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Generating Electricity from Micro-hydro Power Stations to Feed the Isolated Areas of the National Network

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Author's contribution

The sole author designed, analyzed, interpreted, and prepared the manuscript.

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Short Research Article

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ABSTRACT

The construction of small-hydro power stations does not require high technologies, but needs to provide a river or stream water is smooth. Through the establishment of small dams on the stream can control the amount of water necessary to rotate the water turbine, which in turn converts the potential energy of water into kinetic energy. Through the transfer of kinetic energy of rotation of the turbine to the generator can convert this energy into electrical energy. The idea of our plan of research for electrical energy from the power of water using small- hydroelectric plants, which can be built on small rivers, streams, and through the construction of small dams to control the amount of water. Electrical energy derived from small- hydroelectric plants could help feed the electrical loads to areas isolated from the national grid and can be linked with the national grid to add additional electric power.

Keywords: Micro-hydropower; Isolated areas; Hydro-turbine; renewable energy.

1. INTRODUCTION

The energy crisis of the most important problem facing the world today, because of the large increase and ongoing energy consumption [1]. The corresponding specific reserve of conventional energy resources, as well as a significant rise in fuel prices, and the costs of

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transport, and environmental problems caused by traditional sources of energy [2-5]. So, it has become to be thinking about finding new and alternative sources of energy and attention began moving to renewable energies, led by solar and hydropower, as well as wind energy [6-9].

The advantage of renewable energy is that it is not exhausted, and is available in nature, and does not produce for use of environmental contamination [10]. The fact that our country, Iraq has many rivers, streams, and branches that apply where the water is smooth, and the fact that water has the potential energy in it [11]. Also, it has kinetic energy during naturally flowing, so came the idea of our plan of research for electrical energy from the power of water using small- hydroelectric plants, which can be built on small rivers, streams, and through the construction of small dams to control the amount of water. Electrical energy derived from small-hydroelectric plants could help feed the electrical loads to areas isolated from the national grid and can be linked with the national grid to add additional electric power. Also, it can be linked with other types of renewable energy power plants, such as wind and solar energy generators.

2. GOAL OF THE RESEARCH PLAN

Given the urgent need for electrical energy in our daily lives, but not available continuously over time, because of technical problems at the power generation stations, and problems in the processing of the fuel for these stations, and the fact that this type of fuel depleted in the future. So it began to move towards the provision of alternatives energy, and one of these alternatives are viable small- hydropower stations to feed the residential areas, and small complexes isolated from the national grid. In Iraq, there are many rivers, streams, and branches that can be harnessed to produce renewable electrical energy to reduce dependence on the national electricity, as well as to ease the load pressure on the national electric grid.

3. SEQUENCE RESEARCH PLAN

The research plan can be implemented on sequential stages complement each other, and after the implementation of all stages can reach the desired result of building small hydroelectric plants on the streams and rivers that are available in Iraq, and use them as substitutes for energy, as follows:

1- The processing laboratory models for micro-hydropower stations to conduct experiments, and applied research, and include the following:

i . Model for the micro-hydroelectric station, turbine type (Pelton).

ii. Model for the micro-hydro power station, type Kaplan turbines.

iii . Model of a hydroelectric plant floating on the surface of the water, the type of vertical axes.

iv . Model of a hydroelectric plant floating on the surface of the water, the type of horizontal axes.

2- Converting the potential energy of water into mechanical energy, and using an electric generator, mechanical energy is converted into electrical energy, and this is done through the following:

A . Construction of a dam on one of the small rivers or streams to control the amount of water, and get a suitable height, the amount of water can be controlled to get the mechanical energy from the turbine, since the electric power generated depends on two key factors :

- Height of the water column descending to the turbine.
- Amount of water downward to rotate the turbine.

B - Applied research field for electric power generation from rivers, and small streams, and through the water underlying the energy conversion into mechanical energy. Then converted into electrical energy using electrical generators. Applied research is performed on all types of the field to reach the turbine proper location of the station, and get the highest possible efficiency, as follows:

i - Conducting applied research field for turbine type Pelton and study the performance and efficiency characteristics of this type of turbine. It is used in locations where high water column height and few amounts of water.

ii - Perform search field for turbine type of Cross-Flow. It uses this type of turbine when the height of the water column at the site is a few (not to exceed five meters) and the study of the properties of optimal performance and efficiency of this type of turbine.

iii - Conducting applied research field for Kaplan type turbine, as it is used in locations where a large amount of water (the biggest of cubic meters), the study of the properties of performance and efficiency of this type of turbine.

iv - Make several searches for practical ways to electronic control of frequency and voltage generator which is run a mediated turbine. Because the amount of water coming down from the river to rotate the turbine is fixed on the clock, as well as change the electrical loads from time to time lead to change speed of the turbine. Thus change frequency power generated so ruling requires the use of electronic control by load tied with the part of the system, or control the amount of water used to rotate the turbine, and thus control the generator rotation speeds [12-13].

4. RESULTS AND DISCUSSION

Conversion of the kinetic energy of water flow being streamlined into mechanical energy, and then into electrical energy through electrical generators, and this is done by the following steps:

A. The establishment of micro-hydropower stations floating on the water surface with the rotation axis vertical, as dependent mechanical energy generated on the speed of water flow mainly without having to build dams, and without having to use gates to control the water. Without having to use plastic pipes to carry water from the river to the turbine. It used a conveyor belt to get the rated speed of the generator. Applied research can be made for this type of hydroelectric station to include:

i - The study of the mechanical properties of the blades and the axis of rotation of the turbine.

ii – Study the torque generated during the rotation of blades and axles.

iii - A study to get the maximum possible capacity, and the factors influencing them.

B. The establishment of micro-hydroelectric plants floating on the surface of the water with a horizontal axis of rotation, and field research to study the amount of power and torque obtained in this way, and diagnosis of the factors that help to increase the efficiency of this type of hydroelectric stations.

C- Applied research on how to transfer electrical energy from stations erected on the river to the consumption areas by transmission lines with overhead wires and the other by cables buried in the ground, to determine the voltage drop in the wires and cables. Then, identify Specifications - bearing columns aerial wires, as well as the specification of cables energy carriers for this kind of project.

D-Make several applied research where the feasibility study and economic considerations for this type of project when implemented on the ground.

E- Conduct research on ways to store the energy generated from micro- hydroelectric stations, using reservoir batteries for power, and how to link these stations with the national electric grid when needed, as well as linking them with other stations for renewable energies, such as wind farms and solar power plants.

F- Applied research field of environmental pollution, which may be caused by these types of stations, and the extent of benefits or damages resulting impact on the environment and climate.

G- Training staff research specialists in the field of design and construction of micro-hydroelectric power stations in the world centers for renewable energy research, the alternative energy center at the Indian Institute of Technology in Roorkee city in India.

5. CONCLUSION

The construction of small-hydro power stations does not require high technologies, but needs to provide a river or stream water is smooth. Through the establishment of small dams on the stream can control the amount of water necessary to rotate the water turbine, which in turn converts the potential energy of water into kinetic energy. Through the transfer of kinetic energy of rotation of the turbine to the generator can convert this energy into electrical energy. This can be controlled by controlling the speed of the turbine, which depends directly on the amount of water coming down from the river to the turbine. The energy generated can be used to feed the residential areas isolated from the national grid, as well as linking them to the national grid as reserve energy with other types of renewable energies as wind energy and solar energy.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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