# Cazad Green

gazaggreen kz/, www.kas.de









## qazaqgreen.kz



#### **YYV** 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



#### Partners of Association

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









































- 4-5 THE WELCOME SPEECH OF THE PRESIDENT OF THE REPUBLIC OF KAZAKHSTAN KASSYM-JOMART TOKAYEV
- THE WELCOME SPEECH 6-7OF ODILE RENAUD-BASSO, THE PRESIDENT OF THE EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT
- 8-9 THE WELCOME SPEECH OF N.N. KAPENOV, THE CHAIRMAN OF THE BOARD OF DIRECTORS "QAZAQ GREEN" RENEWABLE **ENERGY ASSOCIATION**
- THE PRESIDENT OF KAZAKHSTAN 10 - 16KASSYM-JOMART TOKAYEV: WE HAVE NOT AS YET GOT BEYOND THE POINT OF NO RETURN
- **NANDITA PARSHAD:** 18-24 THE EBRD IS READY TO SUPPORT KAZAKHSTAN ON THE WAY TOWARDS' CARBON NEUTRALITY



- **LOW-CARBON TRANSFORMATION** 26-29 **OF KAZMUNAYGAS**
- **RES ASSOCIATION** 30-34 "GAZAQ GREEN" RAISED **TOPICAL ISSUES TO ALL** PARTICIPANTS OF ENERGY COMMUNITY
- 36-39 **TEST OF STRENGTH**



40-43 **CARBON NEUTRALITY** – A NEW CHALLENGE FOR THE COUNTRY'S ELECTRIC POWER **INDUSTRY** 

**TALAN TOWERS** 46-57 IS A COMPLEX ORIENTED ON "GREEN" TECHNOLOGIES

58-61 **GREEN MINING OF** CRYPTOCURRENCIES IN KAZAKHSTAN



MAXIM BARYSHEV: 62-67 ELECTRIC CARS -ARE CONVENIENT, SILENT AND **EMISSION-FREE** 

68-75 KAZAKH-GERMAN UNIVERSITY TRAINS PERSONNEL FOR TRANSITION TO CARBON **NEUTRALITY** 

78-83 PROSPECTS FOR THE CREATION OF COALBED METHANE **EXTRACTION INDUSTRY IN** KAZAKHSTAN

84-89 **DEVELOPMENT OF THE** CONCEPT OF TRANSITION TO A "GREEN" ECONOMY THROUGH THE CONCEPT OF A "GREEN UNIVERSITY"

HYDROGEN? YES! 92-97 **BUT THERE IS A LOT TO THINK** AROUT



98-103 **TURGUSUNSKAYA HPP:** TAMING OF THE SHREW

114 TEAM OF ASSOCIATION

### **QazaqGreen**

Nº 3 / 2021

Information and analytical magazine

FOUNDER:

"Qazaq Green" Renewable Energy Association

**EDITORIAL COUNCIL:** 

J.D. Rev

N.N. Kapenov

M.Ye. Baltayeva

M. Gainelgazykyzy

A.M. Sospanova

Y.M. Bilyalov

K.R. Khissamidinova

T.M. Shalabayev

**CHIEF EDITOR** 

N.N. Kapenov

**PUBLICATION:** 

"NV-Media" IE

**Editorial Address:** 

010000, Republic of Kazakhstan Nur-Sultan, Esil microdistrict Suganak street, 43 Tel.: +7 (7172) 24-12-81

qazaqgreen.kz

#### MAGAZINE REGISTERED:

Committee of Information of the Ministry of Information and Social Development of the Republic of Kazakhstan. Certificate # KZ19VPY00042949 dated November 19, 2021. Initial registration: 20.11.2019, KZ60VPY00017379.

Magazine coverage:

Republic of Kazakhstan, countries of near and far abroad

Total circulation:

1500 copies

Printed:

Print House Gerona LTD.

Any reproduction of materials or their fragments is possible only with the written permission of the publisher. The editors are not responsible for the content of advertising materials. Editorial opinion does not necessarily coincide with the opinion of the authors.

The magazine is published with the support of the Konrad Adenauer Foundation





#### THE WELCOME SPEECH OF THE PRESIDENT OF THE REPUBLIC OF KAZAKHSTAN KASSYM-JOMART TOKAYEV



#### The President of the Republic of Kazakhstan

Nur-Sultan city, Akorda

08.1.10.12021

Mr. N.N. Kapenov The Chairman of the Board of Directors **ALE 'Solar Power Association of** Qazaqstan'

#### Dear Nurlan Nurgaliyevich,

I got acquainted with the QazaqGreen magazine with great interest.

I consider the activities of QazaqGreen magazine very useful since it covers the issues of ecology and green technologies in the country and Central Asia.

Today's global realities stimulate countries not only to look for new alternative energy sources, but also to move towards greening industry and the economy as a whole. Kazakhstan, being one of the most energy-intensive countries in the world, cannot stay out of these trends.

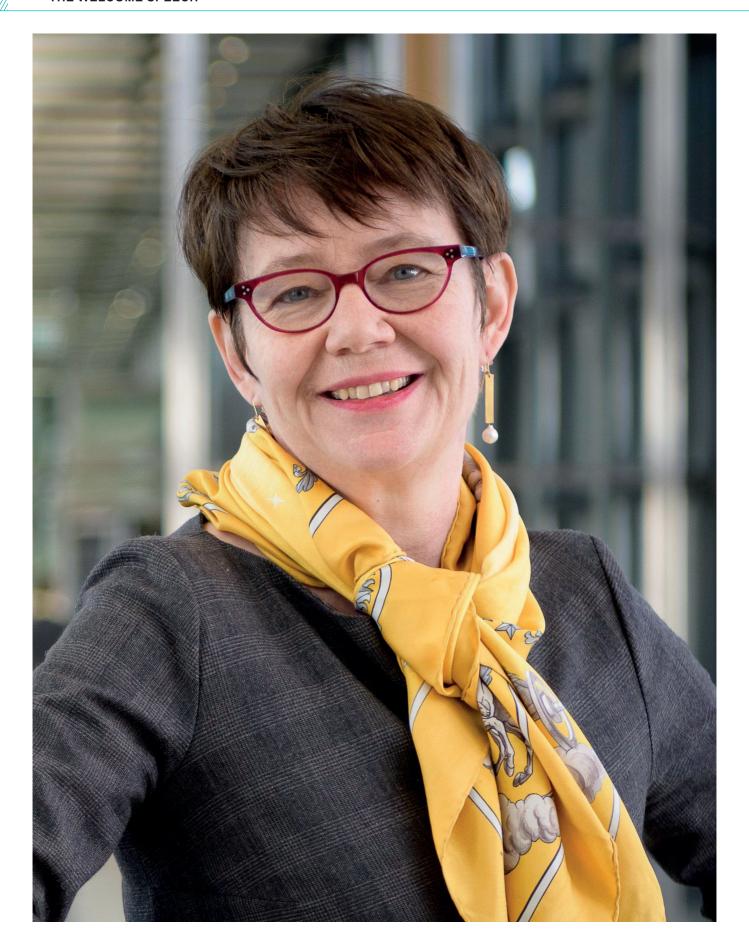
Our country has taken a steady course towards the development of renewable and alternative energy sources. In my message to the people of Kazakhstan, I set a goal to achieve carbon neutrality by 2060. On my instructions, a concept for the low-carbon development of Kazakhstan until 2050 is being developed, the country's energy balance until 2035 is being calculated.

