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The Prospects of the Manufacturing Sector Energy Security Modernization are Based on Renewable Energy Sources of South Kazakhstan Region

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Abstract: Kazakhstan faces broad needs for energy security enhancement, energy diversification and improvements in the state of the environment. Almost all countries have issued laws and regulations to promote renewable energy sources. The article highlights the situation of the current state and prospects of the energy securitymodernization of a manufacturing sector based onusingrenewable energy sources (RES) which has gained a particular actuality and has deep roots at the current stage of the economy innovativedevelopment. The main task in this study is to estimateneeds and opportunities ofthe country in terms of development and consuming electricity throughusing RES. The efforts for the utilization of RES in the country are presented as well, along with barriers in its development. Ways to resolve the problem of the availability, cost and sustainability of energy resources alongside the rapidly rising demand are discussed. However, since the high cost of RES technologies is the main obstacle facing the diffusion of RES power generation, economic and political intervention is inevitable. Joint approaches towards the manufacturing sector balanced energy modernization are proposed - the modern society creates a framework for a global environmental security which will lead to a greater economic efficiency.The assessments and recommendations presented in the article will also provide a solid basis for capacity-building activities that could be implemented to facilitate the implementation of the proposed recommendations. We concluded that the potential exists, but significant efforts are needed to effectively make use of this cheap renewable energy source.

JEL Classification: L - 16 · Q - 14 · Q - 42.
Key words: Modernization · Manufacturing sector · Energy security · High-technological production · Renewable energy sources

INTRODUCTION

The challenge of creating a more secure, sustainable and affordable global energy system is one of the most important issues facing policy makers, researchers and energy industry figures today. On the threshold of Kazakhstan's accession to the World Trade Organization, the economy of the republic is characterized by a raw directivity and high consumption of fuel and energy resources (FER) [1]. A high energy capacity of the economyin comparison with the developed countries of the world leads to an inefficient consumption of the energy resources and reduce the competitiveness of the economy. Today there is an acute problem of fixed assets obsolescence in terms of power supply of the manufacturing sector. This problem is not moral, but physical deterioration of the productive apparatus, the use of not only yesterday's, but the day before yesterday's technology.

Analysis of Recent Research and Publications: The main objective of this research is to study the process of the economy manufacturing sector energy security modernization from the point of view of the using renewable energy sources (RES)prospective. Theoretical and practical aspects of the economy modernization have beenstudied in the works of domestic and foreign scholars. In the economic literature,such categories such as "renewal", "reconstruction", "industrialization", "modernization", "technical re-equipment" have been clearly defined inworks of such prominent economists as Sadykov A.S.

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[2], Sabden O. [3], Bujak [4], Marques &Fuinhas [5], Hans-Gunter Schwarz [6], Narbel [7] etc prove the aforementioned point.

Energy security has recently gained importance for many commercial, industrial and government facilities. Increasing the security of energy supply is essentially a strategy to reduce or hedge risks that derive from energy use, production and imports. Renewable energy is the solution to the growing energy challenges. The Kazakhstan is characterized by a large renewable energy resource. Kazakhstan could begin to develop a national renewable energy industry without risking potential price increases for domestic consumers - a concern of great political sensitivity in Kazakhstan. Rapid population growth and economic development in the country have resulted in rapid increases in energy demand in recent years. In research ofSufang Zhang [8] outline China's key renewable energy and renewable industrial policies and find that China's government has well recognized the need for this policy interaction. China, the emerging economy in the world, is however making exemplary development in renewable energy - in 2004 renewable energy in China grew by 25% against 7-9% growth in electricity demand. In the work Sufang Zhang [8] analyzes China's policy approach to renewable energies and assesses how effectively China has met the ideal of appropriate interactions between renewable energy policy and renewable energy industrial policy. Studied the achievements and problems in China's wind and solar sector during 2005 - 2012 and argue that China's policy approach to renewable energies has placed priority first on developing a renewable energy manufacturing industry and only second on renewable energy itself and it has not effectively met the ideal of appropriate interactions between renewable energy policy and renewable energy industrial policy.

