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# An Extension of the GRA Method for Decision Making In the Environment: Ranking of Alternative Energy Exploitation Project

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### Abstract

Alternative Energy Exploitation Development and utilization of natural energy resources. Air pollution, climate change, water pollution, Thermal pollution and solid waste disposal are energy production and directly with consumption Related environmental issues. Alternative Energy Exploitation is Developing and Growing using natural energy resources to the greatest possible advantage, usually for profit. TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) analysis using the Alternative Energy Exploitation 1, Alternative Energy Exploitation 2, Alternative Energy Exploitation 3, Alternative Energy Exploitation 4, Alternative Energy Exploitation 5, Alternative Energy Exploitation 6 Alternative value and Criterion A. NPV (106 GDR), Criterion B. Jobs, Criterion C. Energy use (1012 cal/year), Criterion D Risk Index Evaluation Parameters in value. Alternative Energy Exploitation 1 is got the first rank whereas is the Alternative Energy Exploitation 3 is having the Lowest rank. In this paper Alternative Energy Exploitation 1 is got the first rank whereas is the Alternative Energy Exploitation 3 is having the lowest rank.

**Keywords:** Energy Exploitation, Gray Relational Analysis (GRA), renewable energy

### Introduction

Exploitation of Alternative Energy – Development and utilization of natural energy resources. Energy is available. Renewable energy sector includes power generation production and consumption depending on natural resources that can be controlled by man. Air pollutants, climate exchange, Water pollution, thermal pollution and Disposal of solid waste. All strength Resources also have some effect on our environment causing Fossil fuels coal, oil and natural gas are notably greater dangerous than renewable energy resources by maximum measures, along with. Basic energy of industrial civilization; Without power, contemporary life might give power will have an effect on the environment in some way. The big hike in gas fees due to the strength crisis is hitting the tourism enterprise very badly. Tourism charges also are growing because of growing fuel charges. Thus, there are many folks that cannot afford it Gray correlation analysis is a method of correlation and determining the degree of influence between system factors or the contribution measure of the main behaviour of the system largest degree of relationship” solution and from the negative-best solution “grey "There must be a small degree of relationship".

### Alternative Energy Exploitation

Alternative strength exploitation projects of low temperature geothermal area. It has been proven that this technique is greater sensible and produces more reliable ratings for troubles together with the assessment of opportunity power exploitation scenarios where the input information is not nicely described [1]. Alternative renewable strength resources. The European Union currently debts for most of the useful resource enter between international locations and there are numerous varieties of renewable power (RE) aid utilization. Solar electricity may be very dominant the various renewable energy sources and appears to be very attractive for power production because it does no longer growth carbon dioxide emissions, does not damage the environment and is environmentally pleasant. Energy in specific styles of buildings has attracted global attention [2]. An alternative to energy production and now many more Popular in countries arena together with USA, Germany, India and China (Pau et al., 2012). In the Eighth Malaysia Plan, renewable strength changed into announced because the 5th gasoline within the electricity deliver blend. Renewable energy is focused as an extensive contributor to the U. S.A. general strength distributor. With this objective in mind Biomass, biogas, solar, wind and Renewable including mini-hydro More resources to sell Efforts are being madestrength production [3]. Alternative sources of power are constantly converting. In fact, the application and RES and others Eco-Energy Friendly Development technology in the nation, alternate technical information with KACST scientists on ideas of sun Radiation measurements, instruments, social activities, information better assessment and control, modeling solar radiation Alternative electricity sources. We have determined to ignore the numerous benefits, benefits and herbal and eco-friendly This type of energy can damage homes and