I think it is very important to develop domestic science, introduce new technologies and train qualified specialists in this industry.

The country has a lot of work to do in this direction. Therefore, I hope that your magazine will contribute to the implementation of Kazakhstan's strategy for the development of "green" economy.

I wish your magazine further creative success!

Kassym-Jomart TOKAYEV



#### THE WELCOME SPEECH OF ODILE RENAUD-BASSO, THE PRESIDENT OF THE EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT

t is my pleasure to welcome "Qazaq Green" journal readers to the magazine that continuously promotes and supports green agenda in Kazakhstan. This is its first issue after the global climate summit, COP 26, held in Glasgow, in which both the EBRD and Kazakhstan took an active part.

At the event many leaders highlighted the need to take ambitious action to deal with climate change and move towards a future powered by clean energy. More than 40 countries have committed to phasing out coal. Kazakhstan plays a significant role in the climate arena as one of the first countries in Central Asia to sign the Paris Agreement and announce its ambition to become carbon neutral.

I have visited Kazakhstan twice this year; the first visit was held virtually in March, while I finally stepped on Kazakh territory in September. Despite the travel problems caused by the global pandemic, both visits were productive and established a fruitful base for cooperation on the "greening" of the economy.

The EBRD wholeheartedly welcomes the Kazakhstan Government's decision to reach netzero emission, and actively supports the government in achieving this ambitious goal. During my first visit to the country we signed a Memorandum of Understanding with the Minister of Energy, which targets the decarbonization of the power sector, fostering climate resilience, reducing greenhouse gas emissions, and eventually reaching carbon neutrality by 2060. It is greatly encouraging to

see the rapid development of the renewables sector in Kazakhstan, helped by great support from the government authorities. We believe that this pace of renewables development could be even more accelerated. This will encourage additional private investment in the Kazakh economy, effectively creating a new industry and jobs and developing new skills among the population.

The development of renewables in Kazakhstan is not only important as a carbon neutral energy source but also from the perspective of healthcare. Kazakhstan's reliance (more than 70 per cent of electricity generation) on ageing coal-fired plants accounts for a significant share of emissions and air pollution, which causes high rates of respiratory diseases among the population.

Kazakhstan is rich in natural resources now. And it will be rich in natural resources in 2060. But instead of in coal and oil, its wealth will be in minerals, land, wind and sun. These are the resources that will be of lasting value in a decarbonzed world.

Over the last 30 years EBRD has been a dedicated partner to Kazakhstan as it has made its transition into the modern, dynamic country it is today. To date, the Bank has invested US\$535 million in 14 renewable projects in Kazakhstan. We are committed to becoming an even stronger partner, investing and mobilising even more in the future green transition.



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

#### Dear readers! Dear friends and colleagues!

would like to congratulate all our readers on the 30th anniversary of Independence of the Republic of Kazakhstan.

Our country has set ambitious goals for the development of renewable energy sources, whereby it is necessary to increase the share of renewable energy in total electricity production to 3% in 2020, to 6% in 2025, to 15% by 2030, and by 2050 renewable and alternative energy sources should account for at least half of total energy consumption. As the President of the Republic of Kazakhstan Kassym-Jomart Tokayev noted in his speech at the international conference on carbon neutrality, by 2060 the share of renewable and alternative energy sources will reach more than 80% of the total power balance of the country.

A completely new energy sector has appeared in Kazakhstan. There are 123 facilities in the country with a capacity of about 1.9 GW. At 2021 year-end, 23 renewable energy facilities with an installed capacity of 391 MW will be commissioned. The share of renewable energy generated in the total volume of electricity production reached 3.9%.

The country has laid a solid regulatory framework for the development of the sector, for four years auctions have been held for the selection of renewable energy projects, which demonstrated a constant reduction in tariffs, foreign investments have been attracted. Auctions for the construction of renewable energy capacities with maneuverable generation mode, in other words, with energy storage systems, will be held in December.

We, being the direct participants in the development of the renewable energy sector, are proud of the results achieved. In order to support the development of the sector, the Solar Power Association of Qazagstan was founded in 2018. Our association held the International Renewable Energy Business Festival Solar Fest Qazaqstan-2019, launched the issue of the industry information and analytical magazine "Qazaq Solar", which in 2020 was recognized as best print publication of the CIS member states at the awards of the Electric Power Council of the Commonwealth of Independent States.

Taking into account that today the issues of "greening" the economy of Kazakhstan are one of the most important strategic directions of the country, in 2021 we decided to rename our association into the of Renewable Energy Association "Qazaq Green", and subsequently rename our magazine, which today is also called "Qazaq Green".

In October 2021, "Qazaq Green" magazine was included in the materials of the International Conference "Ways to achieve the goals of the Paris Agreement and carbon neutrality of Kazakhstan", which was attended by the President and at which the Strategy for achieving carbon neutrality of Kazakhstan until 2060 was presented and new tasks were set for the development of the "green" economy of the country. Our association received a letter of thanks from the

Deputy Head of the Presidential Administration of the Republic of Kazakhstan T. Suleimenov for the issue of "Qazaq Green" magazine, which was highly appreciated by all participants of the conference and the readership.

We always pay great attention to the circulation of the magazine: we send it to the country's leadership, to the government, heads of ministries and development institutions, to akimats of regions, international organizations, investors, developers, universities, and our partners. In mid-October, we received a letter of thanks from President of the Republic of Kazakhstan Kassym-Jomart Tokayev, who got acquainted with our magazine and stressed the importance of our publication in covering the development of the "green" economy of our country. We believe that this is an important recognition of our work and all the efforts of the RES business community to develop our sector!

We would like also to share with you the news that such companies as "NC KazMunayGas" JSC and "Visor Kazakhstan" LLP joined the members of the "Qazaq Green" Renewable Energy Association in the outgoing year. For our association, this means the recognition in the industry and great support from major players in the country's energy market. The Association also signed a Memorandum of Understanding with the AIFC Green Finance Center, which provides great opportunities for the development of "green" financing tools for renewable energy projects in the country.

The development of the renewable energy sector today not only transforms the country's energy sector, but also creates a new image of the socio-economic development of our country. It is no coincidence that the President of the Republic of Kazakhstan Kassym-Jomart Tokayev stressed that this transformation will require us to make deep structural, technological and economic changes that will affect every citizen of Kazakhstan.

In this regard, the Renewable Energy Association "Qazaq Green" has put forward an initiative to include March 30 in the list of official professional holidays as "Renewable Energy Worker Day". March 30 was selected as the RES Worker Day not by accident - the International Earth Protection Day is celebrated on March 30, the main purpose of which is to draw attention to global environmental problems. We hope that our initiative will be supported by the Government of the Republic of Kazakhstan.

The "Qazaq Green" Renewable Energy Association has many tasks, initiatives, and projects ahead of it. We are sure that even greater victories are waiting for us! We express our great gratitude to all our members and partners, especially to the Konrad Adenauer Foundation.

We wish everyone success and health for the benefit of the development of "green" Kazakhstan!



## The President of Kazakhstan Kassym-Jomart Tokayev:

## We have not as yet got beyond the point of no return

I would like to welcome you to the capital of Kazakhstan. We are grateful for your participation in this important event.

It is my pleasure to declare the International Forum "On the road to achieving goals of Paris Agreement and carbon neutrality" open.