Sakar, M.A.R. *et al*. [9] significant opportunities for increasing energy efficiency and conservation by end-users in all sectors - domestic, industrial, commercial, transport and agriculture. In research are discussed action plans to enhance commercialization of energy efficiency and renewable energy technologies have been suggested. Among potential renewable resources solar and biomass have good prospects. Hydropower has already been utilized to a significant extent while the potential of wind energy is limited to coastal zones. In actual practice only a small number of solar photovoltaic devices are currently being used. In the existing scenario energy efficiency and renewable energy can play a more significant role in the energy sector of Bangladesh. This will require a proper and supportive government policy.

MATERIALS AND METHODS

The renewable energy project development is highly complex and success is by no means guaranteed. In this research decisions are often made with approximate or uncertain information yet the current methods employed by decision-makers do not necessarily accommodate this. We applied to an example bioenergy project, the research demonstrates the benefit of incorporating fuzziness for project viability, optimal capital structure and key variable sensitivity analysis decision-making. The proposed method contributes by incorporating uncertain and approximate information to the widely utilised RES measure and by being applicable to a wide range of energy project viability decisions. Finding - creation of conditions for rational and space development on the basis of the new industrialisation covering hi-tech and traditional sectors of economy. In this research were applied theoretical and practical methods: logistic- system approach analyze, synthesis, generalization and etc.; methods economic analyze: observation, comparative and etc. of the modern concept of the prospects of the manufacturing sector energy security modernization of Kazakhstan [10]. This paper provides a detailed overview and re-analysis of the multiple datasets used in the original studies, which consisted of a combination of physical measurement and numerical modeling. The quality of the datasets is assessed and reasons for the discrepancies between predicted resource levels investigated. It is thus concluded that a resource assessment methodology utilising datasets from multiple locations and of short duration significantly reduces the accuracy of the predicted levels of resource. From these results, key learnings for future developments are discussed [11].

The Main Objectives of the Study: According to Bujak [4], in the near future the shortage of traditional energy sources for the purposes of energy flowgenerationsufficient for economy and social sphere of developing and growing humanity, makes a completely new way to look at the issue of the renewable energy,namely, not as a relatively small addition to the basic capacity, but as a dominant source of the energy. The lack of energy in the manufacturing sector will be felt within the next few years even on the condition of the well- timed lead-in into a new planned capacity.From our view point,one of the reasons for the deficit consists in the territorial irregularity of regionsprovisionwithenergy resources. Another reason is the regional economic

growth and its dynamics, new production facilities appear in the areas where there were a small number of industrial enterprisesconcept.

The energy used today in Kazakhstan is mostly derived from fossil fuels. However, as it is known [12], these resources may be exhausted soon - at the current rate of new deposits discovery and reserves consumption there will be enough of oil for humanityfor 50-60 years, gas for 100-150 years, coal from 300 years to 1000 years.

With increasing awareness of environmental protection in the worldwide, the green trend of conserving the Earth's resources and protecting the environment is overwhelming [13].

These facts as well as the requirements for industrial production for being ecologically safemake the issue of consuming an alternative energy not just relevant, but also timely.

The energy supply modernization based on the renewable energy sources [5] (solar, wind, hydraulic, geothermal, biomass and solid waste energy, hydrogen and other alternative energetics) is the best solution theproblem of domestic industrial enterprises. The technical potential of the renewable resources and energy sources only through the wind in the Republic of Kazakhstan is about 1820 billion kWh per year, which exceeds the volume of consumption of all fuel and energy resources 25-fold.

The total energy production from the renewable sources (including hydro sources) in Kazakhstan composed 7.35 billion kilowatt per yearin 1990 or 8.4% of its total production and 7% for the own needs. Currently, the share of the renewable energy sources is 0.3% of the total energy production, more than 90% of which are produced at small hydro energy stations (HES).

About 70% of Kazakhstan's energy is produced from coal, 14.6% - fromthe hydro resources, 10.6% - from natural gas, 4.9% - from oil. In the future, from our view point [6], the factors noted below should be first taken into account for the implementation ofthe energy-ecological strategy:

- Theobsoleteness of the main electrical energy assets;
- The need to replace coal with more environmentally friendly fuels;
- The need the need for modernization of fixed assets electricity in order to improve the low efficiency of the use of their facilities.

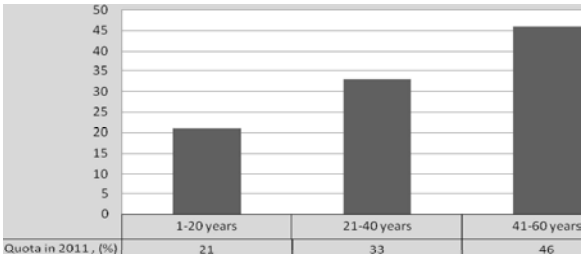

Fig. 1: The service life of existing power facilities
Source: has been compiled according to the data provided by Nazarbayev(2011: 99).

