

QazaqGreen

INFORMATION AND ANALYTICAL MAGAZINE

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QAZAQ GREEN
Association

KONRAD
ADENAUER
STIFTUNG

2022

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**DIVERSIFICATION OF ENERGY
SOURCES: ACHIEVEMENTS
AND CHALLENGES**



QAZAQ GREEN

UNITED PLATFORM

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

AIM – SECTOR CONSOLIDATION

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

MISSION:

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



Astana,
Chubary microdistrict, A. Knayginina Str., 11

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Members of Association and partners



TOO «XEK-KT»



GEOLOGY AND NATURAL
RESOURCES OF THE
REPUBLIC OF KAZAKHSTAN



TOO «KazWind Energy»

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Eurasian Development Bank

Development Bank
of Kazakhstan



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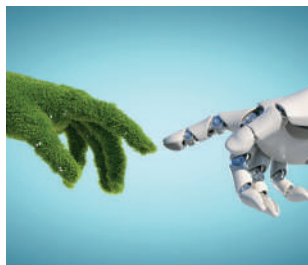
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welcome you to the pages of Qazaq Green magazine - specialist information and analytical magazine on renewable energy in Kazakhstan.

The onset of the autumn-winter period in the electric power industry always causes trouble, especially for energy specialists working at generating facilities and dispatchers. Mr. B.U. Akchulakov, Minister of Energy of the Republic of Kazakhstan speaking at the Central Communications Service in mid-November reported that country would face shortage of electricity this winter. Such a situation with a shortage of electricity in the country has been observed monthly since this May, and in 2021 the deficit was recorded in November, August, July and June. According to the Minister, such situation is a result of frequent emergency disposal of equipment of obsolete domestic energy sources. Advanced obsolescence and low rates of modernization of fixed assets – systemic problem that has led to the current energy crisis: compared to the same period last year, the number of emergency shutdowns increased by 22%, and their duration – by 16%. As of today, the depreciation of generating capacities is about 60%. In this regard, it seems that the current autumn-winter period will once again test out the country's electric power system.

However, it is "hot" from the current state of affairs not only in the traditional energy sector, but also in the renewable energy sector. In this summer, the Ministry of Energy of the Republic of Kazakhstan launched a draft law "On amendments and additions to some legislative acts of the Republic of Kazakhstan on heat and power engineering".

The Draft Law, within the framework of the functioning of the balancing electricity market, assumes the use of financial methods of responsibility for renewable energy facilities for allowed positive and negative imbalances. It should be noted

DEAR READERS! DEAR FRIENDS!



PORTAL ON ISSUES OF GREEN ENERGY

that forecasting electricity generation at renewable energy facilities is a difficult task faced by businesses implementing such projects. Qazaq Green certainly supports the thesis that it is necessary to increase the responsibility of renewable energy stations for forecasting, including through the use of financial mechanisms. However, in order to regulate this issue fairly, it is necessary to introduce a degree of the generation error, for example, 10-15%, at which renewable energy facilities, in case of imbalances and a decrease in electricity generation, should not have a financial burden of responsibility. In addition, an additional measure may be the provision of an opportunity for renewable energy facilities to adjust the projected volumes of electricity generation in 2 hours as part of work on the balancing electricity market.

Also, the draft Law provides for introduction of a Single Buyer mechanism, according to which energy-producing organizations are obliged to sell the generated electric energy to Single buyer of electric energy. What is the question? After the President announced the commitment of the Republic of Kazakhstan to achieve carbon neutrality by 2060 at the end of 2020, many domestic organizations and companies have developed Strategies for low-carbon development, according to which they plan to reduce their carbon footprint, including by investing in

renewable energy facilities, or buying "green" electricity through the mechanism of bilateral contracts (i.e. within the framework of civil law transactions between the consumer and the renewable energy facility). The introduction of Single Buyer model practically blocks the possibility of developing this market, whereas from the point of view of the prospects for development of renewable energy in the country as a whole, the market of bilateral contracts can significantly exceed the auction market and become a driver for further development of the sector. In this regard, we believe that it is necessary to exclude bilateral contracts with

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

renewable energy facilities from participation in the Single Buyer mechanism, including due to the fact that this measure restricts civil transactions and competition.

I must say about the problem of marginal prices for auctions, which the RES business community has faced this year. In mid-September, Decree of the Government of the Republic of Kazakhstan was adopted indicating that maximum auction prices should be determined at the level of fixed tariffs approved by the Decree of the Government of the Republic of Kazakhstan dated June 12, 2014 No. 645. Thus, in implementation of the adopted Decree of the Government of the Republic of Kazakhstan, the Ministry of Energy of the Republic of Kazakhstan had to amend the Order of the Minister of Energy of the Republic of Kazakhstan dated January 30, 2018 No. 33 "On approval of maximum auction prices" and approve the maximum auction prices for 2022 as follows: WPP – 22.68 tg/kWh, SPP – 34.61 tg/kWh, HPP – 41.23 tg/kWh, bioelectric power plant – 32.23 tg/kWh.

However, on November 2, the Ministry of Energy of the Republic of Kazakhstan decided to postpone the auction for HPP (with a capacity of 20 MW) to November 4 this year. At the same time, on November 3, one day before the start of the auction, the Ministry of Energy of the Republic of Kazakhstan published the maximum auction prices for auction for selection of renewable energy projects in 2022, as amended by the Order of the Minister of Energy of the Republic of Kazakhstan dated 15.03.2021 No. 82: WPP – 21.53 tg/kWh, SPP – 16.96 tg/kWh, HPP – 15.2 tg/kWh, bioelectric power plant – 32.15 tg/kWh.

In our opinion, the Ministry of Energy of the Republic of Kazakhstan has violated the rules for organizing auctions both in terms of postponing the dates of auction, and in terms of the timing of publication of documentation (marginal prices) for auctions. In addition, we state that in fact, the Ministry of Energy of the Republic of Kazakhstan does not execute the decision of the Government of the Republic of Kazakhstan. The current situation destabilizes the investment climate both in the industry and in the country as a whole, as evidenced by the auctions held on November 4 (small hydroelectric power plants of 20 MW), November 4 (large hydroelectric power plants of 200 MW), November 7 (bioelectric power plants of 10 MW) and November 8 (SPP of 20 MW), which were declared invalid. In particular, due to the fact that auction participants withdraw their bids after the publication of the maximum auction prices by the Ministry of Energy of the Republic of Kazakhstan and did not submit price proposals during trading sessions.

I would like to note that the Association of RE "Qazaq Green" in order to form the position of the RES business community, including on the above issues, holds meetings, consultations with interested organizations and companies on an ongoing basis

and forms expert opinions that are sent to government agencies. It is thanks to the joint work with government agencies and the business community of the association that it is possible to solve the most pressing issues for renewable energy in Kazakhstan.

For example, one of the urgent problems of the renewable energy sector is high volatility of the national currency, which negatively affects the financial condition of existing and new renewable energy projects. Since the beginning of 2022, Qazaq Green together with the Ministry of Energy of the Republic of Kazakhstan and the RES business community have done a lot of work to improve the investment climate in the industry. Thus, tariff indexation was introduced for the period of construction of renewable energy facility and existing tariff indexation mechanism, which previously had not cover investors' currency risks, was significantly improved. We are confident that new approaches to indexing will contribute to the successful implementation of renewable energy projects in our country.

And, of course, in the outgoing year, in terms of the work of our association, I would like to recall the Qazaq Green Business Expedition on Renewable energy, which took place on July 8-9, 2022. The two-day expedition to the Buiratau Nature Park brought together representatives of government agencies, private companies and experts to discuss topical issues in the field of renewable energy sources in Kazakhstan. During the work of the expedition, two renewable energy facilities were visited in the Akmola region - the Astana EXPO-2017 wind power plants (Kostomar village, Arshaly area) and the First Wind Power Station LLP (Yerementau town). In the format of open discussions, experts had the opportunity to discuss the prospects and problems of implementing renewable energy projects under bilateral contracts, as well as the introduction of energy storage systems at renewable energy facilities.

In the new year 2023, Association of RE "Qazaq Green" has a lot of plans. We will continue to work together with government agencies and business providing a platform to discuss the most pressing problems of the industry. In addition, we plan to organize a number of events, which we will tell you about later on our media channels. Therefore, we invite all interested organizations and companies to work together.

Taking this opportunity, I congratulate all our readers on the upcoming holidays – New Year! I wish you and your families good health, inexhaustible energy and prosperity!



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

A NEW TREND FOR THE DEVELOPMENT OF MICROGENERATION BASED ON SMALL-SCALE RENEWABLE ENERGY FACILITIES

DEAR READERS!

Currently, there is a global trend towards decentralization of power industry. Development of this trend is facilitated by improving technologies, availability of financial opportunities and various incentive programs, as well as public awareness of environmental issues.

According to the International Energy Agency, total installed capacity of home installations (rooftop solar installations with unit capacity up to 10 kW) in the world reached 58 GW* in 2018, and it is planned that by 2024 this figure will be increased by 2.5 times.

Development of distributed generation (micro-generation) based on small-scale RES facilities, used primarily to meet own needs of households and small and medium-sized businesses, not only contributes to achieving



ALL ARTICLES OF
QAZAQGREEN MAGAZINE

energy security of the country, reducing CO2 emissions within the framework of commitments made under the Paris Agreement, but also improving comfort of citizen's homes, especially in rural areas. It is possible to use various renewable energy technologies – solar panels, solar collectors, heat pumps, boilers running on straw (more than 100 units are successfully operated in the North Kazakhstan region).

The state, having taken a course to expand use of renewable energy and having adopted international commitments to reduce emissions, was focused on the development of relatively large commercial projects in the field of RES. However, the sector of small-scale renewable energy facilities remained without proper legal regulation and, accordingly, support schemes due, on the one hand, to non-developed regulatory framework, on the other hand, to

excessive bureaucratic barriers in terms of integrating small-scale facilities into the grid.

WELCOME ADDRESS BY THE DEPUTY OF THE MAJILIS PARLIAMENT OF THE REPUBLIC OF KAZAKHSTAN MR. DYUSENBAY TURGANOV

It is obvious that there is already a steady trend to increase total installed capacity of decentralized systems, both commercial and industrial, and installations for households.

It should be noted that for consumers, the use of small-scale projects brings a lot of positive aspects. Firstly, when used, the cost of generated electric energy will not depend on cost of energy carriers. Secondly, reduced energy consumption saves resources in medium and long term. Thirdly, improving comfort of living and fire safety.

In this regard, the Head of State gave instructions on development of small-scale renewable energy sector at the meeting, dedicated to development of electric power industry on May 26, 2021. Pursuant to these instructions, through deputy initiative, I initiated amendments to the legislation of the Republic of Kazakhstan on support for use of renewable energy sources, electric power industry and natural monopolies.

These amendments to the legislation suggest:

- Introducing the concept of small-scale renewable energy project;
- Exemption of net consumers from the rules governing activities of energy-producing organizations;
- Enabling net consumers not to register as individual entrepreneur at installing small-scale renewable energy facilities and

generating energy by such facilities;

- Expansion of support mechanism in the form of targeted aid;
- Regulation of relationship between net consumers and energy transmission and supply organizations in terms of connecting small-scale RES to the grid, metering of generated electricity, purchase of electricity, etc.;
- Empowering authorized state body and local executive bodies with the competence to regulate issues of connecting small-scale RES and monitoring their functioning.

With current cost levels of electric/thermal energy, use of such systems is not entirely economically profitable without special support measures, but in medium term, use of these systems will be more than justified.

I believe that proposed amendments to legislative acts will contribute to development of small-scale renewable energy projects sector, promoting popularization of renewable energy sources among the country's population and their wider application.



Dyusenbai Turganov,
Deputy of the Majilis Parliament of Kazakhstan



With only eight years until 2030, the Sustainable Development Goals are hampered by the COVID-19 pandemic, a “triple planetary crisis” (climate change, biodiversity loss, and pollution) and conflicts around the world.

We need to get back on track before it's too late.

Along with threats to international security, climate change requires greater international cooperation and solidarity as well.

Around the world, people are facing existential threats from weather and environmental change.

If we are to turn this tide, we need more action, and we need it fast.

Many of us have taken bold steps already. In Kazakhstan, we have pledged the total transformation of the oil- and coal-dependent energy sector into a Net Zero economy by 2060.

To save our planet, we need investment at greater levels than we have ever seen.

However, climate action cannot come at the expense of development or modernization.

Therefore, at COP27 later this year, member states, as well as the global business community, must once again scale up their commitment to greater climate finance.

In the long-term, we aim to diversify our sources of energy, with a particular focus on green hydrogen and renewables.

Speech by the President of Kazakhstan Kassym-Jomart Tokayev at
the General Debate of the 77th session of the UN General Assembly,

20th September 2022



Thinking specifically of global commitment to peace, I express deep appreciation for Kazakhstan's decisive repudiation of nuclear weapons, and its efforts to develop energy and environmental policies, centered on decreased dependence on carbon fuel and on investment in clean sources of energy, the importance of which was emphasized by the International Exhibition, held here five years ago. Together with a commitment to interreligious dialogue these are concrete seeds of hope sown in the common soil of humanity, and it is up to us to cultivate those seeds for the sake of coming generations, for the young whose desires must be seriously as we make decisions affecting the present and the future. The Holy See is at your side in this pursuit.

Pope Francis, Astana, Meeting in Central Concert Hall "Kazakhstan"

Astana, 13th September 2022.

HYRASIA ONE:

"GREEN" ENERGY IN THE SERVICE OF DECARBONIZATION OF INDUSTRY



The autumn visit of the President of the European Council Charles Michel to the capital of Kazakhstan was marked by signature of an important agreement in the field of "green" energy. Hyrasia One plans to build one of the world's five largest plants for production of "green" hydrogen, projects of which are currently under development, in Kazakhstan. Using wind and solar energy, the company will annually produce up to two million tons of hydrogen.



Investment Agreement was signed by the European project's developer and the Government of the Republic of Kazakhstan in the presence of the President of the Republic of Kazakhstan and the President of the European Council.

One of the world's five largest hydrogen production projects has reached another milestone.

- Investment Agreement was signed by the European project's developer and the Government of the Republic of Kazakhstan in the presence of the President of the Republic of Kazakhstan and the President of the European Council.

- Starting from 2032, a wind-solar hydrogen production plant in the Mangystau region will produce up to two million tons of hydrogen per annum.

- Stable economic and legal framework will create a solid foundation for planned investments in the amount of 40 to 50 billion US dollars.

Hyrasia One, a subsidiary of the European holding Svevind Energy Group, operating in the field of environmentally friendly technologies, plans to build one of the world's largest enterprises for the production of "green" (environmentally safe) hydrogen at the territory of Kazakhstan. Hyrasia One project is now moving into the next crucial stage.



Recently, in Astana, in the presence of President of the Republic of Kazakhstan Kassym-Jomart Tokayev and President of the European Council Charles Michel, representatives of Hyrasia One and the Government of the Republic of Kazakhstan signed an investment agreement, which will serve as the beginning of a landmark project.

To implement the Hyrasia One project in the southwestern part of Kazakhstan, it is planned to build wind and photovoltaic facilities with design capacity of 40 gigawatts. Renewable energy produced by these facilities with capacity of 120 terawatt-hours per annum will provide power to industrial zone of electrolyzers at Caspian Sea coast with total capacity of 20 gigawatts and production up to two million tons of “green” hydrogen per annum.

For comparison, such a performance indicator is equivalent to one fifth of the European Union's expected demand for import of “green” hydrogen by 2030.

Thus, Hyrasia One project can become a solid foundation for developing hydrogen markets in Europe, in Kazakhstan itself, as well as in Asian countries.

Signed agreement defines clear parameters of the project, including lands provided for the project, access to infrastructure facilities, free movement of goods and capital and other economic and legal

conditions that guarantee status of investments for the project that has been under development for three years. Based on this investment agreement, Hyrasia One project will move to the stage of negotiations with co-investors, consumers and suppliers of the enterprise, thereby laying foundation for subsequent production of “green” hydrogen.

The start of hydrogen production in the Mangystau region is scheduled for 2030, and the enterprise will be able to reach full capacity by 2032. Final investment decision for a project worth approximately 40 to 50 billion US dollars should be made in 2026.

In summer of 2022, the first stage of project development was successfully completed - concept design study, prepared with participation of consulting companies ILF Consulting Engineers and Roland Berger Management Consultants.

“Thanks to Hyrasia One project, we will be able to ensure safety of energy and raw material reserves on unique industrial scale,” explained Mr. Wolfgang Kropp, General Director of Hyrasia One project, founder and head of Svevind Energy Group.

In his opinion, Kazakhstan is an ideal platform for production of “clean” energy and hydrogen. For example, strong winds blow across vast steppes throughout the year, and intensity of solar radiation is much higher than in the countries of Central Europe.


“Signature of investment agreement allowed moving the project to the next crucial stage. We believe that we are very lucky to find a reliable partner, represented by the Government of the Republic of Kazakhstan, which supports our plans and recognizes enormous economic potential of producing large volumes of “green” hydrogen,” says Mr. Wolfgang Kropp.

According to the study “Global Hydrogen Flows”, published in October 2022 by the Hydrogen Technology Council together with McKinsey, “clean” hydrogen can reduce carbon dioxide emissions by more than five times, which is necessary to achieve global carbon neutrality by 2050. The use of hydrogen will allow reducing the world's carbon dioxide emissions by 80 gigatons by this time.

The study also noted that a number of countries will have to import significant amounts of hydrogen.

In addition to Japan and South Korea, these include the countries of the European Union.

In this background, signature of agreement on strategic partnership for sustainable production of raw materials, batteries and “green” hydrogen, announced by the President of the European Commission, Ms. Ursula von der Leyen and the President of the Republic of Kazakhstan, Kassym-Jomart Tokayev, is an important step.

“The next ten years are crucial for successful energy transition on a global scale. Every action we miss will inevitably be lost for implementation in the future. We want to make a significant contribution with Hyrasia One project,” said Mr. Wolfgang Kropp. 

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ABOUT THE PROJECT

Hyrasia One plans to build one of the world's five largest plants for production of “green” hydrogen, projects of which are currently under development, in Kazakhstan. Starting from 2032, the giant wind-solar enterprise will produce up to two million tons of hydrogen per annum. Hyrasia One is a company of Svevind Energy Group, European developer of renewable energy projects with head office in Dresden, Germany.

Group of Companies also carries out planning, development and implementation of onshore wind power and photovoltaic projects. In northern Sweden, Svevind is currently developing and implementing Europe's largest onshore wind energy cluster, Markbygden 1101 project.

Today, the enterprise already produces 1 700 megawatts of energy. It is expected that upon completion of Markbygden 1101 project in 2026, the capacity of the enterprise will reach 3.6 gigawatts. This indicator will cover approximately 8% of Sweden's electricity needs.





VACANCIES IN RENEWABLE ENERGY

SECTOR APPEARED AT THE WEBSITE ENBEK.KZ



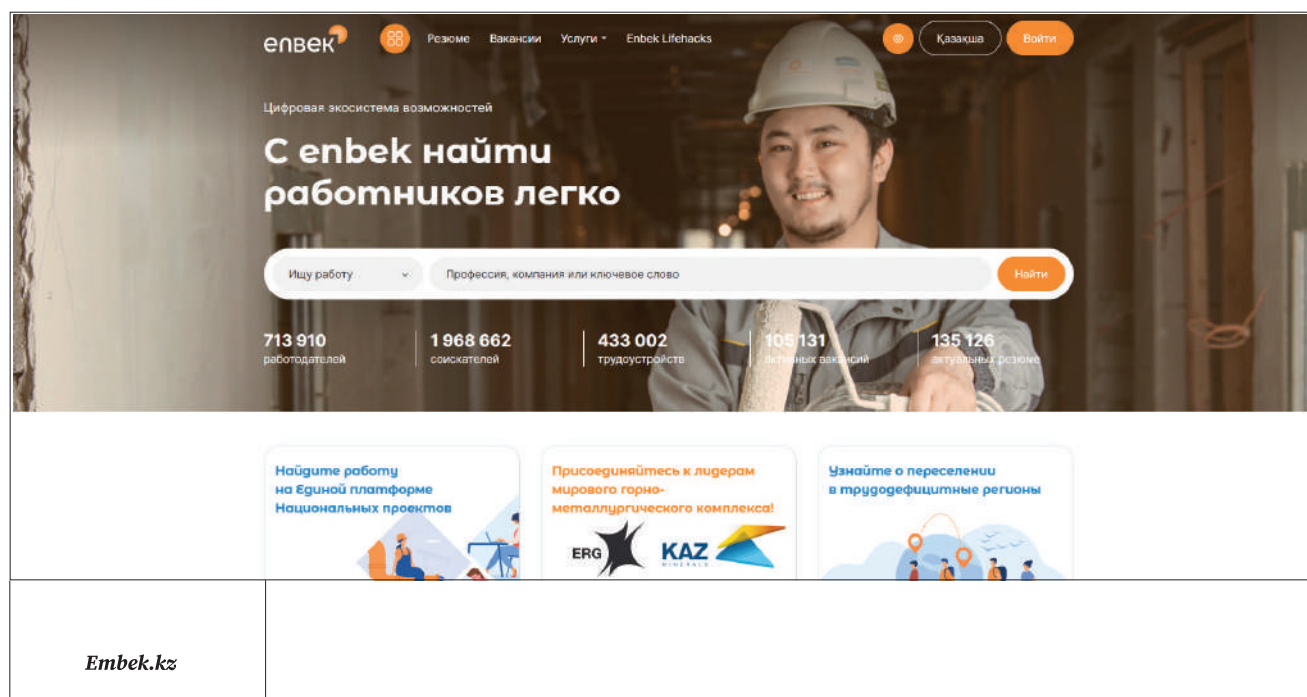
In September, experts from EY consulting practice and representatives of Center for Workforce Development presented a special web page at the electronic labor exchange portal Enbek.kz.



The platform with vacancies in the renewable energy sector (RES) will be available for job seekers and employers free of charge. Thanks to filtering by region, type of employment, level of education and other criteria, search for vacancies and selection of candidates are facilitated. The specialized page also contains general information about the program, excerpts from report on assessment of current state of the renewable energy sector and links to useful resources related to renewable energy. This initiative was implemented with support of the program of the European Bank for Reconstruction and Development and Green Climate Fund in cooperation with the Government of the Republic of Kazakhstan, being aimed at supporting renewable energy sector, as well as promoting gender equality in Kazakhstan.

Speaking about cooperation with CWD, Consulting Practice Manager Dilara Shurshenova noted that the launch of subsection dedicated to professions in renewable energy based on Enbek platform.kz will expand the reach of young people who can potentially be involved in this sector.

“Applicants, especially women and girls, will have the opportunity to see career prospects in the industry, get to know employers and will be able to adjust their professional path according to market requirements. A modern digital platform is not just a website for employment, but a platform for professional growth, expanding boundaries of opportunities for renewable energy specialists,” Dilara Shurshenova stressed.



Embek.kz

Daulet Argandykov, President of “Center for Workforce Development”, in turn, noted the timeliness of this initiative:

“We are pleased to present to the public a specialized page on renewable energy sector in “new opportunities” section of the Electronic Labor Exchange. As noted in the Atlas of New Professions and Competencies, in the coming years Kazakhstan will need more and more specialists in this field. Professions related to design, production of components for renewable energy industry, as well as construction, maintenance and management will develop in the country. Development of the sector should proceed in sustainable and inclusive way, that we have tried to promote with this page.”

EY experts are planning to conduct information campaign among employers and applicants from enterprises of renewable energy sector and universities of the country for greater awareness and popularization of this platform. In the near future, it is also planned to launch a mentoring program, as well as on-the-job training program for students, announcement of “Woman in Renewable Energy” award and other events to support renewable energy sector and promote gender equality.

Development and support of renewable energy sector in Kazakhstan is part of the national strategic vision for more sustainable future of the country, which involves not only development of sector's technical capacities, but also promotion of gender equality within it.

■ INFORMATION ABOUT EY

Following its mission – improving business, improving the world – EY contributes to creation of long-term beneficial effect for customers, employees, and society as a whole, and helps strengthening confidence in capital markets.

EY's multidisciplinary teams are present in more than 150 countries around the world. Using data and technologies, we ensure credibility of information, confirming its reliability, and help clients expand, transform, and successfully conduct their activities.

EY specialists in the field of audit, consulting, law, strategy, taxation, and transactions ask the right questions that allow us finding new answers to today's challenges.

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We interact with companies from the Caucasus and Central Asia, helping them achieve their business goals. More than 1,300 professionals work in eight offices of our company, located in Astana, Almaty, Atyrau, Baku, Bishkek, Yerevan, Tashkent, and Tbilisi.



SMEC

JOINS QAZAQ GREEN ASSOCIATION IN KAZAKHSTAN



SMEC is a global engineering, management and development consultancy delivering innovative solutions for our clients and partners. Leveraging 70-year history of delivering nation-building infrastructure, the company provides technical expertise and advanced engineering services to resolve complex challenges across the project lifecycle, from initial concept, feasibility, planning and design through to construction, commissioning, and operation and maintenance.



In 2016, SMEC joined the Surbana Jurong Group, which is headquartered in Singapore and has a global workforce of over 16,000 employees across 120 offices in more than 40 countries in Asia, Australia, UK, the Middle East, Africa and the Americas.

With global expertise and as a trusted partner for our clients, SMEC has significant experience in renewables projects and enabling sustainability objectives in key infrastructure projects.

Mr. Kawa Baha, Executive Director, Central Asia and Caucasus, stated that SMEC is delighted to be part of the Qazaq Green Association and is ready to share its rich experience in renewables in Kazakhstan.

“SMEC’s renewables expertise includes sustainable energy policy and sector planning, carbon services, load forecasting models, and long-term generation planning using simulation and dynamic programming techniques,” said Mr Baha.

“Our portfolio includes the direct participation in the development of more than 95 solar power plants of 6,7 GW total installed capacities and more than 650 wind turbines of more than 2,6 GW of installed capacities.”

