

Investigation on Solar Energy Industry Development Model in Kazakhstan

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Abstract

Some suggestions for solar industry development in Kazakhstan are put forward in this paper, based on the analysis of global solar energy industry development model. Through the SWOT analysis of solar industry in Kazakhstan, crucial strategies for the development of solar industry in Kazakhstan are provided. For Kazakhstan, how to make use of the abundant solar energy and choose the suitable development model for solar industry are of great significance to the rapid and sustainable development of solar industry in Kazakhstan.

Keywords

Kazakhstan, Green Economy, Solar Energy, New Energy, Development Model

1. Introduction

Kazakhstan has advantageous geographic location and is endowed with abundant renewable energy resources, which give Kazakhstan an inherent advantage of replacing traditional energy resources, and particularly Kazakhstan takes a world-leading position in solar energy [1]. Vast lands, low population density, plentiful sunny days and abundant sunshine give Kazakhstan an edge in development of solar energy industry. It is planned to construct four 77 MW solar power plants in Kazakhstan by 2020. How to develop solar energy industry and choose what kind of development model are urgent issues for Kazakhstan to address.

The solar industry development model of the international community can be broadly divided into three main models. Main arguments of related literature are as follows: the American model: The United States is the dominant economic force to the global energy strategy. There are timely energy consumption patterns, complete industrial model from production to consumption, high technical level, high efficiency, and great government support, particularly attaching attention to the impact of energy strategy security on import trade policy [2]. EU

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model: EU is targeted for achieving emission reduction, through the promotion of advanced solar energy technology to reduce dependence on energy imports. The development of solar energy fundamentally changes the city's business model, bringing new opportunities and challenges [3]. Although solar industry has acquired rapid technological progress, compared with conventional energy sources, it is still not competitive with few exceptions and this is one of the reasons why current solar energy development is blocked in the EU. The other important reason is that during the economic crisis, government support and subsidies are reduced, which result in a sharp reduction in the use of solar energy and damage its objectives and standards expected to achieve, thus increasing dependence on imports [4]. Asian model: The characteristics of Asian model are that the area consists mainly of developing countries, while the solar energy industry in these developing countries is basically at the preliminary stage. For those developing countries, there are several issues in common, such as high initial investment costs, financing difficulties, low level of technical knowledge, lack of information dissemination and technical expertise, etc. Besides, there is no comprehensive industrial development model, the limited suppliers, low market efficiency, government policy not in place, lack of institutional frameworks. The existence of these phenomena presents the problems and challenges faced by different countries of Asian [5]. For Kazakhstan, the main problems of the solar energy industry development are: lagged environmental regulations; lack of specific incentive policies at the national level; lack of funding for scientific research and technology development, inadequate investment; lack of professionals; the high cost of solar power; lack of professional equipment manufacturers [6]. This article seeks to put forward some strategies to promote the formation of the solar energy industry development model of Kazakhstan, based on the analysis of global solar energy industry development model.

2. Global Solar Energy Development Model and Its Revelation

The complexity and importance of energy resources is becoming more conspicuous with increasing focus on energy all over the world in recent years. It has been speculated that energy in 21st century will become a key factor in determining the development of future world [7]. For now, with the massive leap in installed solar power capacity and the rapid growth in global solar industry, solar technologies have growing impact on economy. In the next few decades, solar energy will drive economy in equatorial countries, where solar energy is abundant.

2.1. Solar Energy Industry Development Model in the US

In 20th century, the rapid growth of the US is largely owing to its providing cheap hydrocarbon dominated energy pattern. While the Americans account for 4.8% of the world's population and US' domestic energy production accounts for 17% of the world total energy production, the US' energy consumption takes up 29% of the world total, resulting in energy shortage under the energy development strategy [2]. In order to safeguard US' energy safety, US government attaches greater importance to the renewable energy resources. In 2010, US solar industry grew 34% year on year, with 1.3 million kilowatts put into operation in the fourth quarter [8]. In general, in 2015, renewable energy consumption accounts for 7% of its total energy consumption and the share of solar consumption in renewables takes up 53% with year-on-year growth rate of 60.6%. However, the solar energy capacity is fairly small in total, only 4.7% (3% in 2008) [2] (Figure 1 and Figure 2).

