Economic and Social Commission for Western Asia

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United Nations Development Account project on promoting renewable energy investments for climate change mitigation and sustainable development

Case Study on Policy Reforms to Promote Renewable Energy in Kazakhstan

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Preface

This case-study report was prepared for the Sustainable Energy Division, United Nations Economic Commission for Europe (UNECE) within the framework of the United Nations Development Account (UNDA) project Promoting Renewable Energy Investments for Climate Change Mitigation and Sustainable Development. The project focused on capacity-building for policymakers and project developers in order to promote investments in renewable projects. The project was led by UN ESCWA and implemented in partnership with the UNECE.

The UNDA project included case studies of the experience of renewable energy policy reforms in selected countries from each of the two regional commissions. Four countries were selected from each regional commission: Jordan, Lebanon, Morocco and the United Arab Emirates from UN ESCWA Member States; and Georgia, Kazakhstan, Serbia and Ukraine from UN-ECE Member States.

The present report covers the case study for Kazakhstan, and was prepared by Mr Maulit Abenov, an expert with more than 25 years of professional experience in energy sector; currently involved into the development of national policies on energy efficiency and renewable energy in Kazakhstan. Mr. Viktor Badaker, Regional Adviser, Sustainable Energy Division (UNECE), helped review and finalize the document.

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A. Sector characteristics before the policy reforms

The aggregate installed capacity of all power stations of Kazakhstan is 18,992.7 MW for electricity production, of which 70% is generated by coal-fired stations, 14.6% by hydropower and 10.6%–4.9% by gas- and oil-fired facilities. This situation in Kazakhstan's energy sector could not lead to its being recognized as a developed State. That is possible only by achieving a high level of environmental protection and ensuring a balanced and sustainable development of renewable energy sources (RES).

B. Policy reforms

Within the framework of the concept of transition of the Republic of Kazakhstan to sustainable development adopted for 2007–2024 and approved by Decree No.216 of the President of Kazakhstan dated 14 November 2006, it was stated that the sustainable economic development of Kazakhstan would be achieved through supporting the ecologically effective production of energy, including the use of renewable sources and secondary raw materials.

In order to ensure the rational use of natural resources and solve problems of environmental pollution, the uncontrolled import of outdated and “dirty” technologies and inefficient use of renewable resources, the Head of the State, in his annual address to the nation delivered on 27 February 2007, emphasized the need to formulate and establish the legislative base of the the country in the field of ecologically clean sources of power production.

The current Law on “Energy Saving” (approved in 1997) was aimed to promote the efficient use of fuel and primary energy resources, where, among the regulated standards, it was also foreseen to support the use of renewable energy at the stage of developing energy and environmental programmes.

It also provided for the need to create conditions encouraging the involvement of RES in the total energy balance and to develop power facilities on this basis. In accordance with this legislation, renewable energy was recognized as the priority for the development of the power industry and for the solution of environmental problems. The mechanisms for the implementation of the Law were not detailed, however, due to the lack of further development of the base subordinate legislation.

In addition, the intensive development of RES in Kazakhstan has been held back by a number of other factors, the main ones being:

- Financial barriers related to the lack of sufficient domestic and foreign investment capital: local Kazakh companies which are interested in the use of renewable energy development have limited financial resources and/or restricted access to funds to be used in investment projects implying the use of renewable energy. Participation of foreign capital is partially constrained by instability in business, climate and economic conditions and partly due to the lack of an appropriate regulatory framework and effective system of enforcement of legal obligations;

- Information barriers caused by the lack of information on technologies and their potential uses;

- Institutional barriers conditioned by the insufficient legislative framework in support of renewable energy development; and an unworkable system of measures for enforcing environmental legislation: altogether, they are counterproductive to the growth of awareness and interest in developing the use of more environmentally friendly forms of energy, such as renewable energy.

C. Implementation of policy reform

In the absence of a specific detailed legislative paper supporting the use of renewable energy and ensuring the necessary legal, regulatory and economic support for renewable energy in Kazakhstan, the Law on "supporting the use of renewable sources of energy" was adopted on 4 July 2009 (the Law of 2009).

The Law of 2009 provided for a number of measures to support renewable energy sources, including:

- Retaining in reserve, and priority treatment of, applications for allocating land plots for the construction of renewable energy facilities (local executive bodies may keep in reserve and provide land plots in accordance with the land legislation of Kazakhstan and the plan for their location);
- Obligations for energy-transmission companies to purchase electricity generated by renewable energy;
- Exemption from transport fees for grid transmission of power produced by renewable energy facilities;
- Support by connecting power facilities using renewable energy sources to the grid of transmission companies;
- Providing to individuals and legal entities who are engaged in the design, construction and operation of facilities using renewable energy sources, investment preferences in accordance with the legislation of Kazakhstan (provides for exemption from custom duties upon conclusion of investment contracts).

Relevant activities that followed adoption of the Law of 2009, have identified a number of issues that hindered the implementation of projects with the use of renewable energy, such as the inability to attract loans required at the initial stage of the project, lack of clear guarantees on behalf of investors and banks, impossibility to transfer land plots from one category to another appropriate for the location of renewable energy facilities, etc.

In this connection, it was necessary to introduce amendments and modifications to the Law of 2009. Taking into account the best international practices and the current situation, the Head of State signed the Law on "introducing amendments and addenda to certain legislative acts of the Republic of Kazakhstan on the issues of support of renewable sources of energy" on 4 July 2013 (the Law of 2013).

The Law of 2013 also aimed to provide support for investors and the support of ordinary consumers.

In particular, the Law of 2013 envisaged:

- The introduction of fixed tariffs, which would allow the Law to act as the guarantee of repayment of invested funds for investors and help to clarify tariff rates for renewable energy projects;
- The distribution of electric power generated from RES by establishing a specialized support centre for renewable energy (Settlement and Financial Centre (RFC)), accessible to all consumers, guaranteeing the purchase of electricity generated from RES and ensuring a fair distribution of the costs related to renewable energy support among all electricity consumers;
- Producers operating renewable energy facilities would be exempt from payment of fees for the services of organizations transmitting electrical energy;
- Provision of investment preferences to legal entities engaged in the design, construction and operation of facilities with the use of renewable energy sources;
- Ensuring a transparent scheme of government compensation of 50% of the costs of purchasing renewable energy units to individual clients having no connection to the national networks – the incentive that will stimulate development of renewable energy sources;
- Setting up the conditions for individual clients allowing them to sell the electric energy surplus generated from RES to the public network.

Further, within the framework of the Law on “the Green Economy” (the Law of 2016), additional measures were adopted in support of the Law and certain amendments and restatements introduced). The Law of 2016 provides for:

- The establishment under the RFC of a reserve fund in order to ensure the financial commitments of the RFC taken before the renewable energy facilities for the purchased electricity;

- Conclusion of an agreement related to the connection of facilities operating RES between the power-transmission and power-generation companies using renewable energy sources in order to improve the mechanism of connection to the grid operated by the Unified Energy System of Kazakhstan;

- Annual revision of the levels of previously approved fixed tariffs.

At present, the work in terms of reviewing the norms of indexing fixed tariffs taking into account the foreign exchange rate is in progress, and other issues, such as granting rights to conditional power consumers to independently implement renewable energy projects, as well as further improvement of RES support mechanisms, are being considered.