Environmentally Friendly Exploitation, conversion and utilization of energy have chosen to engage in. [5]. Subsea exploitation capability. Furthermore, fracture length has an extensive effect, while fracture width has no obvious effect on NGH stress extraction overall performance. The quantity of fractures also significantly affects NGH extraction efficiency. With the increase in the number of fractures, the NGH depressurization exploitation performance can be progressed and the gasoline manufacturing fee also can be elevated in reducing amplitude. In addition, fracture spacing significantly affects NGH uptake capacity [6]. Among the above cavitation processes, acoustic cavitation and hydrodynamic cavitation are commercial They have great potential for exploitation Generally Acoustic cavitation to carry out organic reactions is used Since liquids are inelastic compression [7]. The an alternative to energy-assisted desalination plants The proper exploitation of energy is even greater has not been explored to scale, and thus significant results and/or design methods can be obtained. In less studied cases one is the steam cycle for exploitation It's all about using be properly connected to a desalination plant in electricity or shaft work [8]. The technique of externalization is the implementation of an internal round financial system in more than one linkages inclusive of oil exploration, exploitation, Transportation, oil Manufacturing, oil intake, and so forth. Also, this process ought to extend the scope and oil Engineering Services Size. Through this procedure, we can multiply the oil and fuel useful resource industry to build a garage enterprise Chain, the ability to extract resources Upgrade, review prices of the era of reductionist, untouched exploration Selling growth, lessen the environmental impact Study Areas, and Active R&D sales. The method of increasing value brought products. Exploitation and Refinement our oil and fuel Research career should be completerupon technological know-how and era to unfastened itself from quantitative enlargement at a low technological degree, increase the utilization efficiency of mineral resources, and decrease the level of intake as a result of monetary boom. Exploitation: growing an industry chain approach for mining oil and gasoline resources; Strengthening aid era development and innovation strategy, developing method for strength performance development and finishing help system of round economic system [9]. Alternative and renewable strength assets have visible a big increase in the previous few years because of each their demand and higher costs, so they are now available now not simplest for industrial use but also for small families and standard purchasers [10]. The Exploitation and desalination of RES Improving plant life Create capital-intensive installations. At the moment, renewable strength technologies aren't considered completely mature and the diverse machine components are nevertheless pricey. Exploitation capacity per unit of time. Furthermore, the geographical distribution of RES electricity does no longer continually correspond to water pressure depth at the nearby stage. Exploitation, high fee and troubles related to using membranes in desalination packages have hindered the development of business merchandise [11]. Exploitation of Alternative Energy – Development and utilization of natural energy resources. Energy is available. Renewable energy sector includes power generation, directly related to energy production and consumption depending on natural resources that can be controlled by man. NPV (106 GDR) of different sizes or of different periods Compared to investments, the NPV is lower Important because NPV is a dollar amount Revealed, and the more you Investing or more time The more you invest, the higher the NPV. If you find that you're not fully qualified for the jobs you're applying for, whether it's skills or education — or both — that could be a reason you're not getting the job. Employers often won't hire someone who doesn't have most of the skills, education, or work experience needed for the job. Energy use (1012 cal/year) Annual global energy consumption is 580 million Rated interajoules. It is 580 million trillion joules or approx. 13865 million tonnes of oil equivalent. (mtoe). A risk index is a cumulative risk assessment will end. All indicators and symbols in the calculation of risk index can be used. This is probability and is a combination of influence index. Probability: Probability index shows the probability of a risk event.

### Gray Relational Analysis (GRA)

The GRA approach became at the start developed by means of Deng and efficaciously applied to multi-attribute selection-making issues as a part of gray gadget concept, GRA is suitable for fixing issues of complex relationships among Several factors in the current literature and variables. Various A kind of GRA technique is proposed on this have a look at, we introduce an easy and green GRA approach [12]. Gray Relational Analysis (GRA) is MCDM helps with problems is a tool and First proposed with the aid of Deng. It has been correctly utilized in fixing diverse MCTM problems. GRA stands for an outcome evaluation model may degree correlation among collection and Records analysis method or Belongs to the geometric approach category Usually, researchers target They set up the series reference Scope of the research problem Based on Cont. Therefore, the goal of grey correlation evaluation technique is to degree the correlation among the reference collection and the contrast series [13]. Derived from Gray system idea, GRA is a quantitative method for figuring out the connection among sequences the usage of a limited amount of information. The primary The idea of GRA is that of series of curves styles closeness of relationship is primarily determined by The Series quantity is additive and vice versa. GRA two Complexity between factors and variables Ideal for solving problems with contacts. In solving various MCTMs It has been effectively implemented troubles consisting of worker choice [14]. Gray Correlative Analysis (GRA) and techniques for regulation alternatives through simulating the proper solution Both the techniques yielded the same gold standard The parameter level i.E. 10 $\mu$ m particle size, 5% reinforcement, 8mm diameter device, 710rpm velocity, 20mm/min. To become aware of the significance of the outcomes of 139.48N in-feed pressure, sixty-three.92N cross-feed force, forty-two.6N thrust force, sixty-eight.96oC temperature and zero.198 $\mu$ m floor roughness, each procedure on response parameters The impact of the variable is done. All Although the parameters are encouraging parameters, whereas Speed became a less significant factor [15]. GRA (Gray Correlation Analysis) version. First at the grid, the neighbour of each charge Countries and their one-dimensional resonance Statistics by comparing indicators Skills count. 1D-LBP After receiving the signals, in those indicators Statistical settlements are calculated. These functions are GRA are classified using A perusal of the literature well-