To reduce dependency on traditional energy, US has put forward development plan of gradually increasing the green electricity, which can be achieved through wind power, photovoltaic power and biomass power generation. It is anticipated that photovoltaic power will take up 15% installed capacity increment, with accumulative solar energy installed capacity reaching 36 gigawatts, maintain its leading position in photovoltaic power technology. In the future decade, US will make 15 billion US dollars investment each year, creating 5 million jobs related with renewable energy industry [9].

2.2. Solar Energy Industry Development Model in the EU

The US and European countries put a high value on exploration and exploitation of renewable energy resources with the purpose of reducing dependence on energy imports, reducing pollution and coping with global warming. By 2030, solar power will represent 12% of the total electricity production of the EU. The development and use of solar energy change current business model fundamentally and bring new opportunities and technologies for urban development [10].

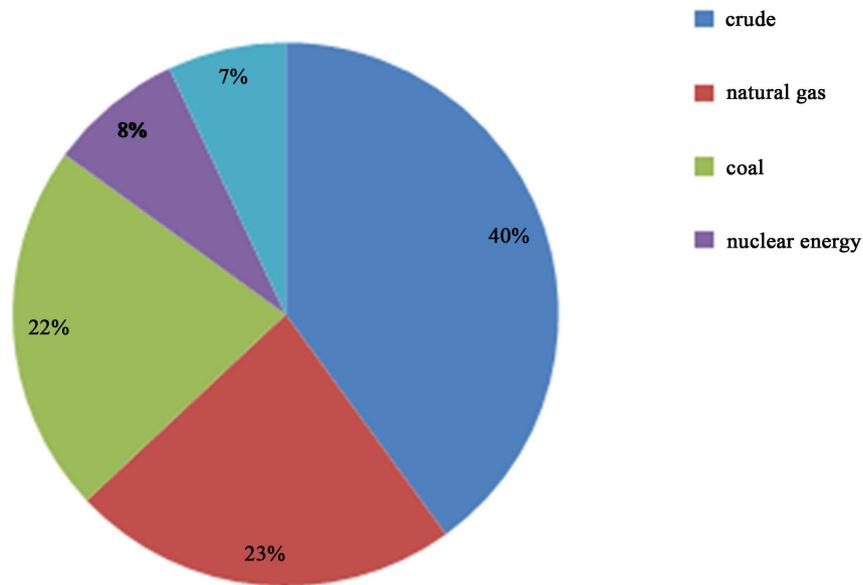


Figure 1. US energy consumption structure in 2015.

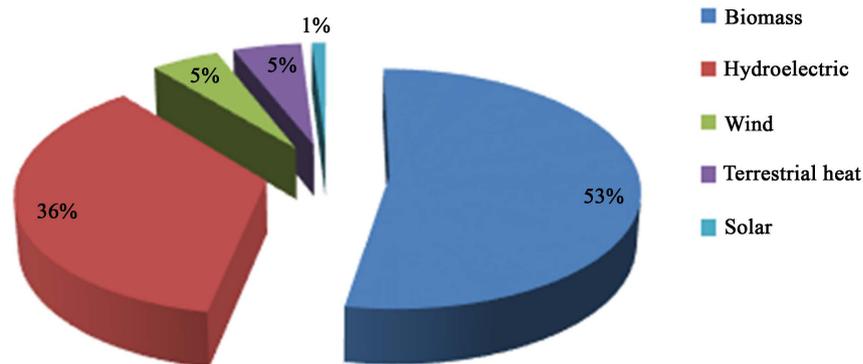


Figure 2. US renewable energy consumption structure in 2011.

The European Union is one of the leaders in development of renewable energy. According to the BP's statistics, the EU takes up nearly 42% of the world renewable energy consumption, with the US 23%, China 9%, and Japan 4%. During the last 15 years, EU encourages renewable energy development and takes a wide variety of measures to bring into effect the policy that the EU and each state take responsibility on a two-level basis. When it came to 2000, EU introduced a package energy related measures with its new goal to increase renewable energy production and consumption of total to 20%. Over the 2002-2011 periods, the total renewable energy production increased by 67% in EU, at an annual average of 7.4% (Figure 3).

