SELECTION OF SUSTAINABLE ENERGY SYSTEMS FOR NEPAL USING ANALYTIC HIERARCHY PROCESS

ABSTRACT

Selection of sustainable energy systems is always problematic. The scenario becomes more complex when there are constraints in economy and several alternatives are feasible. One has to consider multiple criteria, which could prove to be very crucial during the selection process. It is a case of Multi Criteria Decision Making and AHP has already proven to be a useful tool in such scenarios. In this study, various factors, sub-factors and alternatives associated with sustainable energy development in Nepal have been identified and AHP has been used to prioritize these alternatives. The analysis has been done from the perspective of various stakeholders who could be game changers for the development of energy systems in Nepal.

Keywords: AHP, MCDM, sustainable, energy systems.

1. Introduction

The increasing demand of energy and depleting fossil fuel resources have pressurized researchers to search for alternative energy sources. Countries like Nepal with zero petroleum resources are always in search of alternative sources, which could reduce the dependency on fossil fuel. Choosing the best energy system for Nepal is very difficult as several alternatives are present. Further, the failure of past projects shows an evidence of impact of stakeholders in the development of these systems. It is a real case of MCDM and AHP has been adopted as a tool in this research.

Motivation for the research

For the last decade, Nepal has been facing a huge problem of energy crisis, although the country is very rich in natural resources. Due to small economy, it cannot develop all the energy sources at the same time. It becomes important to prioritize energy systems to develop them in step-wise basis. Further, it is also vital to identify important factors, major stakeholders and viable alternatives based on the need of the people.

Research question

Which is the most important sustainable energy system suitable for Nepal?

2. Literature Review

There have been few researches regarding energy systems selection. Abbasi*et al*. (2010) discussed the environmental impacts on biomass energy. Similarly, Akella*et al*. (2008) discussed renewable energy systems' impact on social, economic and environmental, and other factors. Several methods have been adopted in evaluation and selection of energy systems.AHP is capable of breaking complex problems into smaller parts that can be easily handled by human intelligence (Saaty, 2008). Daniel *et al.* (2010) used AHP in evaluation of renewable energy resources in India.

3. Objective

The major objective of this research is to develop a decision model for sustainable energy selection in Nepal.

4. Research Design

This research adopted four tools in addition to literatures: questionnaire, Delphi method, interview and model development using AHP. A pair wise comparison questionnaire based on AHP model has been used for data collection. Interview was

conducted with each of the respondents with the proper demonstration of pair wise comparison process and the inconsistency that may result. Individual data has been checked for consistency. Geometric mean of the valid data collected from individual respondents has been used for further calculation and prioritization of alternatives.

5. Model Analysis
The model developed has five levels with goal at the level 1 and stakeholders, factors, sub-factors and alternatives at level 2, level 3, level 4 and level 5 respectively.
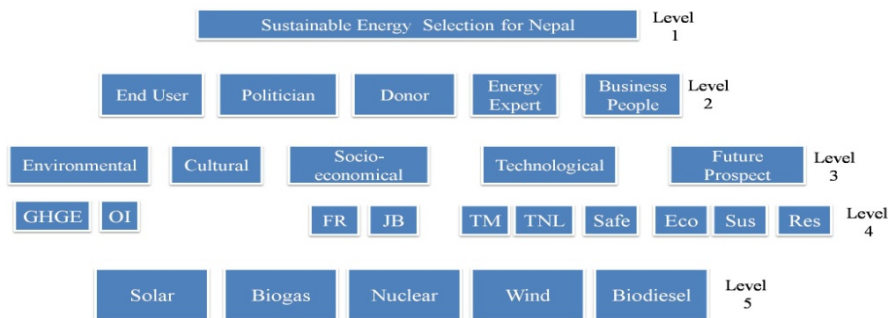
GHGE: Green house gas emission, OI: Other impacts, FR: Financial requirements, JB: Job opportunity, TM: Technology maturity,TNL: Technology known, Eco: Economy, Sus: Sustainability, Res: Resources,

6. Limitations
There is no unanimity about the best method of aggregating the responses. The method relies on subjective judgments for the analysis. The weights that are assigned to the decision makers can be tilted in favor such that the result will reflect the opinion of a selected few people. Maintaining consistency is also a very critical factor for the members' views to be accurately reflected in the results. Within a small group, an inconsistent input from a single member can immediately have an effect on the overall rankings.

7. Conclusions
This research could be a good model for energy system planning within the constraints of resources and time. Further, it could provide guideline for government and private sector for selection of an appropriate energy systems based on the need of the people and the successful completion of energy projects by identifying possible risk generating factors associated with the projects.

8. Key References
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