Regarding the indexation mechanism of fixed tariffs, the issue under consideration deals with the norm of the RES Act, which will take into account the significant fluxes in foreign exchange rates, in excess of 25% compared with the previous year, where the indexation shall be effected up to 30% of the change of the exchange rate.

This provision will enable renewable energy facilities to raise up to 30% of debt financing in foreign currency from international institutions at more affordable terms, as it excludes foreign exchange risk for these financial institutions.

Regarding the risks resulting from the impact of the renewable energy fixed tariff on the performance of large-scale metallurgical enterprises that have their own generating capacity, future enterprises of this type would be given the opportunity to independently implement their own renewable energy projects in exchange for commitments to purchase the renewable electricity from the RFC.

At the same time, introduction of an auction mechanism to select and implement the most effective renewable energy projects with the best technology and ways to minimize the burden of RES on the national economy were also discussed.

Kazakhstan aims to join the top 30 developed countries of the world and has adopted the Strategy Kazakhstan 2050, whereby the Head of State formulated the goal of ensuring that alternative and renewable energy sources will account for at least half of the total energy consumption by 2050.

Consistent institutional measures of the State support to renewable energy sources are based on long-term policy and are implemented through the development and improvement of the regulatory framework. In Kazakhstan, progress in the use of renewable energy is being monitored on an ongoing basis.

D. Benefits of policy reform

State-support measures currently implemented in Kazakhstan are 50 operating renewable energy facilities with a total capacity of 288.3 MW (hydropower - 139.8; wind power - 90.8; solar power - 57.3; biogas - 0.35), from which the majority of facilities (28 units) with an aggregate capacity of 177 MW (total investments of 0.2 billion USD were commissioned after the adoption of the Law of 2009).

In 2015, the volume of electricity generated from RES amounted to 704 million kW/h.Investors' interest in the implementation of renewable energy construction projects continues to grow.

The specific target indicators of renewable energy development and the steps to achieve them have also been adopted. Since 2013, Kazakhstan has been consistently implementing the concept of transition to a "green economy", according to which, by 2020, the share of RES in total energy production will reach 3% and up to 10% by 2030.

It should be noted that, in order to achieve the targets set, it will be necessary to implement projects in the field of renewable energy, the most important of which are listed in the register of power producers that use renewable energy sources.

According to the register, it is planned, before the end of 2020, to have in operation about 53 renewable energy facilities with a total installed capacity of 1,966.24 MW, including: 23 wind farms - 958.95 MW; 17 solar units - 724.8 MW; and 13 hydropower plants - 282.49 MW.

The implementation of these measures will allow Kazakhstan to have a position among the leading countries promoting the development of green energy and will contribute to achieving the strategic objectives for transition to a green economy.

E. Pre-feasibility study on wind-power capacity in the Mangistau region and lessons learned

As part of the agreement with the Akimat of Mangistau region, the industrial site of Fort Shevchenko was used for pilot studies in October 2006, when a meteorological mast of 50 m in height was constructed and year-round measurements of wind speed and direction were recorded. The measurements were made in accordance with international standards in the field of wind-speed measurements set for assessment of wind potential (International Energy Agency (IEA)/ International Electrotechnical Commission (IEC)).

Data verification, processing and evaluation of the wind potential were carried out with the assistance of the international company PB Power, Australia. (See PB Power report for the United Nations Development Programme, Kazakhstan, 2008.)

The results of the preliminary feasibility study of wind-power capacity in the Mangistau region are set out in Part II – General aspects of the project.

II. General aspects of the project

A. Location of the wind farm

The main project site selected was on the coast of the Caspian Sea in Tupkaragan district, Mangistau region, in the vicinity of Fort Shevchenko .

This region has been developing dynamically over the past 10 years, due, to a large degree, to its association with its oil and gas activities. At a distance of 5 km from Fort Shevchenko is the seaport of Bautino, which used to handle the supplies of offshore and other types of equipment to companies involved in oil and gas production in the Caspian Sea basin.

The proposed site for construction of a wind power plant (WPP) is an area at zero sea level in the Tupkaragan peninsula, 10 km south-west of Fort Shevchenko. With the construction of wind farms in mind, the territory is currently being thoroughly researched in order to define the exact location. The area has been selected for the construction of a wind unit with power capacity of 20–50 MW. The advantage of this plateau is the absence of trees and buildings and any other natural or artificial barriers to the wind.

B. Seismic data

Fort Shevchenko and Bautino are located in seismic zone 6, according to the Kazakh database SNIP RK 2.03-30-2006. At the stage of designing and ordering the equipment for the wind farm and voltage booster substation, an increase of 110/35 kV is necessary to follow the instructions of the SN RK 2.03-07-2011 database. In addition, this project will provide for a number of actions to ensure the seismic resistance of buildings and structures of wind-farm facilities.

C. Geotechnical survey data

The indicative data drawn on the maps of the area show that the soil is a mix of clay and loam. Analysis

Figure 1: The area in the vicinity of Fort Shevchenko showing the location of the proposed wind-farm site

of the soil samples taken from the bottom of the pit dug to install a meteorological mast at a depth of 1.5 m confirmed these data. The soil is predominately solid clay. The water table is at a depth of up to 75 m.

Geotechnical surveying and topographical mapping of the area were performed by LLP Mangistau Regional Geotechnical Centre (KazGIIZ).

The site area is 190 hectares (ha, 1,900,000 m2).
The power generated at the wind-farm unit is 42 MW.

D. Need for electric power or heat

Further development of the western Kazakhstan region and the electric energy sector is conditioned by the need for new energy sources in the Mangistau region.

In view of the progressive ageing of the main electrical equipment that is coming to the end of its operating life, it is expected that in the near future about 200 MW of installed capacity may be shut down, which, in turn, may cause a power shortage in the region.

Table 1: Electric Power Balance for the Mangistau Region (million kWh)

Description	2008	2010	2015	2020
Demand				
Power consumption	3,848.4	4,200	7,200	8,500
Supply				
Power generation	4,113.7	5,000	7,800	8,800*
Deficit (–), surplus (+) of power	265.3	800	600	300

* Taking account of prospective construction of nuclear plant of 300 MW capacity in the Mangistau region (MAEK–Kazatomprom)

E. Social and economic aspects

The territory of the Mangistau region is 165.6 ha or 10.4% of the entire territory of Kazakhstan. Initially formed in 1973 as the Mangyshlak region, it was renamed in 1990.

On 1 December 2014, the region was inhabited by 605,200 people; the urban population (48.98%) was insignificantly below the rural (50.69%). The urban population totalled 296,400 inhabitants and the rural 306,800 inhabitants. Compared to the end of 2013, there was an increase in both the overall number and the urban and rural shares of the population. The total population increased by 17,800 people – or 3%.

The region is located in the south-west of Kazakhstan in the Caspian lowlands and in the western part of the Ustyurt plateau. It adjoins the Atyrau region in the north-west, Aktobe region in the north-east, Turkmenistan in the south-west and Uzbekistan in the south-east. It is washed by the Caspian Sea in the west.

The administrative centre is the city of Aktau, with a population of 182,300 inhabitants, being a regional centre and an important port.

The distance from Aktau to Astana is 2,413 km.

The Mangistau region comprises five districts (Tupkaragan, Mangystau, Beyneu, Karakiya and Munaylinsky) and two cities of regional importance (Aktau and Zhanaozen).

