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Electricity Generation from Micro Hydro Power Plant at MGM Gandheli Campus, Aurangabad

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Abstract:

Water is the most important part of human day to day life and natural limited resource.

Hydro energy is source of regenerative energy and also being clean as well as environment-friendly. This research paper intends to show the emerging concepts hydroelectricity generated from hydro power plant. Energy demand increases due to rapid urbanization and increase in population growth. And the time is not far away when we will not have sufficient amount of electricity to fulfill our daily need. To avoid the occurrence of such dark future, this prototype device can be implemented to generate electricity with Micro hydro power plant (MHP) at Gandheli Campus of MGM Institute as it being a rural belt situated atop the South-Eastern hills of Aurangabad**.** The purpose of the study is to design a micro hydro power plant for MGM Gandheli campus. Series of Micro Hydroelectric power turbines can be installed at Main Water Inlet Tank, Farm Ponds at four different locations. The micro hydro power has a huge potential globally and at this site it can be one of the best available solutions for electricity generation. So this will reduce the grid based demand of conventional energy currently utilized. Turbines are the crucial working apparatus required in micro hydro power plants. The theoretical calculations for this concept may serve better on practical implementation. The main motive behind this concept is to generate electricity from efficient non conventional means available on site.

Keywords: Renewable energy, Hydroelectricity, model hydro power plant, current generation, Turbines

1. INTRODUCTION

Energy plays a very important role in our day to day life. The concept of generating electricity with continuous recycling of water having minimum water loss to generate electricity at low cost by Micro hydro power plant (MHP) at Gandheli Campus. [4] MGM Institute is a rural belt atop the South-Eastern hills of Aurangabad**.** Being an infrastructural underdeveloped area it faces challenges of Energy, Transportation and Communication. Currently the grid supplied power is very scarce and major time power is not available, which needs to be fulfilled by owns DG sets present on MGM campus. The campus is dedicated for rural support by providing Agriculture based activities ranging from farm development, Academics to Research and Development in agriculture and allied fields. It also offers training in Agriculture related income sources escalating activities, to the locals for a better tomorrow. The hot and dry climate and the undulating Topography of this site makes it more challenging, yet it is more facilitating and rewarding from viewpoint of possibilities available.

Now-a-days, conventional power sources are becoming inadequate in availability and there cost is also increasing due shortage in production. [6] The energy demand and generation gap is increasing day by day, resulting in rise in inflation and energy shortage in the grid. This energy crises, has paved way to think about new power generating measures. Alternative and renewable sources of energy have to be developed to achieve future energy demand. Non saline water is proving as a limited natural resource on this earth. Water acts as a basic need for all the organisms on this earth. It is required majorly for agriculture, industrial and also for the power generation in recent years. [6] During several years studies were done for micro hydro power plant that can be multiplied, on large extent depending on water availability a local level. The main objective of this study is to review different methodology implantation for generating the power by using runoff water. The electricity produced from this new proposed "Micro hydro power plant" (MHP) can be used for the Gandheli campus. [2]

The very basic aim of this paper is to see the possibilities in generating electricity from hydel resources and economically viable systems for energy creating from falling Water by Micro hydropower plants. Such techniques can save our local site's flora and fauna, from current pollution being generated due to CO2 emission from DG sets. Also, it aims at spreading awareness among the people all over the region, about the advantages and also the long term cost savings from hydropower plants. [1]

ENERGY SCENARIO

According to data available, India stands at 4th position in the world in terms of power generation. The installed capacity or in other words power generating capability is usually more than the actual generation. As throughout the year maximum output cannot be procured from available energy producing resources.