«WE WELCOME THE SMEC COMPANY AS A MEMBER OF QAZAQ GREEN ASSOCIATION. KAZAKHSTAN SETS AN AMBITIOUS GOAL FOR ACHIEVING THE CARBON NEUTRALITY, WHERE THE DEVELOPMENT OF RENEWABLE ENERGY SOURCES IS A CORNERSTONE OF THE DECARBONIZATION PROCESS. UNTIL 2035 THE GOVERNMENT PLANS TO COMMISSION AROUND 6 GW OF RENEWABLE ENERGY SOURCES IN THE COUNTRY AND WE HOPE THAT THE COMPETENCES OF SMEC WILL HELP TO REACH THIS GOAL», - SAID MR. NURLAN KAPENOV, CHAIRMAN OF THE BOARD OF DIRECTORS OF “QAZAQ GREEN” RES ASSOCIATION.

Since 1995 SMEC implemented 40 projects in various sectors, including roads and highways, irrigation, water resources, water supply, sanitation, power transmission, substation and consumption, public opinion, education, administration in the Central Asia and Caucasus region. Currently in Kazakhstan SMEC has ongoing projects in irrigation and drainage, water resources investigation and road infrastructure.

The Company has significant experience in project services related to the power industry, renewable energy projects, green hydrogen, ammonia, and CCS projects, as well as improving energy efficiency and meeting beneficial energy demand to achieve sustainable development.

SMEC has extensive experience in Owner’s Engineer and Detail Design roles for Renewable energy projects including solar farms and wind farms, providing grid connection studies, regulatory assistance and substation design. In addition, the company has extensive experience in biomass, biofuels, hydro technologies, and energy efficiency strategies to provide its clients with efficient and affordable systems for a variety of renewable technologies.



Company offers technical expert experience and advanced engineering services to solve complex tasks throughout the project lifecycle.

GREEN SPARK:

ON THE WAY TO “GREEN” HYDROGEN-BASED ECONOMY

On September 24, 2022, a small, but very famous in the oil and gas industry town of Aksai in western Kazakhstan hosted a significant event for the country's industry, the opening of green hydrogen production, first in our country.

Green Spark company, which launched this production, has already introduced new technologies in its activities. For example, in 2021 Green Spark has built and put into operation its own production facilities in Aksai, a distinctive feature of which is the use of alternative energy, namely solar energy for energy supply of the facility.

Having experience, knowledge, technology and desire to implement and use alternative energy sources, Green Spark is a pioneer in production of hydrogen by electrolysis of water in the Republic of Kazakhstan, this method of production is the most environmentally friendly, as the process does not produce atmospheric emissions of carbon dioxide and other greenhouse gases affecting global warming, that is an important factor for oil and gas industry in Kazakhstan and the world in the past decade.

The goal of this project is to gain experience, knowledge and attract attention to this energy source and in general to the new emerging of renewable energy industry, given the global movement towards decarbonization in all industry sectors, especially oil and gas.

Green Spark is committed to protecting environment and fighting global climate change by replacing traditional energy sources with green technology, thus creating a new market for developing products and services both in the country and abroad. Today many countries are switching to renewable energy sources, and in Kazakhstan, industry and private sector are beginning to transform, following the trend.



Green Spark is also open to cooperation with other potential partners in this area.

Green Spark is also open to cooperation with other potential partners in this area, for example, in June this year, at the hydrogen forum, organized by National Company "Kazakh Invest" JSC in Astana, an agreement was signed to create a consortium of hydrogen manufacturers, and this agreement was joined by companies representing hydrogen industry and new players that see the future prospects of alternative energy.

In developing the new industry we must not forget about obtaining new knowledge and exchange of experience. Following this trend with the view to



JUST LIKE IN KAZAKHSTAN, **GREEN SPARK IS BUILDING PARTNERSHIPS AND IS ALREADY PRESENT IN INTERNATIONAL RENEWABLE ENERGY PROJECTS IN SUCH COUNTRIES AS ITALY, UAE, EGYPT SERBIA AND OMAN**, FOR EXAMPLE IN ITALY GREEN SPARK HAS JOINED A PROJECT TO BUILD AN ELECTROLYZER PLANT AND AS A PARTNER IN THIS PROJECT GREEN SPARK PLANS TO FILL A NICHE OF GREEN HYDROGEN PRODUCTION EQUIPMENT MANUFACTURER.



creating new cluster of young specialists and engineers, Green Spark signed a memorandum with KazMunaiGaz Engineering LLP on joint study of hydrogen energy, sharing experiences and knowledge, allowing specialists of both companies to expand their knowledge and skills. Under this agreement in November this year young specialists of KazMunaiGaz Engineering LLP will visit the of Green Spark production facilities in Aksai for training and knowledge exchange.

We understand that domestic and international market cannot supply large quantities of this product right now, and we are working to enable other companies to follow this exciting path with us to create a green hydrogen economy in Kazakhstan.



A partner in this project Green Spark plans to fill a niche of green hydrogen production equipment manufacturer.

EXPERTS DISCUSS

PROSPECTS FOR RES DEVELOPMENT IN CENTRAL ASIA AT GREEN MEDIA FORUM IN ALMATY

On November 10-11, the International Green Media Forum was held at the Almaty University of Power Engineering and Telecommunications named after Gumarbek Daukeyev (AUES).



The Forum was organized with USAID support. Its agenda includes the topics such as renewable energy in Kazakhstan, the country's decarbonization commitments and their fulfillment strategy.

Representatives of the Parliament, the Ministry of Energy, independent experts in the field of renewable energy and journalists discussed green energy issues and climate change impact, legislative initiatives for environment protection, renewable energy projects in Kazakhstan, experience of European countries in developing RES and hydrogen energy industry.

"THE MEDIA FORUM IS BEING HELD AT AUES

GROUNDS, AS AUES IS A LEADING SECTORAL HIGHER EDUCATION INSTITUTION IN THE FIELD OF ENERGY, TELECOMMUNICATIONS, IT TECHNOLOGIES AND INFORMATION SECURITY, AND

SPACE ENGINEERING," SAULE SAGINTAYEVA, THE AUES RECTOR, SAID IN HER WELCOME SPEECH

A curriculum on renewable energy for undergraduate and graduate students has been developed and implemented at AUES.

USAID and AUES have a number of joint projects and long-term experience of effective cooperation. Besides, USAID is funding six students from Central Asian countries to attend the Master's Degree in RES and Energy Efficiency in AUES, as well as another 10 scholarships at the Kazakh-German University (DKU). Educational visits to RES facilities of Kazakhstan for students and teachers from Central Asian countries are organized on a regular basis

According to Bayan Abylkairova, Deputy Project Manager of the USAID program "Power Central Asia" (PCA), the USAID project aims to help five Central Asian countries achieve their national and regional energy priorities to ensure energy security and support them in obtaining economic benefits of regional electricity trade.

USAID is providing support in all areas of renewable energy development, including improvement of legislation on renewable energy, advice on introducing competitive procurement of renewable energy, development of model PPAs, other documents and much more. Also, Bayan Abylkairova noted that a gender plan, namely support for women in energy sector, was developed with the framework of the project.



Nurlan Kapenov, Chairman of the Board of Qazaq Green Association noted that Kazakhstan set ambitious targets for RES development.

"There are professional internships for female students of energy departments in the Ministry of Energy, KEGOC, Samruk Energy, KOREM, workshops and training on technical topics and development of soft skills: gender policies, role of women in the energy sector in Central Asia. More than 600 women participated in experience-sharing and capacity-building events of energy sector in 2018 - 2022," she said.

Consumption of green hydrogen will grow worldwide, and it will become the major alternative to oil and gas, noted Farkhad Kuanganov, Deputy Chairman of the Board of Astana International Science Complex, adding that Kazakhstan could only benefit from hydrogen exports in the future.

According to him, global market for hydrogen was 85 million tons in 2021. It is expected that this figure will grow by another 35 million tons until 2030.

"HYDROGEN ENERGY INDUSTRY CAN BECOME A POWERFUL DRIVER OF THE ECONOMY. NINETEEN COUNTRIES HAVE BEEN DEVELOPING HYDROGEN ENERGY FOR A PERIOD OF SIX - SEVEN YEARS, AND MANY COUNTRIES ARE ALREADY DEVELOPING HYDROGEN STRATEGY PROGRAMS," SAID FARKHAD KUANGANOV.

He noted that Kazakhstan's hydrogen development program is represented by Svevind, German company which implements projects for construction of green-energy facilities. The company intends to build a giant facility with 45 GW capacity, that will produce up to 3 million tons H2 per annum by 2031, in Mangistau region.

Nurlan Kapenov, Chairman of the Board of Qazaq Green Association noted that Kazakhstan set ambitious targets for RES development. In Kazakhstan, the installed capacity of RES facilities amounted to 2,330 MW by the result of the first half of 2022.

"At the moment, one of the current problems of RES sector is the high volatility of national currency exchange rate, that negatively affects financial standing of existing and new RES projects. Since the beginning of 2022, Qazaq Green RES Association, together with the Ministry of Energy of the Republic of Kazakhstan and the RES business community has been applying major efforts to improve investment climate in the sector. So, tariff indexation during the period of RES facility construction was introduced and the existing tariff indexation mechanism, which did not cover the currency risks of investors, was significantly improved," said Nurlan Kapenov.

On November 11, participants of the Forum went on a tour to operating wind farm of Samruk-Energo JSC.



ASTANA HOSTS **WORKSHOP** ON FOSTERING WOMEN'S PARTICIPATION IN ENERGY SECTOR IN CENTRAL ASIA

The Qazaq Green RES Association jointly with the Office of the Co-ordinator of OSCE Economic and Environmental Activities (OCEEA) and with the support of UNDP Kazakhstan held "Regional Workshop on fostering women's participation in the energy sector in Central Asia" in Astana on December 7-8, 2022.



The participants noted the importance of supporting energy companies to understand the benefits of a gender-diverse workforce and to provide guidance on how to integrate gender equality objectives into recruitment policies and to attract and retain more women.

Nurlan Kapenov, Chairman of the Board of Directors of Qazaq Green RES Association, Giulia Manconi, Project Manager and Energy Security Officer, OSCE, and Kumar Kylychev, Head of Energy and Environment Unit, UNDP Kazakhstan, delivered the welcoming speech.



Green RES Association, Giulia Manconi, Project Manager and Energy Security Officer, OSCE and Silvia Sartori, Gender and Energy Consultant, OSCE.

Women representing state energy industries and companies, NGOs, women's committees, and scientists from Kazakhstan, Uzbekistan, Tajikistan, and the Kyrgyz Republic discussed the status of gender-related policies in Central Asia.

The participants noted the importance of supporting energy companies to understand the benefits of a gender-diverse workforce and to provide guidance on how to integrate gender



In the Workshop programme, the participants discussed topics such as "Setting the Stage: Gender and Energy", "Mainstreaming Gender into Energy Policy", "Women's Participation in the Energy Workforce" and "Gender and Energy Transition".

The moderators of the sessions were Ainur Sospanova, Chairperson of the Board of Qazaq

equality objectives into recruitment policies and to attract and retain more women.

All participants expressed the view that government decision-makers should be supported in their efforts to integrate women's needs and gender equality objectives into energy security and sustainable development policies.



QAZAQGREEN HOSTED

THE EXPERTS' DISCUSSION ON CURRENT ISSUES AND ACHIEVEMENTS OF RES IN KAZAKHSTAN



December 13, 2022, Astana hosted a press conference with representatives of the Ministry of Energy, the Qazaq Green RES Association, Financial Settlement of Renewable Energy LLP, domestic and foreign investors.

Abai Kulanbay, Director of the Renewable Energy Development Department of the Ministry of Energy of Kazakhstan, Johannes D. Rey, Director of the Representative office of the Konrad Adenauer Foundation in Kazakhstan, Gulzhan Nalibayeva, General Director of Financial Settlement of Renewable Energy LLP, Nurlan Kapenov, Chairman of Qazaq Green RES Association Board of Directors and Ainur Sospanova, Chairperson of Qazaq Green RES Association Board.

Kazakhstan has pledged to achieve carbon neutrality by 2060, hence, decarbonisation, development of a sustainable economy, and green energy became a leitmotif of the country's leadership speeches.

In addition, Kazakhstan should address such issues as obsolescence and low modernisation rates, which have led to the current energy crisis.

"The winter starts with power shortages in the country. This power shortage situation has been observed every month since May 2022, and in 2021, there were shortages in November, August, July, and June. The minister attributed the shortages to the increasing frequency of emergency equipment failures of domestic power-generating facilities, which are becoming obsolete," Nurlan Kapenov said.

Compared to the same period last year, the number of emergency shutdowns has increased by 22% and their duration by 16%. The depreciation of generating capacity currently is about 60%.

This energy crisis, according to experts, requires systematic and effective measures in the country.

According to Qazaq Green Chairman, thanks to joint work with government agencies and the business community, the Association manages to solve the most pressing issues for Kazakhstan's renewable energy sector. For example, one of the current problems of the renewable energy sector is the high volatility of the national currency,



which negatively affects the financial condition of existing and new renewable energy projects.

"Since the beginning of 2022, Qazaq Green, together with the Ministry of Energy of Kazakhstan and the RES business community, has worked hard to improve the investment climate in the sector. For example, we have introduced tariff indexation for the period of RES facility construction and significantly improved the existing tariff indexation mechanism which previously did not cover the currency risks of investors. We are confident that the new indexation approaches will contribute to the successful implementation of RES projects in our country," he said.

Abai Kulanbay, Director of the Renewable Energy Development Department of the Ministry of Energy of Kazakhstan, confirmed that two indexation measures have been adopted. Investors who win from this year onwards will receive a one-off indexation for the duration of construction. The formula for indexation of tariff for electricity generated by RES facilities has also been revised.

"The tariff will subsequently be indexed for all participants, taking into account a 100% change in the



national currency to convertible currencies," Abai Kulanbay said.

Ainur Sospanova, Chairperson of Qazaq Green RES Association Board, said the Qazaq Green Association works closely with government agencies and also speaks at press conferences at global and Central Asian venues in Tashkent, Istanbul, Izmir and Tokyo to promote clean energy sources in Kazakhstan and the region as a whole. She believes "the current generation is responsible to the future generation".

"The development of renewable energy sources plays a huge role not only in the generation process but also in improving the environment. There is a lot of work to be done," she said.

Johannes D. Rey, Director of the Representative office of the Konrad Adenauer Foundation in Kazakhstan, said that the Qazaq Green Association and the Konrad Adenauer Foundation is working to educate the public about the environment and renewable energy. They publish the Qazaq Green magazine and recently launched the qazaqgreen.com portal.

"I am glad that the Foundation can participate in this process, build something together, and give our small support," he said.

Johannes D. Rey said the Konrad Adenauer Foundation holds many conferences and civic education events, conducts policy research, organises scientific and expert forums on global issues, promotes dialogue between countries, and supports students. The Foundation also has a unique position among international organisations and brings global principles to humanity: freedom, peace, and justice.

In his closing remarks, Nurlan Kapenov noted that the Qazaq Green RES Association has established an Awards Committee of the Board of Directors, and approved the Regulations on Awards and the Regulations on the Awards

Committee. The Association has awarded the experts, specialists, employees, servants, veterans, heads of organizations of the renewable energy sector, and members of Qazaq Green for their significant contribution to the development of RES in the Republic of Kazakhstan and high results.



The highest Qazaq Green award is a medal for contribution to the development of renewable energy in the Republic of Kazakhstan "For contribution to the Development of Renewable Energy in Kazakhstan". In addition, the following titles were awarded: "Honoured Professional in Renewable Energy", and "Excellence in Renewable Energy" (awarded to persons working in the RES sector for at least three years for conscientious performance of their duties and fulfilment of major tasks for the sector development).



Abai Kulanbay, MINISTRY OF ENERGY OF THE REPUBLIC OF KAZAKHSTAN: GREEN LIGHT FOR "GREEN" INVESTMENTS

“ *Joint project of UNDP and the Ministry of Energy of the Republic of Kazakhstan "De-risking renewable energy investment" has been working in Kazakhstan for more than five years. What has been done within the project framework, what problems have yet to be solved and what is the benefit for consumers and small businesses? This is stated in an interview of our correspondent with Abay Kulanbay, Director of Renewable Energy Department, Ministry of Energy of the Republic of Kazakhstan.* ”

– In 2019, with the support of the UNDP-GEF project, site-specific auction was prepared and held for the first time. In your opinion, how successful was the practice of implementing such auctions and does the Ministry continue to use it?

– Site-specific RE auction is one of the important achievements of initiative by the Ministry of Energy of the Republic of Kazakhstan and UNDP-GEF Project. The essence of this mechanism is that the participants, competing, offer the lowest tariff per kWh of "green"



energy, based on volumes of energy planned for purchase, announced by the state and location of facility's construction, proposed by the potential investor. The pre-made documentation reveals the main technical aspects of the future construction site of renewable energy facilities, namely location, conditions for connecting future facility to the power grid and other aspects, that allows minimizing risks of investors participating in site-specific RE auctions.

Such a mechanism has proven to be successful, and now the Ministry of Energy of the Republic of Kazakhstan uses it independently. In particular, this year it is planned to hold site-specific RE auctions for implementation of wind power projects.

– Important direction of renewables development is the implementation of small-scale RE projects by the population and businesses of the country for their own needs. During the meetings on development of electric power industry in 2021 and 2022, the Head of State drew particular attention to need of stimulating this direction. What steps is the Ministry of Energy of

the Republic of Kazakhstan taking to develop low-capacity RES?

– For consumers, use of small-scale renewable energy projects provides a lot of positive aspects. First, cost of generated electric energy will not depend on cost of energy carriers. Second, reducing energy consumption and, as a result, saving resources in the medium and long term. Third, improving the comfort of living.

Of course, at the current level of the cost of electric/thermal energy, use of such systems is economically unprofitable without special support measures, but in the medium term, the use of such systems will be more than justified. Today, the Ministry, together with the UNDP-GEF Project, initiated a number of amendments to the legislation on support of renewables in terms of stimulating development of small-scale projects. They are related to simplification of procedure for connecting facilities to the grid, introduction of a conceptual framework for small-scale renewable energy projects and a number of other areas. We hope that the amendments will be adopted by the Parliament before the end of 2022.



– At the beginning of 2022, the business community of renewable energy sector faced the problem of a sharp decline in the exchange rate of national currency due to various external factors. Then the issue of implementing tariff indexation mechanism became acute. UNDP-GEF provided analytical and consulting support to find optimal mechanisms for solving the problem. What decisions have been made by the Ministry of Energy of the Republic of Kazakhstan based on the results of this work?

– Yes, this is a big stratum of work. Fluctuations in national currency exchange rate introduce some uncertainty for investors in renewable energy sector, since the main equipment and technologies are exported to Kazakhstan. Several solutions to this issue were considered. Some of them were accepted by the Ministry. In particular, a tariff indexation mechanism was introduced for the construction period of renewable energy facilities. Before that, the beginning of tariff indexation was possible only from the moment the facility was put into operation, representing big time lag, from two to four years.

– As you know, today the renewable energy sector can develop in two directions: through the auction mechanism and through the market of bilateral PPA agreements. How promising is development of bilateral agreements market? What are the arising problems, what does the MoE offer to solve them?

– In general, the Ministry of Energy supports development of bilateral agreements mechanism. This is the current reality and necessity due to tightening environmental policy both in Kazakhstan and in the world. For example, the EU is introducing a cross-border adjustment mechanism (CBAM), when export goods entering EU countries will be checked for carbon footprint.

The main issues of introducing this mechanism are aspects of regulating relationships between process participants, reducing possible risks, as well as issues of technical regulation and balancing of renewable energy facilities connected to power grid.

– UNDP-GEF project "Derisking renewable energy investments" has been working for five years. What are the expectations and wishes of the Ministry of Energy of the Republic of Kazakhstan for further implementation of this project?

– In general, as the national project director, I positively assess the work of the team. I believe that the main tasks have been completed, despite the two-year delay in its implementation. The recommendations are standard ones. It is necessary to strengthen educational work by conducting training workshops among representatives of SMEs on the issues of implementing small-scale renewable energy projects. I would also like to intensify work with financial organizations to complete tasks of project's financial mechanisms.



Fluctuations in national currency exchange rate introduce some uncertainty for investors in renewable energy sector, since the main equipment and technologies are exported to Kazakhstan.



Financial support programs for Kazakhstan entrepreneurs

interested in implementing RES and energy efficiency projects

Two of the financial support programs include subsidizing part of the principal loans:

1

in the field of small renewable energy sources, as part of the project on Reducing Renewable Energy Sources Investment Risks.

Subsidy amount: **25%**
of the principal loan amount

2

in the field of energy efficiency, as part of the project on Sustainable Cities for Low-Carbon Development.

Subsidy amount: up to **40%**
of the initial loan amount

The maximum subsidy amount is calculated using KZT 450 million as a cap, the total amount of the loan is not limited*.

*the loan is likely to be withheld if the subsidy is too small compared to the loan amount and is not expected to reduce the project's payback period by more than 10%

Financial support

is provided after the commissioning of the facility or implementation of energy efficiency improvements

Electricity or heat generation using renewable energy sources

e.g. installation of thermal insulation, heat point, etc.
Projects must be expected to produce results in the form of energy savings, except for the installation of automated heat points, which are supported regardless of the savings achieved

3

Objective of the third program

PROVIDING LOAN GUARANTEES AND PROMOTION OF PROJECTS

in the field of energy efficiency (buildings, infrastructure and other facilities in Kazakhstan)

Maximum loan amount no more than **KZT 350 million**

Guarantee amount no more than **85%** of loan amount

Both a legal entity and an individual entrepreneur or a peasant/farm holding (except for state-owned enterprises and non-profit organizations) can benefit from the financial support programs.

For all three programs, entrepreneurs can get more information and advice on preparing business plans by submitting brief information about their project to fm@undp.org.



For more information please visit the website of Damu Entrepreneurship Development Fund JSC
www.damu.kz



Reducing RES Investment Risks Project is a Joint Initiative of the United Nations Development Program (UNDP) in Kazakhstan and the Government of Kazakhstan, implemented with the financial support of the Global Environment Facility (GEF)

www.kz.undp.org



IMBALANCES IN THE RES MARKET



Financial Settlement
Center of RE



Gulzhan Nalibayeva,
Director General, FSC of RE LLP

TODAY, THE ELECTRIC POWER INDUSTRY IS ONE OF THE MOST HIGHLY PRIORITIZED AND ATTENTION-DEMANDING SECTORS OF THE COUNTRY'S ECONOMY. THE ESTABLISHED VECTOR AND TARGETS FOR DEVELOPMENT OF THIS INDUSTRY ONCE AGAIN CONFIRM THE COMMITMENT OF OUR STATE TO ALL ITS OBLIGATIONS UNDER ALL EXISTING INTERNATIONAL AGREEMENTS. AT THE SAME TIME, TODAY'S REALITIES HAVE SHOWN THAT COMPLETE WITHDRAWAL FROM TRADITIONAL ENERGY SOURCES IS IMPOSSIBLE TODAY DUE TO GEOPOLITICAL AND ECONOMIC CHANGES IN THE INTERNATIONAL ARENA.

1. OVERVIEW OF RES SECTOR

Adopted in 2013, "Concept for the transition of the Republic of Kazakhstan to a green economy" until 2050, provides for "green economy" principles as a direction for future development (increasing the share of renewable energy sources (RES) in total electricity production to 6% by 2025, 15% by 2030 and 50% by 2050 with taking into account alternative energy). The country has set ambitious target indicators for development of "green economy", but progress and development shows that Kazakhstan is increasingly attracting foreign and domestic investors for construction of renewable energy facilities and the share of renewable energy in the energy system of Kazakhstan participating in the production of electric energy is growing every year.

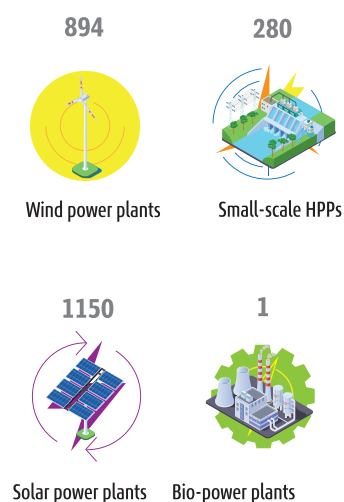
Today, statistical indicators of renewable energy sector show the following picture.

As of the end of September 2022, the total installed capacity of renewable energy facilities in Kazakhstan reached 2,325 MW (according to the Ministry of Energy



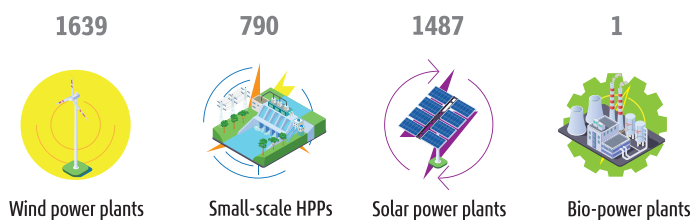
of the Republic of Kazakhstan). Current trends in the development of RES in Kazakhstan indicate that the involvement of investors in construction of solar power plants prevail over other types of renewable energy (share of installed capacity of solar power plants is more than 49%).

Installed capacity of RES facilities for 9 month of 2022, MW



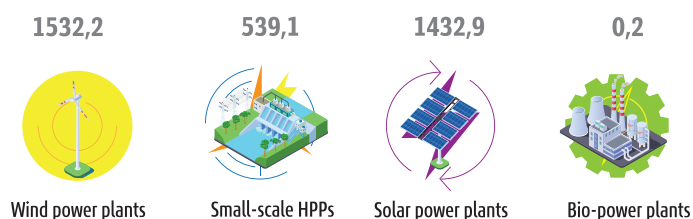
The share of generated RES energy in the total volume of electricity production in Kazakhstan for 9 months of 2022 amounted to 4.6% or 3,917 million kW. With that, large share of renewable energy generation falls to wind power plants, more than 41% or 1,639 million kW.