The forum is dedicated to the upcoming 26th Conference of the parties to the UN Framework Convention on Climate Change in Glasgow.

Kazakhstan is consistent in its support to the UN Secretary General Antonio Guterres' call for achieving net-zero carbon dioxide emissions.

Today we will discuss what we must do to achieve our common goal.

2020 was a very difficult year for the people and the planet. The COVID-19 pandemic demonstrated the fragility of economic and social systems as well as poor protection of people's health and lives.

In this context, the ongoing climate change remains one of the most acute challenges of today's world.

The Sixth Assessment report of the Intergovernmental Panel on Climate Change provides a very alarming overview of the current state of affairs.

According to the report, with current levels of greenhouse emissions, global warming of 1.5 to 2 degrees within this century will become inevitable.

Sea level rise, permafrost-melting, loss of Arctic ice – all that will accelerate as a result of the forecasted warming.

All this will lead to progressive loss of biodiversity, soil degradation, droughts, fires and floods.

Nowadays companies that set a course for carbon neutrality should carry out activities in two directions. First of all it is decreasing emissions from production and transportation. as well as switching to renewable energy sources. Secondly it is necessary to invest in net-zero projects to compensate emissions which cannot be eliminated for whatever reason. How our country plans to achieve carbon neutrality, what is being done to achieve it? International conference on carbon neutrality held in mid-October in Hilton hotel in capital gave an answer to these questions to some extent. The President of the Republic of Kazakhstan Kassym-Jomart Tokayev delivered a speech at this conference. The speech of the President is brought to the attention of readers. PP

We need to act, and we need to act now and immediately.

The last decade has been the hottest in the history of mankind. The rate of warming in our region – in Central Asia – is of concern and requires urgent action. This is especially relevant in terms of preserving water and food security and safety.

Kazakhstan is one of the ten largest producers of food-grade wheat and flour, exporting up to 7 million tons of wheat per vear.

However, in case of the negative scenario, wheat yields may decrease by almost 40% by 2030.

According to 2020 UNDP data, in the conditions of expected climate change by 2030, the yield of spring wheat will be \_ on average in seven studied areas. These are Akmola, Aktobe, West Kazakhstan, Karaganda, Kostanay, Pavlodar, North Kazakhstan regions, with 63-87% of its current level.

Given that Kazakhstan is the only exporting country in Central Asia, this will inevitably pose a threat to the food security of the entire region.

The above is a simple practical example of the fact that the fight against climate change is our common cause. This is an extremely important matter.

It should be clearly understood: the point of no return has not yet been passed. Countries and Governments can still influence climate change and its stabilization.





It should be clearly understood: the point of no return has not yet been passed. Countries and Governments can still influence climate change and its stabilization.

Kazakhstan understands that it is our common task to achieve the global temperature target of the Paris Agreement.

Despite significant dependence on natural resources (coal, oil, etc.), which are sources of energy, employment and fiscal revenues, Kazakhstan was among the first hundred countries to announce the achievement of carbon neutrality by the middle of this century.

Today, the draft Doctrine of Carbon Neutrality of Kazakhstan until 2060 will be presented to your attention.

The Doctrine provides basic approaches to the low-carbon transformation of the economy and industry. The Minister of Ecology, Geology and Natural Resources will present the Government's vision in more detail in his report.

Looking ahead, I want to emphasize that the Doctrine in the final version of the Doctrine should be pragmatic, rational and take into account the urgent needs of our economy, taking into account the specifics and structure. This is extremely important.

It is already obvious that achieving the ambitious goal of the Doctrine will require systemic efforts: modernization of the fuel and energy complex, revision of industrial and agro-industrial policy, new approaches in housing and communal services, construction and, in general, in the way of life of people.

According to the project, all coal-fired power plants will be decommissioned by 2050.

By 2060, the share of renewable and alternative energy sources will reach more than 80% of the total energy balance of the country.

The carbon neutrality scenario assumes active joint efforts of the government, business and society to achieve the declared goals.

Its successful implementation will make it possible to achieve not only the 2030 goal, that is, a 15% reduction in emissions compared to the 1990 level, but also a zero balance of greenhouse gases by 2060.

As a result, more than 9 billion tons of  ${\rm CO}_2$  will be prevented from entering the atmosphere.

According to the draft Doctrine, the country will need almost US\$700 billion to implement this scenario. Half of these investments are needed to modernize the electricity and heat production sector.

Of course, we have to count all the figures very carefully, carefully check the input data and make sure that the set of tools is correct.

The determining factor will, of course, be the support of these initiatives by society.

We are already taking a number of steps. To prepare for the big energy transition, we have adopted a new Environmental Code. It complies with advanced international standards.

Enterprises have been given the opportunity to modernize production facilities due to full exemption from environmental payments.

We are rebuilding the national system of trading GHG quota, and bringing them in accordance with relevant international systems.

Gas is becoming a more "green" alternative fuel to coal.

A large-scale gasification of the country has been completed. Today, almost 10 million of our citizens have access to reliable and environmentally friendly fuel.

We are implementing large-scale projects to convert thermal power plants from coal to gas in the largest cities -Almaty, Nur-Sultan, Karaganda.

By 2025, the ten most polluted cities will be gasified and switched to alternative energy sources.

Kazakhstan has enormous potential for development of renewable and alternative energy.

According to our plans, the share of renewable energy in the energy balance should be at least 15% by 2030.

In this regard, we are improving the regulatory environment, creating the most attractive conditions.

We have certain expectations in this area for a number of projects with our strategic international partners.

Kazakhstan pays great attention to "green" financing. "Green Finance Center" operates in the premises of AIFC.

The first placements took place last year. Kazakhstan Development Institute







"Damu" together with UNDP successfully placed "green" bonds.

This year, two placings of "green" bonds of the Asian Development Bank were carried out on Kazakhstan Stock Exchange to finance renewable energy facilities in Kazakhstan.

According to the UN, due to global warming and man-caused impact, the global water shortage may reach 40% by 2030.

Kazakhstan's water security largely depends on the hydrological and ecological state of transboundary rivers.

Today, there is a decrease in the volume of import water from neighboring countries.

This leads to disturbance of the natural moisture balance of rivers and lakes, as well as to the deterioration of the environment in a number of regions of Kazakhstan.

A number of international agreements regulating the protection and use of international watercourses have been adopted under the auspices of the UN.

I think there is a need to coordinate efforts to actually fulfill international obligations through expanded dialogue and cooperation.

We count on the support of our partners and the international community in this matter.

Active afforestation plays an important role in the absorption of carbon dioxide.

Kazakhstan belongs to the low-forest countries. Total forest area is 30 million hectares, or 11% of the territory.

This year, a large-scale program for greening the country has been launched. 2 billion trees will be planted by 2025. This initiative is becoming a truly national project with great international resonance. The task is highly relevant, so it should be done without arithmetic ostentation and fraud.

We have also adopted a program to increase the planting of saxaul on the drained bottom of the Aral Sea. We plan to cover 1.5 million hectares by 2025.

In this matter, we cooperate with our Uzbek friends.

Kazakhstan is actively working on the climate agenda not only at the national, but also at the regional level.

This year Kazakhstan is chairing the Eurasian Economic Union.





Tomorrow, at a meeting of the Supreme Eurasian Economic Council, the Presidents plans to adopt a statement on the climate agenda of the Union.

