INFORMATION AND ANALYTICAL MAGAZINE

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QAZAQ GREEN Association

KONRAD ADENAUER STIFTUNG

Charter from the RES Community to the Government of Kazakhstan | Green hydrogen | Localization in RES

2023

№ 6 (10) September

ENERGY TRANSITION: CHALLENGES AND SOLUTIONS

QAZAQ GREEN
RES ASSOCIATION

UNITED PLATFORM

for Kazakhstan and international players in the field of renewable energy sourses

AIM – SECTOR CONSOLIDATION

to bring together actors in the field of renewable energy sourses in order to create favorable conditions for development of the sector

MISSION:

formation of a holistic position of association memebers to obtain attractive conditions for investing in the projects of renewable energy sourses

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DEAR READERS!
DEAR FRIENDS!

On behalf of Renewable Energy Association "Qazaq Green", let me welcome you to the pages of our information and analytical magazine QazaqGreen.

As you know, an important component of successful investment attraction in any industry is to ensure certainty and the possibility of medium-term planning. Over the past five years, there has been a practice in the renewable energy sector, according to which the auction schedule was approved three months before they were held. In this regard, many investors have raised the issue that it is impossible to plan participation in the selection of renewable energy projects in such a short period of time, taking into account complex corporate procedures, the need for budget planning, etc. Therefore, the Renewable Energy Association "Qazaq Green" has been making a proposal for a long time about the need to develop an auction schedule for several years ahead.

On May 23 this year, the Order of the Minister of Energy of the Republic of Kazakhstan "On approval of the auction schedule for 2023 and the auction plan for 2024-2027" was signed. Significant renewable energy capacities in the amount of 6 770 MW will be auctioned in 2023-2027: 4,000 MW - wind plants, 500 MW - solar plants, 2,220 MW - hydroelectric power plants and 50 MW - biogas plants. In this regard, it is necessary to note the coordinated work of the Ministry of Energy of the Republic of Kazakhstan, which heard the opinion of the business community of the renewable energy sector and worked out this document.

At the same time, despite the positive aspects in the development of renewable energy, I would like to dwell on some of the challenges that the industry is currently facing.

Firstly, the difficult situation in the electric power industry and the increase in accidents in the system are increasingly leading to restrictions on electricity consumption by industrial consumers. It seems that one of the solutions to the problem is the introduction of new renewable energy generating capacities, including through the so-called mechanism of bilateral contracts, when industrial enterprises build such stations for their own needs. Despite the fact that the Law of the Republic of Kazakhstan "On support for use of renewable energy sources" allows such projects to be implemented, the existing conditions for their implementation do not allow large-scale development of this segment. Thus, for example, for RES projects selected based on the results of auctions, exemption from payment for electricity transmission and priority dispatching are applied,

THE WELCOME SPEECH OF NURLAN KAPENOV THE CHAIRMAN OF THE BOARD OF DIRECTORS QAZAQ GREEN RENEWABLE ENERGY ASSOCIATION

whereas projects under bilateral contracts do not have such preferences. It should be noted that since 2009 until recently, the law provided for such a measure of support for all renewable energy sources without exception. In addition, the system operator applies special regulatory requirements to bilateral contracts. All this makes this segment expensive and unattractive, despite the fact that the country has set ambitious goals for carbon neutrality, and such projects would help reduce the carbon footprint of industrial enterprises. Also, such RES projects receive payment for generated electricity directly from the industrial consumer and do not affect the growth of tariffs for population and consumers in the whole country. In this regard, we call on the Ministry of Energy of the Republic of Kazakhstan to take a different look at the development of the segment of bilateral renewable energy contracts and, since there is a norm in the law of the Republic of Kazakhstan, it is quite possible to develop separate rules providing support measures for implementation of such projects under the new "Single Buyer" market model, which came into force on July 1, 2023.

Secondly, on the eve of the new parliamentary season, I would like to note that there are two draft laws being worked out by the Mazhilis: the first involves amendments to stimulate the development of small–scale RES, the second - issues of the development of heat and electricity.

The development of distributed generation (microgeneration) based on small-scale renewable energy facilities, used primarily to meet the own needs of households and small and medium-sized businesses, not only contributes to achieving energy security of the country, reducing CO2 emissions within the framework of the commitments made under the Paris Agreement, but also improving the level of comfort in citizens' homes. In this regard, following the results of the meeting on the development of the electric power industry and RES on May 26, 2021, the President gave instructions on making proposals to improve incentive measures (sale of surplus generated energy to the grid) for the use of renewable energy sources.

Unfortunately, so far the issue of selling surpluses from small-scale RES is not properly understood and, as a result, this segment has no real incentive measures. At the same time, in this April in Uzbekistan, the President of the country signed a decree on the payment of subsidy in the amount of 1 thousand soums (37.5 tenge) for each kWh of electricity produced by solar panels installed in households and transferred to a single power supply system. In a short period of time – in the first quarter of 2023 – about one thousand households throughout the republic have installed solar panels on their homes and are selling surplus generated energy to the unified grid.

The Renewable Energy Association "Qazaq Green" calls on the Ministry of Energy of the Republic of Kazakhstan to once again consider this support measure, especially taking into account the growing shortage of electricity and the advantages of distributed energy, which has minimal impact on the energy system. The necessary instructions have already been given on this issue at the level of the country's leadership.

Thirdly, we consider it important to take concrete measures to develop energy storage systems in the Republic of Kazakhstan. New gigawatt renewable energy projects, for which the Government of the Republic of Kazakhstan has signed direct contracts with major foreign investors, provide for introduction of energy storage systems. However, this is not a systematic approach. At the moment, relevant and debatable issues are the goal-setting of the implementation of such projects - to align the daily schedule of a renewable energy station or for the needs of the energy system, technical requirements for the implementation of ESS projects, mechanisms for implementation of such projects, tariff formation. Since there are no studies in this regard, we consider it possible to implement the first pilot project of ESS through an auction mechanism based on the principle of technologically open auction with an open marginal auction price. Such a measure will allow us to work out all technical issues on a practical example, to have a so-called track record for its operation based on the results of such a system, the analysis will allow us to determine tariff formation and approaches for purchasing storage services by the energy system to ensure profitability and investment attractiveness of such projects. We hope to discuss this issue with the Ministry of Energy of the Republic of Kazakhstan.

I wish you success and thank you for your interest in QazaqGreen magazine!

Nurlan Kapenov
Chairman of the Board of Directors
QAZAQ GREEN RES Association

DEAR READERS!

On behalf of Financial Settlement Center of RE, let me welcome you to the pages of QazaqGreen magazine.

This year marks the 10th anniversary of the founding of FSE of RE, creation and development of which is caused by the course set by the Republic of Kazakhstan for development of renewable energy sector. For many years, the FSE of RE has been carrying out centralized purchase and sale of electric energy produced by facilities for use of renewable energy sources and supplied to the electric grids of unified electric power system of the Republic of Kazakhstan. In this regard, we can rightfully say that our organization has developed together with the renewable energy sector. However, time poses new challenges.

As you know, since July 1, 2023, a new market model has been launched to implement the adopted amendments to the legislation of the Republic of Kazakhstan – single buyer and balancing electricity market in real time. Single buyer is a model of centralized purchase and sale of electric energy, which is designed to promptly eliminate imbalances in the power system, electricity shortages, unequal competition conditions due to different tariffs of energy-producing organizations.

The implementation of the model will allow:

– excluding speculative transactions in the purchase and sale of electricity;

– minimizing deviations of electric energy flows with the power systems of neighboring states, due to rejection of formation of daily profiles based on the technical capabilities of power plants and the transition to the actual profiles of consumers;

– ensuring the balancing of high tariffs of newly introduced energy sources and prices of imported electricity during a shortage with the current tariffs of existing plants, as well as, in the future, equalizing electricity tariffs between regions.

The Single buyer of electricity is determined to be FSE of RE LLP. If earlier FSE of RE LLP carried out the purchase and sale of electric energy produced by renewable energy facilities and supplied to the unified energy system of Kazakhstan, at present we carry out the planned purchase of electric energy from domestic power plants one day in advance, including by bidding on the electronic platform of centralized bidding – Kazakhstan Operator of the Electric Energy and Capacity Market JSC (KOREM JSC).

WELCOME SPEECH GULZHAN NALIBAYEVA, GENERAL DIRECTOR FINANCIAL SETTLEMENT CENTER OF RE

The introduction of balancing electricity market (BEM) in real time is also an important step to resolve imbalances in the energy system of Kazakhstan, for which the preservation of BEM in simulation mode had a negative impact. Market participants, consumers and energy-producing organizations, realizing the lack of real financial responsibility for imbalances they allowed, did not take proper measures to prevent or mitigate them. Overlapping each other at the same time, such imbalances further worsen the situation in the energy system.

The preservation of balancing market for more than 13 years in a simulation mode without financial obligations of market entities has led to anti-record deviations with the Russian Federation of more than 1 500 MW (permissible overflow of 150 MW). The very absence of any real financial incentives for energy-producing organizations does not allow to fully utilize the existing potential of power plants in daily regulation, which would reduce, and in some cases eliminate certain imbalances in the power system.

In this regard, it should be noted that for new renewable energy projects that will be selected based on the results of auctions after July 1, 2023, new rules of the game will be introduced – they will be financially responsible for the imbalances created in the energy system. It should be noted that this is not a punitive measure, but a measure that encourages renewable energy facilities to treat the issue of forecasting electricity generation in good faith.

I would also like to note that all renewable energy projects for which a long–term contract for the purchase and sale of electric energy has been signed before July 1, 2023 will subject to the rules effective on the date of conclusion of such contracts in accordance with the legislation of the Republic of Kazakhstan. For such projects, the financial responsibility for regulation of imbalances will be borne by Single Buyer.

Of course, there are many problematic issues – the introduction of new models and the implementation of reforms is a complex process that cannot be implemented without mistakes and rough edges. I would like to emphasize that our organization is open to dialogue with the renewable energy business community and is ready to consider all constructive proposals aimed at improving the conditions for the functioning of renewable energy facilities in the new realities.

I wish you success and prosperity!

Gulzhan Nalibayeva
General Director
Financial Settlement Center of RE

CHAIRMAN OF THE BOARD OF DIRECTORS "QAZAQ GREEN" AND MEMBER OF THE BUNDESTAG **DISCUSSED PROSPECTS FOR COOPERATION IN "GREEN" ENERGY**

FROM AUGUST 21 TO 25, 2023, BUNDESTAG DEPUTY DR. CHRISTIANE SCHENDERLEIN VISITED KAZAKHSTAN. DURING THE VISIT, MEETINGS WERE HELD WITH DEPUTIES OF THE PARLIAMENT OF THE REPUBLIC OF KAZAKHSTAN, POLITICAL PARTIES, PUBLIC ASSOCIATIONS, ASSOCIATIONS, MASS MEDIA, UNIVERSITIES. THE VISIT TOOK PLACE WITH THE SUPPORT OF THE KONRAD ADENAUER FOUNDATION IN THE REPUBLIC OF KAZAKHSTAN.

At meeting in the Renewable Energy Association "Qazaq Green", held on August 22, topical issues of the energy transition of the Republic of Kazakhstan and Germany's experience in the development of "green" energy were discussed.

As Ms. Shenderlein noted in her opening speech, at the moment about half of the electricity in her country is generated from renewable energy sources. The share of coal-fired power plants in the total volume of electricity generation is about 30%. In addition, in this April, Germany disconnected the last nuclear power plants from the grid. Against the background of the energy crisis in Europe and rising electricity prices, the issue of generation structure is relevant and is widely discussed in society.

"*In turn, Chairman of the Board of Directors of Qazaq Green Nurlan Kapenov spoke about the development of renewable energy in Kazakhstan and the problems faced by the country's energy system, as well as plans for development of the sector in the future.* It was noted that the current situation in the country's electric power industry hinders the development of renewable energy sources. Social factors and low electricity tariffs from traditional sources are also important factors that need to be taken into account when implementing policies aimed at achieving carbon neutrality.

The Parties exchanged views on a wide range of issues of energy, ecology, education and scientific cooperation.

RES AUCTION SCHEDULE IN 2023

The Ministry of Energy of the Republic of Kazakhstan invites all interested parties to participate in auctions for selection of projects for the construction of renewable generation facilities in 2023.

In accordance with the Order of the Minister of Energy of the Republic of Kazakhstan dated May 23, 2023 No. 187 "On approval of the auction schedule and the auction plan for 2024-2027", the following schedule was approved:

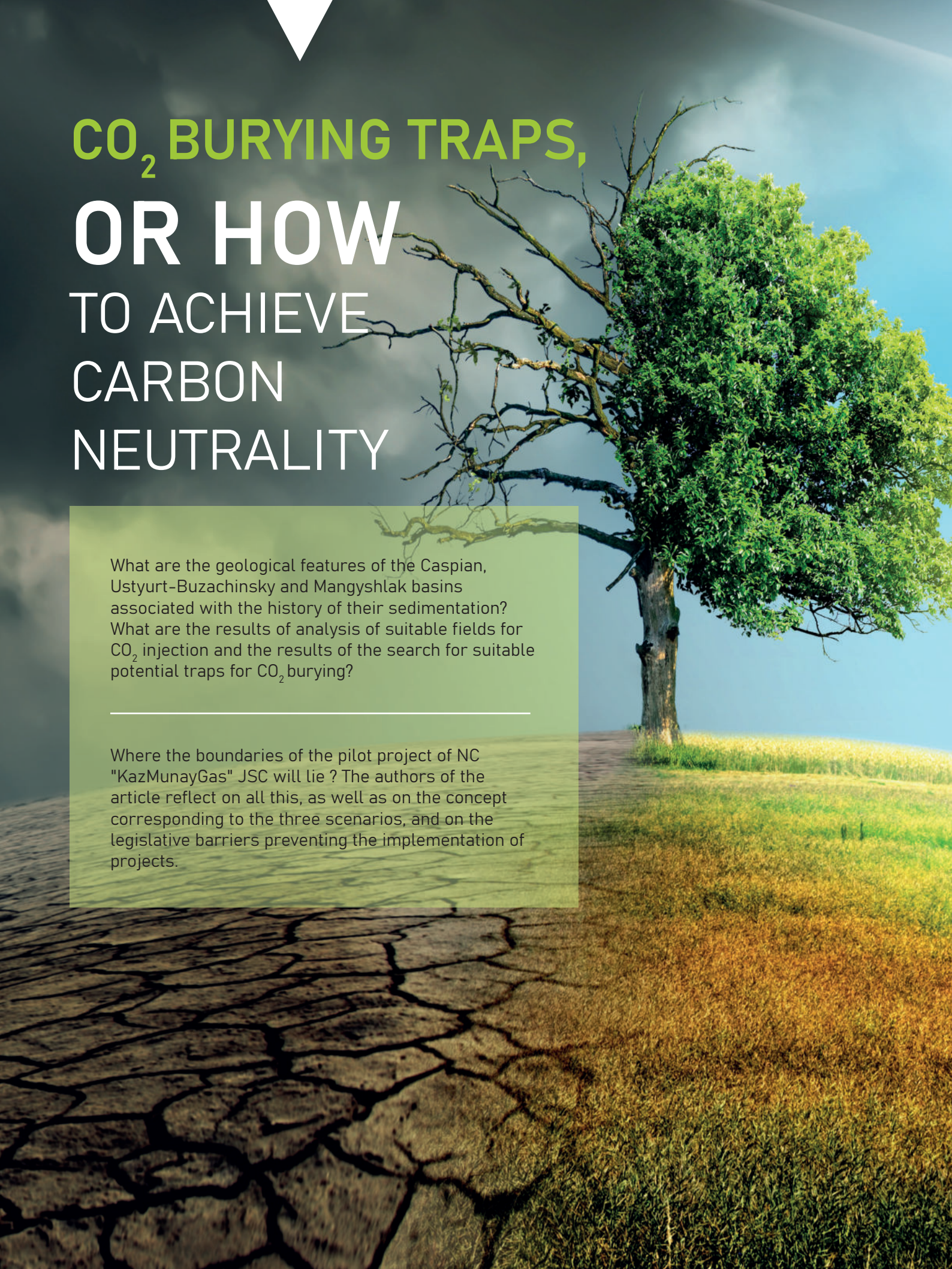
	SMALL	LARGE			
HPP	20	200	Northern and Southern zones	All areas	August 31, 2023.
HPP		200	Northern and Southern zones	All areas	September 1, 2023.
WPP		100	Northern Zone	Kostanay region	November 13, 2023.
WPP		100	Northern Zone	Aktobe region	November 14, 2023.
WPP		50	Northern Zone	Kostanay region	November 15, 2023.
WPP		50	Northern Zone	Kostanay region	November 16, 2023.
WPP		50	Southern zone	Turkestan region	November 17, 2023.
WPP		50	Southern zone	Turkestan region	November 20, 2023.
WPP		100	Northern Zone	Semey	November 21, 2023.
HPP	30		Northern and Southern zones	All areas	November 22, 2023.
SPP		20	Western zone	West Kazakhstan region	November 23, 2023.
SPP		20	Southern zone	Kyzylorda region	November 24, 2023.
SPP		20	Southern zone	Zhambyl region	November 27, 2023.
SPP		20	Southern zone	Zhetisu	November 28, 2023.
SPP		20	Southern zone	Turkestan region	November 29, 2023.
BioPP	10		All zones	All areas	November 30, 2023.

Source: Ministry of Energy of the Republic of Kazakhstan

The total auctioned installed capacity in 2023 is 860 MW, broken down by type of power plants:

- solar power plants (SPP) – 100 MW;
- wind power plants (WPP) – 500 MW;
- hydroelectric power plants (HPP) – 250 MW;
- biogas power plants (BioPP) – 10 MW.

CO_2 BURYING TRAPS, OR HOW TO ACHIEVE CARBON NEUTRALITY



What are the geological features of the Caspian, Ustyurt-Buzachinsky and Mangyshlak basins associated with the history of their sedimentation? What are the results of analysis of suitable fields for CO_2 injection and the results of the search for suitable potential traps for CO_2 burying?

Where the boundaries of the pilot project of NC "KazMunayGas" JSC will lie ? The authors of the article reflect on all this, as well as on the concept corresponding to the three scenarios, and on the legislative barriers preventing the implementation of projects.

Serikkali Brekeshev,
Deputy Chairman of the Management Board of NC KazMunayGas JSC

Anton Bachurin,
Head of the Department of Energy Efficiency and Renewable Energy of NC KazMunayGas JSC

Analyzing its business processes within the framework of implementation of Low-Carbon Development Program for 2022-2031, as well as taking into account the development of the Kazakh economy, JSC NC KazMunayGas concluded that it is impossible to achieve carbon neutrality without the use of carbon capture, utilization and storage systems (CCUS).

In this regard, the Department of Low-Carbon Development of JSC NC KazMunaiGas, with the expert support of KMG Engineering LLP, has started implementing a pilot project on CO_2 capture, utilization and storage (CCUS) and determining the potential for CO_2 injection in order to increase oil recovery of depleted oil reservoirs (see Figure 1). At the moment, the project is at the stage of a preliminary feasibility study, within the framework of which CO_2 sources are being screened, geological surveys are being carried out at the fields of JSC NC KazMunayGas and a search is being carried out for possible traps for CO_2 burying in the immediate vicinity of CO_2 emission sources under the management of JSC NC KazMunayGas.

We started our research with an express analysis of the history of sedimentation from the point of view of the formation of regional reservoirs of the three largest oil and gas basins on the territory of the Republic of Kazakhstan and the spread of potential seals.

Devonian rifting of the Southeastern European Platform contributed to the formation of the Caspian basin with massive carbonate uplifts along the flanks. The immersion of the basin in the carboniferous age led to the subsidence of the basin, where the formation of carbonate structures continued with minimal introduction of terrigenous rocks.

The Late Paleozoic collision of the European and Kazakh tectonic plates limited the Caspian basin from the ancient Tethys Ocean, which led to the formation of a powerful salt layer in the Kungur age and to extensive deformation of the areas of Northern Ustyurt and Mangyshlak.

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The erosion of the impending Kazakh plate entailed the introduction of alluvial and fluvial terrigenous sediments into the northern part of the current territory of the Caspian Sea.

The ongoing salt tectonics has created complex geological suprasalt structures in the Caspian basin.

Collisions of different microcontinents led to inversions, formations of folds and erosion of rift basins of Triassic age in the Northern Ustyurt and the Central part of the Mangyshlak basin

The uplift of the Ural Mountains in the early and Middle Jurassic led to the subsidence of the Ustyurt-Buzachinsky and Mangyshlak basins and the accumulation of fluvial, lake and shallow facies in the region. Therefore, sedimentation of marine carbonates prevailed in the Upper Jurassic. At the same time, the accumulation of marine terrigenous sediments continued until the Middle Cretaceous age, followed by the accumulation of marine carbonates.

PROJECT TEAM

Project Manager: A. Bachurin

Engineering team from JSC NC KazMunayGas: Urazaliyeva Zh.; K.Aliyev; S. Baramysova.; D. Machekhin;V. Ivanov V.A.; S. Shmunk.

Engineering team from KMG Engineering LLP: Ye. Zhakashev; M. Nugiyev; B. Tanirbergenov; A.Yesbatyr.;R. Sadykov; D.Tsoi.; D.Batyrgaliyeva.; Ye.Idrisova.; G.Atemova.

The Caspian basin has limited properties for storing CO_2 for a number of reasons. At the same time, the subsalt part of the Caspian basin lies at great depths, where high pressures and temperatures prevail, and the above-salt floor has a complex geological structure and uneven distribution of reservoirs due to active salt tectonics, which affected the significant anisotropy of the existing reservoirs. At the same time, the recent sediments of the Caspian basin are located at depths unsuitable for CO_2 storage.

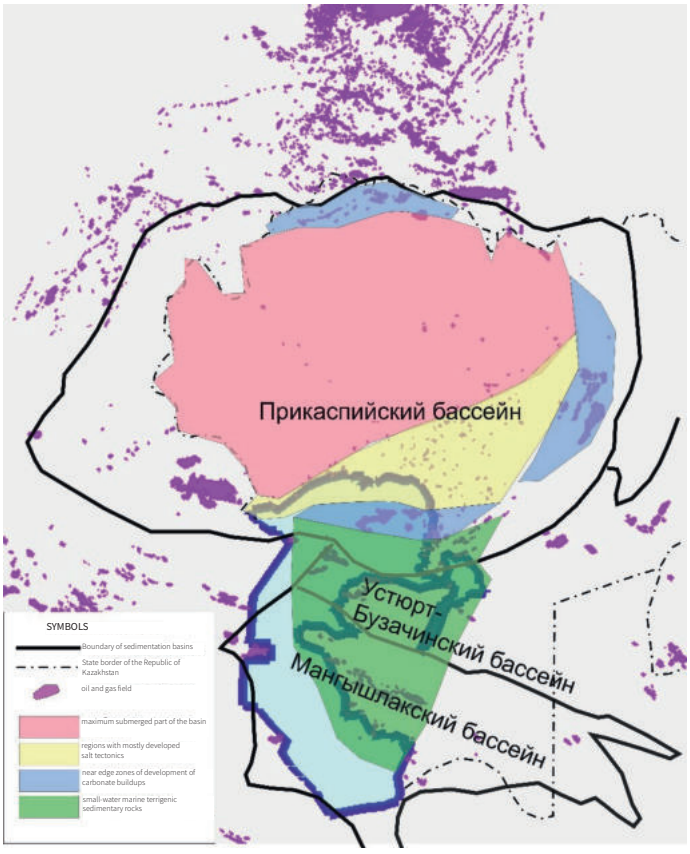


Figure 2 - Diagram of distribution of Cretaceous deposits in the region

Taking into account the history of sedimentation, our team came to the conclusion that the most likely prospects in terms of CO_2 storage are terrigenous fields of the Lower and Middle Cretaceous of the Mangyshlak sedimentation basin and, to a limited extent, the western part of the Ustyurt-Buzachinskiy basin. At the same time, Late Cretaceous marls and local intraformational clays serve as a regional seals.

The Caspian basin has a number of restrictions that significantly limit the possibility of dumping CO_2 emissions.

Despite the limitations of the Caspian basin, our team scrupulously performed screening of all active sources of CO_2 emissions in all three basins and determined their type, volume, and location. In addition, based on the project documentation, we also took into account all the promising sources of emissions that should appear in this region in the next five years.

After that, in order to select a suitable field for CO_2 injection and search for suitable potential traps, we continued a detailed analysis of the geological structure within a radius of 100 km from these sources of CO_2 emissions.

Preliminary selection of fields for CO_2 injection to increase oil recovery was carried out by screening analysis of 21 fields.

At the same time , the main criteria for the selection of fields were:

- sufficiency of emissions from the main nearest source;

- depth of occurrence - more than 700m;
- sufficient volume of the operational wells stock;
- geological oil reserves.

According to the main criteria, 6 fields were selected - Kalamkas, Zhetybai, Uzen, Karamandybas, Asar, Vostochny Zhetybai.

The database for these fields was formed for 63 operational development facilities for further analysis using additional evaluation criteria, such as: depth, viscosity and density of oil, as well as the absence of a block structure and a gas cap at the fields.

At the same time, it is important to understand that the main criterion for the effectiveness of CO2 injection into the reservoir is the condition of miscibility of carbon dioxide with oil, provided by reservoir pressure, therefore, the values of the minimum miscibility pressure were calculated for all development facilities using correlations.

As a result, the Karazhanbas and Kalamkas fields were excluded due to the high viscosity of reservoir oil, and the Asar field was excluded due to the lack of representative downhole samples.

At the same time, a detailed analysis of the geological structure within a radius of 100 km from the sources of CO_2 emissions located in the southeastern part of the Caspian Basin confirmed our preliminary conclusions, which were mentioned earlier (see Figure 3). In particular, only four potential traps were identified, while only one trap with a very limited injection volume was identified in relative proximity to KPI and KLPE.

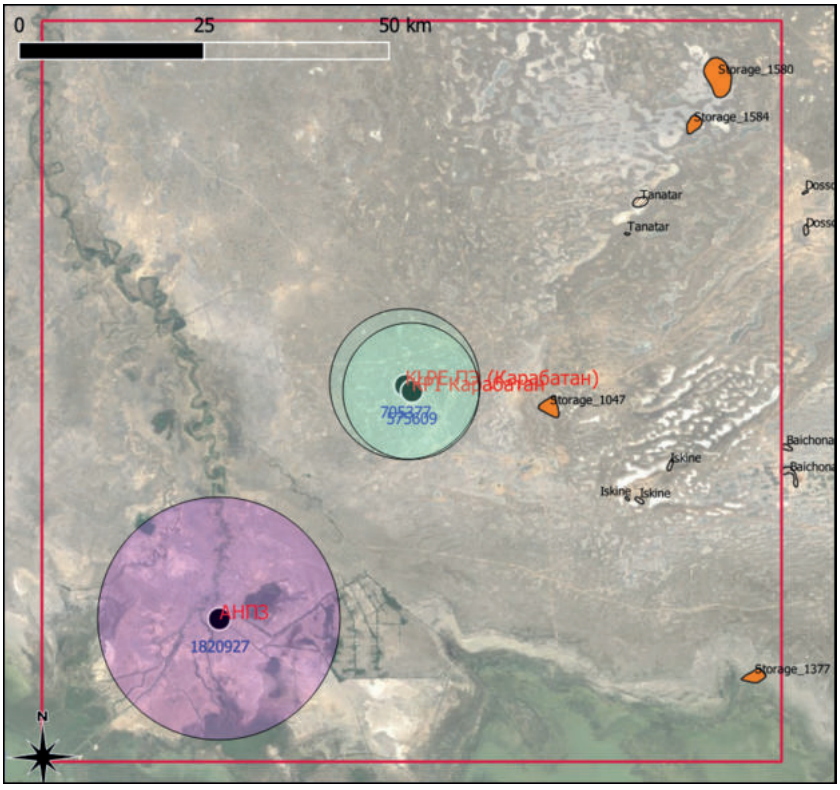


Figure 3. - Selected traps in the area of Karabatan

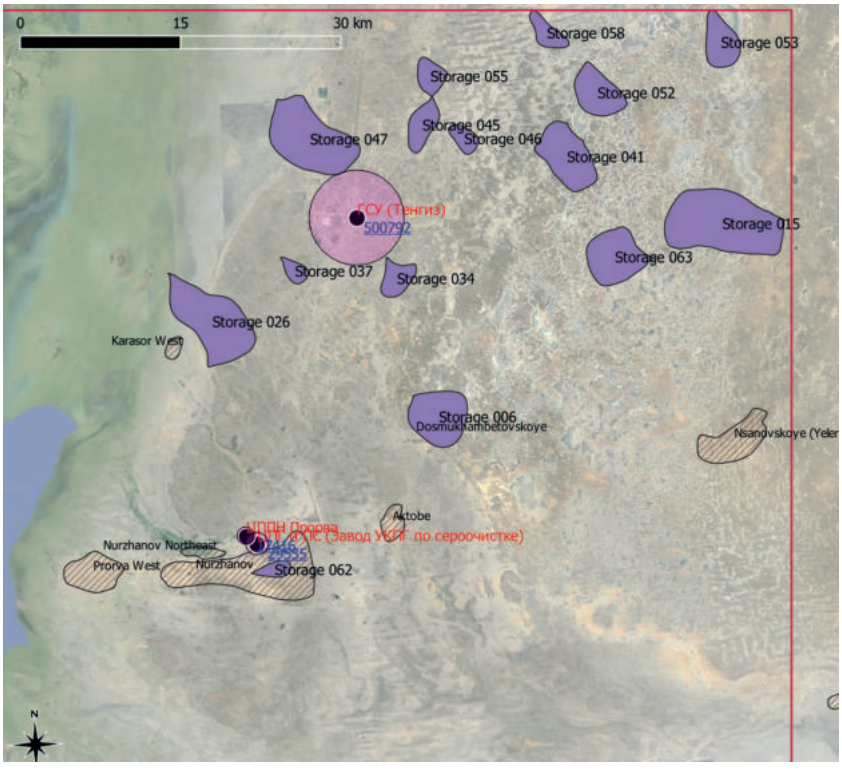
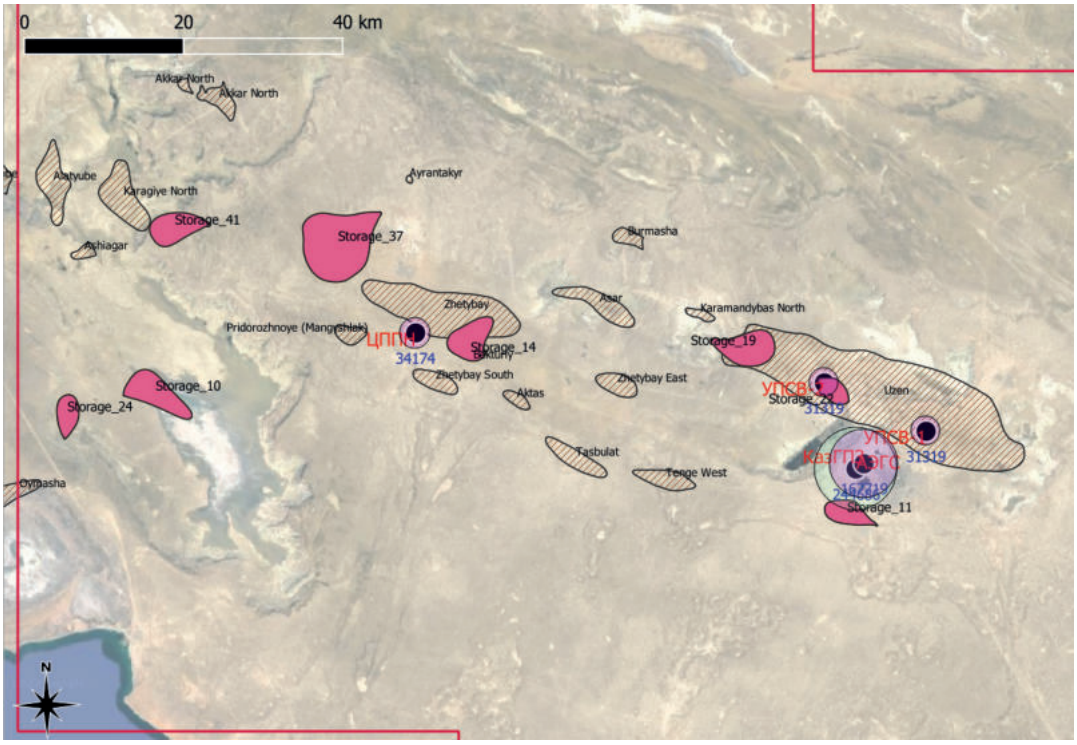


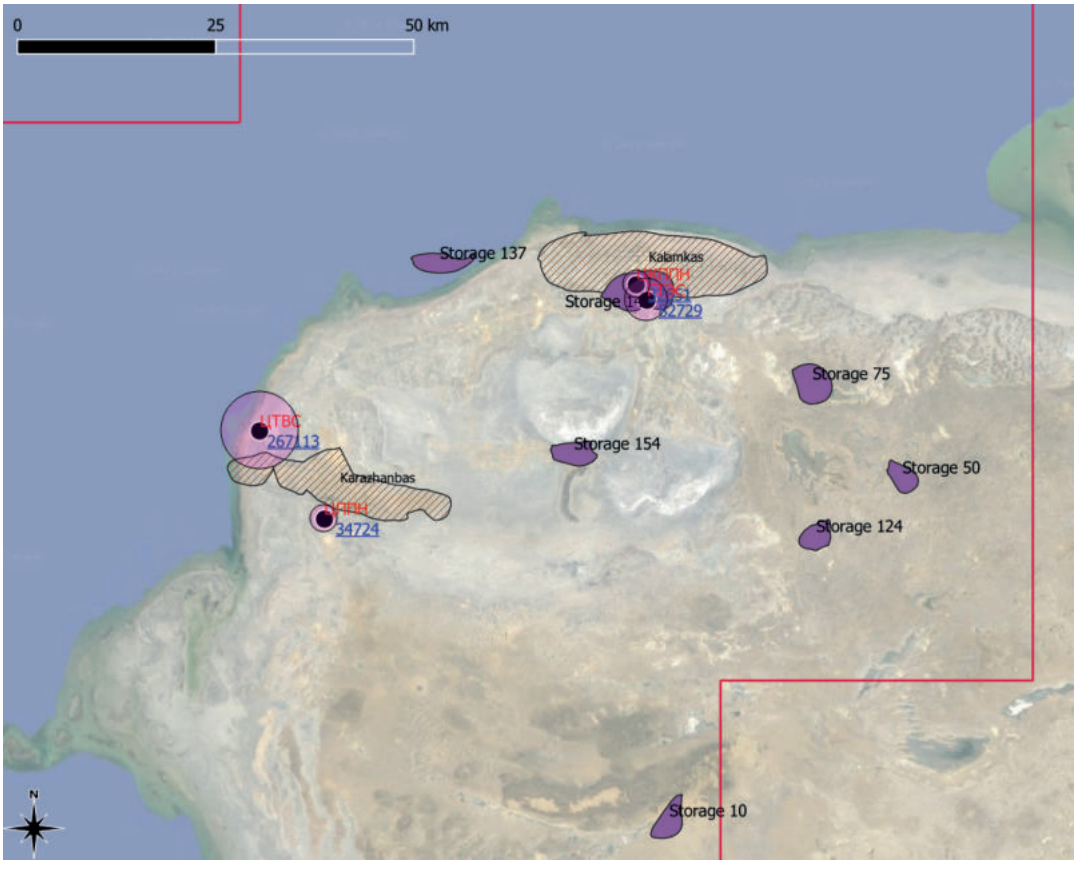
Figure 4. - Selected traps by criteria in the area of Prorva field

As for the detailed analysis of geological structure of the Caspian Basin, despite the fact that the deposits of the Prorvinsk group were excluded at the stage of the screening analysis of the field, we identified 15 large traps that are potential storage for CO_2 (see Figure 4). At the same time, the absence of large concentrated sources of emissions in the immediate vicinity of these traps makes these traps unpromising from the point of view of the CCUS project.