Table 1: Economic expedient potential of renewable energy sources in the Eurasian Economic Community (EurAsEC) (excluding hydrogen energy)

Countries	Evaluated economic potential of renewable energy sources (million tons of the oil equivalent per year)	Note
Kazakhstan	10,46	Mainly solar and wind energy
Belorussia	8,6	Mainly bioenergy
Russia	575,1	Complex energy
Kyrgyzstan	125,8	Mainly hydro energy
Tadzhikistan	26,95 (19,09 to be mastered)	Mainly hydro energy

Source: the table has been compiled according to the data provided byNazarbayev (2011: 85).

From the Figure1, it is clear that about half of the current amount of electricity is generated by the objectswhich have been constructed more than 40 years ago (Fig. 1).

According to the predictions of the scientists, only after 2030,withdrawal of the existing facilities will begin, as a consequence, thepower generation capacity of existing objects will be reduced.

The development of the RES use in the production can bring numerous economic and environmental benefits, howeverthe implementation of these can come across the problem of contradiction between the need for the development of an innovative economy and the possibilities of such a development.The most significant issuesamong them are the high initial investments in the infrastructure and technology [14] and the inability of the marketto evaluate the positive externalities from their use in terms of money.

Kazakhstan's science and technology sector offers a scattered landscape dominated by research institutes which are mainly inherited from the past and still mostly funded by thestate. At the same time, universities in general have not yet become the leading generators of knowledge resulting in innovation as is typical in mature industrialized countries. Improving the level of education leads to increase efficiency of all factors of production [15]. Stock of human capital is often cited as one of the

crucial factor that contributed to their remarkable economic performance. Education have a heterogeneous effect on the productivity growth and technological catch-up of countries [16].

Technoparks and business incubators do not always benefit from close association with universities. Increased exposure to market demands and competition and enhanced linkages with other innovation stakeholders would improve the efficiency of all science,technology and academic organizations. Focused policies could develop the potential of the top universities to becomehubs of innovation, resulting in closer links with new and existing enterprises, better knowhow exchange with international enterprises and improved international projection[1].

It is no accident that Kazakhstansuggested the Future Energy topicfor the EXPO-2017 World Exhibition, which is the topic of finding effective renewable energy sources. This expected WorldExhibition in our country can be a catalyst for diversification and modernization of the real sector and could attract new technologies and investments to our economy.

According to experts, the use of economically viable wind energy potential could amount to about 3 billion kWh per year [17]. The great opportunities ofsuch a method can be explained bythe geographical position of Kazakhstan, which is located in a wind zone of the northern hemisphere of the earth. The density of the wind potential in a number of places of the republic is 10 megawatts per square kilometer - and this is a unique wind potential. The scientists believe that 1 - 2% of alternative energy could meet the needs of the economy across the country [18]. According to the conservative estimates of the scientists, if our country sells a transformed renewable energy, the amount of profit may exceed the income from the sale of "black gold". Owing to the low cost and the excess of the electricity, the industry will be able to produce competitive products.

The fast growth of wind power is in urgent need of more accurate, reliable and adaptive modeling and data analysis methods for the characterization and prediction of wind resource and wind power, as well as reliability evaluation of wind energy conversion systems. In Kazakhstan, the wind and electrical systems have been already built andheating equipment is being modernized by using the renewable energy sources. Thus, today southern region of the countryis a clear leader in terms of development of "green economy".It is more favorable for the installation ofthe wind and solar energy stations, i.e. natural conditions with a bright sun and constant wind favor the development of these types of energy. The average annual wind speed in South Kazakhstan Region (SKR) is equal to 7.4 meters per second.

The wind that blows 25-26 days a month, or about 300 days a year, it allows saving tens of thousands of dollars on electricity and then the exploitation of works of domestic scientists adapted to the local environmental conditions will be effective [19]. However, the domestic wind energy has not yet received proper implementation in all sectors due to the lack of funds.

