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Evaluation of Solar Energy using Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) Method

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Abstract

Solar energy has grown tremendously in recent years. The result is cost reduction and Renewable energy development and Government policies favoring the use of both are due to technological improvements as a result. This study focuses on solar energy development and the technology of deployment, economic and policy aspects. This is more typical than the cost of energy technologies. Other renewable as with energy technologies, many countries offer tax concessions and exemptions, tariffs, and preferential interest rates, renewable portfolio standards and including voluntary tattoo energy schemes From financial and regulatory incentives Advantages of solar energy. Emerging carbon credit markets to harness solar energy is expected to provide additional benefits; However, Provided by current carbon market instruments of the Kyoto Protocol, etc. such as clean development mechanism the amount of incentives is low. Based on Method MOORA is some are commonly Used to solve material selection problems. The reference point approach Efficiency and Full Multiplicity MOORA Method are tested for perceived problems. To understand all three methods Very simple, are easy to implement and are give almost perfect rankings for material alternatives. The dimensionless ratios of the MOORA method avoid these objective normalization difficulties with all different units. In the first part of MOORA, These ratios are aggregated; second, they are a reference point used as distances. Results of the two parts control each other. It is a test of strength. In addition, MOORA multi-objective optimization shows strong dominance over all other methods. The Department of Facilities in Lithuania, Both parts of MOORA resulted in comparable rankings. The alternatives are Total Renewable power, Hydropower, Bio-power, Geothermal, Solar PV, Concentrating solar thermal, and Wind power capacity. The evaluation Parameter is the years 2016, 2017, 2018, 2019, 2020, and 2021. The end result of solar energy is hydropower first grade and wind energy efficiency seventh grade.

Key words: Renewable Energy, Market Developments, Multi MOORA, Fuzzy AHP

Introduction

Considering renewable energy sources is Very Important in this sense, Because although they are eco-friendly, Solar energy is for many reasons for the future world A better choice might be: First, solar energy is renewable energy, is like heat and light It is in various forms that reach the earth. As this energy goes, Most of it is scattered, reflected by clouds, and lost through absorption. By satisfactorily harnessing solar energy Global energy demand Studies have shown that complement can be because it is in nature there is plenty and is a freely available source of energy without cost. Second, it exists in the world as a promising energy source, because it's not exhausted, solid than other energy sources, and Increases output performance. Determine the efficiency of the solar PV industry. Determine the vary greatly across countries. In Asian countries compared to other temperate countries Solar radiation, There is a higher chance of getting because such countries Duration of sunlight More in a year. Most of the solar radiation is not utilized and it should be noted that it is based on dimensionless measurements The MOORA method consists of two parts: rate structure and reference point approach, each controls the other. MOORA applied for a selection among 15 major residential contractors to meet the needs of apartment owners in Vilnius, the Capital of Lithuania. A fourth contractor is classified last, with its favourable ranking still to be mentioned. 10 more contractors are ranked low, but to what extent are not clear. Best contractors in performance, not the best (costs), it seems unusual. On the other hand, the size of the company is very important. Thus the arguments that small enterprises were not considered from the beginning have no merit.

Solar Energy

Other renewable Availability compared to energy sources, Cost-effectiveness, accessibility, efficiency and Based performance Since solar energy are better, To meet future energy demand is One of the best options For the first time, a photosynthetic organism within different regions and The flow of solar energy, Researchers have successfully measured. Because of this, as a first step in research, this is more than is currently possible Uses solar energy more efficiently and Contributes to the development of technologies. Using few-layer MoS2 wafers as the active buffer interface layer can significantly increase researchers at Graphemes Flagship showed that. Awareness of PV technology and understanding,