Detailed analysis of the geological structure in the Mangyshlak sedimentation basin, as expected by the results of the preliminary assessment, showed the most interesting results (see Figure 6).

Figure 6 - Selected traps by criteria in the area of Uzen and Zhetybai



Detailed analysis of the geological structure of the Ustyurt-Buzachinsky basin identified seven potential traps, while the Karazhanbas and Kalamkas fields themselves were unacceptable for CO_2 injection due to the high viscosity of reservoir oil (see Figure 5).

Figure 5 - Selected traps by criteria in the area of Kalamkas and Karazhanbas

First, large potential traps suitable for CO_2 disposal have been identified. Secondly, the Uzen and Zhetybai, Vostochny Zhetybai and Karamandybas field located in the Mangyshlak sedimentation basin turned out to be acceptable for CO_2 injection into them. They are located in close proximity to large potential sources of CO_2 emissions, the construction of which is planned in the medium term (the new KazGPP and the OMG gas power plant). The design CO_2 emissions of OMG and KazGPP combined total more than 400 thousand tons of CO_2

Taking into account all the above, it is in this region that JSC NC KazMunayGas decided to concentrate its further efforts in developing the concept of a pilot project focused on increasing oil recovery of the Zhetybai and Karamandybas fields.

Based on several scenarios, our team is developing a conceptual design (composition and location of the main equipment) of the ground infrastructure.

At the same time, in order to generate a positive cash flow of the project for Zhetybai, Karamandybas and Uzen fields, work is being completed on the calculation of profiles for KIN, taking into account the level of oil miscibility and reservoir capacity, for the following horizons:

- four horizons of the Zhetybai field;
- two horizons of the Vostochny Zhetybai field;
- and one horizon at the Uzen and Karamandybas fields.

Unfortunately, despite the proximity of the Uzen field to the sources of CO_2 emissions, we were forced to abandon the idea of using it due to the insufficient level of oil miscibility. That is why the final scenarios for the development of ground infrastructure did not consider the option of injecting CO2 into the Uzen field.

The project team is adapting additional production schedules for the two most acceptable fields Zhetybai and Karamandybas.

After completion of this stage of work and assessment of capital expenditures for the development of ground infrastructure, JSC NC KazMunayGas will be able to model financially the project (approximately the III quarter of 2023). After development of the financial model, JSC NC KazMunayGas plans to finally approve the concept of the pilot project and consider the possibility of implementing a pilot project for STC of SK Fund with subsequent inclusion in the list of R&D projects of the SK Fund.

In case of a positive decision, JSC NC KazMunayGas plans to carry out the next stage of detailed modeling and design at the expense of R&D of SK Fund with the involvement of international companies specializing in these works.

At the same time, it is worth noting that the capture, utilization and storage of CO_2 is currently an innovative technology and there is no experience in implementing such projects in Kazakhstan, so our team of experts is expected to face significant gaps in the legislation of the Republic of Kazakhstan.

First of all, these are, of course, issues of subsurface use. In particular, according to subparagraph 2) paragraph 3 of Article 213 of the Environmental Code of the Republic of Kazakhstan, the injection of technological solutions and (or) working agents into the subsoil for mining in accordance with the projects and technological regulations for which environmental permits and positive expert opinions provided for by the laws of the Republic of Kazakhstan have been issued is not a discharge of pollutants. At the same time, there are no regulations on CO_2 injection in Kazakhstan at the moment.

In addition, with the almost complete absence of technical regulations and standards, there is no possibility of design, and the implementation of a pilot project becomes simply impossible.

JSC NC KazMunayGas is currently considering the possibility of attracting experts in international and local law in order to:

- study the successful international experience of legislative and technical regulation;
- identify existing gaps in the legislation and technical regulation of Kazakhstan;
- develop a set of legislative initiatives and a list of technical standards and regulations aimed at the implementating CCUS projects in Kazakhstan.

JSC NC KazMunayGas hopes that within the framework of this work we will be able to establish a direct dialogue of the experts involved with the authorized bodies, which will ensure the effectiveness of joint work to eliminate legislative gaps.

PROSPECTS FOR IMPLEMENTATION OF DEMAND MANAGEMENT PROGRAM IN KAZAKHSTAN

> New trends in the electric power industry, the emergence of digital interval electricity meters, development of telecommunications and "Smart Grid" have made it possible to increase the elasticity of consumption by applying the Demand Response concept – an attractive and simple tool for solving energy management problems.

Inna Kim,
Head of Energy Systems Research Department, Energy System Researches LLP

Demand Response is implemented through the so-called Demand Management Program (DMP), which ensures the interaction of operator of power system with end consumers and implies a reduction in energy consumption at certain economic signals of electricity market with the receipt of revenue for this service.

The DMP concept is relatively new for the electricity markets of Central Asia and its implementation will require significant transformational changes to the existing management model of the energy system. Moreover, it becomes a very time-consuming task to create an infrastructure (metering devices with the possibility of remote data transmission, etc.) that provides the opportunity to participate in demand management programs for a wide range of consumers. Perhaps for this reason, the transition to the aggregated demand model until 2025, included in the action plan for implementation of the draft Concept for development of electric power industry of the Republic of Kazakhstan until 2035[1], was excluded from the approved Concept for development of electric power industry of the Republic of Kazakhstan for 2023-2029[2].

At the same time, given the large-scale plans for introduction of renewable energy and shortage of maneuverable capacities in Kazakhstan, the DMP, as a tool to maintain and regulate the balance of supply and demand in the wholesale electricity market, thereby increasing the reliability of the system and reducing prices, should not be ignored.

From the point of view of the power system, the introduction of DMP system provides a number of advantages associated with changing the load curve, filling the gaps in the curve and cutting off the peaks of the load by equalizing the daily electricity consumption and transferring energy consumption to night or to weekends and holidays.

As a result of optimization of energy consumption regime, taking into account the introduction of DMP, the energy system of Kazakhstan receives:

- reduction of peak load of power grid infrastructure, overloads and accidents;
- stabilization of voltage levels and stability of load nodes;
- postponement of investments in development of generating capacities and networks;
- reduction of load losses;
- additional resource for balancing the National Grid of the RK, etc.

Consumers also get a positive effect from the introduction of DMP system:

- reduction of electricity supply costs;
- possibility of obtaining income from participation in DMP;
- improving the reliability of power supply.

[1] Developed by the Ministry of Energy of the Republic of Kazakhstan on the basis of the order of the President of the Republic of Kazakhstan No. ЗТ-К-17709.1 dated January 26, 2022.
[2] Approved by Decree of the Government of the Republic of Kazakhstan No. 263 dated March 28 , 2023.

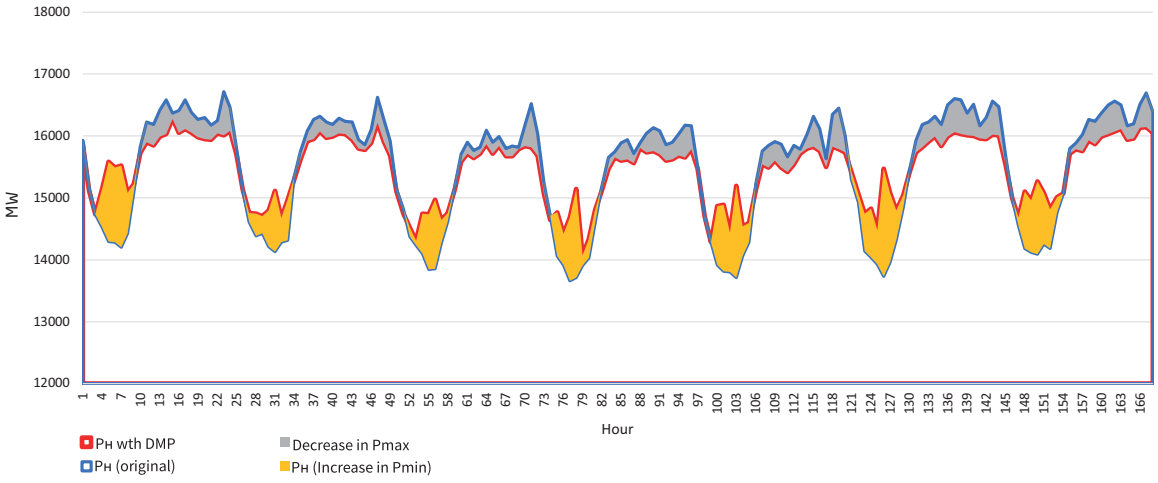


Figure 1 Modeling of impact of DMP on the load profile of the National Grid of the Republic of Kazakhstan at the level of 2030 (summer)

ACCORDING TO VARIOUS ESTIMATES, THE POTENTIAL FOR REDUCING THE PEAK LOAD IN THE POWER SYSTEM OF KAZAKHSTAN DUE TO THE DMP SYSTEM IS UP TO 10% OF THE PEAK LOAD[3], I.E. BY 2025 THE POTENTIAL MAY BE UP TO 1.9 GW.

THE INTRODUCTION OF SINGLE ELECTRICITY BUYER (SEB) AND BALANCING ELECTRICITY MARKET (BEM) IN KAZAKHSTAN FROM JULY 1, 2023 IS A FAVORABLE BASIS FOR THE INTRODUCTION OF DMP.

INTRODUCTION OF DMP IN THE WHOLESALE ELECTRICITY MARKET

The solution that ensures participation in the demand response of end consumers was the creation of specialized organizations – aggregators of demand response.

Demand response aggregators are participants of the wholesale electricity market that sell a set of regulatory abilities of consumers as a single product/service on the wholesale market and/or on the market of system services. The aggregator collects requests for changes in consumption from consumers, distributes the required volume of unloading /loading between consumers and informs them in a convenient format (text message, email, phone call, remote signal directly to the control system of the electrical installation, etc.).

The participation of large consumers of the wholesale market in the DMP is achieved by opening up various market segments, creating the necessary conditions to enable consumers to compete with generating facilities and providing appropriate economic incentives.

[4]Various opportunities for participation have been implemented in foreign demand management mechanisms, for example:

- direct demand response (implemented in the wholesale electricity and capacity market, balancing market);
- guaranteed load release (for emergency demand response);
- rapid reserve program (to ensure the stability of the system frequency in case of unforeseen increase in load or insufficiency of primary regulation, implemented on system services market).

The introduction of DMP usually begins with the involvement of consumers to reduce electricity consumption, such as through the introduction of tariffs differentiated by time of day.

When implementing the DMP in Kazakhstan, it is necessary to take into account the heterogeneity of the distribution of industrial and household consumers in the context of the National Grid zones. Thus, the consumption of Northern and Western zones is characterized by a fairly dense and uniform profile (Tmax≈7400 hours[5]) due to the large share of industrial enterprises (more than 60%). The consumption of the Southern zone has a large share of utilityl consumption (≈35%) and its

[3] *"Demand Management Program for Kazakhstan: Technical Feasibility", USAID Project "Energy of Central Asia", 2022*
[4] *IEA, Demand Response, IEA, Paris https://www.iea.org/reports/demand-response, 2022 г.*
[5] *The number of hours of use of the maximum load, T max – the time during which the same amount of electricity would be transmitted through the electric grid operating with the maximum load, which is transmitted through it during the year according to the actual load profile.*

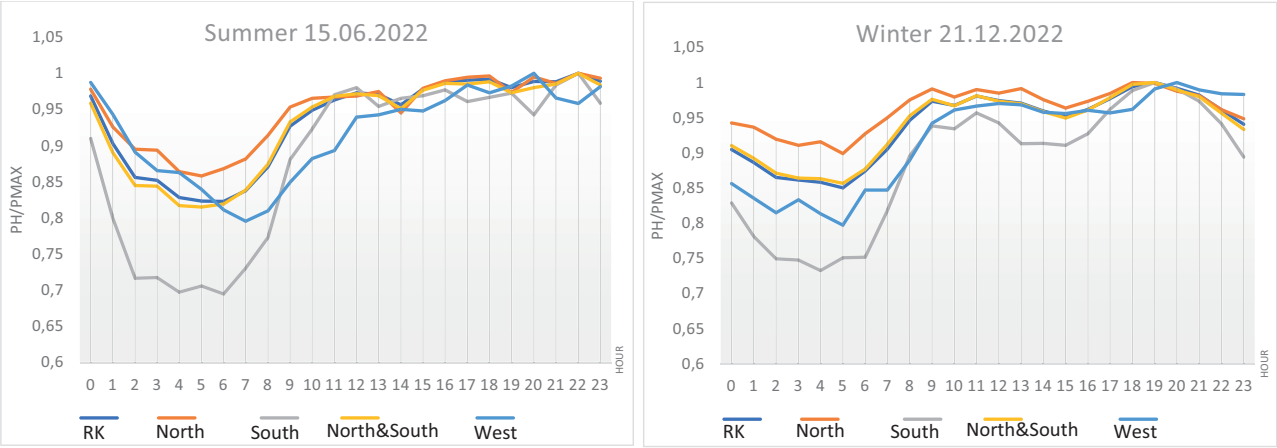


Figure 2. Daily profiles of summer and winter day loads of control measurements

consumption profile is less uniform and dense (Tmax≈6600 hours). Thus, taking into account the uneven load profile, the current deficit and limited capacity of North-South transit, the use of demand response is primarily relevant in the Southern Zone.

On the other hand, the key category of electricity consumers in Kazakhstan are large enterprises of the industrial sector, which can also act as separate entities of the wholesale electricity market. Thus, it makes sense to start implementing the DMP with large enterprises in the wholesale electricity market that have the ability to effectively manage their own load profiles. Pilot projects at the Bukhtarma Cement Plant and the branch of K.Satpayev Channel showed that in the presence of incentive payments, the ability to manage the demand of enterprises can be up to 20-30%[6].

Taking into account the planned development of renewable energy in Kazakhstan, including in the Southern zone, in accordance with the Projected Energy Balance until 2035[7] (PB 2035) and the prospective development of the National Electric Grid (NG)[8], it is advisable to connect primarily industrial consumers of the Southern zone to the DMP, and at later stages industrial consumers of the Northern and Western zones.

IT IS ADVISABLE TO START THE IMPLEMENTATION OF DEMAND RESPONSE IN THE WHOLESALE ELECTRICITY MARKET WITH THE INDUSTRIAL ENTERPRISES OF THE SOUTHERN ZONE.

AT LATER STAGES, IT IS ADVISABLE TO CONNECT INDUSTRIAL CONSUMERS OF THE NORTHERN AND WESTERN ZONES, AS WELL AS CONSUMERS OF THE RETAIL ELECTRICITY MARKET, TO THE DMP.

REALIZATION OF THE POTENTIAL OF MANAGEMENT OF DEMAND OF NET CONSUMERS

Significant demand management potential is concentrated among consumers of retail market (medium and small businesses, household consumption). At the same time, if large industrial enterprises can participate in the DMP by changing the planned daily consumption profile in the wholesale market, then for retail consumers to participate in the balancing market and receive a premium from response to short-term unbalances might be of interest.

Considering that a legislative and regulatory environment has been formed in Kazakhstan to support the renewable

[6] *"Demand Management Program for Kazakhstan: Technical Feasibility", USAID Project "Energy of Central Asia", 2022*
[7] *The forecast energy balance approved by Order No. 104 of the Minister of Energy of the Republic of Kazakhstan dated 24.03.2022 (in the version valid until 30.01.2023).*
[8] *KEGOC JSC is currently implementing the pre-FS "Vision of the development of the National Grid".*

energy sector, the introduction of low-power renewable energy with storage in distribution networks of voltage class 35-10-0.4 kV can be considered an alternative option for implementation of DMP by retail consumers[9].

OIn 2020, the company ESR LLP carried out a feasibility study to determine the potential of distributed generation of renewable energy in the grids of Ontustik Zharyk Transit LLP (OZhT LLP) according to the following criteria:

- Criterion 1 – availability of wind and solar resources near consumption nodes and power grid infrastructure;
- Criterion 2 – availability of suitable land;
- Criterion 3 – potential of consumers in terms of placement of small RES;
- Criterion 4 – loading of electric girds of "OZhT" LLP;
- Criterion 5 – configuration of daily load profile of consumers of OZhT LLP.

The research results showed the following:

- high solar potential throughout the Turkestan region will mainly contribute to the development of SES;
- total potential of distributed generation in the Turkestan region is estimated at 450 MW (185 MW – individual housing, 120 MW – SMEs, 45 – farming, 100 – the growth of electricity consumption);
- the maximum required volume of distributed generation under the condition of reducing the load of transformers at substations to acceptable values is estimated at 110 MW.

However, the demand response resource of an individual retail consumer is relatively small, with significant costs for interaction with the System Operator and operator of the wholesale market. Therefore, the use of this potential requires the development of mechanisms for transmitting the economic effect of reducing the load on the wholesale market to the retail consumer, as well as special regulatory, organizational and technical solutions.

FOR RETAIL CONSUMERS TO PARTICIPATE IN THE BALANCING MARKET AND RECEIVE A PREMIUM FROM RESPONSE TO SHORT-TERM UNBALANCES MIGHT BE OF INTEREST. USING THE POTENTIAL OF RETAIL CONSUMERS REQUIRES SPECIAL REGULATORY, ORGANIZATIONAL AND TECHNICAL SOLUTIONS

PRELIMINARY ASSESSMENT OF THE IMPACT OF THE INTRODUCTION OF DMP IN KAZAKHSTAN

The development of renewable energy, envisaged under the PB 2035, will lead to an increase in the variability of "net load" profile[10] and will require the introduction of significant amounts of maneuverable capacity. Preliminary assessment of the prospective generation structure in accordance with the forecast balance showed the need to introduce renewable energy curtailments in minimum summer and winter modes due to insufficient reserve for reduction. The introduction of DMP will reduce the frequency and size of these restrictions.

In order to demonstrate the effect, an assessment of possible coverage of the load profile for 2030 on the day of the summer minimum ± 3 days before and after was made. The volume of RES was adopted according to PB 2035, and profile of RES generation was calculated using specialized software (WindPRO and PVSyst). When dispatching existing and planned traditional power plants according to PB 2035, the type, maneuverability capabilities and technological limits of operation were taken into account.

The analysis showed that during the minimum load hours, the introduction of the DMP helps to reduce excess power and, consequently, to reduce the under-supply of electricity from RES by reducing the frequency and size of RES curtailments.

[9] The Law "On Support for Use of Renewable Energy Sources" defines the net consumer (Article 1) and measures of support for sale of electric energy produced by renewable energy facilities (Article 9). The Rules for electricity sale-purchase from net consumers (Order of the Minister of Energy of the Republic of Kazakhstan dated July 8, 2016 No. 309) were approved. These Rules define the procedure for purchase and sale of electricity from net consumers and procedure for mutual settlements, and according to which the "net consumer" can consume electricity from its own installation up to 100 kW, and give the surplus to the grid.

[10] "Net Load" is the load minus the generation of renewable energy sources covered by traditional generation sources.

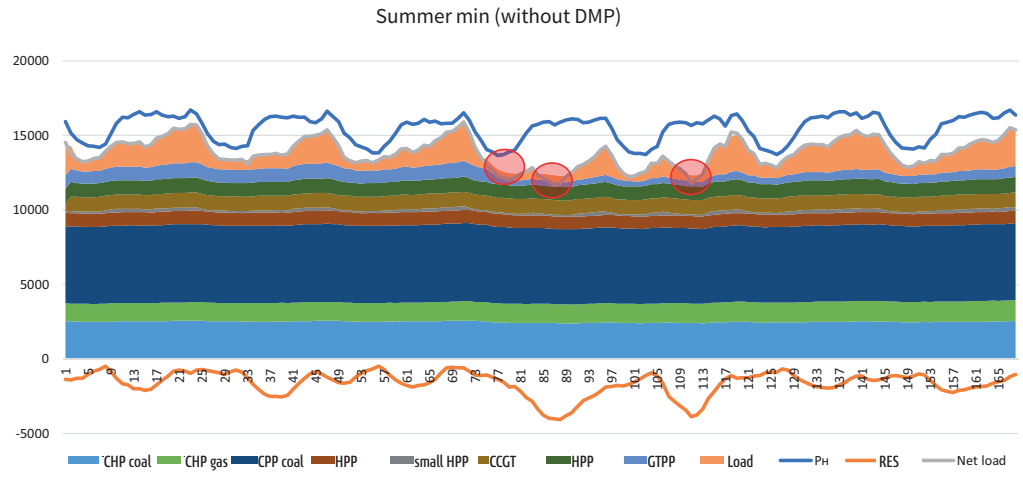


Figure 3. Coverage of summer daily profiles in 2030 (modeling)

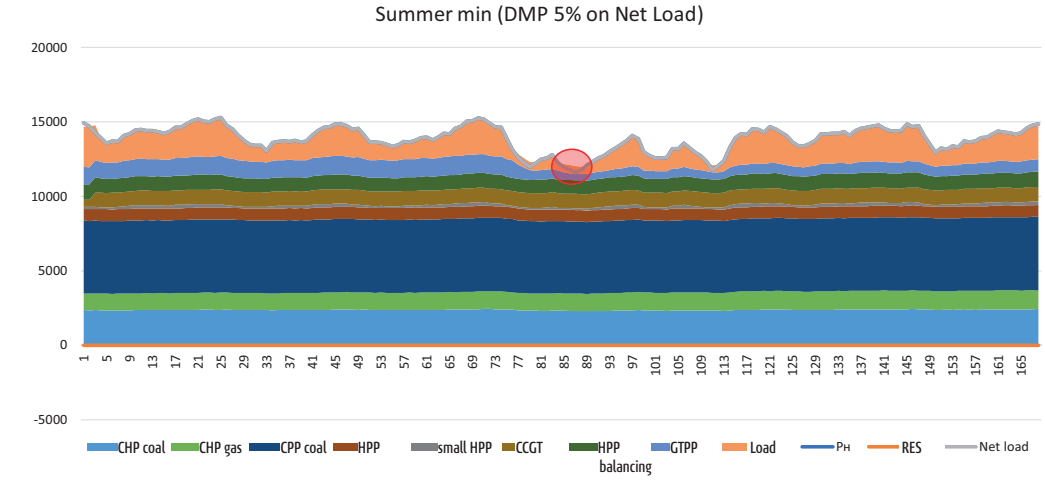


Figure 4. Coverage of summer daily profiles in 2030 with the use of DMP 5% on the "net load" profile (modeling)

In general, the overall assessment of the implementation of DMP in Kazakhstan in the amount of 10% of the load compared to the PB 2035 will lead to

- significant reduction in the need to curtail RES and an increase in the share of RES in electricity consumption by ≈ 3% (PB 2035 ≈ 20%),
- reduction of CUF of gas/coal CPP and emissions by more than 15% (PB 2035 ≈53% and 90 million tons CO_2).

THE INTRODUCTION OF DMP IN KAZAKHSTAN WILL LEAD TO REDUCTION IN RENEWABLE ENERGY CURTAILMENTS, AN INCREASE IN THE SHARE OF RENEWABLE ENERGY, A REDUCTION IN CF OF GAS/COAL CPP AND EMISSIONS.

In addition to creation of infrastructure and registration of demand aggregators, in order to implement the DMP, it is also necessary to make appropriate changes to regulatory legal acts in the field of electric power industry (the law "On Electric Power Industry", "Rules for Organization and Functioning of Wholesale Electricity Market, "Rules for functioning of balancing electricity market", etc.)

To determine the possibility of implementing the DMP system, a large wholesale consumers of the Republic of Kazakhstan – the main suppliers of this service should conduct a detailed analysis of this issue. Consumers often do not know the real flexibility potential of their consumption and therefore need expert support.

INTERVIEW

Ainur Tumysheva:

Investment Director of Hyrasia Energy

PRODUCTION OF "GREEN" HYDROGEN IN KAZAKHSTAN CAN BECOME A NEW AND PROMISING MARKET

Ainur, let's start, perhaps, with the answer to the question, who is the main consumer of "green" hydrogen?

In addition to the well-known hydrogen engines, hydrogen can be used in a wide variety of industrial sectors, especially where large amounts of energy resources are required. The "gray" hydrogen, which is produced from natural gas, has been used in production for more than 100 years, but this type is not considered environmentally friendly. Therefore, today we are focusing on a type of fuel that has the least impact on the environment. Hydrogen itself, among other things, can be used as a component and catalyst in the production of ammonia, the production of methanol, and various chemicals. Hydrogen is also used to purify oil, metals, in the production of fertilizers and food products.

The main consumers of "green" hydrogen are, first of all, industrial sectors that require a large amount of energy or clean fuel alternatives. The scope of its application is very wide.

The transition to clean energy sources today is the driver of the transformation of energy systems in many countries of the world. The development of hydrogen energy, in this regard, is a fairly new trend. What is the reason for development of this industry? What are the prospects for development of hydrogen energy? Ainur Tumysheva, Investment Director of Hyrasia Energy, answers these and other questions of our journalist.

For example, in oil refining, hydrogen is used in various processes at refineries, such as desulfurization and hydrocracking, to produce cleaner fuels with lower emissions.

In ammonia production, green hydrogen is a key ingredient that is used mainly for the production of fertilizers. Ammonia can also serve as a potential carbon-free fuel for ships.

The steel industry uses hydrogen in its production processes, mainly for direct reduction of iron ore and removal of impurities in production. In the chemical industry, hydrogen is an important raw material for various chemical processes, including the production of methanol, ammonia and other synthetic materials.

In the production of electricity, hydrogen can be used as fuel in gas turbines or fuel cells to generate electricity with minimal greenhouse gas emissions. Power plants can use hydrogen both in pure form and in a mixture with natural gas.

Green hydrogen can also be used in fuel cell vehicles as a clean alternative to internal combustion engines. Hydrogen engines offer zero-emission transportation because the only byproduct of using hydrogen in fuel cells is water vapor.

In addition, hydrogen can be stored and used as a medium of excess renewable energy, which allows it to be converted back into electricity if necessary.

The European Union has set itself big goals for the widespread use of "green" hydrogen by 2030. What volume of consumption is projected in the near future? What is the reason for the growing interest in "green" hydrogen?

The publication of REPowerEU plan in May 2022 demonstrates the hydrogen strategy of the European Commission aimed at further strengthening European ambitions for green hydrogen as an important energy carrier. The working paper (SWD/2022/230) accompanying this plan sets out a specific concept of a "hydrogen accelerator" to expand the use of green hydrogen in various industries and methods for decarbonizing the EU energy system. The goal is to independently produce 10 million tons by 2030 and import 10 million tons of “green” hydrogen to the EU.

The growing interest in "green" hydrogen arises from several factors. Firstly, there is a growing awareness of climate problems. With climate change and increasing greenhouse gas emissions, more and more people and organizations are realizing the need to switch to clean, low-carbon energy sources. "Green" hydrogen does not emit carbon dioxide during its production or use, which makes it a promising solution for reducing greenhouse gas emissions and achieving climate goals.

Secondly, the technologies of "green" hydrogen are developing. Advances in electrolysis technology, as well as economies of scale, will reduce the cost of producing “green” hydrogen. This will increase its competitiveness in the future compared to traditional fossil fuels and will contribute to its wider adoption.

Thirdly, there is an expansion of the use of "green" hydrogen. Hydrogen is a universal energy carrier that can be used in various industries, such as energy, transport, chemical industry, etc. It can serve as an energy carrier to store and transport renewable energy, as well as provide a clean alternative to fossil fuels in many sectors.

And the fourth is support from Governments and international organizations. Many countries, including Kazakhstan, as well as international organizations, recognize the importance of developing "green" hydrogen and are taking measures to stimulate its production and use.

SVEVIND company together with the Government of the Republic of Kazakhstan announced the construction of one of the world's largest plants for the production of "green" hydrogen in Kazakhstan in the Mangystau region. For what reasons was the western region of our country chosen for this project?

The growing interest in "green" hydrogen arises from several factors.


Hyrasia one

When choosing a site for the project, several factors were taken into consideration. One of the most important is renewable energy resources: the region has significant renewable energy potential, especially in the form of wind and solar resources. During the study of the World Atlas of Winds, it turned out that the wind speed and density in the Mangystau region is one of the strongest on the continent. The cost of producing "green" hydrogen strongly depends on the cost of producing alternative energy. Thus, access to renewable energy sources makes the production of the final product in the Mangystau region competitive in the market.

The next factor is access to water resources. It is no secret that "green" hydrogen is produced by electrolysis of water. Therefore, the presence of a certain amount of H2O is critically important for the project. Mangystau region benefits from proximity to water resources, including the Caspian Sea.

And last, but not least, is the strategic location of the region, providing access to both the domestic and international markets. Mangystau has access to transport routes, such as seaports and terminals, pipelines, railways, which are key points for the export of goods. Access to the Caspian Sea opens the way for the export of goods via the Trans-Caspian Transport route.

