

Weighting System Emphasizes the Importance of Selected Criteria in the Decision-Making Process

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Abstract

When considering the development of a geothermal project, the complex task of synthesizing and quantifying the influencing factors and their interactions is inevitable, allowing a comprehensive assessment of the use of the geothermal energy. geothermal energy in different ways. The main objective of the scientific work is a revised set of criteria for comprehensive evaluation of a geothermal project focusing on Enhanced Geothermal Systems (EGS) and taking into account geological, technological and, economic and financial aspects of the development project and social and environmental parameters. The newly presented work is designed as a supplement to previous work, identifying and describing in detail twenty-eight factors influencing the assessment of deep geothermal energy. The elements mentioned include the newly introduced 18, 6 superseded and 4 revised criteria based on extensive literature review and expertise integrating all aspects of the development process. EGS project. One of the main conclusions of the method presented is that it provides a broad assessment of an EGS project, applicable to various end-uses, including electricity generation only, heat production only and combine the production of heat and electricity. The proposed methodology can serve as a preparatory guide for more detailed analysis and calculations for the development of a future project, be it a wilderness area or a field. brown, including technology, geology, economy and environment. This approach was tested in a case study in which two different geothermal sites were evaluated for heat generation and power generation scenarios. The two sites, with their key geological parameters, generated electricity production from 263.51 GWh to 927.69 GWh, and heat production from 334.25 GWh to 5,207.68 GWh. This increase in renewable energy production from geothermal sources has avoided CO₂ emissions from 79,686 tons CO₂eq to 1,241,542 tons CO₂eq. The final score for each criterion for power and heat generation scenarios is in favor of Score 2, where better reservoir and economic performance values lead to the highest final score for the overall performance of the score. The combined results lead to the conclusion that the proposed methodology is applicable to evaluate end-use options for a geothermal site and to compare projects at other geothermal sites together.

Introduction

Geothermal electricity is an ubiquitous renewable electricity source. It can offer baseload power, has a small land location footprint and coffee greenhouse gases emissions. However, simplest a small fraction of geothermal ability is used for power generation, or to offer warmth for commercial, industrial, and home buildings.

Namely, massive ability is gift at excessive depths, i.e. in deep geothermal structures, whose improvement is related to excessive technical and financial dangers on the exploration level as a whole lot as massive in advance prices associated with nicely-drilling and ability reservoir stimulation. Existing era is commercially relevant for exploitation of traditional structures, i.e. hydrothermal structures. However, the structures that require technical enhancement thru hydraulic, thermal or chemical stimulation strategies or superior nicely configurations, are currently described as more suitable geothermal structures (EGS). This definition isn't simplest associated with low permeability conductive petrothermal structures, however additionally to low productiveness convective hydrothermal structures that require technical enhancement with a purpose to grow the productiveness of the gadget. The EGS idea includes growing a fracture gadget withinside the focused geological formation used for the injected geothermal fluid circulation. The EGS strength cycle calls for non-stop water injection thru injection nicely. The fluid then circulates thru created pathways wherein it's miles heated after which added again to the floor the usage of a second, manufacturing nicely. At the floor, the warmth is extracted withinside the binary cycle to generate power or is used for direct warmth packages. Potential marketplace for geothermal strength is expected to grow. Additionally, it's miles anticipated that studies and improvement developments in exploration, drilling and fracturing will constantly be tailored from the oil and fueloline industry. However, despite the fact that there's a massive growth of hobby for geothermal electricity exploitation and utilization, and studies and improvement of EGS projects, the EGS era isn't but mature sufficient to be commercially aggressive with different renewable assets which includes wind and solar. As said in the maximum compelling achievements will be the demonstration of a useful petrothermal EGS plant with a success formation of a massive fractured warmth exchanger at intensity and feasible demonstration of latest drilling era that might allow massive discounts in drilling prices.