known shows that no such look at exists. The 1D-LBP technique changed into recently implemented Characteristic from vibration alerts First time to extract. Additionally, it is vibration signals in GRA Used for the first time in the category [16]. The Intuition mixed with vague synthesis The GRA method is a fuzzy set of decision makers Since considering information, many standards of achievement for decision-making problems carries significant risk. Therefore, in fate, this method can be applied to handle Job Evaluation, Dealer Selection, Factory Location manufacturing structures and so on Inclusive multi-criteria decision-making Uncertainty in issues of areas of control choice issues [17]. GRA first interprets the overall All in comparative rankings Performance of alternatives. According to this called ash relative formation. According to these scenarios, a Super target sequence described. then, evaluate all Gary correlation coefficient in rows and A satisfactory target collection is calculated finally this gray contact based on the coefficients, the perfect target sequence and for each variant sequence of gray contact between The size is calculated. [18]. GRA proposes an incorporated GRA for distribution network and AHP technique reconstruction to plan hydropower technology. Particle reinforced stem Electric discharge apparatus GRA to improve the method Provide a sample fabric. Proposes GRA to estimate the relative have an impact on of fuel fee, gross domestic product variety motors and vehicle kilometres travelled to electricity growth. Taiwan uses the Fuzzy-GRA technique to assess the economic overall performance of box lines. Proposes an incorporated GRA approach for provider evaluation of environmental know-how management abilities. Examine and rank the energy performance of office homes the usage of GRA [19]. Gray correlation analysis (GRA) is commonly used in Asia. It is an outcome evaluation version, which On an absolute basis Similarity between rows or measuring diploma of distinction degree of dating. The motive of GRA is to have a look at elements that affect structures [20]. Gray Relational Analysis (GRA) is proposed as a way that may for sequences of the type Measure the correlation between facts evaluation technique or geometric pattern. Reason of GRA technique, primarily based on degree of similarity with interelements Degree of relationship. GRA there are few studies that have used Oil pipelines in gas wells of environmental factors on corrosion Assess the impact, principle of application of GRA Factors identified. with many overall performance characteristics Electro Discharge machining method GRA united states of America for an expatriate task the usage of GRA using a mixed GRA and technique for included water resource protection assessment in Beijing. Decided the pleasant layout aggregate of a product from elements to suit a given product picture represented with the aid of a phrase pair the usage of GRA, introduced GRA and proposed a brand new struggle reconstruction method of trust functions. Electrocardiogram (ECG) Heart Rate Discriminator proposed a technique to degree frequency components in distinct ECG beats the usage of GRA. GRA changed into proposed for prediction-integrated circuit outputs [21]. (GRA) is A system's reference/aspirational state (desired) factors and others for compared (alternative) factors Used to show the relationship between When a systems approach examines the degree of association for two alternatives using the distance measure between. For the GRA model Concepts with computational process are briefly reviewed [22]. GRA is a choice-making technique based totally on the grey gadget principle first developed by way of Deng in gray principle, wherein black represents a gadget with incomplete statistics, while a white gadget represents whole facts. However, the grey relation is associated with incomplete facts and gap of elements may be measured one by one. Gray evaluation enables to make amends for the deficiency in statistical regression while experiments are ambiguous or the experimental technique can't be carried out exactly [23]. GRaphALigner (C-GRAAL) between networks to increase the amount of aligned edges uses heuristics and primarily Based on network topology. So, social, shipping or electric Any kind involving networks It can also be used on a network. Eukaryotic and Prokaryotic PPI networks of species we use C-GRAAL to align and PPI networks between species, and the subsequent renovations are great Connected and functional topology Technically aligned areas We show that We reveal. We are efficiently validating more than one predictions and Across biological specializations Next to change Use alignments organisms. Furthermore, we display that PPI in humans to align networks C-GRAAL can be used pathogens host from network topology Pathogen with proteins It can sense patterns of interactions by myself [24]. Traditional GRA techniques fail to cope with incomplete weight information Intuition above with ambiguous MADM issues a thrilling and vital research topic is a way to derive characteristic weights from each given intuitive fuzzy records and incompletely recognized characteristic weight statistics based at the fundamental best of the traditional GRA technique. For this reason, intuition is ambiguous to fix MADM problems GRA to develop a technique The concept of expanded statistics, wherein facts approximately characteristic weights are incompletely regarded, and attribute values [25].