An important factor for development of hydrogen energy is access to water resources. Kazakhstan is limited in water resources, and the Caspian Sea is a closed reservoir – a drainless lake. In addition,

environmentalists are sounding the alarm that the Caspian Sea is getting shallow. In your opinion, will the launch of a hydrogen production plant aggravate the process of reducing the water resources of the Caspian Sea?

We are conducting a multi-year assessment of our project's environmental impact, not only on the flora and fauna of the Caspian Sea, on nearby territories, as well as on those territories where solar panels and wind turbines will be installed. All this is done according to the highest European ESG standards.

If we talk about the required volume of water, now we are working on detailing the technical process. Currently, we are studying various technologies, especially in the field of cooling equipment, for their technical, economic and environmental suitability for the production of green hydrogen in the Mangystau region. Depending on the results and the chosen technology, the final water demand can be calculated more accurately. Our current calculations show that the water intake of the project has an impact of less than 0.15 millimeters per year on the level of the Caspian Sea. Despite this, we are working on further reduction of this indicator.

From our point of view, it is also important to consider that the environmental benefits outweigh the disadvantages. For example, if we compare the classic ammonia production with the Hyrasia one green approach, we will save about 20 million tons of CO_2 per year. In addition, environmental toxins and other greenhouse gases are not released. These savings have an impact not only regionally, but also globally.

One of the urgent problems for hydrogen energy is its transportation. Taking into account the remoteness of Kazakhstan from Europe, how is it planned to carry out transportation, while ensuring safety for personnel and the environment?

"You're right. The transportation of hydrogen, especially over long distances, is indeed a big issue for the hydrogen industry. Ensuring the safety of personnel and the environment is of paramount importance when transporting hydrogen. In general, there are several possibilities for transporting “green” hydrogen from the Mangystau region to foreign countries.

One of the most common ways of transporting hydrogen is the use of special pipelines. Existing gas pipelines can potentially be repurposed for the transportation of hydrogen, taking into account certain modifications due to the different properties of hydrogen.

Hydrogen can be liquefied by cooling it to very low temperatures, which reduces its volume during transportation and facilitates storage and handling. Liquefied hydrogen can be transported in cryogenic tanks or specialized containers.

Our studied option for today is the conversion of hydrogen into ammonia, which is easier to

transport and which has a developed global transport infrastructure. Ammonia can be produced using hydrogen and nitrogen, and then transported using existing specialized ammonia tanks.

We are conducting an analysis on this issue together with DB Engineering & Consulting GmbH with the integration of international standards and safety rules for the entire supply chain. This includes complying with industry standards and regulations, implementing safety management systems, and conducting a thorough risk assessment at every stage of the supply chain.

One of the parameters for production of "green" hydrogen is the use of renewable energy sources for its production. How is it planned to solve this problem? Will the introduction of large RES capacities affect the imbalances in the energy system of the Republic of Kazakhstan? Is it planned to use the adjusting capacity (storage or maneuvering capacity) to align the schedule of renewable energy stations?

As part of our project, it is planned to build several thousand wind farms and install a large number of solar panels. I mentioned earlier that the total capacity will be about 40 GW.

Our project will operate entirely on autonomous power transmission. We will not connect to the energy system of the Mangystau region. A fully autonomous infrastructure will be built. The generated electricity will be supplied via its own ultra-high voltage transmission lines with a maximum capacity of 750 kilovolts. All the energy produced will be supplied to the production of green hydrogen.

As for the storage capacity, it is worth noting that the electrolysis capacity at our project will be about 20 GW, and the rest of the generated energy will be used for auxiliary processes such as ammonia synthesis and electrical losses.

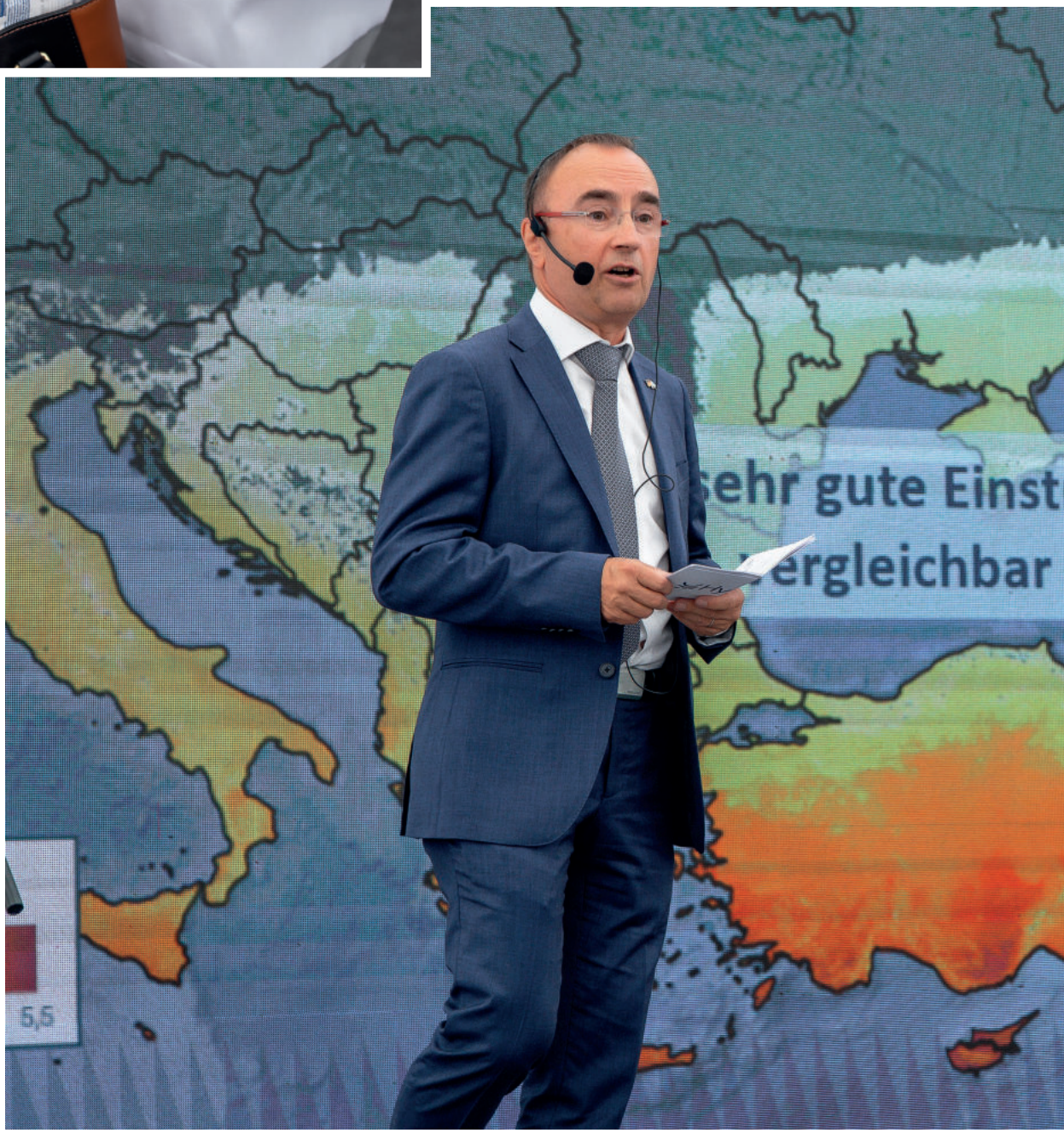
The combination of wind and solar energy and their distribution at different locations will ensure balanced electricity production.

Currently, we are developing a storage concept that ensures stable and safe operation, as well as a minimum cost of production (BESS (battery electric storage system) = a battery electric storage system will be part of this solution).

In addition, the correct arrangement of wind turbines and solar panels will make it possible to balance the generated electricity. Now we have already installed a number of weather masts, with the help of which we will choose the most optimal location of future wind and solar stations.

Our project will operate entirely on autonomous power transmission.

The President has repeatedly set the task of developing local content for the renewable energy sector. The production of solar modules is being launched in the country, transformers, cable products, metal structures are being produced. Given the large capacities for construction of renewable energy stations for the SVEVIND project, are there plans to use local equipment and components and involve local companies at the design and construction stage of the stations? How will this process be built?



The use of local equipment and components, as well as the involvement of local companies in such a large-scale project, of course, can have a number of advantages that should be taken into account.

Firstly, it can stimulate economic growth and development in the region by creating jobs and supporting local businesses.

Secondly, depending on the availability of local resources, purchasing equipment and components locally is often more cost-effective than importing them from abroad. Local suppliers can offer competitive prices and shorter deadlines, which reduces the overall cost of the project.

Thirdly, cooperation with local companies provides an opportunity for knowledge transfer and technology exchange. This allows local companies to acquire knowledge and experience in the hydrogen industry, contributing to the development of a skilled workforce.

Fourth, reliance on local suppliers reduces dependence on foreign sources and reduces the risks of disruptions in the global supply chain and potential logistical problems. This increases the sustainability of the project, ensuring a continuous and reliable supply of materials.

Fifth, local companies can provide ongoing support and maintenance, which allows them to respond more quickly to any operational problems.

And, of course, the use of local equipment and components can potentially reduce the carbon footprint associated with transportation and logistics. By minimizing the distance traveled to find materials, the project can achieve greater environmental sustainability and support the overall goals of green hydrogen production.

Taking into account all the above advantages, of course, we would like to involve local companies as much as possible. However, such decisions and conclusions can be made only after the completion of the design stages of the Hyrasia One project, i.e. Pre-FEED and FEED, scheduled for the end of 2024. It is also important to consider the availability of the necessary equipment, components and resources in the local market.

As a result of Pre-FEED and FEED, the basis of the design will be determined, the basic principles and concepts of procurement, construction, operation of renewable energy and industrial enterprises will be developed. At the Pre-FEED stage, the main parameters of processes and equipment will be determined, such as electrolysis, desalination of seawater, hydrogen storage, synthesis and storage of ammonia, heat recovery and cooling, heat storage and electricity generation, battery energy storage system, as well as wind turbine and photovoltaic energy production and transport.

In addition, the global scaling of the production of "green" hydrogen will require an increase in production capacity throughout the value chain. As part of the Pre-FEED, we are also exploring the possibilities of creating such production facilities and using the results obtained in negotiations with equipment suppliers.

As a result, by the end of 2024, a clear understanding of the necessary equipment, components and resources will be achieved for the implementation of the entire Hyrasia One project during the EPC phase.

At the same time, the procurement strategy will be developed taking into account the necessary materials and equipment, as well as taking into account the decisive factors. These include global production facilities and production areas, deadlines for order fulfillment, the competence of local suppliers, the availability of necessary materials and components.

But the Hyrasia One project requires not only high-tech equipment and components. It is important to note that the project requires a huge amount of construction materials. At the construction stage of the project, we really count on the local market and the availability of basic materials such as cement, concrete, steel structures, pipes, cables of all categories, electrical, control and measuring components, etc. To do this, we plan to involve local specialists. We hope for successful cooperation with local companies and manufacturers in the upcoming stages.

In conclusion, the last question: what value will the implementation of the project for the production of "green" hydrogen bring to the Republic of Kazakhstan?

As part of the project, about $50 billion will be invested in the economy of Kazakhstan. In addition to renewable energy facilities, a high-voltage power line, a plant for the production of hydrogen itself, water treatment and desalination facilities, the investor also undertakes the

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construction of all necessary infrastructure. Including highways, which will also be used by Kazakhstanis. Upon completion of road construction, the company will be ready to transfer part of the roads to the balance of local executive bodies.

The production of "green" hydrogen can become a new and promising market, new jobs will be created, innovations and the development of new technologies will be stimulated.

I would also like to note that we have preemptively addressed the issue of personnel training for our project, which will require a large number of technical specialists. As part of the visit of German Federal President Frank-Walter Steinmeier to Aktau, a capsule of the Kazakh-German Institute of Sustainable Engineering was laid. Representatives of German technical universities have already arrived in Kazakhstan, who will start training local specialists from September this year. Power engineers, geologists, surveyors, engineers and so on will be trained here. Some specialists will receive two diplomas at once within the framework of dual education – Kazakh and German.

Our company will require a large number of specialists of various professions. For example, several thousand jobs will be created only as part of the construction of the project. Since the start of the work of the enterprise itself (electricity generation and hydrogen production), about 1800 permanent jobs will be created.

As for the composition of workers, the main point, according to the plans of investors, it is planned to attract local workers, that is, Kazakhstanis. It is for this purpose that we are already creating a program to train local technical personnel. 90% of these 1,800 jobs will be Kazakhs. The same applies to the management staff – 90% will be citizens of the Republic.

"Green" hydrogen is produced from renewable energy sources, so its production does not lead to the emission of carbon dioxide and other harmful substances. Hydrogen is a clean and efficient source of energy. Its use makes it possible to reduce dependence on fossil fuels and improve energy security.

Thank you for the interview!

Artem Slesarenko:

KAZAKHSTAN NEEDS TO INCREASE LOCALIZATION IN RENEWABLE ENERGY

> **There are already enterprises operating in Kazakhstan that can participate in the construction of renewable energy projects**

In recent years, Kazakhstan has been increasingly talking about the development of renewable energy. The current shortage of electricity in the country and the global trend of switching from fossil energy sources to "green" forces the republics to look more and more towards the construction of solar and wind power plants.

Specific successes can be noted in this direction. Thus, according to the results of the first quarter of 2023, the installed capacity of renewable energy sources in Kazakhstan reached 2.5 gigawatts, and this is immediately a fifth more than a year earlier.

At the same time, electricity generation by renewable energy facilities amounted to 1.5 billion kilowatt-hours, which is 58.5% (!) more than the same period in 2022. Almost all of these volumes are provided by solar and wind power plants (approximately 1.1 gigawatts each).

But even larger volumes of renewable energy are expected to be built ahead: by 2030, Kazakhstan plans to increase the share of renewable energy sources in its energy balance from the current 4.5% to 15%. Indeed, the construction of new "green" projects is an absolute boon for the country, but what is known about them? Who builds them and where do the materials and equipment come from?

WHAT IS HAPPENING IN THE MARKET?

Modern “green" power plants – whether solar, wind or mini-hydroelectric power plants – are complex systems, mostly automated. Global manufacturers are constantly improving their solar panels or wind turbines to achieve maximum energy production while maintaining compactness.

If turbines with a capacity of 1 megawatt seemed normal five years ago, now advanced developments offer at least 5 megawatts. Conditionally, when installing 10 masts at a wind farm, it used to be possible to get 10 megawatts, and now it is many times more. And this means greater coverage of consumers from residential buildings to industrial enterprises.

In Kazakhstan, the production of such equipment has not yet been mastered – there are only plans. For example, within the framework of the construction project in the Zhambyl region of a 1 gigawatt wind farm, it is planned to localize the production of equipment for wind farms. Thus, in May it became known about the plans of the State Energy Investment Corporation of China to build in Kazakhstan “several modern plants for the production of towers, gondolas and blades for wind turbines.”

The Chinese company SANY Renewable Energy, which is one of the world leaders in the supply of such equipment, can become a partner of this industrial project. Tokan Zhanat, SANY's General manager for Central Asia, confirmed localization plans on the sidelines of QazaqGreenFest 2023 international renewable Energy business festival. However, according to him, it is still unclear what exactly and in what volumes will be produced.

Meanwhile, in the country, there is more and more talk on the market about the localization of other parts of renewable energy power plants - about metal structures and auxiliary construction. The fact is that a solar or wind

farm, like any other, requires a lot of construction work. For example, solar panels need to be installed on metal frames and connected to each other with special cables, and then all this should be brought into a common network.

Such structures and cables are already being produced in Kazakhstan. One of such enterprises is Profland company from Karaganda.

Founded in 2007, the plant annually processes about 5 thousand tons of steel and produces more than 10 thousand standard sizes of products – from metal profiles to cable products.

The production uses metal from the country's largest plant "ArcelorMittal Temirtau", which is processed using a variety of equipment from European, Turkish, Chinese, Russian and Ukrainian manufacturers.

ARTEM SLESARENKO, the founder of this company and independent director of the Renewable Energy Association "Qazaq Green", notes that in recent years the company has been trying to actively work in the renewable energy market. Thus, the plant offers a variety of equipment for solar panels: cables and solar profiles, as well as substructures for mounting panels on the roofs of buildings and the ground.

Thus, the company has already supplied 220 tons of metal structures for mounting solar panels to the Kengir power plant near Zhezkazgan with a capacity of 10 megawatts, as well as 1 thousand tons of metal structures to the Kaz Green Energy station with a capacity of 50 megawatts near the city of Balkhash.

LOCALIZATION IS A BIG PROBLEM

According to Artem Slesarebko, despite the successful participation in a number of projects, the market for the most part still remains closed to suppliers.

"WE ARE DEVELOPING THIS MOVEMENT, BUT WE ARE FACING PROBLEMS. FOR EXAMPLE, CHINESE INVESTORS COME (FOR THE IMPLEMENTATION OF A RENEWABLE ENERGY PROJECT. – ED.), AND THEY WANT TO BRING THEIR CHINESE CONTRACTORS WITH THEM. AND IF A LARGE RENEWABLE ENERGY PROJECT FOR 1 GIGAWATT ENTERS THE MARKET, THEY WON'T EVEN TALK TO YOU," SAYS THE INTERLOCUTOR OF QAZAQGREEN.

This situation is developing with almost all projects with foreign general contractors. Because of this, a "vicious circle" arises: foreign investors attract their contractors and suppliers due to the lack of well-known experienced suppliers in Kazakhstan, but at the same time such suppliers do not appear in our country precisely because existing enterprises are not attracted to the implementation of projects.

In this regard, the situation is similar to what has been happening in the oil and gas industry for many years. Much has been said and is still being said about local content, but it was often masked by the opening of local LLP or the creation of joint ventures by the same foreign suppliers. Because of this, money in the implementation of investment projects still went abroad, and did not go to the development of Kazakhstani industries or salaries of local specialists.

Only relatively recently – in 2020 – the country started talking and started creating a "Direct Investment Fund for the development of local content" and an "International Center for the Development of Oil and Gas Engineering and Service". The first one, as the Ministry of Energy reported back in 2021, was supposed to have a positive effect on GDP in the amount of about 270 billion tenge over 10 years. The second goal is to localize the production of goods and services for the needs of the largest oil fields – Tengiz, Karachaganak and Kashagan – through the opening of new production facilities and service centers, as well as expanding the capabilities of existing Kazakh suppliers.

"A LOCALIZATION STRUCTURE IN THE OIL AND GAS INDUSTRY HAS RECENTLY APPEARED. I DIDN'T BELIEVE THAT THEY WOULD WORK EFFECTIVELY, BUT THEY WERE ABLE TO LEAD US TO PROJECTS IN TCO. ALTHOUGH BEFORE THAT WE HAD BEEN QUEUING FOR CERTIFICATION FOR YEARS. BUT THE PROJECTS IN TENGIZ AND KARACHAGANAK ARE STORIES THAT ARE ALREADY COMING TO AN END IN TERMS OF INVESTMENTS," - ARTEM SLESARENKO NOTES.

But new opportunities are opening up in the renewable energy market to create and support local enterprises. The country has announced the implementation of large renewable energy projects with a capacity of 1 gigawatt, and construction of megaproject for the production of "green" hydrogen has begun in the Mangystau region. (it hasn't started yet. Design only.)

During the implementation of the latter, it is planned to build solar and wind power plants with a total capacity of 40 gigawatts – this is at least one and a half times more than the entire existing energy system of Kazakhstan at the moment. It should be noted that the project will produce up to 2 million tons of "green" hydrogen or 11 million tons of "green" ammonia per year.

Attracting Kazakhstani suppliers of goods and services can open up new opportunities for the growth of the processing industry. In this case, the real producers of the country will receive much more benefits than when implementing investment projects in the oil and gas industry.

But for this, the market needs to be developed today, Slesarenko believes. “Kazakhstan needs more such enterprises. Profland can produce products for solar power plants at 150-200 megawatts in capacity. But much more is needed, and there is no market. Why would anyone build if there is nowhere to supply? And there is no place to gain expertise,” he says.

The answer lies in the construction of more renewable energy power plants, and then it will make sense for existing players to expand production, and for new producers to enter the market.

However, the position of foreign investors who bring their contractors remains an obstacle. This can be corrected by taking several measures that will stimulate the customers of the stations to work with Kazakhstani suppliers.

Such measures may include the mechanism of premiums for auctions for the construction of renewable energy stations. This can be explained by an example: let's say two auction participants offer the same tariff of 15 tenge per kilowatt-hour. But one of them plans to attract local suppliers and provide local content, and then they can give such participant a “conditional premium” at a tariff of 2 tenge – 13 tenge per kilowatt hour instead of 15. And such participant will win thanks to the presence of local content.

A similar practice is already used in public procurement, where there are concepts of “conditional” discounts, as well as the company's work experience and other parameters are taken into account.

“IT WILL BE A FAIR GAME. IT IS POSSIBLE TO ISSUE SPECIAL CERTIFICATES TO MANUFACTURERS SO THAT AUCTION PARTICIPANTS CAN CONFIRM THE LOCAL CONTENT,”- ARTEM SLESARENKO BELIEVES.

In the meantime, Profland has participated in several projects for construction of solar power plants as a supplier of metal structures, and this participation was due to the fact that the local company Technogruppservice built the stations. Usually, the general contractors are foreign, and they prefer to work with their suppliers from their own countries.

The situation can and should be changed, - Artem Slesarenko believes. He notes the great advantages of local manufacturers: their enterprises are closer to the

implemented renewable energy projects and logistics for the delivery of equipment is faster. At the same time, Kazakh factories are more flexible than foreign ones — they can change their products to meet the individual needs of each individual project.

The large localization of projects in the renewable energy sector brings direct benefits to the whole country. This includes the expansion of the manufacturing industry, and the growth of qualifications and permanent employment of local personnel in production, as well as, of course, taxes for the budget. The global transition opens up new opportunities for the economy of Kazakhstan, and they need to be used for the overall benefit of the country.

INFORMATION ON PRODUCTION OF ELECTRIC ENERGY BY RENEWABLE ENERGY FACILITIES for the first half of 2023

INSTALLED POWER INCLUDING:

2 525 MW

WIND FARMS

1 107.5 MW

1 910 mln. kWh

SOLAR POWER PLANTS

1 148 MW

976.3 mln. kWh

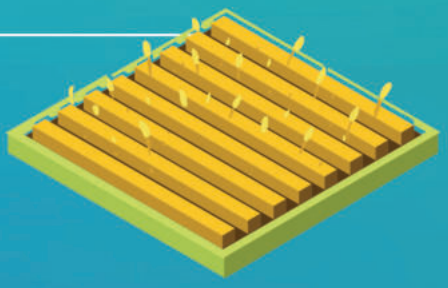
POWER GENERATION INCLUDING:

3 350 mln.kWh

SMALL HYDROPOWER PLANTS

267.4 MW

461.8 mln. kWh



BIO POWER PLANTS

1.77 MW

1.8 mln. kWh

Share of renewable electricity generation in total electricity generation is **5.8%**

Increase in electricity generation by renewable energy facilities for the first half of 2023 compared to the first half of 2022 is **40%**

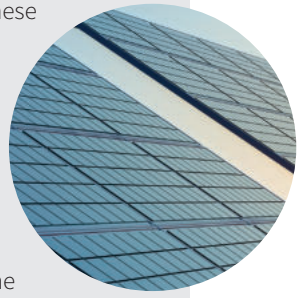
ENERGY STORAGE SYSTEMS: application, support, and challenges

photomate.eu
solar.huawei.com

EU EXPERIENCE: GOVERNMENT AND IFIS SUPPORT

As countries worldwide strive to achieve their clean energy targets and accommodate the growing presence of intermittent renewable power generation, energy storage systems are emerging as vital components in the development of modernised energy markets. These systems play a crucial role in smoothing out the process of renewable energy generation, balancing supply, and demand, as well as providing essential ancillary services like frequency and voltage control for grid reliability and stability.

Despite the rapid growth of battery storage projects, driven by technological advancements and cost reductions, these projects have predominantly been implemented in developed countries. *https://www.trinityllp.com/wp-content/uploads/2023/06/Trinity-Topics-Financing-Battery-Storage-in-Emerging-Markets.pdf*



According to BloombergNEF, in 2022, the energy storage market achieved a remarkable milestone, with the addition of 16 GW/35 GWh of capacity, reflecting a substantial 68% increase compared to the previous year. Notably, numerous markets made significant strides by setting ambitious energy storage targets surpassing 130 GW to be achieved by 2030. *https://about.bnef.com/blog/1h-2023-energy-storage-market-outlook /*

As reported by the European Association of Energy Storage (EASE), Europe will require a cumulative energy storage capacity of 187 GW by 2030 and 600 GW by 2050 to fulfil its renewable energy objectives. Nevertheless, despite the strict goals for reducing carbon emissions throughout the continent, the majority of countries have not yet developed a national strategy or set targets for the deployment of energy storage. However, there are some promising developments. *https://www.woodmac.com/news/opinion/europes-grid-scale-energy-storage-capacity-will-expand-20-fold-by-2031/*
The European Union (EU) is already actively supporting the development of energy storage capacities through various initiatives.

HUNGARY

For example, The European Commission has given its approval to Hungary's 1.1 billion Euro scheme to support large-scale energy storage projects, aimed at facilitating the country's transition to a net-zero energy system. The scheme aims to reduce Hungary's

dependence on fossil fuels and accelerate the integration of renewables into its electricity system. The funding will be available to energy sector companies within Hungary and can also be used for projects outside the country as long as they can provide power through cross-border transmission. *(https://www.energy-storage.news/eu-approves-e1-1-billion-state-aid-for-energy-storage-in-hungary /)*

ITALY AND SPAIN

Italy and Spain have also set ambitious targets to achieve 3 GW and 2.5 GW accordingly by 2030. For these aims, the Spanish government has introduced a funding scheme for hybrid energy storage projects that generate renewable electricity. Under this scheme, five projects with a combined installed capacity of at least 600 MW will receive financial support, specifically for the integration of storage technologies. *https://www.pv-magazine.com/2022/12/01/spain-provides-financial-support-for-600-mw-of-utility-scale-storage/.*

Italy is set to implement supportive measures with a dedicated funding of 450 million Euros. This funding aims to facilitate investments in the integrated production of renewable hydrogen and renewable electricity, including the development of storage capacities. The focus will be on brownfield industrial areas, fostering the smooth transition towards a net-zero economy. *https://safety4sea.com/eu-grants-italy-e450-million-for-renewable-hydrogen-production /*

GREEK

The Greek government has impressive plans too, offering financial assistance for the development of 900 MW of energy storage capacity through a tender. This initiative aligns with Greece's aim of deploying a total of 3 GW of energy storage by 2030, in order to reach its 70% renewable energy target. The process for procuring standalone energy storage is expected to begin this year. *https://www.energy-storage.news/gigawatts-of-energy-storage-projects-approved-in-greece-ahead-of-auction/*

BULGARIA

Promising movements are expected in Bulgaria, which rapidly gained a unique all-around interest for projects in the Renewable Energy Sector across the Balkans region. The local Ministry of Energy together with the European Bank for Reconstruction and Development (EBRD) have entered into two agreements in order to advance country's renewable energy development. They will be aimed at stimulation the expansion of PV capacities and deploying energy storage infrastructure under the Renewable Energy Sources Storage (RESTORE) program. *https://www.energy-storage.news/bulgaria-european-bank-for-reconstruction-and-development-sign-renewables-and-energy-storage-agreements/*

CROATIA

The Government of Croatia in its turn has allocated subsidies totalling EUR 60 million to encourage businesses in installing renewable power plants and batteries. This move also follows a growing trend in European countries to provide subsidies for energy storage facilities associated with new production capacities. Hence, companies, representing processing industry and heating sector are eligible

to apply for subsidies to construct PV plants, biomass- and biogas-fired power plants, as well as energy storage systems. However, there is a condition that the batteries are integrated within one of the specified power plant types and located on the premises. The battery capacity must not exceed 25% of peak daily energy production. *https://balkangreenenergynews.com/croatia-earmarks-subsidies-for-firms-for-batteries-to-store-green-energy/*

ESTONIA

In the meantime, Estonia provides grants for energy storage pilots, including 8MWh ESS. Its Environmental Investment Centre has awarded 5.2 million Euro to support 10 energy storage projects. These projects will involve both heat storage and electricity storage systems. With a goal to generate 100% of electricity from renewable sources by 2030, Estonia recognizes the importance of energy storage in balancing its renewable energy system. The funded projects will serve as pilot examples, showcasing the applications of energy storage to other interested parties. . *ttps://www.energy-storage.news/estonia-provides-grants-for-energy-storage-pilots-including-eesti-energias-8mwh-bess/*

UNITED KINGDOM

The UK government has allocated £30 million funding to support innovative projects focused on capturing and storing renewable energy for future utilization. The funding aims to assist pioneering businesses in testing and preparing their technologies for the energy market, thereby stimulating private investment and generating employment opportunities nationwide. *https://www.gov.uk/government/news/30-million-government-boost-to-capture-and-store-more-renewable-energy*

ENERGY RESILIENCE IN KAZAKHSTAN: ADDRESSING NEEDS THROUGH MODERN STORAGE SOLUTIONS

As for the Central Asian countries, especially, Kazakhstan, the extremely cold winters of 2022 demonstrated the need for structural reforms throughout the region. The reasons behind the last year's energy crisis included worn-out energy infrastructure, lack of investments in new facilities and modernisation of old ones, insufficient reserve capacity,

At the same time, the development of new facilities, especially wind and solar, do require addressing the issue of their unstable generation and upgrading the grid. In addition to implementing such flexible power sources, the deployment of energy storage systems and the introduction of Smart Grid technology are vital *https://www.pwc.com/kz/en/assets/energy-report/energy-report-rus-final.pdf*

This is ESS namely, that will have a crucial role in supporting Kazakhstan to meet its peak energy demands and driving country's transition towards clean energy.

Kazakhstan Electricity Grid Operating Company (KEGOC) has already announced a pilot project for the commissioning of electricity storage systems starting from 2024. Currently, work is are underway to determine the estimated project cost and prepare the terms of reference. The proposed pilot project is located at the 220 kV Zhanakorgan substation in the Kyzylorda region and aims to have a capacity of 5 MW / 20 MWh.

KEGOC expects this project to provide valuable insights into the operational characteristics of implementing Energy Storage Systems (ESS) in Kazakhstan's frigid climate. The grid operator also aims to identify the essential functionalities of these systems and establish technical standards for ESS and their seamless integration into the country's power grid *https://lsm.kz/v-kazahstane-budut-po-novomu-reshat-problemy-elektroenergii*

ESS INSIGHTS: AIMS, APPLICATIONS, AND ESSENTIAL METRICS

Energy storage systems have various applications in different fields. They can be used for peak shaving, load shifting, production peak shifting, and providing system services. ESS also play a crucial role in frequency voltage and grid regulation, particularly for primary regulation due to their fast response. They can be used in combination with PV, wind, hydro, gas, or as standalone systems. Additionally, ESS can facilitate the black start of thermal stations and support trading activities, allowing energy to be bought and sold based on market demand.

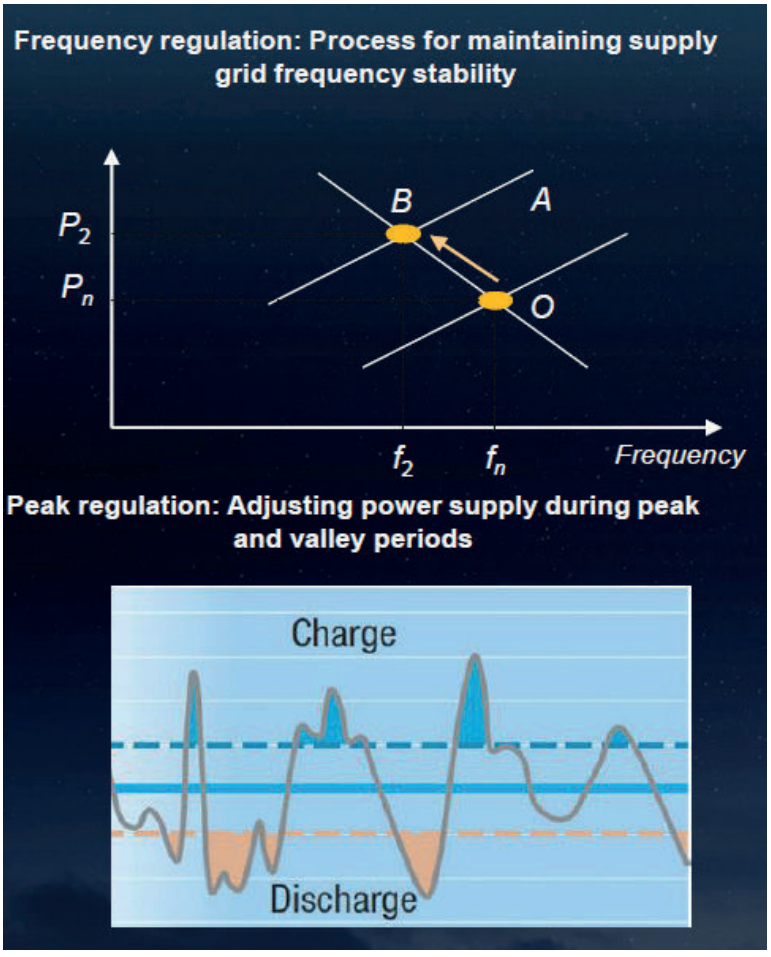
By implementing energy storage systems in countries with consistent emergency shutdowns, the reliability, resilience, and flexibility of the energy infrastructure can be significantly improved. This, in turn, helps mitigate the adverse effects of shutdowns,

ensures continuity of critical services, and enhances the overall energy security of the country.