Over the past five years there has been a steady growth of population in the region (Table 2). The total population of the Mangistau is increasing. At the same time, there was constant internal migration marked by an inflow of urban population.

Table 2: Population of the Mangistau region

Population	2010	2011	2012	2013	2014	01 Dec. 2014
Mangistau region	503,300	524,200	545,700	567,700	587,400	605,200
Urban	269,500	275,900	281,900	287,700	293,100	296,400
Rural	233,800	248,300	263,800	280,000	294,300	306,800

Source: www.stat.kz

Table 3: Main indicators of the manpower market in the Mangistau region*

Index description	2010	2011	2012	2013	2014
Economically active population, number	219,332	241,934	271,734	274,223	283,445
Level of economic activity of the population (%)	71.1	71.8	71.8	70.1	70.9
Number of occupied population	205,249	227,822	256,324	259,082	268,556
- Employed	185,221	205,717	237,399	240,837	248,838
- Self-employed	20,028	22,105	18,925	18,245	19,718
- Unemployed, total number	14,083	14,112	15,410	15,141	14,889
Level of unemployment (%)	6.4	5.8	5.7	5.5	5.3
Economically inactive population, number	89,240	94,878	106,789	117,157	116,520
Level of economically inactive population (%)	28.9	28.2	28.2	29.9	29.1

*Data detailed in breakdown by district are not representative.

F. Migration processes

While the migration processes in the Mangistau region tended to increase annually, the migration balance was in the surplus margin. Thus, for example, in the Mangistau region in the first quarter of 2010, the number of arrivals were 560 people and departures were 144.

Source: Kazakhstan, schankz - Fotolia.com.

Table 4: Migration processes in the Mangistau region (number of population)

	2006		2007		2008		2009		Beginning 2010	
	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
Total for the region	12,845	7,272	14,150	6,590	14,828	7,132	18,603	10,771	560	144
CIS countries	5,359	678	7,863	632	974	20	5,244	705	234	46
Beyond CIS	10	12	8	11	4	4	-	-	235	49
Kazakhstan	7,476	6,582	6,279	5,897	13,850	7,161	-	-	91	49

Source: www.stat.kz

Table 5: Basic macroeconomic indicators for Mangistau region, January–December 2014

Indicators	Growth rate in 2013 compared to 2012 (%)	January–December 2013	January–December 2014	Growth rate in January–December 2014 compared to January–December 2013 (%)
Population number, thousands of people	103.5	585.7*	605.2*	103.3
- Economically active	101.5	274.2**	283.4**	X
- Hired employees (on regular payroll)	101.8	241.6**	248.8**	XX
- Self-employed	106.5	17.4**	19.7**	X
Gross regional product (GRP) (billions KZT)	105.2	1,398.5**	1,636.3**	100.5
GRP per capita (thousands KZT)	112.1	2,431.9**	2,751.3**	113.1
Industrial output (works, services) in existing prices (billions KZT)	XX	2,187.3	2,390.9	X
Index of industrial production volume (%)	X	101.9	103.4	X
Direct investments (billions KZT)	105.7	440.0	529.4	114.0
Consumer prices index (to December 2013) (%)	XX	103.4	107.2	XX
Gross agricultural product (millions KZT)	XX	7,227.2	8,287.6	X
Index of agricultural production volume (%)	X	96.6	100.0	X

Taxes and other payments to the State budget (including account of the National Welfare Fund) (billions KZT) including:	117.1	979.3	1,043.7	106.6
Taxes and other payments to the State budget (excluding National Welfare Fund) (billions KZT)	107.8	288.9	353.0	122.2
- Paid to the State budget, (including account of National Welfare Fund) (billions KZT)	116.3	885.9	938.8	106
- Paid to the State budget (excluding National Welfare Fund) (billions KZT)	101.4	195.6	248.1	126.8
- Paid to local budget (billions KZT)	140.1	93.3	104.9	112.4
Arrears in payments to State budget (excluding bad debt) (billions KZT)	111.1	12 (1 January 2014)	11.5	95.8
Volume of construction works (billions KZT)	100.2	154.3	172.1	106.0
Commissioning of new residential housing (ha)	95.5	532.7	586.4	110.1
Average monthly salary (KZT)	115.6	175,874	211,738	120.4
Number of new jobs	94.8	22,213	26,406	118.9
Unemployment rate				
- General unemployment rate (%)	Decline of 0.2	5.5**	5.3**	Decline of 0.2
- Level of registered unemployment (%)	X	0.6	0.9	Increase of 0.3
- Number of registered unemployed people	105.8	1,738	2,544	1.5 times increase
Number of small and medium-size businesses (thousands)	109.8	31.6*	32.7*	103.6
Number of people employed in small and medium-size businesses (thousands)	106.4	94.0*	96.9*	103.1

* As on 1 December 2013 and 1 December 2014
** For the third quarter of 2013 and of 2014, the statistical data are presented on a quarterly basis by 3–2 months after the end of the reporting period.

G. Social and economic development of the region

The social and economic development of the region is carried out on the basis of the Kazakhstan 2030 Strategy, in compliance with the Strategic Plan for Development of Kazakhstan until 2020, the Indicative Scheme for Territorial and Spatial Development of the Country until 2020, including the relevant State and sectoral programmes, and in accordance with the annual message of the President to the people of Kazakhstan.

H. Development of the regional economy

Industrial production
In the industrial structure of the Mangistau region, mining predominates, as does its share of the total output.

During the period 2011–2013, the number of industrial enterprises increased by 121, totalling 358 companies.

Machinery
The largest share belongs to machinery and engineering. The share of machinery-building products in the total output of the manufacturing sector in 2013 was about 24.1%.

Metallurgy
As part of the Strategy of Industrial and Innovation Development of the Republic of Kazakhstan up to 2015, the regional investment projects implemented in the Mangistau region built two metallurgical steel plants, namely LLP CaspianStal and LLP Aktau Foundry (ALZ, LLP), which have formed and built up this new industry. The main raw materials processed by these plants come from scrap metal obtained from the decommissioning of obsolete equipment of chemical, oil and gas, construction, gas processing and other industries, as well as depreciated piping and other metal products. All metallurgical products are sold for export.

Production of fabricated metal products, except machinery and equipment
Currently, the output of this industry is sold domestically. In the future, after the implementation of expansion projects and construction of new plants for the production of marine metal structures in the framework of developing the Kazakhstan sector of the Caspian Sea, part of the production will be exported.

The construction industry and production of construction materials
The main product line of manufactured building materials comprises shell rock, natural sand, crushed stone, gravel, etc., thus the line of construction materials produced in the region is mainly represented by products obtained by extraction of common mineral resources.

Light industry
The share of light industry in the total production output of the manufacturing sector is insignificant. There are no corresponding raw materials in the region for use by the industry. Imports of feedstock from outside the region make production uncompetitive. Thus, the products are supplied to the domestic market.

Chemical industry
Almost the entire volume of the chemical industry in the region is the production of nitrogen-based mineral fertilizers.

The sales market of the products is split between the domestic market, up to 80% (Kazakhstan agricultural producers, industrial enterprises) and 20% is exported (EU, CIS, Asia).

Petrochemical production
December 2013 marked the implementation of the project for manufacturing road bitumen products on the basis of the Aktau plastics plant with a design capacity of 420,000 tons (420 Mt) of road bitumen.