In the solar energy industry, reduction of solar photovoltaic power cost can be reached by optimizing the production process and technology cycles. For instance, the so-called integration production which is designed and operated in Germany brings down the manufacturing cost about 10% and realized execution control operation and transportation. In 2010, energy companies from UK, Germany, France, Norway, Denmark and Sweden proposed to initiate the same program [11]. Among the EU countries, Germany makes the most prominent progress. The German government is considering making renewable energy a key factor in boosting energy safety and improving economy. In 2004, a special law was passed to promote the use of renewable energy. This act stipulates that network operators should purchase and use the electricity generated by renewable energy and energy companies will be subsidized for producing "clean" electricity by the state. The subsidies will be: 510 euros per MWH by solar power; 100 euros per MWH by biomass power; 90 euros per MWH by wind power; 70 euros per MWH by hydropower. It is EU's plan that, by 2020 the share of renewable energy consumption will

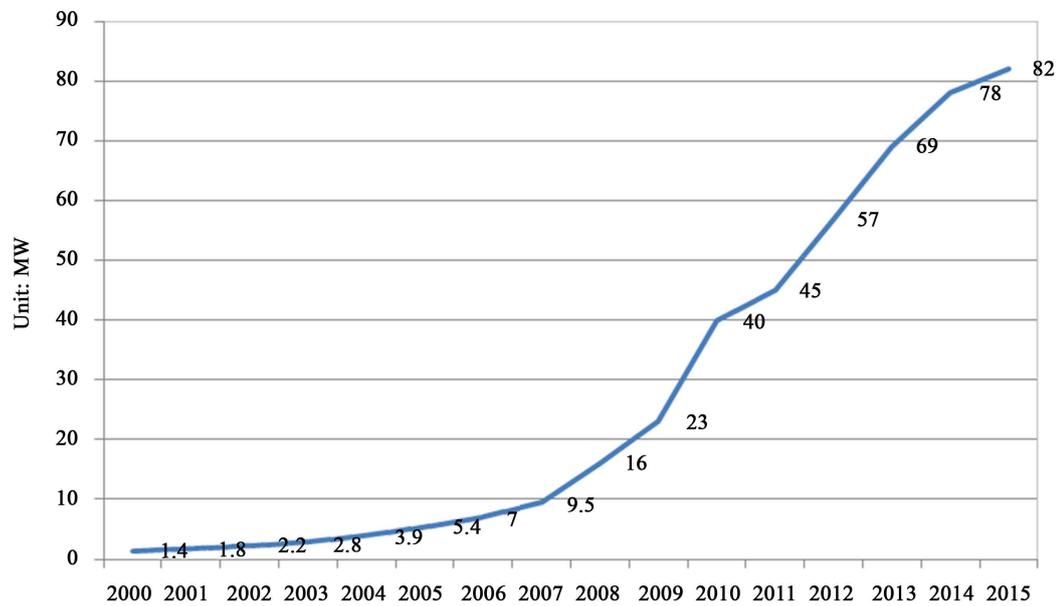


Figure 3. European solar photovoltaic consumption (2000-2015) (unit: MW).

be raised at least to 20%. The EU has spent almost 3 billion euros on supporting wind power and solar power companies so far. **Figure 3** illustrates European solar photovoltaic consumption over the 2000-2015 periods, which sees an obvious upward trend.

Although the technologies are developing rapidly, most renewable energy is of little competitiveness compared with traditional energy. The first factor hindering renewable energy development is government supports on cutting. During economic crisis, the subsidy has become a heavy burden. Currently, the EU has revised the strategy for renewable energy to reduce the amount of subsidy, which will inevitably result in renewable energy use falling dramatically and thus go against previous negotiated goal and standard. The EU will rely on traditional energy imports to keep the economy going [12].

2.3. Solar Energy Industry Development Model in Asia

Restricted by environmental elements, Asian countries take a keen interest in developing renewable energy; Asian takes the first place in the growth rate of renewable energy industry by now. There are several reasons contributing to the fast development of renewables. First, development of renewables will help to mitigate global warming. Second, it will raise energy self-sufficiency rate and help balance the energy diversity. Third, it is a worldwide trend in energy field. However, just like other countries, Asian countries are faced with many severe problems and challenges in the first stage, regarding development of renewable energy as a priority. In developing countries, the main obstacles to the development of renewable energy sources are: high initial investment costs, financing difficulties, low level of technology, lack of information dissemination, limited renewable energy technology suppliers, marketing and distribution inefficiency, lack of financial incentives, lack of institutional framework [5].