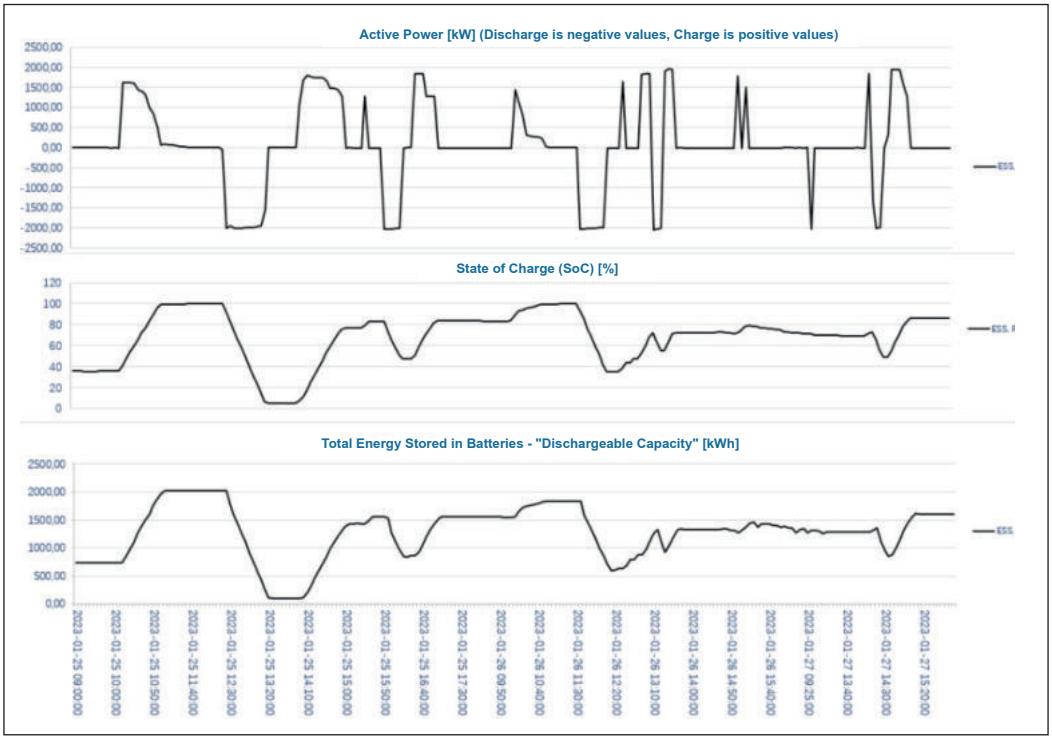
EXAMPLES OF ESS PROJECTS OF VARIOUS SCENARIOS REALISED ON HUAWEI EQUIPMENT

1 SWEDEN: FREQUENCY REGULATION

In certain regions, like Scandinavia, the demand for grid maintenance services, particularly grid frequency and voltage regulation, has given rise to a flourishing market. Among the diverse array of solutions available, energy storage systems have emerged as an optimal choice for fulfilling these crucial roles. Their inherent flexibility and scalability allow for seamless system expansion, enabling them to efficiently regulate the frequency of the electric network.

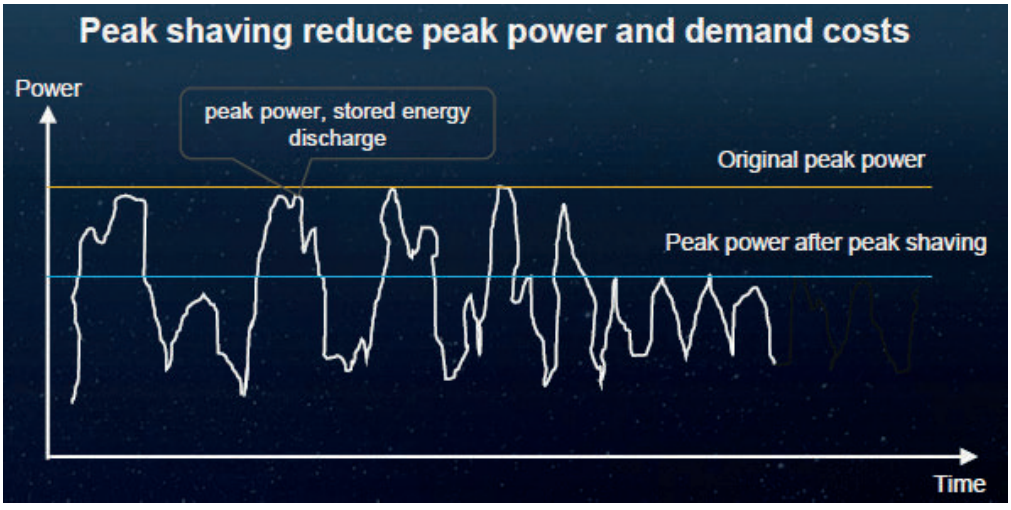


The real example of ESS work in such mode is illustrated below



2 CHINA – EV CHARGING STATION – PEAK SHAVING TO AVOID GRID CAPACITY MODERNIZATION *https://drive.google.com/drive/folders/1CF-tjmDb9kSvGQeO6ButY4SMnx4lMcx8*

With the rise in power consumption due to electric vehicle charging stations expansion, existing facilities require substantial power supply upgrades. However, installing an Energy Storage System can avoid costly retrofits by efficiently providing electricity to cover peak loads. ESS in Peak shaving mode ensures a smooth operation, effectively managing real load peaks and reducing strain on the power supply system.



3 8MWH ESS PROGRAM OF JIANGSU CENTURAY FACTORY, CHINA – BATTERY BACKUP AVOID PRODUCTION INTERRUPTION, SAVE ELECTRICITY COST $0.45 M/YEAR

In the commercial sector or manufacturing, network downtime leads to costs. Solar Power Plants (SPPs) require an electric network to function and in case of electricity shutdown stop working without it. To prevent production interruptions, Energy Storage Systems can be installed for backup power. During a network outage, the ESS becomes the primary electricity source, ensuring continuous operation for the SPP.

4 BUI HYDRO-SOLAR PV HYBRID (HSH) SYSTEM, GHANA

Thanks to Huawei solution that delivers easy maintenance, secure and safe performance and uses high-density lithium batteries, Ghana is on track to achieve its goal of universal access to electricity by 2025. The country is developing a hybrid project, combining hydro and solar capacities with battery storage units to provide a stable supply of power to the grid day and night.

To help provide a continuous supply of electricity from the hydro dam, even when water levels are low in the dry season, the BPA added the solar element to the existing hydropower plant, harnessing the country's abundant solar resources to generate clean power for Ghana's national grid.

The combination of hydro and solar power, alongside Battery Energy Storage System is what enables the plant to provide a stable supply of power to the grid day and night. This is important for the energy security of Ghana.*https://www.pv-magazine.com/press-releases/west-africas-first-hybrid-power-plant-demonstrates-successful-mix-of-solar-and-hydropower/*

5 THE LARGEST ENERGY STORAGE SYSTEM IN SOUTHEAST ASIA, SINGAPORE

Another landmark project, realised on Huawei equipment, was officially launched in Singapore this February, enabling the largest ESS in Southeast Asia. Commissioned in six months, the facility is the fastest in the world of its size to be deployed. The implemented solution maintains optimal temperatures for stable power output, and offers four-layer safety protection, ensuring the project's stability and safety. The project will enhance the power grid stability and resilience, contributing to Singapore's goal of a net-zero future. *https://www.linkedin.com/posts/huawei-digitalpower_energystorage-ess-netzero-activity-7027177552062386176-QVIs?utm_source=share&utm_medium=member_desktop*

6 HUAWEI IS SET TO ENERGIZE THE WORLD'S LARGEST ESS PROJECT – THE RED SEA PROJECT, 1300 MWH, SAUDI ARABIA

Huawei was also chosen to provide its flagship FusionSolar Smart PV + Storage solution that includes the 1300 MWh energy storage system for the world's largest autonomous facility (microgrid) based on Energy Storage Systems (ESS). ESS serves here as a backbone and establishes the network for the solar power station, while also fulfilling the role of storing excess electricity generated by the solar power station during the day to cover loads in the evening and at night.

This project, situated in Saudi Arabia, will definitely become another remarkable endeavour, aimed at achieving complete reliance on sustainable sources, making Battery Energy Storage Systems (BESS) a crucial component. *https://feico.co.th/huawei-to-power-the-worlds-largest-energy-storage-project/*

POWERING ESS DEVELOPMENT: HUAWEI AND PHOTOMATE'S IMPACT AND VISION

As renewable energy and electric vehicles demand continue to grow globally, conventional power grids face challenges transitioning from centralised to distributed generation. Huawei is committed to ensure grid stability, intelligent collaboration and scheduling essential technologies. Through innovation, Huawei enables industries to lower energy consumption, transforms their energy mix, and makes clean and affordable energy accessible worldwide.

Being a leading provider of digital power solutions, Huawei produces smart PV & storage equipment applicable for three application scenarios – utility-scale, commercial & industrial, and residential.

With more than 10 years of R&D experience in energy storage systems that integrates digital, power electronics, and energy storage technologies, Huawei Smart String ESS overcomes the limitations of lithium batteries and adopts pack-level optimization, rack-level optimisation, distributed cooling, and all-modular design, enabling the batteries' full charging and discharging potential and providing optimal LCOS for PV plants. The system ensures complete safety through a robust four-layer protection system, encompassing cell-level short circuit detection, pack-level safety shutdown, rack-level overcurrent protection and fault isolation, and system-level intelligent fire suppression.

All the mentioned solutions are already available for the Central Asian market via Photomate, official VAP and CSP partner for Huawei Digital Power products distribution.

The goal of the company is to supply smart and reliable solar equipment with maximum technical support for our customers in the regions of the company's presence.

Over the past 7 years, Photomate, together with partners, has taken part in the implementation of projects with a total capacity of more than 11 500 MW. Huawei's solutions made it possible to implement projects of various scenarios and capacities: from residential installations (2 kW) to utility-scale SPPs (340 MW).

Photomate was involved in procurement and delivery of BESS for Short Johansfors project in Sweden mentioned above. Huawei was responsible for negotiation with the customer and commissioning of the system. The work was finished in January 2023. After commissioning was performed, energy capacity test followed for the EN 62933. Since February 1st BESS has been sold to a new owner, who is now interested in signing new projects with both companies.

Photomate is currently expanding its' portfolio with the upcoming ESS projects in Estonia, Poland and Czech Republic, that will be put into the operation until the end of 2023.

PHOTOMATE IN NUMBERS:

Active in 23 countries

5 800 MW +
sold in 2022

430 205 kWh +
sold in battery capacity

165 *trainings in 2022*

Together with Huawei, Photomate is committed to introduce reliable and uninterrupted access to clean energy sources for all Central Asian countries, extremely requiring new generating capacities not only to reach their green energy transition targets, but also gain energy independence and grid stability.

The article was prepared by Photomate Kazakhstan team

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INTERVIEW

Ms. Christine Lins:

THE DRIVING FORCE BEHIND THE TRANSITION TO GREEN ENERGY IS RENEWABLE ENERGY SOURCES

The modern world is smoothly drifting towards achieving complete decarbonization of the energy sector by the middle of this century. What is the role of renewable energy sources in this process, how is the policy of national governments changing in this regard, what problems do we have to face, what is the role of women in the energy transition? About all this - in an interview with Ms. Christine Lins, Co-Founder, Global Women's Network for the Energy Transition (GWNET).

Ms. Christine Lins, how important is energy transition for different nations? What is the role of renewables in the process of decarbonization?

The Paris Agreement means nothing less than a total decarbonization of the energy sector at least by 2050. Renewables play a major role in that process. According to REN21's recently launched Renewables 2023 Global Status Report, the ongoing energy crisis, exacerbated by Russia's invasion of Ukraine, has exposed the vulnerability of fossil fuels, bringing more attention to renewable energy as a stable and cheaper energy source.

Although deployment of renewable energy is showing steady growth, they accounted only for 12.6% of total final energy consumption in 2021, while fossil fuels remained at 78.9% and nuclear and traditional biomass at 8.5%. With a record 30% share, renewable electricity is driving the energy transition. Solar photovoltaics (PV) had another record

year of growth in 2022, with a 37% increase in additional installed capacity.

National governments are increasingly recognising the economic and social benefits of renewables. By the end of 2022, 128 countries had in place economy-wide targets for renewable energy, although only 31 countries had targets for 100% renewables, most of them for the year 2050. Deployment of renewables contributes to growth in gross domestic product and creates employment opportunities. In 2021, renewable energy employment increased to reach a record high of 12.7 million jobs; women are still underrepresented in the energy sector.

What common challenges for many countries with high dependence on fossil fuels in electricity generation and heating in the process of energy transition?

It is clear that there will be winners and losers in the energy transition. Research has discussed the expected challenges of fossil fuel producing countries, which risk losing parts of their economies' production capacities, and thus their wealth. The following challenges will be of particular importance:

1. Assessing the macroeconomic implications for fossil fuel reliant countries, taking into account the timeline of the transition
2. Modelling the various price dynamics that could occur as the demand for fossil fuels declines
3. Economic diversification of such countries
4. Identifying scenarios in which the international community compensates states for voluntarily stranding their fossil fuel reserves.

How the energy crisis in Europe effected the EU policies on energy transition? Can we assume the renewables as a mechanism of the energy sustainability and as we can say – national security?

The global energy crisis, characterized by supply chain disruptions, price volatility, and geopolitical tensions, has underscored the importance of energy security. European countries aim to enhance their energy security by reducing dependence on fossil fuel imports and diversifying their energy sources through renewable energy developments. This is highlighted by the emergence of energy related policies such as the European Union's REPowerEU, which aims to bridge the gap between regional energy supply and demand through renewables.

What are the current trends which will make and influence for the future development of renewables? Do you think that energy storage technologies may help to provide with solution for disbalances in the grid from renewables?

There is a growing trend towards decentralized energy systems, where small-scale renewable energy installations, combined with energy storage, cater to local communities and enhance grid resilience.

Furthermore, the rise of electric vehicles presents opportunities for vehicle-to-grid solutions, allowing EV batteries to store and supply electricity back to the grid when needed, thereby contributing to grid stability.

Finally, sector coupling will play a key role in future energy transition scenarios. To achieve significant decarbonization, all major sectors that contribute to emissions such as electricity generation, transportation as well as heating and cooling need to be addressed. Sector coupling facilitates the integration of renewable energy across these sectors, allowing for more efficient and widespread decarbonization.

There is a new direction, which seriously affects many energy policies – development of "green" hydrogen. Besides the fact that technologically there a lot of issues, do you think that it may negatively effects on ecological conditions, for example, water resources sustainability?

CHRISTINE LINS has been promoting the transition to renewable energy sources and energy efficiency for the past twenty years. Her career started in Austria, where she was born and grew up, then spread to the European and global level.
While working in Brussels, she helped create the European Renewable Energy Council. In July 2011, she was appointed as Executive Secretary REN21, a 21st Century Renewable Energy Policy Network headquartered at the United Nations Environment Programme in Paris, France. In May 2017, she co-founded the Global Women's Network for Energy Transition (GWNET)

Green hydrogen is hydrogen produced through a process called electrolysis, where water is split into hydrogen and oxygen using renewable energy sources like solar, wind, or hydroelectric power. It is considered a clean and sustainable energy carrier since its production does not release carbon dioxide or other greenhouse gases. However, the production of green hydrogen does have some potential implications for water scarcity.

The process of electrolysis requires a significant amount of water to produce hydrogen. In regions already facing water scarcity, this could exacerbate the problem. If water is diverted from essential uses like agriculture or drinking water to produce hydrogen, it may worsen water scarcity issues and have negative impacts on local communities.

To address these challenges and ensure sustainable green hydrogen production, several measures can be taken:

1. Water-efficient electrolysis technologies: Carrying out research on improving the efficiency of electrolysis processes to minimize water consumption while maintaining high production rates.

2. Water recycling and reuse: Implementing strategies to recycle and reuse water during the hydrogen production process can help reduce overall water demand.

3. Site selection: Choosing locations for green hydrogen production where water resources are abundant can mitigate the impact on regions already experiencing water scarcity.

4. Integrated water management: Governments and industries should develop integrated water management plans that consider the needs of all stakeholders, including the potential impact of hydrogen production on local water resources.

It's crucial to strike a balance between the benefits of green hydrogen as a clean energy carrier and the potential impacts on water resources to ensure a sustainable energy future.

How important is to secure the gender balance in the energy sector? What problems women are facing with in the energy sector and how fostering of participation of women in the development of renewable may help the processes of transition?

The energy sector workforce is characterised by a gender gap greater than most other sectors. As stated in the report “Renewable Energy: A Gender Perspective” by the International Renewable Energy Agency (IRENA), the energy industry is far from being gender-balanced with only 22% of women in the oil & gas sector workforce and 32% in the renewable energy workforce. According to Ernst & Young’s Women in Power and Utilities Index, only 5% of board executives and 16% of board members of the top 200 utilities are women.

In the Global Roadmap for Accelerated SDG 7 Action in Support of the 2030 Agenda for Sustainable

Green hydrogen is hydrogen produced through a process called electrolysis, where water is split into hydrogen and oxygen using renewable energy sources like solar, wind, or hydroelectric power.

Development and the Paris Agreement on Climate Change, published in early November 2021 and taking into account the UN GA High Level Dialogue on Energy, UN Secretary-General Guterres emphasizes that “gender equality and women’s empowerment must be prioritized, including empowering women in the design, production and distribution of modern energy services, including for productive uses, as well as equal representation of women in decision-making processes in the area of energy”.

Women have a lot to offer for the sustainable energy sector. Scientific research has found that a diversified workforce delivers better results, not only in terms of increased creativity and innovation potential, but also related to better decision-making and greater profits. Initial research findings have also led to conclude that companies with more women on their board of directors are inter alia more likely to invest in renewable power generation, mitigate climate change and proactively address environmental concerns. Still, this potential has not yet translated into a substantially narrower gender gap in the energy sector. Considering that the workforce in the renewable energy sector is predicted to rise from 12,7 million jobs today to about 42 million jobs in 2050, the attraction of female talent will be crucial to ensure a thriving sector.

Could you tell us about Global Women’s Network for the Energy Transition (GWNET) and how women from Kazakhstan can participate?

A group of senior energy professionals including myself got together in 2017 to create GWNET, the Global Women’s Network for the Energy Transition, a global network aimed at empowering women working in sustainable energy in both developed and emerging/developing countries at different career levels from both the public and private sector through interdisciplinary networking, advocacy, training and mentoring.

The network which currently consists of over 3.500 members from 150+ countries is open to individuals and corporations who are committed to gender balance in the energy sector and who wish to connect with their peers to advance the energy transition more rapidly.

In 2022, we implemented a women empowerment project for women in energy from Central Asia on behalf of OSCE. In March 2022, 28 women from all five Central-Asian countries were selected for participation in the programme. The participants came from a range of backgrounds and included engineers, researchers, financiers, and entrepreneurs. They worked for NGOs, universities, utilities, energy companies, international organizations, and investment funds, on energy efficiency, hydrogen, hydropower, waste-to-energy, solar PV, community energy and many other issues. The highlight of the programme for many was the study tour to Vienna, which took place in late October/early November 2022. Seventeen participants enjoyed five days of high-level meetings, site visits, a leadership workshop, and the 5th Vienna Energy Security Dialogue, convened by OSCE and the World Energy Council (WEC).

Currently, a study on study on women in Central Asia's energy workforce is about to be finalized and will be released soon. Stay tuned!

Khorlan Ayazbekova, Head of Strategy Office, Department of Strategy and Investment Portfolio Management, NC KazMunayGas JSC

SUSTAINABLE WASTE MANAGEMENT IN THE CONSTRUCTION SECTOR IS AN IMPORTANT FACTOR IN REDUCING EMISSIONS IN KAZAKHSTAN

About 80% of building materials around the world end their life in the form of waste, which has a great impact on the environment. Production and construction account for 13% of direct greenhouse gas emissions, as well as a significant share of emissions from electricity production. recycling of building materials is a promising solution that will help reduce greenhouse gas emissions and reduce the negative impact of construction waste.

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Possible mechanisms for stimulating the reuse of building materials can be exchange and resale, as well as recycling. The exchange and resale of building materials includes the collection of materials, such as bricks, doors, windows and lumber, from demolition or repair work. Another mechanism is creation of building materials exchanges, which are institutions where builders and individuals can donate, buy or exchange used building materials. Such exchanges are designed to promote the reuse of building materials and reduce the amount of waste that ends up in landfills. Recycling involves splitting construction waste into its component parts and using them to create new materials or products. For example, concrete can be crushed and reused as a filler, and scrap metal can be melted down and turned into new steel products. Recycling can create new products or materials that have a higher value than the original waste. For example, recycled wood can be used to make furniture or decorative items, and recycled metal can be used to create sculptures or works of art. Reuse of building materials in Kazakhstan can help reduce greenhouse gas emissions in several ways: reducing the carbon footprint during production; reducing emissions associated with the transportation of new building materials to construction sites; reducing construction waste, since their degradation is accompanied by methane emissions. For example, in Shanghai, it was estimated that saving 1 ton of construction waste is equivalent to saving 100.4 kg of carbon emissions.

At the moment, research and understanding of the regulatory and institutional framework necessary to support mechanisms for reuse of building materials, as well as potential role of government incentives in promoting sustainable construction methods, have been completed. Thus, this study aims at developing appropriate policy recommendations to support sustainable construction methods.

EFFECTIVE PRACTICES OF REUSE OF CONSTRUCTION WASTE

The European region is the leader in the amount of recycled and reused construction waste. In particular, countries such as Germany, the Netherlands and Sweden have achieved certain results in this direction.

GERMANY IS CONSIDERED A LEADER IN THE FIELD OF CONSTRUCTION WASTE MANAGEMENT. THE COUNTRY HAS ESTABLISHED A COMPREHENSIVE LEGAL FRAMEWORK FOR WASTE MANAGEMENT, INCLUDING RULES REQUIRING THE RECYCLING AND REUSE OF CONSTRUCTION WASTE. FOR EXAMPLE, ABOUT 90% OF MINERAL CONSTRUCTION WASTE IN GERMANY IS PROCESSED IN AN ENVIRONMENTALLY FRIENDLY WAY. IN GENERAL, ABOUT 70% OF ALL CONSTRUCTION AND DEMOLITION WASTE IS RECYCLED AND ONLY 4% IS DISPOSED OF. THE MAIN DRIVERS FOR THIS ARE:

– Advanced waste management practices. For example, the approach of the circular economy "KreislaufwirtschaftBau" at first set goals to reduce waste, and now it is engaged in monitoring and quantifying the total amount of waste generated and their processing.

– Good public awareness and responsibility for creation of waste help to preserve the value of building materials.

– Certification assessments of environmentally friendly buildings contribute to adherence to the principles of sustainable development.

– Many sustainable initiatives, for example, concrete and gypsum recycling, monitoring systems, etc.

Another key policy that has contributed to Germany's success in waste management is the principle of "product quality responsibility". This means that manufacturers are responsible for the waste produced by

their products and are required to collect and recycle their products at the end of their life cycle. This policy creates a financial incentive for manufacturers to develop products that are easier to recycle and use recycled materials in their products.

THE NETHERLANDS IS ANOTHER EUROPEAN COUNTRY THAT HAS MADE SIGNIFICANT PROGRESS IN THE MANAGEMENT OF CONSTRUCTION WASTE. THE COUNTRY HAS IMPLEMENTED A "CLOSED-LOOP ECONOMY" APPROACH TO WASTE MANAGEMENT, IN WHICH PRIORITY IS GIVEN TO THE REUSE AND RECYCLING OF MATERIALS, WHICH IS A KEY FACTOR CONTRIBUTING TO THE SUCCESS OF THE NETHERLANDS IN WASTE MANAGEMENT. THE GOVERNMENT OF THIS COUNTRY HAS IMPLEMENTED POLICIES AND PROGRAMS THAT ENCOURAGE THE REUSE AND RECYCLING OF MATERIALS, AS WELL AS SET GOALS TO REDUCE WASTE AND INCREASE REUSE.

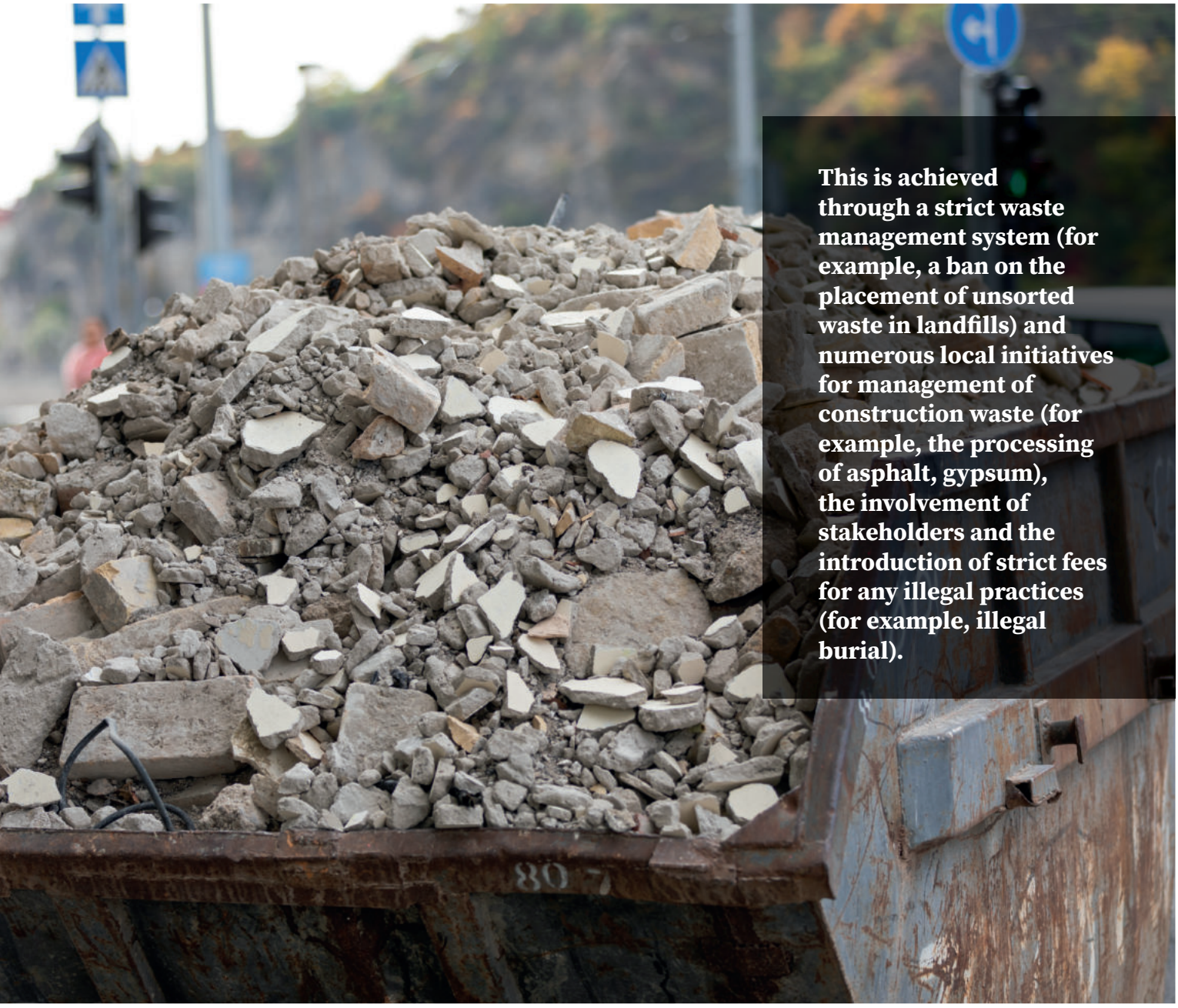
In the Netherlands, most of all construction and demolition waste is recycled into material for the foundation of roads, new residential areas and industrial zones. However, buildings are almost never built from recycled products. In civil engineering in the Netherlands, the use of recycled materials is a daily occurrence: more than 50% of the materials used (excluding earthworks) consists of recycled materials that are used functionally (and thus replace primary raw materials). For example, in the Netherlands it is often necessary to build on "weak" soil (for example, peat), which requires a strong foundation. However, there are practically no suitable raw materials (for example, rubble stone), and secondary substitutes (recycled aggregate) perform this function just as well. In terms of infrastructure, the Netherlands finances modern waste recycling facilities, including waste-to-energy plants and sorting and recycling centers. These facilities allow efficient recycling of various types of waste, including construction and demolition waste, and minimize the amount of waste entering landfills.

The Swedish waste management system is known for its high efficiency and low level of disposal, as well as its emphasis on recycling and converting waste into energy. This is achieved through a combination of policies, regulations, and infrastructure investments. Construction waste management in Sweden has an almost 50% recycling rate and a 1% disposal rate. Mineral-type construction waste is reused in the construction of roads and embankments, and wood waste is burned as fuel. This is achieved through a strict waste management system (for example, a ban on the placement of unsorted waste in landfills) and numerous local initiatives for management of construction waste (for example, the processing of asphalt, gypsum), the involvement of stakeholders and the introduction of strict fees for any illegal practices (for example, illegal burial). These policies create financial incentives for the sustainable management of construction waste, as well as provide support in the decision-making process with the help of accessible infrastructure (waste-to-energy plants).

SUSTAINABLE CONSTRUCTION IN KAZAKHSTAN

In Kazakhstan, the construction sector, which generates the largest amount of industrial waste, is facing rapid growth due to rapid economic development and accounts for 6% of the country's GDP. The development of the construction industry with the support of government initiatives over the past two decades has contributed to an increase in the production of building materials by more than three times. The largest city in Kazakhstan, Almaty, an economic and cultural center, has experienced the first analysis of the closed–loop economy in Central Asia. At the same time, it was found that the industry does not use the full potential of preventing the formation and recycling of waste.

There are various state initiatives that support "green" construction. According to the new Environmental Code, landfills will not accept construction debris from 2021. Another example is the Affordable Housing 2020 Program (Government Decree No. 821 of 2012, expired in 2014), aimed at attracting private investment in the construction of housing stock and the development of public-private partnerships. The program is aimed at developing construction industry, introducing new technologies and using building materials that meet the requirements of energy efficiency and environmental safety. In 2023, the amended UNDC was approved.



This is achieved through a strict waste management system (for example, a ban on the placement of unsorted waste in landfills) and numerous local initiatives for management of construction waste (for example, the processing of asphalt, gypsum), the involvement of stakeholders and the introduction of strict fees for any illegal practices (for example, illegal burial).

Thus, the new legislative act contributes to: 1) the use of alternative building materials instead of cement, steel, aluminum with a lower or zero GHG emission intensity; 2) an increase in the volume of waste processing (including scrap) to reduce the need for processing raw materials as the main source of industry emissions; and 3) the introduction of new production technologies with zero greenhouse gas emissions in combination with capture and carbon storage. In addition, the importance of improving the skills of those responsible for making political decisions for the development of a "green" economy in Kazakhstan is emphasized. The "Green Taxonomy" of Kazakhstan (2021) includes "green" buildings as a separate classification, which shows the strategic importance of adopting sustainable technologies in the construction sector. As threshold indicators, the taxonomy refers to international construction standards (LEED, BREEAM, EDGE, DGNB).