The purpose of this project is to enable the advanced refining of heavy oil from Karazhan field and production of bitumen that will correspond to climatic conditions in Kazakhstan.

III. Technical feasibility

A. Access to energy resources in the Mangistau region

Transmission of electricity in the cities and districts of the region is carried out through the electric networks operated by:

- Joint stock company (JSC) Mangistau REC (JSC MREC) that is responsible for supplying electricity to consumers in the Mangistau region; and
- SCE Aktau Electric Grid Management Unit (SCE AUES) that is responsible for supplying electricity to consumers in Aktau city.

At present, on the balance sheet of JSC MREC there are 57 substations of 35–110–220 kV, 2,658 km of 35–110–220 kV overhead lines (OHL) and 2,463 km of 0.4–6 (10) kV OHL. In addition, the company has 452 unit transformer substations (KTP) on its balance sheet. The total installed capacity of the power transformers is 1,519 kVA. The bulk of the equipment of the substations and overhead transmission lines was built and put into operation in the period between 1968 and 1989 (80%–85%). Out of 55 substations 110–35 kV, 25 units (or 45.5%) have been in operation for over 25 years. The length of the 35–220 kV transmission lines, with an operating time of more than 25 years is 1,161.84 km (43.9% of the total length). The weighted average depreciation factor of the equipment is about 70%.

In order to transmit the power produced by the wind unit into the existing power supply of Fort Shevchenko in compliance with the specifications issued by JSC MEDC No.00-09-3-08/1027 of 25 April 2016 and agreed with JSC KEGOC in its letter No. 24-02-07/3694 of 26 May 2016, it is envisaged to construct the step-up substation 35/110 kW named VES-Fort Shevchenko, to be equipped with a 2 x 40 MVA capacity transformer and connect this substation by a double circuit 110 kV OHL by utilizing an inlet–outlet connection to the 110 kV OHL of Aktau (CDS)-SS Fort Shevchenko.

B. Wind potential for power production

Figure 2: Wind atlas of Kazakhstan

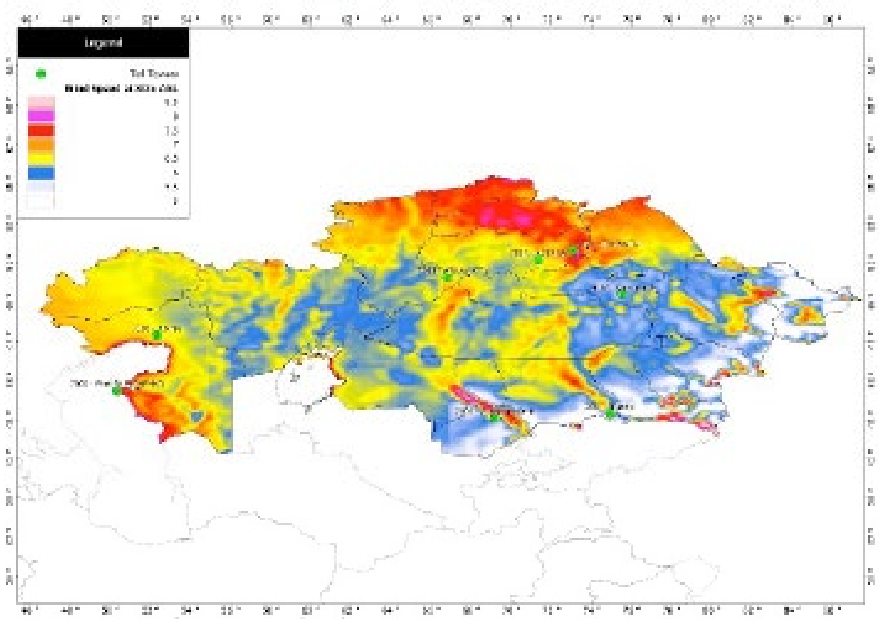


Figure 3: Meteorological mast in the vicinity of Fort Shevchenko

C. Equipment to measure wind potential

The equipment to measure wind characteristics was installed on the top of a 50 m high meteorological mast (Figure 4).

The mast location and configuration of the instrumentation and devices are listed in Table 6. Configuration of devices mounted on the mast complies with international IEA/IEC standards.

Availability of measurements of wind-speed data collected during the one-year period 2006/2007 was 99.3%. Inaccurate data were not used.

As can be seen, average wind speed at a height of 51 m was 7.48 m/s over the 2006/2007 period.

Distribution of the wind speed and Weibull parameters at the altitude of 51 m for the monitored site are shown in Figure 5.

Table 6: Mast location and configuration of instrumentation and devices of Fort Shevchenko wind station

Mast height	Position (WGS84 Zone 42)		Wind-speed indicator			
	To the east	To the north	Height (m)	Declivity	Shift	Arrow orientation (degrees)
49.39 m	0446312	4922576	51	0.04779	0.269	Not available (top installation)
			49	0.04785	0.267	102°
			22	0.04783	0.266	104°
			Wind vane			
			Height	**Shift**	**Arrow orientation (true degrees)**	
			49	282°	102°	
			22	284°	104°	

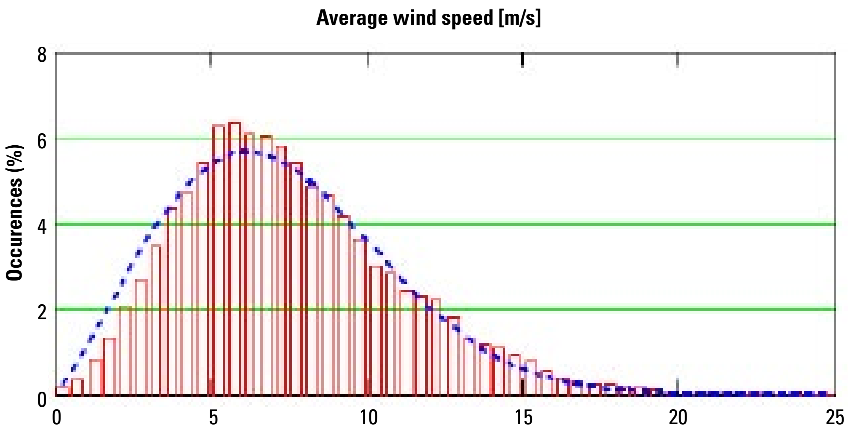
Table 7: Mast data analysis

Recorded period	Date	Time
Beginning	8 October 2006	12:00
Ending	18 October 2007	16:30

Wind statistics	Level 1	Level 2	Level 3
Height above ground level (m)	51.0	49.0	27.0
Minimal wind speed (m/s)	0.0	0.0	0.0
Average wind speed (m/s)	7.48	7.39	6.76
Maximum wind speed (m/s)	22.5	22.2	25.0
Wind blast (m/s)	27	27	26
IEC (15 m/s) turbulence intensity	7.5%	8.1%	10.0%

Environmental statistics	Minimum	Average	Maximum
Temperature (°C)	-16.8	13.2	37.7
Pressure (kPa)	938.0	1006.2	1027.0

