

PV Solar Cell and MAG-LAV Wind Power Hybrid for Irrigation System

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Abstract— This work describes the implementation of VAWT and solar panel for electricity generation from renewable energy sources that are wind energy and solar energy respectively. The VAWT worked on electromagnetism principle has suspension system of permanent magnets instead of ball bearing used in conventional wind turbines. The electrical energy generated by this hybrid system is then used for streetlight purpose.

Keywords: Wind energy, Solar energy, Magnetic Levitation, VAWT, Savonius Turbine, Solar panel

I. INTRODUCTION

This is based on the implementation of an alternate configuration of a wind turbine for power generation purposes. A vertical axis wind turbine (VAWT) is introduced by magnetic levitation technology to optimize the performance. The system utilize nature of permanent magnet as a replacement for ball bearings to levitate the turbine component and thus minimize energy losses while rotating, which is the major problem that faced by conventional wind turbine. The Maglev Wind Turbine is expected to bring wind power technology to the next level. Furthermore, the system can be suited in use for rural and urban areas of low wind speed regions. In addition to that we are using another wind turbine which is horizontal axis equipped with lens combined called that arrangement is WIND LENS. In our project we are combined this two sources in order to make hybrid power generation system. The results obtained will be compared with the model of conventional wind turbine. For comparison we are use conventional wind turbine. The primary factor for survival of human beings is the energy. Everything what happens in the world is the expression of flow of energy from one form to another. Electric power is not available in many rural areas due to high cost of generation and distribution to small dispersed users. For electricity generation we have to greatly depend upon hydraulic and nuclear power plants. But due to their certain disadvantages like area compensation, high initial cost, availability of resources and also the pollution, there is need to rethink on some another renewable energy resources. Solar energy and wind energy are available abundantly all over the world with free of cost. These energies are harnessed by human beings for a long time and with the advanced technologies we can take their advantage to generate electricity The potential of solar energy is 178 billion MW which is about 20000 times the world's demand and the potential of wind energy is 1.6×10^{10} MW equal to magnitude of present energy consumption on the earth. The solar energy can be converted to electrical energy by photovoltaic cells. The kinetic energy of wind can be converted to electrical energy by wind turbine. As conventional wind turbine has certain disadvantages; vertical axis wind turbines (VAWT) are the alternate solution. The merits of VAWT are low initial and running cost, easy installation, less space acquired, capability to capture wind

from any direction and elimination of ball bearings by the use of magnetic levitation technique. The advantage of these two renewable energy resources can be taken by making a hybrid system so we do not required depending on availability of any single resource. The electricity required for domestic purpose can be generated by unique combination of solar system and wind system.

II. LITERATURE REVIEW

Nowadays, we will ultimately need to search for renewable or virtually inexhaustible energy for the human development to continue. Renewable energy is generally electricity supplied from sources, such as wind power, solar power, geothermal energy, hydropower and various forms of biomass. These sources have been coined renewable due to their continuous replenishment and availability for user over and over again. The solar power where sun hits atmosphere is 10¹⁷ watts, whereas the solar power on earth's surface is 10¹⁶ watts. The total world-wide power demand of all needs of civilization is 10¹³ watts. Therefore, the sun gives us 1000 times more power than we need. If we can use 5% of this energy, it will be 50 times what the world will require. Electricity can be produced from the solar energy by photovoltaic solar cells. When photons from the sun are absorbed in a semi-conductor, they create free electrons with higher energies than the electrons which provide the bonding in the base crystal. Once these free electrons are created, there must be an electric field to induce these higher energy electrons to flow out of the semi-conductor to do useful work. The electric field in most solar cells is provided by a junction of materials which have different electrical properties. The photovoltaic effect can be easily described easily for p-n junction in semi-conductor materials of solar cells which are silicon, cadmium, sulphide/copper sulphide, gallium arsenite.

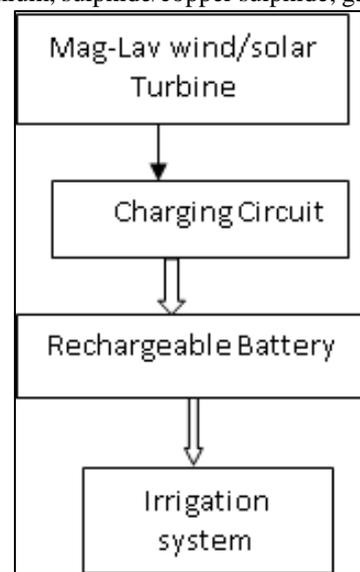


Fig. 1: System flow

III. RESEARCH ANALYSIS

When the wind blows, the blades of the turbine are set in motion which drives a generator that produces electricity. With the vertical axis wind turbines, the concept behind their operation is similar to that of the horizontal designs. The major difference is the orientation of the rotors and generator which are all vertically arranged and usually on a shaft for support and stability. This also results in a different response of the turbine blades to the wind in relation to that of the horizontal configurations.