Kazakhstan has created a number of public financial institutions to implement its Innovative Industrial Development Strategy 2003-2015, which seeks to support business in creating a competitive domestic industry with a higher technological content. These institutions have been recently put under the common umbrella of the Fund of Stable Development “Kazyna”. As part of this strategy, the National Innovation Fund (NIF) was established in 2003, with a charter capital of $150 million. The NIF takes minority stakes in private venture funds, with an investment policy that is in line with overall state scientific and innovation priorities. Public participation in these hybrid funds involves an asymmetric sharing of risks with private partners in order to encourage the development of the venture capital industry. The activities of the NIF have been instrumental in the creation of private local venture funds. It also collaborates with foreign institutions as a way to gain management and technological expertise. The NIF has driven the recent creation of the Kazakh Association of Venture Funds, which is expected to provide a focus for the articulation and defense of the interests of this emerging industry. The NIF also provides grants for research and development and contributes to financing technological incubators. Venture capital investments account for around half of total resources currently but it is projected that, as private venture initiatives take off, resources will be increasingly devoted to financing the innovation infrastructure.Interventions by the public sector play a pivotal role in fostering innovation, including a wide range of policies and instruments that seek to correct market failures, provide guidance to the private sector and facilitate the coordination of the efforts of different stakeholders. The design and implementation of these interventions should be informed by an assessment of the national innovation system that provides an appropriate

diagnosis of the existing situation and offers guidance on how to improve innovation performance, taking into account national characteristics and the lessons that can be drawn from the international experience[1].

The concept of a national innovation system makes reference to the group of institutions that contribute to the development and diffusion of new technologies. These institutions provide the framework in which governments implement policies to influence in the innovation process [20].

A number of recommendations and policy advice can be derived from the assessment of the innovation performance of Kazakhstan which could contribute to increasing the efficiency of the national innovation system and enhancing the innovation capabilities of stakeholders.These recommendations, which concern a large number of innovation related issues, have different scope, including strategic considerations, changes in the allocation of resources, new policy orientations or the design of specific instruments.The assessment and recommendations to reduce administrative barriers and other obstacles to business development should result from a dialogue between the government and the business community.

One of the prospective directions for the use of alternative energy is the construction of *small hydro energy stations*[21]. Their construction is expedient from both an environmental and an economic viewpoint. If the potential of all water resources of the region is usedto the fullest extent,the region can receive an additional order of 100 MW of electricity and this is one of the methods of solving energy shortage problems for industrial enterprises and as well asnon-energy imports from Uzbekistan [22].

The use of a solar energyattracts an extensive practical and investment interest. We believe that the development of this direction in the SKR, as the sunniest region of the country, is not just possible, but very indigent- there is more sunlight in the region than the wind. The duration of sunshine is 2200-3000 hours per year and the solar radiation energy is 1300-1800 kW / m^2 per year. In connection with this, the government needs to prepare a series of proposals which will attract potential investors. It is just necessary to manufacturers be interested in such projects and they will keenly set on their implementation. Besides, it should be noted that these ideas are not cheap. At least a million dollar must be invested to get one megawatt of electricity. But, the thing that should be taken into accountis that electricityis a commodity which is always in a great demand and such projects are attractive for investments.

In our opinion, one of the solutionsto thisproblem istransition of enterprises to operation with the energyinstallationswhich are offered by domestic energy developers. Following to Buktukov and Maylibaev's [23] elaboration, the unconventional position of the wind energy stationbladeswill increase the coefficient of the useful efficiency and by working 6,000 hours per year, it exceeds Western counterparts many times (for example, in Europe wind energy stations work 2.5 - 3.5 thousand hours per year,butnowadays, wind energy stations in Kazakhstan work less than two thousands for 2 hours), besides, it costs twice as much cheaperthan Western counterparts. The blades are not only placed in the horizontal axis they can mechanically (without the use of expensive electronics) change the rotation angle under the force of the wind. Thus, the stronger the wind, the lower area of the blades it blows, as a result,the speed of the wind energy station remains constant. This design of the construction protects it from destruction in case of a strong wind. And the most important thing about it is that the energy station does not stop working even if the wind speed is very high, while the foreign counterparts have to lock the door and stop energy generation to avoid breaking the rotating blades. Moreover, the recondition of the wind blades will cost a fortune for the company's budget or for its owner.

Since our country has all advantages for developing the agriculture, the government aims at developing export of agricultural products and to turn it into a food center of Asia [24]. The main condition for the attainment of such a center will be the modernization transformation. We note that the agro-industrial complex in the South needs modernization and this problem is particularly relevant in terms of a greenhouse industry.

