Development of green economy via commercialization of green technologies: experience of Kazakhstan

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Abstract

Purpose – This paper aims to analyze the development tendency of green economy in Kazakhstan emphasizing commercialization of green technologies and compare it with world best indicators.

Research Design, Data, and Methodology – The study's methodological basis included Kazakhstan's legislative and regulatory Acts, state programs and Concept for transition to Green economy, and data about innovations in the field of green technologies. Experts of National Institute of Intellectual Property and Technological park of KazNU were interviewed in order to determine factors which interfere to commercialization of green technologies.

Results – The research shows that despite Kazakhstan's intentions to update and develop much of its infrastructure over the coming 20 years, inefficient use of resources is currently observed in every sector. It is necessary to encourage scientist and entrepreneurs to invent and commercialize new green technologies. That would be basis for successful implementation of transition from "brown" to green economy. Challenges and obstacles to gain this have been determined during the study.

Conclusion – Kazakhstan will increase its GDP by few times, its industrial output as well as the size of infrastructure in approximately the next decades. These transformations together will offer the opportunity to apply fundamentally new technologies, integrated closed-loop production systems and innovative approaches for improvement of resource productivity and appliance of green technologies, also to create sustainable economy.

Keywords: transition to green economy, green economy in Kazakhstan, green technologies, commercialization of innovations, sustainable development.

JEL Classifications: Q01, Q55, Q58, O31, O38.

I. Introduction

Today the task of ensuring the sustainable development of human civilization is being viewed as the guiding principle of the life of the economy and of the society in general. Sustainable development is considered to be a development which "... satisfies our current needs without jeopardizing the capability of generations to come to satisfy their own future needs [1]. In a most general sense, the solution of this task is linked to the shaping of "a new model of green economy"[2].

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Researchers focus their interests on the commercialization of new green technologies that will substantially improve social welfare and ensure process of transition to green ecomomy.

The OECD has defined green growth as follows: “Green growth is about fostering economic growth and development while ensuring that the natural assets continue to provide the resources and environmental services on which our well-being relies. To do this, it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities” [3].

Deep “ecologization” of the economy on the basis of the key priority of modern development – to increase the value of nature and natural resources, as well as of human life and health is a challenging task in the agenda. Implementation of the sustainable development tasks based on market economy means to ensure market demands on natural resources, ecosystem services and related characteristics of the goods, consumer demands (including by population and State). This measure will enable to stimulate the developed countries to diminish the negative environmental impact as well as to encourage the developing countries into defining ways of their development towards the green economy, preservation and augmentation of natural capital through its capitalization and receiving benefits from the global community.

II. Background

2.1 Analysis of current situation in Kazakhstan regarding development of green economy

Green Economy is instrumental to nation’s sustainable development. Transition to Green Economy will enable Kazakhstan achieve the proclaimed goal of entering the top 30 developed countries of the world.

According to estimates, the transformations to be implemented as a part of a Green Economy will additionally increase the GDP by 3%, create more than 500,000 new jobs, develop new industries and services and generally provide higher living standards all over the country by 2050. Overall investments required for transition to a Green Economy will be about 1% of GDP per annum, which is equivalent to USD 3 to 4 billion [4].

There are certain reasons for transitioning to a Green Economy:

1. Inefficient use of resources. According to experts, this translates into USD 4 to 8 billion lost by the economy each year and may amount to USD 14 billion by 2030. Furthermore, the energy saving potential amounts to USD 3 to 4 billion per year, which is likely to reach USD 6 to 10 billion per year by 2030 [5].

2. Inadequate system of tariffs and pricing for energy resources disincentivises industrial technology improvements.

3. Currently, Kazakhstan is facing a situation where its natural resources and environment are seriously deteriorating across all crucial environmental standards.

Almost one third of the agricultural lands are either degraded or under serious threat of being so, with more than 10 million ha of potentially arable land abandoned so far.

Currently, the economy is forecast to run short of 13 to 14 bcm of sustainable water resources by 2030.

No integrated waste management system exists. 97% of solid municipal waste (MSW) ends up in uncontrolled landfills and waste disposal sites that do not meet the sanitary requirements. Historically, toxic and radioactive industrial waste is also a serious problem.

4. Kazakhstan has inherited great territorial heterogeneity in terms of economic parameters, living standards and environmental conditions. Development of new industries and green clusters will make it possible to reduce inequality in the development of various regions and harness their potential in the renewable energy sector, agriculture, water management, waste disposal and other sectors.

