

# Innovative and Co-Generating of Pedal Based Power Generation for Remote Area

Vishnu Shivhare, Prof. Sagar Tomar  
M. Tech. Scholar, Professor  
Department of Electrical Engineering  
NRI Institute of Information Science and Technology,  
Bhopal, M.P.

**Abstract:** - The main objective of this research work is to investigate the development of a new hybrid design layout and its performance by simulating it in MATLAB through the application of load.

This paper shows the establishment of the comparative study of Photovoltaic Applications with low dc input voltage with pedal generation techniques. The concept of achieving high efficiency due to reduction in voltage stresses on switch and compactness in the size is the main paradigm in the present day Power Electronic Industries. The main feature of this converter transfers the capacitive and inductive energy simultaneously to increase the total power delivery to the load by reducing losses in the system. Since using IGBT in DC-DC converter gives better performance, less distortion in output which causes low harmonics injects into the power system so better efficiency of the converter, In this research IGBT is used in place of MOSFET. With these improved performance, the converter can maintain high efficiency under low power and low input voltage condition.

**Keywords:** Pedal Generator, PV array, IGBT, MOSFET, MATLAB, PCS, Converter topology, Plug-in hybrid electric vehicles (PHEVs).

## I. INTRODUCTION

Renewable energy sources can also be called. Such as solar energy, bio-energy, bio-fuels grown sustainably, wind energy and hydropower etc. are number of the cases of renewable energy sources. A renewable energy system converts the energy utilized in sun (photon energy), falling-water, sea-waves, under floor heating, wind, or biomass etc. in order that we can use inside the assortment of heat or electricity. Virtually all of the renewable energy comes from sun or end and it can never be emptied.

However nearly all of the entire planet's energy sources came from traditional Source and Fossil fuels such as petroleum, organic gases and coal. It will finish, Even though the access to these fuels are big but because of decrease in amount of sources which are day after a couple of decades. Energy supply demand increases since it is environmental friendly, free of pollution and cost free that reduces the greenhouse effect.

Most of the rural areas of India don't have access to electricity. The cost of setup and maintenance of transmission lines in those regions is because of low population densities. Some of these areas won't have access to reliable power even in the next ten years. Therefore alternate means of electrical energy will need to be utilized with enhanced power quality and preparation at the local level. One such choice is to produce electrical energy using Manual Charkha (Pedal generator) as per the Power Generation System. Small scale power plants are set up under the village energy security programme (VESP) which was implemented by Ministry of new and renewable energy (MNRE), India to achieve the requirement of power. This plan intends to arrange unique sources of renewable energy based systems to satisfy energy requirements of villages in an efficient, cost effective and reliable manner.

Currently, the DC distributed power system for a home will ease the power sources' execution from renewable energies with much efficiency of electricity sending and less complexity connection. From these types of advantages, a power generation based on workout bike gets energy.

Some neighbour countries like Bangladesh is a working on the development of new small power generation techniques that may be used in rural areas without harming environment. Study shows that, Pedal generation unit consists of an Electro-Mechanical system. This system demonstrations the conversation of kinetic energy to electrical energy by using alternator and stores it by using battery.

**Pedal Operated Power Generation:-** Here, we discuss the very basic principle conversion of mechanical energy into electrical energy. Previous research shows power generation from kinetic energy using pedal generator [1]. The idea of our study is to use that sort of kinetic energy produce electricity.