Speaking about corporate initiatives, KazGBC trains specialists in the principles of "green" construction. The Almaty Master Plan develops more environmentally friendly principles aimed at making Almaty a "city for people". ArchCode encourages citizens to participate in debates on

deciding the fate of architectural heritage. At the same time, the EBRD is developing a project involving the creation of a centralized facility for the processing of construction and demolition waste in order to reduce the reuse of resources. In addition, the EBRD is developing a roadmap and technology that will allow the development of low-carbon cement. While JSC NC KazAvtoZhol used ash and slag waste in road construction as a substitute for natural stone materials.

A number of requirements were set for improving energy efficiency in industry and the housing sector in 2015. Including: mandatory energy reporting, energy audit and energy management plans for more than 9,000 large installations; introduction of standards defining the thermal characteristics of buildings for new construction and modernization projects; indication of the energy efficiency class on appliances and equipment. The OECD reports that, according to data for 2014-2017, the dynamics of the volume of work performed on "green" construction tends to increase.

The IEA in its report claims that in the construction sector, existing measures do not equate to a comprehensive set of codes covering new construction and capital modernization, and local authorities do not ensure effective compliance with energy performance certificates. Industry represents 15% of the demand for petroleum products in 2020, especially in ferrous metallurgy, mining and construction. The development of the construction sector in Kazakhstan

At the same time, the EBRD is developing a project involving the creation of a centralized facility for the processing of construction and demolition waste in order to reduce the reuse of resources.

(new buildings) and the high demand for heating due to cold winters may lead to an increase in emissions, which indicates the need for appropriate measures, as well as controls to promote energy efficiency. Despite the fact that energy efficiency requirements have been in effect for ten years, the available data indicate that energy efficiency has not been given priority in the design, construction and operation of buildings, and there are concerns about their implementation and compliance. For example, building certificate is issued at the design stage and is not subject to subsequent verification of actual energy consumption. Moreover, local authorities reportedly do not necessarily take into account the energy characteristics of the building when issuing construction permits. Energy intensity levels in Kazakhstan are among the highest in the world, which provides significant opportunities for improving energy efficiency, especially in the building sector.

The number of plants for processing construction and demolition waste in Kazakhstan is limited. Therefore, construction companies face certain problems. For example, they claim that Kazakhstan lacks standards for the storage and disposal of construction debris. In Kostanay region, only a few enterprises have installed equipment for processing wood, concrete and plastic. But these volumes are only a small part, because construction debris is also plastic, roofing materials, floor coverings, glass and much more.

In 2017, about 6% of construction waste was buried. In general, waste generation in the construction sector tends to increase over time. Construction and dismantling works lead to the formation of waste, which is mostly inert and has a high potential for disposal or backfilling. Although there is statistical information on construction and demolition waste in Kazakhstan, additional information on their management is limited. Table 1 shows that it is not indicated how much construction waste is reused or recycled, there is data only regarding industrial waste. The official statistics also do not indicate the amount of greenhouse gas emissions from the construction sector, the figures are given for the entire industrial sector (see table 2).

Currently, there is no infrastructure for recycling materials, which is the main obstacle, according to stakeholders of the Kazakh construction sector. In addition, there is no database for relevant materials from other projects for new designs. An important criterion for choosing materials is the ratio between price and quality. However, information about the origin of the components of materials is often missing, which makes it difficult to determine their suitability for recycling. Contractors face problems with waste management, including a lack of detailed information on disposal, coordination between design and construction teams, late ordering of materials, insufficient awareness of personnel about waste prevention and insufficient quality control of incoming materials. However, the development of waste management plan could significantly reduce the amount of construction waste, and most respondents recognize its potential usefulness.

Table 1– Waste generation in construction in 2010-2021 Source: stat.gov.kz

	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Production and consumption waste generation*													
Construction	1000 t/ year	-	-	-	-	-	-	273,1	410,2	478,4	477,1	358,8	499
Total waste generated	1000 t/ year	-	-	-	-	-	-	320 946	405 023	445 417	515 958,1	457 931	777 765
of these, waste by source**													
Construction (ISIC 41-43)	1000 t/ year	202,5	165,1	138,8	267,6	247,4	225,6	185,5	107,9	82,2	363,7	220,6	30,7

Table 2– GHG emissions in the industrial sector (2010-2020). Source: stat.gov.kz

	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Industrial processes, the use of solvent and other products	Million tons / year	18,74	19.08	19.02	21.19	20.56	22.42	23.02	23.39	22.37	20,87	22.29

WHAT TO DO?

Thus, the growth of construction in Kazakhstan continues to create construction waste, however, due to the ban on the disposal of construction debris and in the context of a limited number of processors of construction debris and a limited number of rules and regulations for the placement and storage of construction debris, this creates a problem for construction sector companies that do not know how to properly dispose of waste. Reuse of construction waste can help reduce waste, conserve natural resources and reduce greenhouse gas emissions, as well as create new jobs. All this can be achieved by combining the adoption of appropriate policies for investment in processing infrastructure.

Here are some key policies that can support the development of the construction and demolition waste recycling industry:

1. A review of the literature, laws, and strategic documents showed that Kazakhstan currently lacks specific goals for (a) the amount of recycling of construction waste, (b) the number of greenhouse gas reduction targets associated with the construction sector. In particular, such targets should be added to the following documents: "Green Taxonomy", Environmental Code, NDC RK and other national strategies and plans for waste management.

2. It is necessary to develop norms and rules for the disposal and storage of construction debris, a waste management plan for construction sector to facilitate the waste treatment process. These plans may include strategies for waste prevention, recycling, and the use of recycled materials in new construction projects.

3. Adaptation of existing certifications on sustainable construction (for example, LEED, BREEAM, etc.) to Kazakhstan regulatory acts and realities can contribute to the promotion of sustainable construction methods.

4. Development of financial incentives (subsidies, tax incentives, government orders, loans with low interest rates) to support the development of a closed-cycle economy in construction. For waste sorting landfills – setting payments for each ton of sorted construction debris.

5. Support of innovations and technologies, research to

identify new ways of using construction waste through grant programs in educational institutions and cooperation with industry.

6. Training programs and campaigns to raise awareness of stakeholders (citizens, politicians, construction sector workers) about the methods of sustainable management of construction waste, reuse and recycling of waste.

7. The main limitation in this study was the lack of statistics on the amount of waste generated in the construction sector of Kazakhstan. Nevertheless, monitoring the amount of construction waste, monitoring the amount of recycled waste, monitoring greenhouse gases associated with the construction sector can contribute to understanding the potential impact of reuse of building materials on reducing greenhouse gas emissions. Future research may be conducted in the field of quantification of construction waste.

The article is prepared within the framework of internship in SEC "Green Academy"

FROM MINERS TO RES OPERATORS. HOW COLLEGE FROM KARAGANDA TRAINS EMPLOYEES OF GREEN ENERGY

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Karaganda Higher Polytechnic College keeps up with the times and offers educational programs for "green" economy.

Although Kazakhstan's energy system is still mainly coal-fired, the renewable energy sector is developing and becoming more visible.

By the end of 2022, according to the Ministry of Energy of the Republic, the share of RES in electricity generation reached 4.5%. In total, 12 renewable energy projects with a total capacity of 385 MW were implemented throughout the country last year, and this year they plan to introduce another 15 projects with a capacity of 276 MW. There are still many new renewable energy power plants ahead: last year it was reported that a total of 40 projects are planned to be implemented by 2025.

The stations do not work out of thin air – they need specially trained specialists (more than 3 thousand people until 2025). If earlier workers from traditional energy were retrained "in process and in practice", now many universities and colleges in Kazakhstan have launched specialized educational programs. Karaganda Higher Polytechnic College is one of them.

THE FIRST MINING COLLEGE OF THE COUNTRY

The history of the college begins in the 1930s, when development of Karaganda coal basin began, and it was the city of Karaganda that was to become the base for supply of coking coal to the metallurgical plants of Ural.

The newly created coal basin was in dire need of qualified personnel, and one of the solutions was the opening of educational institutions "on the spot". The first of them was the Karaganda Higher Polytechnic College.

However, then it had a different name and its prototype was the educational and production plant at the trust "Karaganda". It included a coal mining college, which solved the issue of training medium-technical personnel for the mines of Karaganda. For a long time, it remained the only educational institution in Kazakhstan that trained miners.

In 1936, the first graduate of the mining college was 16 people, and in 1937 130 people were already trained. The educational institution has been operating for nine decades, and during this time about 60 thousand graduates have been trained, who actualized in their profession. Many of them are successfully building careers at

manufacturing enterprises, making a significant contribution to the development of the economy of Kazakhstan.

Karaganda Higher Polytechnic College today is an educational institution that annually proves its status as one of the best in its field with its achievements.

Thus, in 2020, the college became a participant in the project “Zhas Maman-2020” in four professions included in the “Atlas of new professions and competencies of Kazakhstan". At the same time, the Center for Foresight and Innovation Competencies “Zhas Maman” was created.

The educational laboratories of the center are equipped with innovative equipment of the latest generation. The main emphasis is placed on automation and digitalization of production technologies and processes, with the help of which college students can master the features of modern production.

In addition, in 2020, Creative Thinking Center was launched within the walls of the college, which is designed to form the competencies of the XXI century among students, improve the quality of education and competitiveness of college graduates in their future professional activities.

NEW PERSONNEL FOR A NEW INDUSTRY

All this work is aimed at achieving the main goal – to give students an up-to-date education with which graduates will be in demand in the labor market. Success in this direction is clearly seen in the example of Department of “Energy Disciplines”, established in 1993.

Now it trains specialists in the field of energy and thermal power engineering in the direction of “Engineering and Practice of engineering” and the group of educational programs “Electrical Engineering and Energy". Such programs include “Electrical equipment”, “Thermal power plants of thermal power stations” and “Renewable energy".

The latter opened in 2021 according to the Atlas of New Professions. The main goal of this program is to train a new generation of specialists in the field of renewable energy in accordance with the requirements of employers and the needs of the labor market.

Together with theoretical training, it includes industrial training and professional practice. The practice is divided into educational, industrial and pre-graduate.

Educational and familiarization practice is conducted on the basis of the college to inform students of safety regulations, familiarization with the base of production facilities, where in the future they will be sent to undergo professional and industrial practices.

The terms and content of industrial training and professional practice are determined by the educational process plan and work curricula, and the evaluation of learning outcomes is confirmed by various types of control – this is both the current control of academic performance, and intermediate and final certification.

Tests and term papers are carried out at the expense of the study time allotted for the study of the module, and exams – within the time allotted for intermediate or final certification.

Most of the industrial training and professional practice are conducted on the basis of industry enterprises – these are “Karagandy Zharyk” LLP, “SES SARAN” LLP, “Nurkuat Energy” LLP and “220 VOLT” LLP, with which relevant contracts have been concluded.

Educational, introductory and locksmith-mechanical practices are conducted within the premises of college itself, in the training centers “Energopark”, “Zhas Maman”, in the workshops of the college.

The final stage of training, in accordance with the recommendations of the managers, the final certification in the form of qualification exams.

Training in this relevant specialty for the economy of Kazakhstan brings the Karaganda Higher Polytechnic College to the leaders in training personnel for the “green” economy. After all, the massive development of the renewable energy sector in the country is simply impossible without professional workers.

An important part of this work is the college's membership in the Association of Renewable Energy “Qazaq Green” as accredited observers. This helps the educational institution to “keep abreast” of the development of the industry and adapt to its changes.

WHY DOES KAZAKHSTAN NEED ITS OWN BIOFERTILIZER HUB?

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Sultan Kaspakov,
"QazBioEnergy" LLP

The development of this sector will increase efficiency in agriculture and at the same time increase Kazakhstan's exports.

Agriculture remains one of the key sectors of the Kazakh economy, which simultaneously provides food security for the whole country and permanent jobs for rural residents. At the same time, it has a negative impact on the environment. The fact is that farming is associated with greenhouse gas emissions, especially methane, a gas that contributes to global warming and climate change on Earth.

Because of this, the industry is constantly looking for solutions that will help reduce the impact of agriculture on the environment. Biogas plants have become one of such solutions, which help to reduce methane emissions and, at the same time, produce energy for the needs of citizens and enterprises – primarily in the agricultural industry.

Biogas plants are systems that use organic material to produce biogas, from which thermal and electrical energy can then be generated. Thanks to this, it turns out not only to reduce greenhouse gas emissions, but also to provide additional generation capacity for the country's energy system. For Kazakhstan, this is the way to achieve the UN Sustainable Development Goals and the development of alternative energy sources.

There are already several successful examples of the operation of biogas plants in the republic. One of such projects is biogas plants seven kilometers from Kogershin settlement in the Zhambyl region. Here, on an area of 30 hectares, there is a pig-breeding complex, the daily productivity of biogas is 5,300 cubic meters per day.

In Kostanay region, on the territory of Karaman-K farm, a biogas plant has been operating since 2011, where annual energy generation exceeds 100 thousand kilowatt-hours. In the East Kazakhstan region, a biogas plant is operating in Privolnoye settlement on the basis of Bagration farm, which allows processing 10 tons of manure per day and producing 400 cubic meters of gas. In the Aktobe region, Sazdy settlement, a biogas plant operates in the Bolashak farm and allows receiving two cubic meters of biogas per day.

One of the active players in this market is “QazBioEnergy" LLP. On July 5, the Director of this company Sultan Kaspakov told about the prospects of biogas production by his example at the National Forum on Methane in Astana.

QazBioEnergy has been promoting biogas technologies in Kazakhstan for several years, supporting an eco-friendly approach to waste management in agriculture and energy production. So, for four years of operation, the company produced more than 11 million kilowatt-hours of electricity worth more than 400 million tenge, for which more than 220 thousand tons of chicken manure were processed. The company has trained 20 locksmiths and operators in the methods of operating a biogas plant to produce biogas.

At the same time, there are a number of obstacles to the development of this industry. One of them is subsidized tariffs and their indexing. The relevance and potential profitability of these indicators in Kazakhstan has been steadily decreasing over the years, and as a result, financial interest in biogas projects is weakening, and their implementation is being delayed more and more every year.

The solution to this problem may be transition of the input tariff to the indexing mode, which entails regular updates and re-indexing on an annual basis.

The significant capital costs associated with the implementation of the biogas project make it less competitive compared to wind and solar power plants. Therefore, it is possible to increase the cost of a kilowatt-hour for biogas energy.

Another important problem is the availability of funding for such projects. There are about 60 meat and egg poultry farms in Kazakhstan in the country, and this is a promising market for biogas plants.

But this sector depends on government subsidies and is currently experiencing difficulties in terms of qualitative development, which leads to the closure and bankruptcy of many enterprises. Unfortunately, not every poultry farm has the finances to secure long-term bank loans for construction and equipment, not to mention covering all project costs.

Despite the considerable interest of entrepreneurs in the implementation of such projects, the high costs and technological difficulties associated with the maintenance of biogas plants puts off even the largest market players.

This situation highlights the critical dependence of the biogas industry on the availability of fast and affordable financing options. Currently, most of the available financing programs require a minimum investment of at least 30% of the project cost, which makes it almost impossible to build a high-quality biogas plant.

According to the company “QazBioEnergy", to solve these problems and promote the mass construction of biogas plants in all regions of Kazakhstan, the industry needs special financing programs and attracting investment capital.

Such initiatives will provide the necessary financial support and incentives for the development of the biogas industry in the country. Now the introduction of biogas plants at enterprises is mostly the enthusiasm of individual managers.

If we talk about the prospect of mass introduction, it is necessary to oblige large poultry farms to process manure at biogas plants, but in view of the difficult situation of existing poultry farms, this is not feasible.

SULTAN KASPAKOV BELIEVES THAT AS A FIRST STEP, IT IS NECESSARY TO OBLIGE NEW POULTRY FARMS TO INTRODUCE BIOGAS PLANTS THAT ARE BEING BUILT "FROM SCRATCH". THOSE SMALL POULTRY FARMS THAT CLEARLY CANNOT AFFORD SUCH PROJECTS, COMBINE INTO CLUSTERS AND RECYCLE WASTE FROM TWO OR THREE POULTRY FARMS AT ONE LARGE STATION IN THE REGION, SINCE THE CONSTRUCTION OF ONE LARGE STATION IS MUCH CHEAPER THAN THE CONSTRUCTION OF TWO SMALL ONES.

In addition, there are problems associated with the production of biofertilizers. Despite the fact that existing biogas plants in Kazakhstan produce from 5 to 20 tons of biofertilizers per day, none of them undergoes further processing into the format of granular organic fertilizer NPK.

The main reason for this lies in the high cost associated with the creation of a pellet production shop, which usually requires a minimum investment of 200 million tenge. Not every biogas plant can afford it, and the lack of an affordable market for organic fertilizers further reduces the incentives to create processing enterprises.

To solve these problems, strategies should be explored that encourage the creation of processing plants and stimulate the demand for organic fertilizers on the market. This may include the implementation of financial support programs or creation of partnerships between biogas plants and interested players in agriculture to ensure a permanent and profitable market for organic fertilizers.

Using the potential of biofertilizers and promoting value-added products, Kazakhstan can gain additional economic and environmental benefits in the biogas industry.

The dominance of subsidized mineral fertilizers in the market inadvertently led to the marginalization of organic fertilizers, which made further processing unprofitable for biogas plants and burdened farmers with unreasonable costs.

However, we must not forget that organic fertilizers have significant advantages in comparison with mineral analogues, since they improve soil health and eliminate the need for idle land.

Many large agricultural countries are actively acquiring this type of fertilizer. Unfortunately, the current market conditions make financial investments of ordinary farmers in organic biofertilizers unprofitable.

To solve this problem and use the potential of organic biofertilizers, Sultan Kaspakov proposes to create a large center of wholesale and distribution trade in Kazakhstan. It will serve as a centralized authority for procurement and standardization of all available biofertilizers from biogas plants.

At the intergovernmental level, this will facilitate the export of these standardized biofertilizers to foreign players. This initiative will serve as the agricultural equivalent of "Financial Settlement Center" in the renewable energy sector, providing a stable channel for trade in organic biofertilizers.

By creating such a hub, Kazakhstan will be able to open up new opportunities for both the biogas industry and farmers. This will provide a much-needed market for biogas plants to sell their biofertilizers and encourage them to invest in further processing.

At the same time, the hub will give farmers access to high-quality organic biofertilizers at more affordable prices, which will allow them to improve soil health and increase productivity in their farms.

Moreover, the creation of an international export market for organic biofertilizers will strengthen

Kazakhstan's position as a player in the global agricultural sector. This initiative will not only support the country's economic growth, but also contribute to sustainable farming practices and environmental conservation.

In the world market of biofertilizers, the average price is about 120 thousand tenge per ton, which gives opportunities for profitable trading. Biogas plants in Kazakhstan with a pricing strategy that allows them to sell biofertilizers at a price of 50 thousand tenge per ton can get more than 50% margin. This will make it possible to make significant investments in the proposed center of wholesale and distribution trade.

WITH THE CREATION OF THE HUB, KAZAKHSTAN WILL BE ABLE TO MEET THE GROWING DEMAND FOR BIOFERTILIZERS AROUND THE WORLD. EVERY YEAR, THE HUB CAN RECEIVE MORE THAN 50% OF ITS INCOME FROM THE SALE OF FERTILIZERS, AND THE CONCLUSION OF LONG-TERM CONTRACTS FOR PURCHASE OF BIOFERTILIZERS WILL INCREASE THE INVESTMENT ATTRACTIVENESS OF BIOGAS PROJECTS.

In addition, the hub can establish strong ties with the Ministry of Agriculture of Kazakhstan, which will allow for distribution within the country and facilitate the export of surplus fertilizers. Together with competitive prices, this will benefit all interested parties.

With connection biogas plants to the hub, the process will become even more efficient. Biogas plants can focus on electricity generation, as the hub becomes the sole buyer of biofertilizers.

Biogas plants will no longer need to spend time and resources searching for buyers, and farmers will receive reliable supplies of environmentally friendly fertilizers, attracting new investments and introducing sustainable farming methods. At the same time, it will be easier for banks to finance projects with 100% sales of products, which will increase their confidence in lending to the sector.

Thus, cooperation between biogas plants, the hub and the Ministry of Agriculture will contribute to the creation of sustainable and profitable ecosystem that will benefit all stakeholders.

TECHNICAL COMMITTEE 117: TOWARDS THE STANDARDS OF THE FUTURE

CREATED IN NOVEMBER 2020, THE TECHNICAL COMMITTEE 117 SETS ITSELF TASKS AIMED AT UNLOCKING THE POTENTIAL OF RENEWABLE ENERGY, DEVELOPING SPECIFIC PRACTICAL RECOMMENDATIONS FOR CREATING A FOUNDATION FOR THE GROWTH OF RENEWABLE ENERGY.

Alan Bokayev,
Chief Specialist, ECOJER Association

APPROVED STANDARDS

SOLAR ENERGY (7)

- ST RK "Photovoltaic (PV) systems. Characteristics of interface nodes"
- ST RK "Photovoltaic devices. Part 1. Measurement of photovoltaic volt-ampere characteristics"
- ST RK "Renewable energy. Solar energy. Solar cells. Technical description and technological data of crystalline silicon-based solar cells"
- ST RK "Ground-based photovoltaic stations. Design Guidelines and recommendations"
- ST RK "Solar thermal installations and their components. Solar collectors. Part 1. General requirements"
- ST RK "Electric cables for solar panels"
- ST RK "Solar photovoltaic energy systems. Terms, definitions and designations"

WIND POWER (2)

- ST RK "Guidelines for the design of wind farm grounding system to ensure the safety of personnel"
- ST RK "Monitoring of condition and diagnostics of wind turbines. Part 1. General requirements"

GEOTHERMAL ENERGY (1)

- ST RK "Heat pumps. Principle of operation and use of renewable energy sources"

HYDROGEN (1)

- ST RK "Hydrogen is gaseous. Filling stations"

This year, in accordance with the National Standardization Plan for 2023, 12 standards are being developed, expected to be approved in 2024.

STANDARDS UNDER DEVELOPMENT

SOLAR ENERGY (2)

- ST RK "Photovoltaic systems. Operational characteristics. Part 1. Monitoring"
- ST RK "Photovoltaic autonomous systems. Serviceability testing"

WIND POWER (3)

- ST RK "Wind energy generation systems. Part 26-1. Availability of wind power generation systems"
- ST RK "Renewable energy. Wind energy. Wind power installations. Part 21-1. Measurement and evaluation of electrical characteristics. Wind turbines"
- ST RK "Wind turbines. Part 11. Methods for determining the characteristics of acoustic noise"

HYBRID RENEWABLE ENERGY SYSTEMS (2)

- ST RK "Recommendations on small renewable energy systems and mixed systems for rural electrification. Part 9-3. Integrated systems. User Interface"
- ST RK "Recommendations on small renewable energy systems and mixed systems for rural electrification. Part 9-4. Integrated systems – user installation"

HYDROGEN (4)

- ST RK "Connecting devices for refueling ground vehicles with gaseous hydrogen fuel"
- ST RK "Hydrogen generators based on the electrolysis process"
- ST RK "Gas storage devices transported. Hydrogen absorbed by reversible metal hybrid"
- ST RK "Hydrogen is gaseous. Filling stations. Part 5. Distribution hoses and hose assemblies"

STORAGE FACILITIES (1)

- ST RK "Recommendations on small renewable energy systems and mixed systems for rural electrification. Part 8-1. Selection of batteries and battery management systems for autonomous electrification systems. A special case of automotive lead-acid batteries available in developing countries"

The structure of the technical committee consists of five subcommittees: solar, wind, hydro, geothermal and alternative energy.

One of the main activities of TC 117 is the development of national standards of the Republic of Kazakhstan in accordance with modern international standards (ISO / IEC / CEN) in the field of renewable energy.

On July 1, 2023, the Committee of Technical Regulation and Metrology of the Ministry of Trade and Integration of the Republic of Kazakhstan approved 11 national standards in the field of renewable energy developed by RSE "KazStandart" in accordance with the National Standardization Plan for 2022.

The national standards of the Republic of Kazakhstan must comply with modern international standards. To stay in the trend, it is necessary to prepare the standards of the future right now, which is directly related to the use of green technologies.

KAZAKHSTAN IS MASTERING THE PRODUCTION OF "GREEN" TECHNOLOGIES

The country may have its own enterprise for the production of components for wind farms

In May, during the state visit of Kazakhstan President Kassym-Jomart Tokayev to China, several important documents were signed that will give a new impetus to the development of renewable energy in our country.

One of them is the construction of a 1 GW wind farm in Zhambyl region. A memorandum of co-operation to kick-start this project was signed in Xi'an by the Samruk-Kazyna JSC, the Ministry of Energy of Kazakhstan, the China Power International Holding Ltd. (CPIH) and SANY Renewable Energy Co., Ltd (SANY RE).

This project, as officially announced, will increase the total installed capacity of renewable generation in Kazakhstan by 40 %. At the same time, an energy storage facility will be built next to the park of "wind turbines", which will smooth out fluctuations in wind generation when weather conditions change.

This project will become another renewable energy "giant" that is planned to be realized in Kazakhstan. Similar plans have already been announced, for example, by France's Total Eren and Saudi Arabia's ACWA Power. In all cases, they are talking

about the construction of 1 GW wind farms, which will contribute to the fight against energy shortages in the country.

However, the difference between the Chinese project and others is the plans to localize the production of equipment for wind farms. Thus, in May it became known about the plans of the CPIH to build in Kazakhstan "several modern plants for the production of nacelles and blades for wind turbines".

SANY RE, one of the world's leading suppliers of such equipment, may become a partner of this industrial project. Mr. Tokhan Janat, General Manager of SANY RE for Central Asia Region, reminded on the sidelines of the international RES business festival "QAZAQ GREEN FEST 2023" that Kazakhstan has very good conditions for the development of wind energy.

He also confirmed that there are indeed plans for localization as part of the wind farm construction project. However, according to him, it is yet to be determined what exactly will be produced and in what volumes.

"We have concluded an agreement for (the construction of a wind farm with a capacity of. - Auth.) 1 GW with the Samruk-Kazyna JSC, and one of the investors will be the CPIH. This includes our localization plan - to organize the production of elements in Kazakhstan. There will be meetings on what exactly to produce. Kazakhstan has a lot of resources that are needed for the production of equipment elements, and this proximity is convenient for organizing production," Mr. Tokhan Janat said.

Meanwhile, the Kazakh media reported back in April that SANY proposed to build a plant for the production of wind turbine towers in Zhambyl region. The estimated design capacity of the enterprise will be 200 sets of towers per year, the total investment volume will be 23.6 billion tenge. It is also planned to create about 160 new permanent jobs.

MEANWHILE, KAZAKHSTANI MEDIA REPORTED BACK IN APRIL THAT SANY RE PROPOSED TO BUILD A PLANT IN ZHAMBYL REGION TO PRODUCE WIND TURBINE. MR. TOKHAN JANAT MEANWHILE POINTED OUT THAT SANY RE ALREADY OFFERS KAZAKHSTAN PARTNERS TWO TYPES OF WIND MODULES WITH 5 MEGAWATT AND 6.25 MEGAWATT TURBINES. "THEY ARE VERY SUITABLE FOR THE CONDITIONS OF KAZAKHSTAN," THE SPEAKER EMPHASIZED.

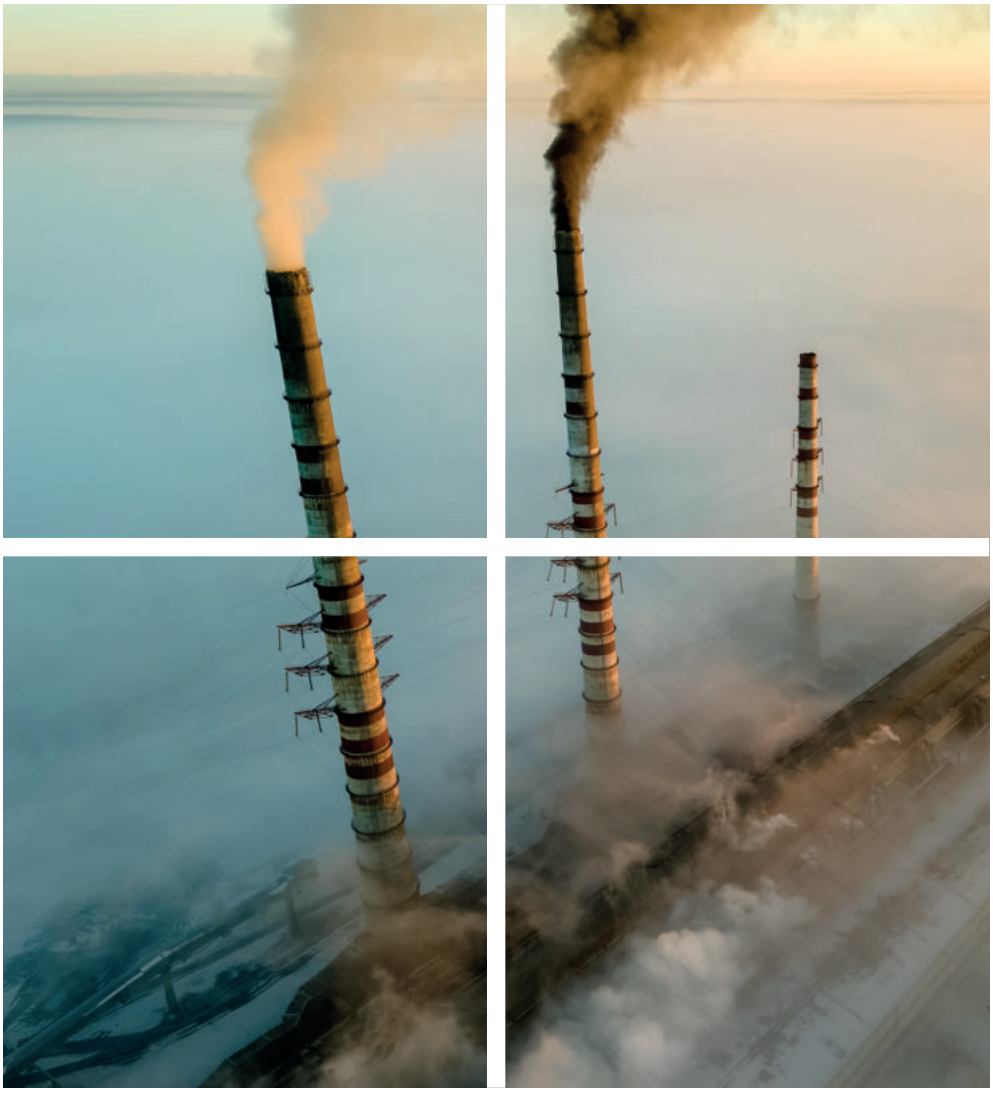
By the way, in Kazakhstan, this company has already acted as a supplier of equipment for several RES projects. One of them is a wind farm near the town of Arkalyk in the Kostanai region. There they are installing 10 sets of equipment with turbines with a capacity of 4.8 MW each. Thus, the capacity of the future station will be 48 MW, and it will be able to provide the surrounding rural areas and businesses with clean energy.

It should be noted that Chinese partners are generally actively involved in Kazakhstan's RES projects. For example, the State Energy Investment Corporation of China launched a 100 MW wind farm in Sarysu district of Zhambyl region in 2021, and another 100 MW Shokpar wind farm is expected to be commissioned in 2024.

Mr. Tokhan Janat, General Manager of SANY RE for Central Asia Region

Kazakhstan as a whole has great potential for wind energy development, and now this sector is reaching a new level. By the end of 2022, 46 wind farms with a capacity of 958 MW were operating across the country, but there could be more in the foreseeable future.

In case of successful localization of production of wind turbine components, our country will be able to implement new projects more actively, and thus achieve its goals of "greening" its energy system faster.



GLOBAL COMMITMENT TO CUT METHANE EMISSIONS:

opportunities and prospects for Kazakhstan

The Global Metal Pledge (GMP) is an initiative aimed at reducing emissions of methane, one of the main greenhouse gases that significantly affects climate change. Methane (CH_4) has a much stronger greenhouse effect compared to carbon dioxide (CO_2), although its concentration in the atmosphere is much lower, so reducing methane emissions has great potential to reduce global warming.

Alena Severinenko,
The Center "Cooperation for Sustainable Development"

The main sources of methane emissions can be:

• Anthropogenic sources: methane emissions produced as a result of agricultural activities, extraction and transportation of fossil fuels, as well as landfills of organic waste.