6. The global community expects Kazakhstan to successfully implement several land mark projects: the EXPO 2017 exhibition entitled Energy of the Future and the Green Bridge Partnership Program aimed at contributing to sustainable development in Central Asia and other regions of the world. Countries in the region such as Mongolia, China and South Korea have already started implementing their ambitious Green Economy plans as promised internationally by their presidents. For example, South Korea has committed 2% of its GDP to green growth and China's investments account for 1.5% of its GDP, and this figure is expected to grow by up to 2% by 2015 [6].

The Green Economy Concept is to be implemented in accordance with the provisions of the Constitution of the Republic of Kazakhstan, Strategy "Kazakhstan-2050" and "Kazakhstan-2030: Prosperity, Security and Growing Welfare of All the Kazakhstanis" and the Strategic Plan for the Development of the Republic of Kazakhstan until 2020. The matter of the Green Economy Concept implementation will be regulated by legislative acts of the Republic of Kazakhstan related to the transition towards Green Economy [7].

The tools for implementing specific tasks of the Concept by sector are the existing program documents as amended and supplemented with respect to the implementation of the main areas of the Green Economy Concept, such as the Program of Agro-Industrial Complex Development for 2013-2020 (Agribusiness-2020), the State Program for Expedited Industrial and Innovational Development of Kazakhstan in 2010-2014, National Education Development Program of Kazakhstan in 2011-2020, local development programs, strategic plans of governmental bodies, Zhasyl Damu Industry Program for 2010-2014 and other industry programs that will be updated to include new areas of focus such as on air quality, waste management, prevention of desertification and land deterioration, improving soil fertility, development of fisheries, aquacultures and fish breeding . The plan is also to develop the State Program for Water Resource Management for 2014-2040.

The top-priority measure to assess the situation and determine action priorities is to introduce a system of indicators of sustainable development. These are primarily indicators of the resource intensity and energy intensity in economic growth and specific indicators of pollution. Moreover, accumulated environmental damage, resource depletion, landscape degradation and the impact of pollution on human health should be taken into account. It is principally important, especially to determine

prospects for development and to asses the use of 3 renewable energy sources, to evaluate ecosystem services (including various ecosystems, biological resources, biodiversity and area of protected natural reserves). Therefore, we compare key indicators of green economy for Kazakhstan and other developed countries (See Table 1).

Table 1. Key indicators of green economy for Kazakhstan in comparison with other countries [8, 9]

Countries	Energy efficiency (GDP per unit of energy)	The share of fossil fuels (% of total)	The share of renewable energy (% of total)	Carbon dioxide emissions per capita (tonnes)	Urban pollution (mg/m3)	Exhaustion of natural resources (% of GNI)	Satisfaction with the actions for the protection of the environment (% satisfied)
Norway	8,1	58,6	45,3	10,5	16	10,6	51,5
Netherlands	7,7	92,5	4,4	10,5	31	0,8	66,1
Germany	8,3	80,1	8,9	9,6	16	0,1	61,8
Sweden	6,6	31,1	32,4	5,3	11	0,2	62,9
Denmark	9,5	80,4	18,9	8,4	16	1,5	64,3
France	7,4	51,0	7,6	6,1	13	0,0	57,5
Czech Republic	5,5	81,5	5,4	11,3	18	0,3	56,6
United Kingdom	10,1	90,2	2,8	8,5	13	1,2	66,8
Poland	6,8	93,8	6,3	8,3	35	1,0	43,6
Belarus	4,1	92,1	5,5	6,5	7	0,9	50,6
Russia	3,0	90,9	3,0	12,1	16	14,5	18,3
Kazakhstan	2,5	98,8	1,1	15,3	15	22	37,4
China	3,7	86,9	12,3	5,2	66	3,1	73

2.2 Main principles and general approaches of transition to a green economy

Transitioning to Green Economy will require adhering to the following principles:

1) Improvement of resource productivity.
2) Responsible use of resources.
3) Modernization of the economy using the most efficient technologies.
4) Investment attractiveness of measures for efficient use of resources.
5) Prioritization of profitable measures.
6) Education and culture supporting the environment in the business community and among all citizens of Kazakhstan.

The social aspect of transitioning to Green Economy is expressed through the creation of new jobs in the five industrial clusters which will make it possible to diversify the economy of Kazakhstan.

