

# Generation of Electrical Energy by Dynamo

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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 on going 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.

**Key Words:** *Bicycle, Dynamo, Inverter, Pedal, Power, Rectifier.*

## 1. INTRODUCTION

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.

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 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.

Electricity found its first practical use not in generating mechanical work but in lighting, with the arc light (invented in the first decade of the 1800s but not commercial for another 50-70 years) and starting later but ultimately killing off arc lights, the incandescent bulb (with different designs patented by a number of inventors in the 1870s, of which Edison's was the most practical, allowing him after 10 years of patent litigation to get declared the father of electricity). In a light bulb, electric charge moving through a highly resistive filament generated tremendous amounts of heat, which in turn produces radiation. Demand for electric lighting was rapid, with the first house in England electrified only three years after Edison's patent. The first electric companies providing electricity (one of which was Edison's own business) were meeting demand for lighting, not electric motors. Large scale electricity use required some means of producing electricity other than the earliest primitive batteries and was possible only because of the development of the generator, which converts mechanical work to electrical energy.

The connection between electricity and mechanical work was known since 1821, when the great Michael Faraday figured out that when he ran an electric current near a permanent magnet, he generated a force that moved the wire carrying the current. That's the principle of the electric motor, but for the next 50 years, motors were toys and laboratory demonstrations only. Early electric motors, only the latest of which are commercial. Most technical development concentrated on generators instead. In the first electric generators or dynamos, some source of mechanical work turns loops of wire within the field of a permanent magnet. That motion forces electrical current to flow through the wires, producing a flow of current in one direction, what we call direct current or DC. The electric motor didn't get commercial use until one dynamo manufacturer realized at an industrial exhibition in 1873 that one of his dynamos that was actively producing electricity had gotten accidentally connected to another and was turning its shaft, that is a dynamo run in reverse was a motor. From that point on using electricity to move things became a focus of industrial development.

## 2. OVERVIEW

### 2.1: Power Generation

It has a DC motor which runs as generator to produce electricity. We have developed gym cycle which includes fan along with power generation. Initially a DC motor (DC dynamo 12V DC) is chosen to work as generator and a suitable V belt is chosen which can fit perfectly on front wheel rim. Suitable wooden base is bolted on to front wheel to align motor and front wheel rim on the same base. A pulley is chosen as per the width of the belt. Motor is kept on a wooden base provided at the front left end of the front wooden base. Motor is clamped to the wooden box using clamp to restrict the axial movement of the DC motor. Hence as the user pedals front wheel rotates which in turn runs the motor shaft at higher rpm and hence power is generated. DC bulb is connected to indicate the power generation. We have developed a low cost air cooler using DC fan (12V, 65amp) which is being installed at back side of the sheet metal duct. This fan is run by the DC motor. A sheet metal stand is made to give correct alignment to the user. A wet husk is provided in between the duct. Two holes being drilled at the top and the bottom centre of the pipe. Funnel is used to supply the water to the wet cloth. Seals being used to avoid the drained water to scatter. As the gym cycle user runs the cycle, motor starts generating the power. This power is used to run DC fan which in turn sucks the air axially and made it to pass through the wet cloth. Wet cloth adds the moisture content in the air and blows it over user body. This will produce breezing effect over the user.

#### 2.1.1: Power Generation using Bicycle

There are various renewable energy sources such solar, wind, hydropower etc. In addition, people use fossil fuels, which are non-renewable. These resources are very expensive. Therefore, there is a need for cheap, renewable energy source. As long as we are pedaling and the system is working fine, we can get the power whenever needed. Power generation using bicycle is very cheap and eco-friendly. Even though people have been using pedal power for various day-to-day chores, generating electricity from pedaling was not in vogue until few decades back. Today dynamo equipped bicycles are common which power the incandescent headlights during night. The rotational energy that is generated when the tire rotates because of the application of force on the pedals can be used in two ways. This energy can also be used in dynamo/alternator, which is then converted to electrical energy. Rotational energy of the tire can be used to pump water out from the well, to drive a washing machine, to operate blender/grinder etc. These applications can be of very great use in un-electrified places. Refrigerators can also be powered by pedaling, which are used to preserve the food during a bicycle trip. Pedal powered pump can pump water from wells and bore wells, which are very deep and can be used for irrigation and

drinking water purposes. In pedal powered washing machine, the plastic barrel rotates as we pedal. Thus, water consumption can be also reduced. Using exercise bikes also power can be generated. Particularly for people living in cities, it is an added advantage that no separate time is needed and along with exercise, our effort will not go waste.