• Natural sources: methane emissions from wetlands, termites, emissions from terrestrial and marine geological sources, as well as thawing permafrost.

The goal of Global Methane Pledge (GMP) is to reduce anthropogenic methane emissions by at least 30% by 2030 compared to 2020 levels. GMP implementation will prevent warming by 0.2 °C by 2050, as well as keep the limits of global warming growth at no more than 1.5 °C. Within the framework of GMP, countries commit to using the methodology of greenhouse gas inventory of the best practices of Intergovernmental Panel on Climate Change (IPCC) at the highest level, as well as to work on continuously improving the accuracy, transparency and completeness of reporting under the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement.
At the global level, countries cooperate through international organizations such as the United Nations and the World

Meteorological Organization (WMO) to develop and implement measures to reduce greenhouse gas emissions, including methane. For example, the Paris Agreement adopted within the framework of the UN Convention on Climate Change in 2015, provides for obligations of countries to reduce greenhouse gas emissions, including methane, in order to achieve the global goal of limiting global warming. In addition, many countries are taking national measures and developing strategies to reduce methane emissions in various sectors of the economy: energy, agriculture, waste and transport. These measures include the use of more efficient technologies, methane utilization, control of emissions at enterprises and monitoring of greenhouse gases. However, in order to more effectively combat the problem of methane emissions and its impact on the climate, further strengthening of international cooperation and development of even more ambitious strategies and measures at the national level are necessary. Progress in implementation of global commitments on methane will play an important role in achieving sustainable and environmentally responsible development of the world.

Kazakhstan, as a country with diverse sources of methane emissions, can play an important role in reducing these emissions and take an active part in international efforts to combat climate change. According to the UNFCCC data for 2021, the energy sector accounts for the most methane emissions in Kazakhstan, followed by the agriculture and waste sector, and other sectors of the economy complete the list (scheme 1).

Let's analyze some of the opportunities and prospects for Kazakhstan: the gas industry, waste disposal, agriculture, energy efficiency and renewable energy, as well as interaction with international programs.

Kazakhstan, as a country with diverse sources of methane emissions, can play an important role in reducing these emissions and take an active part in international efforts to combat climate change.

Gas industry: Kazakhstan is one of the largest producers of natural gas in the world. The introduction of technologies to reduce methane emissions during its extraction, transportation and processing can significantly reduce the country's contribution to the greenhouse effect.

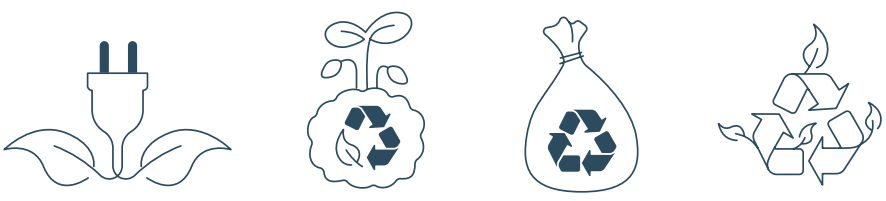
Waste disposal: landfill waste and animal husbandry waste are significant sources of methane. Investing in modern waste disposal methods, such as biogas plants, can help reduce methane emissions into the atmosphere and at the same time contribute to the production of additional energy.

Agriculture: Agriculture also contributes significantly to methane emissions through organic waste recycling and rice growing. The use of advanced technologies, such as aerobic rice growing or modern manure treatment methods, can reduce these emissions.

Energy efficiency and renewable energy: Investing in energy efficiency and renewable energy can help reduce the need to use fossil fuels such as natural gas, which in turn will reduce methane emissions.

Interaction with international programs: Kazakhstan can cooperate with international organizations and programs aimed at reducing methane emissions and participate in global initiatives to combat climate change. Implementing an effective policy to reduce methane emissions can bring several significant benefits to Kazakhstan, including reducing the negative impact on the environment, reducing energy costs and waste disposal, as well as supporting sustainable development and creating new environmentally friendly jobs. However, for the successful implementation of such measures, it is necessary to pay attention to technological development, innovation, financing and effective management of processes related to reducing methane emissions.

Methane emissions in Kazakhstan (2021) according to UN FCCC



POWER INDUSTRY	AGRICULTURE	WASTES	OTHER
49%	40%	10%	1%

Scheme 1 – Methane emissions in Kazakhstan

One of such innovative instruments is the European Bank for Reconstruction and Development (EBRD), which takes various actions aimed at supporting the development of "green" financing. The EBRD's regions of activity are 38 countries, including Kazakhstan (Fig. 1).

Fig. 1 – EBRD-funded regions

Central European and Baltic countries
1. Croatia
2. Czech Republic
3. Estonia
4. Hungary
5. Latvia
6. Lithuania
7. Poland
8. Slovak Republic
9. Slovenia

South-Eastern Europe
10. Albania
11. Bosnia and Herzegovina
12. Bulgaria
13. Kosovo
14. Montenegro
15. Northern Macedonia
16. Romania
17. Serbia

Eastern Europe and the Caucasus
18. Armenia
19. Azerbaijan
20. Belarus
21. Georgia
22. Moldova
23. Ukraine

Central Asia
24. Kazakhstan
25. Kyrgyz Republic
26. Mongolia
27. Tajikistan
28. Turkmenistan
29. Uzbekistan
30. Greece
31. Turkey
32. Russia

Southern and Eastern Mediterranean
33. Egypt
34. Jordan
35. Lebanon
36. Morocco
37. Tunisia
38. West Beach and the Gaza Strip

The EBRD is an international financial institution that provides financial support and investments in projects in Europe, Central Asia and other regions. The main task of the EBRD is to support sustainable development, stimulate the private sector and promote economic reforms. The EBRD supports private sector participation through policy reform, including the development of long-term low-carbon development paths. 64% of the EBRD's investments in the environment are in the private sector. The EBRD actively supports efforts to reduce methane emissions and combat climate change by funding and providing technical assistance for projects aimed at reducing methane emissions and improving environmental sustainability. At the same time, the EBRD has its own approach to reducing methane emissions (Table 1).

The EBRD also intends to increase the mobilization of funds to the private sector to finance measures to combat climate change by 2025. In addition to the main financial support of the private sector, the EBRD has its own commitments in the climate:

- Increasing the share of "green" financing to more than 50% of the annual business volume by 2025;
- Bringing activities in line with the objectives of the Paris

Table 1 – EBRD's approach to reducing methane emissions

SCIENCE	INVESTMENTS AND FINANCING	POLICY AND MARKETS
Financing of national/corporate measurement campaigns (including the use of innovativetechnologies)	Feasibility studies	Support and improvement of national/ corporate reporting standards (OGMP 2.0)
Verification and identification of emission sources	Direct financing of investment programs	Reporting and disclosure of information, including setting targets for methane emissions (NDC, sectoral targets)
National baseline emissions	Study of climate change financing instruments (monetization of emissions reduction in accordance with Article 6 of the Paris Agreement)	Support for implementation of market mechanisms/regulation of methane emissions

Agreement by the end of 2022;
- Doubling the attraction of climate financing of private sector by 2025

In one of her speeches, the President of the EBRD, Ms. Odile Renaud-Basso, very correctly noted: "The Bank supports the economies of the countries in which it invests in improving their environmental sustainability, including by supporting the fight against methane in the agro-industrial sector, waste and energy sectors. We intend to work closely with the signatories of the Global Methane Pledge to help them achieve this goal." The advantages of the Global Methane Pledge are obvious, but here they have more financial interest from the private sector. The below are other benefits of the Global Methane Pledge:

- The signatory countries of the Pledge agree to take voluntary actions to achieve the collective goal of reducing methane emissions by 30% by 2030 compared to the 2020 level, which will help to mitigate global temperature change by more than 0.2 °C by 2050.
- 150+ countries have joined the Pledge and gained access to international funding to assess the baseline and sources of methane emissions (among them Uzbekistan, Kyrgyzstan, Turkmenistan from the Central Asian region).
- Reducing methane emissions can help achieve national corporate decarbonization goals and reduce the additional costs of exporting products that will follow the introduction of EU border carbon tax (Carbon Boarder Adjustment Mechanism).

The EBRD's work to reduce methane emissions is part of the institute's broad strategy to support sustainable development and combat climate change. It contributes to achievement of international climate goals and promotes sustainable development in the countries in which the EBRD actively operates. For clarity, the EBRD's methane reduction activities have been repaired (Fig.2).

The European Bank for Reconstruction and Development actively supports projects related to the production and use of biogas and biomethane. Biogas is a gas that is formed as a result of the biological decomposition of organic materials under anaerobic conditions (in the absence of oxygen). Biogas mainly includes methane (CH_4) and carbon dioxide (CO_2), as well as small amounts of other gases.

The EBRD supports the following projects related to biogas and biomethane:

Biogas plants: The EBRD invests in construction and modernization of biogas plants that allow the processing of organic waste, such as agricultural waste, food waste and the production of biogas.

Biogas recycling projects: The EBRD finances projects for utilization of biogas in order to prevent its release into the atmosphere and use it as a renewable fuel or energy.

Biomethane production: The EBRD supports biomethane production projects by purifying and improving biogas to standards suitable for use in gas supply networks or as an autofuel.

Figure 2 – EBRD's work on reducing methane emissions

Methane 1.0	Gas industry	Ukarine 2019 – (suspended)	• (Level 4) National emission baselines have been identified • Investment program and roadmap have been prepared • Naftogas joined OGMP 2.0 in 2020: Level 1 emissions report submitted in 2021, Level 3 report is under preparation
		Kazakhstan 2021 – (2023)	• Review of available estimates of methane emissions/methane baselines • The first measurement campaign has been launched (in 2022) • QazaqGaz investment projects are considered
		Egypt 2020 – (2023)	• Review of current practices and procedures • Initial nationwide survey of methane emissions - the first measurement campaign was conducted • Egypt's support in joining the global methane pledge
Methane 2.0	Gas industry	Uzbekistan 2023 – (2025)	• Support for Uzbekistan in joining the global methane pledge • Procurement process for the selection of consultants has begun
	Agriculture	The EBRD is actively working with various stakeholders in the countries of operation to continue this initiative. For example: improvement of farming and farming methods and development of the biomethane market	
	Waste recycling		

The introduction of biogas and biomethane contributes to reducing methane emissions, which is an important step in combating climate change and achieving climate goals such as reducing the greenhouse effect and limiting global warming. The EBRD plays a key role in supporting such projects and stimulating the transition to more sustainable and environmentally responsible energy.

ASSET ONGARBAYEV, LONGI Regional director in Kazakhstan

HOW TECHNOLOGIES ARE CHANGING THE ENERGY SECTOR IN KAZAKHSTAN

THE GLOBAL TREND SPEAKS ABOUT THE PRIORITY OF RENEWABLE ENERGY

The International Energy Agency, in its review of renewable energy sources for 2022, writes that there is a sharp acceleration in the construction of renewable energy sources in the world. At the same time, overall capacity growth worldwide will almost double in the next five years, overtaking coal as the largest source of electricity generation.

If we talk about specific figures, then the world's renewable energy capacity will grow by 2,400 gigawatts from 2022 to 2027, which is equal to the entire capacity of China's energy system today. In the future, it is renewable energy sources that will account for more than 90% of global electricity production growth over the next five years.

"IN THE NEXT FIVE YEARS, THERE WILL BE AS MUCH RENEWABLE ENERGY IN THE WORLD AS IN THE PREVIOUS 20 YEARS," - SAYS FATIH BIROL, EXECUTIVE DIRECTOR OF THE INTERNATIONAL ENERGY AGENCY.

There are more and more renewable high-tech stations in the country

ENERGY is the key to economic development. The stability of energy supply to residential buildings and enterprises, coupled with acceptable tariffs, allow existing businesses to grow, and new enterprises to open up and explore new niches in the production or provision of services.
This is also relevant for Kazakhstan, which, nevertheless, faces problems in this sector. KPMG Caucasus and Central Asia conducted an audit of 55 power plants in Kazakhstan, the total installed capacity of which exceeds 19.5 gigawatts.
The study showed that the capacity of just over 2.5 gigawatts is in the red zone – this is a consideration for phased decommissioning. Almost 6.1 gigawatts are in the yellow zone, which corresponds to consideration for reconstruction and modernization. The remaining 11 gigawatts are in the green zone, which means good operating conditions and focus on best maintenance practices.
This means that almost half of the power plants in Kazakhstan need repairs or decommissioning altogether. In such conditions, the development of the renewable energy sector becomes relevant. Renewable energy stations are being built faster than traditional ones and offer competitive tariffs that become cheaper over time, while not polluting the environment.

At the same time, investments in this sector will also grow. The renewable energy policy in the United States of America and India will increase investments in solar energy production by $25 billion until 2027. At the same time, China will remain the dominant player in the market with a 75% share by 2027.

Kazakhstan does not bypass the trend either. About 70% of the energy in our country is produced by coal, but the stations are aging and require large investments in modernization. At the same time, renewable sources are actively developing, which can be the key to solving the problem of energy shortage.

Thus, by the end of 2022, 130 renewable energy facilities with a total capacity of almost 2.4 gigawatts were commissioned throughout the republic, and their share in electricity generation was 4.5%. In 2018, an auction mechanism for selection of “green” projects was launched, and over five years 232 companies from 13 countries took part in auctions.

To date, the renewable energy sector has been able to attract more than 1 trillion tenge of investments and create more than 2 thousand permanent jobs. But there is a lot of room for development ahead. The share of renewable energy in the energy balance by 2030 should be 15%, and the forecast balance assumes the commissioning of 6 gigawatts of new renewable energy capacity by 2035.

MORE TECHNOLOGICALLY AND EFFICIENTLY

Renewable energy sources (RES) make a significant contribution to the energy system of Kazakhstan, as can be seen from the example of already functioning stations. For example, the Kaz Green Energy solar power plant located near Balkhash. This plant, launched in 2022, has a capacity of 50 megawatts at the first stage, while expansion plans to expand to 100 megawatts are being prepared.

According to preliminary calculations, the plant generates about 295 thousand kilowatt-hours of electricity every day, and the total volume reaches more than 79 million kilowatt-hours a year, depending on weather conditions and the time of year.

This plant occupies approximately 70 hectares and consists of 94 150 photovoltaic panels with a capacity of 530 watts and above each. The plant is equipped with new generation panels with increased efficiency, which is twice as high as the standard indicators of other Kazakhstani plants. This allowed optimizing the occupied area.

Some of these panels are equipped with robots that automatically clean them from dust, thereby facilitating maintenance. The panels are double-sided and are capable of generating energy from both direct sunlight and light reflected from the ground.

These advanced panels were manufactured in China at the enterprises of LONGi, the world leader in this industry, and installed together with Technogruppservice, which used LONGi Hi-MO 5 modules.

Double-sided panels enhance efficiency by capturing the light reflected from the snow, which is especially important in the conditions of the Kazakh winter, when the average daytime temperature is about -20 ° C and traditional power plants experience a decrease in productivity. However, due to

the high efficiency of module conversion and advanced technology, LONGi modules ensure stable and efficient operation of the power plant.

During the six-month maintenance period of the station by the Technogruppservice team, since the launch of the station, its electricity generation exceeded the planned figure by 5.2%, reducing air polluting carbon dioxide emissions by about 35 thousand tons. This is an important moment for such an industrial region as the Karaganda region.

ASSET ONGARBAYEV, LONGI REGIONAL DIRECTOR IN KAZAKHSTAN, ON THE SIDELINES OF THE INTERNATIONAL BUSINESS FESTIVAL OF RENEWABLE ENERGY "QAZAQ GREEN FEST 2023" NOTES THAT THE COMPANY – THE WORLD'S LARGEST MANUFACTURER OF SOLAR MODULES – WILL CONTINUE TO PROVIDE KAZAKHSTAN WITH ITS HIGHLY EFFICIENT PRODUCTS AND SERVICES.

"The partnership of both sides will increase the effectiveness of projects and become a catalyst for the socio-economic development of Kazakhstan for the benefit of our people," - Asset Ongarbayev believes.

The representative of the company notes that Kazakhstan has "incredible potential for the development of renewable energy sources" because it has significant solar energy resources.

LONGi is currently focusing specifically on the Central Asian market. The productivity of the company's factories in China allows producing modules with a total capacity of about 85 gigawatts per year. In addition to industrial plants, LONGi offers solutions for installation on roofs and walls of residential buildings, industrial, office and commercial buildings, train stations, airports, parking lots and gas stations.

The work of manufacturer of this level in the market of Kazakhstan opens up new opportunities for the country's energy sector, making renewable energy more attractive for construction and addressing the urgent problem of the country's energy system – the obsolescence and failure of power plants operating on traditional sources.

Tatiana Lanshina,
Ph.D., Project Manager International at Agora Energiewende

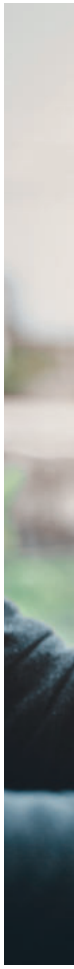
MODERNIZATION THROUGH VARIABLIZATION: ENERGY TRANSITION CHALLENGES AND SOLUTIONS IN KAZAKHSTAN

In recent years Kazakhstan has set important climate and decarbonization goals. In December 2020, its president Kassym-Jomart Tokayev pledged that the country will achieve carbon neutrality by 2060[1]. In 2023, this was followed by the adoption of the Strategy to achieve Carbon Neutrality of the Republic of Kazakhstan by 2060[2]. According to this document, in 2020, the energy sector of Kazakhstan accounted for almost 78% of greenhouse gas emissions, including LULUCF, and the contribution of coal to national net emissions exceeded 55%[3]. The strategy notes that "phasing out coal dependence of the Kazakhstan's economy is important for low-carbon development and achieving carbon neutrality by 2060." However, neither the Strategy to achieve Carbon Neutrality by 2060, nor other official documents contain a clear intention to ever abandon coal, and possible timelines for such a phase-out are also missing.

The author of this article analyzes how the uncertain plans for coal in Kazakhstan fit in with the global energy transition concept, and how Kazakhstan could overcome the challenges (and they are huge) of energy transition to achieve carbon neutrality by 2060.

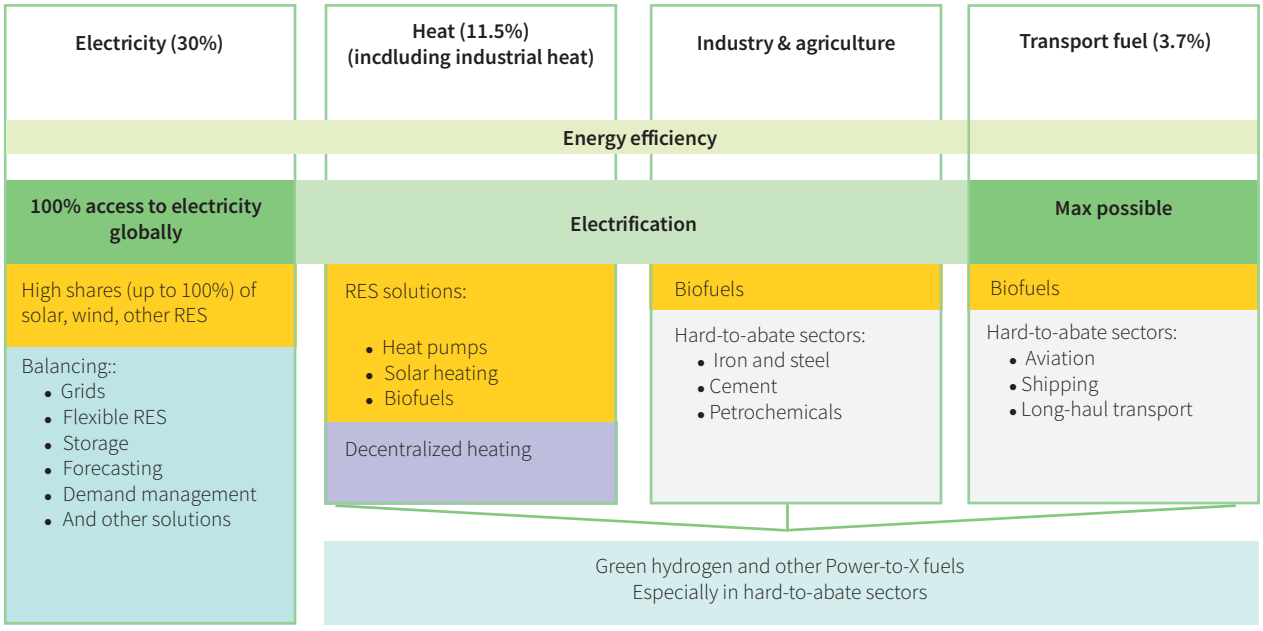
MODERN GLOBAL ENERGY TRANSITION CONCEPT AND DEVELOPMENTS IN KAZAKHSTAN

Taking into account the current level of technological development, international organizations (such as IEA, IRENA, etc.), transnational corporations (e.g. bp and Shell) and other important global stakeholders envision the global energy transition as follows (Figure 1). Energy efficiency is regarded as the most important and in some countries (including Kazakhstan) almost untapped renewable source of energy that allows to avoid emissions, save natural resources and eventually reduce costs. And other critical strategies of energy transition are the increasing reliance on renewable electricity (up to very high levels) and the electrification of heat (including for industrial uses) and transport. These drivers should lead to a gradual reduction of coal, oil and natural gas consumption. Hard-to-abate sectors, such as aviation, shipping, long-haul transport and some industrial uses (iron and steel, cement, petrochemicals), are more likely to transit to green hydrogen and other power-to-X (PtX or P2X) fuels[4], instead of the direct use of renewable



[1] *Climate Ambition Summit (2020). Kassym-Jomart Tokayev President of Kazakhstan. URL: https://www.climateambitionsummit2020.org/ondemand.php.*
[2] *Указ Президента Республики Казахстан от 2 февраля 2023 года № 121. Об утверждении Стратегии достижения углеродной нейтральности Республики Казахстан до 2060 года. URL: https://adilet.zan.kz/rus/docs/U2300000121.*
[3] *Ibid.*
[4] *Power-to-X technologies provide for the conversion of water into green hydrogen and oxygen using renewable electricity. Green hydrogen can be used as a fuel or further converted into other green energy carriers, such as synthetic methane, methanol, ammonia, etc.*

Figure 1. Pathways to zero emissions from fossil fuels and global current shares of renewables in relevant energy supply sectors



Source: author and REN21 (shares of renewables: for electricity the data is provided for 2022, for other energy supply sectors – for 2020).

electricity, as well as to biofuels. At the moment technologies for these sectors are not yet fully commercially available but they are progressing fast. Thus, renewable electricity may become a key industry in the energy sector of future, while coal power plants are likely to turn into stranded assets. And, as follows from Figure 1, with almost 1/3 of global electricity coming from renewables, energy transition processes in the power sector have been historically developing much faster than in heat and transport sectors.

Kazakhstan's vehicles run almost exclusively on fossil fuels, and the electrification of heat and transport sectors in the country is still ahead. Solar PV and wind are two emerging sources of power in Kazakhstan that reached a combined share of 5% of electricity generation by the middle of 2023[5]. According to the existing national goals, by 2030, their share is expected to rise up to 15%[6], and by 2050, the share of alternative (i.e. including projected nuclear generation) and renewable energy (including all hydropower) in the electricity mix should reach 50%[7]. However, the Energy Balance of the Republic of Kazakhstan until 2035 envisions that the share of variable RES in Kazakhstan will reach almost 15% by 2030, remaining unchanged afterwards until 2035, while the share of alternative energy will exceed 40% by 2035, due to the commissioning of nuclear power (which is not used today)[8]. Thus, the optimistic plan for variable RES for Kazakhstan might be limited to 25% by 2050.

For comparison, Germany plans to generate 80% of its electricity from renewables by 2030, some other European countries, such as Portugal, Denmark and Austria – 100%, and the implementation of national renewable electricity goals in the EU-27 countries by 2030 will increase the share of renewables in the power mix of the EU-27 up to 63%[9]. The neighboring Uzbekistan plans to achieve carbon neutrality by 2050 specifically in the energy sector, and for that purpose in 2021 its Ministry of Energy signed a Memorandum of Understanding with the European Bank for Reconstruction and Development (EBRD)[10]. The country plans to focus on nuclear, solar PV, wind and hydropower, as well as on the modernization of its grid.

International organizations and transnational corporations expect that electricity will be dominated by wind (both onshore and offshore) and solar PV generation. These technologies cause the least harm to the climate and the environment, they are safe, reliable, scalable, applicable in almost any country and economically viable, and in many regions of the world they are the cheapest sources of electricity. However, they are variable and this raises concerns that if their share becomes significant, they will pose threats to the stability of the entire energy system. And this might be one of the reasons why Kazakhstan avoids setting more ambitious goals for solar PV and wind up to 2050, though the world already knows examples of very high variable renewables shares in the national power mixes, such as Australia (25%), Chile (28%), United Kingdom (29%), Germany (32%), Spain (33%), Uruguay (36%), Denmark (61%)[11].

KAZAKHSTAN'S ENERGY TRANSITION CHALLENGES AND SOLUTIONS

High shares of variable electricity sources, such as solar PV and wind, raise the problem of balancing supply and demand in the power system. There is a number of standard solutions, the holistic introduction of which allows to solve this problem.

Grid reinforcement and development is maybe the solution that is needed most urgently in Kazakhstan, and this issue has been on the agenda of the Ministry of Energy for years. The grid has not been significantly modernized since the Soviet time, the number of unscheduled outages after a drop in 2019 was again on the rise in recent years[12], and the western energy zone is still disintegrated with the rest of the country, while the connection between the northern and southern zones is also weak. Thus measures to increase the overall stability of the grid and to enable the transportation of variable power over greater distances are necessary. And the sequence should be not grid expansion following new generation, as it often happens, but grid planning and VRES deployment going in parallel[13].

Flexible generation, often gas-fired power plants, can be dispatched on command to compensate for the intermittency of solar PV and wind technologies. However, Kazakhstan faces scarcity of natural gas for domestic consumption, and even now, with a relatively low level of development of variable RES, there is a shortage of flexible capacities and growing dependence on Russia for balancing the energy system. Starting from July 1, 2023, a balancing market has been in operation in Kazakhstan, which might give price signals to investors and stimulate them to invest in flexible capacities. However, natural gas is a fossil fuel that can be considered as transitional, but only within a limited time frame. Given that investments in new flexible natural gas capacities are long-term (for the next 30-40 years, but in practice often for longer periods), it is necessary to think in advance about their conversion to clean fuels in the future, for example, to biogas or green hydrogen.

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[5] The Ministry of Energy (2022). Information on the production of electricity by renewable energy facilities in the first half of 2023. URL: https://www.gov.kz/memleket/entities/energo/documents/details/496972?lang=ru.
[6] Kazinform (2021). I set the task to increase the share of renewable energy sources in power generation to 15% by 2030 - Head of State. URL: https://www.inform.kz/ru/uvelichit-dolyu-vie-v-elektrogeneracii-do-15-k-2030-godu-poruchenie-glavy-gosudarstva_a3792969.
[7] Decree of the President of the Republic of Kazakhstan of May 30, 2013, #557. Concept for transition of the Republic of Kazakhstan to Green Economy. URL: https://adilet.zan.kz/rus/docs/U1300000577.
[8] Order of the Minister of Energy of the Republic of Kazakhstan dated March 24, 2022 No. 104 "On approval of the Energy Balance of the Republic of Kazakhstan until 2035" (as amended on January 30, 2023). URL: https://online.zakon.kz/Document/?doc_id=37351758&pos=4;-90#pos=4;-90.
[9] Ember (2023). EU power sector 2030 target tracker. URL: https://ember-climate.org/data/data-tools/european-renewables-target-tracker/.
[10] UZ Daily (2021). EBRD to support Uzbekistan in achieving carbon neutrality. URL: https://www.uzdaily.uz/en/post/65118.
[11] Ember (2023). Yearly electricity data. URL: https://ember-climate.org/data-catalogue/yearly-electricity-data/.
[12] KEGOC (2017-2021). Annual Reports 2017-2021. URL: https://www.kegoc.kz/ru/for-investors-and-shareholders/raskrytie-informatsii/annual-reports/.
[13] Agora Energiewende (2019). A word on grids. How electricity grids can help integrate variable renewable energy. URL: https://agora-energiewende.de/en/publications/a-word-on-grids/.

The growing complexity of the energy sector calls for a comprehensive transformation of the overall energy system.

There is also flexible (dispatchable) renewable generation, such as hydropower and biofuel/biomass power plants. Kazakhstan has a significant hydropower industry that generates about 8% of all electricity in the country and is the third most important source of electricity, after coal (67%) and natural gas (20%)[14]. Biofuel power plants are unfortunately rare in Kazakhstan. Compared to variable wind and solar PV power plants that together generated almost 2.9 bln kWh, biofuel power plants produced just 1.8 mln kWh electricity in the first half of 2023[15]. At the same time, agriculture is important for Kazakhstan, and crop and livestock waste could be used to generate electricity.

Energy storage is another solution. In 2026-2027, the French company Total Eren, together with the Kazakh companies Samruk-Kazyna and NC KazMunayGas, intends to build a 1 GW wind farm with a power storage system of 300 MW – 600 MWh in the Zhambyl region in Kazakhstan. Another 500 MW wind power plant with an energy storage system is planned to be built by the state investment development fund KIDF and the UAE-government owned company Masdar. Energy storage systems are just beginning to develop in the country, and this process should be accelerated.

Qualitative forecasting of variable RES generation and good electricity demand management are two more promising tools for integrating RES into the grid, the use of which still needs to be improved in Kazakhstan.

And many other flexibility solutions might be appropriate as well, such as increasing the flexibility (modernizing) of existing coal power plants to integrate more variable renewable electricity. This is of cource not a preferable solution, but if it allows more solar and wind power to penetrate the grid in the medium term, it might be a better option than building new coal power plants that will remain in the system for another 30-40 years or longer or turn into stranded assets.

Generating power at small or micro scale RES facilities (e.g. rooftop solar for small and medium enterprises and households) and feeding it into the grid at medium or low voltage might also be helpful. This is especially important given the fact that carbon neutrality implies electrification of transport and heating/cooling, and in that case the more electricity is produced locally, the better it is due to lower transmission and distribution losses. Also such appliances as electric vehicles can be charged when there is an abundance or excess of cheap locally produced electricity – e.g. solar electricity during the day.

In a longer term flexibility may also be provided by electrolysers which can be used in the periods of high variable generation, to avoid the curtailment of excessive solar PV and wind generation. Moreover, electrolysers can be installed at locations before grid bottlenecks, given of cource the availability of water.

Electricity and heat are interconnected in Kazakhstan through CHP to a much higher extent than in most other countries of the world, and CHP is highly reliant on coal. It means that electricity sector cannot be planned entirely separately from heat sector. Moreover, Kazakhstan needs to plan all its energy infrastructure together, at the same time considering modern tendencies in the developed energy markets, such as the penetration of heat pumps and pellet boilers, the electrification of heat and transport, emerging green hydrogen and other P2X technologies, gradual phaseout of coal, etc.

The growing complexity of the energy sector calls for a comprehensive transformation of the overall energy system. Electric vehicles, heat pumps, green hydrogen production are not yet visible in Kazakhstan and will not be in the coming few years. But for an efficient energy transition, even if it will be far from 100%, a holistic management taking into account all modern energy trends in the whole energy sector and providing for a phaseout of coal is vital. A lack of such an approach is typical not only of Kazakhstan but of the global energy transition leaders as well. However the sooner Kazakhstan starts to address it, the faster it will catch up with other countries and the lower its losses from stranded assets will be.

[14] *IEA (2020). Kazakhstan. URL: https://www.iea.org/countries/kazakhstan.*
[15] *The Ministry of Energy (2022). Information on the production of electricity by renewable energy facilities in the first half of 2023. URL: https://www.gov.kz/memleket/entities/energo/documents/details/496972?lang=ru.*

THE SOUTH OF KAZAKHSTAN IS OVERGROWN WITH RENEWABLE SOURCES

VADIM KULIK,
Director of Zhanatas WPP for business development

Zhanatas Wind-Power Station LLP

> These regions of the country have great potential for implementation of major projects

Kazakhstan has a significant potential for renewable energy sources, and this attracts international companies to implement large-scale projects here. For example, the French Total Eren, together with KazMunayGas and the Samruk-Kazyna Fund, have agreed to build a 1-gigawatt wind farm, there are similar plans in partnership with ACWA Power from Saudi Arabia.

