Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 04, April -2018

DEVELOPMENT OF DECENTRALIZED RENEWABLE SOURCE OF ENERGY

Manoj Kumar Shukla[1]

[1]*Lecturer (TPO), Kalaniketan Polytechnic College, Jabalpur (MP) India,*

Abstract:-*Providing access of electricity to remote and backward areas is an important requirement in present scenario. Connecting these locations to regular electrification grid is difficult in terms of investment and availability of infrastructure. However decentralized electricity generation through exploitation of renewable source of energy like hydro power can be a viable solution to this prime requirement. India has a huge hydro power potential. Looking forward to this advantage of hydro power and need for its development, Government of India is giving special attention to this specific sector. The pivotal role of the renewable energy development programme will be developing indigenous knowledge, technology and capacity. Primary focus ought to be in this area. In the present work method for making available electricity to such remote area is done by exploring the concept of decentralized electricity generation.*

Keywords:-R*enewable energy, Decentralised Generation, Decentralised Distribution, Hydro Power.*

I. INTRODUCTION

Rural electrification in present scenario is facing acute shortage due to number of reasons. Remoteness from grid center, Transmission and Distribution (T&D) losses, uneven population distribution are some of the reasons for absence of electricity in rural areas at maximum duration. A decentralized electricity generation system can serve the problem well. This approach can reduce transmission losses due to nearness to grid/load centers. Renewable energy provides sound economic opportunities, especially for local entrepreneurs due to its occurrence. Unlike petroleum and other fossil fuel resources, which are confined within the boundaries of very few countries, renewable energy occur almost in all countries and is considered a very democratic resource. Electricity generation by one of the renewable energy source i.e. hydro power plant system can be applied as per the feasibility and sustainability of the option. The method adopted in the present study includes assessment for the hydro power generation, calculating electricity demand, identifying hydro power sites, estimating available flow and head, conducting preliminary design, assessing environmental and social issues. The condition of electricity availability remote area is very poor round the year. Due to this normal living of peoples is affected by various numbers of reasons. Also since main occupation in village is farming and irrigation in which electricity plays a very important role for good farming which is affected due to lack of electric power. Lighting is another important factor for comfortable which is also adversely effected. The proposed method is beneficial in terms of social, environmental, economic impacts so that the project can be made sustainable.

II. SIGNIFICANCE OF THE PRESENT WORK

This study aims at evaluating the small hydropower potential for rural setting. Lack of adequate source of electrical energy in rural area is a serious problem which hinders the development process. The study has significant aspect of contributing for development of small hydropower plants in rural energy. It is limited to rural setting for proposing methods of electricity generation thereby making community less dependent on traditional methods of meeting energy demands. The study is done for understanding the prevailing condition of acute shortage of electricity. Major advantage of the work includes:

(i) Prime Objective: To explore methods for decentralized power generation system in competitive market environment under various conditions/constraints for sustainable power supply.

(ii) Energy Security: As result of the research, lesser dependence on large generation plants to contribute towards bridging the gap between domestic power supply and demand in rural areas.

(iii) Energy Independence: Suggesting Renewable sources of to contribute towards bridging the gap between fossil fuel based electricity supply and demand.

(iv) Energy Availability and Access: Augment energy needs of agriculture, cooking and captive generation in rural sectors.

(v) Contribution to National Energy Policy: Contribution of renewable hydro energy resources in total electric power supply of our country.

(vi) Overcome Technology Gap: Opportunity still exist for integration with power sources for uninterrupted power supply in rural and remote areas for an all round development of society.

(vii) Premium Power: Uninterrupted power supply at proper quality in remote area.
(viii) 21st Century Solution to Energy Problems: Because of low or no emissions, low maintenance, excellent part-load performance, modularity and environmental advantages renewable energy can be solution to energy problems.
(ix) T&D Losses: with applications of decentralized power generation little or no transmission and distribution (T&D) expansion costs, research focus should be laid on the policy framework on distributed energy technology, which can fulfills the demand locally.
Availability of electricity in remote area is not continuous in a day. Distribution of electricity is also non uniform which ranges. Rate of electricity expense in the villages is high which can be reduced by using renewable sources of energy. The major source of income generation in the region is agriculture and ancillary works. In the present time all major agricultural equipments requires availability of electricity. Investments made in agriculture can be expected to produce good results only after making available basic energy requirements. Also to maintain minimum living standard availability of electricity is required.