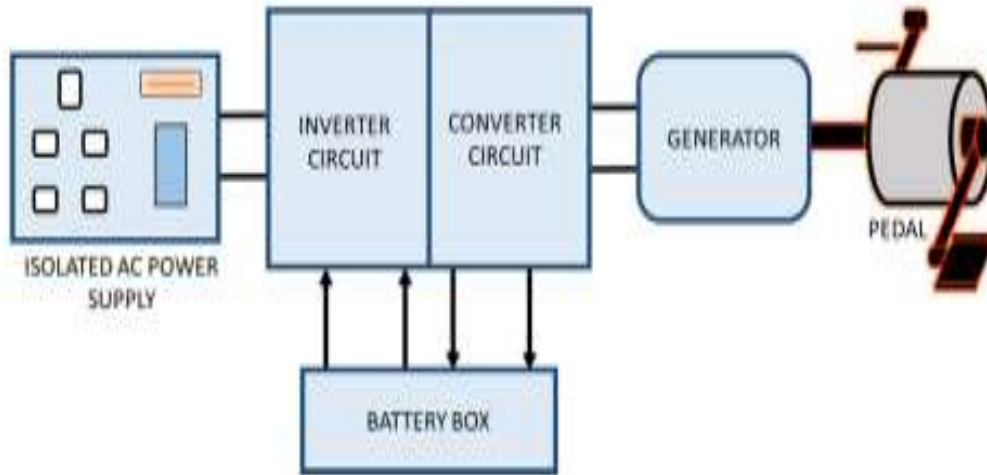


Fig. 1: Block diagram of Pedal System

It's an optimum but easy way to make energy out of pedal power. Generally, the majority of the rural men and women are dependent on bicycles for their convenience.

## II. LITERATURE REVIEW

**K. M. Ahsan-uz-Zaman, Kafi Mohammad Ullah, Md. Mishir and Mahafujul Alam, "Generation of Electrical Power Using Gymnasium Bicycle", 2017 IEEE / 978-1-5386-2175-2/17/\$31.00 ©2017 IEEE [1],**

Now the requirement of existence is electricity and it might control developments almost any nation. Funds for generation of power is among the cause of that although Bangladesh is a developing nation. In Bangladesh most of their energy is created using standard energy resources and they're decreasing daily. On the other hand energy resources are liable for global warming and pollution. That is the reason why we need energy supply to come up with energy generating that are sustainable, clean and eco-friendly. That is a method to create energy is introduced by our study. Our mechanism harvest power employing the strain energy via gymnasium bicycle in human's motion. It's an system. This system indicates the dialog of energy to electrical power and tap battery being used by it. This paper presents the system's efficacy. We expect that our energy switching system (mechanical to electric) is comprising low losses to create power. Actually we're currently attempting to gifts a mechanism whereby Bangladesh's power problem is going to be decreased.

The target of this research work will be to create electricity out of the bike that is gymnasium. Probability was analyzed by it in gyms as a power supply. The system that is recorded is non-conventional along with energy production technique's means is. This system could possibly be regarded to IPS system through the period of load. This mechanism can be used with no pedaling for some length of time, to ride it. Implementation on gymnasium gear treadmills might be regarded as future work of the study.

**Ganchanasopa Warongkidh, "An Exercise Bikes Assisted Main Energy Source In DC Distributed Power System", 2017 –ICITEE [2],**

The DC distributed power system for a home will ease the execution of their tiny power sources from renewable energies with much efficiency of electricity and sophistication connection. From these types of advantages, a energy generation based on workout bicycle gets energy. An energy is created and delivered to some DC distributed grid of the home period. The level of energy is kept equal to some level of this DC distributed grid. The torque level is a value of a generator present that sends and generates into the DC distributed grid. In the experimentation of outcomes, they could send the electric capacity to the appliances together with the efficacy more than 99 percent and also assisted semi energy providing in the primary energy source like 125W using a set of workout bicycle unit along with 252W with two sets.

A tiny power production from energy supply for DC distributed power system. They are sometimes assisted partial energy providing in the primary energy supply, but merely a span of pedaling from individual exercise. Origin is character doubt performances. As a result, the hybrid vehicle power supply system using an current public power system behave as the primary electric power supply for maintaining the dependability of the DC grid of the home.

An individual energy generation with exercise bicycle gets feasible renewable energy, even if delivered its output to DC distributed power system DCPS right without electricity storage system and also with reduced power losses in the transmission line like the DC distributed grid. The lack of batteries within a machine unit becomes an energy generation using the revival time along with pollution.

The increasing of power cost in the future may significantly reduce more quote revival period of the HPG system dependent on the exercise bicycle, which makes it economically achievable.

