



Risk Assessment Approaches in Sustainable Energy Development

Laila Gazieva¹ and Timur Aygumov²

¹Kadyrov Chechen State University, 32 Sharipov Street, Grozny, Russia

²Dagestan State Technical University, 70, I.Shamyl Ave., Makhachkala, Russia

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Abstract: Energy consumption is a growing factor in the economy in many activities such as food production, keeping apartments warm, commercial use, lightning, manufacturing, and more. But all of these economic activities depend on the production of conventional energy through the use of natural resources that emit large amounts of environmentally harmful gases. Much of the country relies on fossil fuels for energy production and tries to ensure economic growth as much as possible, but this has come at a huge price on two fronts. To meet demand, they use a lot of non-renewable natural resources. When natural resources are used for energy production, large amounts of environmentally harmful gases are emitted. As a result, we lose resources and money to meet our energy needs. That's why sustainable energy development has become a major concern in recent years because of frequent environmental reactions and consistency in natural tragedy. In this article, we have tried to conduct an overview assessment of the risks of sustainable energy development. Technological advancements have brought opportunities to produce renewable energy, which has been widely accepted around the world to eliminate negative impacts on the environment. Hence, the development of alternative energy sources has sparked a revolution in sustainable energy development.


1 INTRODUCTION

There are many ways to produce energy from renewable sources such as hydroelectricity produced from water flow, solar energy produced from sun radiation, tidal energy produced from tidal current, bioenergy produced from biofuels or biomass, and geothermal energy produced from temperature. Hence, to produce sustainable energy from renewable sources, producers have to face a lot of risks. One of the most important risks is financial risk. Sustainable energy development is more expensive than conventional energy production. To this end, although developed countries have undertaken such renewable energy projects, developing countries have not shown such courage to undertake such projects to promote sustainable energy development. Suppose a hydroelectric power plant requires a lot of investment because of the complexity of the project. Thus, financial issues are an undeniable risk to undertake such a project (Rafiq et al., 2022).

Correspondingly, development projects such as hydropower, wind power, and biomass energy are also at great risk, because such projects require a large amount of data to be acquired and evaluated, and are difficult to operate. Farm-based data cannot be manipulated in developing countries due to resource constraints. Suppose, a developing country, bought a lot of machinery and technology to start a renewable project, but it cost them a lot and made it more difficult to operate. In fact, they don't have enough risk assessment tools to identify risks, or even technological advances to reduce them. Cyber-attacks have recently become a major issue, which is also considered the biggest risk in data-based operations. Weekly regulatory regimes are also associated with these risks. Most countries are not politically stable. For this reason, they cannot undertake such projects for a long time because the investors are unpopular and unhappy with the political conditions.

The main concern is to assess the risks of the project so that it can be easily managed without interruption. The purpose of this study was to extensively review the literature and assess the risks

^a <https://orcid.org/0000-0002-0080-1401>

^b <https://orcid.org/0000-0002-8737-0228>

of sustainable energy development and find solutions to reduce the risks. In the literature, various articles and papers discuss energy development risks, focusing on financial and management risks, and looking for possible solutions to manage the risks of renewable energy projects (Wall et al., 2021). The research will explore multiple sources to identify risk assessment techniques in sustainable energy development projects and to find the best techniques to maintain these risks. Therefore, the aim of this study was to identify risk assessment techniques in sustainable energy development.

2 MATERIALS AND METHODS

The methodology of the research is the procedure of planning the research which comprises data collection, calculating, and analysis on the basis of the research objectives. The study then set out to categorize various technologies to assess the risks associated with sustainable energy development and to find the best technologies to sustain those risks. Then, the study will follow a PRISMA (Preferred Reporting Item for Systematic Reviews and Meta-Analyses) analysis to identify sources and evidence for risk assessment tools (Page et al., 2021). Hence, samples will be collected from published academic literature, project reports, articles, research papers, and management strategies for risk assessment. Hence, in order to master the valuation tools, a systematic scoping review will be conducted to collect data. After collecting the data with a scoping assessment, the study will systematically represent the different risk assessment factors in energy development from renewable sources. The assessment will provide appropriate guidelines and recommendations to the relevant authorities so that they can assess the risks of sustainable energy development from renewable energy sources. A critical analysis will be conducted to detail each risk assessment strategy.

With the recent increase in renewable energy investment, the risks and uncertainties associated with renewable energy development need to be weighed throughout the planning, development, and operation process. Investors, developers, and policymakers will face numerous financial, technological, and political uncertainties. Since the risks of using fossil fuels are more severe than that of renewable energy, it must be assumed that the technological risks of renewable energy development are much lower than those of conventional energy development. In the energy sector, investors,

policymakers, and developers face financial risks from the cost volatility habits of energy development tools, oil price volatility, technology costing, and more. Generally speaking, the risks of sustainable energy development are multi-dimensional and depend on the complexity of the company.