III. METHODS TO FULFILL THE DEMAND

Therefore decentralized grid connection system can be solution to energy problem which is yet to be explored on a commercial basis. As we know that there are many dams, irrigation canals and HPP in our country, a systematic modeling of which can support the development of small/mini/micro HPP in the downstream side of reservoir. Government is also supporting in this direction with the publicity of RGVY, decentralized distributed generation [DDG] under Rajiv Gandhi Grameen Vidytikaran Yojana for rural electrification. Benefits from DDG are:

- Rural economic benefit from project development by ways of increasing local tax to the government.
- Emission free electricity giving tangible carbon emission reduction.
- Substantial job creation
- Sustainable renewable source of energy development

An urgent need of policy planning is required which can help authorized decision makers so that they can initiate a requisite action plan for all round development of unexplored energy potential. By increased energy supply from renewable sources and the use of clean energy technologies such as hydro energy, we can meet our energy needs, avoiding increase in greenhouse gas emissions and reducing sensitivity to energy price shocks. Clean renewable energy from hydro power has been found to be most promising method for near future. India has a large potential of HPP which should be properly explored. The most challenging and upcoming methodology is to form cascaded Hydro power plant which can fulfill multifaceted objectives. Optimum electricity generation from river basin, water flowing system lies in proper scheduling, proper dispatch in order to fulfill the commitment of energy generation. A sustainable decision support system for scheduling Hydro power generation is required. The concept can be well extended for decentralized distribution network where rural community is still deprived of electricity.
There is a huge gap between demand and supply in urban as well as rural areas. Situation is poorer in rural areas as compared to urban areas. Present condition of rural electrification is very challenging especially in more remote areas. Electricity is one of the vital ingredients of socio-economic development of modern society (Abosedra et al. 2009). Energy is a prime mover of development. There is direct correlation of energy consumption and economic growth of a society or country. Access to modern energy services is fundamental to fulfilling basic social needs, driving economic growth and fueling human development. This is because energy services have an effect on productivity, health, education, safe water and communication services. If rural areas are to make self sufficient then initiative has to be taken for rural electrification. If rural areas are able to fulfill their basic needs then migration from villages to cities can be reduced thereby reducing loads on cities. For these popular professions in village that is farming should be provided with modern facilities so that village people can compete with rest of the world. Electricity is one of the back bones for meeting this demand.

If we want rural areas to be well electrified then means of electricity generation at very nearby places have to explored, this system of electricity generation is called decentralized electricity generation (DEG) and decentralized electricity distribution (DED). There can be number of methods for DEG & DED depending upon the feasibility of particular location. Electricity Power generation is centralized in maximum number of cases in the present time, but there is a progressive trend towards more decentralized energy. The electricity supply network in India is still largely centralized. Decentralized power generation has many benefits over traditional centralized generation. Small/mini/micro scale power generation is closer to the end user, significantly reducing transmission losses and costs. This generates potential cost savings for users and ensures greater efficiency. Small/mini/micro scale power production is therefore thought to be more reliable, cheap, efficient and environmentally friendly than centralized generation. Centralized renewable are a move in the right direction but decentralized renewable can be the destination. Various applications DE exist depending upon the community for which it is going to serve. Major factors that decides which type of energy generation plant is to be installed are population to be served, load duration demand, distance from demand site, average income group, raw material available for generation, capital investment available and environmental clearance required. The various renewable DE technologies available are solar photovoltaic panels, crystalline-silicon technologies, thin-film technologies, roof-top/local wind turbines, small/ mini/ micro hydro power, small-scale tidal, run-of the river, geothermal

energy, renewable energy powered fuel cells, thermal based technologies, biomass-fired engines, biomass-fired steam turbines, gas turbines/ micro turbines and plug-in electric hybrid vehicles. The wide dispersion of renewable energy resources is a form of energy that's harnessing will essentially to the local area of occurrence of the renewable energy resource, resulting in local involvement and creation of room for local investments.