**S K jitendra Kumar Prasad, Dr. Anupritamishra, "Comparative Study of MOSFET and IGBT as a switch in SMES System for High Power DC Application" in IEEE-EECCMC. Jan 2018 [3],**

Energy storage systems are the urge potential solutions for improving efficiency and energy quality. In addition, it can increase the efficacy of electricity grid with important penetrations of renewable energy. This paper clarifies the substantial developments and study functions of SMES system that's hybrid linked with all the PV array. This apparatus have a extremely quick response time and therefore are acceptable for applications using quick charge and discharge requirements. For big DC program (for instance, heavy load lifting, rolling machines ) we want a trusted supply with backup mechanism for easy functioning. A SMES unit attached to your solar system can consume and store power from the system and also to inject these forces into this system when they're wanted.

Comparing to other storage technology, the SMES has significant benefits in being able to proactively inject electricity into the grid. Additionally SMES has benefits of high energy density, higher charge-discharge speed and no environmental contamination, so it is one of supreme energy storage gear.

This study clarifies that SMES system may be a great for power system stability. SMES using its own facility to release a enormous quantity of energy through limited amounts of time may control the rate of the ability to develop into steady the dc link voltage, which then leads to boost the stability and boost the general performance of power systems. SMES using PV array can't just enhance the equilibrium in the total system, but also make it even more reliable at precisely the exact same moment.

**Alimul Haque Khan, Md. Moniruzzaman, Md. Muhibullah Mehedi Hasan & Niaz Morshed, "Empowering Remote Area of Bangladesh Using Pedal Generator" 978-1-5090-0169-9/15/\$31.00 c 2015 IEEE [4],**

Now-a-days, Bangladesh is facing a problem with lack of natural resources particularly in gasoline sector. A large variety of people in Bangladesh don't have the amenities of power. Apart from the folks of distant area are generally far from contemporary amenities for example schooling, wellness, online services etc.. Generally, they use kerosene as fuel for lighting function and it's a challenge for them to get modern technologies like cellular, computer, net, e-health. Pedal generator, also a flywheel driven by individual and combined with an electrical generator. May be an alternate solution in these circumstances. The efficacy and the operation were great. It may be worked in a standalone manner or might be utilized with PV module for a hybrid system. However, the study was performed with regard to Bangladesh, this may be applicable anywhere. This will give a simple, economical, convenient and pollution free source of electricity by way of chainsaw.

This is a handy machine at locations where many men and women gather and remain together (meetings, residential colleges). It's not hard to keep and create. The project was extremely hard, intensive enormous amounts of time, resources and energy. On the other hand, the wisdom and expertise acquired was hugely valuable and has given assurance to operate with more complex electric jobs. Installation of the device at a remote area for where it had been created, is essential to acquire field level information. This setup will also offer profound and very clear details concerning the durability, reliability, feasibility, and simplicity of usage as well as further modification of this machine.

### III. PROPOSED METHODOLOGY

Some important characteristics of filters must be considered in the designing of LCLR filter, such characteristics are: (i) filter size (ii) filter design (iii) amount of current ripple (iv) cost of the filter (v) switching attenuation performance of the filter. In case of the only LCL filter there is chance of resonance due to the reactive power requirement and because of this capacitor of filter will interfere with grid resistance; therefore must add passive component as like resistor in series with the capacitor. The passive component-resistance is added in series with capacitor to smooth the current ripples. The active components can be used to solve these problems.

The important parameters required for the filter design are:

$V_{ph}$ : Phase voltage of inverter output

$V_{LL}$ : Line to line voltage of inverter output

$P$ : Rated active power

$V_{DC}$ : DC voltage from renewable energy sources i.e. input voltage to the inverter