There are indeed opportunities for the implementation of such projects. Thus, the Samruk -Energo's "review of the renewable energy market in the Republic of Kazakhstan" specifies that wind speed is 4-5 meters per second at an altitude of 30 meters on about half of the country's territory.

The highest wind potential is available in the Caspian Sea region – in Atyrau and Mangistau regions, as well as in Northern and Southern Kazakhstan. In total, according to the Concept of Development of fuel and energy complex of Kazakhstan until 2030, the wind potential of Kazakhstan is more than 1 trillion 820 billion kilowatt-hours per year.

Similarly, there is great potential in solar energy. it also has significant potential. The Concept for development fuel and energy sector states that its potential is about 2.5 billion kilowatt–hours per year, since 2.2 to 3 thousand solar hours are observed on the territory of the country for 12 months.

In addition, in terms of absolute indicators of potential hydro resources, Kazakhstan ranks third among the post-Soviet countries. Experts estimate the hydropower potential of our country at about 170 billion kilowatt-hours per year, and technically feasible – at 62 billion.

Hydro resources are distributed throughout the country, but among them it is worth noting three areas, including the Irtysh basin with the main tributaries, the Southeastern zone with the Ili basin and the southern zone as part of the Syrdarya, Talas and Chu river basins.

LEADERS GO TO KAZAKHSTAN

It is the country's considerable potential and ambitious decarbonization plans that attract international investors. For example, the State Power Investment Corporation plans to build several enterprises in our country for production of components for wind farms. We can talk about the production of towers, gondolas and blades for “wind turbines”.

Moreover, with another Chinese company – SANY Renewable Energy – a wind park with a capacity of 1 gigawatt will be built in Zhambyl region, and this will immediately increase the total power generation capacity from renewable sources in Kazakhstan by 40%. According to media reports, an energy storage facility will be built next to the wind farm park, which will smooth out fluctuations in wind generation when weather conditions change.

In addition, we can note the above-mentioned project of Total Eren, KazMunayGas and Samruk-Kazyna for construction of a wind farm in Mirny settlement, Zhambyl region, with a capacity of 1 gigawatt and a cost of $ 1.9 billion. The power plant is planned to be launched in 2026-2027. The plant will also use an electricity storage system to make the energy supply to the system more stable. Another large-scale project is planned to be implemented with Saudi ACWA Power - also for 1 gigawatt.

All these projects together will help Kazakhstan cope with the shortage of electricity and, at the same time, make the energy system more “green”.

The latter is relevant for the economy of Kazakhstan, especially exports. For example, the European Union accounts for about 40% of our country's total foreign trade turnover, and carbon regulation is being tightened there.

Kazakh exporters may lose up to **$ 250 million**

Soon, the goods of companies with a high "carbon footprint" (i.e. large emissions during production) will be subject to new import duties, which will affect their competitiveness in the European market.

EY writes that according to the World Bank, after the introduction of carbon regulation by the European Union in 2026, Kazakh exporters may lose up to $ 250 million in revenue annually with metallurgy sector most affected.

That is why it is more important for Kazakhstan to develop renewable energy than ever before – because it offers clean energy to businesses. Meanwhile, 130 renewable energy stations with a total capacity of 2.4 gigawatts are already operating in the country. If we specify by type of sources, these are 44 solar stations with a capacity of 1,148 megawatts, 46 wind stations with a capacity of 958 megawatts, 37 mini-hydroelectric plants with a capacity of 280 megawatts and three bioelectric power plants with a capacity of 1.77 megawatts.

At the same time, during 2023, according to media reports, it is planned to put into operation 15 more renewable energy facilities with a total capacity of 276 megawatts.

CONCENTRATION IN THE SOUTH

Almost all future giant renewable energy projects are planned to be implemented in the southern regions of Kazakhstan, and this is no coincidence – there are large wind and solar resources here. The attractiveness of these regions is confirmed by the fact that several renewable power plants have already been built and are operating here.

One of them is Zhanatass wind farm in Sarysu area of Zhambyl region. Its capacity is 100 megawatts, and it covers the energy needs not only of this area, but also of several nearby settlements.

This project was implemented by Visor International DMCC with Kazakh roots and China China Power International Holding Limited. They invested about $ 130 million in the construction of station, and now a station of 40 wind turbines with a capacity of 2.5 megawatts

each is operating near the city of Zhanatas in southern Kazakhstan.

> "THE STATION WAS BUILT IN AN OPEN FIELD FROM SCRATCH – THIS IS ONE OF THE FIRST SUCH LARGE PROJECTS IN KAZAKHSTAN WITH A CAPACITY OF 100 MEGAWATTS. CURRENTLY, THE CONSTRUCTION OF SECOND STAGE OF THE WIND FARM FOR ANOTHER 100 MEGAWATTS IS UNDERWAY," VADIM KULIK, DIRECTOR OF POWER PLANT FOR BUSINESS DEVELOPMENT, SAID ON THE SIDELINES OF THE INTERNATIONAL BUSINESS FESTIVAL OF RENEWABLE ENERGY "QAZAQ GREEN FEST 2023".

It is worth noting that the first stage of Zhanatas WPP has been operating for the second year, and about 360 million kilowatt-hours of energy is provided in the network of KEGOC operator.

At the time of commissioning, it was the largest wind power plant in Central Asia. It was possible to implement such a project, among other things, thanks to the installation of the most modern turbines at that time: while turbines with a capacity of about 1 megawatt were installed at most wind farms, 2.5 megawatt turbines were used here.

According to Vadim Kulik, even more modern wind turbines are used – already at 4.5 megawatts during the implementation of second stage. According to him, this will allow reducing the area of the entire station, while maintaining power.

In general, this project solves an important problem for Zhambyl region – stability of supply of electricity in rural areas. At the same time, local mining enterprises that have received a reliable source of clean energy benefit.

According to open sources, the power plant provides social assistance to the region. An ambulance was donated to the Central Hospital of Zhanatas, the roof of a residential building was repaired and five apartments were repaired, and Yntymak alley was landscaped.

RENEWABLE ENERGY IN AUSTRALIA: EXPERIENCE, STAGES OF DEVELOPMENT

In today's world, renewable energy is becoming increasingly important, and many countries are exploring and implementing new technologies and approaches to transition to a sustainable and environmentally friendly future. In this context, the Australian experience in the field of renewable energy is of particular interest. Australia, known for its rich energy heritage, has pioneered the use of renewable energy and the development of innovative solutions to address its energy needs.

Diyara Massygutova,
MEng in Renewable Energy
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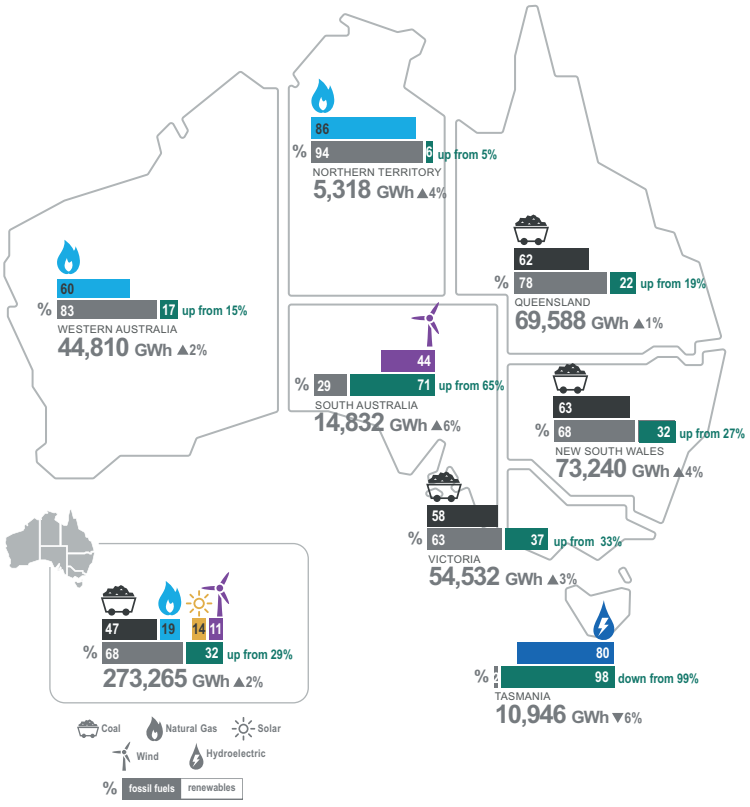
The Australian energy system includes a variety of components, such as competitive electricity markets, the gas system and the retail energy trading sector. The Australian electricity system has competitive electricity markets where various participants, including producers, distributors and retail electricity suppliers, interact and trade energy. In addition, there are regulated network that ensure the transmission of electricity from producers to end users.

There have been significant changes in the use of renewable energy sources in the Australian energy system. In 2022, the total volume of electricity production was 273 265 gigawatt-hours (GWh), which means an increase of 2% compared to the previous year. The share of renewable energy sources in total production was 32%, and the largest source was solar energy (14%), followed by wind energy (11%) and hydropower (6%). Fossil fuel-based energy sources contributed 68% to total electricity production, while coal remained the main source, accounting for 47% of total production. These data reflect the

Australia Energy Statistics map June 2023



overall picture of electricity production in Australia and highlight the growing share of renewable energy sources in the country's energy mix.

The development of renewable energy in Australia has had a long way, starting from the first steps and progressing to the current state.

THE MAIN STAGES OF DEVELOPMENT

1. Early steps (before 2000):

- In the 1970s, the first attempts were made to use renewable energy sources in Australia. Most of them were related to wind and solar energy, including experimental projects and the installation of small capacities.

- In the 1990s, the first national and state programs to support renewable energy were developed. This created the basis for further development of the industry.

2. Implementation of fitting laws (2000-2010):

- In 2000, Australia introduced a system of fitting laws mandatory for energy supply companies. Fitting laws required that a certain percentage of the energy consumed by the grid be supplied from renewable sources.

- Tax incentives and subsidies have been introduced for investments in renewable energy. This stimulated the emergence of new wind energy, solar energy and hydropower projects.

3. The renewable energy boom (2010-2018):

- During this period, there was a significant increase in renewable energy in Australia. Wind power and solar energy have become the main areas of development.

- In 2011, the first commercial solar power plant with a capacity of 1.2 MW was launched. This was followed by new large-scale solar energy projects.

- Wind energy has also been developing rapidly. Large wind farms were launched, such as Snowtown (370 MW) and MacArthur Ridge (420 MW).

4. Policy changes and expansion of renewable energy (after 2018):

- In 2018, federal elections were held in Australia, after which political changes took place that had a negative impact on renewable energy. However, despite this, the growth of the industry continued.

- The states and territories of Australia have become active in spreading renewable energy. Victoria and South Australia have announced plans to build large energy storage batteries, as well as to increase the capacity of solar and wind power plants.

- In 2020, the implementation of the Sunshine State project began in Australia, which provided for construction of the world's largest solar power plant with a capacity of 10 GW.

CURRENTLY, AUSTRALIA CONTINUES TO DEVELOP RENEWABLE ENERGY AND IS TAKING MEASURES TO INCREASE THE SHARE OF RENEWABLE ENERGY SOURCES IN ITS ENERGY SYSTEM. RENEWABLE ENERGY IS BECOMING MORE COMPETITIVE, AND INVESTMENTS IN THIS INDUSTRY ARE GROWING, WHICH ALLOWS THE COUNTRY TO ACHIEVE A MORE SUSTAINABLE AND ENVIRONMENTALLY FRIENDLY ENERGY SYSTEM.

MEASURES TO SUPPORT THE DEVELOPMENT OF RENEWABLE ENERGY

1. Increasing climate ambitions: The adoption of the Climate Change Act of 2022, doubling the emissions reduction target by 2030 and setting a goal of achieving zero emissions by 2050 are important steps in support of climate goals. This provides clear direction and marketing confidence for renewable energy projects.

2. Joining the Global Methane Pledge: Australia's accession to Global Methane Pledge demonstrates its commitment to reduce harmful emissions in all sectors. This allows the country to focus on developing clean energy sources and facilitating a global energy transition.

3. Increasing the share of clean energy: Australia aims to ensure that clean sources of electricity account for more than 80% of its energy mix by 2030. This encourages the country to continue developing solar energy, as well as pay attention to the

flexibility of electricity supply system through interconnections, storage systems and a variety of renewable energy sources..

4. Initiatives of the Australian Energy Supply Plan and Capacity Investment Schemes: Government initiatives such as the Powering Australia Plan and the Capacity Investment Scheme play an important role in increasing the flexibility of the electricity supply system. They contribute to the development of interconnections, energy storage and a variety of renewable energy sources.

5. Supporting the export of energy and strategically important minerals: Australia continues to be a major exporter of energy and strategically important minerals used in clean energy technologies. The country is committed to advancing progress in the fields of hydrogen, strategically important minerals and sustainable supply chains, which contributes to the global energy transition and ensures energy security in the future.

THE ENABLING ENVIRONMENT FOR INVESTMENT

Australia is taking measures to create an enabling environment for renewable energy investments, including national renewable energy share targets, investor support through various financial incentives such as reverse-feed tariffs and renewable energy certificates, and the establishment of financial institutions such as Clean Energy Finance Corporation (CEFC) and Australian Renewable Energy Agency (ARENA). In addition, various states and territories are also implementing their own initiatives to support renewable energy.

INVESTING IN BATTERIES IS PART OF STRATEGY TO DEVELOP RENEWABLE ENERGY AND IMPROVE THE SUSTAINABILITY OF ITS ENERGY SYSTEM. BATTERY SYSTEMS ARE AN IMPORTANT ELEMENT FOR STORING ENERGY THAT IS GENERATED FROM VARIABLE SOURCES, SUCH AS SOLAR AND WIND ENERGY. THIS HELPS TO SMOOTH OUT FLUCTUATIONS IN PRODUCTION AND ENSURE CONTINUITY OF ELECTRICITY SUPPLY.

INTEGRATION OF LARGE-SCALE BATTERY SYSTEMS AND USE OF EFFICIENT TECHNOLOGIES

One of the most famous projects in Australia is the Hornsdale Power Reserve in South Australia. This project was developed by Tesla and includes the installation of lithium-ion batteries on the territory of Hornsdale Wind Farm.

The first 100 MW/129 MWh were completed in November 2017. During the first two years of operation, the Hornsdale backup power unit confirmed the advantages associated with large-scale power system batteries in the national electricity market and saved South Australian consumers more than $150 million. Following this success, the expansion to 50 MW/64.5 MWh was completed in September 2020. As part of this expansion, the entire 150 MWh capacity is being modernized to include a virtual machine mode from Tesla, which will allow the battery to provide inertia support services for the electric grid.

In addition to large-scale battery systems, the technology of "Neighborhood batteries" is being studied, which is the latest technology that can make a significant contribution to the transformation of the energy system in Victoria and, more broadly, in Australia. Within the framework of program "Energy Storage and Network Integration" at the Australian National University (ANU), many studies were conducted on the socio-techno-economic aspects of batteries in neighborhoods. Research shows that this type of battery can provide a wide range of benefits for all participants in the energy process, whether they are power grid operators, energy suppliers, consumers, governments or local authorities.

What these batteries have in common is that they are all located close to consumers, connected to the distribution network and can provide energy storage for hundreds of homes. They vary in size from cabinet to container, with a capacity of 0.1 to 5 MW and complement household batteries and large-scale batteries.

ANU creates training programs in cooperation with local companies, therefore, in addition to theory and the use of software for designing such as PVSyst and OpenWind, opportunities are provided to visit wind farms and SPP.

During Royalla Solar Farm's visit, it was possible to observe the application of "Solar Grazing", which is the most common form of land sharing for large-scale power plant solar farms due to compatibility with land-based solar photovoltaic panels. The integration of solar energy and grazing on one site provides an opportunity for renewable energy operators and owners/farmers to work in partnership to maximize the productive use of rural land and reduce operating costs for all parties.

The program also provided access to the Capital Wind Farm with an installed capacity of about 140 MW, which consists of 67 wind turbines scattered across the picturesque hills of rural New South Wales. The manager of the facility noted the importance of interaction with society and consultation with residents to inform them about changes and give them the opportunity to make suggestions. In addition, social benefits and contributions are provided to support local projects and initiatives.

Hornsdale Power Reserve and Hornsdale Wind Farm

Neighborhood battery in Victoria, Australia

Capital Wind Farm

AN IMPORTANT STAGE IN THE GLOBAL ENERGY EVOLUTION

The Australian experience in the field of renewable energy represents an important stage in the global energy evolution. The use of large-scale battery systems, such as the Hornsdale Power Reserve, has proven the enormous potential of renewable energy sources to ensure a sustainable and environmentally friendly future. The development of the renewable energy sector in Australia has acquired strategic importance, confirming the benefits that these sources can bring to the national energy system.

The success of Hornsdale Power Reserve in optimizing the operation of the electrical network and reducing costs for consumers is an encouraging example for the global community. The final conclusion emphasizes that the integration of large-scale battery systems and the use of efficient technologies, such as Tesla's Virtual Machine Mode, can play a key role in stimulating the transition to a sustainable energy future.

Thus, the Australian experience in the field of renewable energy plays an important role in the global fight against climate change and the transition to sustainable development. This experience demonstrates the opportunities that are opening up for countries seeking to diversify their energy resources and reduce their dependence on traditional fossil fuels. Continued investments in renewable energy and scientific research in this area will have a long-term positive effect on the environment and the well-being of society.

Royalla Solar Farm

LACK OF QUALIFIED PERSONNEL: ANOTHER OBSTACLE TO THE "GREEN" TRANSITION?

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Today, renewable energy is an important industry in the energy sector, especially given the growing interest in reducing greenhouse gas emissions and more sustainable development.

Table 1 – Dynamics of installed RES capacities in the period 2019-2021, GW

	2019	growth	2020	growth	2021	growth	2022
RES in the world	2538,4	10,3%	2799,1	9,5%	3064	10%	3372
SPP	584,7	21,5%	710,3	18,7%	843,1	25%	1053
WPP	622,3	17,8%	733,3	12,6%	825	9%	899
HPP	1190,5	2%	1210,7	2%	1233,5	2%	1256
RES in RK	1,050	55,8%	1,635	23%	2,010	19,5%	2,400
SPP	0,542	68,3%	0,912	14%	1,038	10,6%	1,148
WPP	0,284	71,3%	0,486	40,8%	0,684	40%	0,958
HPP	0,222	4%	0,230	22%	0,280	–	0,280

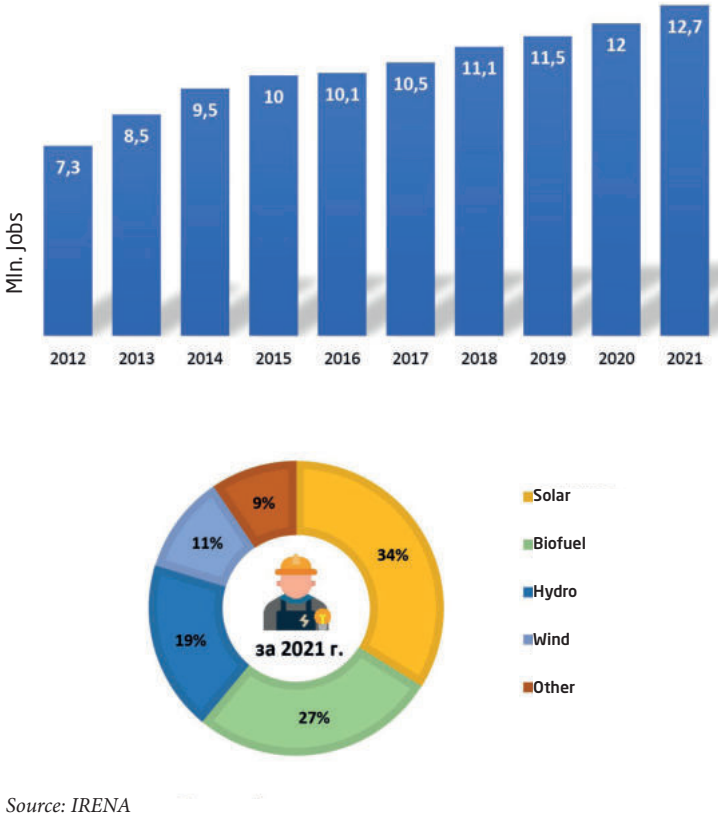
Source: IRENA, Ministry of Energy of the Republic of Kazakhstan, [2]

THE COMPLEXITIES OF THE ENERGY TRANSITION IN THE WORLD

According to the REN21 report, 2021 was another breakthrough year for renewable sources, despite restrictions during the COVID-19 pandemic and rising commodity prices (see Table 1). However, in the middle of 2022, the world was experiencing an energy crisis due to the outbreak of war between Russia and Ukraine, which contributed to the development of renewable energy as an instrument of energy independence and energy security. This situation has particularly affected European countries such as Germany, Italy, France, etc., which depend on the import of fossil fuels from Russia. As a result, most developing countries have accelerated their energy transition by replacing fossil fuels with RES.

In reality, the energy transition is not just a rejection of the use of some fuels in favor of others, but a complex and multifaceted process that requires the participation of governments, business, the public and the international community. It plays a key role in combating climate change and creating a sustainable and environmentally friendly future for our planet. For a safe transition to clean and environmentally friendly green energy technologies, it is necessary to take into account technological, economic, political and social factors. According to the latest research by IRENA and the UN International Labour Organization, the rapid growth of renewable energy in the global energy balance of generating capacities has contributed to an increase in demand for qualified specialists. Thus, in 2021, the renewable energy sector provided 12.7 million people with jobs, and in 2022 the number of jobs increased by another 700,000, and according to the analysis, most of the specialists work in the field of solar energy (see Fig. 1). In its analysis, the IEA predicts an increase in the share of renewable energy by 75% over the next five years, which will also lead to a doubling of the demand for qualified workers.

Figure 1 – Dynamics of global employment growth in the field of renewable energy



Source: IRENA

THE PROBLEM OF SHORTAGE OF PERSONNEL IN THE FIELD OF RENEWABLE ENERGY: THE MAIN REASONS

The problem of shortage of personnel in the field of renewable energy can slow down the development of this industry and become a serious obstacle to zero net emissions. The main reasons for this trend are:

1. Rapid growth of the industry: renewable energy sources, such as solar and wind energy, are gaining momentum and becoming increasingly popular due to their environmental safety and the potential to replace traditional energy sources. The rapid growth of this industry may lead to a shortage of qualified specialists able to meet the demand for professionals in this field.

2. Technical complexity: Developing and maintaining renewable energy systems requires specialized knowledge and skills that may be different from traditional energy industries. For example, engineers and technicians need to understand the technologies of solar panels, wind turbines, hydropower and other alternative energy sources.

3. Limited education and training: In some regions, there may be no suitable educational programs and courses that contribute to the training of specialists in the field of renewable energy. This may lead to the fact that graduates are not enough to meet the needs of a growing industry.

4. Competition with traditional energy industries: the need to attract highly qualified specialists in the field of renewable energy may face competition with other industries, such as oil and gas or coal industry, which also need professionals with technical skills.

5. Regulatory and legal aspects: Some countries and regions may have complex legislation and regulations related to renewable energy, which may deter potential workers.

To solve this problem, it is already necessary to take care of the development of the personnel potential of the renewable energy sector. In the USA, for example, over the next decade, 537,000 jobs will be created annually in the field of "green" energy, however, due to the low unemployment rate (3.5%), local companies may have difficulties in finding qualified personnel. To solve this problem, US energy companies in the field of renewable energy began to train veterans of the armed forces, women and former prisoners for free.

According to the German Economic Institute, in the coming years, Germany is expected to have a shortage of personnel in the field of solar and wind energy in the amount of 216,000 people. In order to achieve its ambitious zero emissions targets by 2035, the German government has approved a new skilled workforce strategy that includes measures to help companies and businesses attract and retain skilled workers. Such measures include the training of women and pensioners, the involvement of foreign specialists and targeted training of young professionals working without professional qualifications.

In Japan, an acute shortage of qualified personnel in all industries is expected from 2027. This is due to the demographic situation of the country: a decrease in the birth rate and an aging population. According to Bloomberg, by 2040, Japan may face a shortage of more than 11 million jobs, 6.74 million of which will be for foreign specialists. In order to avoid such a problem in the future, Prime Minister Fumio Kishida prioritizes increasing the demographic decline, and also allocates 1 trillion yen ($7.6 billion) to train workers in more highly qualified specialties over the next five years.

THE SITUATION IN KAZAKHSTAN

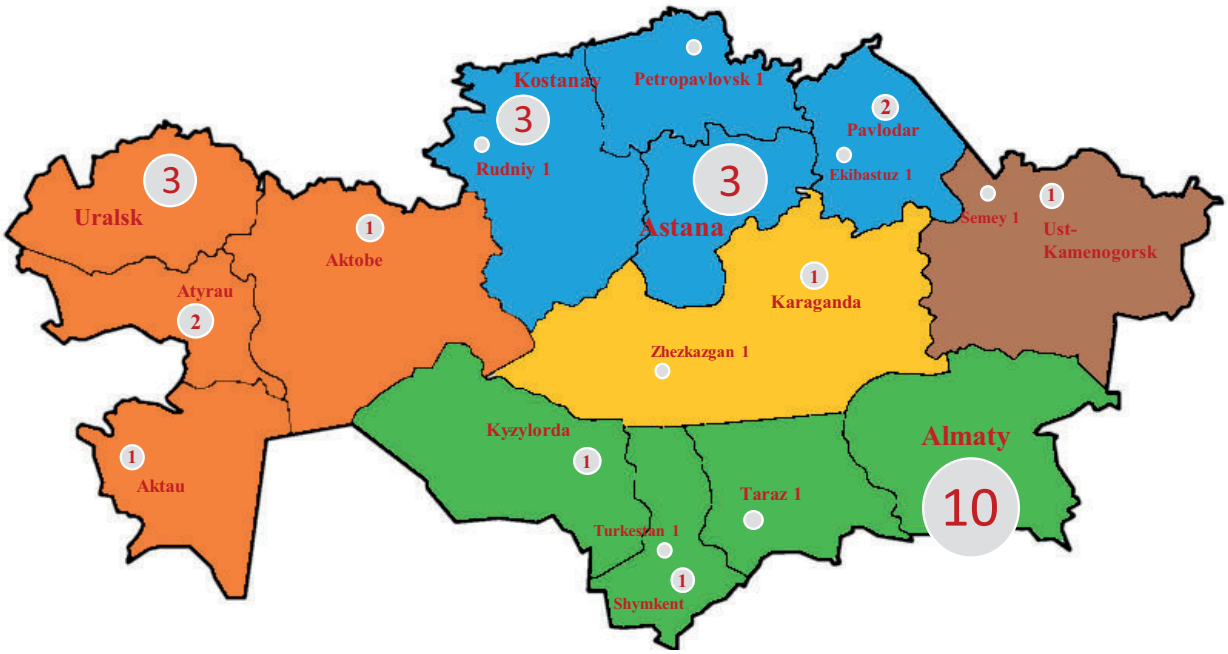
There is also a 20% shortage of qualified personnel in Kazakhstan, but this statistic concerns not only the renewable energy sector, but the energy sector of Kazakhstan as a whole. According to the chairman of the Kazakhstan Trade Union of Power Engineers Orazbek Bekbas, over the past four years, about 3,000 specialists have left the energy industry due to low wages and the unattractiveness of the profession. In addition, the growing interest in IT and digital specialties among young people aggravates the situation on the labor market, and may lead to a shortage of technical specialties. Therefore, it is very important to create a positive perception of technical specialties, provide stimulating working conditions, emphasize their importance in society and promote a variety of career opportunities.

Currently, there are 36 technical universities in Kazakhstan, on the basis of which qualified specialists are trained in the educational program "Electric Power Industry" (see Fig. 3).

As the study shows, most technical universities train specialists in the field of energy production, transmission and distribution, and only some of them conduct training in alternative energy specialties. In view of this, the creation of centers for the training and retraining of personnel is relevant. Such centers could include training of personnel for the renewable energy sector from various fields, such as:

- Management: the complexity and scale of renewable energy projects (WPP, HPP) require qualified specialists in project management to ensure their successful implementation.
- Legal and economic expertise: The implementation of renewable energy projects requires knowledge in the field of law, finance and economics to ensure compliance with legislation and sustainability of financing.

Figure 3 – Map of technical universities of Kazakhstan by OP "Electric Power Industry"



Almaty
Satbayev University
G.Daukeyev Almaty University of Energy and Communications
Academy of Logistics and Transport
Kazakh-British Technical University
Kazakh-German University

Kazakh National Agrarian Research University
Al-Farabi Kazakh National University
Kazakh Railway University
Eurasian Technological University
Caspian University

Taraz
M.H.Dulati Taraz State University

Shymkent
M.Auezov South Kazakhstan State University

Turkestan
H.A.Yassavi International Kazakh-Turkish University

Kyzylorda
Korkyt Ata Kyzylorda University

Ust-Kamenogorsk
D.Serikbayev East Kazakhstan Technical University

Semey
Alikhan Bokeikhan University

Aktobe
K.Zhubanov Aktobe Regional University

Atyrau
Atyrau Engineering and Humanitarian Institute
S.Utebayev Atyrau University of Oil and Gas

Uralsk
Zhangir Khan West Kazakhstan Agrarian and Technical University
Kazakhstan University of Innovative and Telecommunication Systems
West Kazakhstan University of Innovation and Technology
Aktau
Yessenov University

Karaganda
Abylkas Saginov Karaganda Technical University

Zhezkazgan
O.A.Baikonurov Zhezkazgan University

Astana
S.Seifullin Kazakh Agrotechnical University
Nazarbayev University
L.N.Gumilyov Eurasian National University

Petropavlovsk
Manash Kozybayev North Kazakhstan University

Pavlodar
Toraighyrov University
Innovative Eurasian University

Ekibastuz
K.Satpayev Ekibastuz Engineering and Technical Institute

Kostanay
M.Dulatov Kostanay University of Engineering and Economics
A.Baitursynov Kostanay Regional University
Academician Z.Aldamzhar Kostanay Socio-Technical University

Rudniy
Rudnenskiy Industrial Institute

• Engineering: Engineers and technicians play a crucial role in the design, construction, installation and maintenance of renewable energy facilities.

• Maintenance and technical support: Maintenance specialists play an important role in ensuring the efficient operation of renewable energy facilities throughout their entire service life.

• Research and development: The development of more efficient and environmentally friendly renewable energy technologies depends on research and development in this area.

HOW TO OVERCOME THE SHORTAGE OF GREEN ENERGY SPECIALISTS

Summarizing the above, despite the relatively moderate development of renewable energy in Kazakhstan, the energy sector is already experiencing a shortage of green energy specialists. A timely solution to this problem will help ensure the sustainable development of the industry and bring new technologies to the energy sector in the future. According to the analysis, we note the main steps to overcome this problem:

1. Development of specialized educational programs and courses aimed at training personnel with the necessary knowledge and skills to work in the field of renewable energy: specialists versed in the technologies of solar panels, wind turbines, hydropower, nuclear power and other alternative energy sources; specialists engaged in the study of energy storage; specialists in the maintenance of electric vehicles, etc.

2. Creation of centers for training and retraining of specialists from other industries.

3. Development of career prospects: providing professional growth and competitive salary.

4. Awareness raising: organization of information campaigns about the advantages and prospects of working in the field of renewable energy, promotion of renewable energy as an environmentally and socially responsible industry. This may include events, publications, presentations, and the use of social media.

5. Promotion of innovation: support and encouragement of innovations in the field of renewable energy can attract more specialists. The creation of startup accelerator programs, contests and grants can stimulate the development of new ideas and attract talented people.

6. Partnership of universities with enterprises: development of educational programs, curricula and internships that meet the requirements of the industry, which will help meet the demand for qualified specialists.

QAZAQ GREEN

II International Business Festival on Renewable Energy Sources

QAZAQ GREEN FEST 2023

Energy security of Kazakhstan: low-carbon transition

QazaqGreenFest 2023

ЖАҢАРТЫЛАТЫН ЭНЕРГЕТИКА БОЙЫНША II ХАЛЫҚАРАЛЫҚ ІСКЕРЛІК ФЕСТИВАЛІ

Location: Rixos Borovoe Hotel
Burabay, Kazakhstan

RIXOS BOROVOE

CHARTER

APPEAL TO THE GOVERNMENT OF THE REPUBLIC OF KAZAKHSTAN

FROM BUSINESS COMMUNITY OF RENEWABLE ENERGY INDUSTRY ON FURTHER DEVELOPMENT OF RENEWABLE ENERGY IN KAZAKHSTAN

(following the II International Business Festival on Renewable Energy Qazaq Green Fest, held on May 25-26, 2023 in Burabay area of Akmola region)

The business community of the renewable energy industry (RES) supports the initiatives of the President of the Republic of Kazakhstan K.K. Tokayev on the transition of the Republic of Kazakhstan to a green economy and sustainable development.