It is planned to confirm the intention to develop economic cooperation to achieve the UN Sustainable Development Goals and the Paris Agreement.

At the EAEU level, we will endeavor to use energy-efficient approaches and technologies, introduce renewable and alternative energy sources, and develop low-carbon transport.

Given the close industrial, technological and economic ties within the Union, joint actions are certainly the key to success.

This is also true for global context. The future climate and the fate of our planet depend on the coherence of the actions of the international community.

Kazakhstan is ready to contribute to the common cause - the achievement of the global temperature goal.

I hope that today's conference will help us to come up with concrete solutions.

I wish you success!

#### **Dear Ladies and Gentlemen!**

Valuable opinions were expressed at today's meeting.

I think today's meeting was effective.

We are facing large-scale tasks that require bold decisions.

Significant funds are required.

In fact, we will achieve our goals if we will work together.

At the same time, climate requirements should not hinder trade and investment.

During the period of energy changes,



developed countries play an important role.

In this sense, it is not enough for them to become an example for others.

In order for the emerging countries to accelerate the reduction of carbon share, they need to be provided with technological and resource support.

This is one of the important tasks. The Government should develop cooperation in a new direction, i.e., on climate issues.

In this regard, it is necessary to strengthen relations with the United Nations organizations, the World Bank.

It is necessary to work with international financial organizations and governments of developed countries.

It is necessary to work with international financial organizations and governments of developed countries.

I wish you all good health and prosperity!

I WOULD LIKE TO EXPRESS MY APPRECIATION TO ALL PARTICIPANTS, **INCLUDING OUR FOREIGN PARTNERS** FOR CONSTRUCTIVE AND EXTREMELY HELPFUL INPUT. I HAVE NO DOUBT THAT **EVENTUAL SUCCESS WILL BE REACHED** AS SOON AS WE WILL BE TOGETHER. MUCH WORK AHEAD OF US. IT IS GOING TO BE VERY DIFFICULT JOB. BUT AS I HAVE ALREADY SAID - WE MUST GO AHEAD. OTHERWISE, WE AS A COUNTRY WILL STRATEGICALLY LOOSE. WE NEED TO WIN, AND WE MUST OVERCOME IT. LET'S GO AHEAD TOGETHER AS ONE COMMUNITY, ONE FAMILY. I WISH **EVERYBODY SUCCESS.** 

#### **KEY INDICATORS**

## CONCEPTS FOR THE TRANSITION OF THE REPUBLIC OF KAZAKHSTAN



Eliminating water supply deficit at the national level population population  Eliminating water supply deficit at the national level population  Elimination of water scarcity at the basin level coverage of the deficit for the basins as a whole (by 2025)  Agricultural industry  Labor productivity in agriculture  Wheat yield (t/ha)  Water consumption for irrigation (m²/t)  Energy efficiency  Decrease in the energy intensity of GDP from the level of 2008  Electric power industry  Share of alternative sources in electricity generation  Share of gas-fired power plants in electricity generation  Reduction of the regions  Reduction of the current level of carbon dioxide emissions in the electric power industry  Emissions of sulfur and nitrogen oxides into the environment  Emissions of sulfur and nitrogen oxides into the environment  Emissions of sulfur and nitrogen oxides into the environment  The fastest possible coverage of the deficit for the basins awhole (by 2025)  No shortage for each basin  No shortage for each basin  Shotyatory (as in the deficit for the basin say awhole (by 2025)  Solar and wind: at least 30%  30%  50%  50%  50%  50%  50%  European emission level  European emission level	Sector	Goal description	2020	2030	2050
Elimination of water scarcity at the basin level (by 2025)  Agricultural industry  Labor productivity in agriculture  Wheat yield (t/ha)  Mater consumption for irrigation (m³/t)  Decrease in the energy intensity of GDP from the level of 2008  Electric power industry  Share of alternative sources in electricity generation  Share of gas-fired power plants in electricity generation  Gasification of the regions  Reduction of the current level of acrobin dioxide emissions in the electric power industry  Emissions of sulfur and nitrogen oxides into the environment  Emissions of sulfur and nitrogen oxides into the environment  Covering the population with the removal of solid household waste  Sanitary waste storage  Elimination of the deficit for the basins as a whole (by 2025)  Three-fold magnification  2.00  Association as a whole (by 2015)  2.00  Association as a whole (by 2015)  330  330  Solid and wind: at least 30%  30%  30%  50%  50%  50%  6asification of the regions  Reduction of the current level of 2012  -15%  -40%  Almola and Karaganda regions  European emission level	Water resources				Solve water supply problems finally
agriculture  Wheat yield (t/ha)  1.4  2.0  Water consumption for irrigation (m³/t)  Energy efficiency  Decrease in the energy intensity of GDP from the level of 2008  Share of alternative sources in electricity generation  Share of gas-fired power plants in electricity generation  Gasification of the regions  Reduction of the regions  Reduction of the current level of carbon dioxide emissions in the electric power industry  Emissions of sulfur and nitrogen oxides into the environment  Emissions of Sulfur and nitrogen oxides into the environment  Covering the population with the removal of solid household waste  Sanitary waste storage  I.4  2.0  330  300  50%  50%  50%  50%  60°  25%  30%  Northern and Eastern regions  European emission level  100%  100%  100%	Θ		coverage of the deficit for the basins as a whole		
Water consumption for irrigation (m³/t)  Decrease in the energy intensity of GDP from the level of 2008  Share of alternative sources in selectricity generation  Share of gas-fired power plants in electricity generation  Gasification of the regions  Reduction of the current level of carbon dioxide emissions in the electric power industry  Emissions of sulfur and nitrogen oxides into the environment  Emissions of sulfur and nitrogen oxides into the environment  Covering the population with the removal of solid household waste  Sanitary waste storage  Decrease in the energy intensity as 300  Solar and wind: at least 30% 50% 50% 50% 50% 50% 50% 50% 50% 50% 5	Agricultural industry		Three-fold magnification		
irrigation (m³/t)  Decrease in the energy intensity of GDP from the level of 2008  Share of alternative sources in electricity generation  Share of gas-fired power plants in electricity generation  Gasification of the regions  Reduction of the current level of carbon dioxide emissions in the electric power industry  Air pollution  Emissions of sulfur and nitrogen oxides into the environment  Covering the population with the removal of solid household waste  Sanitary waste storage  Decrease in the energy intensity 450  25% (10% by 2015)  30%  30%  50%  50%  40%  25%  30%  Akmola and Karaganda regions  Eastern regions  Level of 2012  -15%  -40%  European emission level		Wheat yield (t/ha)	1.4	2.0	
Decrease in the energy intensity of GDP from the level of 2008  Share of alternative sources in electricity generation  Share of gas-fired power plants in electricity generation  Gasification of the regions  Reduction of the current level of carbon dioxide emissions in the electric power industry  Emissions of sulfur and nitrogen oxides into the environment  Emissions of Sulfur and nitrogen oxides into the environment  Covering the population with the removal of solid household waste  Sanitary waste storage  Solar and wind: at least 30%  50%  50%  50%  50%  50%  50%  50%			450	330	
electricity generation 3% by 2020  Share of gas-fired power plants in electricity generation  Gasification of the regions  Reduction of the current level of carbon dioxide emissions in the electric power industry  Air pollution  Emissions of sulfur and nitrogen oxides into the environment  Covering the population with the removal of solid household waste  Sanitary waste storage  95%	Energy efficiency	intensity of GDP from the level	25% (10% by 2015)	30%	50%
plants in electricity generation  Akmola and Karaganda regions  Reduction of the regions  Reduction of the current level of carbon dioxide emissions in the electric power industry  Level of 2012  -15%  -40%  Air pollution  Emissions of sulfur and nitrogen oxides into the environment  Covering the population with the removal of solid household waste  Sanitary waste storage  95%	Electric power industry			30%	50%
Reduction of the current level of carbon dioxide emissions in the electric power industry  Emissions of sulfur and nitrogen oxides into the environment  Covering the population with the removal of solid household waste  Sanitary waste storage  Fegions  Eastern regions  Level of 2012  -15%  -40%  European emission level  100%  100%			20%²	25%	30%
of carbon dioxide emissions in Level of 2012		Gasification of the regions			
Emissions of sulfur and nitrogen oxides into the environment  Covering the population with the removal of solid household waste  Sanitary waste storage  European emission level  100%		of carbon dioxide emissions in	Level of 2012	-15%	-40%
nitrogen oxides into the environment  Covering the population with the removal of solid household waste  Sanitary waste storage  European emission level  100%  100%	Airpollution				
with the removal of solid household waste  Sanitary waste storage 95%		nitrogen oxides into the		•	
	Waste disposal	with the removal of solid		100%	
Percentage of recycled waste 40% 50%		Sanitary waste storage		95%	
		Percentage of recycled waste		40%	50%