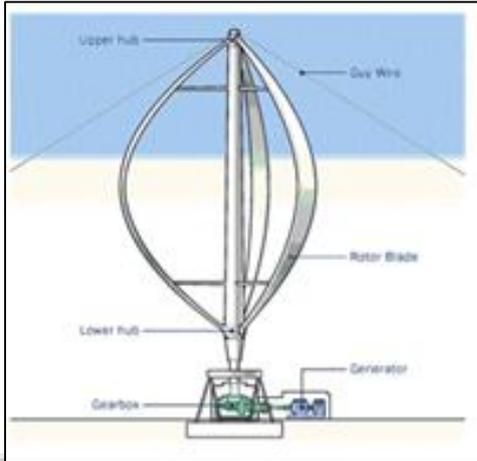


Fig. 2: Maglev Model

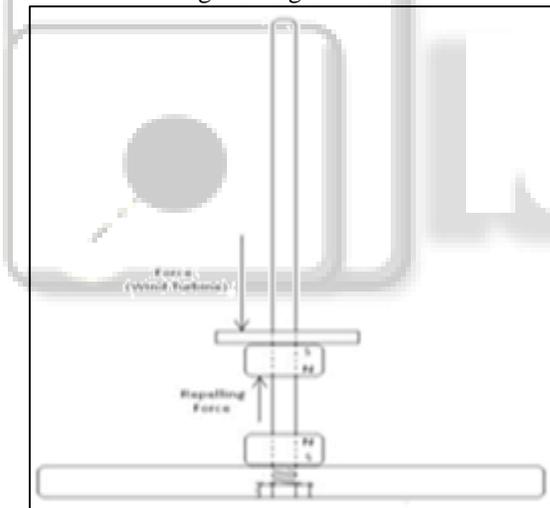


Fig. 3: Magnet Arrangement

Magnetic levitation weight reduction structure for a vertical wind turbine generator includes a frame, a fixed permanent magnet, an axle, a revolving permanent magnet, a blade hub, and a generator. The fixed permanent magnet fixed to the frame has a first repulsive surface. The axle is connected to the frame. The revolving permanent magnet fixed to the axle has a second repulsive surface in relation to the first repulsive surface of the fixed permanent magnet. Both the first and the second repulsive surfaces repel with each other. The blade hub and the generator are connected to the axle. When the revolving permanent magnet is rotated, the axle functions as a balance center. An out structure supports the stator and the rotor is placed over turbine head. The main components of the system is the maglev zone, blade hub and generator. It will convert the kinetic energy from the wind to the electricity for usage. A modified roof ventilator is

used as wind turbine. The main function of the free spinning roof ventilator is to provide fresh air in roof space and living area all year round 24 hours a day free of charge. The new idea of the magnetic levitation helps to improve the turbine speed and electrical production. This modification has benefits of the better air ventilation, but also have extra electricity supply for load appliances.

IV. IMPLEMENTATION

In wind turbine addition to the diffuser shape of the shroud, the back has a brim. This brim disturbs the wind flow which creates vortices that cause a low pressure area to be formed behind the wind lens. The wind then flows to the low pressure area through the blades of the wind lens. The increased airflow through the blades leads to another reason of higher power production. [The diffuser shape and the brim combined creates more efficiently placed and accurate airflow. This results in a higher amount of energy that is produced. Charging circuit is used for the charging the battery. It is a micro controller based charging circuit with LCD display. Display will show the status of charging. Battery (electricity), an array of electrochemical cells for electricity storage, either individually linked or individually linked and housed in a single unit. An electrical battery is a combination of one or more electrochemical cells, used to convert stored chemical energy into electrical energy. Batteries may be used once and discarded, or recharged for years as in standby power applications. Miniature cells are used to power devices such as hearing aids and wristwatches; larger batteries provide standby power for telephone exchanges or computer data centers.

V. CONCLUSION

Proposal of Mag-lav based vertical axis wind turbine and concept of wind lens is very beneficial to us. Non conventional energy system is very essential at this time to our nation. Over all, the magnetically levitated vertical axis wind turbine was a success. The rotors that were designed harnessed enough air to rotate the stator at low and high wind speeds while keeping the center of mass closer to the base yielding stability. The wind turbine rotors and stator levitated properly using permanent magnets which allowed for a smooth rotation with negligible friction. The Vertical Axis Wind Turbine (VAWT) with magnetic levitation performed better than the conventional wind turbine.

REFERENCES

- [1] Wind Power Generation in Germany The Journal of Trans disciplinary Environmental Studies vol. 10, no. 1, 2011.
- [2] MAGLEV Data sheets – NUENERGY TECHNOLOGIES
- [3] Wind energy }hydrogen storage hybrid power generation Int. J. Energy Res. 2001; 25:449}463 (DOI; 10.1002/er.696)
- [4] MagLev Wind Turbine Technologies RFI - Vertical Axis Wind Turbine 200 Mega Watt Off Shore Wind Farm
- [5] Wind Power Generation and Wind Turbine Design by Wie Tong.

- [6] Bekele, G. and Tadesse, G., "Feasibility Study of Small Hydro/PV/Wind Hybrid System for Off-Grid Rural Electrification in Ethiopia," *Applied Energy*, Vol. 97, pp. 5-15, 2012.
- [7] Saheb-Koussa, D., Haddadi, M., and Belhamel, M., "Economic and Technical Study of a Hybrid System (wind-photovoltaic-diesel) for Rural Electrification.
- [8] Fadaeenejad, M., Radzi, M. A. M., AbKadir, M. Z. A., and Hizam H., "Assessment of Hybrid Renewable Power Sources for Rural Electrification in Malaysia," *Renewable and Sustainable Energy Reviews*, Vol.30, pp. 299-305, 2014.
- [9] Akikur, R. K., Saidur, R., Ping, H. W., and Ullah, K. R., "Comparative Study of Stand-Alone and Hybrid Solar Energy Systems Suitable for Off.