Generation of electric energy by RES in RK for 9 month of 2022, mln. KW



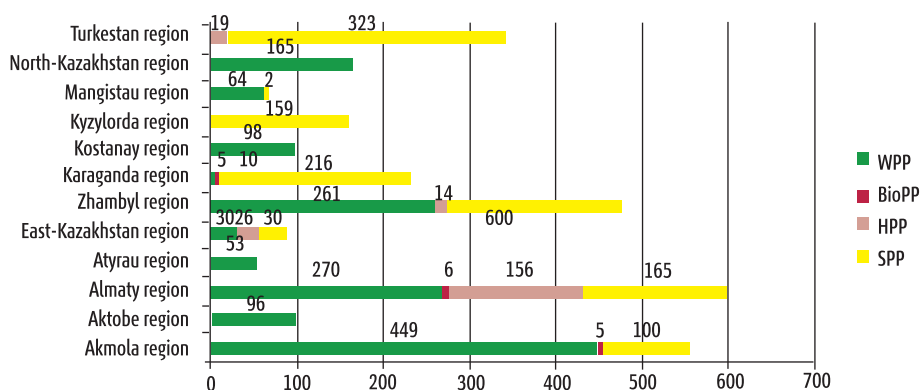
About 90% or 3,504.4 million kWh of renewable energy was sold through FSC of RE LLP. Wind power plants also account for the largest share of electricity generation, more than 44% or 1,532 million kW.

RES electric energy, sold through "FSC for RES" LLP in 9 month of 2022, mln. KW



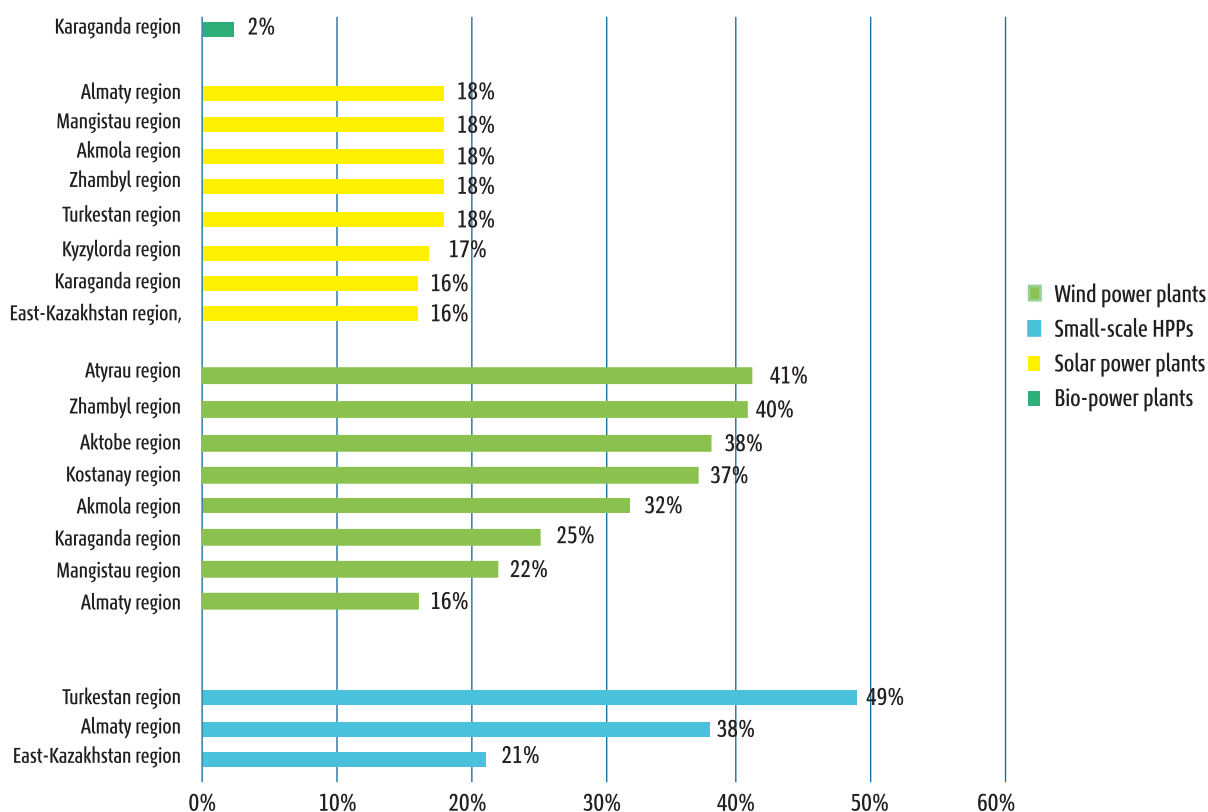
In accordance with the legislation in the field of renewable energy, the function of balance provider for renewable energy facilities is carried out by FSC of RE LLP within the framework of concluded long-term contracts, consolidating daily production schedules from 91 renewable energy facilities with total installed capacity of about 2,094 MW for all types of renewable energy.

RES installed capacity according to contracts, concluded with "FSC for RES" LLP in breakdown by regions of RK



Installed Capacity Utilization Factor (ICUF) by region shows the natural and climatic potential of the region for each type of renewable energy. The average annual ICUF by region was calculated as the ratio of the actual electric power generation of each power plant to its maximum possible for each hour over the past 12 months (from September 2021 to September 2022).

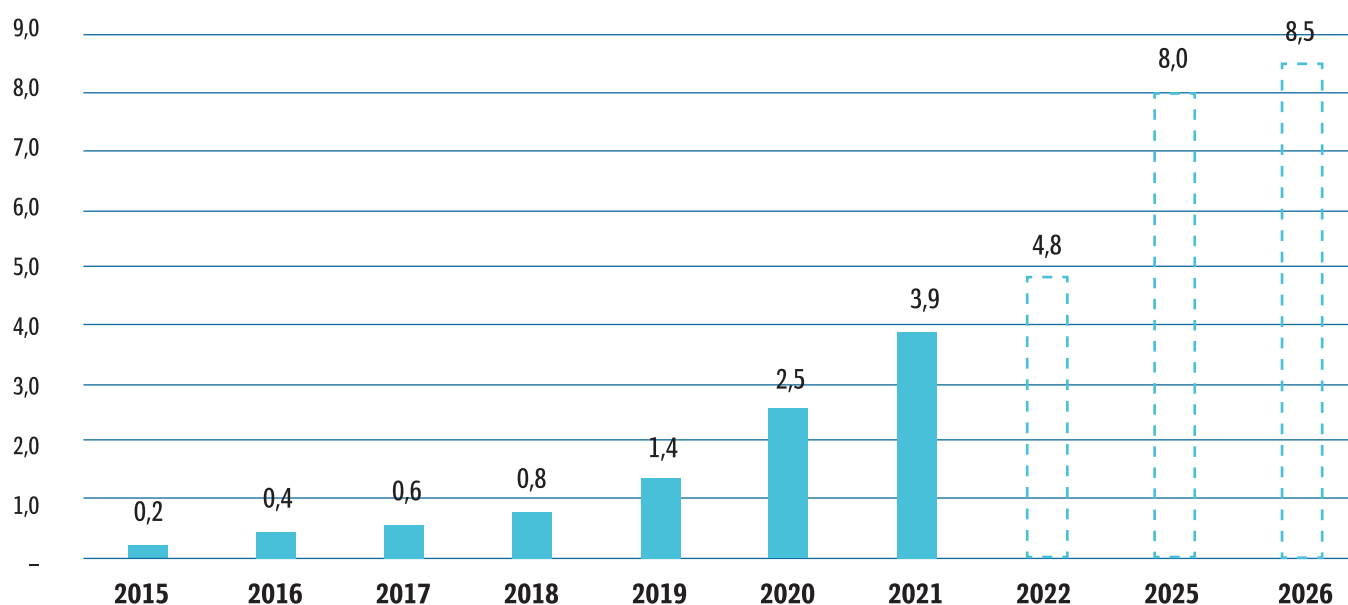
Average ICUF by regions from October 1, 2021 to September 30, 2022



*ICUF is calculated for renewable energy facilities that have been operating for a full calendar year

The above graph shows that there are sufficiently high resource indicators for SPP projects mainly in the south and west of Kazakhstan, as well as wind resources in the northern regions, Atyrau and Zhambyl regions.

Volum of RES energy purchase by "FSC for RES" LLP,
bln. KW (actual / planned)

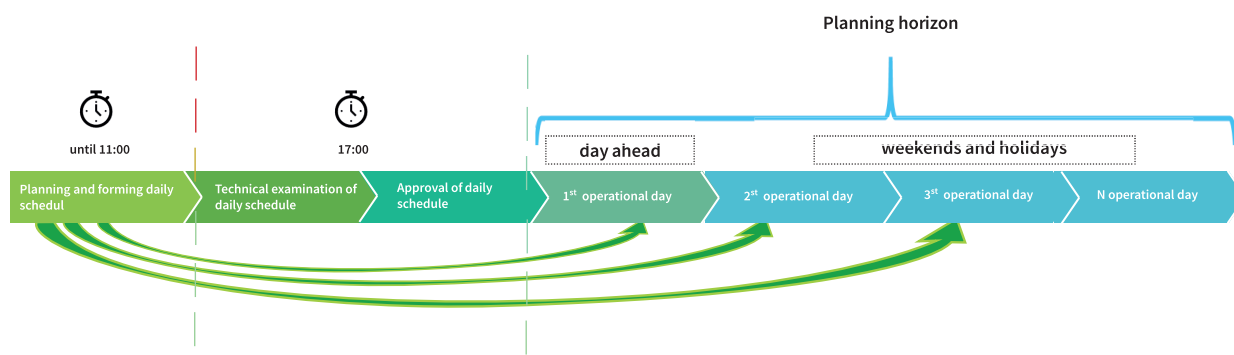


2. ANALYSIS OF RES IMBALANCES FOR 9 MONTHS OF 2022 UNDER CONTRACTS CONCLUDED WITH FSC OF RE LLP

Renewable energy development trend shows that investors, whether domestic or foreign, are paying more attention and showing interest in construction of wind farms and solar power plants in the country. From the environment point of view, this is a favorable phenomenon, but the energy industry of Kazakhstan does not actively support such initiatives. This happens due to the fact that along with the growth of electric energy production from renewable energy facilities, a number of other negative phenomena arise in the energy system of Kazakhstan.

From the point of view of the integration of RES into the Unified Electric Power System of the Republic of Kazakhstan (UES RK), one of the main problems associated with the generation of energy by RES is the failure of RES facilities to comply with the daily schedule of electricity production. Poor-quality planning of daily schedule significantly complicates operations and hinders fulfillment of objectives set to ensure constant balance of electricity production and consumption. This problem is aggravated by the shortage of maneuverable generation in Kazakhstan. The shortage of maneuverable capacities in the UES of the Republic of Kazakhstan, as well as the planned increase in electricity production from renewable energy sources, leads to an increase in dependence on the Russian Federation for balancing and regulating the energy system.

The current scheme for formation of daily schedule



It is important to note that the current scheme for formation of daily schedule in accordance with the legislation of the Republic of Kazakhstan assumes submission of formed daily schedule for all wholesale electricity market entities (including RES) until 11:00 of the day preceding the operational days by uploading application to web interface of the System Operator's planning system. Further, until 16:00 of the day, the System operator coordinates with the authorized dispatching units of neighboring states schedules of interstate contractual flows of electric energy and conducts technical examination of daily schedule with subsequent approval

and posting it at the website of planning system until 17:00.

The graphs below show examples of deviations in electricity generation of solar and wind power plants from the planned values in August and September of this year.

It is worth noting a tendency to minimize these deviations during formation of daily schedule a day in advance before the start of operating day, while forecasting for weekends and holidays is done several days in advance and has a stick-slip nature. Such a direction of deviations is observed in many renewable energy facilities, and especially for SPP projects in winter.

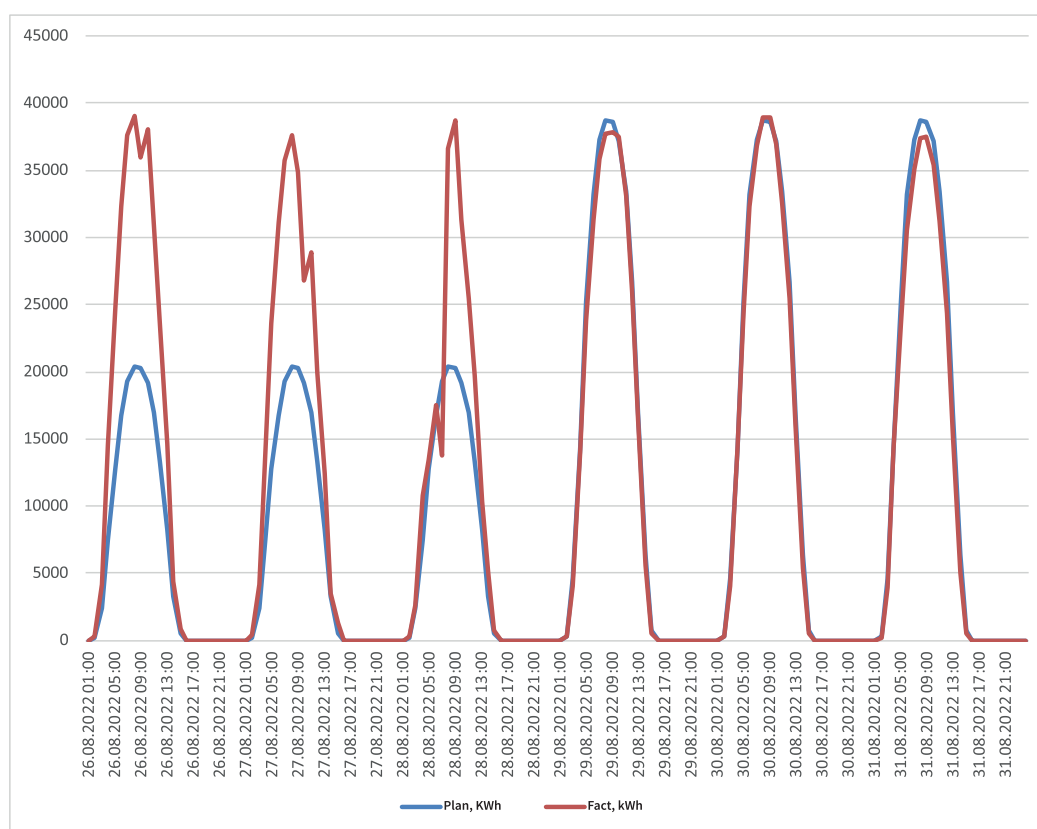


Figure 1. Schedule of deviations in actual production of 50 MW SPP from planned values (26.08.2022-31.08.2022)



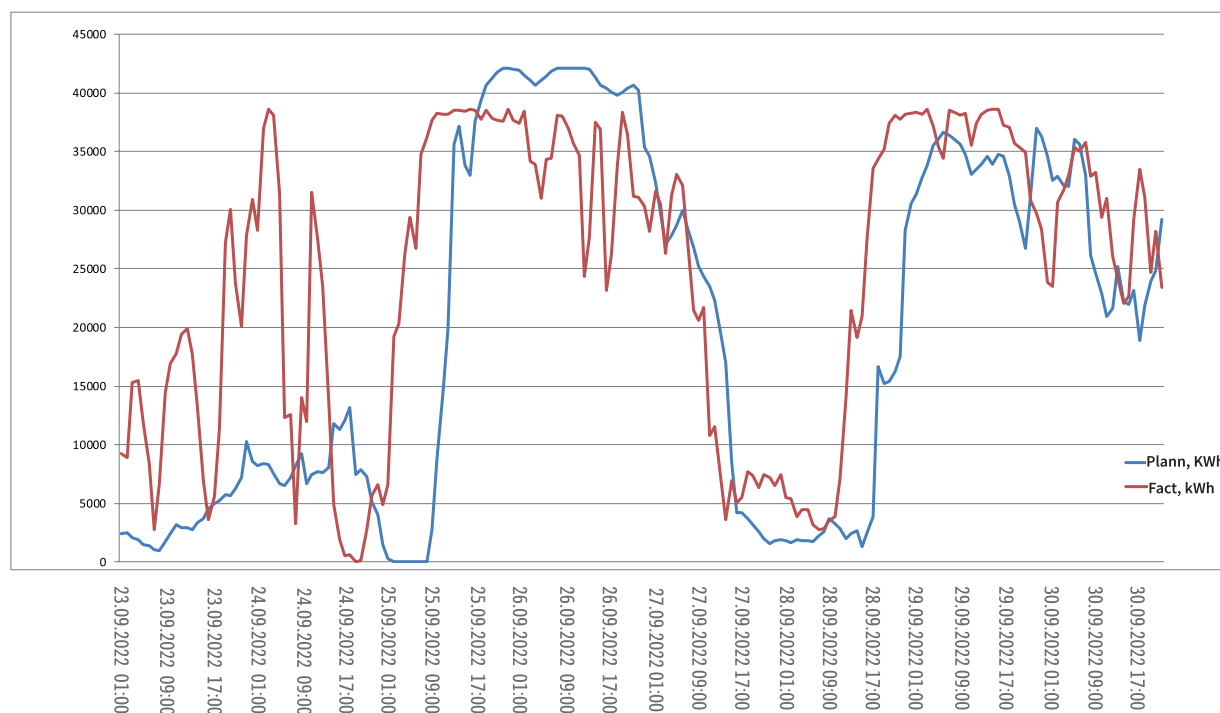


Figure 2. Schedule of deviations in actual output of 48 MW wind farm from planned values (09/23/2022-30.09.2022)

According to analytical data for 9 months of 2022, it was revealed that total imbalances from renewable energy facilities, both positive and negative, amounted to 1751 million kW with actual generation of 3504.4 million kWh! This fact indicates that there is a big problem in forecasting production of electric energy by renewable energy facilities and lack of financial instruments to stimulate their compliance. Sooner or later, this problem will lead to significant imbalances of electric energy during operation of Balancing Electricity Market in real time, increase in dependence on power system of the Russian Federation and financial risks on the side of RES balance provider. Out of total imbalances, SPPs account for about 489 million kW. or 28%, WPP – 1182 million kW or 67%, HPP – 79 million. kW or less than 1%.

The month of March is characterized by the peak

of imbalances in energy system from renewable energy sources, which amounted to 249 million kW of underperformance, 220 million kW of over-production by all types of renewable energy sources.

The average hourly deviation by types of renewable energy for 9 months of 2022 looks as follows:

- SPPs - 40.67%;
- WPPs - 60.73%;
- HPP - 22.88%;

The largest average deviations within specified period for SPPs fall to January - 62.02%, for WPPs – January, June, approx. 62%, for HPPs – January – 27.30%. This factor is connected, in my opinion, with the seasonal difficulties of forecasting for SPPs and HPPs.

At the same time, the number of hours with deviations from a certain range was:

Deviation range	Number of hours					
	SPP*		WPP		HPP	
x<10%	1546	23,6%	1795	27,4%	3346	51,07%
10%<x<20%	888	13,55%	1619	24,7%	1502	22,9%
20%<x<30%	566	8,64%	1399	21,35%	909	13,9%
30%<x<40%	315	4,81%	877	13,39%	591	9,02%
x>40%	1531	23,37%	862	13,16%	204	3,11%

*taking into account the hours of sunshine for the period under review

3. PARTICIPATION OF RES IN BEM

Electric energy producers using renewable energy sources should already think today that when balancing market is operating in real time, all financial responsibility for imbalances created by them in the hourly daily schedule of electric energy production will be assigned to them.

of traditional generation at the lowest cost without compromising reliability of the system. At the same time, it is important to note that RES forecasting is driver of the process, but in itself does not increase the network flexibility. Correct forecasting must be used in conjunction with other components. For example, increased system

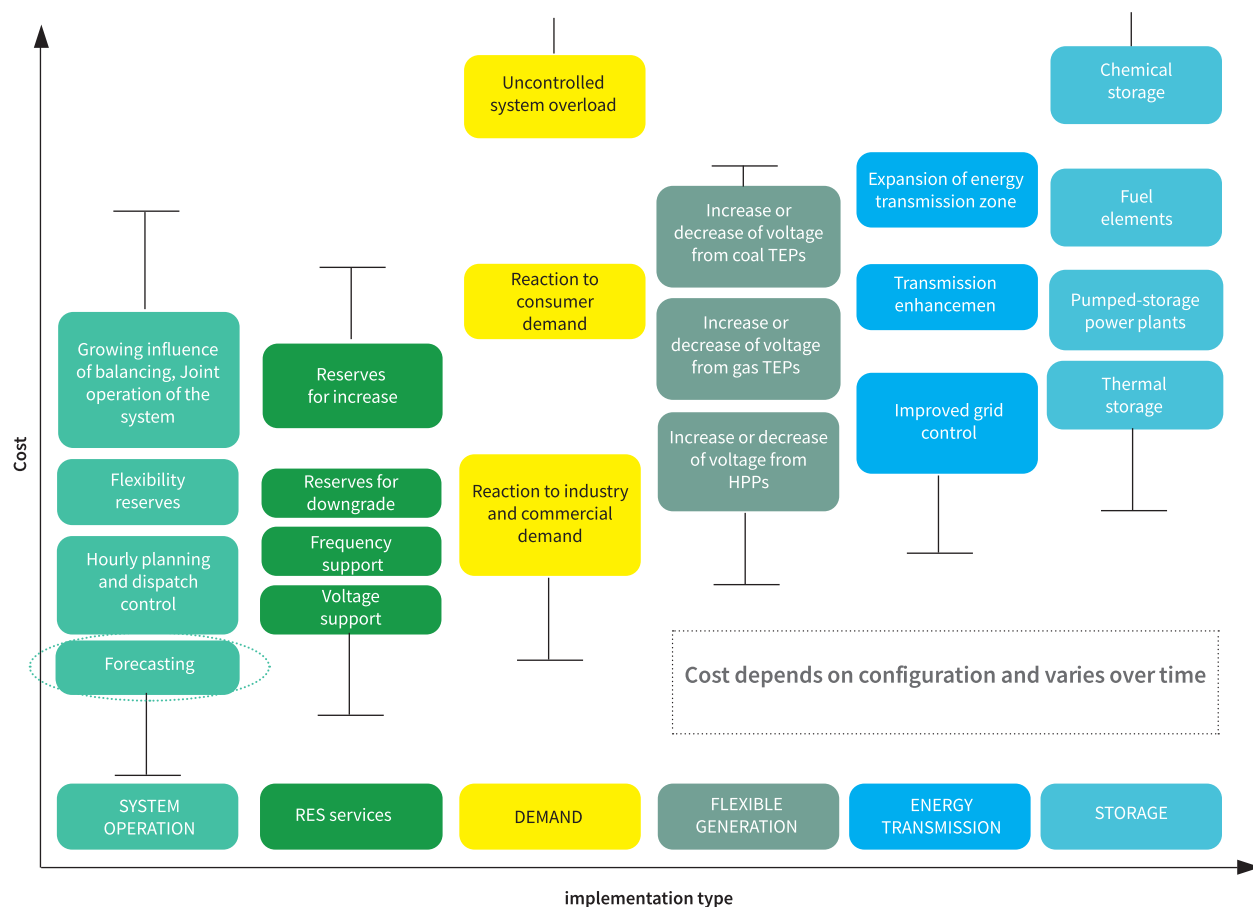


Figure 3. Relative economic characteristics of integration options (flexibility matrix) *NREL research

One of the key factors in increasing integration of renewable energy variables into the energy system is the flexibility of the system. Flexibility is the ability of a system to respond to the variability and uncertainty of supply and demand. Higher flexibility of the system can be achieved in several ways. Figure 3 illustrates various options for increasing network flexibility at a relative cost.

According to the International Energy Agency (IEA), qualitative generation forecasting for renewable energy facilities is one of the most cost-effective ways to compensate for variability of output. Proper forecasting of RES provides the basis for using the full flexibility

flexibility requires a combination of qualitative forecasting for RES, short-term economic dispatch control and sufficient flexibility of conventional energy installations.

Currently, the authorized body, the Ministry of Energy of the Republic of Kazakhstan, together with the electric energy market players is actively working to improve legislative framework in the field of electric power, for introduction of real-time balancing market and unified energy buyer mechanism. These proposed initiatives assume that all wholesale electricity market entities will independently bear financial responsibility to authorized organization at the BEM for deviation from

planned modes of daily production and consumption schedule. RES facilities, not being an exception, will also be responsible for created imbalances, both through the

balance provider (FSC of RE LLP) within the framework of the contract concluded with it, and independently within the framework of concluded bilateral agreements.