Source: Decree of the President of the Republic of Kazakhstan dated May 30, 2013. "On the Concept for the transition of the Republic of Kazakhstan to a "green" economy

<sup>&</sup>lt;sup>1</sup> Solar power plants, wind power plants, hydroelectric power plants, nuclear power plants,
<sup>2</sup> With the transfer in the largest cities of thermal power plants to gas, if there are available volumes of gas and an acceptable price for gas.



### Nandita Parshad:





# The EBRD is ready to support Kazakhstan on the way towards carbon neutrality

99 On 12th of December 2020 at the UN Climate Ambition Summit, Kazakhstan President Kassym-Jomart Tokayev announced that Kazakhstan will reach carbon neutrality by 2060. The country's energy sector will require big transformation coming with plenty of opportunities. We asked Nandita Parshad, Managing Director for Sustainable Infrastructure Group, at London-headquartered European Bank for Reconstruction and Development (EBRD) to share her thoughts on what needs to be done to successfully reach the "net-zero".



- Kassym-Jomart Tokayev last year announced that Kazakhstan will reach carbon neutrality by 2060. As we all know, power sector contributes most of GHG emissions in country's carbon footprint. What do you think are key challenges and opportunities of the energy transition?

- The EBRD welcomes Kazakhstan's pledge to reach net-zero by 2060, and we are ready to support the country on this journey. One of the critical elements for the decarbonization of the country is energy transition as in Kazakhstan 70 per cent of electricity is still generated by coal-fired power plants. As a result, the country is the sixth largest greenhouse gas emitter among the EBRD's countries of operations. A key challenge is that energy transition requires significant financial investments to diversify the coal-dependent economy at a pace required to meet the netzero timetable. At the same time, it is important to support a just

transition for affected workers and communities (e.g. in coal mining towns), to ensure that the benefits of a green economy transition are shared widely.

However, the good news is that Kazakhstan is currently developing a long-term Doctrine for Carbon Neutrality by 2060, which creates an enabling environment for the energy sector transition at the national level. We are grateful to have been able to participate in the preparation of the Doctrine over the last 18 months. At COP 26 conference, Prime Minister Askar Mamin announced that the country will adopt the document by April 2022, which is a strong signal for private sector investors and donors, including multilateral climate funds.

Rapidly developing renewable power generation is becoming cheaper than traditional energy sources not to mention the environmental benefits it brings. A successful energy transition has the potential to create huge tangible benefits

to society and the economy, including the introduction of economic stimulus, the creation of new professional roles, better air quality and many others. Kazakhstan is already taking advantage of its vast renewable energy resources and scaling up green investments. EBRD is proud to have supported the renewables in Kazakhstan from day one and we look forward to continuing to support the country's net-zero plans.

#### - Until very recently electricity from fossil fuels was considered far cheaper than electricity from renewables. When and why has this changed?

- Renewable energy sources have become far more affordable in recent years. Coal and other conventional energy sources are now struggling to compete with renewables in terms of price, even without factoring in cost of carbon, local air pollution and public health. According to the recent report published by the



International Renewable Energy Agency (IRENA), nearly two-thirds (62 per cent) of the wind, solar and other renewables that came on stream in 2020, were cheaper than the cheapest new fossil fuelled facility.

There are many reasons as to why we are seeing this revolution in renewables. First of all, the technology is ripe and ready. Advances in the technologies themselves have increased

efficiency and resulted in smaller capital expenditures per MW – and these advances are continuing to push the envelope and make renewable technologies more and more accessible.

There have also been changes in the market and we are beginning to see the competitive process really take off. The combination of competitive bidding and increasing numbers of experienced developers

competing for project opportunities is yielding low tariffs. In economies, which are able to create the right investment environments, we see prices as low as 1–2 US cents per kWh for solar or below 2.6 US cents for wind.

With cost becoming less and less of a barrier, Kazakhstan has a clear direction for its future activity – the country must continue to build renewable energy capacity



and provide households and businesses with reliable, affordable and clean power.

- During the last meeting between the President of Kazakhstan Mr. Tokayev and President of EBRD Ms. Renaud-Basso in October, it was mentioned that the EBRD in Kazakhstan is a key financial institution, which supports the renewable energy sector. What

#### factors may have contributed to the EBRD leading in this sphere?

- Sustainable development is in the Bank's DNA. The EBRD launched its climate action efforts in 2006 when the Bank adopted its initial Sustainable Energy Initiative (SEI), with priority investments in energy efficiency and renewable energy sources to decrease a very high-energy intensity of the economies in our countries of

operation. Through the new Green Economy Transition approach approved last year, the EBRD will further increase green financing to more than 50 per cent of its annual business volume by 2025 in line with its strategic priorities. Responding to the increased urgency of the climate emergency, the EBRD will also from the end of 2022 align all its activities with the goals of the Paris Agreement, aiming to accelerate decarbonization across the regions where it invests, supporting countries in reaching net-zero emissions by midcentury.

The EBRD was present at the very beginning of the renewables sector in Kazakhstan and is now contributing to the sector's development through policy dialogue, donor funded technical cooperation projects and investments. Since 2015, the Bank has invested in excess of US\$500 million, to support 788 MW of renewable energy capacity through 14 projects in Kazakhstan, which represent about half of country's newly added 1.8 GW renewable energy generation. Most of these projects were financed under Kazakhstan Renewables Frameworks I&II, cofinanced by international climate funds, which were developed to facilitate changes in the country's power generation sector by promoting the development of private renewable energy projects and more sustainable power market. A good example is a recent syndicated US\$95.3 million deal, co-financed by Green Climate Fund (GCF), to build Zhanatas 100 MW wind farm in Southern Kazakhstan.