Green construction. Current dynamic of the construction sector shows that the number of new houses to be built by 2030 will be equal to total current housing stock. Moreover, Kazakhstan imports a lot of main construction materials, such as windows, heat insulation, and copper pipes. If it were arranged that even 50% of such products were produced domestically, this would make it possible to create up to 150,000 new jobs by 2030.

Agriculture. Implementation of the Concept will make it possible to create around 400,000 new jobs in the agricultural sector. Up to 150,000 jobs are expected to be created from the extension of pastures and agricultural lands. An additional 50,000 jobs will be created as a part of the extension of greenhouse facilities. More than 200,000 jobs will also be created by developing the whole value chain, including food production.

New technologies in the energy sector. Significant investments in the energy sector in the amount of around USD 50 billion by 2030 and around USD100 billion by 2050 will provide employment opportunities for people with scientific, engineering, technical or construction qualifications. A great share of such investments (up to 50%) will be allocated to renewable and alternative energy sources, and this will make it possible to create new jobs in the high tech renewable energy sector.

Waste management and closed-loop material handling. Global practice shows that the waste management and recycling sectors are very labor-intensive, engaging mainly specialists with engineering and general qualification. Collecting and recycling waste across Kazakhstan may open up to 8,000 new jobs by 2030.

Public water supply and water management. 3,000 to 8,000 new jobs will be created in waste water treatment and irrigation sectors; temporary jobs may also be created for the period of construction of new infrastructure facilities [10].

2.3. Science and Innovation for Sustainable Development and «green» economy

Belying the idea that commercialization of innovation is a simple construct are the multiple definitions, conceptualizations, and operationalizations that have emerged across studies. Commercialization of innovation refers to the activities required for introducing an innovation to market. Experts measured commercialization of innovation as the early indication of commercialization, operationalized as the first sale of the target product or service [11]. However, when an innovation is introduced in the market, only technology enthusiasts typically procure in the early stage, and such enthusiasts comprise less than three percent of the market. Reaching the mainstream market in this manner is often difficult, and the threshold for "successful" commercialization of an innovation will likely lie somewhere between these two extremes - single sale on the one hand and saturating the mainstream market on the other. We therefore define the ability to commercialize an innovation as a firm's capacity to bring a product into a market and reach the mainstream of the market beyond the initial adopters.

Energy conservation, agro-technology, environmental management, resource conservation, bio- and nanotechnology are recognized as priority areas of scientific and technological activities in Kazakhstan. The main tasks of the priority field of «Energy and Energy Efficiency» are: ensuring the introduction of atomic power into the energy system; creating a new trend in production of lighting products based on LEDs; developing and increasing production of alternative fuels and energy sources; purifying natural waters and condensates used for power engineering needs. In the field of renewable energy, hydroelectric power plants with the a total yield of 102.1 MW will be commissioned, the total electric power capacity of wind farms shall grow up to 460 MW, and the capacity of other energy sources (vegetative waste, solar, municipal waste, petroleum coke, etc.) will increase to 863.5 thousand tons of eq. fuel (provisional). Use of new advanced technologies in electricity production will reduce the specific fuel consumption for electricity generation. The main objective in the field of «Industrial and Construction Technologies and Production» is the implementation of the concept of conservation of energy and resources in creating new machinery and constructing and operating residential and industrial premises. New models of vehicles are being developed which correspond to international environmental standards Euro 4 and Euro 5, energy-efficient housing projects, energysaving environmentally friendly technologies for a new generation of domestic construction materials. In «Chemical Technology, Nanotechnology and Biotechnology», biopharmaceuticals and technologies are being developed for agriculture, industry, health and environmental protection. Among the main objectives in this field are the organization and increase of production of low-tonnage chemistry with maximum use of traditional chemical intermediates and domestic raw materials.

There are provisions for the development of new technologies and facilities for sustainable use of natural resources; standards for sustainable forest management have been developed; methodological approaches to environmental protection, flora and fauna preservation have been defined. The results of the most promising scientific developments have been introduced into the real economy with the support of the state, primarily through the mechanism of the State Program of Industrial-Innovative Development, which was first drawn up in 2003. Currently a new program for the period 2015– 2019 is being implemented [12]. The state’s efforts are aimed at applying an integrated approach to promote high-tech R & D, within which the innovation infrastructure facilities (research and production centers, industrial parks, etc.) implements the whole range of activities - from the scientific idea of development to its implementation, including for the area of «green» economy. Currently, there are a number of innovation infrastructure facilities: research and technology parks, research and production centers, business incubators, etc.