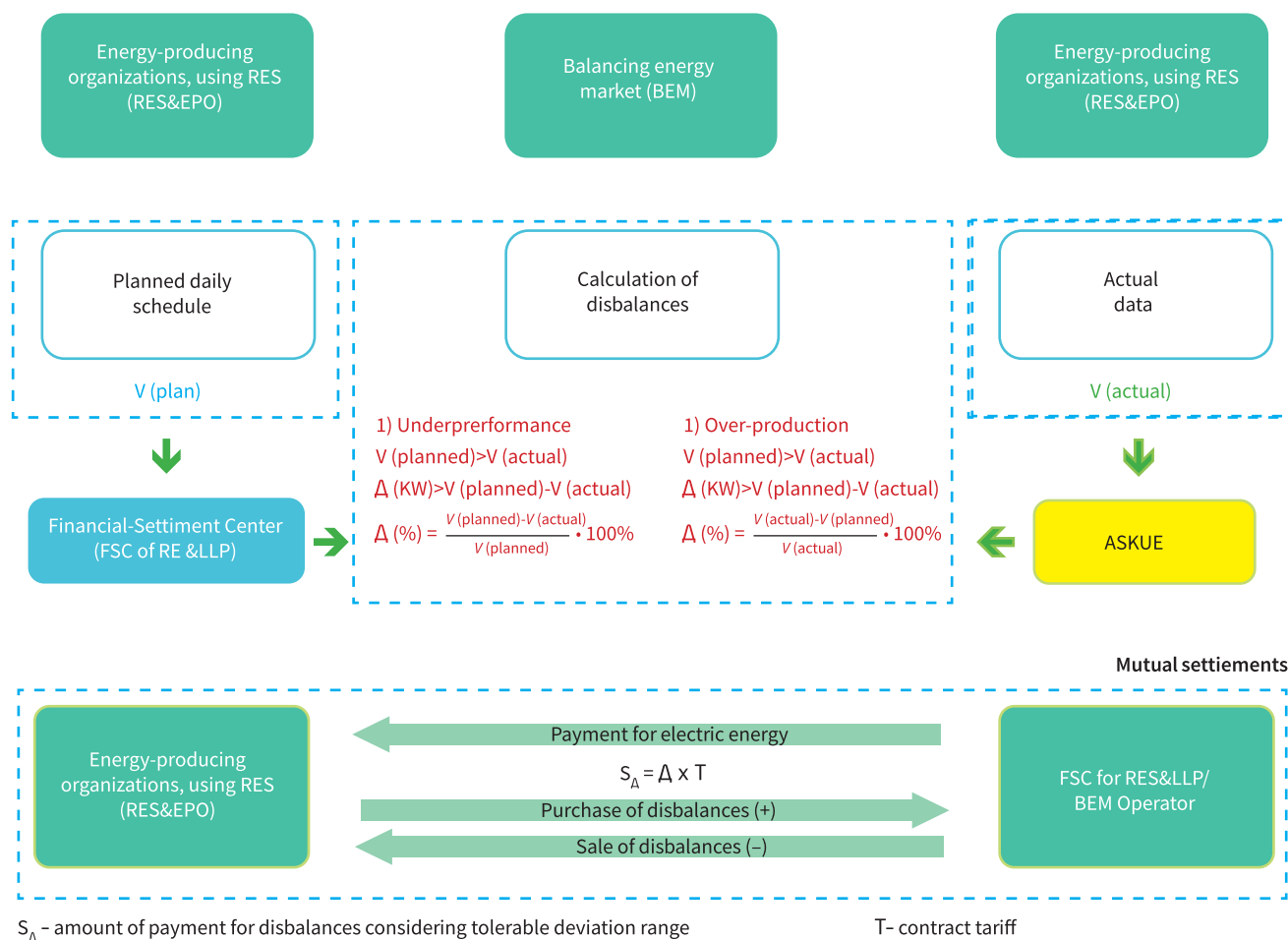
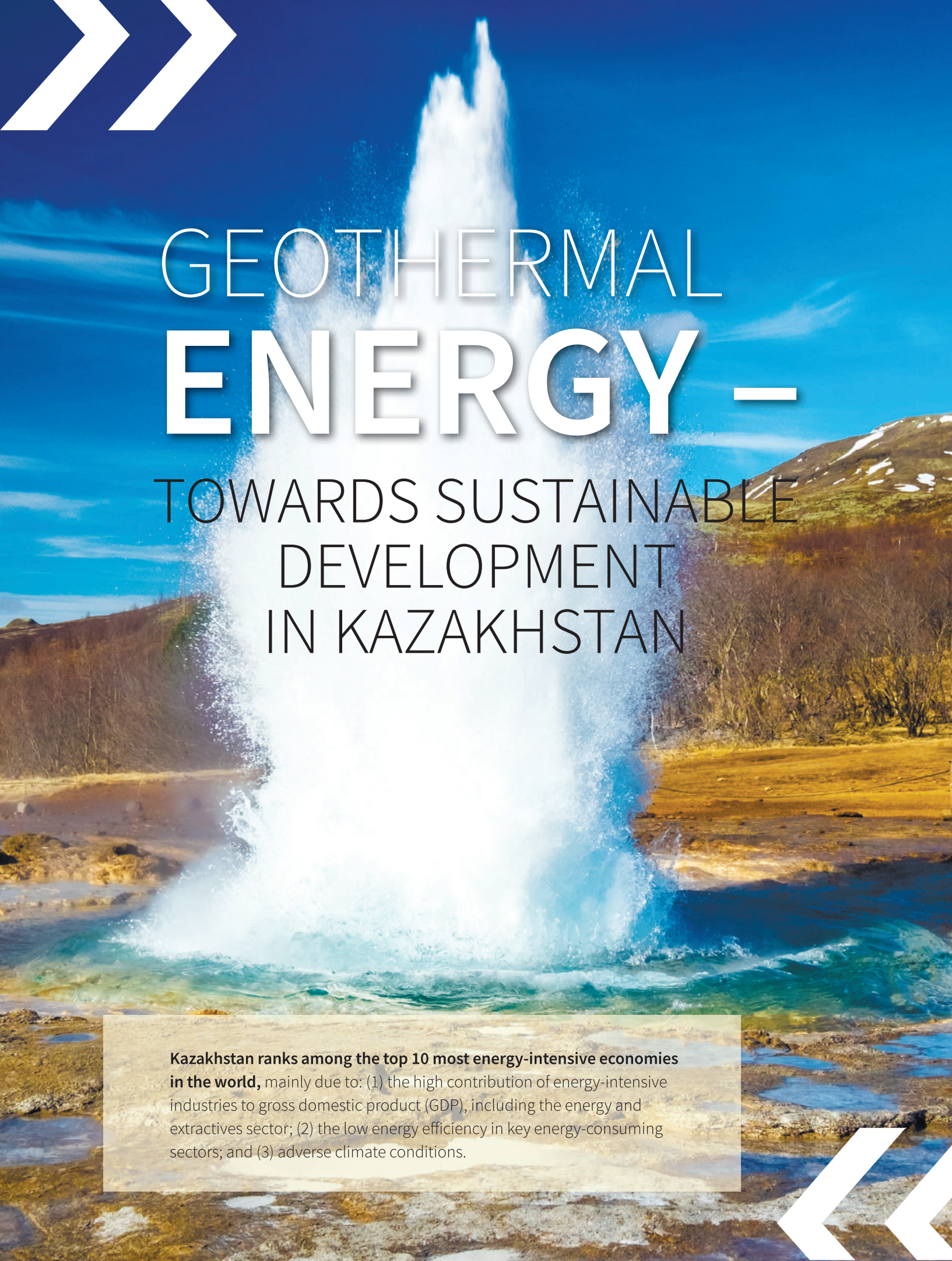


Figure 4. Proposed model for participation of RES in BEM





GEO THERMAL ENERGY – TOWARDS SUSTAINABLE DEVELOPMENT IN KAZAKHSTAN

Kazakhstan ranks among the top 10 most energy-intensive economies in the world, mainly due to: (1) the high contribution of energy-intensive industries to gross domestic product (GDP), including the energy and extractives sector; (2) the low energy efficiency in key energy-consuming sectors; and (3) adverse climate conditions.



Carine Chatenay,
Civil Engineer at Verkis



Þorleikur Jóhannesson,
Mechanical Engineer at Verkis



Elín Hallgrímsdóttir,
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World Bank



Kazakhstan is a major oil and gas producer and exporter. In Kazakhstan, nearly 30 million tons of oil equivalent (toe) of energy is consumed annually in the power and heat generation sectors alone. 74 percent of this is coal, 21 percent is natural gas, and about 1 percent is oil and oil products. While the country's production volume could meet the total gas demand, supply within Kazakhstan is not always fully reliable and some central and northern regions experience gas shortages. The use of natural gas by households is mainly dependent on the availability of gas networks and prices. Nonetheless, according to a survey conducted by the International Energy Agency (IEA), coal and firewood were used by 30 percent of Kazakhstan's households in 2018.

The country's climate is characterized by harsh winters, and energy consumption for household space heating is high. The space heating sector is a major consumer of energy in Kazakhstan and lack of investment has made the sector one of the most energy-intensive in the country. According to the study by the International Energy Agency, "Clean Household Energy Consumption in Kazakhstan: A Roadmap", residential energy consumption for heating was about 116,500 gigawatt-hours (GWh) in 2018 and was expected to increase to 142,900 GWh by 2030 in a business-as-usual scenario, a 22 percent increase compared to 2018.

Despite the government subsidies, which keeps energy prices low for citizens, compared to other countries worldwide, energy poverty

remains an issue in Kazakhstan, with 67 percent of households in rural areas still using coal as a primary heating source. Despite relatively low energy prices and energy resource abundance, many households cannot afford adequate energy services due to a combination of income inequality, high heating demand and energy inefficiency. Further to this, combustion coal and solid fuels for heating purposes cause indoor pollution and pose serious health risks.

Few renewable energy (RE) projects have been developed to date and those developed are mainly for electricity production. It is estimated that RE represented less than 2.4 percent of Kazakhstan's total primary energy supply in 2016, mostly divided between biomass and hydropower. This low percentage has led Kazakhstan to adopt ambitious targets and policy measures on renewable energy development focused on increased renewable energy utilization. These targets include increasing the share of renewables in electricity production, aiming not to be less than 50% by 2050.

Kazakhstan has, furthermore, adopted several policy measures to support investment in renewable energy projects.

GEOTHERMAL RESOURCE

Geothermal resources are fluids within the earth and stored in geologic formations in its crust. They may be characterized by various parameters such as temperature, pressure, and enthalpy.



Perhaps the most common categorization is by temperature: low (~20 to 80°C), medium (80 to 150°C), and high (>150°C). This practical categorization makes it easy to align the resource with its potential uses. High-temperature resources are often prioritized for electricity production. Low- to medium-temperature resources are less suitable for electricity generation but are much more widespread and lend themselves to direct use applications. Geothermal direct use refers to all applications where the commodity of value is extracted directly from the geothermal fluids from heat, minerals, and gases, *see Figure 1*.

for geothermal power generation or direct use applications.

In theory, geothermal energy will last as long as the earth's core heats the fluids in the earth's crust. While some fluids emerge naturally through hot springs, most low to middle temperature resources are exploited by drilling and pumping them out of reservoirs. Where sustainable, long-term use is the objective; the key is to reach a state where the natural recharge of the reservoir, combined with reinjection, is in equilibrium with the exploitation in terms of flow and temperature.

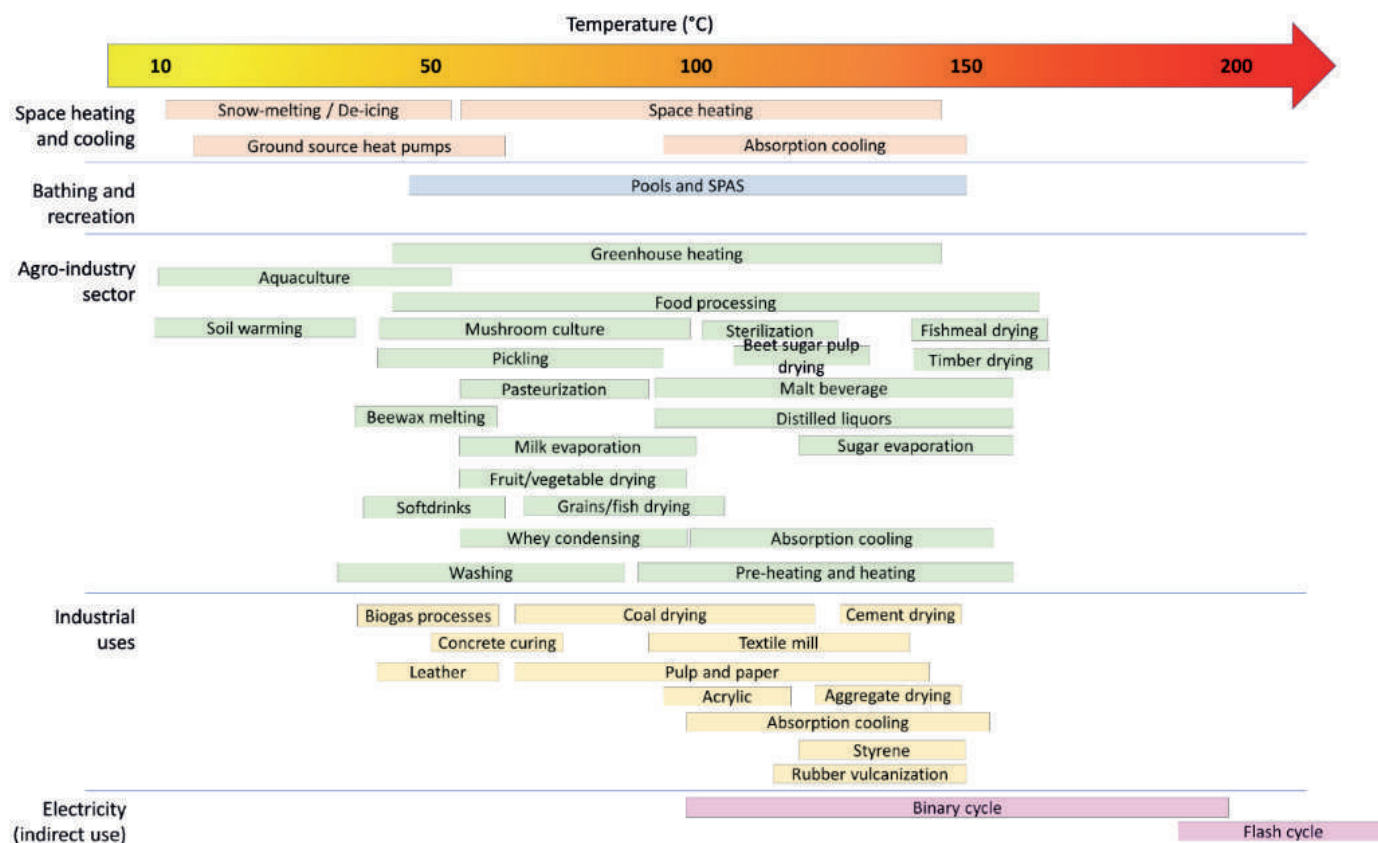


Figure 1: Overview of potential utilization by temperature of the geothermal fluid (Based on Lindal – 1973 and prepared by Mannvit-Verkis 2021).

Each geothermal system is unique in its chemistry and the type of geological formation in which it is found. A thorough survey and study of the resource are critically important for the successful development of projects. Factors such as depth, accessibility, the resource's abundance, and the geothermal fluid's characteristics need to be considered when deciding on a utilization method;

The limited uptake of geothermal direct use in countries points toward certain barriers including: (1) limited familiarity with the resource; (2) challenges in matching resource location to the production process in which it is an input; (3) relatively small-scale production facilities that limit interest and availability of capital from investors; and (4) the adequacy of the legal and regulatory

framework and government policies. However, geothermal direct use technology is relatively simple. Economic activities that rely on heat as input are ideal for geothermal direct use, and private capital markets slowly realize the monetary benefits of climate-friendly and resilient projects.



Figure 2: Kazakhstan's main deepwater sedimentary basins are classified according to their exploration/exploitation status for hydrocarbon production based on the KazEnergy Association publication of 2015.

GEOTHERMAL RESOURCES IN KAZAKHSTAN

Kazakhstan is believed to hold considerable low-to middle temperature geothermal resources, mainly of the sedimentary basins, see Figure 2. This information is acquired from existing deep wells, which have mainly been drilled as petroleum and/or gas wells and have yielded hot water. Surface manifestations (hot springs) also provide evidence of such resources. Furthermore, there are parallels between the geological conditions (deep sedimentary basins) in parts of Kazakhstan and the geological conditions of sedimentary basins in other parts of the world with extensive low-temperature geothermal utilization (e.g., in Eastern Europe and China).

The geothermal resources of Kazakhstan are currently minimally utilized for spas, bathing, and greenhouses. Still, the country's potential is suitable for direct use applications, such as district and space heating, agro-industries (e.g. greenhouses, food drying, pasteurization), and balneology for

health, recreation, and tourism. In addition to being a local renewable source of energy, geothermal can contribute to reducing greenhouse gas emissions and local pollution linked to the use of fossil fuels for heat (including natural gas, oil, and coal).

COMPREHENSIVE STUDIES OF GEOTHERMAL RESOURCES IN KAZAKHSTAN WERE CONDUCTED IN THE 1980'S, IN THE MOST PROMISING REGIONS OF SOUTH KAZAKHSTAN. THESE STUDIES INCLUDED PROSPECTING AND APPRAISAL WORK DURING 1982 – 1991 REGARDING SPACE HEATING AND HOT WATER SUPPLY IN THE CITIES OF TURKESTAN AND ARYS, AS WELL AS IN THE ALMATY OBLAST (ILY AND USEK). THE RESULTS INDICATED CONSIDERABLE GEOTHERMAL RESERVES AND WAS CONFIRMED IN A PRE-FEASIBILITY STUDIES CONDUCTED IN 2022.

In 2006, a feasibility study of 40 existing deep wells in the south and southeast parts of the country was carried out, identifying the most promising areas for further prospecting and exploration.

In 2008, in the Zharkent sub-basin in SE-Kazakhstan, an exploitable geothermal reserves assessment was conducted, which included the study of a deep well (2800 m), producing 90°C water that consequently has supplied a large greenhouse complex with thermal energy.

In 2015-2016, the Ministry of Energy and Mineral Resources of Kazakhstan carried out deep exploration drilling for geothermal energy at the Zharkunak site in the Zharkent basin to assess whether sufficient geothermal reserves for direct use existed in the area. This project was successful, and medium temperature hot water from 2 – 3 wells has been used locally.

Geothermal systems in Kazakhstan have been identified in the western, south, and central parts of the country and are generally hosted in sedimentary basins, a summary report was published in 2019 on "Preliminary review of geothermal resources in Kazakhstan". Some of the available information was collected from wells drilled specifically for the purpose of geothermal exploration, whereas oil and gas exploration wells have also been a good source of geothermal information.

The significant need for adequate heating services for the Kazakhstan population, provided in a sustainable manner, is an opportunity to assess the potential and characteristics of geothermal energy resources in Kazakhstan, and identify whether and how they can be harnessed to meet some of the household and industries energy needs.

UTILIZATION OF LOW/MEDIUM TEMPERATURE GEOTHERMAL RESOURCES IN KAZAKHSTAN

The information available indicates that the geothermal resources in Kazakhstan are comparable to those observed in many places in China, France, Germany, and Eastern-Europe where direct use projects have successfully been conducted for district heating as well as agro-industries and balenology.

District heating systems are an efficient way to harness geothermal resources for space heating, and possibly domestic hot water. In Kazakhstan, the space heating sector is a major energy consumer in the country, with additional impacts in terms of greenhouse gas emission. This could be improved where geothermal resources are available near urban areas and where the systems are technically and economically viable. Consequently, this sector is deemed to have great potential for direct use of geothermal. But other uses should also be investigated, such as food production (for green houses, food drying, fish farming, and soil heating) but also for Kazakhstan's thermal bathing and recreation industry, which has considerable potential.

OFTEN, THE RESOURCES CAN BE SHARED ACROSS A SET OF USERS, A METHOD CALLED CASCADING, AND THESE APPLICATIONS ARE SOMETIMES COMBINED AS PART OF A DISTRICT HEATING SYSTEM. **THEY PRESENT THE ADVANTAGE OF DIVERSIFYING THE TYPES OF USERS AND REVENUE STREAMS, AND CAN IDEALLY CONTRIBUTE TO OPTIMIZING THE UTILIZATION OF THE FACILITIES AND THE RESOURCES OVER THE YEAR.**

GEOTHERMAL DIRECT USES AS A DECARBONIZATION OPTION

A strong rationale for geothermal direct use lies in its potential to help decarbonize heat. About half of all end-use energy consumption globally is in the form of heat, which is more than the energy consumption for other purposes distinctively. In addition, heat supply has proven challenging to decarbonize. Renewable technologies that are becoming cost effective in power production have yet to break through in displacing heating fuels. Currently, only around 10.4 percent of global heat demand is being met by modern renewables and only 0.3 percent by geothermal direct use (IEA 2020c).

Utilizing Kazakhstan's geothermal energy through direct use applications can also provide other benefits at local and national levels by strengthening energy independence, advancing the development of a varied sustainable energy sector, and supporting diverse end-use industries.





The reasons why Kazakhstan should explore geothermal direct uses potential, with a particular emphasis on the utilization of geothermal heat, and how it can be developed to bring economic and social benefits to various segments of the population and eventually contribute to various economic and policy goals that are often not adequately addressed by the private sector, such as enhancing food security, fighting energy poverty, increasing energy independence, promoting economic development, mitigating climate change, fostering resilience to volatile energy prices, and advancing decarbonization.

The use of geothermal direct use is well suited for economic operations that depend on heat as an input, and private financial markets are gradually becoming aware of the financial advantages that environmentally friendly and robust projects provide.

Technical parameters driving the design of geothermal applications include the temperature and available flow rates, which determine the energy potential of a given resource. The cost of a geothermal direct use system is highly dependent on the resource, location (distance from end use), capacity factor, and chemistry. Preparing a geothermal project is often a long process that may involve high capital expenditure to get a project up and running. Therefore, it is crucial to perform the project preparation in a systematic and disciplined way to make informed decisions at each stage.

As with all geothermal projects, Kazakhstan's direct use of low- to middle-temperature geothermal resources must be planned and done cautiously. Overexploitation over a long period may have an irreversible impact on the resource or affect it in such a manner that it would take a long time to recover.

AN ENABLING ENVIRONMENT FOR GEOTHERMAL DIRECT USE

Where does it make the most sense to support the development of the direct use of geothermal resources? This question cannot be easily answered unless each geothermal area's economic feasibility and social desirability are thoroughly assessed. Even in cases where a suitable resource is available for needed applications, the viability of geothermal direct use projects depends on an adequate enabling environment. This requires support from public and private stakeholders, including local communities surrounding the geothermal areas, which can benefit from their development. A supportive enabling environment is characterized by geothermal knowledge, government policies, legal

framework and social acceptance and community support.

Geothermal knowledge about a country's resources is the key and reduces the risk of developing geothermal. Mapping the Kazakhstan's geothermal potential at a regional or country level is a necessary first step. It is important to consider local conditions and the environmental and social implications that these locations have. The quality of data available on local resources, coupled with information on potential markets for various applications, is critical to determine the feasibility of geothermal direct uses projects. In many countries with geothermal energy resources, including Kazakhstan, basic relevant knowledge



and experience may be lacking, which can pose a barrier to innovative thinking about how to use and effectively deploy them. This can be addressed at the national level by implementing educational strategies emphasizing fields related to geothermal utilization. It is important to inform policymakers of the geothermal direct use benefits, focusing on a contributor to socioeconomic development. The incentives of gender equality and inclusiveness can also be emphasized in these efforts.

Geothermal countries have at hand or can create tools to promote investment in geothermal direct use projects as part of their overall national goals and policies. Investment in geothermal direct use can come from both the private and public



**INVESTMENT IN
GEOTHERMAL DIRECT
USE CAN COME FROM
BOTH THE PRIVATE
AND PUBLIC SECTORS
OR IN THE FORM
OF PUBLIC-PRIVATE
PARTNERSHIPS.**

sectors or in the form of public-private partnerships. Globally, the public sector has been a major risk taker as a developer of geothermal resources due to issue debt at lower interest rates. Governments can also set up risk sharing mechanisms that protect private entities during exploration phases and ensure that the benefits are shared when geothermal resources are found and developed. The nonfinancial benefits of geothermal direct use, such as diversification of the country's energy sector, reduction of the country's long-term greenhouse gas emissions, stimulation of the national economy through job creation, and promotion of gender equality within the local community, are also relevant for scale up geothermal energy.





KAZAKHSTAN NEEDS A SUPPORTIVE LEGAL FRAMEWORK TO SUCCESSFULLY DEVELOP GEOTHERMAL RESOURCES AIMING TO ENSURE A TRANSPARENT, COHESIVE, AND RELIABLE ENVIRONMENT FOR THE DEVELOPMENT OF THE GEOTHERMAL SECTOR IN GENERAL AND DIRECT USE IN PARTICULAR. THIS IS A PREREQUISITE FOR SECURING LONG-TERM INVESTMENTS IN THE INDUSTRY AND THE SUSTAINABILITY OF THE RESOURCE.

Communities near geothermal areas may be benefited from various aspects related to the development and operation of a project. Therefore, it is generally good practice to include the local community and its organizations early in the project's development (during the project planning stage) and to conduct extensive public consultations. This inclusion is the best way to share the many benefits of geothermal development and its direct use with the communities, such as a better quality of life, improved job opportunities, and a healthier society.



GEOTHERMAL DIRECT USE PROJECT PREPARATION

We have discussed the geothermal resource and how the enabling environment contributes to the success of a project, but how a project is prepared is equally important. Preparation of a geothermal project is often a process that may involve up to 30 percent of the capital expenditure needed to get a project up and running (highly dependent on drilling needs and available infrastructure). Therefore, it is of great importance to perform the project preparation in a systematic and disciplined way to maximize the chances of making informed decisions.

The necessary effort to complete a geothermal project varies, corresponding to its size and complexity. However, developing a geothermal project involves stages, at the end of which the project developer decides whether to carry on with the project or not. Therefore, all stakeholders in the project are clear on the project goals, risks, and decision points at each stage.

Finally, to prepare a successful project, the developer must ensure best practices in conducting studies to evaluate the geothermal resource, environmental compliance, market analysis and technical design, as well as provide engagement with stakeholders to demonstrate the project's benefits and minimize the risk of local opposition.

TAKEAWAYS

Geothermal resources in Kazakhstan are low-to-middle temperature geothermal resources. Large-scale electrical power production is not expected to be competitive with other energy sources in the country. Although at specific sites where the temperature is reasonable high, small-scale geothermal power plants may be considered in combination with heat production to increase the economic viability of such projects.

Kazakhstan should aim for direct use of its geothermal resources. In that sense, replacing the conventional heat sources, which are mostly either natural gas or coal, with geothermal direct use is expected to positively impact climate change, improve local air quality, and enhance the energy independence of the local communities. Additionally, exploring the possibility of developing geothermal direct use into a resource park with multiple off takers implementing complementary direct use applications in a cascading heat usage system will allow higher efficiency and optimal utilization of the total heat potential available at the geothermal areas.

Geothermal projects that have the possibility to develop different direct-use applications might have higher up-front costs for exploration and construction, but once a viable location has been identified, they offer greater, more diversified revenue streams. This opens up business opportunities for geothermal direct use but requires a thorough analysis of the market for demands: current and prospect.

The development of an efficient and comprehensive regulatory framework for geothermal utilization and district heating in Kazakhstan should have a priority. This regulatory framework should encompass the following aspects: definition of geothermal resources; clear ownership and access rights; licensing, permits, and fees; institutional jurisdiction; clear delineation of resource management principles and responsibilities; and environmental regulations.