As it is known, the Republic of Kazakhstan has declared its commitment to the goal of achieving carbon neutrality by 2060. In February 2023, the President signed the Strategy for Achieving Carbon Neutrality of the Republic of Kazakhstan by 2060. Within the framework of the Paris Agreement, the country declared its contribution in the form of an unconditional reduction of greenhouse gas emissions by 15%, as well as a conditional (in the case of international support) reduction of 25% by 2030 from the 1990 level.

Today, more than ever before, the Kazakh society is aware of the great responsibility for ecological future of our country and the health of the nation. One of the tools to achieve all the set goals is the introduction of renewable energy technologies.

At the same time, currently there are constraints to the development of renewable energy in the market of Kazakhstan, which were discussed in detail

at the II International Business Festival on Renewable Energy Qazaq Green Fest, which brought together more than 300 business representatives in the field of "green" energy, according to the results of which the RES business community sent the following recommendations to authorized state bodies and the Government of the Republic of Kazakhstan for implementation these measures in order to improve the investment climate in the renewable energy industry.

SUSTAINABLE POLICY AND INVESTMENT CLIMATE FOR THE DEVELOPMENT OF THE RENEWABLE ENERGY SECTOR

1

A stable and predictable policy, coupled with a clear vision for development of the renewable energy sector, is the most important factor in attracting investment in green energy.

As it is known, in 2022, the authorized state body adopted a Forecast balance until 2035, according to which it is planned to introduce 6 GW of installed renewable energy capacity.

As a result of recent visits, agreements were signed with a number of leading foreign companies Total, Masdar, AcwaPower, China Power for construction of 4 wind parks with a capacity of 1 GW each.

At the same time, since 2018, an auction mechanism for selection of renewable energy projects has been operating in Kazakhstan, in which 232 companies from 13 countries have participated over the past 5 years. This project selection mechanism is recognized by international organizations and has proven itself as a transparent tool for determining the winner who will implement a renewable energy project based on the lowest submitted price.

In this regard, questions arise as to how the Government of the Republic of Kazakhstan sees the further implementation of the tasks for development of renewable energy: what volumes will be implemented through direct contracts with foreign partners, what volumes will be implemented through the auction mechanism for the selection of projects, what volumes will be provided for segment of bilateral renewable energy contracts (B2B), what volume can be implemented through the development of small-scale renewable energy projects?

One of the tools to resolve the conflict may be the development of 5-year auction schedule, which would allow companies to plan investments for several years ahead. In this regard, the RES business community welcomes in general the adoption of the Order of the

Minister of Energy of the Republic of Kazakhstan No. 187 dated May 23, 2023. "On approval of auction schedule for 2023 and the auction plan for 2024-2027". However, further implementation of large-scale renewable energy projects (more than 100 MW) should be carried out through an auction system with prequalification of potential participants.

The issue of qualification selection at auction is important and debatable. Its implementation will reduce the risks of non-implementation of renewable energy projects for the state and open access for companies with the necessary experience and access to technology. In this regard, for its part, the RES business community declared its readiness to participate in the discussion.

In order to get answers to the above questions, we ask the Government of the Republic of Kazakhstan to form a further vision for development of renewable energy generation in terms of capacities, regions and technologies, as well as mechanisms for selection and implementation of such projects.

2 THE IMPACT OF THE NEW "SINGLE BUYER" MARKET MODEL AND THE BALANCING ELECTRICITY MARKET IN REAL TIME ON RENEWABLE ENERGY FACILITIES

In April 2023, The President signed the Law of the Republic of Kazakhstan adopted earlier by the Senate of the Parliament of the Republic of Kazakhstan "On Amendments and additions to some legislative acts of the Republic of Kazakhstan on administrative reform of the Republic of Kazakhstan", which involves amendments to the legislation of the Republic of Kazakhstan on heat and power engineering (hereinafter – the legislative draft).

This Law of the Republic of Kazakhstan provides for a radical reform of the country's electricity market through the introduction of a new market model – a "Single Buyer" and a balancing electricity market in real time (hereinafter – BEM). Conceptually, the introduction of new rules of the game for renewable energy facilities (RES) implies: the sale of generated electricity to a "Single Buyer" and the application of financial liability measures for imbalances in the energy system.

Qazaq Green sees significant risks for the development of the electric power industry and the renewable energy sector, which arose with the adoption of this Law of the Republic of Kazakhstan. **In this regard, the RES business community asks the Government of the Republic of Kazakhstan to consider the following initiatives:**

- preserve a provision of long-term purchase and sale of electricity from renewable energy facilities of the previous operating modes for existing contracts (signed before July 1, 2023), on the terms of signed contracts;
- ensuring the possibility of implementing renewable energy projects under bilateral contracts with settlement of imbalances through the services of System operator for organization of balancing the production /consumption of electric energy;
- for projects for which contracts are signed after July 1, 2023, provide for an adjustment to decrease (down) and increase (up) the daily schedule of production-consumption of electric energy approved by the system operator, no later than two hours before the corresponding hour of actual production-consumption of electric energy;
- for projects for which contracts are signed after July 1, 2023, determine the margin of error of 15% in case of positive and negative imbalances, under which renewable energy facilities will be exempt from financial responsibility in the balancing electricity market;
- for projects for which contracts are signed after July 1, 2023, determine the minimum sizes of increasing and decreasing coefficients within the framework of responsibility for imbalances in the balancing electricity market.

These measures will contribute to the successful implementation of renewable energy projects and significantly reduce risks for investors.

3 AFFORDABLE LONG-TERM FINANCING IN NATIONAL CURRENCY FROM FINANCIAL INSTITUTIONS IS A CRUCIAL FACTOR FOR DEVELOPMENT OF RENEWABLE ENERGY INDUSTRY AND THE FINANCIAL SUSTAINABILITY OF PROJECTS IN THE REPUBLIC OF KAZAKHSTAN

Affordable long-term financing in national currency from financial institutions is a crucial factor for development of renewable energy industry and the financial sustainability of projects in the Republic of Kazakhstan. To date, second-tier banks do not lend to renewable energy facilities due to the fact that the projects are long-term, carry certain currency risks. In addition, the Monetary Policy Committee of the National Bank of the Republic of Kazakhstan decided to keep the base rate at 16.75% per annum with a range of +/- 1 p.p. In this regard, the issue of attracting affordable financing for renewable energy projects is crucial both for the successful implementation of such projects and for reducing the level of tariffs for RES electricity.

In order to achieve affordable financing conditions, it is necessary to consider the possibility of developing a targeted state program to support the financing of "green" investment projects, which provides for the possibility of reducing the interest rate by providing preferential funding to financial institutions for "green" projects. Examples of such preferential lending in Kazakhstan can be the financing of industry and mortgage loans for up to 25 years at low interest rates.

We ask the Government of the Republic of Kazakhstan to initiate a program of long-term repayment financing in national currency at low interest rates for implementation of renewable energy projects in Kazakhstan in order to achieve the strategic goals for development of "green" energy.

4 DEVELOPMENT OF MARKET OF BILATERAL RENEWABLE ENERGY CONTRACTS

It is necessary to provide a flexible approach to the development of renewable energy in the country, taking into account the interests of consumers and investors, in order to achieve strategic goals on carbon neutrality. The opportunity to implement renewable energy projects for their own needs and use the existing package of support measures for renewable energy should be provided to all enterprises, regardless of ownership forms. Thus, the development of renewable energy as a direct tool for decarbonizing the economy should become a nationwide task.

One of the instruments for development of the renewable energy market is the segment of bilateral renewable energy contracts, when an industrial enterprise enters into a direct contract with a renewable energy generator for the purchase of "green" electricity to reduce its carbon footprint. According to experts, this segment has great prospects due to the fact that most companies in the real sector of the economy have adopted strategies at the corporate level aimed at decarbonizing production processes. In general, the market of bilateral contracts can be much larger than the RES auction market and become a driver of further development of the sector and at the same time will not affect the growth of tariffs for population and business of the country.

Despite the fact that the legislation regulating the development of renewable energy sources does not exclude the development of the market of bilateral contracts, the key barriers to the development of this segment are:

- uncertainty of prospects for bilateral renewable energy contracts in the light of the introduction of the "Single Buyer" model;
- lack of "rules of the game" for market participants;
- there is a problem of excessive requirements of the system operator for connecting such facilities, despite the fact that renewable energy facilities are not directly connected to the network;
- the issues of balancing, free transportation and priority dispatching for such projects remain debatable;
- the possibility of selling surplus electricity under bilateral contracts to a single buyer;
- there is no understanding of how financial organizations can lend to such projects, given the absence of any mechanisms to reduce risks, in the event of termination of the purchase of electricity from a renewable energy facility by an industrial enterprise;
- for the state and quasi-public sector that would like to implement renewable energy projects, access to a package of state support measures (investment, customs, tax preferences) is limited. The Entrepreneurial Code limits the shares and the period of participation of such organizations in investment priority projects and for them the implementation of renewable energy projects becomes problematic;
- allocation of land plots for bilateral renewable energy projects.

In this regard, **we ask the Government of the Republic of Kazakhstan, together with the RES business community, to develop and approve the Rules for implementation of bilateral RES projects.**

5 DEVELOPMENT OF SMALL-SCALE RENEWABLE ENERGY SOURCES FOR POPULATION AND SMALL AND MEDIUM-SIZED BUSINESSES

Currently, there is a global trend towards the decentralization of energy. The development of this trend is facilitated by the improvement of technologies, the availability of financial opportunities and various incentive programs, as well as public awareness of environmental issues.

The development of distributed generation (microgeneration) based on small-scale renewable energy facilities, used primarily to meet the own needs of households and small and medium-sized businesses, not only contributes to achieving the country's energy security by reducing CO_2 emissions within the framework of the commitments made under the Paris Agreement, but also to improving the level of comfort in citizens' homes.

According to the results of modeling, experts of the UNDP-GEF of the distribution grid of the Turkestan region, including Shymkent, on the integration of small renewable energy projects into the network: the potential of 5-10% of households is equivalent to the construction of a large thermal power plant with a capacity of 500 – 1000 MW. Connection to the electric network of the so–called home installations of solar power plants on the scale of the region will contribute to improving the reliability of the network as a whole, unloading overloaded nodes and reducing electrical energy losses.

At the same time, at the moment there are several key barriers to the development of small-scale renewable energy projects: restrictions on the capacity of small-scale renewable energy (up to 100 kW), difficulties in connecting at the level of regional power grid companies, as well as the lack of measures to support the development of this segment from the state.

International experience shows that the most effective mechanism for supporting small-scale RES is the establishment of increased "green" tariffs for net consumers.

In this regard, one of the ways to stimulate net consumers is to establish an economically reasonable and attractive level of tariffs for the sale of excess electricity to the grid. In this regard, we propose that the authorized state body establish such tariffs, which will allow them to be adjusted in the future, taking into account the need for the development of small renewable energy generation and the interests of consumers and other energy market players.

We ask the Government of the Republic of Kazakhstan to support the issues of increasing the capacity of small-scale renewable energy sources, simplifying procedures and deadlines for connection, introducing a mechanism for selling surplus from net consumers in the network at an increased "green" tariff.

6 LOW RATES OF DEVELOPMENT OF THE MOST RELIABLE AND PREDICTABLE RENEWABLE ENERGY SOURCE – SMALL HYDROELECTRIC POWER PLANTS

According to the results of the past at least 2 years and auctions conducted for the selection of renewable energy projects, the system of selecting projects for concluding PPA contracts for HPP facilities characterized by exceptional individuality (geological, hydrological, geodetic features that determine the level of capital expenditures) has shown its complete failure. As a result, there are no new projects being implemented and the HPP sector is characterized by "complete calm". At the same time, it should be noted that mainly the owners of small HPP projects are domestic investors and representatives of SMEs in Kazakhstan.

In order to optimize the structure of generating capacities and involve maneuverable hydropower facilities, the energy system needs a large-scale start of the construction of hydroelectric power plants through the creation of attractive conditions.

The first step in this regard has been taken – a fairly attractive level of the marginal tariff for hydropower has been approved, but the auction system, which limits the total volume of HPP projects, requires revision.

For hydropower, which has enough technical problems and permissive restrictions in the literal sense of the word, a "GREEN" light is needed for a surge and rapid development of hydropower construction. It is necessary to abandon the barrier in the form of an auction for the selection of projects.

In this regard, we ask the Government of the Republic of Kazakhstan to consider the following proposals. It is proposed to withdraw HPP facilities from the auction selection mechanism, which limits the total volume of projects. To enable the implementation of HPP projects at a fixed tariff within the approved marginal price, while determining the term of a long-term electricity purchase agreement. We also ask you to provide an opportunity for existing small hydroelectric power plants that want to modernize and reconstruct their stations to participate in the auction and in the system of fixed tariffs. This measure will increase the volume of electricity generation from the most stable source of renewable energy – small hydroelectric power plants.

7 DEVELOPMENT OF ENERGY STORAGE SYSTEMS

As is known, renewable energy facilities, due to their dependence on natural and climatic factors, are a source of imbalances in the energy system. According to analytical data for 2022, it was revealed that the total imbalances from renewable energy facilities, both positive and negative, amounted to 1,867.8 million kWh with an actual generation of 4,561.6 million kWh.

These imbalances lead to dependence on flows from the Russian Federation for balancing in the energy system. With an acceptable level of overflows in the amount of 150 MW, the volumes in the power system reached the level of 1500 MW. According to the Ministry of Energy of the Republic of Kazakhstan, the share of renewable energy facilities in deviations on the border of the Republic of Kazakhstan and the Russian Federation was 23% by the end of 2022.

One of the tools for leveling the daily schedule of renewable energy stations is the introduction of energy storage systems. We note that at the moment there are no implemented projects on energy storage systems in the National Grid of the Republic of Kazakhstan. At the same time, there are also no norms regulating technical requirements for such systems, as well as mechanisms for the implementation of such projects. At the same time, energy storage systems can become effective tools for ensuring the energy security of the country.

However, it should be noted that the use of energy storage systems for balancing purposes in the system is an expensive, costly and, accordingly, technically (short service life, rapid degradation, losses) and economically inefficient solution for the renewable energy market. Therefore, such energy storage systems can only be used to smooth out the daily schedules of the renewable energy facilities themselves. At the same time, the System operator must create conditions in the energy system for the safe integration of renewable energy into the network, while using such tools as: maneuverable generation, available capacity reserves, automated control systems, market mechanisms (for example, demand management, differentiated tariff, balancing market), effectively built transnational flows with neighboring states.

In addition, it is necessary to separate RES auctions and auctions for energy storage systems. The presence of two components in one lot is not justified and reduces the transparency of auctions. It is advisable to model the necessary parameters of EES for the power system and hold separate tenders for this equipment without reference to specific renewable energy facilities and their volumes.

Taking into account the trend towards the development of energy storage systems in the world, the availability of these technologies, and the reduction of their cost, we propose to the **Government of the Republic of Kazakhstan to conduct pilot auctions for renewable energy projects, including hybrid ones, with EES in the amount (10-20% of the installed capacity of renewable energy sources), allowing to align the daily schedules of generation of a renewable energy facility.** For implementation of such a pilot project, additional calculations are also needed on marginal tariffs for bidding, regulatory regimes and financial responsibility for deviations. Market mechanisms for implementation of ESS projects also need to be discussed with the participation of the business community

Based on the results of implementation of this pilot project, the authorized state body and the System Operator, together with the business community and interested parties, conduct practical studies and calculations necessary for the further implementation of ESS in the National Grid of the Republic of Kazakhstan.

8 DEVELOPMENT OF LOCAL CONTENT FOR RENEWABLE ENERGY SECTOR

The issue of development of local content for the renewable energy sector is one of the most urgent. At the meeting on development of the electric power industry and renewable energy sources on May 26, 2021, the President instructed the Government of the Republic of Kazakhstan to make proposals for localization of production of components and other components of technical structures of renewable energy and energy in general.

Today, large foreign manufacturers and suppliers of equipment supplying solar panels, inverters, generating equipment for wind and hydropower are working in the renewable energy sector in Kazakhstan. However, domestic manufacturers also supply metal structures, cable products, transformers, for example, for solar energy. Domestic entrepreneurs are also trying to establish the production of solar panels.

At the same time, the development of local content directly depends on the annual volume of auctions and the commissioning of renewable energy capacities. For example, in 2021, the trading

volume for solar power plants amounted to 20 MW, and in 2022 – 40 MW. However, according to the Order of the Minister of Energy of the Republic of Kazakhstan No. 187 dated May 23, 2023, "On approval of auction schedule for 2023 and the auction plan for 2024-2027." significant volumes are planned for selection of renewable energy projects. Thus, in the medium term, it is possible to plan the volume of commissioning of renewable energy capacities.

In addition, according to information from open sources, direct agreements have been concluded at a high level for implementation of large-scale renewable energy projects with an installed capacity of 1 GW each with companies such as TotalEnergies, Masdar, AcwaPower, China Power. Thus, in the near future, in addition to the projects selected by auctions, 4 GW of wind energy capacity should appear in the country's energy system. These volumes provide the basis for planning the domestic production of components. The RES business community believes that in order to implement such large-scale RES projects, contracts with companies should prescribe requirements for local maintenance and use of locally produced equipment and components.

In this regard, **we ask the Government of the Republic of Kazakhstan to consider the development of local content in the renewable energy sector, taking into account the planned volumes of implementation of renewable energy projects in the coming years and to make concrete proposals of a non-discriminatory nature, having discussed with the business community.**

9 DEVELOPMENT OF DOMESTIC MARKET OF VOLUNTARY CARBON STANDARDS

In our country, more and more companies in the corporate sector are setting themselves the task of reducing the carbon footprint and expressing interest in both the implementation of low-carbon projects and consumption of "clean" energy. At the same time, one of the tools for reducing emissions is carbon offset – activities aimed at reducing greenhouse gas emissions and (or) increasing the absorption of greenhouse gases.

It should be noted that in the business environment of the country, after the announcement of commitment to the goals of achieving carbon neutrality, there is a great demand for projects that reduce the carbon footprint. Today, telecommunications and IT companies, the banking sector, and medium-sized businesses from the service sector are applying, which are interested in using ESG principles in their corporate policy. In this regard, the development of a voluntary market of carbon units will allow private companies that are not part of the trade system of the Republic of Kazakhstan to confirm their commitment to the principles of ESG and cover the carbon footprint with carbon units.

At the same time, there are currently no domestic voluntary carbon standards in Kazakhstan. Companies are forced to turn to foreign standards, while the country loses the financial incentive for "green" investments. It is important to note that the voluntary carbon market does not affect the existing mechanism at the legislative level – the Emissions Trading System and does not affect the carbon budget.

To this end, the Renewable Energy Association "Qazaq Green" has taken the initiative to launch the first voluntary domestic carbon standard – Qazaq Green Certificate, which aims to assist companies in achieving carbon neutrality.

We ask the Government of the Republic of Kazakhstan to support the development of the domestic voluntary carbon market and the corresponding standard.

INFORMATION SUPPORT FOR THE DEVELOPMENT OF RENEWABLE ENERGY SOURCES.

10

In the Message of the President of the Republic of Kazakhstan to the people of Kazakhstan "Kazakhstan in a new reality: time for action" dated September 1, 2020, The President defined the task of "greening" the economy and environmental protection as one of the seven basic principles of the new economic course of our country.

In December 2020, Kazakhstan, before the entire international community, has announced its commitment to achieving carbon neutrality by 2060.

Speaking at a meeting on the development of the electric power industry and RES, May 26, 2021, President of the Republic of Kazakhstan K.K. Tokayev instructed to identify the main priorities of energy development as a systematic and consistent increase in clean energy sources, primarily hydropower, renewable energy sources and maneuverable capacities on gas, as well as a phased transition to new technologies "clean coal" with the use of modern combustion and filtration systems. The President also instructed the Government of the Republic of Kazakhstan to ensure broad explanatory work among the population on the development of nuclear energy by the end of 2022.

To date, one of the few printed industry information and analytical journals on the development of "green" energy and renewable energy is the magazine "Qazaq Green", which has been published by the Association of Renewable Energy "Qazaq Green" for more than 3 years (Certificate of registration of the periodical publication No. KZ57VPY00033826 dated March 29, 2021). The magazine covers the development of the "green" economy, renewable energy sources, environmental protection, ecology. The magazine is published in 1500 copies in State, Russian and English languages and is distributed on the territory of Kazakhstan and Central Asian countries. To date, the issue of the journal is funded by the support of international organizations.

The issue of the magazine "Qazaq Green" was highly appreciated by the President of the Republic of Kazakhstan K.K. Tokayev, who sent a letter to Renewable Energy Association "Qazaq Green", in which he considered the publication's activities very useful for covering environmental issues and "green" technologies in the country and Central Asia and expressed hope that the magazine will contribute to the implementation of the strategy of Kazakhstan on the development of the "green" economy.

In this regard, we ask **the Government of the Republic of Kazakhstan to consider the possibility of allocating a state order for implementation of the state information policy at the republican level for placement of materials on development of the "green" economy, development of clean energy sources, decarbonization, achieving the goals of carbon neutrality and ecology for the magazine "Qazaq Green".**

11

PROFESSIONAL HOLIDAY "RES WORKER'S DAY"

An additional measure stimulating the development of RES not only from the point of view of economic instruments, but also from the point of view of encouraging employees of the entire sector can be the initiation of creation of a professional holiday – the RES Worker's Day.

As it is known, "cadres are the key to everything" and the renewable energy sector is no exception to these rules. Thousands of specialists work in the sector today: power engineers, engineers, builders, economists, civil servants, investors, scientists, analysts. Thanks to their work, a completely new sector of the economy has appeared in the country in a short period of time, and 130 renewable energy facilities with a total installed capacity of about 2.4 GW generate renewable energy.

In the period from 2018 to 2022, 232 companies from 13 countries of the world took part in the auction for the selection of renewable energy projects. More than 1 trillion tenge of investments have been attracted to the sector.

International organizations such as UNDP, USAID, as well as international financial institutions (EBRD, ADB, EDB, Clean Technologies Fund, Green Climate Fund, etc.) work in the Republic of Kazakhstan on renewable energy, all of them have implemented or ongoing projects in their portfolios. A separate division of Astana International Financial Center deals with the topic of "green financing". Global oil and gas companies ENI, Shell, Total are engaged in the implementation of renewable energy projects in different parts of our country.

In the universities of the country, energy students are taught courses on renewable energy, a renewable energy landfill is successfully operating at Nazarbayev University, a full-fledged master's program "Strategic Management of Renewable Energy and energy efficiency" has been launched at the Kazakh-German University, specialists defend doctoral dissertations on renewable energy.

We ask the Government of the Republic of Kazakhstan to establish a professional holiday "RES Worker's Day" as a measure to stimulate the influx of young professionals into the industry.

RECOMMENDATIONS TO THE GOVERNMENT OF THE REPUBLIC OF KAZAKHSTAN

ON DEVELOPMENT OF ESG POLICY BASED ON THE RESULTS OF SESSION "ESG POLICY: GENDER ASPECTS AND CORPORATE GOVERNANCE" WITHIN THE FRAMEWORK OF THE II-TH INTERNATIONAL BUSINESS FESTIVAL ON RENEWABLE ENERGY "QAZAQ GREEN FEST"

MAY 25-26, 2023

1. Set specific and measurable gender diversity goals for boards of directors, executive teams and all staff. These goals should be consistent with industry best practices and take into account the unique circumstances of the company's activities. For example, gender indicators. Formulate a position or policy recommending that all enterprises and companies publish an annual sustainability report and an assurance from a third independent party to ensure transparency and reliability.

2. Advocate for introduction of transparent payment systems and regular payment equity checks to eliminate the gender pay gap. Call for public disclosure of data on the gender pay gap and taking the necessary steps to ensure equal pay for equal work.

3. Promote the adoption of inclusive workplace policies that support work-life balance, parental leave, flexible work hours and placement in childcare facilities. Encourage companies to implement comprehensive anti-discrimination and harassment policies to ensure a safe and inclusive work environment.

4. Encourage companies to implement mentoring and sponsorship programs that support the professional growth and development of women in the labor market. These programs should provide opportunities for professional development, career growth and leadership training.

5. Encourage companies to implement supplier diversity programs that promote the inclusion of women-owned businesses in their supply chains. Implement practices in organizations to take into account gender diversity and inclusivity as criteria in their procurement processes.

6. Advocate for increased engagement with stakeholders, including employees, customers, investors, and local communities, on gender issues. Encourage practices to create mechanisms for feedback, consultation and cooperation so that the voices of various stakeholders are heard and taken into account.

7. Encourage organizations to improve their ESG reports, including specific indicators and indicators related to gender aspects. Promote transparency and disclosure of information on progress made towards achieving gender equality goals, including sharing best practices and lessons learned.

8. Promote collaboration between companies, industry associations, NGOs and government agencies to share best practices, research and resources related to gender equality and ESG. Encourage the creation of partnerships and initiatives that promote gender equality and inclusivity. One example may be the holding a series of round tables by the Government of the Republic of Kazakhstan in partnership with international companies to familiarize key private sector companies with best practices in the field of ESG.

9. Attach importance to monitoring and evaluating progress towards achieving gender equality goals. Involve independent auditors and third-party evaluations to ensure transparency and credibility of gender initiatives.

10. Promote education and awareness programs to challenge gender stereotypes, biases, and unconscious biases. Conduct gender-related trainings for employees and conduct awareness-raising campaigns to foster a culture of inclusiveness and respect. Make recommendations to universities and educational institutions regarding inclusion of courses on ESG and sustainable development in their curricula.

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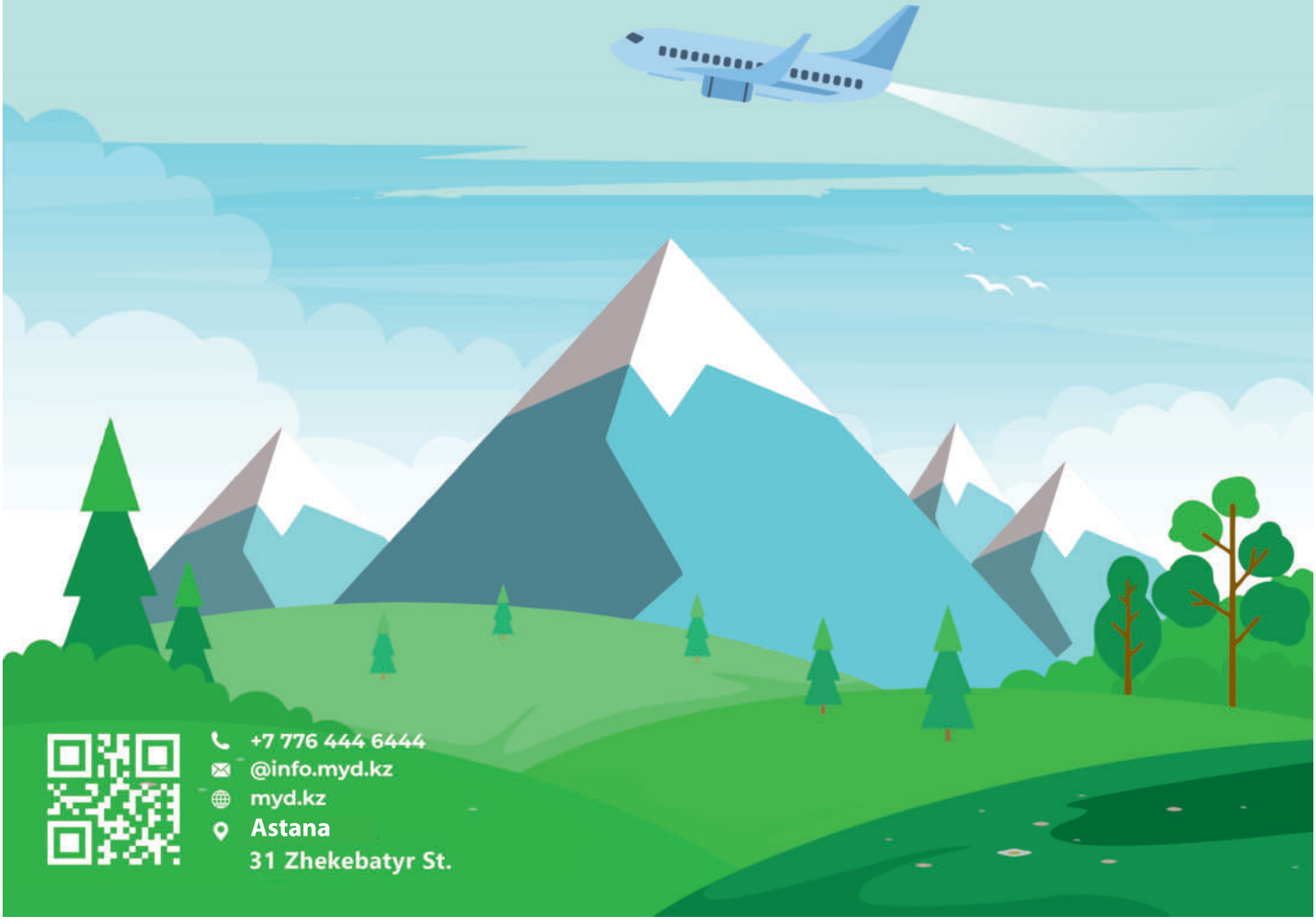

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QAZAQ GREEN Association

PLATFORM FOR NATIONAL AND INTERNATIONAL PLAYERS IN RENEWABLE ENERGY SOURCES

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ASSOCIATION AS INFORMATIONAL RESOURCE

The Association is a resource that will allow members of the Association to receive information about changes in legislation immediately.
Association is a resource that creates public opinion, and also contributes to the promotion of renewable energy. It will allow you to form a positive image around an event in the activities of both a member of the Association and the Association itself.

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Plant area:
6 664 sq.m.
Plant capacity:
200 MW per year (363 635 pieces of 550 watts each)
Cell Type: : Mono Perk
Warranty: 15 years
Service life: 25 years

Investment

Own funds 2,400,000,000 tenge (by 2025 it is planned to increase investments to 4 600 000 000 tenge), of which: Equipment manufactured in Spain, Germany, Finland, China.

Localization

The local content share will be 40-50% (Glass, aluminum profile, mounting tape, cable, junction box).

Sale

BExternal and internal market. The main share - export (USA, Uzbekistan, CIS countries).

Logistics

The largest railway Dry port "KTZE-Khorgos Gateway" is located 500 meters from the plant in Central Asia, which provides a full range of services in the field of processing, storage and transshipment of goods from China to Kazakhstan, the countries of the European Union, Central Asia, the Persian Gulf, the Caspian region, etc.
In addition, there is a transport corridor (motorway) near the plant Western Europe — Western China.

Certificates:

Certificates UL (USA), IECEE (EC), CT KZ, Industrial certificate, Certificate of conformance EAEU, ST RK ISO 9001-2016, ST RK ISO 14001-2016, ST RK ISO 45001-2019, ST RK ISO 22000-2019, ST RK ISO 1179-2003, ST RK ISO 50001-2019.

KONRAD ADENAUER STIFTUNG

The Konrad Adenauer Foundation is a political foundation of the Federal Republic of Germany. With its programmes and projects, the Foundation actively and effectively promotes international cooperation and mutual understanding.

The Representative Office of the Foundation in Kazakhstan began its work in 2007 at the invitation of the Government of the Republic of Kazakhstan. The Foundation works in partnership with government agencies, the Parliament of the Republic of Kazakhstan, civil society organizations, universities, political parties and enterprises.

The main purpose of the Foundation's activities in the Republic of Kazakhstan is to strengthen mutual understanding and partnership between the Federal Republic of Germany and the Republic of Kazakhstan through cooperation in the field of political, educational, social, cultural and economic development, thus contributing to the further development and prosperity of Kazakhstan.

The Konrad Adenauer Foundation has the following priorities in the Republic of Kazakhstan:

- **Policy and Party Counselling**
- **Interparliamentary Dialogue**
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- **Local Self-Governance**
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