On November 22, 2012 Astana was chosen by the International Exhibitions Bureau (BIE) as the venue to host EXPO-2017, which will focus on the theme "Future Energy". The theme is aimed to concentrate on both the future of energy, but also on innovative, but practical energy solutions, and their global impact [13].

The Ministry of Education and Science of Kazakhstan, the Ministry of Investment and Development of Kazakhstan, development institutions – JSC «NMH» KazAgro»,

JSC «NMH «Baiterek» JSC «Entrepreneurship Development Fund Damu», JSC «National Science and Technology Holding «Parasat», JSC «KazAgroInnovation», JSC «National Agency for Technological Development», JSC «Kazakhstan Industry Development Institute», LLP «Technology Commercialization Center» Innovation Park Eurasian National University named after LN Gumilev and a number of public organizations of Kazakhstan support the competition of technological innovations for green economy.

Mission of the online competition "EXPO 2017" is to bring together the entire scientific and innovative potential of the country to find the best «green projects» in the country, to accompany their implementation, thereby providing content filling EXPO 2017.

Innovative projects were received by following sections:

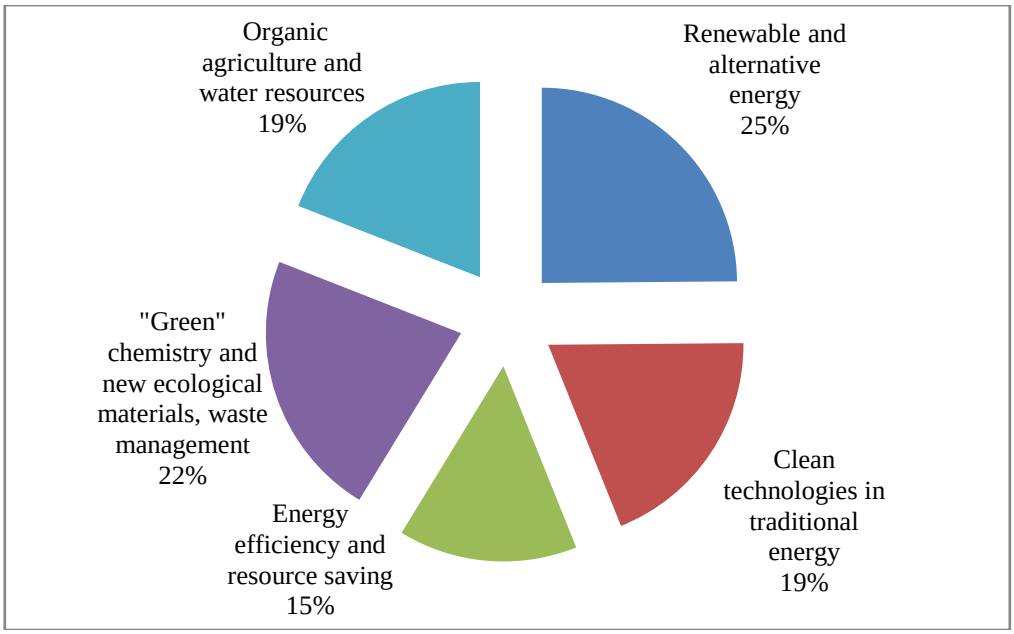
1) Renewable and alternative energy sources – 47,

2) Clean technologies in the traditional energy sector (storage and transportation of energy, coal, hydrocarbons, coal mine methane, passing gas oil and others.) – 36;

3) energy efficiency and resource conservation – 28;

4) «green» chemistry and new composite ecological materials, recycling of waste (solid, liquid, air) and CO2 – 42;

5) organic agriculture, adapting to climate change, promoting the absorption of CO2 and methane emission reduction, and sustainable water supply – 36 [14].



III. Findings and results

Kazakhstan aims to diversify the economy with alternative, cleaner sources of energy and will reform its agricultural and industrial sectors to spur scientific innovation and the use of advanced technologies.

Such strong government endorsement should stimulate economic drivers of green development. Of course, 'greening' the economy of an oil-producing resource-based country requires sustained political commitment, significant long-term investments and a range of other enabling conditions.