Installation of renewable energy plant can be done for DG (distributed generation). It is used to improve the operations of the electricity delivery systems at or near the end user. These systems may or may not be connected to the electric grid. A distributed generation system can employ a range of technological options from renewable to non-renewable and can operate either in a connected grid or off-grid mode. The size of a distributed generation system typically ranges from less than a kilowatt to a few megawatts. DG options can be classified either on the basis of the prime movers used i.e. engines, turbines, fuel cells or on the basis of fuel resources used i.e. renewable and non-renewable. In India, many renewable energy technologies are being employed in a number of distributed generation projects. The technologies include biomass gasifiers, solar thermal, photovoltaic systems, small wind turbines and small hydro-power plants. The figure illustrates the technology options for distributed power generation.

DE in general can provide significant benefits like environmental, economic, efficiency, resource conservation, reliability and security. What makes renewable DE distinct is that renewable DE technologies, as the name suggests, employ sources of energy to make electricity that can be replenished or that do not run-out over time. Renewable energy like small/ mini/ micro hydro power therefore can be used in DE applications.

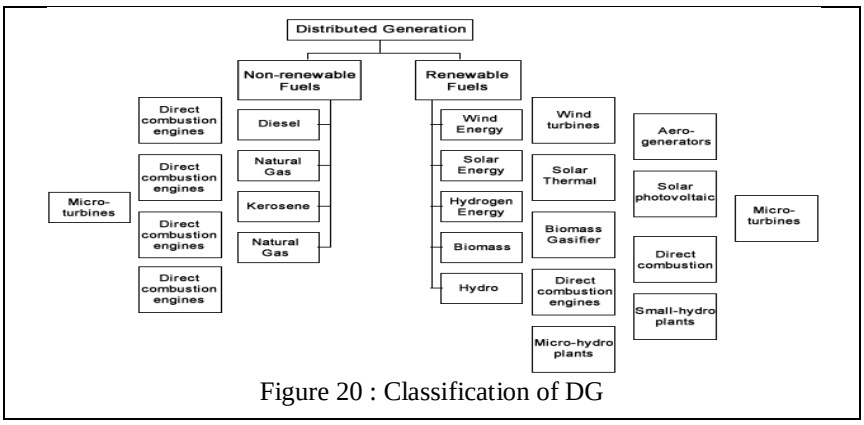

Figure 20 : Classification of DG

IV. BRIEF OVERVIEW OF THE SELECTED METHOD

Sustainable energy sources includes all renewable sources such as hydro power bio fuels, solar power, wind power, wave power, geothermal power and tidal power. Renewable energy is from an energy resource that is replaced by a natural process at a rate that is equal to or faster than the rate at which that resource is being consumed. Hydro power one form of renewable energy since it is naturally replenished. Hydropower is a key component of renewable energy and supports protection against climate change. Figure 7 below shows the hydrological movement which is the continuous movement of water on, above and below the surface of the earth.

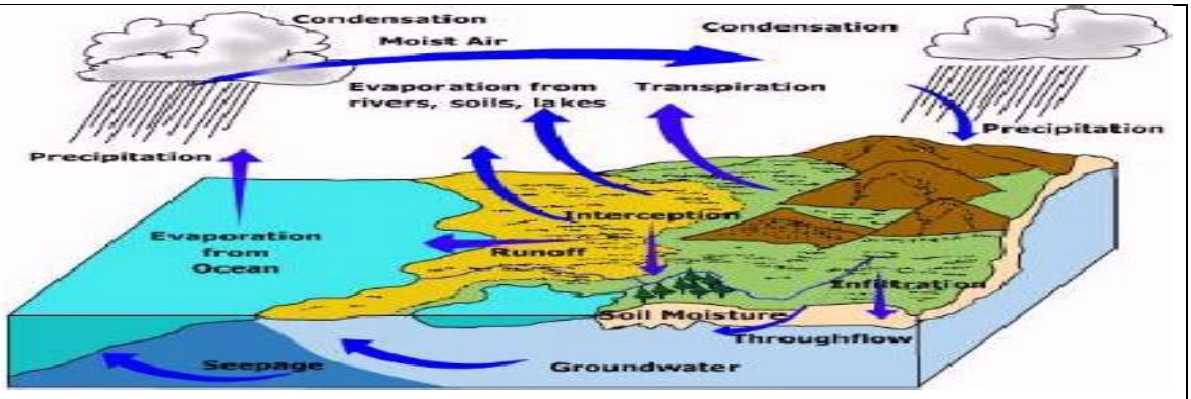

Figure 21: Hydrologic Cycle
(Reference: http://www.google.co.tz)