In some countries, such as South Korea, Kazakhstan, Uzbekistan, Turkmenistan, Mongolia, Malaysia, Singapore, renewable energy production accounts for no more than 3% - 5% of the total energy production. That ratio in Russia is 3%, where hydropower plays an important part. Then the share of renewable energy in Pakistan, India, Indonesia and Thailand is 20% - 40%, and North Korea (12%), China (14%) and Cambodia (70%). Renewable energy production in Tajikistan and Kyrgyzstan accounts for respectively 39 and 45% of the total energy production [13].

Currently, cooperation in the field of renewable energy is increasingly common and deeper among nations. Some Asian countries are developing renewables through development aid. Besides, national leaders work together in formulating policies related with renewable energy, which provides the foundation for rapid development of renewable energy [14].

2.4. Enlightenment of International Solar Energy Industry Development Model to Kazakhstan

At present, although the development of solar energy has entered into economic and technical maturity, it still lacks competitiveness compared with traditional energy resources. However, it is only a matter of time. Over the next 10 years, it is anticipated that renewable energy will cross the break-even point. Traditional energy prices are rising, which will promote the development of renewable energy and increase competitiveness in energy market.

In the past three years, the solar industry has developed rapidly. In the United States, Japan, Germany, China and South Africa, the solar industry is supported with fiscal and financial support and tax incentives. In some countries, due to the unique geographical location and natural conditions, regard the development of solar energy industry as a priority target. Take Kazakhstan as an example, the country is endowed with sufficient solar energy resources. The potential solar energy capacity is estimated about 25 billion kWh per year. About 70% of the days are sunny all year around in Kazakhstan; sunshine time is about 2800 - 3000 hours and of sun radiation at least 19×10^{19} kcal in its territory. Therefore, the development of solar energy industry is an important factor in achieving sustainable economic development of the country.

The weather condition in Kazakhstanis conducive to the development of solar technology, which can be effectively applied to the national economy. However, in the solar energy market of Kazakhstan, impeded by economic, technological, legal and financial reasons, no large-scale application has been realized. To overcome these obstacles, well-coordinated action is required from all ministries and departments. Methods to overcome the economic obstacles, carbon tax should be levied on the traditional fossil power plant and energy consumption and tax incentives and financial subsidies should be offered to solar energy industry. Technical barriers can be overcome by introducing new energy technologies to increase competitiveness of renewable energy in the energy market, thus promote economic development. Law passed in July 2009 created favorable conditions for “supporting the matching use of renewable energy”, in order to increase the amount of renewable energy used to generate electricity and heat in Kazakhstan [15].

3. SWOT Analysis on Kazakhstan Solar Industry

Kazakhstan, along with the United States, China, Germany and Norway, became the fifth country that is capable to complete the entire production cycle of solar photovoltaic power generation. Kazakhstan is able to build a vertically integrated ZPV project in a very short time. This is a complete industrial chain, which covers the entire production cycle from mining to production of finished solar modules [16].

The following **Table 1** illustrates current situation of solar industry in Kazakhstan using the SWOT analysis. The outcome is expressed in matrix form, through analyzing Kazakhstan solar industry’s own competitive strengths and weaknesses, as well as the external opportunities and threats. Strategies and approaches dealing with current market situation are obtained systematically. Based on the SWOT analysis, the future direction of the solar industry development model in Kazakhstanis established.

Kazakhstan has abundant solar and wind energy, in the short-term, it should introduce the advanced technology and expand existing wind power capacity to meet the electricity demand gap. In the long term, the government should strengthen the construction of solar thermal power plants in order to reduce dependence on traditional energy sources, and position itself as a clean energy exporter. To achieve these goals, Kazakhstan should not be satisfied with the existing legislation and should encourage investment, and promote renewable energy industry by tax cuts and financial subsidies, on the basis of “green development” of industry and export, to raise Kazakhstan non-commodity goods export potential, thus build a “green” energy bridge connecting Europe, Central and South Asia, Southeast Asia and China. Renewable energy market in Kazakhstan has great market value. As technology continues to update and advance, Kazakhstan renewable energy industry can not only serve the country and people, but can become a lucrative export business as well [17].

