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THE USE OF ALTERNATIVE SOURCES OF ENERGY IN KAZAKHSTAN

Abstract

The main aim of this research was to discover and analyze the opportunities of Kazakhstan in establishing RSE. There were used the research methods like primary data collection through interviewing and secondary data collection though analysis and discussion of existing works. The crucial research results were revealed in terms that Kazakhstan has all the good chances in sustaining the RSE within its territory, however, there were recognized some governmental, financial, political and operational barriers. Nevertheless, most of the results follow the pattern that in foreseeable future, Kazakhstan might become one of the leading countries in utilizing the RSE. The contribution of the study is vital, due to the reason that this research highlights the common issues and offers the available solutions to them according to new and already existed discoveries. There is a necessity in further research, like more detailed strategies in establishing the RSE facilities and operational structures. Also, huge need in organizing the research and activities related to educational aspects that would allow to increase the intellectual resources for this sphere specifically.

Key words: alternative energy sources, energy balance, Kazakhstan, green opportunities in Kazakh energy sector.

Introduction

Every country is unique. The shift from fossil fuel to renewable energy sources is more challenging for some than for others, and Kazakhstan, which has vast hydrocarbon reserves, is an example of such a country. As a result, this transformation has created and will continue to create issues for oil producing countries in general, and for Kazakhstan in particular. Due to the scarcity of these natural resources, negative externalities that are appearing through utilization of fossil fuels, increasing costs and modern necessity to obtain innovative methods of energy production the topic of using alternative sources of energy becomes even more relevant. In the world, there are cases of developed countries using the RES in an efficient way, it took lots of time for them to achieve this kind of results and it is an optimal opportunity for Kazakhstan to look over these examples and create their own decisions regarding the features and specific characteristics of the country. Therefore, this article focuses explicitly on the opportunities and variations that Kazakhstan has and could handle in the future.

When discussing the topic of this article, it is vital to emphasize its significance. And this significance is supported by the following factors:

- The oil era is unavoidably coming to an end. If effective adaptation measures are not launched immediately, the Kazakh economy would face huge challenges.
- Kazakhstan, the world's ninth largest country, offers enormous potential for the development of renewable energy sources, particularly wind and solar.
- Another important incentive for rapid action in the discussed sector is the country's increasing environmental deterioration.

- The country has accepted international commitments, such as the Kyoto Protocol and the Paris Agreement.
- Raising public awareness of environmental issues in the country and throughout the world.

Research objectives of this research are related to deeply understanding the alternative energy industry's current state, its foreseeable opportunities and expectations that were held based on the data from the secondary research/ literature review.

- Will Kazakhstan be able to transfer to renewable sources of energy in the foreseeable future?
- What are the potential implications of this transfer?
- What are the ways for this transfer?

This paper is designed as follows: Section 1 describes the abstract and introductory part of the research that highlights the relevance and urgency of the topic; Section 2 contains literature review where range of perspectives of different authors were revealed in their statistics, discussions and analyses; Section 3 explains the methodology of the research and the results with discussions that were presented in statement forms, tables and recommendations; Section 4 shares the conclusion and acknowledgement parts of overall article; Section 5 presents the references of all sources that were used in this work.

Main provisions

Even though various studies have been conducted, there is a scarcity of prior study on this issue. This study aims to address that gap by capturing broad patterns and dependencies, as well as developing appropriate adaptation techniques targeted at mitigating any negative outcomes.

Literature review

Generally, much research have highlighted the natural dominance and advantages of the territory, that allows to adapt range of RSE panels and facilities. According the results of Defect and Diffusion Forum within a topic of Renewable energy potential of Kazakhstan, it was mentioned that Kazakhstan has a big land making it an ideal location for renewable energy generation. Most of the terrain is suitable for solar energy harvesting, as well as a wide region with strong wind speeds, which has a significant potential for producing adequate wind energy. Wind turbines offer a significant potential for energy generation in areas like Jungar Gates and the Chylyk Corridor. Due to a lack of water, the area between Balkhash Lake and the Aral Sea in Kazakhstan is sparsely inhabited. Simultaneously, this location receives a lot of sunlight. It is feasible to capture a big amount of solar energy if it has several solar panel arrays [9]. That information is supported in many scientific notes and considered to be major advantage that keep the trust in Kazakh RSE prosperity.