Educational programs in universities and not only at college levels should be introduced at primary and middle school levels as well. Additionally, to promote the rapid spread of BIPV adoption, the Media plays an important role. About Solar Technologies Pay more attention to the mass media must have a special section. Fast-growing worldwide industries, And to keep that momentum going, material use, Energy consumption to manufacture these products, Device design, and When it comes to production New developments are on the rise. Technologies, as well as new concepts to improve the global performance of cells. In the first phase of this research from the teachers' point of view Understanding of photovoltaic solar energy is discussed. It can be observed that the authors' definitions of photovoltaic solar energy contain common terms: "electricity", "solar radiation", "direct generation", and "conversion". Therefore, we can adopt the following photovoltaic solar energy Definition as a concept: received directly. Reasons for favoring bioenergy in basic models include its high versatility, its widespread applicability across the existing energy system and its potential to by combining it with carbon capture and storage and Produce negative emissions from biomass. However, sustainable biomass resources and Basic land requirements in 2050 Primary bioenergy production is 100-300 EJ per year (i.e., the secondary energy production of 50-150 EJ). Estimated to be restrictive, whereas for solar energy Technological potential is high. 7-9 times the bioenergy and century exceed the total projected global energy demand in the mid-term. The latest market developments are established and in emerging markets Point to the rapid growth of solar energy. So far the energy system raises the question of why solar energy is only partially represented in the future. From this point of view, Let us first examine the historical scenes, Compared to actual deployments, In Global Energy and Mitigation Scenarios We see that solar energy has been systematically underestimated so far. We investigate the reasons for this underestimation and Public Incentive Schemes, Cashless options, and Accelerated technical learning We found that the models did not observe Second, for PV deployment We analyze current barriers, Especially intermittent solar power Rising costs of integration into the power system, It consists of less developed financial institutions It is a challenge for countries. We argue that these barriers can be overcome, It is in phase and new financing projects indicating increasing opportunities to accommodate a greater share of PV Finally, the lessons learned from this analysis We use an integrated evaluation model for recall, In more cost-optimal climate mitigation scenarios We see PV covering 30-50% market share in electricity generation. "Solar Energy at the Earth's Surface Not evenly distributed. There are privileged areas; others are less favored by climate. If the former is present, it will be prosperous they can harness the sun's energy. Tropical countries will be conquered by civilization, and In this way returns to their origin. Its final sentence article makes a point that still makes a lot of sense today (if we just oil in coal, Add gas and nuclear power): “Our black and nervous civilization is coal if based on a peaceful civilization will follow. To advance the use of solar energy neither harms human happiness."

MOORA method

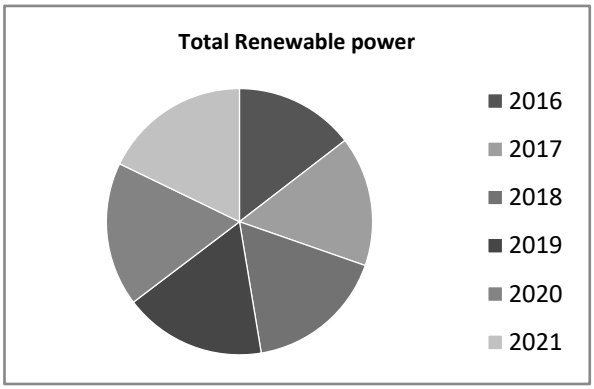
MOORA method is Very easy to understand and easy to implement. This time Simple ratio analysis is only based on its being of a certain size and Involves mathematical calculations, making it very useful and effective for decision-makers without Back to math a strong background, Due to its minimal computational requirements, of the MOORA method counting timeless. Another one of these methods the main advantage is its calculation process as with other MODM methods, for this reason, the MOORA method for various decision problems is Very stable. Ratio analysis method of Multi-Objective Optimization (MOORA) Improved nominal group technique and fulfills the criteria with the help of the Delphi method. In addition, MOORA multi-objective optimization seventh condition using 2 different methods somewhat satisfying. Any other method conditions for not feeling well, MOORA is a very robust method. Based on dimensionless measurements there are two parts of the MOORA method: Integration of dimensionless ratios and these rates for a reference point are used remotely. Sending application of MOORA to contractor alternatives in Lithuania's facilities sector respond to seven strong criteria Multiple criteria Also called multi-attribute optimization, is two or more subjects to certain restrictions Conflicting Traits (Notes) It is a simultaneous upgrade process. This is in a production environment The MOORA method deals with various attributes (objectives). The decision starts with the team showing the performance of various alternatives. In addition, MOORA for the seventh condition is somewhat satisfying. MOORA is a very robust method because any other way seven criteria are not well met. The following case study is MOORA-based and explains the application of the Taguchi method. For washing machine manufacturers in Turkey machines and the factors that characterize their sizes are determined. Later, this study was developed MOORA-based using the Taguchi model these factors and their interactions are analyzed. in the optimization process and their solution performance compared with the proposed model. Any method was other than the MOORA-based Taguchi method optimization. Details on case study models and application steps are presented in the following sections. The MOORA system is designed to improve academic achievement. In facilitating decision-making using the MOORA method a variety of problems can be overcome. As per the eligibility of the students who need it Scholarship recipients enhance academic achievement For decision makers to make quick decisions, The methodology used to select recipients of PPA scholarship funds is Based on the set criteria It means using the MOORA method. Preference will be given to becoming a scholarship recipient. To get scholarships using the MOORA system to select the best students. The stages of research are carried out step by step. MOORA method for attributes Multiple criteria Also known as multiple optimization methods. Two or more Subject to some conflicting criteria, attributes (goals) to improve is to carry out simultaneous processes The working process of MOORA method. When MOORA is combined with the full multiplication pattern, these methods collectively form the name MULTIMOORA. The authors assert that MultiMura represents a more robust approach to multi-objective optimization (Bryoers & Zavatskas, 2012). Yıldırım and Önay have evaluated some companies using cloud technology using Fuzzy AHP and MOORA methods. The right choice of ERP for companies