4. Strategies to Promote Formation of Development Model of Solar Energy Industry in Kazakhstan

One of solar energy development models in Kazakhstan is to go through the “green” development, to realize the transition to a green economy. The economic sector with a clean and “green” technology is expected to help im-

Table 1. SWOT analysis on Kazakhstan solar industry.

	Strengths (S)	Weaknesses (W)
	<p>S1 non-polluting; S2 3 - 5.5 thousand hours of effective work at full capacity-in Europe at least 3 thousand hours/year; S3 favorable sunny climate; S4 proximity to the main high-capacity sales markets.</p>	<p>W1 seismic activity in the Southern and South-Eastern Kazakhstan, which limits the use and increases the cost of the construction of renewable energy facilities; W2 lack of own production facilities for the manufacture of electrical equipment; W3 high costs of importing renewable energy facilities.</p>
Opportunities (O)	<p>O1 creation of domestic industries and technologies in the field of green energy, construction and synthetic materials; O2 raise radical innovation ability to improve the productivity; O3 improvement of the environmental situation of megacities by transferring their energy to environmentally friendly and renewable energy sources.</p>	<p>WO</p> <p>(1) Lack of infrastructure and transmission lines with minimal loss; (2) Creation of additional export and transit energy routes.</p>
Threats (T)	<p>T1 safeguarding of capital preservation and enforcement of intellectual property rights; T2 lack of technology and design expertise for the development and implementation of new technologies; T3 relationships with suppliers of equipment; T4 coordination Risks planning which can lead to delays in the construction and installation.</p>	<p>WT</p> <p>(1) Lack of transmission line infrastructure; (2) Lack of own production facilities for the manufacture of electrical equipment; (3) Regulatory and legal risks.</p>

prove the ecological system and realize gains. Through present and future generations using natural resources prudently and reasonably, it would be easier for Kazakhstan to transit to a new stage of development created by environmentally friendly products. The development of a green economy protects the ecological environment and helps to achieve a healthy and sustainable economic development [13].

4.1. Exported Goods Made with Domestic Raw Materials and Made in Domestic

Kazakhstan will be negotiating the Astana Solar LLP project in the 2017 World Expo, in an attempt to promote the development of solar energy industry, in which Kazatomprom Company has excellent performance [7]. In order to achieve effective project management, Kazakhstan plans to implement joint projects in solar energy projects, and is going to confirm “Russia and Kazakhstan will consider the possibility of establishing joint ventures” and sign memorandum of “road map” before August 1st this year. Kazakh Kazatomprom Company and Qatar Company have signed a document on development of solar energy. According to the agreement, Kazatomprom is becoming a strategic shareholder of Qatar company, and the Kazatomprom is able to expand the industrial chain from raw materials of the solar panels to solar power generation, increasing the existing production capacity [6].

4.2. Emphasize Green and Eco-Friendly Development

Nowadays environmental problems are standing out, having posed a serious threat to public health and economic development. In recent years, energy consumption has steadily risen. In response to environmental requirements the international trading system is increasing requirements of energy-consumed “non-green” products. Kazakhstan is a country of top ten energy intensity in the world and emissions of Kazakhstan ranked 17 in the

world. In order to tackle environmental problems and realize the transformation, the government approved the “green economy” Action Plan for 2013-2020 in August. In particular, Kazakhstan should carry out industrial waste management plans, revise garbage classification rules to comply with European standards, inspect major industrial landfills, construction of infrastructure and industrial waste treatment; introduce the environmentally-friendly technologies and processes, including integrated treatment technology of persistent organic pollutants and other hazardous wastes; update emission standards (on nitrogen oxides, sulfur oxides, particulate matter, etc.), and develop modern urban solid waste management system. Currently taking “Green growth” as guidelines, Kazakhstan implements ecological protection and restoration project, through the “green” policy, optimize the use of natural resources, and introduces technologies related with renewable energy, energy efficiency to reduce damage to the environment and achieve health sustainable economic development [5].