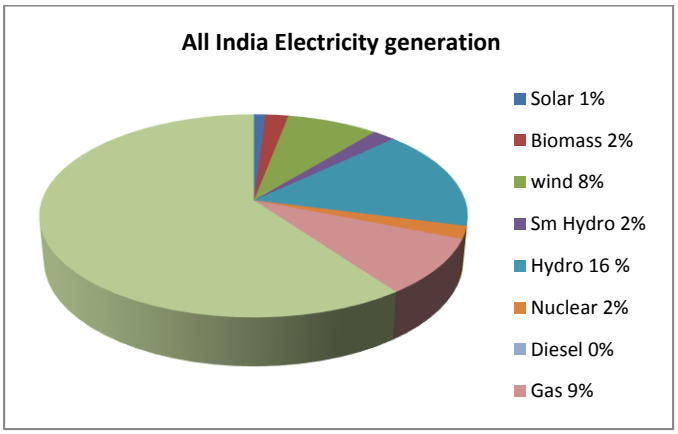

Fig-1: All India Electricity generation (2011-12) [1]

2. LITERATURE REVIEW

1. Paper publish by S.U.Patel, Prashant.N.Pakale, Mechanical Engineering Department, D.N.Patel COE shahada-425409, Maharashtra, India : Study on power generation by using cross flow water turbine in micro hydro power plant.

According to S.U.Patel, Prashant.N.Pakale, increasing demand of power can be efficiently and ecologically fulfilled by the use of micro hydel power generation system, as human civilization can be seen near water reservoirs and there increasing power demand due to population growth can be fulfilled by this ecologically renewable hydel power project method.

Basic principal in this system is energy generation from flowing water, even if it is low in pressure. Force produced on blades of turbines due to direction of water diverted on turbines. This process in turn moves the generator in circular motion to produce electricity.

The basic objective of this research topic is to study outcome, after introduction of cross movement of water stream in turbines installed in micro level hydro electric plant [MHP] for power generation. [2]

2.One literature review done by Department of Electrical and electronics, Karunya University, Coimbatore by professor Prawin Angel Michael and , C.P. Tawahar : Design of 15 kW Micro Hydro Power Plant for Rural Electrification at Valara.

This topic has been taken for rural electrification of Valara village in Idukki, India. In Valara around 120 families reside without the facility of electric supply, as there is absence of grid connected distribution network. This project was a pilot prototype to do research on the economics involved and techniques which can be implemented with respect to hydro projects as there was water available at current site and water being a free resource can be utilized for low cost micro scale hydro project and accordingly suitable electro mechanical components can be studied and used. [3]

For this 15kW micro scale hydel electric system was designed, installed and tested in rural distribution type of conditions. This plant is not only fulfilling the power needs of tribal families but also providing a source of livelihood to them by the means of maintenance and daily working of the plant. This is also developing skills in tribal by means of practical knowledge of hydro power systems. [3]

3. METHODOLOGY

This research methodology includes the collection of data, construction of questionnaire, field work and framework of analysis.

3.1 Collection of Data

Here at MGM Gandheli site two types of data are basically put to work i.e. basic data and advanced data. The Preliminary Data is procured from Mr. Madhukar Gaikwad- Chief Engineer MGM, Mr. Prashant Jagtap Electrical engineer MGM- . B. T. Deshmukh H.O.D of Electrical department and others MGM Gandheli staff and students who have supported to make this report directly via interviews and from the survey data of Gandheli. Secondary Data is gathered through articles from journals and from websites.

The main objective of this study is to review different methodology used for generating the power by using runoff. The electricity generated from the micro hydropower plants can be used for the Gandheli campus. Site selection for physically and practically implementation of micro hydropower plants at Gandheli campus can be accomplished by taking help of remote sensing and GIS.

The most important thing is the availability of water. Soil type, Topography, Land use and land cover, slope, rainfall data, contour are the parameters required for selecting the suitable site. To ideally select a turbine in a micro hydel electric plant, basic turbine structure and its working apparatus should be economically feasible and also technologically advanced providing maximum power output in less time and limited water utilization. The surrounding environment should also not be damaged due to daily activities of power plant. The selection of micro hydropower plants can be done by using the satellite data and other data sources. The different methods used for runoff calculation and selection of suitable sites are discussed in this review paper.