## Analysis and Discussion

TABLE 1. Alternative Energy Exploitation

	Criterion A. NPV (106 GDR)	Criterion B. Jobs	Criterion C. Energy use (1012 cal/year)	Criterion D Risk index
Alternative Energy Exploitation 1	43.65	140.69	33.16	35.63
Alternative Energy Exploitation 2	23.63	142.97	38.65	45.63
Alternative Energy Exploitation 3	36.63	130.56	42.51	53.36
Alternative Energy Exploitation 4	23.17	148.50	46.51	41.63
Alternative Energy	45.56	186.41	36.65	50.16

Exploitation 5

Table 1 shows the Alternative Energy Exploitation for Grey relational analysis. Criterion A. NPV (106 GDR), Criterion B. Jobs, Criterion C. Energy use (1012 cal/year), Criterion D Risk index and Alternative Energy Exploitation 1, Alternative Energy Exploitation 2, Alternative Energy Exploitation 3, Alternative Energy Exploitation 4, Alternative Energy Exploitation 5 in this Alternatives and Evaluation value.

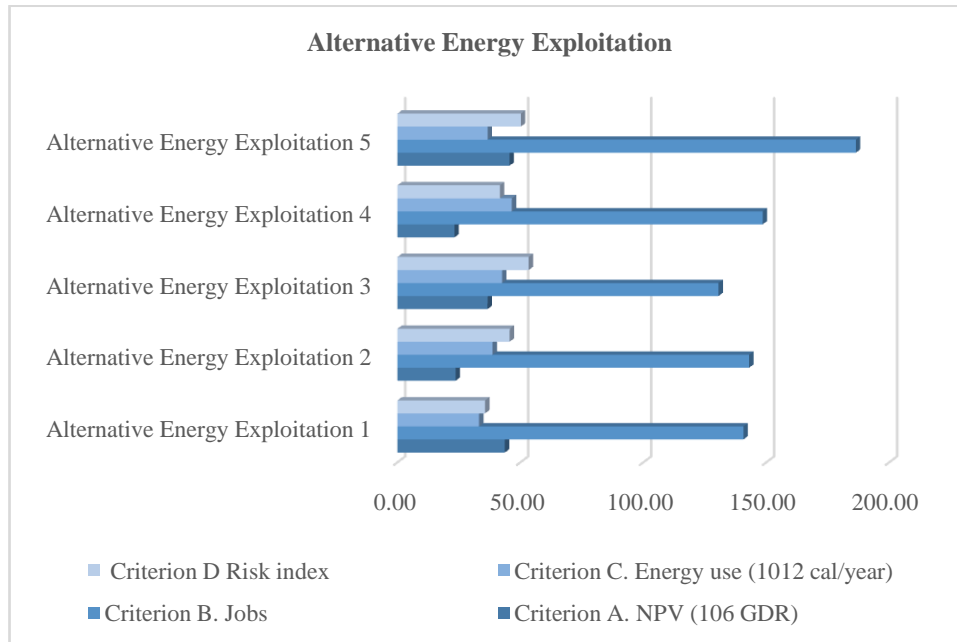


FIGURE 1. Alternative Energy Exploitation

Figure 1. Shows Alternative Energy Exploitation like Alternative Energy Exploitation 1, Alternative Energy Exploitation 2, Alternative Energy Exploitation 3, Alternative Energy Exploitation 4, and Alternative Energy Exploitation 5. From the figure 1 and table 1 it is seen that Alternative Energy Exploitation 5 is showing the Highest Value for NPV (106 GDR) and Alternative Energy Exploitation 4 is showing the Lower value. Alternative Energy Exploitation 5 is showing the Highest Value for Jobs and Alternative Energy Exploitation 3 is showing the lowest value. Alternative Energy Exploitation 4 is showing the Highest Value for Energy use (1012 cal/year) and Alternative Energy Exploitation 1 is showing the lowest value. Alternative Energy Exploitation 3 is showing the Highest Value for Risk index and Alternative Energy Exploitation 1 is showing the lowest value.