Karande and Chakraborty said is very important to solve this decision problem they used the fuzzy MOORA method. This makes for a hassle-free end product choosing the right materials. Because of the need for hassle-free wireless Internet access, A good network connection is essential, Archana and Sujata point out. They are integral to passing this test and have proposed a fuzzy Moore-Gray method. The company has selected an ERP software system.

Result and Discussion

TABLE 1. Solar energy

	2016	**2017**	**2018**	**2019**	**2020**	**2021**
Total Renewable power	1578.00	1712.00	1849.00	1875.00	1898.00	1934.00
Hydropower	1018.00	1055.00	1064.00	1070.00	1086.00	1098.00
Bio-power	88.00	93.00	106.00	115.00	124.00	132.00
Geothermal	12.10	12.80	13.20	23.00	27.00	29.00
Solar PV	138.00	177.00	227.00	254.00	267.00	287.00
Concentrating solar thermal	3.40	4.40	4.80	5.40	5.70	6.00
Wind power capacity	319.00	370.00	433.00	474.00	489.00	510.00
	B	**B**	**B**	**NB**	**NB**	**NB**



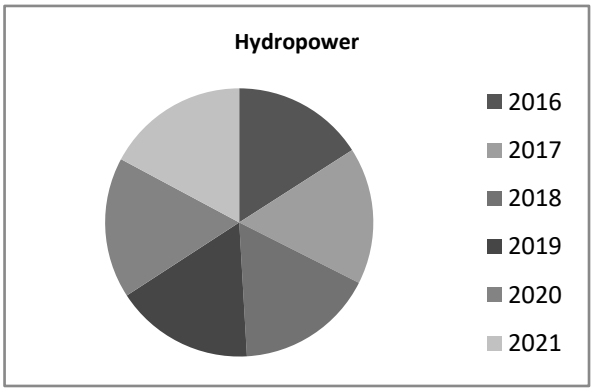


FIGURE 1, (A) **FIGURE 1**, (B)

Table 1 and Figure 1(A)(B) shows the MOORA method and Solar Energy Evaluation Parameters in are years 2016, 2017, 2018, 2019, 2020, and 2021. Alternatives are Total renewable energy, hydropower, bio-energy, geothermal, solar PV, concentrated solar thermal and wind energy potential.