3.2 Introduction to Micro Hydro Power Plant (MHP)

Hydro power is renewable source of energy. Electricity is generated by motion of turbines through flowing water. This water will be reused for different agriculture activities in the campus. Hydel energy generation can be considered as

primitive techniques of energy generation, which converts kinetic energy into electric energy with the help of flowing water. [2]

3.3 Basic Theory of Micro Power Plant (MHP)

Water is being pumped from Pardhari Dam over Dudhana River required 178 electric units, about 2KMS away from Campus. A pressure of 600 Liters/ mins is generated by a 30HP pump; which is used to provide the lift of around 85M, from Dam to Campus resulting in a pressure of 300 Liters / min at Campus. 200mm Diameter pipe is used for getting water from Pardhari Dam till campus. This is diverted to RO Water Tank in Inlet Tank with 100mm Diameter pipes respectively

Further, Water from Inlet Tank is pumped to various 04 Nos. of Farm Ponds at strategic locations; the 67M x 37M x 7.60M (220FT x 120FT x 25FT) Farm Pond is the biggest of all.

A micro hydroelectric power generation unit is designed to be implemented at MGM Gandheli campus. Series of Micro Hydroelectric power installations can be installed at the Water Inlet Tank, dividing the 300 Liters / Min in various outlets which give pressure up to 15 Liters / Min. Such Micro Hydroelectric power turbines can be installed at Main Water Inlet Tank, Farm Ponds at four different locations.

The principle of micro hydroelectric power generation works on conversion of kinetic energy into electrical energy in an ecological way by utilizing a water wheel mechanism. Here accordingly as the inlet flow rate or pressure in the water lines increases, this in turn increases the per hour electricity generation. But the per hour electricity generation is wholly dependent on the coil capacity of the turbines. To get a constant production of power the flow rate in the pipes should be at optimum pressure, if this is not followed it can result in loses on the side of power generation in turbines. During recent years, in many foreign countries Micro Hydroelectric Power plant are being installed in remote areas, farms, and many other commercial places. Micro hydroelectric systems are mainly systems which generate power on the scale of 5 kW to 100 kW.

Classification of Hydropower by Size :

In India capacity of hydro power plant is lower than 15 MW is termed 'small hydro'. The classification of hydropower plants depends on the installed capacity. [1]

1. Micro hydropower plants (0.1 MW) – provide supply to a rural area from the grid.
2. Mini hydropower plants (2 MW) – Often supply into a grid or stand alone schemes.
3. Small hydropower plants (15 MW) – Provide Supply into a grid
4. Large hydropower plants (>15 MW) – Provide Supply to a large electricity grid. [1]

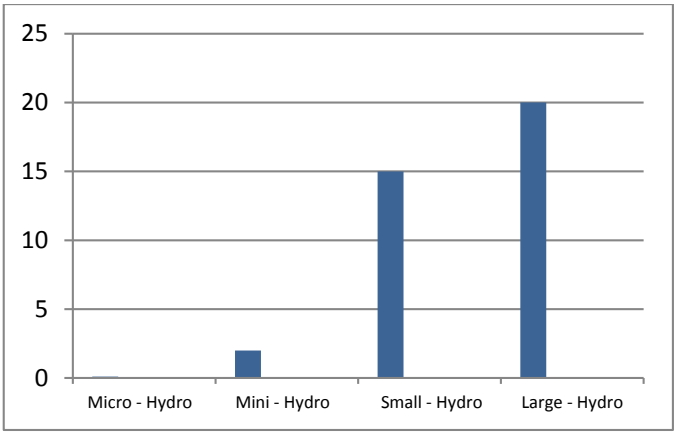

Fig 2: Classification of Hydro Power by Size

3.5 Site Survey

Topographical Survey: MGM's Gandheli campus is the site for installation, which falls in rural belt on the south-eastern hills of Aurangabad. Nanasaheb Kadam College of Agriculture Gandheli, Aurangabad has over 160 Acres slightly contoured land now it is fairly plain.