The EBRD also supports electricity distribution companies and is ready to extend our cooperation at the transmission grid level, as a key prerequisite for successful deployment



Harry Boyd-Carpenter, Managing Director of EBRD for green economy and climate action

of intermittent renewable energy sources is a reliable grid infrastructure. In addition to grid strengthening, we are also ready to work with the government to support the introduction of storage technologies, including through auctions, as well as demand side management and smart grids solutions.

 We understand that the policy dialogue is one of the EBRD's major mechanism to support the sector development.
 Could you please share a few recent examples?

– The EBRD has been involved in Kazakhstan's renewable energy market since 2008, prioritising renewable energy projects and associated technical cooperation activities focused on regulatory support.

In March 2021, EBRD President Odile Renaud-Basso and the Minister of Energy of Kazakhstan signed a memorandum of understanding, targeting the decarbonization of power sector, fostering climate resilience, reducing greenhouse gas emissions, and eventually reaching carbon neutrality by 2060. As part of this agreement, the Bank together with USAID is helping the Ministry of Energy to develop a long-term decarbonization roadmap for the power sector, which will inform on the specific

steps to undertake for phasing out coal and achieving carbon neutrality in energy sector.

We are also working with the Ministry of Energy on another important aspect, which is using the renewables development for building expertise and expand local supply chains contributing to green energy. The energy transition offers growth opportunity not only in manufacturing but also in services such as O&M. This could lead to creating a new set of professional jobs in the country, which will require a trained skilled workforce. Our analysis shows that, working with international partners, Kazakhstan could attract investments into specific

components of the wind and solar value chain.

Another policy dialogue area for us is the promotion of gender equality and youth inclusion in the relation to the green transition of the energy sector. On this note, I commend the Kazakh Government for removing the list of jobs banned for women in Kazakhstan. We are now working with relevant authorities on removing barriers to women and youth employment and on providing them with the market-relevant skills necessary to find good jobs in the energy sector. We are also working on developing new occupational skills standards in relation to energy efficiency, green and digital skills, which will help the Kazakh energy sector keep up with the green transition.

We are also pleased to report on our joint work with the Ministry of Energy on the implementation of site-specific wind auctions for three utility-scale wind power projects. This initiative builds on the positive results of the existing auctions scheme that Kazakhstan successfully introduced in 2018 and having already awarded 1,219 MW, at prices 29% below previous feed in tariffs for solar and wind on average, demonstrating the true success of the competitive process. What the country needs now is auctioning larger sizeable capacity, potentially together with storage, to achieve economies of scale and low prices.

#### - What do you think are the key challenges facing Kazakhstan's renewable sector right now?

- I think Kazakhstan faces two key challenges. First, there is a need to strengthen networks to successfully integrate significant larger volumes of intermittent renewable energy, needed to decarbonize the power sector. The country will have to make significant investments in modernising and strengthening

electricity grid infrastructure and operations, as well as increasing flexible generation capacity.

Second, there is a regulatory and financing aspect. In order to attract international investment in renewable energy on a large scale it is important to ensure a predictable and enabling regulatory environment.

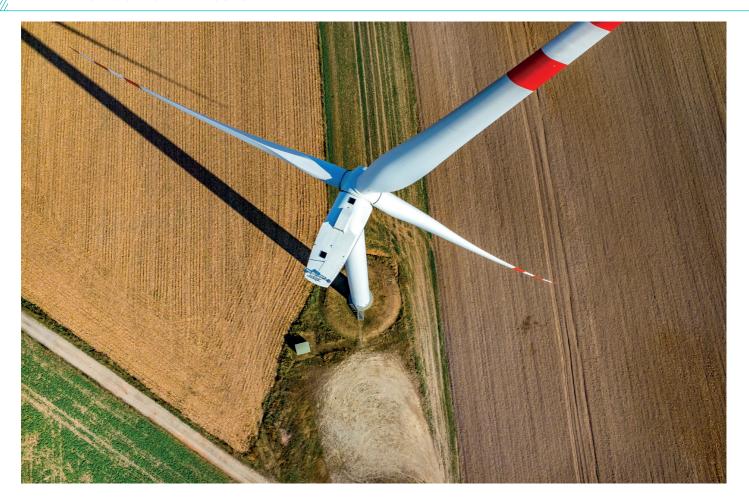
- As we know, besides working on the development of renewable energy market, the Bank is also engaged in the development of the local carbon market. How do you view effectiveness of introducing carbon market to decarbonization process in Kazakhstan?
- In 2013, Kazakhstan became the first country in the Commonwealth of Independent States (CIS) region to set up an Emissions Trading Scheme (ETS) and the Bank has been supporting Kazakhstan in this area from the very beginning. The EBRD started contributing in 2009 to carbon market developments in Kazakhstan as well as the country's initial Nationally **Determined Contribution** (NDC). This was followed-up by contributions from other parties such as the Partnership for Market Readiness (PMR).

In our continued engagement with the Kazakh government on this matter, we are assisting the Ministry of Ecology, Geology and Natural Resources and other relevant stakeholders (including Zhasyl Damu, the operator of the ETS in Kazakhstan) in the further strengthening of the domestic carbon market regulations, particularly focusing on the issue of environmental integrity. Subject to further improvements to its design and operations to enhance integrity, liquidity and price signal, the ETS in Kazakhstan has the potential to provide a key contribution to the achievement

of the climate pledge defined by the country in its NDC under the Paris Agreement and further toward its long-term net-zero goal.

- What about other clean sources of energy, green hydrogen is gaining a momentum in global discussions. Do you believe it is a viable option to help accelerate decarbonization?
- Certainly, the potential of clean hydrogen generated by renewable energy is a very exciting prospect. Hydrogen can serve as an energy carrier or as a feedstock, and what's better is that it can be used to store seasonal renewable electricity. While it is still early, the industry is growing quickly.
- IN MAY 2021, THE BANK LAUNCHED A TECHNICAL ASSISTANCE PROJECT TO ASSESS THE POTENTIAL FOR A LOW CARBON HYDROGEN **ECONOMY ACROSS THE EBRD ECONOMIES INCLUDING** KAZAKHSTAN. IT EXPLORES A NUMBER OF ECONOMIC, COMMERCIAL, INSTITUTIONAL AND TECHNICAL DIMENSIONS IN ORDER TO ASSESS THE MOST COST-EFFECTIVE AND SUSTAINABLE WAYS OF DEVELOPING A ROBUST AND RESILIENT HYDROGEN ECONOMY.

Many countries where we operate have a combination of energy-intensive industries in the process of decarbonization and industrial manufacturers using a mix of fossil-based hydrogen and/or having access to affordable natural gas. Often, these same countries have also favourable local conditions for the production of green hydrogen from cost-competitive local renewable sources. These factors may create favourable conditions for a wider use of green hydrogen.



# - The EBRD was a pioneer working with municipalities under the Green Cities program. What role does the Green cities program play in the decarbonization?