Our paper is an effort to ask difficult questions and start discussing potential pathways and available options. Therefore we interviewed experts of National Institute of Intellectual Property and Technological park of KazNU, analyzed and classified their answers as the factors which interfere to the successful commercialization of innovations both in green technologies and other fields (See Table 2).

Table 2. Terms for the development of commercialization. and the factors hampering innovation activities in Kazakhstan

Terms of innovation	Factors hampering innovation activities
The demand for innovation	Underdevelopment of the national high-tech market; State erroneous position to warrant the incompatibility of fundamental research to the innovation process
Capacity development (achievements, personnel, infrastructure)	The lack of institution innovation managers, professional experience and knowledge in the field of commercialization of innovative structure
Incentives and motivation to engage in innovation activities	The lack of policies of state protectionism of national science, including the innovative grants, grants for youth and women; favorable conditions for venture capital funds
The legal, economic and organizational conditions	Inharmonious legislation on IP; the absence of a developed institute of public contracts; bureaucratic restrictions innovation as the costs of transition from a planned to a market economy; lack of regulation of product markets and related standards, competition rules

Progress in the dissemination of the ideas of sustainable development and active participation in this process means their adjustment to the specifics of each country. The concepts of sustainable development and the ways of its implementation are different in various countries and will undoubtedly keep changing further on. It is necessary to assess achievements and challenges on the way to sustainable development at the national level. The success of the implementation of the ideas of sustainable development depends on the pro-active position and awareness by the broader population. This requires educational and outreach activities, targeted work by the media and social advertising. Culture (including cinema, pop music and literature), natural and cultural heritage sites should play a special role to set sustainable development as a priority for the broader public.

By analyzing current situation in Kazakhstan regarding green economy, we propose next steps and measures to develop this process of moving toward sustainable development:

1. Focus the green economy policy concept on specific sectors such as renewable energy, energy efficiency, water governance or waste management

2. Assess the viability of the proposed investment mechanisms and ensure a wide variety of economic actors, not just the largest technology and infrastructure players, can access them

3. Establish coherent measures to mainstream the green economy — such as a multi-stakeholder green economy forum, screening of public expenditure, green accounting

4. Set up an inter-agency green economy coordinating body with a regulatory mandate, for example, a State Commission or a Council under the President.

5. Increase Kazakh institutional capacities and governance, to improve accountability and enable effective public oversight of the green economy programme

6. Carry out fiscal reform to shift incentives from 'brown' to green economic activities, and towards inclusive approaches

7. Review subsidies and other incentives, notably in the oil and gas, mining and agricultural sectors. Subsidies should address the social as well as the environmental impacts

8. Clearly define the options for transferring of ownership of publicly funded research results from the state (government) to the (public or private) agent performing the research, down to the level of the individual inventor;

9. Establish clear incentives for innovation by protecting the rights of researchers and scientists, while creating favourable conditions for the creation of firms based on the results of their research which will enhance effectiveness of usage of green technologies;

10. Provide precise guidelines that allow knowledge organizations to understand the opportunities and limitations of IPRs and offer guidance on how to deal with the different options. Based on this, organizations would be able to develop their own intellectual property guidelines, providing clear and strong incentives to the inventor.

11. Ensure public finance accountability and oversight over new environmental programmes.

12. Adopt a step-by-step approach in order to create dialogue and engagement with Kazakh industries and businesses — and a strong business case for the green economy concept.

13. Develop a strong communication strategy to support policy breakthroughs in the short-to-mid-term, in order to promote investment in renewable energy, energy efficiency, water and waste management technologies.

IV. Conclusion

Kazakhstan's new capital city Astana will host the international trade fair, EXPO in 2017. It has chosen the theme Future Energy, which aims to "promote and discover sustainable, energy solutions". The next few years will be crucial for laying the groundwork if Kazakhstan is to make a meaningful transition to a green inclusive economy by then.

Domestic support is essential, while international engagement can help to ensure that the process is more inclusive and brings benefits across Kazakhstan's population. New international financial and institutional instruments are also needed to support Kazakhstan's national endeavours to embrace a greener future.

In our time, it is important to build an effective relationship between science, production and business. This applies to all fields of science. But we separately analyzed the transition to a green economy, and concluded that the commercialization of new green technologies significantly contribute to sustainable development. Necessary measures have been taken for this purpose, but there are problems and challenges that need to be solved.

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