TABLE 2. Normalized Data

Normalized Data				
Criterion A. NPV (106 GDR)	Criterion B. Jobs	Criterion C. Energy use (1012 cal/year)	Criterion D Risk index	
0.9147	0.1814	1.0000	1.0000	
0.0205	0.2222	0.5888	0.4360	
0.6012	0.0000	0.2996	0.0000	
0.0000	0.3212	0.0000	0.6616	
1.0000	1.0000	0.7386	0.1805	

Table 2 shows the Normalized data for Alternative Energy Exploitation. Criterion A. NPV (106 GDR), Criterion B. Jobs, Criterion C. Energy use (1012 cal/year), Criterion D Risk index and Alternative Energy Exploitation 1, Alternative Energy Exploitation 2, Alternative Energy Exploitation 3, Alternative Energy Exploitation 4, Alternative Energy Exploitation 5 it is also the Normalized value.

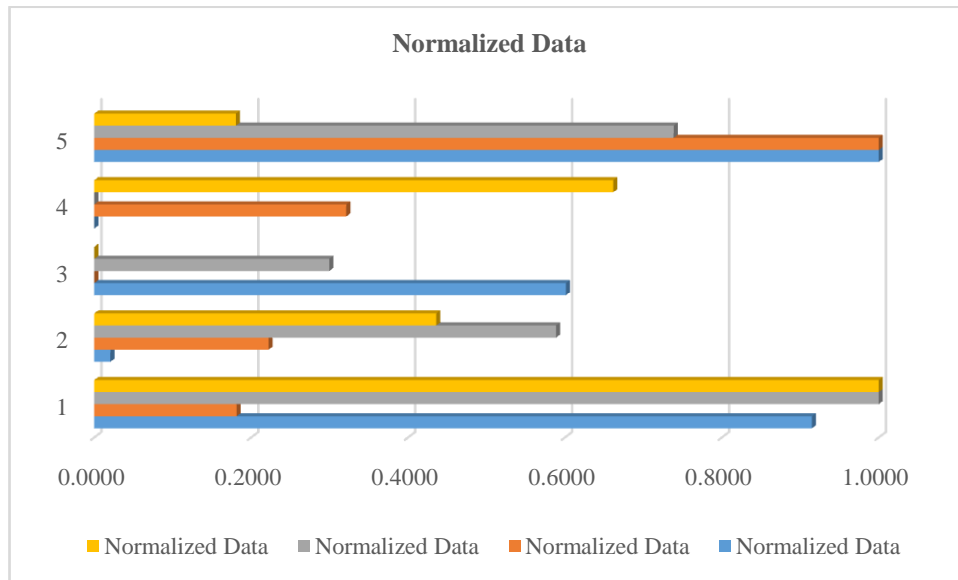


FIGURE 2. Normalized data

Figure 2 shows the Normalized data for Alternative Energy Exploitation. Criterion A. NPV (106 GDR), Criterion B. Jobs, Criterion C. Energy use (1012 cal/year), Criterion D Risk index and Alternative Energy Exploitation 1, Alternative Energy Exploitation 2, Alternative Energy Exploitation 3, Alternative Energy Exploitation 4, Alternative Energy Exploitation 5 it is also the Normalized value.

TABLE 3. Deviation sequence

Deviation sequence				
Criterion A. NPV (106 GDR)	Criterion B. Jobs	Criterion C. Energy use (1012 cal/year)	Criterion D Risk index	
0.0853	0.8186	0.0000	0.0000	
0.9795	0.7778	0.4112	0.5640	
0.3988	1.0000	0.7004	1.0000	
1.0000	0.6788	1.0000	0.3384	
0.0000	0.0000	0.2614	0.8195	

Table 3 shows the Deviation sequence for Alternative Energy Exploitation. Criterion A. NPV (106 GDR), Criterion B. Jobs, Criterion C. Energy use (1012 cal/year), Criterion D Risk index and Alternative Energy Exploitation 1, Alternative Energy Exploitation 2, Alternative Energy Exploitation 3, Alternative Energy Exploitation 4, Alternative Energy Exploitation 5 it is also the Maximum or Deviation sequence value.