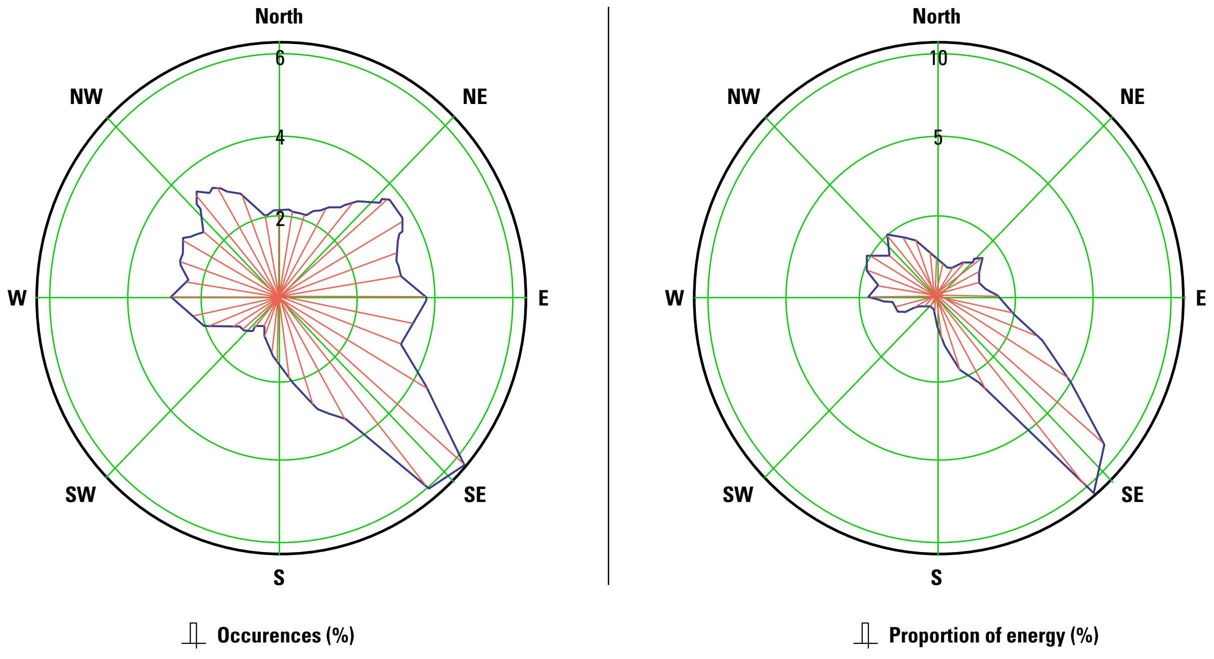
Figure 4: Distribution of wind speed and Weibull parameters at 51 m height



Actual Average	7.48
Weibull Parameters	
c (m/s)	8.11
k	2.21

The Weibull curve is the best fit to give similar energy

Figure 5: Wind-direction rose (left) and wind-power rose (right)



The wind-direction rose diagram and wind power rose at 50 m height, are shown in Figure 6. The wind-direction rose shows that the predominant wind comes from the south-east. The distribution of wind energy shows that the bulk of wind energy also comes from the south-east.

The seasonal distribution of wind speeds, shown in Figure 7, shows the nature of wind-speed changes by month in relation to the annual average wind speed.

Correlation of wind speed with account of long-term data

In order to forecast the long-term average wind speed at the site, the relationship between the wind data from the National Centre for Atmospheric Research (NCAR, USA) and the meteorological mast in Fort Shevchenko was modelled. The correlation results are shown in Table 8.

The long-term wind speed at the site of the meteorological mast was defined as 7.83 m/s at a height of 51 m.

Specialists of PB Power conducted a simulation of the wind flow for the Fort Shevchenko area. The following climatic and topographic input data were used for the simulation:

- Wind data. Wind data were extrapolated for the meteorological mast at a height of 80 m for the turbine rotor axis location;
- Average air density. The temperature and pressure data were obtained from the meteorological mast. The calculated air density for the site was assumed as the average air density at the height of 80 m for all the turbines on the site. The air density is 1.212 kg/m3.

Figure 6: Monthly patterns of wind speed at 51 m height

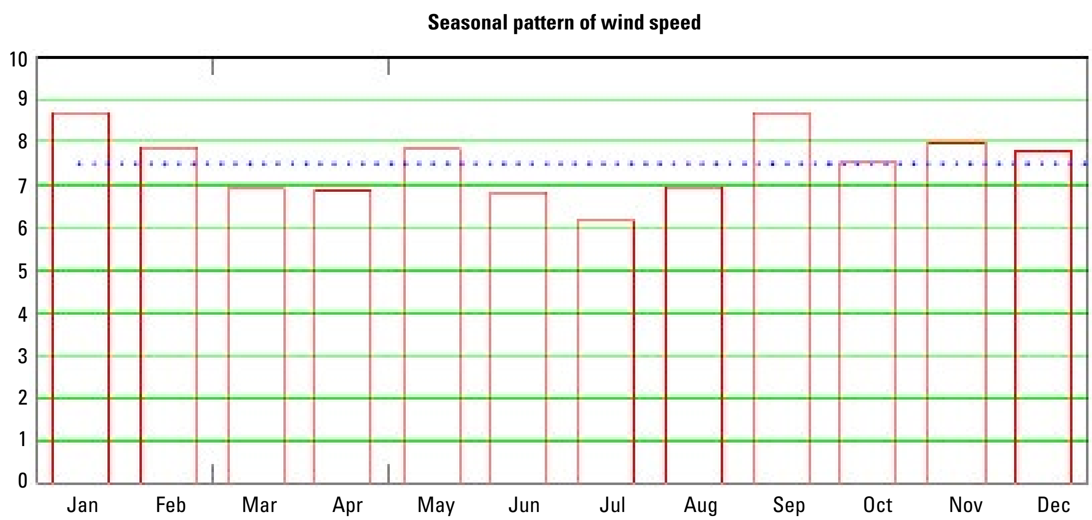


Table 8: Modelling results for long-term average wind speed at Fort Schevhenko

Local mast	Correlation results	Local average wind speed in the area (m/s)	Average wind speed on the base site (m/s)	Overlapping wind speed at the base site (m/s)	Local long-term average wind speed (m/s)
Fort Shevchenko	72.45%	7.47	5.64	5.22	7.83

D. Description of wind-power unit

1 – Technological design of wind-power units

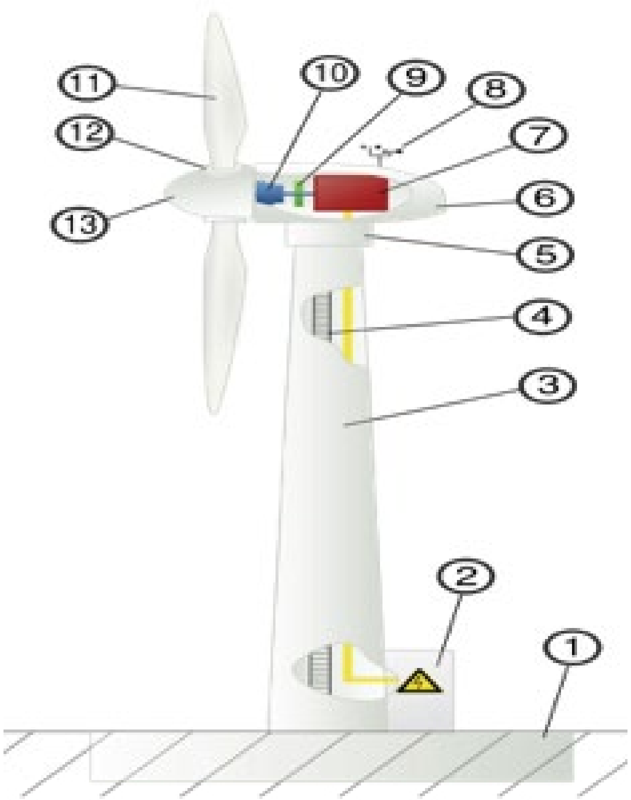
The equipment selected for the implementation of this project is manufactured by Vestas Central Europe A/S (due to confidentiality issues, the technical aspects of the equipment are omitted in this paper).

