2ND INTERNATIONAL SYMPOSIUM K-FORCE 2019

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IMPLEMENTING MCDM AHP IN TECHNOLOGY SELECTION PROJECT RENEWABLES CASE STUDY

INTRODUCTION

Decision making is a really complex process, especially in the planning phase of a new project. The most prominent challenge is the amount of criteria, objectives, preferences and alternative to account for. From technology options to the specific brand, cost or availability; the set of choices is large and with different utility values in the eye of the designer. Multi criteria decision methods, and in specific AHP, offer a quantitative tool to account for every relevant detail in this process. Apart from quantitative criteria, it offers the possibility to account for qualitative criteria which are equally important. The aim of this paper is to offer an overview of the advantages MCDM, AHP offers in evaluating all the options available in new project selection.

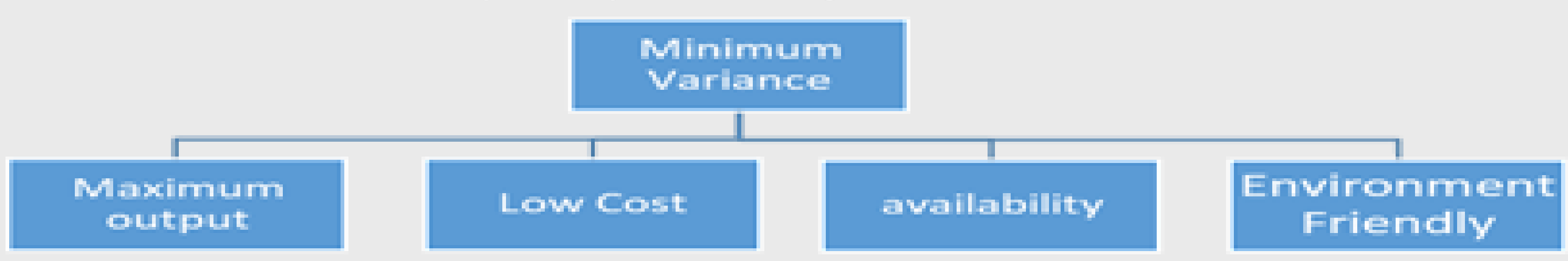
Facilitate decision making through MCDM AHP, to manage the risk of adverse selection in developing alternate renewable sources harvesting technologies

AHP was developed by Thomas Saaty in 1980. it can become really handy in the planning phase of a new energy project. Small energy generating capacities are developing fast in Albania; with small hydropower (less then 5MW) facilites flourishing through the country. Through AHP we will illustrate the decision process of an entrepreneur in this case. The region selected is in the upper river flow in Osum, discussing three renewable technologies alternatives. The proposed capacity of installment is 1 MW for each technology. Weather data from Weather Analytics are used to model techology performance for Wind and Solar, and data on the Criteria were generated from SAM. Modeling on Hydro power is made through an EXCEL spread sheet program TurbinePro.

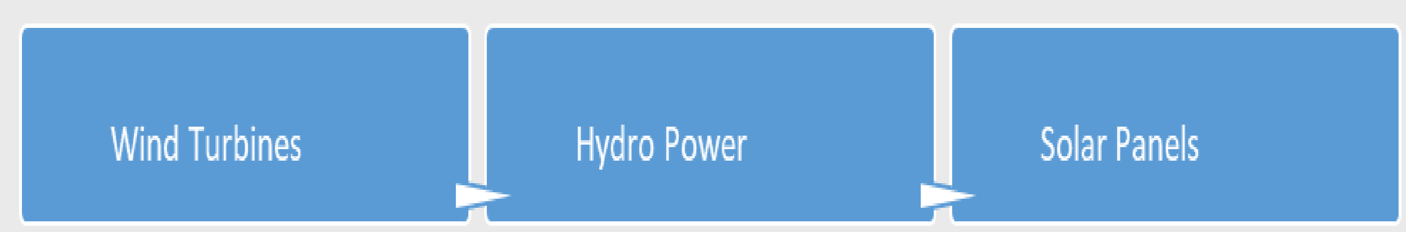
A small energy capacity has a production schedule to fulfill. Production schedules on renewable energy resources are subject to risk, since they depend on natural resources availability: sun radiation; wind speed and flow volume and speed.

All tables below are authors calculations

Priority of Objectives Diagram



Set of Alternatives



Criteria Relevance Matrix

	LCOE	Output	Variance	Availability
LCOE	1.0000	0.5000	0.2500	2.0000
Output	2.0000	1.0000	0.5000	10.0000
Variance	4.0000	2.0000	1.0000	12.5000
Availability	0.5000	0.1000	0.0800	1.0000
sum	7.5000	3.6000	1.8300	25.5000

Weight Vector

					Weight
LCOE	0.133	0.139	0.137	0.078	0.122
Output	0.267	0.278	0.273	0.392	0.302
Variance	0.533	0.556	0.546	0.490	0.531
Availability	0.067	0.028	0.044	0.039	0.044

EVALUATION OF CHOICES:

Wind	28.2800	1.20	12.5000	1.00	
Solar	45.7000	1.10	20.4000	5.00	
Hydro	2.3300	1.50	33.1300	8.00	
sum	76.31	3.80	66.03	14.00	

	COLUMN-NORMALIZED MATRIX:					
Wind	0.370594	0.315789	0.189308	0.071429		Cost
Solar	0.598873	0.289474	0.30895	0.357143		Output
Hydro	0.030533	0.394737	0.501742	0.571429		Variance
checksum	1.000	1.000	1.000	1.000		Disponibility

	SCORES:
Wind	0.244
Solar	0.341
Hydro	0.415
checksum	1.000

From the scores matrix we can see that the best solution is to invest in hydropower. To make sure that the solution offered is consistent to our preferences (minimum variance); we calculate consistency index.

In our case; this would be necessary to prove the usefulness of the method. Remember hydro had higher operational risk than wind and solar but still is proven to be the best solution.

Nevertheless AHP in this case helps us identify that this technology in this specific area has higher competitive advantage in comparison to the others.

Conclusions

- MCDM and in particular AHP offer to the decision maker an important tool that incorporates many objectives and criteria in the decision making process.
- AHP advantage is that it accounts for qualitative criteria and gives weight to the developers preferences
- The risk in this kind of decision making is that the solution offered might not be consistent with the priorities set.

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