TABLE 4. Grey Relation Coefficient

Grey relation coefficient			
Criterion A. NPV (106 GDR)	Criterion B. Jobs	Criterion C. Energy use (1012 cal/year)	Criterion D Risk index
0.8543	0.3792	1.0000	1.0000
0.3380	0.3913	0.5487	0.4699
0.5563	0.3333	0.4165	0.3333
0.3333	0.4242	0.3333	0.5964
1.0000	1.0000	0.6567	0.3789

Table 4 shows the Grey relation coefficient for Alternative Energy Exploitation. Criterion A. NPV (106 GDR), Criterion B. Jobs, Criterion C. Energy use (1012 cal/year), Criterion D Risk index and Alternative Energy Exploitation 1, Alternative Energy Exploitation 2, Alternative Energy Exploitation 3, Alternative Energy Exploitation 4, Alternative Energy Exploitation 5 it is also Calculated the Maximum and minimum Value.

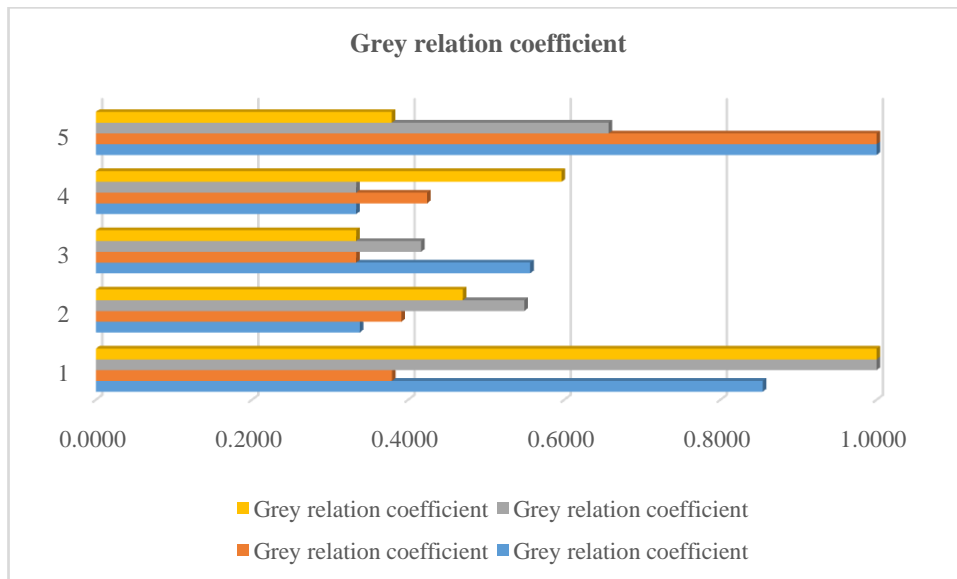


FIGURE 3. Grey relation coefficient

TABLE 5. Result of final GRG Rank

	GRG	Rank
Alternative Energy Exploitation 1	0.8084	1
Alternative Energy Exploitation 2	0.4370	3
Alternative Energy Exploitation 3	0.4099	5
Alternative Energy Exploitation 4	0.4218	4
Alternative Energy Exploitation 5	0.7589	2

Table 5 shows the Result of final GRG Rank of GRA for Alternative Energy Exploitation. GRG Rank Alternative Energy Exploitation 1 is showing the highest value for GRG Rank and Alternative Energy Exploitation 3 is showing the lowest value.