$f_{sw}$ : Switching frequency of the inverter

$f_g$ : Grid frequency

$Z_g$ : Grid angular frequency

$f_{res}$ : Resonance frequency

$m$ : Inverter modulation factor

$ka$ : Desired attenuation constant

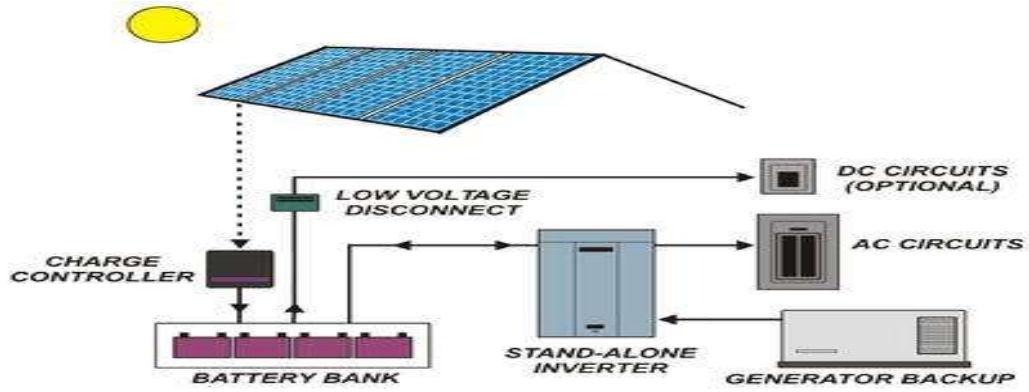


Fig.2: Diagram of the simplified Hybrid Power Generation System

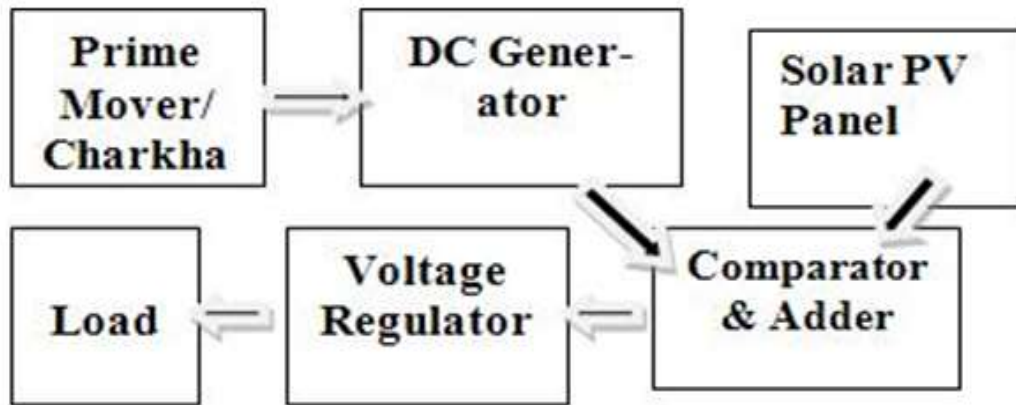


Fig. 3: Block diagram of the Proposed System

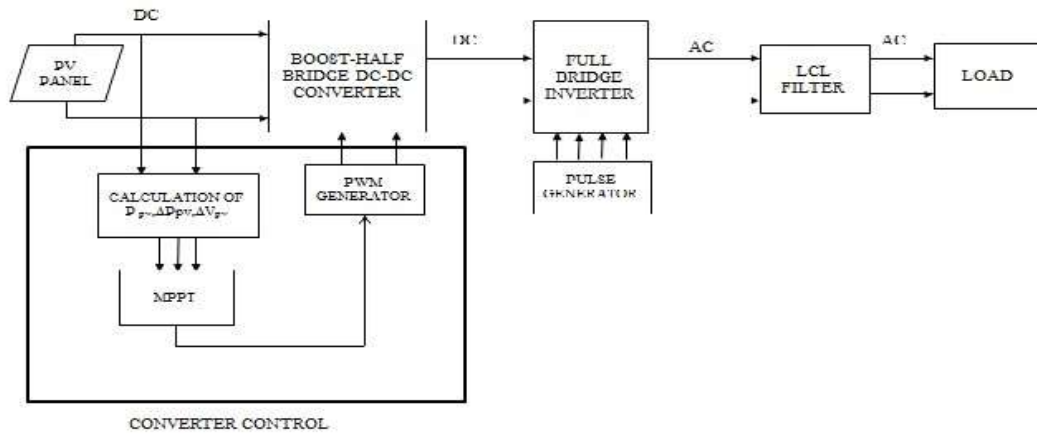


Fig. 4: Block diagram of Proposed Hybrid Power Generation System with hybrid filter