One study on the “Comprehensive Actuarial Risk Evaluation – CARE” has produced by the “International Actuarial Association (IAA)” which revealed a comprehensive technique of risk assessment faced by the enterprises (Ioannou et al., 2017). The study has proposed a new strategy to categorize non-statistical and statistical risks associated with the energy firm. With this, the risk of an energy project can be measured mathematically or statistically called “stochastic modelling” of the existing knowledge is not helping to find the assessment strategy. The risks of sustainable energy development depend on the different technological factors and regulatory factors on the basis of stakeholders’ perspectives.

Hence, the most critical risk may be an economic risk, which includes many factors such as market risk and financial risk. Market risk is related to fluctuations in profits caused by fluctuations in electricity prices and energy demand. Correspondingly, financial risks may arise from insufficient working capital and investment channels. On the other hand, interest rates are fluctuating due to the current pandemic. Sustainable energy development requires many investment opportunities and renewable energy development pathways. On the contrary, due to the political situation, the possibility of changing the national economy and having a huge impact is high. Theta why political instability may be a major uncertainty for sustainable energy development. In fact, this risk may also lead to changes in regulatory regimes, such as RPS targets or tax credits. Hence, public awareness has become a major issue as public acceptance is mainly related to health issues. For this reason, the risk of project acceptance can be high when citizens do not embrace sustainable ideas. Technical risk is one of the most concerning issues in energy development risk, which can generate various risks such as project development risk, construction risk, operation risk, maintenance risk, and resource management risk (Jun et al., 2020).

3 RESULTS AND DISCUSSION

Risk assessment and management include the systematic process of identifying project risks, which

includes a series of risk assessment processes and developing strategies to mitigate numerous risks. The analysis follows different dimensions of assessment, such as institutional and contractual relationship analysis, allocation risk assessment, and financial modelling and estimation. Risk analysis includes two techniques, the identification of financial risks and thematic analysis of semi-structured interviews. The risk assessment technique is not only related to identification planning, analysis of the risks, and mitigation strategies but also to monitoring and controlling the risks (Dounavi et al., 2022). The assessment technique will not only increase the possibility of identifying the severe risks but also help to mitigate the impact of each risk. Each risk has some degree of impact, given its severity. The existing literature from European countries has already shown different kinds of risks on the basis of renewable energy development projects. This literature suggests three main risks associated with the sustainable energy development project. First, financial risk includes contractual risk, investment risk, credit risk, and interest rate risks. Then, the second most important risk is associated with technology which indicates the uncertainty of operation and maintenance. In the end, the ultimate risk has to do with the price of fuel, electricity, and carbon dioxide (Gielen et al., 2019).

Identifying systemic risks in renewable energy development is worth assessing, as risks will become more frequent in the coming years due to technological and financial diversity. However, governments can adopt strategies to mitigate these risks. Technical risks can be mitigated through investing in R&D through local or international sources. Financial risks can be eliminated not only through local and foreign investment but also through initiating policies (Agarwal et al., 2022). In renewable energy development projects, technology and fiscal policy need to take the same priority as other risks. Government policies are probably the most important policies for developing countries to attract foreign investors and can reduce financial risks. In the field of sustainable energy development, managing and minimizing risk is critical to achieving goals. Therefore, risk should be measured from a systemic point of view to take effective measures for long-term (Mentsiev et al., 2020).

In the field of developing renewable energy production, managing risk is a major concern in achieving goals. As a result, investment in risk assessment has increased significantly in recent years, and risk management research has also made significant progress (Mentsiev et al., 2020).

Developing sustainable energy from sustainable sources is not an easy task due to the associated risks. For developing countries, the risk may be more severe than for developed countries, because developing countries have fewer investment facilities and less advanced technology. Consequently, lower investment facilities create a significant financial risk in developing sustainable energy. Likewise, technical risks can lead to more complex functional and operational activities due to weak data management techniques. Finally, the two most serious risks we can assess as the most important for the development of sustainable energy development. There is an opportunity to reduce and maintain risk by sharing technology and enhancing investment opportunities in both countries (Sovacool et al., 2022). Hence, it's only possible by taking risk assessment techniques to reduce the risk and achieve success in energy development from sustainable renewable sources.

4 CONCLUSIONS

In this paper, the study incorporates a process for the identification, assessment, and mitigation of risks and uncertainties associated with sustainable energy development from renewable energy sources. This risk could affect the profitability of the project and could be at risk if energy development is successfully completed. Therefore, the application of risk assessment tools in renewable energy development projects is the only possible way to successfully develop renewable energy. Appropriate government policy is the most important factor in risk management. With appropriate policy support, investors can invest with confidence, and developed countries share technical support and continue to provide data management support. Therefore, the government. Implementing proper policies can play an important role in proper installation and operation. The work was supported by the Ministry of Education and Science of the Russian Federation, supplementary agreement dated April 21, 2020 No 075-02-2020-1529/1.

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