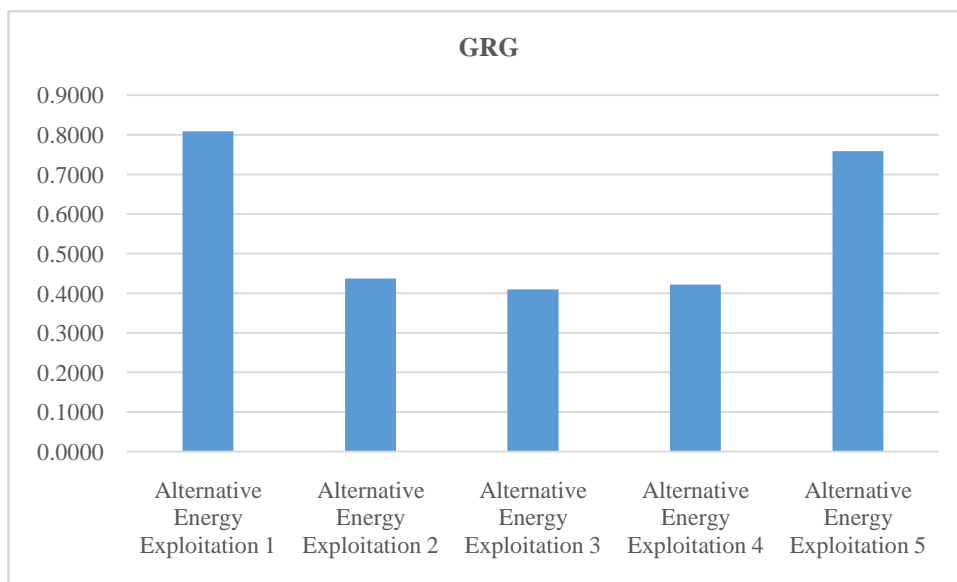


FIGURE 4. GRG

Figure 4 shows the GRG of GRA for Alternative Energy Exploitation. GRG Alternative Energy Exploitation 1 is showing the highest value for GRG Rank and Alternative Energy Exploitation 3 is showing the lowest value.

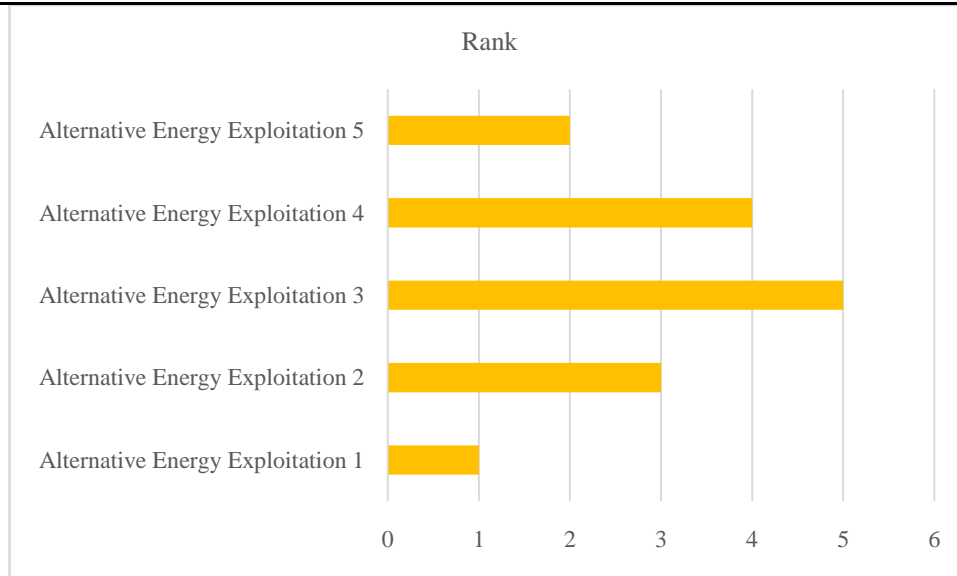


FIGURE 5.Shown the Rank

Figure 5 shows the Rank of GRA for Alternative Energy Exploitation. Alternative Energy Exploitation 1 is got the first rank whereas is the Alternative Energy Exploitation 3 is having the lowest rank

### Conclusion

Alternative strength exploitation projects of low temperature geothermal area. It has been proven that this technique is greater sensible and produces more reliable ratings for troubles together with the assessment of opportunity power exploitation scenarios where the input information is not nicely described Alternative renewable strength resources. The European Union currently debts for most of the useful resource enter between international locations and there are numerous varieties of renewable power (RE) aid utilization. The GRA approach became at the start developed by means of Deng and efficaciously applied to multi-attribute selection-making issues as a part of gray gadget concept, GRA is suitable for fixing issues of complex relationships among several factors in the current literature and variables. TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) analysis using the Alternative Energy Exploitation 1, Alternative Energy Exploitation 2, Alternative Energy Exploitation 3, Alternative Energy Exploitation 4, Alternative Energy Exploitation 5, Alternative Energy Exploitation 6 Alternative value and Criterion A. NPV (106 GDR), Criterion B. Jobs, Criterion C. Energy use (1012 cal/year), Criterion D Risk Index Evaluation Parameters in value. Alternative Energy Exploitation 1 is got the first rank whereas is the Alternative Energy Exploitation 3 is having the Lowest rank.

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