– Cities worldwide are the source of at least three-quarters of emissions, making them a vital starting-point in tackling climate change. This is particularly true of cities in the EBRD region – Central and Eastern Europe, Central Asia and the Southern and Eastern Mediterranean – where obsolete

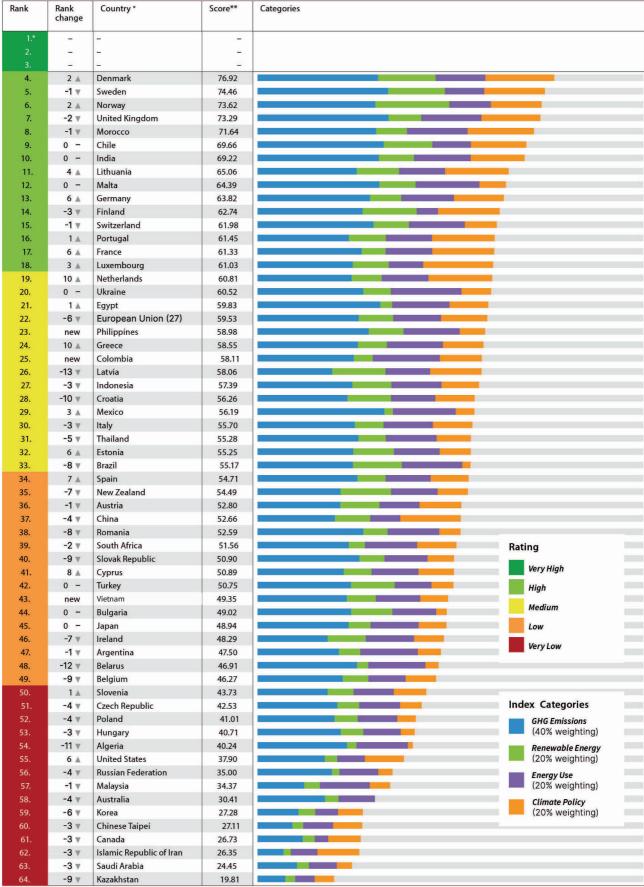
urban infrastructure is often degrading the quality of life of citizens, by increasing greenhouse gas emissions and preventing communities from adapting to climate change. EBRD Green Cities, which has already grown to include 52 cities, is helping municipalities create a tailor-made list of priority environmental investments and policy actions to address their environmental challenges through Green City Action Plans (GCAP).

In 2020, Almaty became the first city in the country to join

Green Cities and start developing its Green City Action Plan. It is focusing on addressing the issue of coal-fired heating plants, the reduction of energy consumption, the introduction of electric public transport as well as circular economy and smart city solutions. Oskemen and Semey have also joined Green Cities and started GCAP preparation in October 2021. Rapid greening of cities is critical for the success of country's climate policies and for improving the quality of people's life.

Let me conclude by saying that we, at the EBRD, firmly believe in Kazakhstan's energy transition potential. There are solid foundations for future investment and development, but challenges remain. It will be impossible to reach carbon neutrality overnight, and consistent efforts coupled with necessary experience will be essential. I hope the country will be able to facilitate accelerated clean energy transition by capturing the abundance of sun and wind – the natural and abundant treasures Kazakhstan is blessed with.

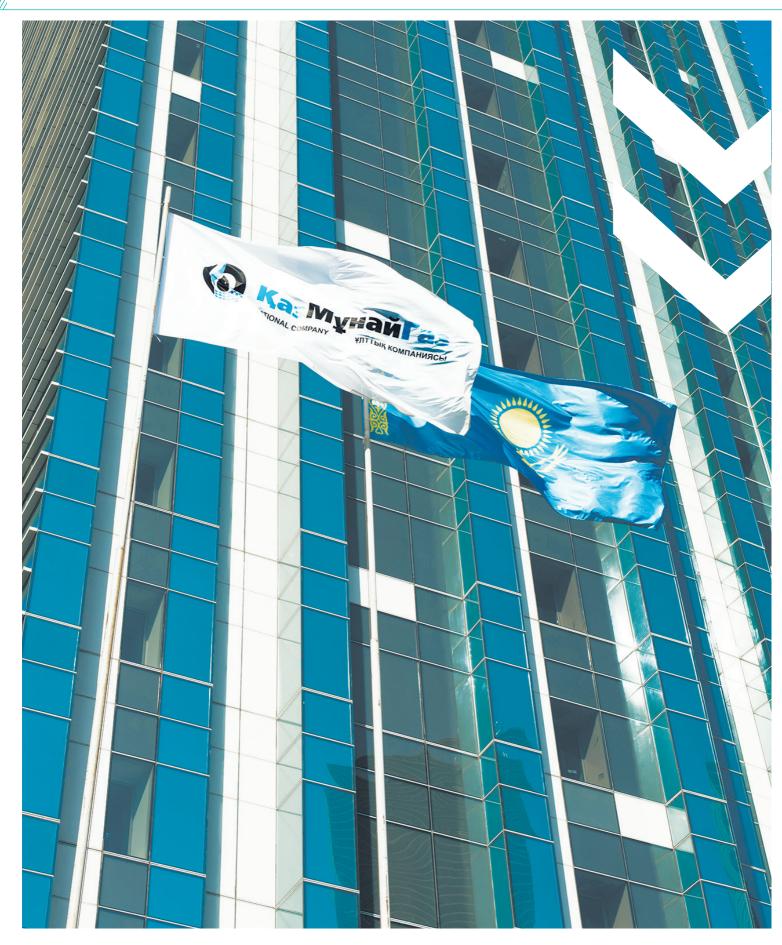
#### Climate Change Performance Index 2022 - Rating table 1



\*None of the countries a chieved positions one to three. No country is doing enough to prevent dangerous climate change.

<sup>\*</sup>Rounded.

<sup>&</sup>lt;sup>1</sup> Climate change performance index is an index calculated by Germanwatch to enhance the transparency in international climate policy.



## Low-carbon transformation of KazMunayGas

### Dastan Abdulgafarov

Deputy Chairman of the Management Board for strategy, investments and development of business NC "KazMunayGas" JSC





oday, the global community is making intense efforts to combat climate change. In support of the Paris Agreement, nations and corporations set goals to reduce greenhouse gas emissions demonstrating their varying ambitions; carbon regulation is tightened up at the global, regional and national levels.

Our country has not been left out of the climate agenda either. The President of the Republic Kassym-Jomart Tokayev has repeatedly stated Kazakhstan's intention to achieve carbon neutrality by 2060.

The national company "KazMunayGas" also supported the country goals. The company was the first in Kazakhstan to approve the Low-Carbon Development Program for 2022-2031 (hereinafter - LCD Program). The main goal of the program is to determine the company's climate ambitions, systematize the main approaches and measures in the field of reducing the carbon footprint through an analysis of the existing potential, identifying key areas of development and increaseing the level of readiness.

Given the importance of the climate agenda, the company intends to reduce carbon dioxide emissions by 15% by 2031 from the 2019 level or 1.6 million tons of CO<sub>2</sub>. This indicator is planned to be achieved through energy efficiency measures and implementation of renewable energy projects.

These goals correspond to the country-wide goals under the Paris Agreement on Climate Change. At the same time, 2019 is defined as the base year, the closest to the typical operating activity of the KMG group of companies.

It should be noted that in 2019, the direct emissions of the KazMunayGas group of companies amounted to about 7.4 million tons, and indirect emissions - 3.3 million tons.

"We intend to focus on moderate, balanced and consistent decarbonization of our operations. The company's LCD program includes both current opportunities to reduce the carbon footprint, including through energy efficiency improvements and the use of renewable energy, and additional activities for decarbonization. This include projects related to the capture, storage and utilization of



It is obvious that the key factor in reducing the energy intensity and carbon intensity of KMG production is to increase energy efficiency and resource-saving at all stages of the company's production cycle, both during production and during transportation and refining of oil.