TABLE 2. Normalized Data

	2016	**2017**	**2018**	**2019**	**2020**	**2021**
Total Renewable power	0.8254	0.8333	0.8438	0.8416	0.8398	0.8395
Hydropower	0.5325	0.5135	0.4856	0.4803	0.4805	0.4766
Bio-power	0.0460	0.0453	0.0484	0.0516	0.0549	0.0573
Geothermal	0.0063	0.0062	0.0060	0.0103	0.0119	0.0126
Solar PV	0.0722	0.0862	0.1036	0.1140	0.1181	0.1246
Concentrating solar thermal	0.0018	0.0021	0.0022	0.0024	0.0025	0.0026
Wind power capacity	0.1669	0.1801	0.1976	0.2128	0.2164	0.2214

Table 2 shows the various Normalized Data for the years 2016, 2017, 2018, 2019, 2020, and 2021, Total renewable energy, hydropower, bio-energy, geothermal, solar PV, concentrated solar thermal and wind energy potential Normalized value is obtained by using the formula

TABLE 3. Weight

	2016	**2017**	**2018**	**2019**	**2020**	**2021**
Total Renewable power	0.25	0.25	0.25	0.25	0.25	0.25
Hydropower	0.25	0.25	0.25	0.25	0.25	0.25
Bio-power	0.25	0.25	0.25	0.25	0.25	0.25
Geothermal	0.25	0.25	0.25	0.25	0.25	0.25
Solar PV	0.25	0.25	0.25	0.25	0.25	0.25
Concentrating solar thermal	0.25	0.25	0.25	0.25	0.25	0.25
Wind power capacity	0.25	0.25	0.25	0.25	0.25	0.25

Table 3 shows the solar Energy Weight all same value.

TABLE 4. Weighted normalized decision matrix

	2016	**2017**	**2018**	**2019**	**2020**	**2021**
Total Renewable power	0.2063	0.2083	0.2110	0.2104	0.2099	0.2099
Hydropower	0.1331	0.1284	0.1214	0.1201	0.1201	0.1192
Bio-power	0.0115	0.0113	0.0121	0.0129	0.0137	0.0143
Geothermal	0.0016	0.0016	0.0015	0.0026	0.0030	0.0031
Solar PV	0.0180	0.0215	0.0259	0.0285	0.0295	0.0311
Concentrating solar thermal	0.0004	0.0005	0.0005	0.0006	0.0006	0.0007
Wind power capacity	0.0417	0.0450	0.0494	0.0532	0.0541	0.0553

Table 4 shows the weighted normalized decision matrix Total renewable energy, hydropower, bio-energy, geothermal, solar PV, concentrated solar thermal and wind energy potential. The evaluation Parameter is the years 2016, 2017, 2018, 2019, 2020, and 2021 the weighted default result is calculated using the matrix formula (2).

TABLE 5. Assessment value and Rank

	Assessment value	Rank
Total Renewable power	-0.0046	4
Hydropower	0.0235	1
Bio-power	-0.0060	5
Geothermal	-0.0041	3
Solar PV	-0.0237	6
Concentrating solar thermal	-0.0004	2
Wind power capacity	-0.0265	7

Table 5 shows the Assessment value amp; Rank value used. Assessment value for Total Renewable power -0.0046, Hydropower 0.0235, Bio-power -0.0060, Geothermal -0.0041, Solar PV -0.0237, Concentrating solar thermal -0.0004, Wind power capacity -0.0265. Total Renewable power is fourth rank, Hydropower is first rank, Bio-power is fifth rank, Geothermal is third rank, Solar PV is sixth rank, Concentrating solar thermal second rank, Wind power capacity is 7th rank.