4.3. Strengthen International Technical Cooperation

KazPV project began at the beginning of this year, Kazakhstan conducts in-depth cooperation with South Africa, Algeria, India, Qatar, the United Arab Emirates, Russia, China and other countries, relevant cooperation including: supply of raw materials, production and sales of products, operation of solar power plants and technical services to complement each other with advantages and achieve a win-win situation.

5. Conclusions

Kazakhstan has abundant solar energy resources. However, in the solar energy market of Kazakhstan, impeded by economic, technological, legal and financial reasons, no large-scale application has been realized. Global solar energy industry development model provides good experience and enlightenment for the development of solar energy industry in Kazakhstan.

(1) US model: The production, consumption and import of solar energy in US take a leading position in the world, owning a complete industrial chain with a huge market demand, but it is unable to be self-sufficient and relies much on large imports. Besides, US attaches great importance to energy security strategy.

(2) The EU model: The EU is a leader in solar energy technology development and application and focuses on energy conservation, environmental protection, through the active promotion of solar technologies to reduce dependence on energy imports. In promoting the development of solar energy industry, the Government has supported with many subsidy policies. But the instability of policies has impacts on industrial development.

(3) The Asian model: The development of solar industry most developing Asian countries is still in the early stage. Generally, they are facing problems of high initial investment costs, financing difficulties, slow dissemination of information and other issues, including inadequate government policies, especially the lack of institutional frameworks. The problems faced by different developing countries are different.

As Kazakhstan is also a developing country, it has not yet formed a complete solar energy industry development model. How to learn from the advanced experience of international models puts forward the goal to improve its future development. Strengthen government support, based on their own, and encourage exports; pay attention to environmental protection; strengthen international technical cooperation are important measures to promote continuous improvement of solar energy industry development in Kazakhstan.

References

- [1] Han, X.P. (2007) Definition of “New Energy”. *Energy Conservation and Environmental Protection*, **5**, 6-11.
- [2] A Energy RU (2012) World Production of Solar Energy in 2012 Reached the Level of 100,000 Megawatts. *Electronic Resource*, **6**, 27-34.
- [3] The Research Company Bloomberg New Energy Finance (2015) Global Renewable Energy Market. 1-4.
- [4] (2014) Energy Sector Management Assistance Programme.
- [5] Decree of the President of the Republic of Kazakhstan (2010) The State Program of Forced Industrial Innovative Development of Kazakhstan for 2010-2014.
- [6] Buckley, P.J. and Casson, M. (2012) Analyzing Foreign Market Entry Strategies: Extending the Internalization Approach. *Journal of International Business Studies*, **29**, 539-562.
- [7] Alternative Energy—The News Portal (2010) Analysts Predict the Growth of Investment in Renewable Energy. *Electronic Resource*, **26**, 31-48.

- [8] The World Bank (2010) Annual Status Report 17 of the Asia Sustainable and Alternative Energy Program (ASTAE), Fiscal Year 2009.
- [9] Tenelbaeva, N. (2007) Forum of Energy Specialists in Kazakhstan. *Almaty News Channel*, **29**, 78-91.
- [10] The Research Company Bloomberg New Energy Finance (2011) Global Renewable Energy Market. 1-4.
- [11] IEA Working Paper (2010) Deploying Renewables in Southeast Asia: Trends and potentials. IEA.
- [12] (2008) Energy Sector Management Assistance Programme.
- [13] Prospects for Wind Energy Development in Kazakhstan (2006) Project of United Nations Development Programme and the Government of Kazakhstan "Kazakhstan-Wind Power Market Development Initiative". *Almaty*, **41**, 15-26.
- [14] (2010) Kazakhstan and Kyrgystan: Opportunities for Renewable Energy Development. *Joint UNDP/World Bank program*.
- [15] Green Gas and Asia Renewables form Joint Venture for Renewable Energy Development and Investments in Asia. Press Release of Green Gas International B.V. 8 June 2009.
- [16] Закон, Р.К. (2014) О ратификации устава Международного агентства по возобновляемым источникам энергии. *VZRK*, **61**, 82-103.
- [17] Oil, M. (2012) The Attractiveness of Investment in Renewable Energy Is Falling Because of Shale Gas. *Electronic Resource*, **40**, 84-97.



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