There is ample vegetation in and around the site. The campus is dedicated for rural support by providing agriculture based activities including training, R&D and academics. It is located around 20 Km away from Aurangabad. A internal connecting road is available from Beed bypass and Gandheli. Land of 160 acres with surface character of: Hill with Ground Surfaces covered by Black cotton soil, Red-earth surfaces and hard murrum & soft rock surfaces is available. Winds at hill-side are at much higher speed than 5m/sec. abundant sunlight and radiations with clear skies more than 20-25 days a month are available 9 to 10 month occurrence. [6]

Application of Remote Sensing and GIS: GIS is a computer software which utilizes maps or geological inputs and in creating data of geographic form. Remote sensing can be defined as the observation of targets from distance without physical contact. GIS gives approximate and systematic data useful in managing complicated and huge database. Remote sensing and GIS plays a important role for land and water resource study. One of crucial advantage in utilization of remote sensing data in ecological resource management is capacity of generating the data in temporary and spatial domain, which is important in model analysis, to predict and validate the scenario. [6]

Climate*:* Aurangabad city and adjacent areas have a partial arid climate zone. Accordingly co-ordinates of Aurangabad are N 19° 53' 47" – E 75° 23' 54". There are hills all around the city. Mean Annual temperatures ranges between 17 to 33 °C, with an increase in summer season reaching up to 40°C. Rainfall period is from June to September. Average annual rainfall is 710 mm. Day to day temperature of the city throughout rainy season frequently reaches around 22 °C due to the cloud cover.

Land Use: Currently campus is engaged in construction of new school project, and undertaking a major agro based

institutions and convention center. In comprehensively planning and restoring the campus they have an approach that includes native plants and species as major part of campus agriculture based studies. Ideally, planting native plants has also supported in maintaining higher level of biodiversity in and around campus. 2000 native plant species were planted by staff and students in the campus on the occasion of 15th June MGM's Plantation Day. Some trees were donated by the forestry, and many are purchased by MGM through the voluntarily efforts of the College of Agriculture and MGM nursery.

3.6 Turbines used in MHP plant system:

Turbine is a very important component in hydro power plant which converts the flow and pressure energy into mechanical form of energy. Basically turbine is made-up of different components i.e shaft, runner, blades, nozzle, starter, coils, etc. at the start the nozzles create high speed jet of water which moves the runner, which in turn converts the kinetic energy generated by rotating shafts into mechanical energy and this mechanical energy is converted into electric energy. Blades are attached to these runners. [2]

Two models in turbines are available basically:

1. **Impulse Turbines:** These types of turbines are generally used for high or medium head (above 10M) so this method is used for Gandheli campus due to high head (above 85 M). Penstock of turbines converts the pressurized water into high speed water that convert the kinetic energy due to rotational impact of blades and cups. The pressure drop in the water flow occurs at the nozzle and the runner operates at atmospheric pressure. [2]
2. **Reaction Turbines:** These types of turbines are generally used for low head range (less than 10 M) in which water passes stator swirl the flow through spiral casing. The flow is directed through the blades. Water forces rotation in the runner opposite to impulse turbines. The water pressure drops at the stator and the runner. [2]

4. CALCULATIONS

A series of Micro Hydroelectric power installations can be installed at the Water Inlet Tank, dividing the 300 Liters / Minute in various outlets which give pressure up to 15 Liters / Minute.

Such Micro Hydroelectric power turbines can be installed at the Farm Ponds as well.

According to standards 15Liters / Minute generate 75 W of electricity. We get up to 300 Liters / Min pressure at Main Water Inlet Tank. So we can have multiple water inlets so as to get up to 15 Liters / Min pressure.

- According to Statistics 15 Liters / Minute generates 75 W of electricity so 300 Liters / Min can give up to 1500 W / Min.
- 1500 W x 60 Minutes = 90,000 W per Hour
- We get water supply from Pardhari Dam for 18 Hrs.
- 90,000 W x 18 Hrs. = 16,20,000 W = 1620 KW = 1.62 MW per day
- 1.62 MW per day from one hydroelectric turbine installations.