In this direction, the use of the modern developments of domestic inventors, *Nekrasov's [25] bioenergy installation*, the winner of the Innovative Kazakhstan Republican contest, is the most optimal for farming economy which allows producing gas from manure and use it as a source of electricity and even in the form of source raw materials to create fertilizer. Besides there isa possibility of saving money due to the recently accepted "green tax" on biowaste. Thus, due to modernization of energy stations, we will get light and heat from alternative energy sources which have been practiced in foreign countries.

It is extremely important to conduct innovative modernization of the manufacturing sector and to achieve strategic goalsby 2050 in the country with such unique objective factors as well asnatural climatic conditions, rich resourceand human resource potential and export opportunities.

First of all, it is important to create conditions necessary for the influx of large investments and new technologies in the manufacturing sector, to developthe institutional infrastructure and also to reform science in order to form more highly skilled staff [26] which would allow enhancing the quality and impact of the scientific researches and increasing their implementation in manufacturing processes. The problem of technological depreciation of industrial enterprises in the field of energy saving and environmental parameters of equipmentand product qualityhave already been there for a long time. None of the companies engaged in the steel industry has been modernized for over the last 20 years and it is primarily due to the expensiveness of the process.

The total need of the Kazakhstan industrial complex in investments for technical re-equipment and modernization for the next decade is estimated at $ 15 billion annually.

CONCLUSION

The conducted economic studies suggest that the energy supplymodernization of the manufacturing sector based on the renewable energy sources is the only expedient way to overcome energy hunger of any other country. Based on this, we have recommendedthe five basic steps for its effective modernization:

Firstly, the highest initial investment in infrastructure and technology in connection with necessity of creating favorable conditions for investors in this sector of economy is the most important of those constraints which hinder the development of the energy modernization.

*Secondly,*we emphasize the need of intensification of research and development in orderto support thesustainable energy development.

Thirdly, transition to renewable energy sources allows solving the energy deficit problem of regions.

Fourthly, to expand the government funding of the fundamental [26] and applied scientific research and demonstration projects andhighly-constructed elaborationsin the field of the renewable energy sources.

Fifthly, equipment manufacturers for the production of RES, the renewable energy potential customers [7], investors, banks and other business representatives do not see the ways of generating profits from the use of RES and therefore, they do not include RES in the business development plans.

Sixthly, development of the international cooperation in the field of the renewable resources and alternative energy sources use.

Legal confirmationfor the comprehensive modernization will be *the law on modernization* of industrial enterprises,which provides a temporary deliverance from duties and value added tax, goods imported for modernization, energy saving and environmental technologies instillation and from the maximum percentage taxationup to 50% of the goods profitswhich are credited to a special account and are directed to the modernization. The key to attract such "qualified" investmentsis a fair stable policy,whichthe governmentimplements strictly.There are numerous investments which have been attracted due to the credibility of foreign investorsto Kazakhstan. From 1991 up to the first half of 2012, total gross inflows of direct foreign investmentsin Kazakhstan amounted to about 160 billion U.S. dollars. Forty percent of them have been directed to professional, scientific and technical activities, one third to mining and quarrying, 10 percent to the manufacturing industry of the country.

Today, in the times of the global crisis and also in light of the rise of the integration processes, the contest for investments will only increase. Therefore, the main priority is to strengthen efforts to attract major foreign wealthy investors, competencies and technologies.

The main problem of the renewable energy sources use in the energy sector, including in agriculture, is not only high cost of RES, but also problems when it comes to getting a loan.

Based on the positive experience of developed countries [14, 27, 28], in terms of implementation of the energy installations using RES, it is necessary to develop and implement the statepolicies to support the energy development in our country. Suchdevelopment should include not only developmentof innovative projects, production of domesticequipment and its implementation, but alsograntsat the initial stage.

Despite the fact that currently the use of RES still requires subsidies, the analysis of development of technology and costs tendencies [26] has shown financial attractiveness for RES implementationprojects in the near future.

Thus, the estimation of the republic’s capacity in terms of the use of renewable energy sources allows us to conclude that hidden reserves in South Kazakhstan are

barely used and combined efforts of all stakeholders in this area are very promising, which suggests great opportunities for cooperation and solutions of the most important and necessary tasks.

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Endnotes:

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