### 2.2: Dynamo

Bicycle dynamos are alternators equipped with permanent magnets, which produce AC current. Two types of dynamos available are the hub dynamo and the bottle dynamo. Hub dynamo is built into the hub of a bicycle wheel. Here generation of electricity is done by using the rotation of the bicycle wheel. A bottle dynamo is also small electric generator like hub dynamo. It is generally placed to the rear wheel of the bicycle. A bottle dynamo acts like a small alternator.

#### 2.2.1: Need of Dynamo

Dynamo can be used to convert mechanical energy to electrical energy. Alternating current can be produced normally using the dynamo. This current can power devices, which work on AC directly, can be converted and used for devices working on DC. The amount of power generated from a dynamo by pedaling is sufficient to power the devices, which require low power. Most of the electronic gadgets including mobile phones and iPods can be powered using this. These devices can be charged while either riding the bicycle or by keeping the bicycle stationary and pedaling. Dynamo is small, lightweight and is therefore best to use in bicycles. The problem with a simple generator is that when the rotor rotates it eventually turns completely around, reversing the current.

## 3. CIRCUIT DESCRIPTION

A ceiling fan motor with a generator winding that mainly consists of motor axle, stator and rotor. The stator is fixed on the motor axle. In this embodiment, the stator is formed by stacking a predetermined number of metal plates. The stator is surrounded with a plurality of first magnetizing coils, each of which is wound with a second magnetizing coil with a generator winding. The second magnetic coil detects the received EMF around it. The stator has a predetermined number of equally spaced coil arms in the perpendicular direction toward the motor axle. Each of the coil arms has a concave section for the corresponding first magnetizing coil to wind around. The second magnetizing coil further winds around the corresponding first magnetizing coil. In particular, each of the first magnetizing coils is electrically connected with an energy saving driver controlling circuit. The energy saving driver controlling circuit receives an input voltage and controls the electrical current phases of the first magnetizing coils.

The second magnetizing coil is electrically connected with a power distribution controlling circuit for converting the back EMF detected and received by the second magnetizing coil into electrical power for output. The rotor is pivotally mounted on the motor axle through a bearing. In this embodiment, the rotor has several magnetic objects around the stator. The magnetic objects can be permanent magnets. The rotor is surrounded with several connecting parts for fixing a blade frame. The blade frame has several blades. The bottom of the blade frame is pivotally installed with an illuminating unit. In practice, each of the first magnetizing coils is driven by the input voltage to produce an induced magnetic field. The rotor is thus driven to rotate with respect to the stator and build up inertia. When the rotor rotates with respect to the stator, the rotor rotates and cuts through the magnetic lines.

A back EMF is thus generated in the induced magnetic field. The second magnetizing coil on the stator detects the received EMF. The received EMF is converted by the power distribution controlling circuit into electrical power for output. In this embodiment, the power distribution controlling circuit is electrically connected with the illuminating unit at the bottom of the blade frame. The electrical power output from the power distribution controlling circuit can drive the illuminating unit at the bottom of the blade frame.

