

## **SELECTION OF RENEWABLE ENERGY SOURCES USING ANALYTIC HIERARCHY PROCESS**

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### **Abstract**

In recent years, there is a growing interest in Renewable Energy (RE) sources both in the developed and the developing countries; in the developed countries for clean energy sources and the developing countries to meet growing demand for energy. For an energy starved country like Bangladesh, harnessing renewable energy sources is of paramount importance for sustainable economic growth so that the economic development activities of different sectors are not constrained due to shortage of energy. According to a report published in 2000, only 18% of the population in Bangladesh has access to electricity. The major energy sources as of now are biomass fuel (55%), natural gas (24%), imported coal/oil (19%) and hydro-electricity (2%). In 1996, the Government of Bangladesh has for the first time adopted a National Energy Policy setting a number of objectives. Some of which are: (i) to meet energy needs of different zones of the country and socioeconomic groups, (ii) to ensure environmentally sound sustainable energy development programs causing minimum damage to environment, (iii) to encourage public and private sector participation in the development and management of energy sector. Notwithstanding the declared policy and the effort of a number of government and non-government organizations, there is no significant progress in commercialization of RE technologies. It appears that there is still a great deal of uncertainty regarding the choice of a suitable source of energy at any given location.

Given the geographical location of Bangladesh, the principal sources of renewable energy are solar, wind and biogas (leaving out bio-mass which is principally used for domestic cooking and heating purposes in rural areas). The technologies for harnessing energy from these sources are now in a state where commercial exploitation is feasible. The choice of a particular RE technology, however, cannot be based solely on techno-economic factors. One has to consider social, environmental and location aspects also. Thus, the choice of a renewable energy technology is a multi-criteria decision making (MCDM) problem.

There are several techniques now available in the literature to deal with multi criteria decision making problem. Some of the well known techniques are Multi Attribute Utility (MAU) model, Simple Multi Attribute Rating Technique (SMART), Analytic Hierarchy Process (AHP) and Fuzzy Hierarchical Decision Making (FHDM) method. In this paper, we have used AHP to determine the preferential ranking of alternative sources of renewable energy because of its inherent capability to handle both quantitative and qualitative attributes and data uncertainty. The method is comparatively simpler, more easily comprehensible and has wider applications.

Following AHP methodology, first we have identified the important criteria using relevant literature and opinion of experts in the field and developed a hierarchical structure of criteria and sub-criteria. The first level criteria are technical, economic, social impact and location. The importance of the criteria has been obtained from experts' judgment by making pair-wise comparisons and then the weight of each criterion

has been determined by standard procedure. The RE technology options have been compared with each other in turn for each sub-criterion and higher level criterion and their preferential weights have been determined. The results of the analysis are presented in the paper in detail.