Hydropower Development

Hydropower is the production of mechanical energy by passing water through a hydraulic machine that is rotated by the action of water and the machine in turns rotates an electrical generator to produce electrical energy (Wazed and Ahmed, 2008). In hydropower, the kinetic energy of the water depends on two aspects, head and flow. Hydropower plant can be classified according to the power they produce into the following large, medium, small, mini, micro and pico hydro which can be employed for DE. Run off the river schemes or dam based schemes concepts are most popularly used for making HPP. Small/mini/micro hydro power projects usually are run off the river schemes.

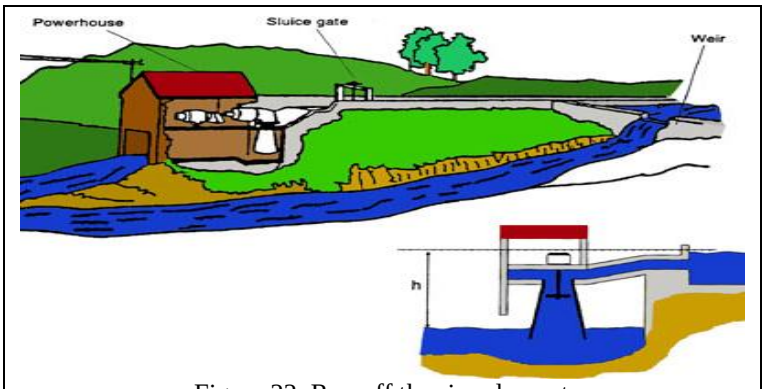

Figure 22. Run off the river lay out

Small/mini/micro hydro power plant overview:
Small/mini/micro hydropower schemes combine the advantages of large hydro on the one hand and a decentralized power supply on the other hand. Large hydro plants have many of the disadvantages such as environmental issues and high cost of investment. Moreover harnessing of small hydro-resources, being of a decentralized nature, lends itself to decentralized utilization. Local implementation and management, making rural development possible with entrepreneurship and the use of natural, local resources. Small hydro power plants can be connected to national electricity grid. Most of them are run-of-river type.Figure 26 shows layout of typical small and micro hydro power plant system.

Rural electrification is important for the sake of retaining people in rural areas and prevents migration. Electrification is needed to secure the living standard and create opportunities for jobs. There are many environmental, economic and social benefits of rural electrification.

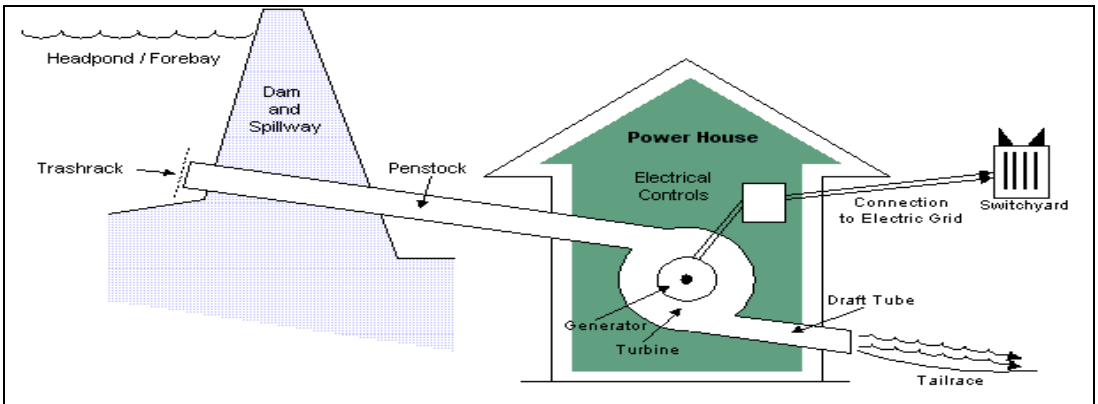

Figure 23. General description of hydro power plant production setup.