CORPORATE PPAs ARE THE NEXT STEP FOR ORGANIC GROWTH OF THE RES SECTOR



Bilyalov Vernar,
Director Central Asian
Renewable Energy Resources LLP

Currently, Kazakhstan is actively developing the renewable energy sector. It is important to note that thanks to introduction of fixed tariff mechanism and creation of the Financial Settlement Center of Renewable Energy LLP, Kazakhstan received the first large-scale projects in its portfolio. The next stage in industry's development was development and implementation of a new tool - auctions for selection of renewable energy projects. This helped the country to receive new investment projects in the field of renewable energy with market tariffs and new investors.



What will be the next step for development of renewable energy industry?

Ernar Bilyalov, Partner and Director of the Consulting division of CARER Group, consultant to UNDP in Kazakhstan, will tell about this in our interview

Development of corporate PPAs would be potentially correct answer to this question. Within the framework of “Derisking investments into renewable Energy” implemented by UNDP in partnership with the Ministry of Energy of the Republic of Kazakhstan, with financial support of the Global Environment Facility, a study was conducted to analyze possibilities and advantages of corporate PPA mechanism, taking into account world experience in this field.

CORPORATE PPA REFERS TO A CONTRACT BETWEEN CORPORATE BUYER AND PRODUCER OF ELECTRICITY FROM RENEWABLE ENERGY SOURCES FOR PURCHASE OF ELECTRICITY AT PRE-AGREED PRICE FOR CERTAIN PERIOD. IN CASE OF CORPORATE PPA, THE LONG-TERM BUYER OF ELECTRICITY FROM RES (OFF-TAKER) IS A CORPORATE BUYER.

WORLD EXPERIENCE

According to BloombergNEF, the growth of corporate PPAs is gaining momentum and this mechanism is becoming popular among corporate buyers. In 2021, the volume of signed corporate PPAs amounted to 31.1 GW (increase of 24% compared to 2020).

Corporate PPAs were signed by 137 companies in 32 countries by the end of 2021.

North and South America are the leaders in corporate PPAs with a reported capacity of 20.3 GW, where the United States of America has made a major contribution to development of PPAs with capacity of 17 GW. The American market is followed by the countries of Europe, the Middle East and Africa with a capacity of 8.7 GW.

The countries of the Asia-Pacific region announced implementation of 2 GW, but at the same time, new legislative initiatives are being introduced in the region to support the development of corporate PPAs. For example, South Korea introduced new legislation on corporate PPA in October 2021.

Technological IT companies have become the largest corporate buyers of clean energy in 2021. For the second year in a row, Amazon is the largest buyer of clean electricity in the world, announcing 44 PPA deals in nine countries for a total capacity of 6.2 GW. This enabled increase in total capacity of renewable energy projects based on PPA to 13.9 GW.

THE GROWTH OF CORPORATE PPA IS PRIMARILY CAUSED BY DESIRE OF CORPORATE BUYERS TO MEET THE SUSTAINABLE DEVELOPMENT GOALS. ALSO, IT SHOULD BE NOTED THAT ENERGY SECURITY IS AN IMPORTANT ELEMENT IN DEVELOPMENT OF LARGE COMPANIES, ACCORDINGLY, CORPORATE BUYERS ARE TRYING TO DIVERSIFY THEIR SOURCES OF ELECTRICITY AND CORPORATE PPAS HAVE BECOME AN EFFECTIVE METHOD OF SOLVING THIS ISSUE.

AUSTRALIA'S IMPLEMENTATION EXPERIENCE

Australian energy market is somewhat similar to the market of Kazakhstan, so experience of this country should be considered as an example. Australia has one of the largest proved coal reserves in the world (8.57% of world reserves), that allowed creating coal-generation based country's energy system (66% of the country's electricity is produced by coal-fired thermal power plants). At the same time, the volume of electricity generation from renewable energy sources is 13% of total electricity production (wind and solar power plants).

Currently, Australian energy sector is undergoing transformation, where traditional coal-fired generation is being replaced by renewable sources of electricity. In the next two decades, Australia will decommission 16 GW of coal-fired thermal power plants, putting into operation 26-50 GW of large solar and wind power plants, according to the forecast of Australian Energy Regulator.

The RES market and corporate PPA market are actively developing thanks to the created legislative system. This system is based on the Renewable Energy Target (RET) program, which focuses on development of large and small RES in Australia.

Every year, Australian government determines a list of players (mainly electricity retailers) who are obliged to buy LGC and provide a report on them. One of the ways to obtain an LGC is to sign a corporate PPA with renewable energy producer.

One of the most striking examples of using LGC for development of corporate PPA is Shell Energy. Shell Energy is a major retailer in Australian market and the company's main role is to supply electricity from producer to the buyer.

LGC (Large-scale generation certificate, 1 LGC = 1 MW) are certificates that retailers who sell electricity from producers to end customers, as well as other organizations that consume electricity, are required to buy and hand over annually.

In connection with the introduction of LGC, the company began to offer new services to its customers, including a corporate PPA. Shell Energy can play different roles in the structure of a corporate PPA. In case of a request from a corporate buyer, Shell Energy can build new renewable energy facility in the immediate vicinity of buyer's facilities. Also, Shell Energy can play the role of a retailer and include conditions for provision of a certain amount of electricity from renewable energy sources into current electricity sale-purchase contract, in this case, electricity is not physically delivered. The most popular mechanism is the so-called Wholesale PPA (virtual corporate PPA).

Operating principles of virtual corporate PPA:

1. Shell Energy acts as a retailer under contract with electricity buyer, buys and provides electricity from common grid based on wholesale prices determined at the wholesale market.

2. Producer of energy from renewable energy assets sells electricity to common grid based on wholesale prices determined at the wholesale market, signs a corporate PPA with the buyer of electricity, receives a fixed tariff from the buyer of electricity, issues and transfers LGC to the buyer of electricity.

3. The buyer of electricity pays to Shell Energy for supply of electricity from the common grid, pays to renewable energy facility on the basis of fixed tariff, receives LGC from renewable energy facility and can receive the difference between the wholesale tariffs and the fixed tariff of PPA from the renewable energy facility, in case of increase in wholesale prices.

Virtual corporate PPAs are becoming more common mechanism for development of renewable energy in Australia, where the state allows businesses to decide for themselves which scheme to choose and does not set any special requirements for template of a PPA contract.

In general, the following main drivers of corporate PPA development in Australia can be identified:

1. Development of companies taking into account Sustainable Development Goals;
2. Hedging tool against growth of wholesale electricity prices for electricity buyers;
3. No connection requirements, no CAPEX costs for buyers, possibility to purchase renewable energy for each individual buyer's facility (geographical flexibility);
4. Obtaining LGC on a permanent basis with minimal financial costs.

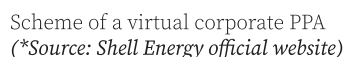
RECOMMENDATIONS FOR KAZAKHSTAN

Despite the fact that the Australian energy market has a number of similar elements to the energy market of Kazakhstan, we need to work out schemes and mechanisms for development of corporate PPAs. According to our proposals, we have presented two main schemes for organic growth of corporate PPAs:

1. Direct bilateral Corporate PPA

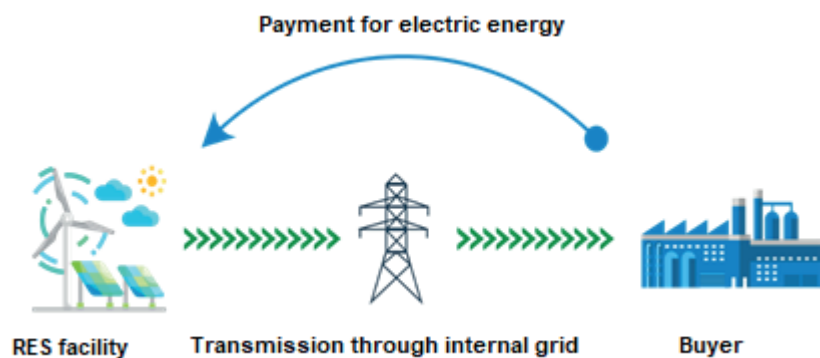
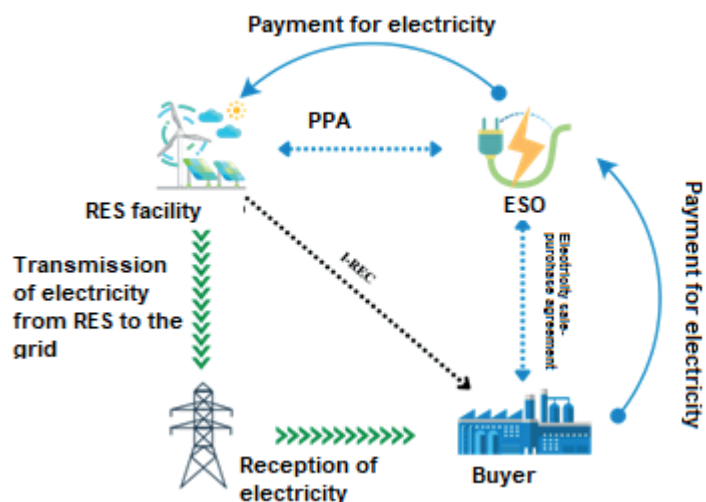
Direct corporate PPA (bilateral agreement) will allow implementing renewable energy projects between two legal entities, in which one party will build renewable energy facility and subsequently sell electricity, and the other party will be the buyer of electricity (off-taker), and it should be borne in mind that the seller and buyer may be affiliated and within the same group of companies.

This scheme assumes that the national operator or regional grid companies cannot establish additional requirements for balancing electricity, since electricity transmission is carried out through internal grid and



In our opinion, these schemes and mechanisms will create conditions where private business will be able to solve problems of obtaining electricity independently, with minimal intervention of authorized bodies. However, this requires amendments to the current legislation of the Republic of Kazakhstan. In turn, corporate PPAs can become a new link not only for development of renewable energy, but also for development of the energy industry as a whole.

It is important to note that currently in Kazakhstan, ESOs have an active role in transmission of electricity from producers to buyers, electricity is purchased from existing energy-producing organizations, including large hydroelectric power plants.





CURRENT DOMESTIC DEVELOPMENTS IN THE FIELD OF RENEWABLE ENERGY



Zhanar Nurkanova,
Project manager,
TGS-Energy LTD

Digitalization in the RES field

Air pollution costs the economy of Kazakhstan more than \$10.5 billion (according to the World Bank calculations for 2022).¹ Conclusion: cheap coal is not so cheap if we consider all the consequences of its use.

Green energy presents not only the main measure to achieve carbon neutrality according to the Concept for transition of the Republic of Kazakhstan to "green economy", approved by the Decree of the President of the Republic of Kazakhstan dated May 30, 2013 No. 577, but

also significant savings of public funds and possibility of attracting investments to the economy (about \$ 3-4 billion per annum). At the same time, the Concept planned that by 2030 the total installed capacity of NPP would be 1.5 GW, capacity of WFs - 4.6 GW and SPP - 0.5 GW. However,



in our opinion, the Concept did not pay due attention to need for digitalization of power industry.

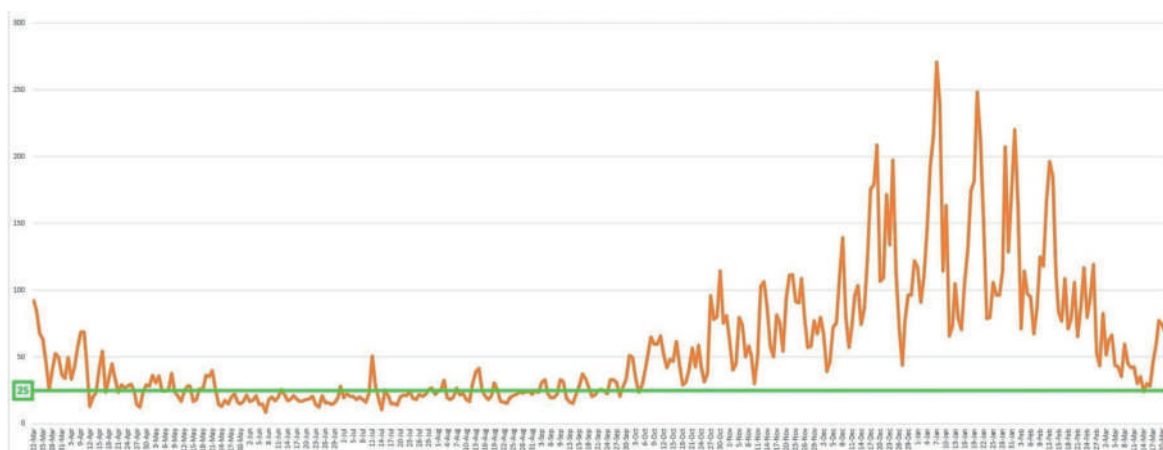
AT THE SAME TIME, SPECIALIZED IT SERVICES CAN SOLVE SEVERAL TASKS TO IMPROVE RELIABILITY OF THE UNIFIED ENERGY SYSTEM OF THE REPUBLIC OF KAZAKHSTAN, REDUCE IMBALANCES FROM RES, ACCELERATE KAZAKHSTAN'S TRANSITION TO A GREEN ECONOMY. TO THIS END, GREEN TECHNOLOGIES CENTER (GTC) LLP, WHICH IS PART OF TGS GROUP OF COMPANIES, SPECIALIZED IN DIGITALIZATION, IS CURRENTLY DEVELOPING A DIGITAL POWER PLANT PROJECT (DIGITAL POWER PLANT, DPP), GREENLIGHT AND INTECH-FORECAST PROJECTS.

Analogues of DPP software already exist in the world, allowing many traditional stations significant reduction in operating and maintenance costs. General Electric was one of the first in the world to introduce digitalization at power plants and achieved significant results for 500 MW thermal power plant:

¹ <https://www.vsemirnyjbank.org/ru/news/press-release/2022/03/28/cost-effective-air-quality-management-in-kazakhstan>

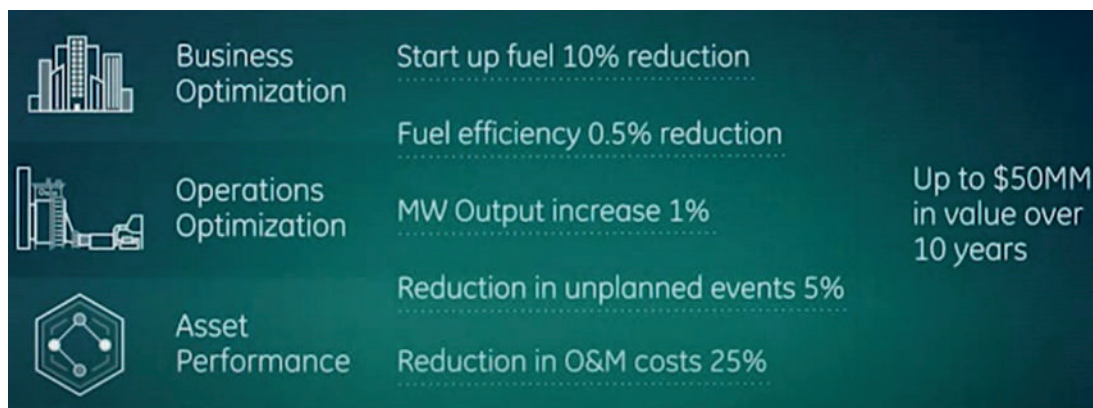
² <http://esgrs.org/?p=22342>

Level of Air pollution in Almaty by PM2.5 particles, $\mu\text{g}/\text{m}^3$



MPC level in winter and summer in Almaty city. Green line - average daily norm according to WHO standards (25 μg).

Thermal power plants and private sector are main sources of pollution, not cars, according to popular opinion.²



^[3] https://www.youtube.com/watch?v=3zz5Os_VcBo

Reduction of fuel consumption at startup by 10%; reduction of fuel consumption by 0.5%; increase in MW capacity by 1%; number of unplanned events reduced by 5%; operating and maintenance costs reduced by 25%; up to \$50 million net present value over 10 years.^[3]

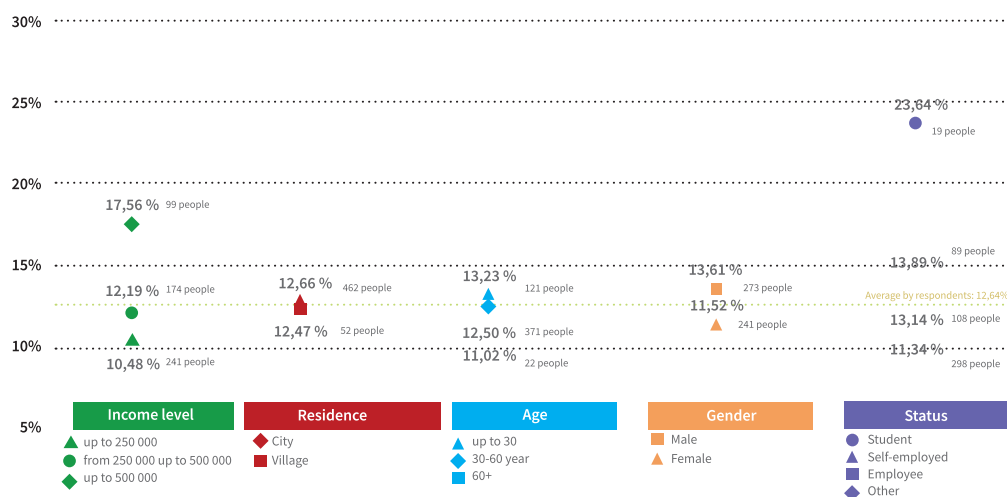
It is obvious that digitalization of renewable energy facilities will also contribute to their greater financial attractiveness both for investors and for operating personnel. The imbalances that renewable energy facilities create in the country's overall energy system is a task that needs to be solved on a large scale and promptly. One of the measures would be construction of power storage system (PSS), but currently Kazakhstan's economy is not ready for such technological solutions due to significant increase in costs of RES construction projects and, as a consequence, the need to increase tariffs.

High-quality forecasting of electricity generation by RES facilities is a sufficiently effective step to minimize imbalances in the RES sector. In order to solve this problem, GTC, supported by QazInnovations, offered a domestic IT service – "InTech-Forecast", which:

- provides convenient function of forecasting electricity generation by renewable energy facilities a day in advance;
- Automates interaction of RES power plants personnel with the System Operator and FSC for RES;
- Creates constantly learning pattern of artificial intelligence based on historical weather data and electricity production volumes;
- Increases the efficiency of the Unified Electric Power System of Kazakhstan by forming accurate daily forecasts and minimizes their negative impact on the reliability of UES of the Republic of Kazakhstan.

In addition to internal tools that contribute to development of renewable energy industry, it is also important to understand the loyalty of Kazakhstanis to transition to "green economy" and their awareness of environmental issues.

How much more are the Kazakhstani ready to pay for electric energy from RES



512 people took part in the survey

According to my survey, almost 86% of respondents, most of whom are urban residents aged 30 to 60, realize renewable energy as environmentally friendly alternative to coal-fired power plants and 89% believe that production of clean electricity should increase.

77% of the total number of respondents would use electricity from renewable energy sources in their households, 35% see business opportunities in renewable sources and 36% would charge their electric car with green energy. 78% of those who support renewable energy believe that green energy cost should decrease.

As for the willingness to pay extra for green energy, percentage of those who want to "prove their loyalty in practice" decreases but does not deprive them of optimism – 72%.

THE ABOVE STATISTICS SHOW THAT THERE ARE **ENOUGH PEOPLE WILLING TO VOLUNTARILY SUPPORT KAZAKHSTAN'S TRANSITION TO GREEN ENERGY** AND THIS GIVES US THE OPPORTUNITY TO OPEN ANOTHER CHANNEL OF INVESTMENT IN THIS INDUSTRY.

Another IT initiative of GTC is the GreenLight service, which provides an opportunity for every citizen of Kazakhstan to buy green energy through an application in smartphone, making their conscious choice in favor of the country's ecology. Moreover, it aims to convey the climate change and air pollution issues to public.

PRESENTATION OF GREENLIGHT PROJECT AT POWEREXPO ALMATY 2022

In addition to opening up new investment opportunities, GreenLight is a positive factor in expressing active citizen position in environmental issues by our compatriots. Every citizen will be able to have their own levers of influence on ecological scenario of Kazakhstan. Today is the time to offer solutions that overcome obstacles and create additional growth factors for the renewable energy industry. Digitalization, which has become independent industry and gained its own independent professional holiday this year, celebrated on November 10, can make a significant contribution to further development of renewable energy projects in Kazakhstan and Central Asian countries.



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SMEC –

LEADING THE PATH IN HYDROPOWER & PUMPED STORAGE PROJECTS IN SOUTH AND CENTRAL ASIA



SMEC: At SMEC, we partner with clients and organisations to provide cost-effective, practical and sustainable project outcomes.

SMEC, a member of Surbana Jurong Group, is a world leading Hydropower engineering, management and development consultancy with a significant presence across Asia. SMEC has its origins in the iconic Snowy Mountains Hydroelectric Scheme, recognised as one of the civil engineering wonders of the modern world. The multi-purpose project undertaken between 1949 and 1974 and brought together over 100,000 workers from 30 countries.

SMEC's journey in Asia began in 1968 with a hydropower project in Nepal that connected people in remote Himalayan areas with water and power. Since then, SMEC has grown a strong local presence in the region.

As per a recent study conducted by the World Bank, South Asia has witnessed a growth in energy demand over

Snowy Mountains Hydro facts

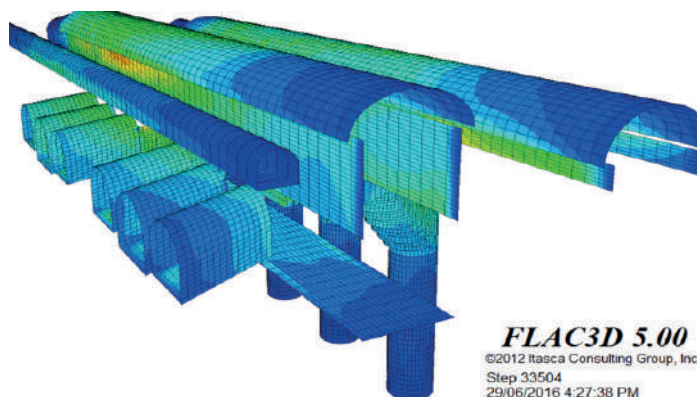
- 16 major dams
- 7 power stations
- One pumping station
- 145km of tunnels
- 80km of aqueducts
- 2,000km of roads

the past two decades, increasing by over 50 percent since 2000. In Bangladesh, Bhutan, India, Nepal and Sri Lanka in particular, electricity demand has grown on average by more than five percent annually over the past two decades and is expected to more than double by 2050. In Central Asia there

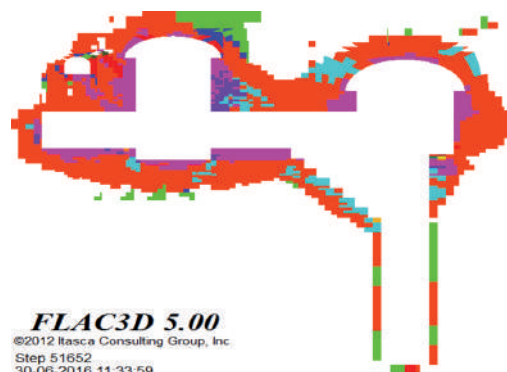


1,000 MW Tehri Pumped Storage Project, India

3D model of the BVC-PAC



Camera Screen shots of the process



are opportunities to unlock renewable energy resources and support the growing demand for energy. Across central Asia, countries are increasing cooperation with regards to regional energy programs.

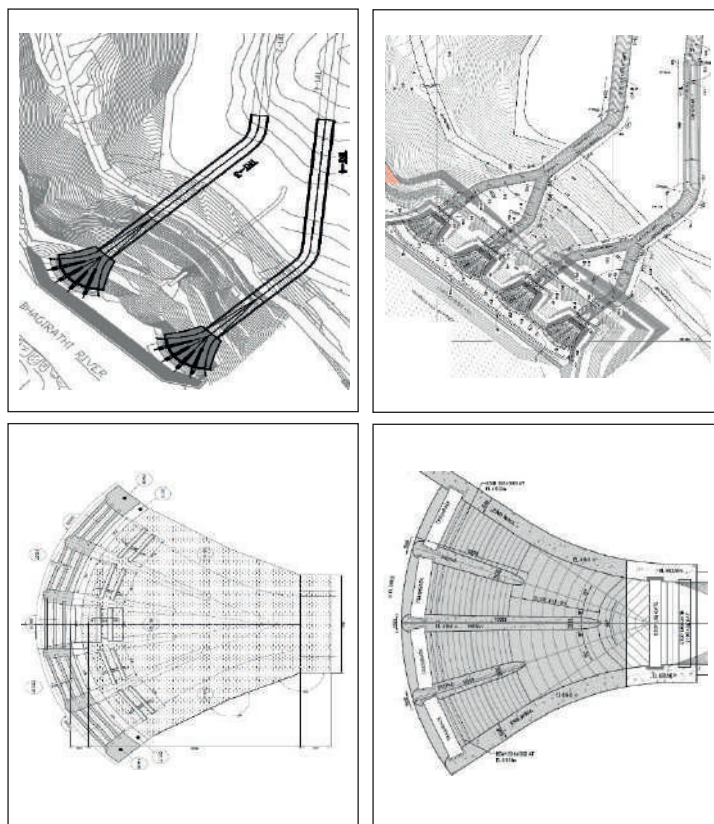
SMEC currently employs over 2,000 people in Asia and approx. 10,000 people globally. Recent hydropower accomplishments in the region are outlined below.

1,000 MW Tehri Pumped Storage Project, India

The 1,000 MW Tehri Pumped Storage Project (PSP) forms a part of the 2,400 MW Tehri Hydro Power Complex. Nearing completion, Tehri is one of the largest pumped storage projects in India. The Project is now listed under the 'National Infrastructure Pipeline', a first-of-its-kind, whole-of-government exercise to provide world-class infrastructure across India and improve the quality of life for all citizens.