Other anticipated moves encompass overall performance enhancements in exploration, downhole instrumentation, geotechnical computation and simulation and incremental fee discounts in lots of areas. Despite the reality that EGS era has been advanced during the last forty years in numerous nations, nearly all 18 massive EGS pilot strength plants, want to be at the same time based through governments and/or different kingdom associated entities with a purpose to broaden and/or operate. In different words, a developing hobby withinside the packages of the improved structures and medium-to-low temperature geothermal assets may be determined withinside the ultimate many years with an expanded interest proven to the opportunities of growing EGS in ultimate 5 years, especially in nations like USA, Iceland, Britain, Germany, China, Portugal, and the Netherlands, but often the repository in this field does not exist. Different horizons and actors from different perspectives are involved in the design and optimization of geothermal projects. In particular, decision-making in geothermal projects requires consideration of geological, technical, economic, environmental and social impacts. Therefore, this process is often very complex and requires the evaluation of many different criteria and at the same time satisfying the preferences of subjects with different points of view. When considering a geothermal project, these actors may include a group of individuals, local or regional administrations, local communities, potential investors, academic institutions, etc. Technical, environmental groups and government agencies, through their rating systems and priorities, have interests at stake and either directly or indirectly, influence the decision-making process. Decision-making around geothermal energy presents a multidimensional issue involving the complex interplay of environmental-socio, economic-technical and geophysical factors. After reviewing the literature, the problems and solutions presented can be classified into four types of identity problems. The problems do not correspond to any type of problem. above are referred to as "others". The problem classes include source selection, geothermal potential, site selection, and technology efficiency. Specifically, various studies were carried out to select the best renewable energy source for the study area, and geothermal energy was compared with other sources.

In different specifications, resource availability, socio-economic, environmental, political, legal and organizational aspects were included in the Model Secondary Analytical Process. tiers (AHP) to evaluate and prioritize different power plants, including geothermal. In a comparative analysis of the ranking of renewable energy sources for electricity in Taiwan using four different multi-criteria decision-making methods (MCDMs) was presented. Geothermal energy is the fifth best choice, and moreover, it has been shown that each MCDM method has its pros and cons and no one dominates the others.

The potential geothermal resource areas are evaluated mainly using different GIS models and methods based on key geological and geophysical data such as fault distribution, Bouguer anomaly severity, temperatures at different depths, etc. Theoretical, technical and economic potential of EGS systems worldwide and in Europe as well as for combined heat and electricity production from hydrothermal geothermal sources in Germany, has also been studied. Study investigated five geothermal resource target areas in the Songyuan region of China by considering only geothermal assessments directly related to geothermal resources, thereby ignoring the geothermal resources. metrics such as land use or environmental impact.

Conclusion

The work presented in this paper presents the methodology of multi-criteria decision-making with an EGS focus and includes a revised and improved set of criteria for global geothermal project evaluation area. The presented methodology offers a new approach to the evaluation of EGS projects as only a few scientific contributions have been addressed to the global assessment of geothermal projects.

The work presented contributes to an extensive and detailed set of criteria comprising twenty-eight influencing factors that can be grouped into five main groups. Specifically, by combining the geological, technical, economic, environmental and social aspects of geothermal projects, multi-criteria decision-making presented in this work will provide an widely priced on EGS projects. In addition, the work presented contributes to the scoring and thresholding system for each criterion. One of the main contributions of the method of learning presented is the equality of all sub-targets according to the factors that are profoundly influenced and thus reduce the risk of project failure. The set of proposed criteria can be used as a preliminary guide for more specific analysis and calculation for future development of the project, a Greenfield or Brownfield project. In addition, the method is proposed in a technical enough and can be used by both experts (e.g. in industry professionals) and popular users (e.g. local communities). Installation Decision Multherroseria (MCDM) tested with MCDM matrix in a case study made for two geothermal operation site where it is used to evaluate two different production scenarios and comparative analysis. The evaluation of the project depends strongly on the selected weight allocated to different criteria. In the work presented in this article, it is considered that every criterion is of equal importance in the decision-making process. Therefore, the weights, related to each criterion, are considered identical and evaluated with unit weight. However, it is important to highlight that the weight assigned to each criteria may vary depending on the view of DM. Therefore, the final project evaluation results will vary depending on the interests and benefits of the DM.