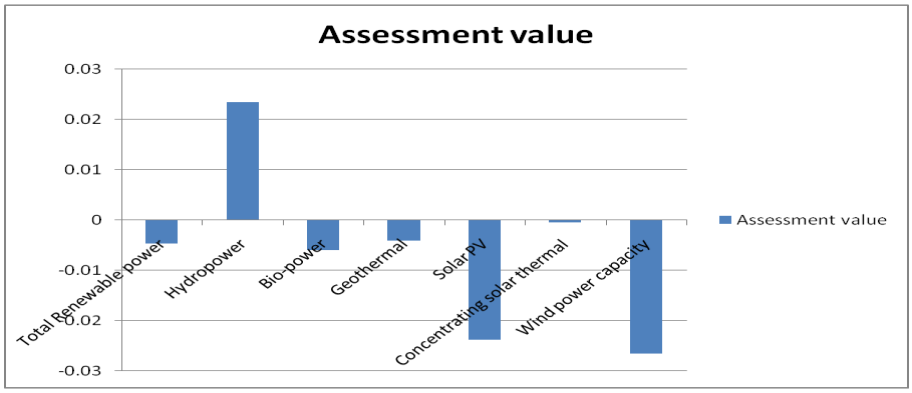


FIGURE 2. Assessment Value

Figure 1 graphical view of the MOORA method using Hydropower is showing the highest value Wind power capacity showing the lowest value.

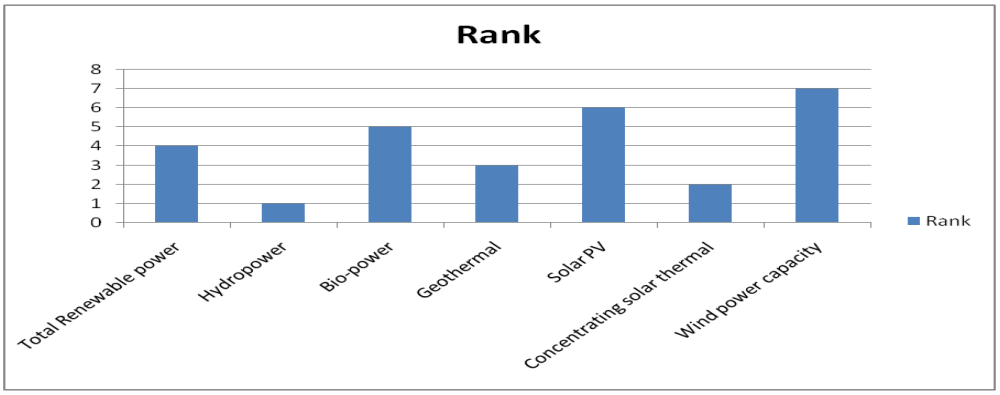


FIGURE 3. Rank

Figure 2 shows the graphical view of Total Renewable power is the fourth rank, Hydropower is the first rank, Bio-power is the fifth rank, Geothermal is the third rank, Solar PV is the sixth rank, Concentrating solar thermal second rank, Wind power capacity is the seventh rank.

Conclusion

In India, in the country to overcome barriers to growing the PV market, Research on Solar Energy (R&D) and Development requires more effort. One of the major barriers to solar energy is the capital investment required is a very high economic barrier. Costs of solar energy technologies in recent times show a rapid decline and a significant decline in the future reveals possibilities, including tower type CSP The level zed cost of any solar technologies Minimum values are present Low-cost solar technology. Even if the capital costs of solar energy technologies are reduced by 25%, the Level zed costs of conventional technologies for power generation will exceed the maximum values. At present, for large-scale use of solar energy technologies, this is the primary obstacle. Also, scaling up solar energy technologies, and finance, Constrained by technical and organizational constraints. Various funds to promote solar energy and Regulatory tools have been used. The selection of optimum process parameters in different welding processes using the MOORA method is presented. Six illustrative examples are considered to demonstrate the applicability of this method. In all cases, the top-ranked alternatives almost match those obtained by past researchers. The MOORA method can consider all the attributes with their relative importance and therefore, it can provide a better and more accurate evaluation of the alternatives. The method is computationally very simple, easy to understand, and robust, as it can simultaneously consider any number of quantitative and qualitative selection characteristics. But it is not so efficient when the result matrix has a large number of quality attributes. This method is general and can consider any number of quantitative and qualitative selection criteria simultaneously. The proposed method can be applied to any type of selection problem involving selection criteria. The result of solar energy is hydropower first grade and wind energy efficiency seventh grade.

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