The benefits of renewable energy preserve long-term global economic production while minimizing the usage of conventional energy. The five main sources of renewable energy are sun, wind, geothermal, biomass, and hydropower. In contrast to traditional energy sources, renewable energy is abundant, safe, and clean. Many people believe that renewable energy may alleviate energy security issues and lower emissions as it is a carbon-free energy source. In order to achieve the global emission reduction target of 50% by 2050, renewable energy is essential to sustain in our cluster [13]. The scientific article named "Role of economic growth, renewable energy, and technological innovation to achieve environmental sustainability in Kazakhstan" have shared such ideas, that crucially support this article to great extent. In that manner the analysis of existing works allows us to maintain the trustworthy research with range of justifications and discussion points.

Through brainstorming processes, analysis of the available data related to the topic, there were some ideas that had been discussed earlier with an addition of a new glance at it. There are shared opinions on the barriers on entering and establishing the alternative sources of energy on a regular basis in Kazakhstan, which is presented in a work named "A review of current energy systems and green energy potential in Kazakhstan". Low power pricing, inefficient technologies with poor

regulatory and legal frameworks, and a high-risk business climate are all obstacles to development of the alternative sources of energy is the insight that is shared in research [6].

Also, the summarizing idea from the International Journal of Energy Economics and Policy correlates with final findings and conclusions of this article, in which it is assumed that Kazakhstan has tremendous potential for alternative energy development. Even if there is a relatively low percentage of overall energy output and the existing capabilities of RSE plants are not completely exploited there. The correlation with this journal's notes is significant in determining the actuality of the research. The conclusion that is supported by many specialists is mentioned there also [7].

Within the statistically interesting article named "Future development of price instruments of state support for the use of renewable energy sources in Kazakhstan", there was precisely analyzed and described the financial perspective of the energy cluster. It is one of the important factors that is having to be taken into consideration, while exploring the issue of RSE. For instance, with the purpose of choosing renewable energy projects, Kazakhstan has instituted an auction bidding procedure. The set tariffs that were in effect up until 2018 were replaced by this method, which at first made it possible to establish the Republic of Kazakhstan's renewable energy industry. The primary goals of implementing the auction process are to provide competitive market rates for energy produced by RES facilities and to identify the most successful RES projects [10].

Moreover, the negative push factors were discovered within the energy cluster case. The article "Energy Security Strategy in Kazakhstan: Environmental Security and Renewable Energy Sources" had deep discussions related to the core issue that is making all countries all over the world to search the clean energy sources. The progressive depletion of resources and equipment deterioration is another difficulty Kazakhstan will have to deal with in the next decades. This may cause challenges in the fuel and energy balance, which may eventually result in an energy crisis and a restriction on the export of gas and oil. This problem is linked to dwindling financial resources, insufficient capability, and a lack of energy independence. Ensuring the state's energy security is one way to solve this issue, and it is a major area of interest for scholars both domestically and internationally [11].

The idea of the green economy also helped to advance the use of renewable energy sources. It has set forth several goals that the government and society must accomplish, including the increasing production and use of renewable energy, even if it is only a concept and not a law. Such idea was described in work called "Energy security in Kazakhstan: The consumers' perspective", that declares about the energy cluster from being seen though different lenses and different perspectives. The relation and the participation rate of the citizens in supporting the establishment of RSE in contrast appeared to be even more significant than the governmental participation. The reasons of societal impact were taken, and the main consumer rates also have shown the influence over this cluster, due to the reason that exactly the householders are controlling these sources by invisible hands [12].

Kazakhstan, as Central Asia's largest country, has a lot of solar energy potential, each year 1300–1800 kWh of solar radiation per square meter are produced and solar energy has a 2.5 billion kWh yearly potential, according to estimations. The territories of southeast Kazakhstan depict the Aral Sea basin, Almaty, and Fort Shevchenko (on the Caspian Sea shore) are the key point locations, where the highest flow of solar energy have been noticed for sustaining there the solar panels [2]. Moreover, Kazakhstan can generate up to 760 GW of wind energy at a reasonable cost in the Atyrau Region and a strip west of Nur-Sultan that encompasses the Kostanay, Akmola, and Karagandy regions. Wind is the most powerful source of energy in the former region, notably near Fort Shevchenko, and it may be less expensive than the gas fired electricity that predominates there, moreover, Diungarian Gates on the Xinjiang border, is one of the most potential wind energy development areas too [3].

Additionally, it is important to mention that Kazakhstan is a strong agrarian economy, cultivating a wide range of crops and producing considerable volumes of agricultural waste. One possible solution is to convert these undesirable and leftover residual amounts into bioenergy for cooking, heating, and electricity generation. The integration of renewable energy into energy balance is regarded to be the most important factor in ensuring the implementation of Kazakhstan's Green Economy program [1].