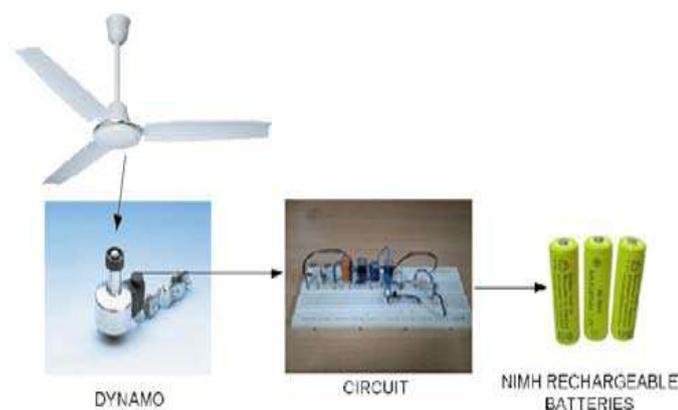


Fig. 3.1: Charging NIMH Batteries using Dynamo

Therefore, the illuminating unit can produce light without additional electrical power. However, it should be mentioned that the energy saving driver controlling circuit can convert external AC power into DC power and eliminate the power supply noise interference. The charging NIMH batteries using dynamo shown in fig. 3.1. When the circuit is operating the energy saving driver controlling circuit can detect the position of the rotor in rotation and therefore determine the electrical current phases of individual first magnetizing coils. In this embodiment, the energy saving driver controlling circuit has a predetermined number of hall elements. Each of the hall elements can detect the polarity of

the rotator in rotation. The energy saving driver controlling circuit can thus determine and control the electrical current phases of the first magnetizing coils for them to build up the inertia.

The rotor can thus continue its rotation with respect to the stator. Moreover, the energy saving driver controlling circuit provides an energy saving control means, which uses the input voltage in an intermittent way to start the energy saving driver controlling circuit. When the energy saving driver controlling circuit receives the input voltage, it controls the ON time of the first magnetizing coils. The rotor is driven to rotate with respect to the stator and maintain its inertia. When the energy saving driver controlling circuit does not receive the input voltage, the rotor continues to rotate with respect to the stator due to inertia. The rotor still cuts through the magnetic lines and produces a back EMF. Therefore, even when the energy saving driver controlling circuit does not receive the input voltage, the power distribution controlling circuit still uses the back EMF detected and received by the second magnetic coil to generate electrical power. This can effectively increase the power generating efficiency.

The first magnetizing coil and the second magnetizing coil share the magnetic objects on the rotor. Therefore, the production cost of the invention can be reduced. It uses the second magnetizing coil to detect and receive the back EMF produced because the rotor rotates and cuts through the magnetic lines. The back EMF is used by the power distribution controlling circuit to generate electrical power. Therefore, without additional power supply, the invention can light up an illuminating unit or charge a chargeable battery. Therefore, the invention can save energy and reduce the utility cost. The invention further uses an energy saving means on the energy saving driver controlling circuit to supply the input voltage in an intermittent way to the energy saving driver controlling circuit. This helps reducing the electrical power. When the energy saving driver controlling circuit does not receive the input voltage, the rotor still rotates with respect to the stator due to inertia and produces a back EMF. In this case, the power distribution controlling circuit can still use the back EMF detected and received by the second magnetizing coil to generate electrical power. This effectively increases the power generating efficiency of the invention.

### 3.1: Principle Construction of Dynamo

It is known that when an electrical conductor cuts across a magnetic field an EMF is induced in the conductor. If the circuit is completed between the ends of the moving conductor a current will be established as shown in fig. 3.2, which current will, in turn, react on the magnetic field and exert a force tending to stop the motion of the conductor the arrow a shows the direction of motion while C shows the direction of the reacting force. If we continue to move the conductor against this force, the current will continue to

flow but work must be done to move the conductor against the opposing force, thus it might be said that we have converted dynamic energy into electrical energy, for electrical energy has been obtained at the expense of mechanical effort. A machine for generating electrical energy that operates on this principle is called a dynamo electric machine or an electric generator. These terms are often abbreviated in dynamo and generator.

#### 4. CONCLUSION

At a time when there is crisis casting its shadows all over the world one has to look into alternate renewable sources. One such alternate way to generate power is presented in this seminar. The rotational energy of the dynamo can be used to operate several small powered devices. Both dynamo and alternator can be used. The various applications where this power can be used are charging of laptops, cell phones etc. It is also observe that 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.

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