Components of a small/ mini/ micro hydro power plant
In general larger the scale of a system more the number of components like channel weir, water conductor system, de-silting basin with spillway, flow regulator, control gates, Spill flow, Forebay tank, buffer to control sudden flow and pressure variations, Trash rake/wire mesh needed to prevent silt, leaves and other debris,**P**enstock, Power house(consists of turbine generator, control valves, electrical control panels, Switch yard, Tail race channel, turbine, runner, blades or

buckets, Governor. Turbine general name refers to runner, nozzle and surrounding case. Turbine expected to produce power under part-flow conditions, also plays an important role in selection. The basic principle of hydro power is that if water is released from a higher level to a lower level, then the resulting potential energy of water is be used to do mechanical work (Mtalo et.al.2007). The water head is used to move a mechanical component which converts the potential energy of the water into mechanical energy. Hydro turbines convert water pressure into mechanical power, which can be used to drive a generator (Mohibullah.et al.2004). Hydro power is a very clean source of energy and only uses water, the water after generating electrical power, is available for other purposes. Hydropower is currently the world's largest renewable source of electricity.

V. CONCLUSION

Integrated sustainable decision support system for DDG described here could probably be commercialized in near future. Also further application of study can be implemented to hydro-thermal power plant setup. Further efforts are needed to develop these integrated systems for sustainable power developments for rural electrification. The research includes conducting feasibility study for setup of cascaded hydro power plant fulfilling the constraints and uncertainty analysis. Establishing reliable relationship and perfect correlation start-up procedures for successful operation of the plant, developing process controls that accounts for potential fluctuations in input quality and quantity, optimizing the plant design for given constraints feedback type, inflow content and other factors as per site specific variables. Like any village electrification program, DDG would contribute to rural development by providing sustainable electric power for basic residential needs as well as cottage enterprises and agricultural equipment such as irrigation pumps, reducing T&D losses. The technology described will enable rural areas to generate income by attracting electricity-consuming industries and by exporting surplus electric power to urban demand centers. The export of electricity can benefit rural communities.

VI. FURTHER STUDY

A model can be framed for the purpose of hydro power plants setup to convert electricity from flowing water. Model is used to address:

1. Move for setup of more SHP, canal head based Hydro power plants.
2. Addressing environmental issues.
3. Providing socio-economic security in rural areas.

This topic is also of interest for off-grid sustainable power generation with low impact to the environment. By conducting further study in this subject area it is expected to be able to recommend SHP/Mini/Micro HPP developers a decision support system. Model will help for framing policies necessary for hydro power plant system and address the gap between the exploited HP / potential available of HP.

REFERENCES

1. Decentralized electricity solution setup by TERI 2008.
2. Energy system planning analysis using the integrated energy model.
3. Wazed, Md. Abdul and Ahmed, Shamsuddin, Micro Hydro Energy Resources in Bangladesh: A Review (2008). Australian Journal of Basic and Applied Sciences, Vol. 2, No. 4, pp. 1209-1222, 2008.
4. A. Aslan, H. Kum, O. Ocal, and O. Gozbası, “Energy Consumptıon And Economıc Growth: Evıdence From Mıcro Data,” Proc. ASBBS Annu. Conf., vol. 20, no. 1, pp. 280–288, 2013.
5. William Arthur, Porter Stephan “Comaprison of HP option for developing countries with regard to the environment, social and economic aspects” International conference on renewable energy for developing countries, 2006 UK, Nottingham Trent University, UK
6. South pole carbon asset management ltd. South Pole Project No. 300 494 “Sustainable Small Hydropower Stations,Rural South West China”
7. Morozowski,” the problem of managing a HEPP: An approach based on traditional techniques and SD”, Brasil
8. Howard CDD, Oct 2006,” Hydroelectric system operation optimization “, World renewable energy Canada forum.
9. Peter Meisen, October 2006, “Overview of Renewable Energy Potential of India”, President, Global Energy Network Institute (GENI).
10. India Ministry of Non-Conventional Energy Sources (MNES) http://mnes.nic.in/
11. Maps of India http://www.mapsofindia.com