Methodology and data

Firstly, there were eight primary interviews conducted. Interview respondents are specialists, people, who's professions are tightly related to the energy production industry and their answers were considered as expert opinions. Each respondent gave personal and expanded answer to questions, that helped to create the result board.

Secondly, secondary data sources from the internet were actively used. The websites/online sources that were used for secondary data research are credible and all have the time actuality for the past 10 years, they are available in the reference part.

Additionally, the analysis tools like SWOT and Porter's Diamond model were used for deep understanding of the data and filtering it in categories.

- Information gathering through the relevant literature review.
- Interviews with experts in this field of knowledge, market players, government officials and representatives of academia.
- Analyzing the collected information and drawing conclusions.
- To minimize the risk of bias, the information gathered was cross checked where possible. Clarification calls were made when necessary.
- The analytical part was initially discussed with experts, market players, government officials and academia representatives.

Results and Discussion

The analysis of primary and secondary data was done in this part. The data from the primary interviews from eight different experts were analyzed contextually and presented in bullet points. Secondary data sources were paraphrased, analyzed and used actively in discussion parts. Both of the sources of information were correlated together to build the SWOT analysis table and Porter Diamond model. Additionally, the research recommendations were shared below the analyzed work.

Table 1 – SWOT analysis of RSE in Kazakhstan

SWOT analysis of RSE in Kazakhstan	
Strengths: ◆ Presence of large and free territories ◆ Available human capital ◆ The support of current energy sources from natural resources ◆ Experience of other developed countries	Weaknesses: ◆ Systematic errors, the structure of organizations, which are not well established ◆ Corruption ◆ High rate of returns on foreign investment
Opportunities: ◆ Construction of an energy infrastructure aimed at achieving regional self sufficiency ◆ The best available technologies and practices for converting energy sources ◆ Entering the top countries in alternative energy sources	Threats: ◆ Dependance on foreign financing ◆ Unskilled and unqualified labor force ◆ Uncertainty in department regulations

Porter Diamond Model:

Chance:

- Alternative sources of energy in Kazakhstan

Firm strategy, structure and rivalry:

- Presence of department for extraction alternative sources of energy
- Foreign invested organizations

- Research and development
- Experience of advanced developed countries

Factor conditions:

- Huge stocks of renewable natural resources
- Available foreign and both domestic investments
- Human capital

Demand conditions:

- Dependance on non renewable resources
- Growing population
- Necessity in larger amounts of electricity
- Regions with limited energy sources
- Green energy demand

Related and supporting industries:

- World organizations
- United Nations ESCAP
- The Green Finance & Development Center
- Eurasian Research Institute

Government:

- Regulation of monopolistic oil extraction companies
- Subsidiaries for alternative sources of energy
- 2050 plan of sustaining green energy

Interview results:

- Renewables can have negative effects on the environment as well.
- There are serious issues with the integration of renewable energy generation projects into the country's energy system.
- Energy losses in power grids are enormous. There is an urgent need to decrease them.
- Risks of investments in RES projects are high.
- Kazakhstan is at the beginning of this process. So, there is no need to repeat mistakes made by other countries or cases. Just to follow paths, which already proved to be successful. Examples: most efficient solar panels or the system of carbon emissions trading.
- Lack of government support. Government institutions do not properly facilitate and support the development of renewables in the country, although there is no shortage of official declarations and international commitments.
- The legal and especially regulatory framework requires substantial improvements. For example, still there is no established system of carbon emissions trading or measures to support microgeneration.
- High costs of RES projects. Financing of RES projects is most often provided by development banks.
- Low electricity tariffs. This is a government policy.
- Prices on energy from renewables are still expensive for the majority of the population though they are declining.

According to the interim results of the interview, there was an understanding that RES is the new direction for Kazakhstan to follow, but there are barriers like finances, mindset of population, and the old methods of energy production that take control over most of the activities of the country within the market.

The secondary database research built an understanding that Kazakhstan has already functioning power stations and producing the energy source from wind specifically. However, most of them are not functioning on a wide range and they are short in financing, therefore, some technical difficulties take longer to be solved, as there are not enough specialists, who deal with RES stations and also the repairing process itself is expensive to conduct for small ownership companies, therefore, topic of RES in Kazakhstan is not widely and loudly expanded nowadays, except for electric vehicles that are entering the market with upward moving tendency.

Recommendations:

- Increasing public awareness remains the main path towards the transition to the renewable source of energy. The respondents repeatedly addressed this issue.
- Strengthening the legal and regulatory framework.
- Increasing government support, including financial incentives.
- Studying the experience and technologies of developed countries and adopting the most successful examples in the country.
- Strengthening our own educational and R&D spheres for the successful development of RES projects.
- Due attention to be paid to energy efficiency and energy conservation measures.

