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Methodology of Feasibility Studies of Micro-Hydro power plants in Cameroon: Case of the Micro-hydro of KEMKEN

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Abstract

Hydroelectricity is the largest source of renewable energy. However, large hydroelectric power stations will no longer be built enough. But there is tremendous potential for small hydropower that is seen as a more suitable renewable energy source. Cameroon has also a great hydroelectric potential. This work presents a simple method of the feasibility studies of a Micro Hydroelectric Power Plant (MHPP) project, in the intention to contribute to its development in Cameroon. The study was supported by feasibility studies of the KEMKEN MHPP project. It is a project of 320 kW of installed power, where the Kaplan turbine is recommended, the investment cost evaluated at 212 486 656 FCFA with a payback period around 7 years. This work contains the necessary elements of the feasibility studies of a MHPP project in rural locality.

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Keywords: Project; feasibility studies, micro-hydro power plant.

1. Introduction

Hydroelectricity is one of the most mature renewable forms of energy, providing about 20% of the world's electricity consumption. Hydro-electric power is a form of renewable energy resource, which comes from the flowing water. To generate electricity, water must be in motion. When the water is falling by the force of gravity, its

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potential energy converts into kinetic energy. This kinetic energy of the flowing water turns blades or vanes in a hydraulic turbines, the form of energy is changed to mechanical energy. The turbine turns the generator rotor which then converts this mechanical energy into electrical energy and the system is called hydro-electric power station.

Countries such as Brazil, the United States, Canada, China and Norway produce large amounts of electricity with very large hydroelectric stations [14]. Nowadays, very large hydroelectric power plants are less and less developed because of their socio-environmental impacts such as: flooding caused by large dams and reservoirs, displacement of massive population, changes in the local ecosystem, Landscape impact, changes in water used ...etc. On the other hand, for the same reasons and in the concerns of the sustainable development of any locality, most experts agree that hydropower of more than 1MW cannot be considered as renewable. This is due to factors which reducing its capacity after a number of years [26]. Not only a small hydropower plant with 1MW of power can supply 630 households throughout the year, but also avoids the emission of 2500 tons of CO₂ per year in the atmosphere. For these reasons, several small hydropower plants have been developed and commissioned around the world. In China, for example, more than 19,000 MW of electricity is produced by 43,000 small hydropower plants [15].

The rate of access to electricity in Cameroon was 49% in 2012, which less than 20% in the rural area [16]. However, that country has significant hydroelectric potential. But only large power plants are often developed, leaving out many other sites favorable to the implantation of the MHPP, able to satisfy the needs of electrification in the remote rural areas and thus contribute to their sustainable development. There is the lack of data and skills in that area in Cameroon.

The aim of this study is to set up a methodological guide for the feasibility studies of the MHPP in Cameroon, based on the case study of the fall river of KEMKEN.

2. Materials and methods

The study was carried out between March and October 2016. It took out several steps, including site visits, data collection, measurements, field surveys, meetings with local populations and analyzes.

2.1. Study site and materials

The hydroelectric potential of the site chosen is a water called KEMKEN, on a river in Banéghang district (5 ° 26 '54 "North, 10 ° 18' 49" East), Bansoa village, Penka-Michel subdivision, Menoua department, West Region of Cameroon [29]. The following figure shows a photo of waterfall.

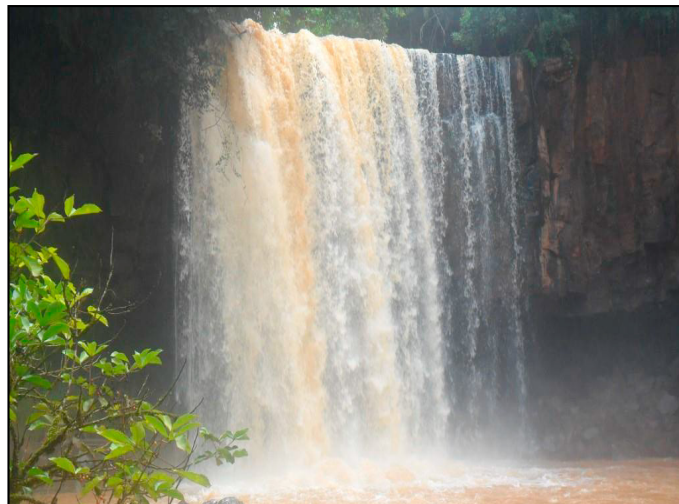


Figure 1: The waterfall of KEMKEN (Source: authors)

The national interconnected South (RIS) network covers some neighboring villages. The distance between the site and the nearest national grid point is currently estimated at 9.5 km. The inhabitants closest to the site have no electricity.

Topographic maps, electronic laser level with Global Positioning Systems (GPS), questionnaire series, length

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