Scope of delivery:

- Thirteen pieces of V117-3.3 MW wind turbines generator systems, including a conical steel tower with a height of 91.5 m and an anchoring ring. In accordance with the technical requirements laid down in the technical specifications, the wind turbines shall have a horizontal axis and three-bladed upwind type;
- Colour RAL 7035 (light grey);
- VestasOnlineTM Business SCADA system (SCADA equipment), in accordance with the technical requirements set out in Annex 2 (VestasOnline® Review);
- Transformers for 35 kW wind turbines in a gondola;
- Switchyard units for the wind farm;
- Monitoring and controls;
- Logo in Vestas gondolas;
- Delivery of the wind-farm turbines to the site, storage in the port, installation;
- Operation and testing of the wind unit and SCADA equipment;

With the exception of the work of the general station and civil construction
With the exception of other works (such as the concrete foundation, lighting and marking of aircraft signs, icing detection, customer logo in gondolas, etc.)

Figure 7: Structure of industrial wind unit



1 - Foundation
2 - Power cabinet, including power contactors and control circuit
3 - Tower
4 - Ladder
5 - Rotating mechanism
6 - Gondola
7 - Electric generator
8 - Tracking system for wind direction and speed (ane mometer)
9 - Brake system
10 - Transmission
11 - Blades
12 - System changing the blade angle of attack
13 - Rotor cap

E. Power consumption

Power production in the Mangistau region was 4,628 million kWh, consumption was 4,707 million kWh, the volume transmitted to other regions was 79 million kWh, from the total generation 4,598 million kWh was produced at thermal power plants (TPPs) and 30 million kWh generated at other power stations.

There are 20 power plants in the region with a total capacity of 1,360 MW.

The largest power producer is LLP MAEC-Kazatomprom, which operates two power plants, TES-2 and TES-3, with a total capacity of 1,255 MW. The available capacity of the LLP MAEC-Kazatomprom facilities is 892 MW. The annual electricity production is more than 3 billion kWh.

Due to age of the basic electrical equipment, it is expected that in the near future about 200 MW of installed capacity will be decommissioned, which can cause power shortages in the region.

The main consumers of electric power in the region are:

- Kuryk seaport, 60 MW;
- Cement plant, 40 MW;
- Petrochemical complex for polyethylene production, 25 MW;
- Oil pipeline Iskene-Kuryk, 172 MW;
- Oil- and gas-sector industries, 600 MW.

F. Sourcing of equipment – local or foreign suppliers

The general contractor under the project for construction of 42 MW capacity wind-power station in the Tupkaragan district of the Mangistau region will be determined on a competitive basis after the tender results.

As contractors and subcontractors are to be engaged for all necessary works, it is proposed to involve organizations specializing in the power construction sector of Kazakhstan and partially in CIS countries, such as SU Promstroy, Management Unit for Mechanized Operations, Avtokombinat, JSC Imstalkon, JSC Kazmehanomontazh, JSC Sredazenergomontazh, construction units Kazhimelektromontazh, Kazteploizolyatsiya, Sredazenergozaschita and SPU Kazgidrospetsstroy.

The supplier of the basic equipment is expected to be Vestas Wind Systems A/S, which will supply the wind turbine to the installation site and supervise the installation of the equipment supplied. Vestas Wind Systems A/S is one of the oldest and largest global producers of wind generators.

Terms of procurement, shipment, storage and installation of the main equipment, provision of household and industrial buildings and temporary structures will be determined upon conclusion of the contract.

IV. Economic feasibility

A. Demand for electricity

In connection with the elapsed normative service life of the main electrical utilities of LLP MAEK-Kazatomprom by 2017, the expected decommissioning and disposal of 200 MW of installed capacity may cause power shortage in the region.

Tupkaragan district

Fort Shevchenko is located in the Tupkaragan district of the Mangistau region on the Caspian Sea coast. The region is characterized by the rapid development of the oil and gas industry and related infrastructure. At a distance of 5 km from the town of Fort Shevchenko is the seaport of Bautino. The port is designed to support offshore oil operations in the Caspian Sea. The power supply in this area is secured through a 110 kV OHL with a length of about 120 km from the LLP MAEK-Kazatomprom in the city of Aktau. Electricity consumption in the region was 61.4 million kWh in 2014.

Economic development of this area conditions and determines new demands for electricity. At the same time, the only source of energy supply for the whole Mangistau region remains LLP MAEK-Kazatomprom, which operates two thermal power plants TES-2 and TES-3 with an aggregate capacity of 1,255 MW. Available capacity of LLP MAEC-Kazatomprom is

892 MW; annual electricity production is more than 3 billion KWh.

To generate electricity at TPPs, LLP MAEK-Kazatomprom uses oil and gas. The cost of electricity from LLP MAEK-Kazatomprom risks a significant increase, which could have a negative impact on the social and economic development of the region. Plans to build a gas turbine with power capacity of about 300 MW in the city of Aktau are under discussion.

An alternative option for supplying power to Fort Shevchenko is the use of wind energy. Fort Shevchenko is located in a zone of high wind loads (7–9 m/s average wind speed), which makes it possible to generate electricity on a large scale.

Wind power plants (WPP) can provide additional electricity for the Tupkaragan region at a reasonable cost, which does not depend on market prices for gas and oil.

The indicative capacity of the wind plant at this site is about 100 MW.

The main consumers of energy in Fort-Shevchenko are:

- Rybkombinat fishery;
- Seaport Bautino;
- Mining companies producing shell limestone.

B. Cost of construction

- Proposed and indicative conditions
  - Annual average wind speed at a height of 80 m is 8.43 m/s
  - Potential generation share of the equipment is 40.3%
  - Average air density at a height of 80 m is 1.212 kg/m3
  - 42 MW capacity
  - Windmill equipment: VESTAS, 3.35 MVt x 13 units
- Information related to the certified reduction of emissions
  - The cost of certified reduction of emissions is X20/t (October 2009);
  - The net effect of emission reduction by the use of electricity from renewable energy sources is estimated as 0.6214 t/kWh (annual volume of electricity production is 72 598.5 MW/h = 0.6214 x 45 x 112.7 t @ € 20/t = € 902 254.2;
  - The costs excluded from transportation payment include the cost of transportation of energy-conservation devices that are not part of the equipment for wind-power generation, as well as EMS and other devices, and the cost of civil construction works;
  - The costs of control means include general expenses, travel and other expenses during the preparatory period;
  - The cost of construction includes the cost of the industrial building area of 300 m2, which will house the power plant control equipment and the equipment for heating and air cooling;
  - The site area is 190 ha;
  - Reserve funds include the provisions established to secure the payment of interest and other expenses during the period from the time of fund-raising to the start of power generation.
- Other
  - Freezing factor assumes that ice density is 700 kg/m3;
  - Estimated thickness of surface ice is 30 mm;
  - The distance between the towers is in compliance with international standards (minimum distance is about 300 m).