3-D Analysis of Underground Caverns

All the components of the Tehri PSP are located underground, essentially inside one hill within the vicinity of the existing 1,000 MW Tehri Hydro Power Project. The upstream and downstream surge shaft chambers were proposed to be 20-25m wide. As can happen with such projects, as geological information became available, it was apparent that the geological environment was not suited to construct chambers this wide. Through extensive 3D analysis, including modelling rock bolting to replicate actual underground conditions, SMEC re-planned the chambers and a width of 15m was determined as the best solution. The analysis done was one of its kind carried out in the geotechnical industry and appreciated internationally.



Previous plan of discharge structures TRT

Elaborated plan of discharge structures TRT

Powerhouse FEM Model

The Powerhouse FEM Model in Tehri was carried out using MIDAS FEA software. The Dynamic behaviour of the foundation plays an important role in providing normal operating conditions for the supported turbine-generator.

In designing the turbine foundations the team took into account seismic forces as part of the lateral load calculations. The foundation should have sufficient bearing capacity to support the turbine, generator and its auxiliary equipment, whilst also being designed to limit the vibration amplitudes of the shaft, the rotor and the bearings

SMEC initiated physical model studies of the tail race tunnel (TRT) which found flaws in the design. Having

through physical model studies, bringing critical parameters including exit velocities, submergence and equitable distribution of flows under control.

This approach enhanced safety whilst enabling the project to meet its deadlines and technical expectations. design

720 MW Karot Hydropower project, Pakistan

Powered by the Jhelum River, Karot Hydropower plant will generate 3.2 billion kilowatt-hours of electricity each year, meeting the energy demand of five million people. It will also reduce 3.5 million metric tons of carbon emissions annually and save around 1.4 million tons of standard coal equivalent each year. SMEC has worked on the project since



720 MW Karot Hydropower project, Pakistan

inherited the design from a previous consultant, SMEC took up the challenge of proposing an alternative optimised solution.

Using detailed numerical modelling studies, SMEC proposed converting the two larger outlet structures into four smaller ones. This modified TRT configuration was confirmed

its inception, initially undertaking feasibility studies for the site in 2009.

Karot Dam is the first Asphaltic Concrete Core Rockfill Dam in Pakistan and the first renewable energy project constructed under the China Pakistan Economic Corridor. SMEC has provided a world class team with



detailed knowledge of international building standards for hydropower facilities. As part of the scope, SMEC also undertook detailed analysis of the proposed design. To reduce risk, SMEC made several amendments to the dam's design and construction methodology. By providing ongoing training and mentoring to the client team and building contractors, SMEC has added value throughout the construction phase.

600 MW Kameng Hydropower Project, India

Kameng Hydropower Station commenced commercial operation in February 2021, becoming the largest power plant in the northeast region of India. During the construction

600 MW Kameng Hydropower Project, India



phase, SMEC undertook extensive layout optimisation to ensure the design was built in accordance with international best practice. Two dams (Bichom 69m and Tenga 25m in height) divert water from the Kameng River to a new powerhouse facility, through an 14.52 Km water conductor system.

Issues resolved during tunnelling

During tunnelling SMEC provided advice to accelerate the progress of the trans basin tunnel works. The trans basin tunnel faced hindrances due to high cover zones of 2km, squeezing conditions, high seepage in the tunnel and cavity formation in the crown of the tunnel. SMEC also carried out detailed design and engineering for the fragile slope cut upstream from the Powerhouse. The team devised a shear piling solution which enabled the weathered slope to withhold the necessary load. The method proposed by US Navy Manual, Soil mechanics (DM 7.01) was selected for the analysis of the proposed bored pile construction at respective elevations of the Powerhouse slope.

The project provides 13 percent of its generated power for free, supplying 72MW to the State and 6MW for local area development. The dam's legacy delivers a clean reliable source of fuel, new skilled employment opportunities and improvement of rural road infrastructure.

The Cross-border electricity trade in the region has improved markedly in recent years. Asian Countries are increasingly coming together and committing to regional cooperation to diversify electricity supply resources, enabling a greater role for renewable energy resources. Across Asia SMEC is well positioned to support our clients in the transition towards a greener, sustainable, and resilient future.





GREEN ENERGY:

working mechanisms for development and promotion of RES in Kazakhstan

Ambitious goals to reduce emissions of CO₂ into atmosphere, creation of competitive markets, active investments by oil companies, support of world banks with affordable loans in the field of green energy

actively stimulate renewable energy industry in the Republic of Kazakhstan.

USAID Program "Energy of the Future" is aimed at accelerating transition to cost-effective, low-carbon, energy-safe, climate-sustainable and green energy by expanding use of renewable



professors, experts and trainees can communicate through interactive dialogues, information exchange, networking and curriculum development

In 2018, for the purpose of assisting investors in RES in the Republic of Kazakhstan, at the request of the Ministry of Energy of the Republic of Kazakhstan with funding from the U.S. Agency for International Development (USAID), under the «Future Energy» Regional Program, a «Guide for investors for implementation of renewable energy sources projects in Kazakhstan» was developed. Also, USAID assists Kazakhstan in holding auctions for selection of renewable energy projects, which create favorable competitive environment in the sector, within the framework of the "Future Energy" program. This document includes 3 blocks, 14 chapters and covers all issues related to implementation of RES construction project in the Republic of Kazakhstan ranging from participation in auction to connection of power plant to the grid.

Of course, international academic base, successful experience of other countries and state regulation are key mechanisms for transition to green energy, along with practical expertise and real competencies for implementation of RES projects. As an example of functional solutions, we propose to consider one of the leading engineering companies, specialized in the field of RES.

ZEINET & SSE

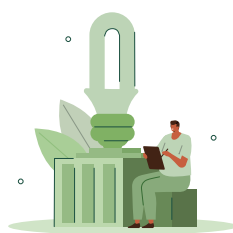
one of the leading engineering companies in Kazakhstan with specialization in the field of renewable energy

As Kazakh-Italian joint venture, Zeinet & SSE has been providing integrated solutions in the field of automation and digitalization of production processes for industrial enterprises of Kazakhstan and Central Asian countries for more than 15 years. A strong team, successful expertise in the industry, experience in working with equipment from leading manufacturers, projects implemented both in Kazakhstan and in other countries of the world within SSE group, training and advanced training in Europe, own engineering staff - all this allows successful follow-up of projects with level of complexity and offering customers the best world practices.

As a full-cycle system integrator, Zeinet & SSE can implement projects of any complexity. The portfolio of solutions allows covering the following aspects of automated process control, in particular:

energy and improving energy efficiency in our country. International Renewable Energy Agency (IRENA) is also working actively. As an intergovernmental organization, it is aimed at improving political framework conditions and assisting in increased use of renewable energy in industrially developed and developing countries. Since 2012, IRENA has developed a program called "International partnership for training in RES". Within the framework of this program, Kazakhstan has the following information:

- world database of education and training;
- library of training materials in the field of RES;
- participation in training seminars;
- e-learning platforms (Academy), where students receive online support (lectures and seminars);
- knowledge sharing (forum) where



SINCE 2012, IRENA HAS DEVELOPED A PROGRAM CALLED "INTERNATIONAL PARTNERSHIP FOR TRAINING IN RES".

1. **Concept design** for new RES facilities
 2. **Development and implementation** of the following solutions in the field of RES:

- Integrated systems for dynamic equipment
- Automated process control systems, SCADA, DCS
- Digital solutions for the Industrial Internet of Things (IIoT)
- Digitalization solutions in operations
- Industrial Analytics
- Cybersecurity
- Vibration measurement, vibration monitoring and analysis systems
- Fire extinguishing and gas detection systems (F&G)
- Security and video surveillance systems (CCTV)

3. **Technical audit** as part of modernization at existing RES facilities

Integrated solutions of Zeinet & SSE in the field of automated control systems, SCADA are aimed at building reliable systems for renewable energy facilities, which enable collection, processing, storage, integration, analysis of a large volume of strategic data. Combining digitalization, IIoT, cybersecurity and classic automated control systems, Zeinet & SSE solves issues of productivity and efficiency of technological processes, tracking key indicators in real time, while reducing operational costs and expense, reducing downtime, unplanned shutdowns and preventing accidents.

Vibration measurement systems make it possible to predictively diagnose the condition of expensive equipment, thereby increasing reliability during operation and reducing risks of downtime, accidents. For wind generators, this is the most key indicator of the plant's operability, timely detection of anomalies due to advanced analytical tools will help avoiding serious breakdowns and costs.

Wide portfolio of services and strong expertise in the field of industrial automation allows Zeinet & SSE engineering team to design systems with any level of complexity for RES, including SIL3 - level emergency safety systems, security and video surveillance (CCTV) systems, perform technical audit of existing systems, identifying reserves for improving efficiency and reducing risks.

Zeinet & SSE successfully implements large-scale renewable energy projects in partnership



with Italian company Eni through local subsidiary - Arm Wind LLP.

We bring to the reader's attention the projects implemented by the engineering team of Zeinet & SSE.



Figure 1 - Badamsha Wind Farm

IMPLEMENTED PROJECTS**• Badamsha**

Expertise and strong competencies of Zeinet & SSE team are demanded at the Badamsha project, in particular, Badamsha (Phase 1, 48MW) and Badamsha (Phase 2, 48MW) in the Aktobe

ZEINET & SSE SUCCESSFULLY
IMPLEMENTS LARGE-SCALE
RENEWABLE ENERGY
PROJECTS IN PARTNERSHIP
WITH ITALIAN COMPANY
ENI THROUGH LOCAL
SUBSIDIARY - ARM WIND LLP.

region. During implementation of 1-2 phases of Badamsha project, advanced solutions in the field of industrial automation were applied in compliance with international standards for EHS & ESG.

The team has successfully integrated the following solutions:

- High Pressure CO₂ Fire protection System
- SIL-3 (safety integrity level) Emergency shutdown systems
- Redundancy at the aggregation level of communication channels for LACP servers (link aggregation control protocol)
- SCADA-level redundancy for uninterrupted monitoring and control
- Integration of network infrastructure according to PERA (Purdue Enterprise Reference Architecture)
- Unidirectional data transmission to DMZ demilitarized zone via IoT protocols – high-level protocols
- Integration with HVAC system at the substation
- Implementation and integration of CCTV system with SCADA
- Integration of Automated Commercial Electricity Metering System (ACEMS) with SCADA A

• *Shaulder*

In Shaulder 50 MW solar power plant project in southern Kazakhstan, Zeinet & SSE team participates at concept design stage. Zeinet & SSE puts more emphasis on cybersecurity, taking into account requirements of current realities. Capability and experience in designing data transmission lines using various level protocols is an indicator of high expertise of the engineering team.

Without a doubt, Zeinet & SSE implements the best local automation solutions based on qualitative and quantitative experience in energy engineering, analytics, data processing and transmission. Increasing security level for production personnel and cybersecurity of the production itself, eco-friendliness are the main priorities of the company in any projects. Cooperation of Zeinet & SSE with Eni during design and implementation of projects creates a high quality standard - “high bar” for development of other renewable energy projects.

Joint projects with KEGOC

Joint projects with KEGOC on automatic power and frequency control (APFC). Design always includes several stages, the first of which is development and approval of technical design assignment, development of detailed design and application software.

National operator KEGOC is actively engaged in implementation of Smart Grid. Within the framework of “smart networks” concept, the company has implemented the APFC project (automatic power and frequency control system). This project is a bridge to renewable energy sources, since APFC automatically compensates instability of RES, allows transferring surplus to grid and creating correct forecasts for consumption and production.

Zeinet & SSE actively promotes digital transformation projects, expanding its portfolio of projects, implemented in the RES sector. Applying new technologies, building expertise and experience, expanding strong engineering

EXPERIENCE IN POWER SECTOR



**KEGOC/ APFC
(SMART GRID Technologies)**

**KEGOC/WACS
(SMART GRID Technologies)**

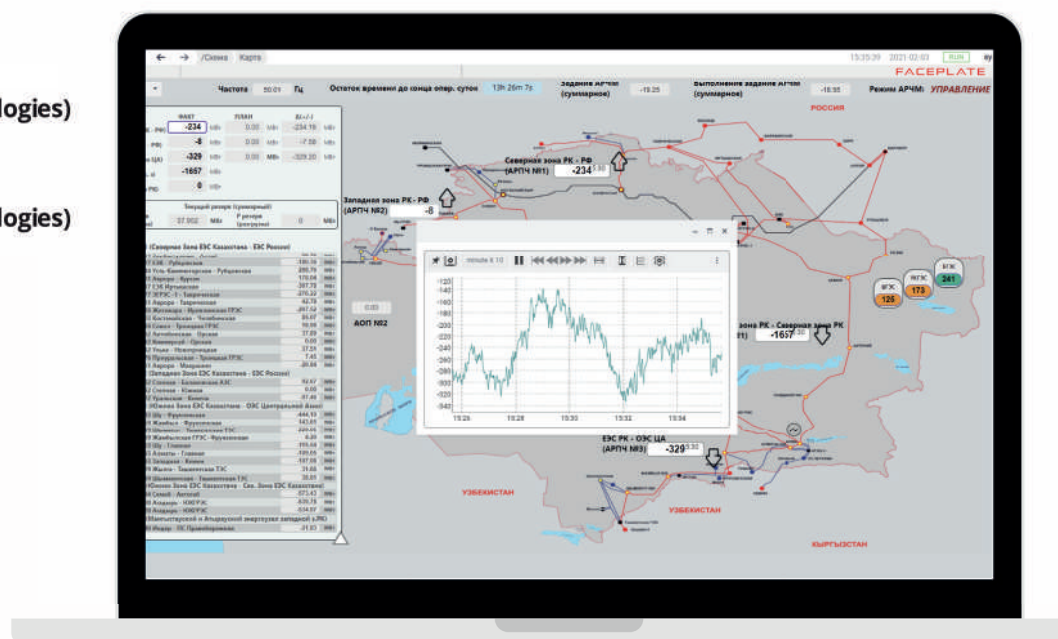


Figure 2 - Joint projects with KEGOC



team, investing in development of new domestic software products, Zeinet & SSE aims to continue working in the field of renewable energy projects.

Obviously, the next stage in renewable energy sector is green hydrogen. Kazakhstan has a great potential to become one of the largest suppliers of green hydrogen in the world. According to the latest information from open sources, German-Swedish company Svevind is going to build one of the world's largest plants for production of green hydrogen with capacity of 20 GW in Mangystau region. Such solutions in the energy sector of Kazakhstan creates the need to attract strong engineering teams with experience, expertise and ability to create trends.



► CONCLUDING THE ARTICLE ABOUT RENEWABLE ENERGY, ZEINET & SSE ENGINEERING COMPANY AND MAJOR PROJECTS, IMPLEMENTED IN KAZAKHSTAN, **WE WOULD LIKE TO NOTE INCREASING CONSISTENCY, AWARENESS, ENVIRONMENTAL FRIENDLINESS OF STATE REGULATION IN ENERGY SECTOR AND RENEWABLE ENERGY IN PARTICULAR, WHICH ALLOWS US MASTERING THE FUTURE ENERGY AND BUILDING NEW REALITY.**



<http://finprom.kz/>
<https://www.samruk-energy.kz/>

<https://kapital.kz/>
 РwC в Казахстане



POTENTIAL OF "GREEN" HYDROGEN IN KAZAKHSTAN

As the Head of State, Kassym-Jomart Tokayev noted in his State-of-the-Nation Address "Unity of the people and systemic reforms are a solid foundation for the nation's prosperity" dated September 1, 2021, our country cannot stay away from greening of industry and economy. By 2030, Kazakhstan is being predicted a shortage of electricity, and therefore there is an urgent need for reliable sources of basic energy generation. Therefore, production of "green" hydrogen, as stated by the President, has a promising direction for many purposes, including the goal of carbon neutrality. In this article we will talk about the potential of "green" hydrogen in Kazakhstan.



Edige Tagaev,
master's program,
Kazakh-German University

Many experts believe that hydrogen is one of potentially significant sources of alternative energy, along with industrial gas, solid domestic waste, nuclear energy, coalbed methane, biofuels, solar collectors, geothermal energy, hydropower, use of which will make a feasible contribution to achieving greenhouse gas reduction indicators. However, it is worth noting the need to develop legislative regulation of alternative energy market.

DEVELOPMENT POTENTIAL OF "GREEN" HYDROGEN IN KAZAKHSTAN

One of the main conditions for production of "green" hydrogen is availability of water, land and energy produced from renewable sources for the process of splitting water molecules into two different elements (hydrogen and oxygen). This process is called water electrolysis. Thus, in order to obtain "green" hydrogen, it is necessary to have at least three of the following resources: 1) water; 2) an object that produces electricity using wind, solar, water and other renewable energy sources; and 3) land (territory) for construction of inextricably linked facilities, facility for production of electricity from renewable sources and industrial building in which the processes of producing "green" hydrogen will take place, as well as other auxiliary buildings and structures.

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SIGNIFICANCE OF USING ALTERNATIVE ENERGY SOURCES

Kazakhstan, being a party to various international agreements on climate change, makes a feasible contribution to reducing emissions of greenhouse gases to the atmosphere. Nevertheless, according to the data of EDGAR – Emissions Database for Global Atmospheric Research for 2020, sources of ~ 75% of greenhouse emissions are energy sector activities related to production of electricity and heat. To reduce these indicators, it is necessary to achieve zero carbon dioxide emissions by decarbonizing the energy sector. This can be achieved through transition to "green" alternative (hydrogen) economy.

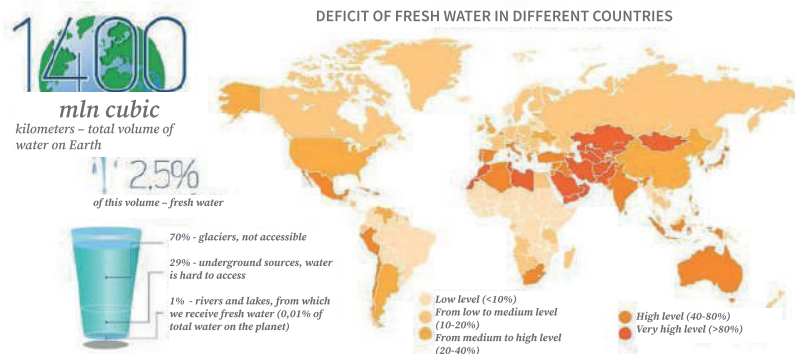
at least three of the following resources: 1) water; 2) an object that produces electricity using wind, solar, water and other renewable energy sources; and 3) land (territory) for construction of inextricably linked facilities, facility for production of electricity from renewable sources and industrial building in which the processes of producing "green" hydrogen will take place, as well as other auxiliary buildings and structures.

According to data from presentation "Hydrogen energy, justification of sites in Kazakhstan for export production" by Doctor of Technical Sciences, member of the international association "World Energy Leader" M. N. Kambarov and doctoral student of DBA, A. B. Tuleuliev, Almaty MPN of KEGOS JSC, there are regions in the country that are most suitable for hydrogen production. Among them, scientists include Dzungarian Gate on the border with China in the east of the country, Mangystau Peninsula in the west and Yerementau wind corridor in the north of the country.

Each of these sites has its own advantages. For example, the Dzungarian Gate is famous for inexhaustible wind flow, which can produce seven times more energy compared to other countries of the world. The proximity of transport and infrastructure facilities that connect China and Russia is also useful. The advantages of the Mangystau region include, in addition to the large reserves of Caspian Sea water resources, possibility of using both solar and wind energy. As for Yerementau, which is located in Akmola region, wind power is one of the features of this region.

According to data of "Targets for the Protocol on Water and Health Problems of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Republic of Kazakhstan)" of 2017: "there are about 39 thousand rivers and temporary watercourses in the republic, of which more than 7 thousand have a length of more than 10 km. Most of the Kazakhstan rivers belong to internal closed basins of the Caspian and Aral Seas, lakes of Balkhash, Alakol and Teniz. Only Yertis River belongs to Arctic Ocean basin."

"THE MAIN AMOUNT OF SECONDARY WATER ENTERS THE RIVERS OF THE SYR DARYA (47%) AND IRTYSH (34%) BASINS, THE REST FALLS ON ILI (8%) AND NURA (1.1%) RIVERS."



Source: <https://www.stepandstep.ru/statistika/15-stran-po-obyomu-presnoy-vody/>

According to research of experts from the Institute of World Resources "Ranking of the world's countries with the greatest water shortage in 2040" dated August 26, 2015, Kazakhstan ranks 20th out of 33 identified countries in which the largest share of water scarcity is predicted.

At the same time, according to World Bank study, Kazakhstan's water resources are projected to decrease by 16% by 2030 (from 90 billion cubic meters to 76 billion cubic meters). To solve this problem, the State has taken a number of measures, including adoption of new Environmental Code with new term "adaptation" to climate change in order to avoid adverse effects and damage from climate change. However, fulfillment of tasks in this area requires collective conscious actions in order to conserve water resources.

Nevertheless, possible limited access to water has not become and is not a barrier for a number of large investors who are at the stage of implementing their projects for production of green hydrogen in Kazakhstan. Moreover, Kazakhstan, according to various independent studies, "is among the top ten countries in terms of export potential of green hydrogen ...".

However, based on publicly available data, investors now prefer to explore the central-western and western parts of the country for possible projects of producing "green" hydrogen, production of "green" ammonia from "green" hydrogen, and some investors have already signed certain framework agreements for these regions of Kazakhstan.

LEGISLATION / INVESTMENT PROTECTION / BENEFITS AND PREFERENCES

Kazakhstan has sufficiently developed legislation in the field of support for renewable energy sources. It has significantly improved in recent years, becoming

attractive both for foreign investors and for domestic ones. Meanwhile, it should be noted that investors who are focused on production of "green" hydrogen in Kazakhstan rely on legislation for support of renewable energy sources in the absence of legislation that would regulate support of alternative energy sources or support of the production of "green" hydrogen.

According to the concept of transition of the Republic of Kazakhstan to a "green" economy, the share of renewable energy sources by 2030 should reach 10% of the total volume of energy produced, and by 2050 – 50%. The government has introduced the concept of auctions for renewable energy projects, and all the produced energy is being sold to the national grid.

However, such a concept of auctions and sale of energy to the national grid is unacceptable for enthusiasts of "green" hydrogen. In order to ensure that the energy produced by investors' renewable energy facilities will be directed only to hydrogen production, the concept of an "island network" should be established. The Government of Kazakhstan should create conditions so that all the renewable energy produced is directed only to production of hydrogen, and not for other needs. In the meanwhile, other norms are prescribed in the legislation.

To circumvent these requirements, it is necessary to conclude a bilateral international agreement between authorized representative of the Government of the Republic of Kazakhstan and the investor. At the same time, a prerequisite for such an agreement is its ratification by the Republic of Kazakhstan, since in accordance with the provisions of the Law of the Republic of Kazakhstan "On International Treaties of the Republic of Kazakhstan", the provisions of such an agreement will have priority over provisions established by Kazakh legislation.

In addition, in terms of investment protection, provision of benefits and preferences (tax benefits, customs benefits, monetary benefits, use of foreign currency, attraction of foreign labor workforce, etc.) can also be separately included in an international agreement. In terms of national regulation, the state guarantees the protection of investments, the right to free recourse to court, including arbitration. The Republic of Kazakhstan is a party to many international treaties, the provisions of which may apply to relations between parties to an international treaty.

Thus, based on the above, it can be concluded that the legislation of the Republic of Kazakhstan is quite flexible, and if there are national interests and

political will, the state can agree to conditions other than those provided for by national legislation. This is undoubtedly a big advantage for investors, taking into account possible guarantees for protection of investments and appeals to international arbitration institutions in case of litigation.

The State has also adopted a number of other documents that directly or indirectly contribute to achieving planned strategic goals and objectives. It is worth noting that, despite economic and geopolitical challenges on the world stage, the state adheres to its plans. When choosing a country for investment, this direction of state policy appeals to investors.

INTERNATIONAL COMPANIES CHOOSE KAZAKHSTAN TO INVEST IN PRODUCTION OF "GREEN" HYDROGEN.

From November 6 to November 18, 2022, a conference of world leaders on climate change was held within the UN framework. One of significant events for Kazakhstan at the conference was conclusion of the Memorandum of Understanding on Strategic partnership in the field of sustainable raw materials, batteries and value chains of green hydrogen between Kazakhstan and the European Union (hereinafter the "Memorandum"). The signatories of the Memorandum were the Prime Minister of Kazakhstan (Alikhan Smailov) and the President of the European Commission (Ursula von der Leyen). The Prime Minister of Kazakhstan noted that "our country has all the necessary factors of attractiveness for European business, including diversified energy sources and high transit and transport potential." In accordance with paragraph 3 of Chapter 1 of the Memorandum, the parties agreed that cooperation will be carried out in full compliance with the provisions of Article 148 of the Agreement "On Enhanced Partnership and Cooperation between the Republic of Kazakhstan, on the one hand, and the European Union and its member States, on the other hand" dated December 21, 2015, that are aimed at developing and strengthening cooperation, respecting the principles of transparency and non-discrimination, creating the best environment for trade, "favorable for direct foreign investment in production and trade of raw materials and energy goods." It is expected that a Roadmap for strategic partnership will be developed until mid-2023, which should define specific actions for cooperation in all agreed areas of work. On the sidelines of the conference, the second significant event for Kazakhstan was the signing of a Framework Agreement "On implementation of green hydrogen production projects" with Fortescue Future Industries (hereinafter "FFI"). In this regard, it is believed that the previously signed Memorandum will serve as a kind of fulcrum, within which the issues of transportation (export) of green hydrogen to the European market by FFI and the Republic of Kazakhstan will also be regulated. At a meeting between the Foreign Ministers of Germany and Kazakhstan on November 1, 2022, representatives of Germany announced a plan to open a bureau (office) of "Hydrogen Diplomacy" in Astana. Kazakh side supported this initiative. The office will serve as a center for exchanging experience, supporting solution of issues, attracting experts and responsible persons to achieve the goal of reducing emissions to zero.