5. ANALYSIS OF THE STUDTY AND FINDINGS:

Water turbines can install at Main Water Inlet Tank, Farm Ponds at four different locations. The generated Electricity can be utilized to replace the DG Set to pump water from DAM location (As MSEB power is available for only 08 Hrs. – rest 10 hrs. DG Power back up is required which consumes Diesel at a rate of 8 Liters / Hour.

Replacing the DG Back up with Hydroelectric generated energy will not only stop the used of Diesel (Fossil Fuels – Non Renewable Resource) but also will cut the CO2 emissions. The generated electricity can be utilized to power up water heating equipment installed at Hostels and Canteen for Food Cooking. The Power can be utilized to charge batteries of Electric Vehicles which can be used in and around campus transportations, further reducing the toxic emissions by Vehicles. The Power can be used to light up surrounding villages 24 x 7. The surplus can be given to MSEB grid and further benefits can be enjoyed.

6. SUMMARY AND CONCLUSION

A micro hydro power plant has been planned for MGM Gandheli campus, Aurangabad in the state of Maharashtra. The site has huge potential and it can be one of the best available solutions for electricity generation. The study involves the selecting the suitable sites for micro hydropower plants. This paper tells about the ability of selecting the suitable site by utilizing the different methods in Remote Sensing and GIS. The proposed micro hydro power plant is found to be technically and economically feasible and it not only fulfill the energy demand of agriculture campus at Gandheli but also replacing the DG Back up with Hydroelectric generated energy will not only stop the used of Diesel (Fossil Fuels – Non Renewable Resource) but also will cut the CO2 emissions.

REFERENCES

[1] S. O. Anaza1, M. S. Abdulazeez, Y. A. Yisah, Y. O. Yusuf, B. U. Salawu, S. U. Momoh (2017) "Micro Hydro-Electric Energy Generation-An Overview" American Journal of Engineering Research (AJER) Volume-6, Issue-2, pp-05-12

[2] S.U.Patel, Prashant.N.Pakale "Study on power generation by using cross flow water turbine in micro hydro power plant" International Journal of Research in Engineering and Technology, eISSN: 2319-1163 | pISSN: 2321-7308

[3] Prawin Angel Michael, C.P. Jawahar. "Design of 15 Kw Micro Hydro Power Plant for Rural Electrification at Valara", Energy Procedia, 2017

[4] Aditya Agrawal1, Aditya Sharma, Harsha Yadav "Hydroelectricity Generation by the Recycling of Water" Journal of Water Resource Engineering and Management, Volume 2, Issue 3

[5] Elie BertrandKengne Signe[ab]Oumarou Hamandjoda[a] JeanNganhou[a] "Methodology of Feasibility Studies of Micro-Hydro power plants in Cameroon: Case of the Micro-hydro of KEMKEN" International Conference on Technologies and Materials for Renewable Energy, Environment and Sustainability, TMREES17, 21-24 April 2017, Beirut Lebanon

[6] Dr. S. Vidhya Lakshmi G. Reddi Sarvani "selection of suitable sites for small hydropower plants using geo-spatial technology" International Journal of Pure and Applied Mathematics, Volume 119 No. 17 2018, 217-240

[7] Roshni Bhoi#1, Dr. S.M. Ali "Potential of Hydro Power Plant in India and its Impact on Environment" School of Electrical Engineering, KIIT University, Odisha, India , International Journal of Engineering Trends and Technology (IJETT) – Volume 10 Number 3 - Apr 2014

[8] Yulianus Rombe Pasalli, Adelhard Beni Rehiara "Design Planning of Micro-hydro Power Plant in Hink River" Engineering Department, University of Papua, Manokwari, 98314, Indonesia , 4th International Conference on Sustainable Future for Human Security, SustaiN 2013