Conclusion

Renewables are a great chance for Kazakhstan in development perspectives. Therefore, the country can and shall develop alternative sources of energy using available means and creating the needed ones. Difficult environmental situation, international obligations taken by the government of Kazakhstan and the global energy transition make this path unavoidable. According to the main results of conducted interviews, the legislative, social and financial aspects of energy cluster need to be adjusted in firsthand. By sustaining the structure and system, this cluster would be better to monitor and evaluate. Unfortunately, by using the SWOT analysis and Porter Diamond model there were revealed barriers of monopolistic control of the sphere, scarcity of intellectual human resources and social non acceptance by citizens that slow down the processes of establishing the RSE. However, the strategy that would consider all these aspects is possible to solve the appearing barriers and issues, but this article did not present the great strategy yet, only the recommendations and discussions. And it is the largest limitation of the research, as the exact and frankly stated strategy is missing out. There is a lack of precise solutions toward the identified problems, as most of the research was dedicated to analysis and recognition of data, but not solving and updating. For further research purposes the study of RSE strategies that were used by developed countries is a good choice. That research would be more practical and compare/ contrast style, which would give more information and push factors for upward movement in the energy cluster of Kazakhstan.

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ҚАЗАҚСТАНДАҒЫ БАЛАМАЛЫ ЭНЕРГИЯ КӨЗДЕРІНІҢ ПАЙДАЛАНЫЛУЫ

Аңдатпа

Бұл зерттеудің негізгі мақсаты ЖЭК белгілеудегі Қазақстанның мүмкіндіктерін анықтау және талдау болды. Сұхбат арқылы бастапқы деректерді жинау және бар жұмыстарды талдау және талқылау арқылы қосымша деректерді жинау сияқты зерттеу әдістері қолданылды. Зерттеудің ең маңызды нәтижелері Қазақстанның өз аумағында ЖЭК-ті орнатуға жақсы мүмкіндігі бар екендігі анықталды, алайда кейбір үкіметтік, қаржылық, саяси және операциялық кедергілер анықталды. Осыған қарамастан, нәтижелердің басым бөлігі болашақта Қазақстанның ЖЭК-ті пайдалану бойынша жетекші елдердің біріне айналуы мүмкін екенін көрсетті. Зерттеудің үлесі өте маңызды, өйткені ол жалпы мәселелерді айқындап, жаңа және өткен зерттеулерге сәйкес қол жетімді шешімдерді ұсынады. ЖЭК нысандары мен операциялық құрылымдарын орнатуда егжей-тегжейлі стратегиялар сияқты қосымша зерттеулерге қажеттілік бар. Сондай-ақ осы сала үшін зияткерлік ресурстарды ұлғайтуға мүмкіндік беретін білім беру аспектілерімен байланысты зерттеулер мен іс-шараларды ұйымдастыру керек.

Тірек сөздер: энергияның баламалы көздері, энергетикалық теңгерім, Қазақстан, қазақстандық энергетиканың «жасыл» мүмкіндіктері.

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ИСПОЛЬЗОВАНИЕ АЛЬТЕРНАТИВНЫХ ИСТОЧНИКОВ ЭНЕРГИИ В КАЗАХСТАНЕ

Аннотация

Основная цель данного исследования заключалась в выявлении и анализе возможностей Казахстана в установлениях ВИЭ. Использовались такие методы исследования, как сбор первичных данных посредством интервьюирования и сбор вторичных данных посредством анализа и обсуждения существующих работ. Самые важные результаты исследования были выявлены в том контексте, что Казахстан имеет хорошие шансы для поддержания ВИЭ на своей территории, однако были выявлены некоторые правительственные, финансовые, политические и операционные барьеры. Тем не менее большая часть результатов соответствует модели, согласно которой в обозримом будущем Казахстан может стать одной из ведущих стран по использованию ВИЭ. Вклад исследования имеет весомое значение, поскольку оно подчеркивает распространенные проблемы и предлагает доступные решения для них в соответствии с новыми и существующими исследованиями. Имеется необходимость в дальнейших исследованиях, таких как более детальные стратегии создания объектов и операционных структур ВИЭ. Также присутствует огромная потребность в организации исследований и мероприятий, связанных с образовательными аспектами, которые позволили бы увеличить интеллектуальные ресурсы именно для этой сферы.

Ключевые слова: альтернативные источники энергии, энергетический баланс, Казахстан, «зеленые» возможности казахстанской энергетики.