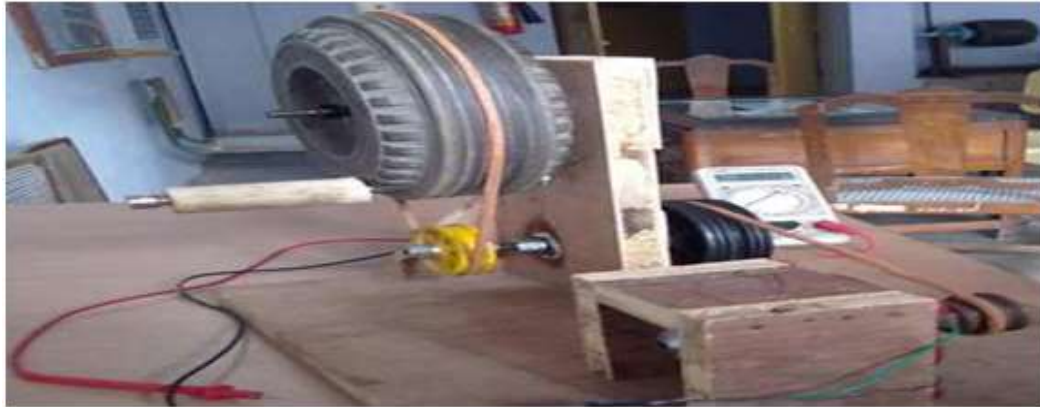


Fig. 5: Model for Manual Charkha Base power generation

Hybrid solar and pedal generator model is connected to the Grid via converter and Hybrid filter. Reference current for Controller is generated using Synchronous Reference Frame Theory. Total Harmonic Distortions is found using Fast Fourier Transform in MATLAB for two cases. With solar and pedal generator and without solar and pedal generator (Active power filtering mode). Real and reactive power is also measured with and without Hybrid Filter. The proposed work will be performed in department of electrical engineering laboratory of Jabalpur Engineering College Jabalpur with its testing and validation along with real time environment.

#### IV. SIMULATION RESULT

In order to verify the effectiveness of the anticipated converter, the converter was designed in MATLAB/SIMULINK environment.

