16 rotations per second

2. Rectifier Voltage

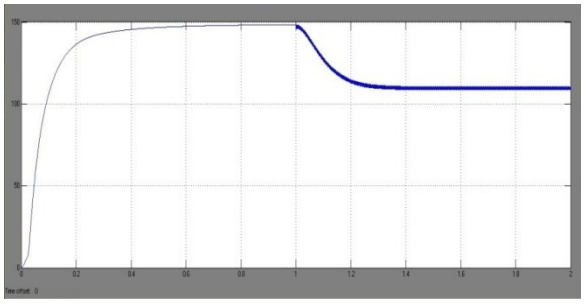

Fig.12 Rectifier voltage at pedal speed 16 rotations per second

3. Inverter Voltage

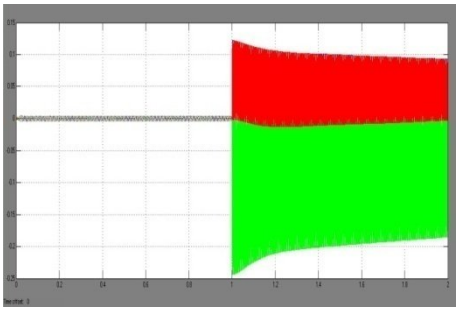

Fig.13 Inverter voltage at pedal speed 16 rotations per second

4. Output Voltage

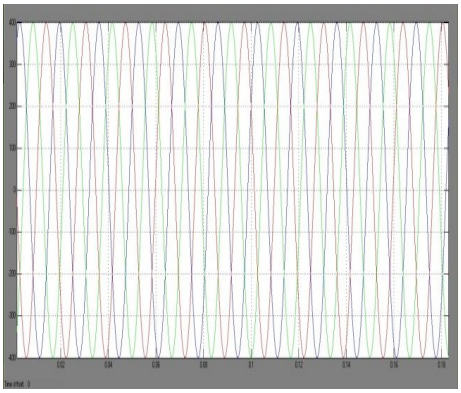

Fig.14 Output voltage at pedal speed 16 rotations per second

5. Output Current

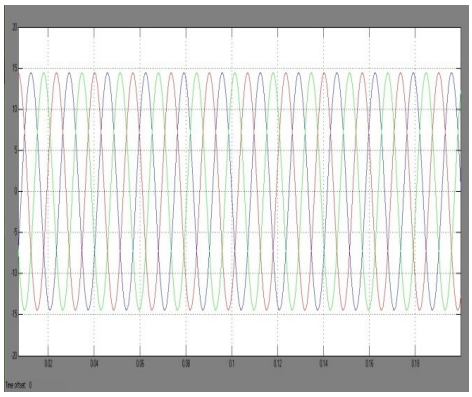

Fig.15 Output current at pedal speed 16 rotations per second

6. Flux

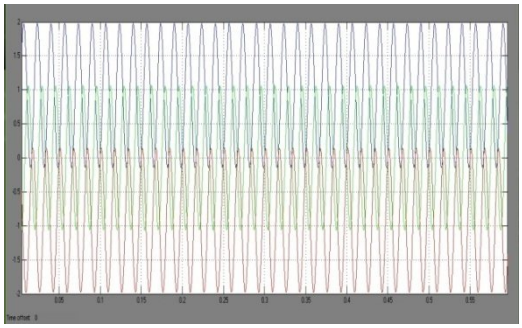

Fig.16 Flux at pedal speed 16 rotations per second

V. CONCLUSION

At a time when there is energy crisis casting its shadow all over the world, one has to look into alternator renewable energy sources. One such alternator way to generate power is presented in this paper. The rotating energy of the tries in the bicycle, generated by pedaling can be used to operate mall powered devices. Both dynamo and alternator can be used and various options and situation where a dynamo or alternator can be used are provided.

VI. REFERENCES

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