Modelling the feasibility of retrofitting hydropower to existing South African dams

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Abstract

An investigation was carried out with the primary objective of ascertaining whether it is possible to develop a model for determining the feasibility of retrofitting hydropower to existing dams in South Africa. The need for such a model is primarily due to the growing importance of small-scale hydropower projects resulting from the global shift towards renewable energy and the South African energy crisis, the increased price of energy and the introduction of feed-in tariffs for renewables. The model is intended for engineers, typically working on behalf of a client who would like a simple first order assessment of feasibility. It therefore takes all technical, environmental, social and financial considerations into account in order to provide a recommendation on whether or not a project would be feasible.

Achieving the primary objective required an in-depth study of the theory and literature related to the current electricity situation in South Africa as well as all the different components and considerations of hydropower projects. This theoretical knowledge could then be utilised to develop a computer model which combines the most important considerations into a cohesive whole in order to make a recommendation on feasibility. The accuracy and applicability of the model could then be ascertained through testing, using actual case studies in South Africa. Three test cases were utilised which yielded positive results.

A number of difficulties were encountered. These related mainly to the development of an accurate means for pricing the different components primarily due to a lack of response from suppliers. Such issues were solved through the use of theoretical formulas and studies which provided good results. Ultimately, a model was developed which includes financial, environmental and social considerations and provides values that are accurate enough as an initial tool in determining whether or not to continue with a retrofitted hydropower project.

Keywords: hydropower, retrofitting, feasibility