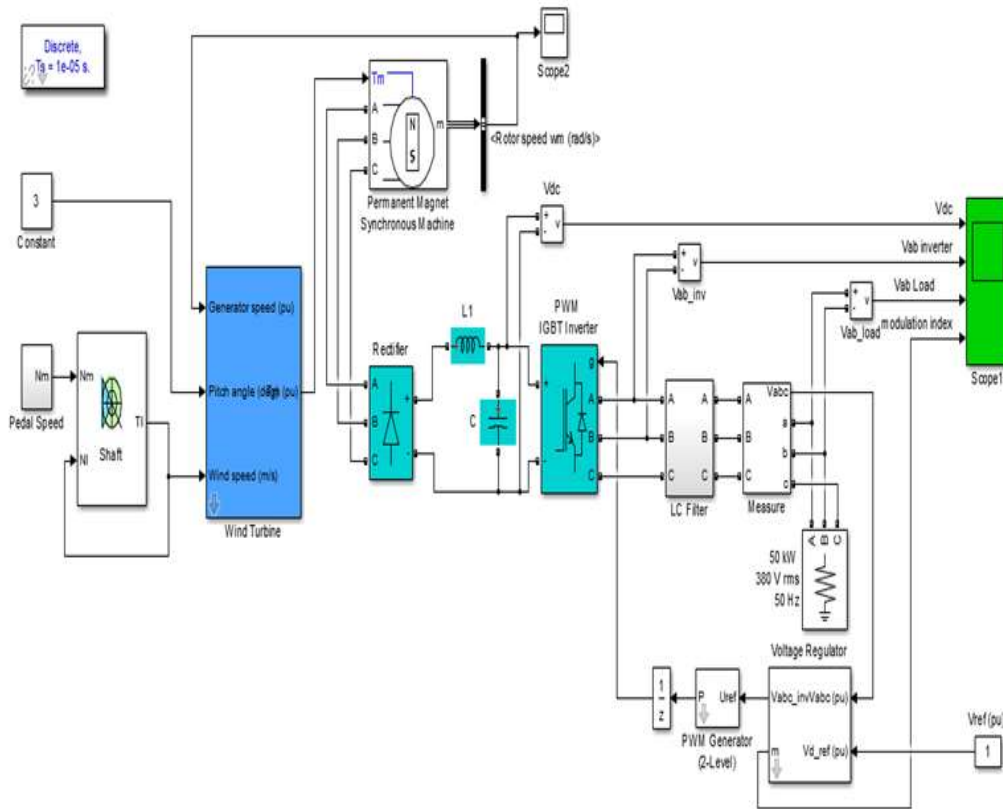


Fig. 6: Simulation diagram of solar based high boost ratio converter

Figure 6 represents Simulink model of solar based high boost ratio converter. In this input voltage is given to this converter by solar. The voltage is stepped up using a boost converter and due to the capacitance  $C_o$  the ripples will be reduced and the fine DC voltage is obtained at the output side of the circuit.

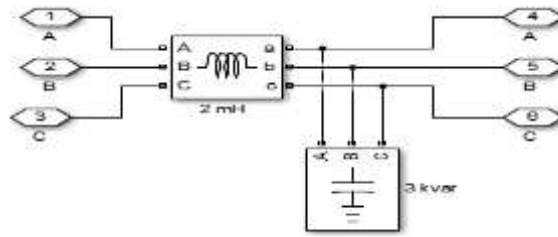


Fig. 7: Internal circuit of the filter unit connected

Above shown figure is the internal circuit of the filter unit connected with the inverter. Now, below shown graph is the result of MATLAB simulation