Evaluation of technical risks that determine the major risk factors, forecast and range of changes, proposed actions for risks mitigation

Technology risks
Potential technological risks are generally associated with a longer-than-expected period of WPP

production technology transfer, compared with the time scheduled under the project. Moreover, it would be difficult to reproduce the highest quality in a short time.

The technical risks are related to non-compliance of the basic equipment with specification requirements. The volume of output can be significantly lower than the estimated output from the financial and economic model. This can cause material damage to the project and reduce profits.

The cost of repair and replacement of damaged parts during breakdowns of equipment in operation relates to numerous operational risks, such as force majeure, disruptions, interruptions in the operation of the power supply system and other unforeseen circumstances that may be significant. Moreover, repeated and lengthy stoppages could result in termination of contracts, litigation, damages and penalties for non-compliance with the contract or legislation, reducing the cash flow and increasing financing costs. What is more, these amounts may not be covered by insurance.

Production risks

Dependence on suppliers

Major parts of the equipment and key materials for this joint project will depend on imports. Potential export restrictions or delays in the issuance of export licenses for certain vendors of the main types of equipment and certain dual-use materials – in particular for the production of blades – may be among those risks.

The number of suppliers of the equipment eligible for the project is limited and is, therefore, a risk to the joint venture, which may not be able to control construction of the WPP. In the case of any unforeseen delays or other problems related to the procurement and supply of such equipment, the project development will be jeopardized. On the other hand, the increasing number of similar projects developed worldwide may also affect the terms, conditions and prices that can be negotiated with suppliers.

Changes in market prices for equipment components and raw materials

Usually, it is in the interests of the investor to enter into long-term contracts in order to maintain fixed prices for the procured equipment parts and consumables. If the joint venture fails to fix a contract in relation to the WPP, it will fall in dependence on market prices, which may be unstable and susceptible to volatility due to a variety of factors, such as the level of demand, economic conditions, government policies, weather conditions, availability and the cost of analogues on the global scale. The increase in market prices above a certain level may have a negative impact on financial results.

Project risks

Construction

Investing during the construction phase may result in "construction" risks for the joint venture, which include delayed completion of the project, budget overspending and the breaking of agreed specifications. Even if some of the risks are more associated with construction contractors, the majority of the risk remains within the framework of responsibility of the joint venture.

Any delays in project implementation and consequent increase in financing may result in a slowdown of cash movement, increase in capital required for the completion of the construction and may also lead to insolvency of the general contractor, the main subcontractor and/or supplier of the main equipment. All together, these factors can have a negative impact on the initial success of the project.

On the other hand, to proceed with the construction and operation of such projects it is necessary to obtain the required permits for construction from various agencies. This procedure may be delayed and may reveal the difficulty to comply with specific requirements. In addition, the permits and authorizations may contain conditions, the non-compliance with which could lead to sanctions and fines.

Development and construction risks

Any investment project being at the preliminary stage of discussion or initial planning and development carries a risk of failure with respect to any projects under discussion and a number of risks common to the projects under development for which an agreement has already been reached. Key risks comprise the following:

Capital investment risks
The in-development investment projects dealing with the production sector assume the major construction and capital costs usually borne by the investor, which may often vary due to the cost of the various underlying assets, equipment (which, in turn, may differ according to location and shipment convenience), the manner of construction and the availability of infrastructure and communication aids. A significant increase in all or some of these costs could have an adverse effect on the financial position of the joint venture and its capability to achieve any of the objectives and business plan.

Permits and consents
One of the most significant risks in any investment project is the possible failure to obtain a construction permit required for project development. As mentioned above, the regulatory requirements of the country are the subject of further development and may, in the future, be subject to frequent changes. Any failure in obtaining the necessary permits for a project may result in significant damage to its implementation.

Furthermore, if assumed that all permits have been obtained, any delay in the construction schedule may cause the expiry of those permits. Other access approvals that will be required for development, construction and operation include obtaining a construction permit and a production license.

These permits must be obtained in time to ensure that the project is free from risks, ready for the construction phase and eligible for funding. Inability to obtain any permit or delay in its issue could cause serious damage to the financing of the projects.

Land use
Industrial projects require land for the installation and operation of equipment for production, as well as for the construction of appropriate infrastructure. The right to use the land can be obtained on the basis of obtaining land ownership rights, lease rights, etc. If the question of land use is not resolved, the start of work may be negatively affected.

In the case of delayed receipt of permits, including for planning and other regulatory permits, the right to land use may be lost or may have to be renegotiated. This may adversely affect the ability to develop the project and may also make it impossible to operate in the region, resulting in the loss of money spent on obtaining land-use rights.

Risks related to delayed works execution
Taking into account the certain novelty of the project for Kazakhstan, it may be assumed that the general contractor may experience some difficulties caused by lack of experience in implementing similar projects or failure to ensure compliance with the project design and budget documentation.

Risk mitigation actions
All these potential risks can be properly addressed, mitigated and even eliminated.

Following the commercial approach, the developing wind-energy market in Kazakhstan and other CIS countries provides the need for system-based wind power plants. Strong governmental support and promotion will play an important role. Vertical integration is deemed to be the mandatory strategy to ensure the supply–demand chain for wind turbines because not only will the basic parts for the WPP be procured, but also shipment, installation and maintenance services. The use of equipment manufactured locally will create competitive advantages for the project.

Renewable energy is characterized by the unstable and probabilistic nature of energy supply, which conditions the need for accumulation and back-up power.

Global efforts allow solutions to the problem of instability to be found. The world practice of operating networks of wind-power stations illustrates that this problem can be successfully resolved. According to the statistical data from Gamesa and WinWind companies, the forecast accuracy for electric output from WPPs under hourly planning for the market a day ahead currently exceeds 95%. This is a very high level to ensure the reliable operation of the energy system. The foreign practice of management of systems incorporating wind generation undoubtedly confirms that the proper planning of network development and wind-turbine siting, increases reliability and quality.

A group of researchers from the University of Stony Brook and the University of Delaware (United States) simulated a hypothetical system of interconnected WPPs, located along the entire east coast of the United States at a certain distance from the shoreline, and found that it could be a reliable source of energy.

Wind-energy potential is enormous; according to some estimates, it alone can cover the entire global demand for electricity. But with ever-changing weather conditions, power plants of this type are ineffective; engineers have proposed to combine wind-farm groups located at a considerable distance to smooth out fluctuations in wind speed, but precise calculations have yet to be made.

The authors examined the meteorological data collected over five years of monitoring 11 automatic stations located along the United States east coast between Florida and Maine at a distance of 2,500 km. Calculating the efficiency of the 5 MW wind turbines installed in the same locations as the weather stations, the researchers evaluated the results of their networking, according to Compuline news.

It appeared that, throughout all five years of operation of such a network, the inflow delivery of power did not cease entirely. That is to say, the output capacity generated by the entire system would not have fluctuated as much as that of a single wind turbine. For example, the output capacity for each of the 11 locations could often drop to zero and varied by more than 50% in one hour, but the aggregate network output did not rise or fall by more than 10% per hour. "In other words, an unstable and unreliable source of energy is transformed into a relatively stable and reliable one," says study participant Willett Kempton. (Energyland.info; www.e-apbe.ru).