SVEVIND PROJECT

The delegation of the Government of the Republic of Kazakhstan and representatives of the Svevind Group met in Sweden in October 2021 to sign a roadmap for development of the green hydrogen project in Kazakhstan. Svevind plans to produce 2 million tons of "green" hydrogen per year in Kazakhstan for domestic consumption and export to the EU. Subsequently, the company will build renewable energy facilities with a capacity of 30 MW. The implementation of this project will allow Kazakhstan to become one of the largest producers of "green" hydrogen in the world by 2030. The project was named "Hyrasia One". Such projects will help our country to achieve carbon neutrality by 2060, as it was planned by the first resident of the country.

Resolution of the Government of the Republic of Kazakhstan dated November 24, 2021 No. 837 approved a Framework agreement on the basic principles for implementation of renewable energy projects and production of "green" hydrogen in the Mangystau region between the Government of the Republic of Kazakhstan and NEH Eurasia GmbH" [affiliate company of Svevind – author's note].

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In accordance with the terms of this agreement, the parties agreed that each party will make efforts to maximize project implementation, including regulation of legislation in the field of land relations, currency regulation, attracting external investment, co-investors and foreign labor, import and export issues, creation of legislation in the field of hydrogen energy and others issues. These provisions show that Kazakhstan is ready to promote and support the production of "green" hydrogen by creating legislative benefits for convenience of investors.

According to the international economic news portal Bloomberg, on October 27, 2022, as part of the official visit of the President of the European Council Charles Michel to Kazakhstan, an investment Agreement was signed on the project "Creation of a



center for production and distribution of renewable energy and "green" hydrogen". This center is located in the Mangystau region. The agreement was signed by the Government of the Republic of Kazakhstan and the company "HYRASIA ONE".

The head of Svevind Wolfgang Kropp noted that the choice of Kazakhstan as a platform for implementation of its project was conditioned by a number of factors. First of all, these are: ideal conditions for production of energy from renewable energy sources: constant year-round wind flows and good conditions for production of solar energy, as well as a low cost threshold for production of one unit of "green" hydrogen.

In accordance with the project plan, the start of technological process for production of "green" hydrogen is scheduled for 2030.

HYDROGEN ALLIANCE

The agreement on creation of Alliance of "green" Hydrogen of Kazakhstan was signed on June 29, 2022 in Astana International Financial Center at the First Forum on "Green" Hydrogen. The alliance is designed to unite the efforts of parties by exchanging experience and finding common solutions in implementation of projects in this area. Among the founders of the Association were Linde (Germany), Svevind Energy GmbH (Germany), Roedl & Partners (Germany), Qazaq Gaz (Kazakhstan), Atasu Group (Kazakhstan), Green Spark LTD (Italy), AIFC Green Finance Center (Kazakhstan), GCA Partners (Kazakhstan), Ajusa Hydrogen

Technologies (Spain) and other international companies from the EU.

In addition to the creation of Alliance, other agreements were signed at the forum, including "Cooperation Agreement between the French Association Hydrogen Task Force and Investment Task Force Kazakh Invest" and "Agreement on the development of technology for the first hydrogen refueling in Kazakhstan between Green Spark and GRAF Industries S.p.A."

The meeting was attended by representatives of authorized and competent state bodies. This shows the country's high interest in development of hydrogen industry, its desire to reduce atmospheric pollution, improve investment environment, create a platform for exchange and cooperation between representatives of investing parties, and much more. Thus, it can be concluded that through joint efforts, both on the part of the state and on the part of representatives of investors, the attractiveness of the development potential of the "green" hydrogen industry in Kazakhstan will increase significantly.

EXPECTED ENERGY DEMAND/ REDUCTION OF HYDROCARBON EMISSIONS

The geopolitical situation in the world leads to a sharp and large demand for energy carriers, including alternative ones, due to voluntary refusals by various European countries from acquisition and use of natural resources (energy carriers) supplied directly from the Russian Federation. The report of the International Energy Agency notes a decrease in the consumption of Russian natural gas by more than 50 billion cubic meters. General increase in prices in economic environment of European countries is predicted due to rising energy prices. Expected increase in prices affects decisions of many countries' governments to the approach of choosing and



using energy carriers. Due to its geographical location, Kazakhstan has a good opportunity in the near future to export relatively inexpensive energy resources, including "green" hydrogen and "green" ammonia. All this together makes the Kazakhstan market very attractive for foreign investors.

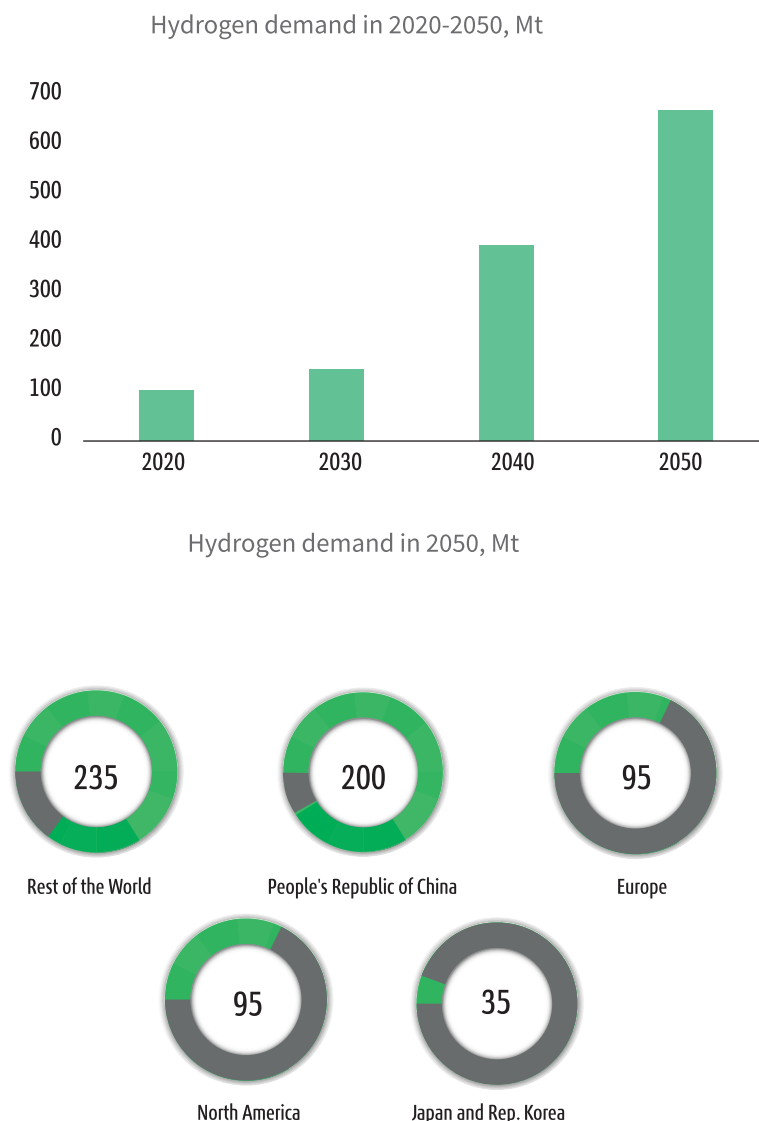
Preliminary report of the Asian Development Bank "Towards Hydrogen Economy in Kazakhstan" No. 1344, October 2022 (hereinafter referred to as "ADB Report", forecasts consumption of hydrogen energy carriers at the level of 660 million tons by 2050. At the same time, developed countries, including the People's Republic of China and the EU countries will consume up to 45% of hydrogen energy by this date (*see Figure 1: Hydrogen Demand in 2050-2050* below). It is noteworthy that, together with the global policy to reduce emissions to zero and corresponding transition to alternative renewable energy sources, Kazakhstan can significantly cover the demand for hydrogen due to geographical location between the mentioned countries, and taking into account the issues of storage, transportation (logistics) of delivering energy to final consumers.

According to the data from ADB Report (Table 7 of the Report), the use of hydrogen technologies in such areas as metallurgy, chemical production, transport will lead to significant results in reducing hydrocarbon emissions, both in the short and long term. ADB Report concludes that the use of hydrogen technologies is a priority for decarbonizing economy of Kazakhstan, however, the authors of the ADB Report suggest first creating a financial base for use of hydrogen technologies in Kazakhstan, through initial exports, and then focus on domestic market.

WHAT IS THE RESULT?

Of course, when discussing this kind of global things, an investor should take a comprehensive approach to his choice, studying in detail all the risks and barriers associated with the project of producing "green" hydrogen and further supply chains (exports). In general, legislation in the field of alternative energy, including hydrogen, needs to be developed separately. We need a clear concept on "green" hydrogen, we need our own research, so as not to rely only on conclusions and studies of investors. The Government is facing a huge and complex work in this direction, including preserving the balance of water resources used to produce hydrogen. Nevertheless, the clean hydrogen industry itself, its development and production are a necessary component of the energy industry, both for government officials and business community.

Figure 1: Hydrogen Demand in 2020–2050



Source: Preliminary Report of the Asian Development Bank "Towards Hydrogen Economy in Kazakhstan" No. 1344, October 2022

In this regard, based on the global directions of achieving hydrocarbon neutrality, we believe that Kazakhstan needs to develop itself in the field of "green" hydrogen, meeting all accepted standards for its production.

The government and investors should develop a strategy and make certain efforts to implement green hydrogen projects in Kazakhstan. In general, our country has a great potential to become a leader in the hydrogen market.



INFORMATION ON PRODUCTION OF ELECTRIC ENERGY **BY RES**

FACILITIES FOR 9 months of 2022



Installed capacity

2 325,3 MW, including

Wind
power plants

893,9 MW

Small
HPP

280,21 MW

Solar power
plants

1 149,78 MW

Bio power
plants

1,47 MW



Generation

mln. kWh including

Wind
power plants

1 638,79 mln. kWh

Small
HPP

789,78 mln. kWh

Solar power
plants

1 487,7 mln. kWh

Bio power
plants

1,12 mln. kWh

The share of electricity generated by RES in the total
volume of electricity generation

4,6%

Compared to 2020, increase in RES
electricity production in 2021 is

21%

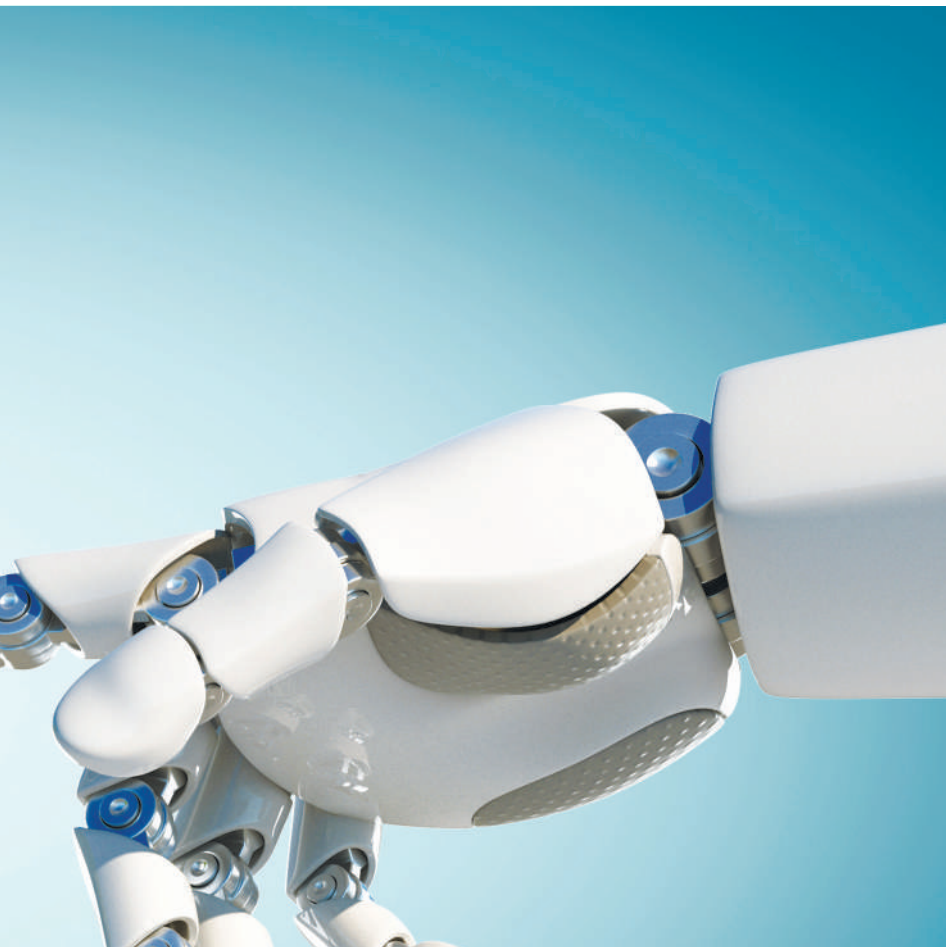


Dr. Maik Reder,
Founder & CEO / CTO ANNEA

USING DIGITAL TECHNOLOGIES TO MONITOR AND PREDICT THE HEALTH OF **RENEWABLE ENERGY** PRODUCTION ASSETS



Marcel Frenzel,
Founder & CFO / CSO ANNEA



KAZAKHSTAN IS SEEKING TO REHAUL ITS CURRENT ENERGY INFRASTRUCTURE TO MAKE IT CLEANER AND MORE EFFICIENT. THIS WILL SEE THE COUNTRY MOVE AWAY FROM ITS RELIANCE ON DOMESTIC GAS, OIL AND COAL RESOURCE AS IT MOVES TOWARDS ITS GOAL OF SUPPLYING 50% OF ITS ENERGY FROM RENEWABLES BY 2050. HAND IN HAND WITH THIS WILL BE THE OPPORTUNITIES THAT WILL ARISE IN THE OPERATION AND MAINTENANCE OF THESE RENEWABLE ENERGIES. BELOW, WE LOOK AT DIFFERENT DIGITAL SOLUTIONS CURRENTLY AVAILABLE ON THE MARKET THAT ENABLE GREEN ENERGY PRODUCERS, SPECIFICALLY WIND ENERGY PRODUCERS, TO PREVENT, MAINTAIN AND REPAIR THEIR ASSETS IN THE MOST EFFICIENT WAYS POSSIBLE.

INDUSTRY INSIGHTS

The renewable energy industry faces various challenges, such as competition with conventional energy sources on a cost basis due

to high operation and maintenance expenses (O&M). As renewable energies have become more competitive with conventional sources, competition between renewable energy operators increased. With the right strategy, digital technologies help to counteract O&M challenges, give renewable energy operators competitive advantages, and increase their contribution to net-zero emissions.

The sector has made strides in its approach to machine maintenance by moving away from the traditional practice of run-to-failure maintenance which involves “fixing it when it fails”. Currently many operators use a preventive maintenance strategy which instead favours periodically scheduled maintenance and repair work. Also in use, is predictive maintenance. Predictive maintenance, as suggested by the name, involves knowing when an asset or component will fail, how will it fail, and what will be the root cause of the failure. Going up another level, in prescriptive maintenance, the turbine then also tells the operator how to avoid the predicted failure.

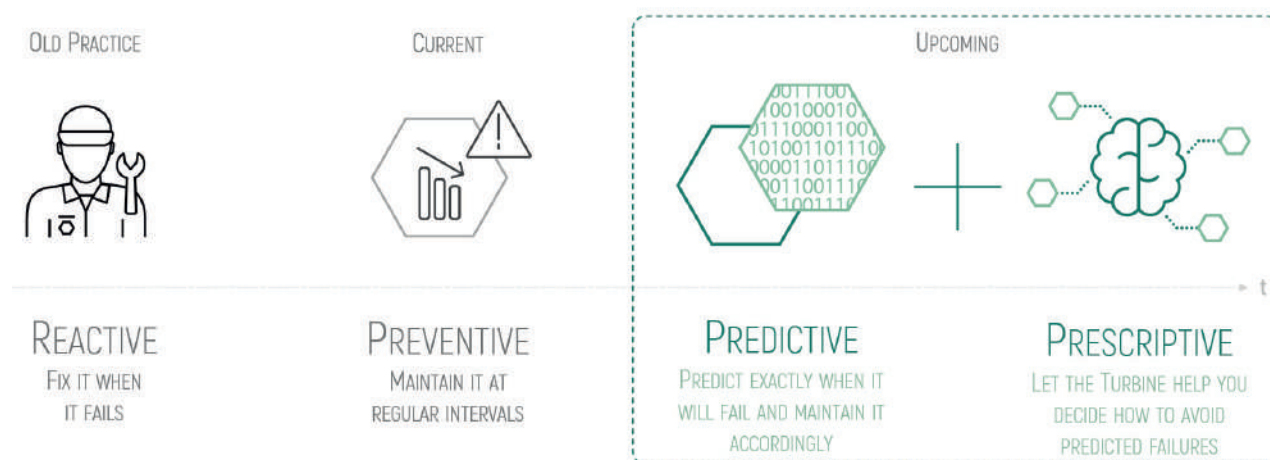
Together, these strategies prevent wind turbine owners, operators, and maintenance providers, from spending resources unnecessarily on the maintenance of their assets.

Based on estimates from European markets such as Germany, the UK and Denmark, O&M costs are estimated to be between 1.2 c€ and 1.5 c€ per kWh of wind power produced, over the total lifetime of a turbine. This translates to 20-30% of the Levelised Cost of Energy. For U.S. markets, O&M costs are usually lower (estimated at \$0.01 per kWh).

The cost savings for maintenance and labour can be extensive. Data from the U.S. and Europe suggest the repair and maintenance portion to be between 46% and 57% of overall O&M costs. A 20% reduction in this portion would yield annual cost savings of over \$11,000 for a 2.5-MW turbine and about \$34,000 for a 7.5-MW turbine. Limiting O&M expenses is a high priority for the wind power sector. Nowadays, given the access to vast amounts of data, the wind farm operators can use machine learning to turn under-utilized sensor data to lower overall turbine O&M costs.

The reduction in O&M spending depends on the use cases identified, available capabilities





and the resultant solution developed. For instance, solely AI-focused companies usually expect to see a 3%-5% decrease in O&M costs. Companies that combine industry knowledge, machine learning and reliability modelling see this figure jump to 30%-50%.

Further to this, with the arrival of digitalisation, the industrial IoT (IIoT), and artificial intelligence (AI), more companies are moving towards getting value out of their assets' data. This promotes a future where companies use predictive and prescriptive maintenance strategies. To make this possible, solutions should be user-friendly tools using cutting-edge technologies such as digital twins.

DIGITAL TWIN TECHNOLOGY

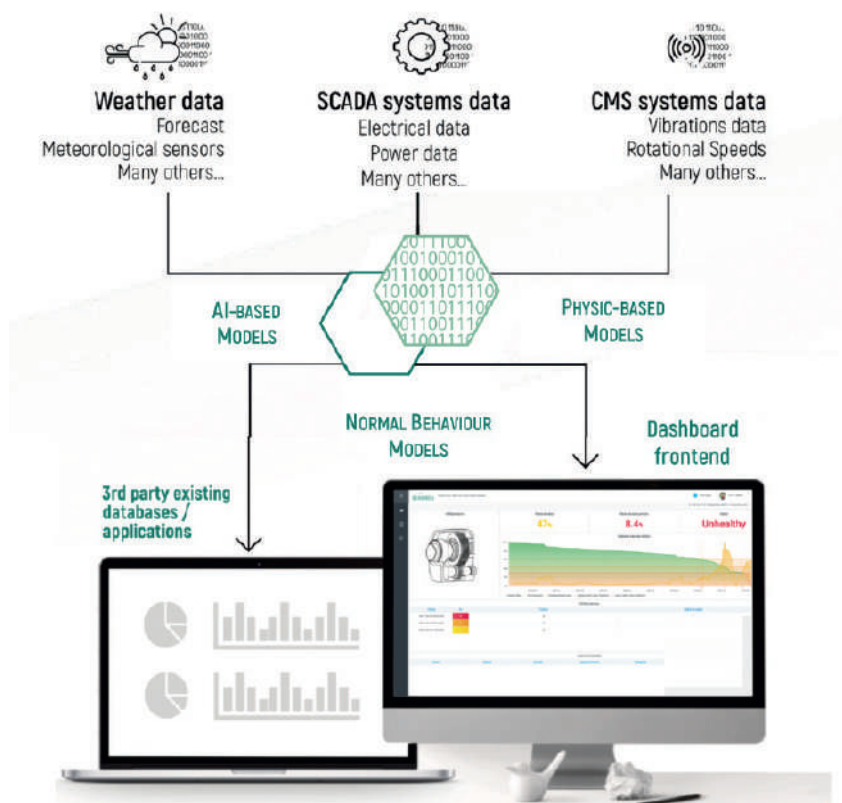
A digital twin is the digital representation of a physical object or system based on the data that is emitted from the same physical object or system. Digital Twin technology has a huge impact on the product development processes involving engineering knowledge. Digital twins are mainly used to predict various outcomes in different scenarios. As a result, the technology generates great value for businesses that put them to good use.

Most modern renewable energy assets are equipped with SCADA-systems, generating a huge amount of information that can usually be obtained free of any additional cost. Maintenance platforms can use these already existing sensors and data sources to feed data into the digital twin, thus creating a digital copy of the asset that can be remotely used for analysis and predictions. This is one of the greatest strengths that comes with the digitalisation of maintenance operations as it reduces the impact of unplanned outages.

Digital twins ultimately help end-users to better predict, and therefore prevent, future failures while improving performance significantly.

One way in which maintenance developers are utilising digital twins is through the development of holistic dashboards. These dashboards visualise data and boast several modules designed to bring the activities of renewables to the next level.

Comprehensive solutions that are currently on the market offer various modules on IIoT-platforms.





Clients can choose which modules fit their need and subscribe to these based on a monthly fee (SaaS). This fee is usually dependent on client requirements, the features and the duration of the maintenance plan booked. Below we look at two key examples of solutions that maintenance platforms seek to offer.

PREDICTIVE MAINTENANCE

A predictive maintenance module is centred around failure prediction. This solution generally provides detailed information on the assets and their components' health status, remaining lifetime, performance, and operating conditions. In this module, the information is often split into three levels of detail to allow clients to easily access maintenance details as and when they are required.

For instance, the first level aims to provide a high-level overview of all the wind farms which the clients have connected to their maintenance platform. At this level, wind farm assets display KPIs, predicted failures, and malfunctions in real-time. The second level usually offers a more detailed view - allowing the user to zoom closer into the asset data. In this view, information concerning the health status of the turbines, remaining lifetime, performance, and operating conditions should be available at any point in time. The last layer will aim to provide an in-depth, lower-level view of one of

CURRENTLY MANY OPERATORS USE A PREVENTIVE MAINTENANCE STRATEGY WHICH INSTEAD FAVOURS PERIODICALLY SCHEDULED MAINTENANCE AND REPAIR WORK.

the main components. This showcases current and future health statuses, the root cause of any current or future malfunctions, and actionable O&M insights that allow the client to solve any situation that may have developed.

Such failure prediction modules use an automated predictive engine. These engines represent a complex software application that is able to predict wind turbine failures. Some market solutions do so up to a year before they actually occur. This module is usually developed in conjunction with a health index to enrich the data and which showcases the overall operational efficiency of turbine components. Additionally, advanced digital twins provide a detailed estimation of the remaining useful lifetime value of turbines and the recommended maintenance actions. These actions are usually made visible through the various layers of the dashboard as well as a combined overview.

EFFICIENCY UTILISATION

Underperformance detection should be a second target of operations and maintenance solutions, as remedying such issues boosts efficiency massively. ANNEA can offer rich insights into various aspects of the turbine operation, for instance identifying where the most power is lost and the reasons for this loss.



an aggregated view of holistic underperformance activity to be viewed in real-time on wind farm level, considering the wind farm layout and wake effects. This information offers a general but useful showcase of the power production, power loss, the detected underperformance, and its cause. Additionally, it provides actionable suggestions on how to improve performance and offers an understanding of the performance related state of the wind turbine. The second layer usually provides an overview of the turbine's underperformance, highlighting the relationship between energy loss, loss of revenue, and total energy loss. Clients are able to view the efficiency of the turbine and the costs associated with underperformance and inefficiencies.

Maintenance platforms are also able to monitor turbine components to detect underperformance and provide recommendations. That is when data-driven underperformance modules detect the root cause and provide recommendations on how best to counteract the problem. By following the recommendation, clients can boost the performance of their assets by improving energy production and minimising revenue loss.

CONTRIBUTION TO KAZAKHSTAN'S GREEN ENERGY PLAN

In line with the goal of the Qazaq Green Association



uniting renewable energy players to create favourable conditions for industry development, maintenance platforms are keen to offer the association members their expertise and unique solutions to further pursue their cause.

Combining digital twin technology with different modelling techniques enables green energy producers to predict failures up to 12 months ahead on a component level with 99.9% accuracy, without installing additional hardware. With the right strategy, cutting-edge technology from maintenance developers and their counterparts within wind operations – we can overcome maintenance challenges often associate with renewable and contribute to achieving net-zero emissions.

Platforms such as the one by ANNEA utilise predictive maintenance, machine learning and reliability modelling to enable increased reliability, minimise unplanned downtime and offer an extended lifetime whilst simultaneously optimising performance.