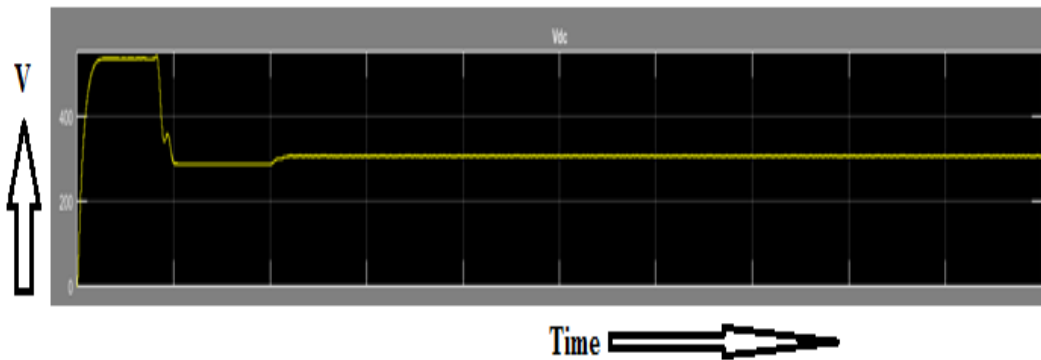


Fig. 8: Graph between DC voltage vs time for solar based converter

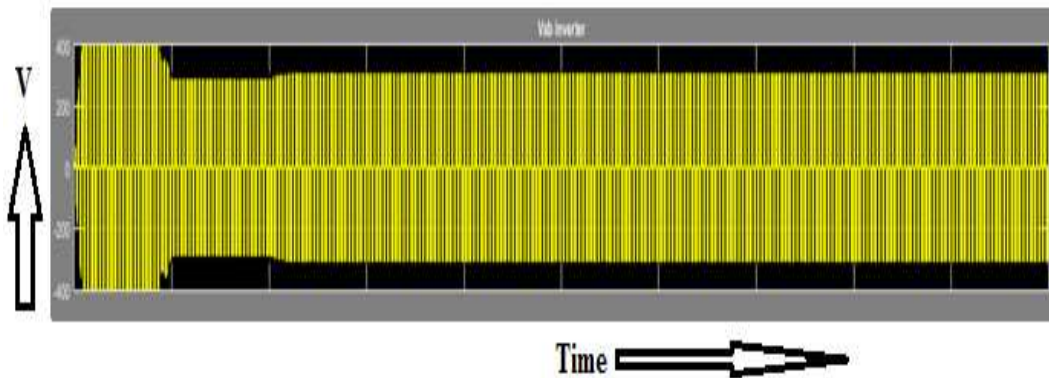


Fig. 9: Graph between inverter voltage vs time for solar based converter

**V. CONCLUSION**

This paper presents comparison between- A High-Boost Ratio Hybrid Transformer DC-DC Converter for Photovoltaic Applications with low dc input voltage with following features and benifites and pedal generation The concept of achieving high efficiency due to reduction in voltage stresses on switch and compactness in the size is the main paradigm in the present day Power Electronic Industries. The main feature of this converter transfers the capacitive and inductive energy simultaneously to increase the total power delivery to the load by reducing losses in the system.

**REFERENCES**

[1] K. M. Ahsan-uz-Zaman, Kafi Mohammad Ullah , Md. Mishir , Mahafujul Alam, “Generation of Electrical Power Using Gymnasium Bicycle” in 978-1-5386-2175-2/17 /\$31.00 © 2017 IEEE.  
 [2] Ganchanasopa Warongkidh, “An Exercise Bikes Assisted Main Energy Source In DC Distributed Power System” 978-1-5090-6477-9/17/\$31.00 ©2017 IEEE.R.

- [3] S K Jitendra Kumar Prasad, Dr. Anupritamishra, "Comparative Study of MOSFET and IGBT as a switch in SMES System for High Power DC Application" in IEEE-EECCMC. Jan 2018
- [4] Anyanwu, S. Ikechukwu, Ashinze E. Anthony, "Design and Fabrication of a Pedal Operated Power Generator" Innovative Systems Design and Engineering ISSN 2222-1727 (Paper) ISSN 2222-2871 (Online) Vol.7, No.3, 2016
- [5] AlimulHaque Khan, Md. Moniruzzaman, Md. Muhibbullah, "Empowering Remote Area of Bangladesh Using Pedal Generator," 978-1-5090-0169-9/15/\$31.00 c2015 IEEE.
- [6] Rajneesh Suhalka , Mahesh Chand Khandelwal , Krishna Kant Sharma , AbhishekSanghi, "Generation of Electrical Power using Bicycle Pedal," International Journal of Recent Research and Review, Vol.VII, Issue 2, June 2014 ISSN 2277 – 8322.
- [7] Swati. M. Mudaliar, Anagha R. Soman, "Electrical Power Generation Harnessing Human Energy and its Analysis,"978-1-4673-6817-9/15/\$31.00 ©2015 IEEE
- [8] [en.wikipedia.org/wiki/Rotational energy](http://en.wikipedia.org/wiki/Rotational_energy)
- [9] [http://www.web-ormulas.com/Physic Formulas/Electric Power.aspx](http://www.web-ormulas.com/Physic_Formulas/Electric_Power.aspx).
- [10] [en.wikipedia.org/wiki/Electric generator](http://en.wikipedia.org/wiki/Electric_generator).
- [11] Nuno Brito, Luis Ribeiro and Joao SenaEsteves , " Electroic Power Generating Bicycle" 3ed International Conference on Hand-on Science-2006 H-sci ISBN.
- [12] ChetanKhemraj, Jitendra Kumar, Sumit Kumar and Vibhav Kausik, "Energy Generation And Storage Using Bicycle Pedal System" Special Issue of International Journal of Sustainable Development and Green Economics (IJSDDGE) ISSN No: 2315-4721, V-2, I-1, 2013.
- [13] Rajesh Kannan Megalingam, Pranav Sreedharan Veliyara, Raghavendra Murali Prabhu, Rocky Katoch, "Pedal Power Generation" Researchgate/publication/259980152/Jan2012
- [14] R. Podmore, , Ray Larsen, Henry Louie, Brian Waldron, "Affordable Energy Solutions for Developing Communities" 978-1-4577-1002-5/11/\$26.00 ©2011 IEEE