On the technical side, the production and assembly of blades, towers and wind turbines represent a large-scale manufacturing technology. Unison and KM Enterprises have the necessary expertise, knowledge and technical skills in technology transfer. The technical risks can be substantially reduced through technical involvement of Unison and KM and the appropriate technical training of the staff of local companies.

In procurement, the majority of equipment parts have no restrictions. Well-known suppliers of basic equipment are Pema, Winergy, ABB and SKF. among others. Given there is an early application, the export of equipment for commercial use in Kazakhstan has no obstacles. Most technological materials for producing blades, such as glue, epoxy resins and consumables, are secure in terms of their delivery in Kazakhstan. With proper organization of the process, the extra costs for transportation will not be increased.

On the financial side, the risks are minimal, as long as the commercial, technical and procurement risks are reduced adequately and the company is working without interruption. Funding for the project has to be guaranteed at the beginning of the WPP design stage. This risk could be addressed with the active involvement of large national and international companies, national institutions for the development of advanced technology and central government bodies.

To address the institutional risks, it is reasonable to involve in the project a renowned international partner, a financially stable and successful company that enjoys the support of first-class investors, as well as of local and central government bodies, and has extensive experience in the application of high technology and sales. It is desirable that the company has been a long-term partner of national companies and there is also a need for strong government support. Potential institutional risk can be minimized, because qualified engineers and managers will be selected for this project. They will be given intensive training in the leading companies manufacturing wind farms and will then be sent to the WPP in the Mangistau region for on-site practice and training. This approach can exclude all potential risks of skilled labour shortage.

When carrying out financial analysis and evaluating effectiveness, it is also required to assess and take into account the sustainability of the project in relation to changes in a number of factors that characterize the general economic situation, such as:

- State policy in the energy sector;
- Taxation system;
- Inflationary price changes.

State policy in the energy sector
State regulation of investment activities is called upon to provide incentives to, and encourage, investors,

to protect their rights and to attract investment. It provides both the direct State participation in investment activities and the creation of favourable conditions for their development. State regulation is implemented through the adoption of legislative acts or setting a system of market incentives and restrictions aimed at managing business solutions of the companies in relation to pricing, sales policy, methods and production volumes.

A legislative and regulatory framework for investors was also developed and a number of laws were adopted. Such legal support actions include the Law on "foreign investments", the Law on "State support of direct investments", presidential decrees on "approval of the list of priorities in Kazakhstan economy sectors for attracting direct domestic and foreign investments" and on "approval of the list of preferences and procedures of their provision for conclusion of contracts with investors". These actions provide guarantees for the protection of investments and government support in the form of granting privileges and preferences. The State policy in the energy sector defines a set of measures to increase both the level of energy security (Law No.165-IV of the Republic of Kazakhstan dated 4 July 2009 on "supporting the use of renewable energy") and the extent of stability of power-supply companies in general; it also provides guidelines for the main sources of financing.

Actions for risk mitigation
The above-mentioned risks are considered as crucial for the project and there is, therefore, a need to develop a set of measures dealing with the probability of their occurrence.

The set of measures for risk reduction refers to a set of actions and interventions aimed at reducing the risks under a project, as well as to cover losses from their occurrence.

By introducing a package of measures to guard against project risks, it is proposed to include in the documents regulating the implementation of the project, relevant procedures containing mechanisms (processes) to reduce risks, as well as supervision of their practical implementation.

Conclusion

- It is planned to launch the wind-power plant with a capacity of 42 MW.
- The production capacity of this WPP is approximately 151,411 MWh of electrical power per year and, subject to the depreciation and loss coefficient at the level of transportation and consumption for own needs, the average annual estimated volume of electricity sales can be 149,897 MWh.
- The basic units for the wind plant, including turbines, blades, wind concentrator and tower, are projected to be sourced from VESTAS.
- The total cost will be US$ 62,853,547.
- The electricity produced from the wind plant is expected to be sold to the grid to JSC Mangistau REC under the following conditions:

- Selling price: US$ 0,10 /kWh (35.87 KZT/kWh VAT inclusive);
- Sales period: 15 years.

C. Fuel pricing

Not-applicable.

D. Electricity prices and sales

To date, tariffs effective in Mangistau region are:

- Tariff of LLP MAEK-Kazatomprom is set at 8.73 KZT, excluding VAT;
- Tariff of JSC MREC is set at 3.55 KZT, excluding VAT.
- Estimated tariff for WPP is 35.87 KZT/kWh, including VAT.

E. Taxes and import duties

The taxation system has a significant impact on the economic parameters of the project. Taxation rates are used for setting norms of the current liabilities under the project, projection of the financial results and preparation of basic forms of financial reporting. Based on these norms, the net result, tax performance and budgetary efficiency of the project are calculated. Payment of taxes and other obligatory budgetary payments are carried out in accordance with the Code of the Republic of Kazakhstan on “taxes and other obligatory payments to the State budget” (Tax Code), as well as the normative legal acts, the adoption of which is stipulated by this Code.

The indicators in Table 10 confirm the acceptability and feasibility of the project. It is thus possible to state with a high degree of confidence that the reviewed economic, technical and institutional conditions for implementating the WPP (within the scope of proposed basic design, architectural, planning and arrangement solutions) are favourable from the point of view of all stakeholders.

The project is economically and commercially feasible in the long term (starting from the third year). Its implementation will result in 12 new stations. Ultimately, the project will contribute to improved investment attractiveness of the region and facilitate innovative activities.

Table 9: Taxes and import duties in Kazakhstan

Description	Tax rate	Taxable base
VAT	12% since 2009	Sales volume
Social tax	11% since 2008	Payroll fund
Individual income tax	10%	Average value is used for estimation purposes.
Property tax	1.5%	Payable from average for the yearbook value of the taxable assets, determined from the accounting data
Land tax	0.58 KZT/m^2	Land plots provided to organizations in compliance with the established legislation of Kazakhstan, including land plots under the support poles for transmission lines and substations
Corporate income tax	20%	From profit
Ecological fees	Environmental section	Volume of emissions and discharges

Source: Kazakhstan, olgapedan - Fotolia.com.

V. Schedule

Progress schedule

Typically, the duration of the construction period of the WPP with a capacity of 42 MW is subject to regulation by the technical standards SNIP RK 1.04.03-2008 “Standards of construction duration”, Section 1. In the absence of direct regulations applicable to wind-power stations of this capacity, the duration of construction is determined as being nine months.

Works description	Year One				Year Two				Year Three			
	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4
Studies/feasibility confirmation	■											
Financing	■											
Development of feasibility study	■	■										
Conclusion of the State expertise review		■										
Development of project design and budget cost documentation		■	■	■								
Conclusion of the State expertise review				■								
Announcement of construction and installation works tender (CIW)				■	■							
Procurement/shipment of equipment						■	■	■				
Civil construction and engineering									■	■	■	■
Completion of works												■
Commissioning, fine-tuning and testing transmission												■
Generation/transport/ sales												■

VI. Legal and regulatory aspects

The principle law governing the sector of the renewable energy is the law on the support of the use of renewable energy.

The Law of the Republic of Kazakhstan No.165-IV of 4 July 2009 on "supporting the use of renewable energy" (with modifications and amendments as of 28 April 2016).

VII. Conclusions for future national policy development and adoption of a similar approach in neighbouring countries

Governmental support for the introduction and use of renewable energy is crucial to its development.

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