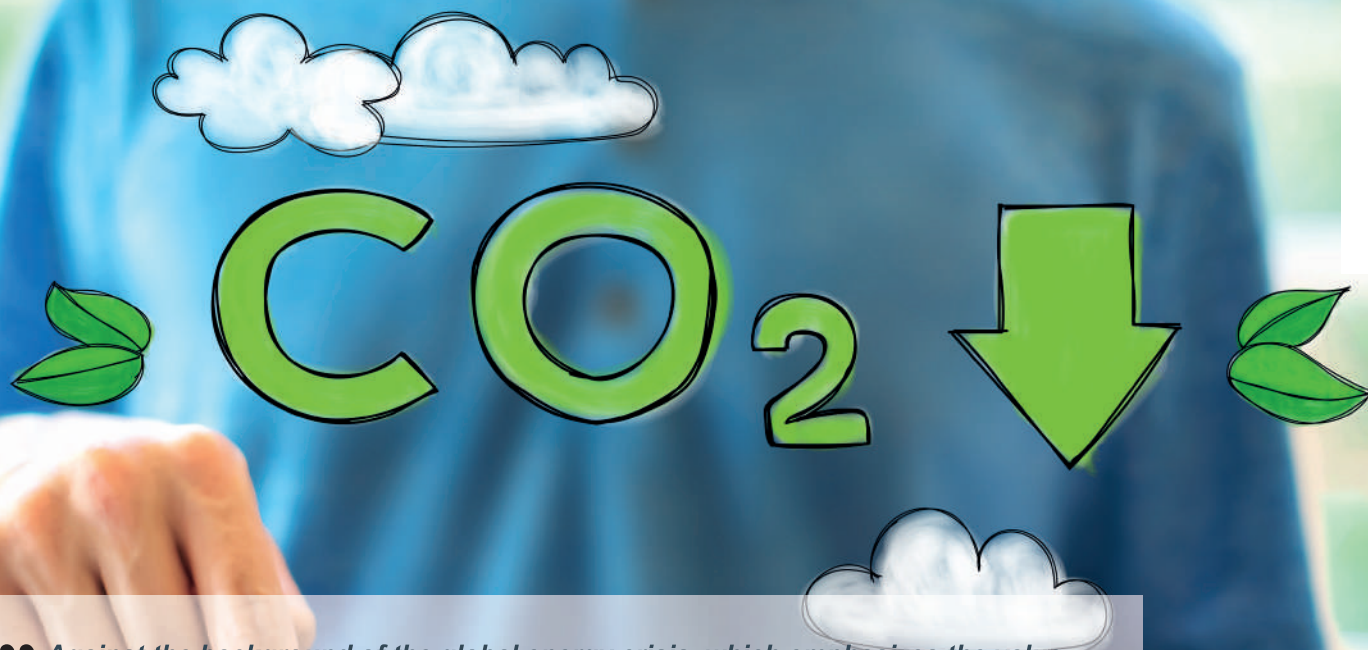
Get in touch with an ANNEA representative to understand how your maintenance systems can be utilised to best improve efficiency: www.annea.ai

RESULTS OF AUCTIONS FOR SELECTION OF RES PROJECTS IN 2022

 November 4 HPP 20 MW	November 10 Tesis LLP SPP Auction price KZT/ kWh (without VAT) 16,95 20 MW	Evrus LLP (Kazakhstan) WPP Auction price KZT/ kWh (without VAT) 13,33 50 MW	November 28 Aspan Energo LLP (Kazakhstan) WPP Auction price KZT/ kWh (without VAT) 12,97 50 MW
November 4 HPP 200 MW			
November 7 BioPP 10 MW	November 11 Darmen Shuak LLP (Hong Kong) WPP Auction price KZT/ kWh (without VAT) 15,2 50 MW	November 24 Orkan LLP (Kazakhstan) WPP Auction price KZT/ kWh (without VAT) 12,98 15 MW	November 29 Mezgilder Qushteri LLP (Hong Kong (China) - Kazakhstan) Auction price KZT/ kWh (without VAT) 12,39 100 MW
November 8 SPP 20 MW			
November 9 Damona LLP SPP Auction price KZT/ kWh (without VAT) 16,95 20 MW	November 21 «Sarkylmas Kuat» ЖШС (Гонконг) WPP Auction price KZT/ kWh (without VAT) 14,51 50 MW	November 24 Afrikk LLP (Russian Federation) WPP Auction price KZT/ kWh (without VAT) 15,96 35 MW	 
	November 22 Next Green Energy LLP (Kazakhstan – China) WPP Auction price KZT/ kWh (without VAT) 12,99 50 MW		

- *The auction was declared invalid
- ** Auction with prepared documentation

Source: Kazakhstan Electricity and Power Market Operator JSC



“Against the background of the global energy crisis, which emphasizes the value of traditional energy sources, the climate agenda and the issue of transition to renewable energy sources in Kazakhstan remain important aspects of sustainable development. More and more companies in the corporate sector are setting for themselves the task of reducing their carbon footprint and are expressing interest both in implementing low-carbon projects and in consuming “clean” energy. At the same time, one of the tools for reducing emissions is carbon offset – activity or activities aimed at reducing greenhouse gas emissions and (or) increasing absorption of greenhouse gases.”

VOLUNTARY CARBON MARKET: concept, examples and potential

CARBON MARKETS

There are two types of carbon offset markets: regulated and voluntary.

An example of a regulated market in Kazakhstan is the Emissions Trading System, which was launched in pilot mode in 2013. The amount of emissions of 20,000 tons of carbon dioxide per annum is used as a threshold value, according to which facilities are included in the National Carbon Quota Allocation Plan (NCQAP). Today, the ETS covers (controls by quotas) only carbon dioxide emissions¹.



Timur Shalabayev,
Executive Director
RES Association "Qazaq Green"

Regarding requirements for monitoring, reporting, verification (MRV), an evaluation (calculation) method is used, which assumes verification by a third party.

Thus, the regulated carbon market operates on a top-down basis. According to experts, the reverse bottom-up approach is peculiar to voluntary carbon units market, where pollutants themselves seek to reduce their carbon footprint in order to fulfill corporate obligations to reduce climate impact, improve company's image, increase investment attractiveness,

receive bonuses for carbon-neutral products or prepare for future offset of carbon units after introduction of regulatory instruments to control emissions. Currently, Kazakhstan does not have its own standards for voluntary carbon offsets. In this connection, companies use foreign standards.

Experts around the world note great development potential of voluntary offset markets². In 2021, turnover of voluntary offset market set a new historical record – more than \$ 1 billion (for comparison: about \$ 300 million in 2018, and for the entire existence – \$ 6.7 billion), but this is a drop in the bucket compared to forecasts. According to experts, this figure will only grow from \$ 100 billion by 2030 to \$ 550 billion by 2050, that is already comparable to today's turnover of regulated markets.

Taking into account these forecasts, some multinational corporations have already started implementing climate projects independently, both for their own purposes and for further diversification of their revenue. In particular, large oil and gas companies that are consumers at voluntary carbon markets, have already begun to buy projects themselves or large shares in the projects with the intention of protecting themselves from rising prices for carbon units in the future.

WELL-KNOWN STANDARDS AT VOLUNTARY OFFSET MARKETS

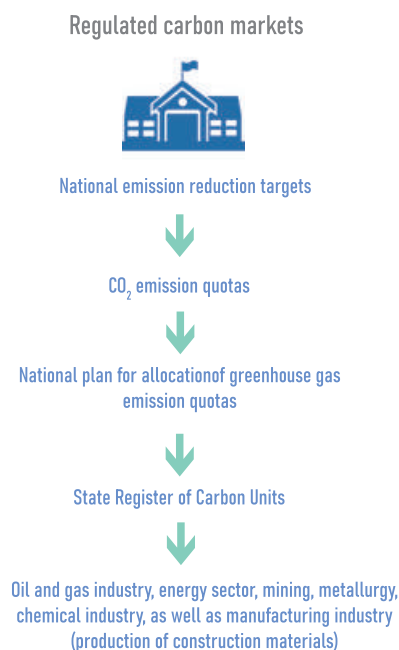
According to experts³, the most popular international standards for verifying and confirming

¹ Kovalenko V., *What is happening in the market of carbon units and how to prepare for carbon regulation in Kazakhstan and the world?* EY, 2022

² Voluntary carbon unit market is on the rise, *OilCapital.ru*, 2022

CARBON MARKETS: REGULATED VS VOLUNTARY

Emissions trading system



Source: V. Kovalenko, EY, 2022

The main difference between a regulated market and a voluntary one is a top-down approach, where national goals for reducing emissions and/or achieving carbon neutrality dictate quotas for CO₂ emissions.



- reducing carbon footprint
- fulfillment of corporate obligations to reduce climate impact
- improving company's image
- increasing investment attractiveness, receiving bonuses for carbon-neutral products
- preparation for future offset of carbon units with introduction of regulatory instruments for emission control

Voluntary carbon markets provide companies with a tool to offset part of their carbon emissions by purchasing carbon offsets from projects that absorb or reduce greenhouse gas emissions.

project effectiveness (85% of the total market) are Verified Carbon Standard (VCS) and Gold Standard (Gold Standard, GS). A new standard, the Global Carbon Council (GCC), is also successfully developing at the market.

Verified Carbon Standard (VCS)

Verra was founded in 2007 by environmental and business leaders who beheld the need for greater quality assurance in voluntary carbon markets. Verra implements many climate programs⁴, one of main ones is VCS program.

The VCS program allows certified projects to convert reduction and absorption of greenhouse gas (GHG) emissions into tradable carbon credits. Since its launch in 2006, the VCS program has grown into the world's largest voluntary greenhouse gas emissions program. VCS projects include dozens of technologies and measures that lead to reduction of emissions and removal of greenhouse gases, including conservation and restoration of forests and wetlands, management of agricultural land, improving transport efficiency and much more. Currently, almost 1,600 projects have been registered in more than 80 countries, resulting in over 450 million carbon credits, that are equivalent to 98 million passenger cars decommissioned within one year.

³ Kovalenko V., *What is happening in the market of carbon units and how to prepare for carbon regulation in Kazakhstan and the world?* EY, 2022

⁴ <https://verra.org/about-verra/who-we-are/>

Gold Standard (GS)

Gold Standard was established in 2003 by the World Wildlife Fund and other international non-governmental organizations to ensure that projects aimed at reducing carbon emissions are distinguished by the highest level of environmental cleanliness, and contribute to sustainable development. Following the adoption of Paris Climate Agreement and Sustainable Development Goals, best practice standard for climate and sustainable development intervention was launched.

The Gold Standard was based on the principle that measures to combat climate change cannot be unilateral – climate projects should bring significant benefits in the field of sustainable development, in addition to reducing emissions. The success of this approach has urged both UN Clean Development Mechanism (CDM) and other voluntary standards to raise the bar and include sustainable development in some of their climate projects.

By the end of 2021, Gold Standard has issued 191 million carbon credits for projects located in 98 countries around the world: these are 2,600 projects that helped to reduce 209 million tons of CO₂ emissions.

Global Carbon Council (GCC)⁵

GCC was established as the first global voluntary carbon offset program in the Middle East and North Africa (MENA) region. This is an initiative of the Gulf Organization for Research and Development (GORD). The program complements existing carbon market programs to address the issue of carbon offsetting in the MENA region.

Carbon credits from projects registered with GCC are called Approved Carbon Credits (ACC). The standard has also been approved by CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) of the International Civil Aviation Organization (ICAO). This gives the program global recognition of honesty in issuing carbon credits.

GCC plans to launch a regulatory framework for the following types of projects:

- Carbon capture and storage,
- Carbon capture and utilization,
- Direct air capture,
- Energy storage projects,

- Desalination plants based on renewable energy sources,
- Water-saving projects,
- Scaling up energy-efficient buildings and districts.

Indeed, there is great potential for carbon credits in the MENA region, as solar, “blue” and “green” hydrogen, as well as initiatives to reduce emissions, are gaining momentum. GCC has issued 133,000 credits since 2020, when it began receiving carbon emissions reduction projects. The Council has received about 200 projects, 121 of them have already been evaluated.

The GCC program also hopes to receive about 2,000 project applications by the end of this year. If this happens, as expected, the program will enter the top of the best carbon offset programs.

Experts note that there is a potential for using carbon units to reduce the carbon tax as compensation for emissions. Thus, the results of climate projects verified according to VCS and GS standards are already recognized by regulatory mechanisms for tax reduction in Colombia and South Africa, CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation), and Upstream emissions reduction mechanism, which involves offsetting initiatives to reduce emissions during production of fuel.

BY THE END OF 2021, GOLD STANDARD HAS ISSUED 191 MILLION CARBON CREDITS FOR PROJECTS LOCATED IN 98 COUNTRIES AROUND THE WORLD: THESE ARE 2,600 PROJECTS THAT HELPED TO REDUCE 209 MILLION TONS OF CO₂ EMISSIONS.



⁵ <https://carboncredits.com/qatars-world-cup-carbon-program-expands-to-issue-up-to-50m-carbon-credits/>

⁶ Kovalenko V., *What is happening in the market of carbon units and how to prepare for carbon regulation in Kazakhstan and the world?* EY, 2022

external projects. Offsets (confirmed emission reductions) are deducted from the organization's emissions to determine organization's net emissions.

I-RECs are used to solve the problem of indirect greenhouse gas emissions associated with purchased electricity (Scope 2 emissions) by verifying use of a renewable source of electricity with zero or low emissions. I-REC (MWh of renewable energy) is used in calculations of gross market Scope 2 emissions (according to Greenhouse Gas Protocol) based on the emission factor of renewable generation transmitted together with I-REC.

Many organizations begin managing their impact by developing greenhouse gas emissions inventory. In accordance with WRI/WBCSD Protocol on Greenhouse Gas Emissions, the organization follows a standard set of accounting guidelines for measuring emissions and developing emission inventory that separately considers the emissions for which the organization is responsible as a result of its activities, purchase of energy and supply chain in three different registers known as Scope 1, 2 and 3.

Key differences between offsets and I-REC

	Offsets	I-REC
Measuring unit	Measuring unit of offsets is usually one metric ton of CO ₂ -equivalent emissions.	I-REC is based on 1 MWh of renewable electricity.
Goal	Offsets represent emission reductions, provide support for emission reduction activities, and can reduce costs of mitigating greenhouse gas emissions.	I-REC expands consumers' choice of electricity, reports on the use of renewable electricity.
Source	Offsets can be obtained from all kinds of projects that reduce, remove or prevent emissions.	I-RECs are generated only from renewable sources of electricity (i.e., solar, wind, geothermal, biomass, hydropower).
Statements	The buyer of offsets can state reduction or prevention of direct greenhouse gas emissions outside the activities of its organization.	The I-REC buyer can claim to use 1 MWh of renewable electricity from a low- or zero-emission source. REC buyers should avoid misleading statements such as: "My purchase "offsets" emissions.
Accounting	Offsets can be used to compensate or "offset" organization's emissions in categories 1, 2 or 3 (according to Greenhouse Gas Protocol). Offsets are separate document designed to determine the "net" emission indicators when documenting achievement of a goal.	I-REC allows an organization to reduce its market emissions under Scope 2 (according to Greenhouse Gas Protocol).
Additional requirements	Offsets should represent real, permanent, verified and enforceable reductions. Most importantly, they should be generated by activity or project that is complementary to what would happen in a normal scenario. This requirement of "complementarity" for offset projects is central to ensuring that the ton of emission reductions you use as offset is fully equivalent to the ton of emission reductions from your activities.	When applying I-REC to Scope 2 market emissions, an organization is not required to demonstrate additional requirements.

Source: epa.gov , Offsets and RECs: What's the Difference?, 2018

Greenhouse gas emissions		
Scope 1	Scope 2	Scope 3
Greenhouse gas emissions from sources owned or controlled by the organization	Greenhouse gas emissions from generation of electricity, heat or steam purchased by the organization, but the generating equipment does not belong to it	Greenhouse gas emissions from sources that organization does not own or control, but which are the result of organization's value chain or its activities
<ul style="list-style-type: none"> - Transport and equipment - Stationary sources - Local landfills and wastewater treatment - Fugitive emissions 	<ul style="list-style-type: none"> - Buying electricity - Buying heat or air conditioning - Buying steam 	<ul style="list-style-type: none"> - Losses on transmission and distribution of electricity - Business trips - Contracted solid waste - Employees who use transport for travelling to work - Supply chain - Contracted wastewater

Source: ghgprotocol.org

Categorization of emissions helps to distinguish emissions from sources that an organization directly owns or manages (direct emissions) from emissions that are a consequence of the organization's activities, but originate from sources owned or controlled by another organization (indirect emissions). This separate accounting should ensure that two or more organizations do not account emissions in the same category. With this framework, organizations can evaluate their performance and determine which mitigation options should be used.

Carbon offset is "a specific activity or set of measures aimed at reducing greenhouse gas emissions, increasing carbon storage or increasing removal of greenhouse gases from the atmosphere." The project should be considered complementary; resulting emission reductions should be real, permanent and verified; and credits (i.e., offsets) issued for verified emission reductions should be enforceable.




Offsets can be used to eliminate direct and indirect emissions associated with organization's activities (for example, emissions from a boiler used to heat your organization's office building). Reducing greenhouse gas emissions in one place can be used to "offset" emissions in another place. Offsets can be purchased by organization to compensate emissions in Scopes 1, 2 and 3. Offsets can also be used in addition to actions taken by an organization within its operational boundaries to reduce emissions. Offsets are often used to fulfill voluntary commitments to

reduce greenhouse gas emissions when it is impossible to reduce organization's direct or indirect emissions.

PROSPECTS FOR DEVELOPMENT OF THE VOLUNTARY OFFSET MARKET IN KAZAKHSTAN

As mentioned above, the country has been operating Emissions Trading System since 2013. One of the main drawbacks is that the domestic emissions trading system covers a limited number of economy sectors – oil and gas industry, energy sector, mining, metallurgy, chemical industry, as well as manufacturing industry associated with the production of construction materials such as cement, lime, gypsum and brick.

However, it should be noted that in the country's business environment, after announcement of commitment to achieve carbon neutrality, there is a great demand for projects that reduce carbon footprint. For example, telecommunications and IT companies, banking sector, and medium-sized businesses from service sector who are interested in using ESG principles in their corporate policy address "Qazaq Green" RES Association. In this regard, development of voluntary carbon market will allow private companies that are not part of trade system of the Republic of Kazakhstan to confirm their commitment to the ESG principles and offset carbon footprint with carbon units. 



IMPLEMENTATION OF RENEWABLE ENERGY

I. Participation in the auction



1. Check the auction schedule

Order of the Minister of Energy of the Republic of Kazakhstan No. 202 of May 21, 2020 "On approval of the auction schedule for 2020"



2. Register at the website of KOREM JSC, conclude an agreement and undergo a training on the use of the trading system

- title documents *
- documents on the land plot
- documents on the connection point
- * Foreign legal entities shall provide the equivalent documents with notarized translations of each document into the Kazakh and Russian languages



3. Financial guarantee for auction participation

- for auctions without documentation - 2000 KZT per 1 kW of installed capacity
- for auctions with documentation - 5000 KZT per 1 kW of installed capacity



4. Auction participation

- FSC provides envelopes with financial guarantee
- observers gather in the hall
- 30 minutes before the auction, the envelope is opened, and the data is entered into the system
- trading session opens (accepting and changing bids)
- trading session closes, auction results



5. Auction results

- auction winners
- auction prices
- volumes of selected capacity

II. Post-auction activities and project implementation



1. Inclusion in the RE Facilities Siting Plan and the List of Energy Producing Organizations Using RES

The Ministry of Energy of the Republic of Kazakhstan shall include the winners in the RE Facilities Siting Plan and the List of Energy Producing Organizations Using RES within 5 working days from the date of receipt of the Register of winners from the organizer



2. PPA conclusion

The winner submits an application for the conclusion of the PPA to the FSC within 60 calendar days from the date of inclusion in the List of Energy Producing Organizations using RES



3. PPA financial guarantee

The amount of financial guarantee of the fulfillment of the terms of the purchase agreement is 10,000 (ten thousand) KZT per 1 (one) kW of installed capacity



4. Project implementation terms (from the date of PPA conclusion)

- for SPP - 24 months
- for WPP and BioPP - 36 months
- for HPP - 48 months



5. Registration of land rights, design and survey works

- land plot selection
- obtaining the permit to use the land plot for design and survey works
- design and survey works (D&S)
- obtaining the land plot rights
- obtaining the water use rights (for HPP)

PROJECTS IN KAZAKHSTAN



6. Grid connection

- request to identify the closest connection point to the energy transmitting organization
- development of power generation scheme
- obtaining technical specifications for a connection to the electric grid
- approval of the power generation scheme by the system operator
- conclusion of an agreement on RE facility connection



7. Preliminary project procedures and design

- obtaining source materials to develop construction projects
- approval of schematic design with the construction authority
- development of project documentation (Feasibility study, Design and estimate documentation), approval, expert examination of DED by a design institute (state or private)
- installation and construction works



8. Environmental Permit

- environmental impact assessment (Ministry of Ecology)
- environmental emissions permit (egov.kz)



9. Investment preferences under Entrepreneurial Code



10. State registration of the right to a constructed renewable energy facility

- inclusion of identification and technical information on newly created immovable property in the information system of the legal cadastre (egov.kz)



Commissioning *

** SPP as an example*



1. The contractor notifies the customer of the facility's readiness for commissioning

2. The customer asks to provide (within 3 days):

- contractor - declaration of compliance
- technical and designer supervision - conclusion on the quality of the works performed
- technical supervisor - conclusion on the quality of the completed construction and installation works



3. Substation commissioning

Grid connection:

- Acceptance in Commercial Operation of Automated Commercial Energy Metering System (ACEMS) and registration in the ACEMS register
- signing contracts for system services with SO and REC
- compliance with technical conditions for grid connection
- notification of FSC about carrying out complex tests in set period
- successful completion of complex tests
- connecting the substation to the grid

Substation commissioning:

- signing of the commissioning act by the customer, general contractor, authorized technical supervisor
- registration of the act with the justice authorities
- registration of rights to immovable property
- creation of a facility's technical passport
- sending documents to FSC in the set period



4. Solar park commissioning

- signing of the commissioning act by the customer, general contractor, authorized technical supervisor
- registration of the act with the justice authorities
- registration of rights to immovable property
- creation of a facility's technical passport
- sending documents to FSC in the set period



SOLAR FEST QAZAQSTAN

INTERNATIONAL BUSINESS FESTIVAL ON RENEWABLE ENERGY

*Solar Fest Qazaqstan is organized in the heart of the
National Park Burabay in the Rixos Borovoe hotel*

Solar Fest Qazaqstan was supported by:





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PLATFORM FOR NATIONAL AND INTERNATIONAL PLAYERS IN RENEWABLE ENERGY SOURCES



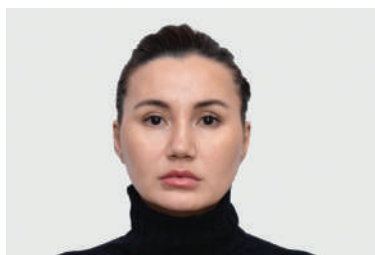
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KALIYA KHISSAMIDINOVA
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Member of the Board



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Member of the Board



YERNAR BILYALOV
Member of the Board

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.



ANATOLIY SHKARUPA
Independent Director



SANIYA PERZADAYEVA
Independent Director



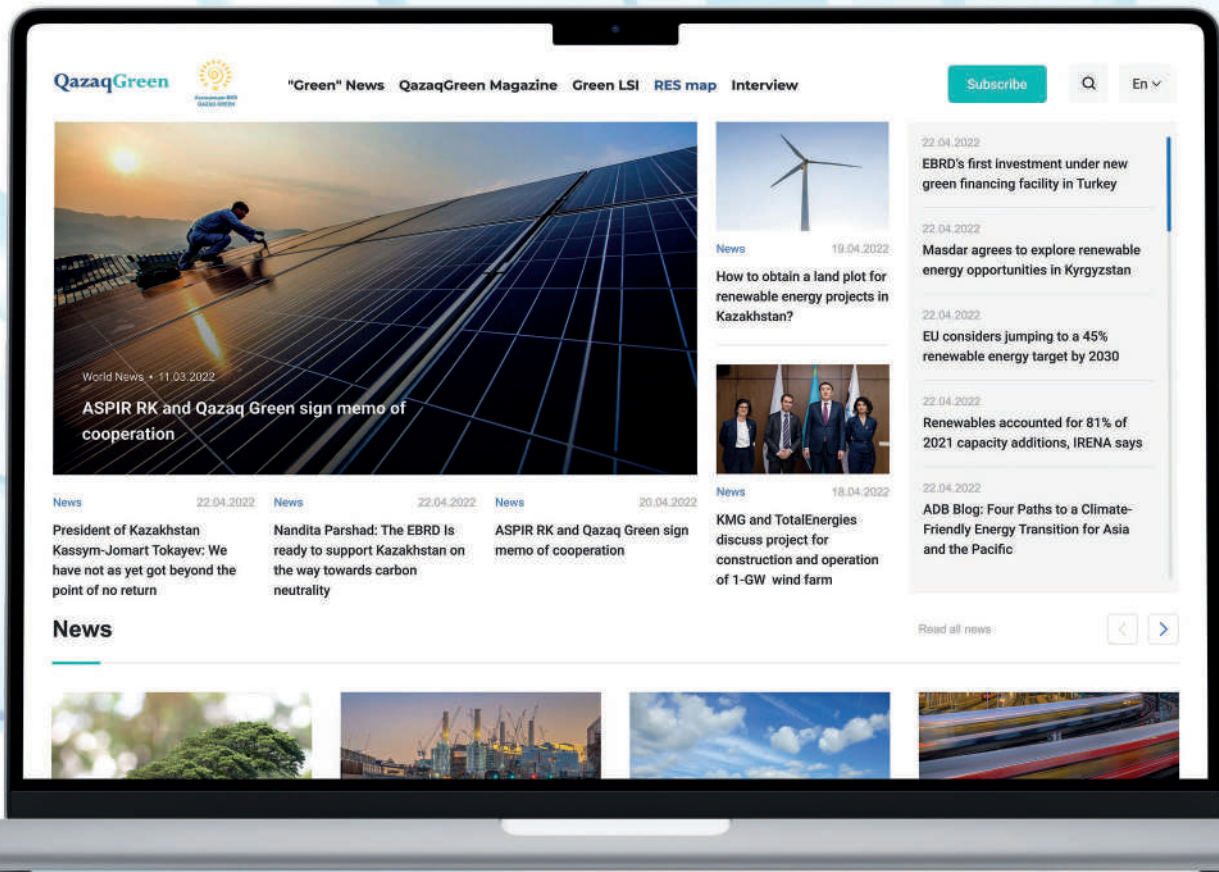
ARTYOM SLESARENKO
Independent Director



TIMUR SHALABAYEV
Executive Director



ZHANAR KUANYSHBEK
Manager



Qazaq Green has launched information portal on "green" economy of Kazakhstan



www.qazaqgreen.com

information portal will present latest news from Central Asia, Kazakhstan and all over the world, as well as articles of QazaqGreen magazine.



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
- Energy and Climate
- Local Self-Governance
- Political Education
- Media
- Sur-Place Scholarships



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