CO<sub>2</sub>, the implementation of forest carbon projects and the production of hydrogen," – said D. Abdulgafarov, Deputy Chairman of the Management Board for Strategy, Investment and Business Development of KazMunayGas.

It is obvious that the key factor in reducing the energy intensity and carbon intensity of KMG production is to increase energy efficiency and resource-saving at all stages of the company's production cycle, both during production and during transportation and refining of oil. Each enterprise of the KazMunayGas company is now obliged to develop its plans in this direction within the framework of the LCD Program.

KazMunayGas pays serious attention to the use of renewable energy sources in the context of the possibility of using carbon offsets and reducing CO<sub>2</sub>. The company is working on several areas related to renewable energy.

Firstly, the possibility of implementing wind and solar power projects is being studied. It is emphasized that this approach will allow developing competencies in the field of renewable energy, following the example of other global oil and gas companies, and will also increase the energy independence of the company's assets.

Secondly, KazMunayGas is working on the issue of concluding direct contracts with the owners of renewable energy facilities for the purchase of "green" energy. The company can become a consumer of "green" renewable energy by concluding an offtake contract with large potential investors. This approach will make it possible to partially replace traditional electricity consumption with renewable energy without attracting serious investments in major construction work, thereby reducing the carbon footprint.

The third direction is that the construction of a small-scale distributed and autonomous renewable energy generation units at the facilities of the KMG group of companies will allow using renewable energy technologies in the public utilities sector and in production processes (preheating of oil during extraction / transportation, lighting, hot water supply and others).

The signing of a number of memoranda with partners also indicates the KazMunayGas' commitments in the field of decarbonization.

In particular, they agreed to cooperate with Eni on the development of energy transition projects for the production and sale of electricity from renewable energy sources. The prospects for the implementation of projects in agriculture for the production of biofuels and in the field of hydrogen energy are also being studied.

Together with Total Energies, SWF "Samruk-Kazyna" JSC and the Ministry of Energy agreed to participate in the implementation of a large-scale renewable energy project for 1 GW using energy storage systems.

As to additional medium-long term decarbonization measures, the company, together with Shell Kazakhstan B.V., is exploring the possibility of implementing a pilot project on carbon capture, utilization and storage (CCUS). This technology is important due to its potential to reduce emissions throughout the energy system.

Hydrogen production is also gaining momentum in the world today. The leaders of the oil and gas sector see hydrogen as an opportunity to expand their dominant influence. KazMunayGas has also started studying the prospects for hydrogen production in the long term. Currently, the company is working on the issue of creating a Competence Center for Hydrogen energy.

The hydrogen mobility project to be implemented by Air Liquide in accordance with signed memorandum, will allow testing the use of hydrogen in transport at one of the company's enterprises.

We have agreed with Linde technology company on cooperation and joint development of projects in the field of clean energy in Kazakhstan. The first stage of cooperation will explore the possibility of producing hydrogen and ammonia using natural gas as raw materials ("blue" hydrogen and "blue" ammonia) and/or electrolysis of water ("green" or "blue" hydrogen and "green" or "blue" ammonia).

"Low-carbon development become ingrained in global political, investment and trade agenda. Therefore, it is important for us to implement pilot projects in all these areas to build up our competencies and our own potential. If we get positive results, we will be able to scale them across the entire KazMunayGas group of companies," – D. Abdulgafarov stressed. W



## RES Association "Qazaq Green"

# raised topical issues to all participants of energy community



ARO TYP Aenyy Hap

he Vice-Minister of
Energy of the Republic of
Kazakhstan Zh. Karagayev
in his speech noted that the
beginning of the autumnwinter period in the electric power
industry was always a test of the
stability of the National Grid System.

It's no secret that this year the system has faced new challenges. As a consequence of the sharp increase in electricity consumption due to the rapid development of digital mining, there was a shortage of generation in the system, which was aggravated by the emergency failure of power units at key energy facilities of the country.

"If we take historical data, our energy consumption has been

growing by about 1–2% in recent years. Maximum 2% per year. But over these 10 months, we have noted an abnormal growth of about 8%. This is a fairly large increase in consumption. Here we are talking about 1000–1200 MW of electricity and, of course, we associate an increase in consumption with an increase in consumption on the part of miners," – Zh. Karagayev said.

Deputy of the Majilis of the Parliament of the Republic of Kazakhstan Dyusenbai Turganov noted that for the rapid development of renewable energy, our National Grid System with basic generation obtained from traditional coal plants, was absolutely unprepared for new trends. The shortage of maneuverable capacities and the almost inability to regulate the system has led to a growing dependence on overcurrents from neighboring countries.

As you know, the problem of shortage of maneuvering capacity found a legislative solution at the end of last year. For its implementation, auctions will be held in this December for the construction of generating units with a maneuverable generation mode for a total amount of 1,140 MW of electric capacity to ensure the availability. These are combined-cycle gas stations, installations using hydrodynamic water energy or gas

99 On November 22, "QAZAQ GREEN" Renewable Energy Association with the support of the Konrad Adenuer Foundation held a round table on: "The current situation in the electric power industry of Kazakhstan: challenges and problems". The event was attended by Vice-Minister of Energy of the Republic of Kazakhstan Zhumabai Karagayev, Deputies of the Majilis of the Parliament of the Republic of Kazakhstan Dyusenbai Turganov, Edil Zhanbyrshin, Yeldos Abakanov, Chairman of the Board of "Samruk-Energy" JSC Sungat Yessimkhanov, Managing Director of "KEGOC" JSC Zhandos Nurmaganbetov, heads of relevant departments of the Ministry of Energy of the Republic of Kazakhstan, representatives of the business community, public organizations, international financial institutions.





for generating electric energy, as well as generating installations that do not use minerals as fuel (that is, renewable energy stations with energy storage systems).

According to the Deputy of the Majilis of the Parliament of the Republic of Kazakhstan Turganov D.N., there are also some problems here. "According to the research of "KEGOC" JSC for 2 MW of installed renewable energy capacity, 1 MW of maneuverable capacity is needed for regulation. In other words, today we need at least 1 GW of maneuverable capacity. According to the established indicators of renewable energy development, by 2025 the renewable energy

sector should grow by 2 times (6% of the share of renewable energy generation in the energy balance). Taking into account the time for the construction of maneuverable capacities, as well as the problem of providing gas to such facilities, there are risks that the problem of the shortage of balancing capacities will not be solved in this way," the speaker concluded.

The chief dispatcher of the National Dispatch Center of JSC "KEGOC" Bekzhan Mukatov presented a report on the current situation in the country's electric power industry. Thus, since the beginning of the year, electricity generation at coal-fired power

plants amounted to 66.9 billion. kWh, i.e. 69% of the total output. Gas-fired power plants generated 18.9 billion kWh or 19.5% of electricity, hydroelectric power plants – 7.4 billion kWh or 8% of electricity, RES – 3.6 billion kWh (about 3.5%). In order to resolve the situation related to the growing energy shortage, the Ministry of Energy of the Republic of Kazakhstan and the System Operator are taking measures to prevent a system accident.

It should be noted that over the past year, important changes have been taking place in the electric power industry of Kazakhstan, which generally lay the foundation



for a deep modernization of the industry. On the one hand, this is our country's attempt to keep up with global challenges, such as the energy transition and the process of decarbonization of economies, which determines the "green" vector in the energy sector. On the other hand, it is an active search for solutions to meet the needs of the country's growing economy for electricity in the medium term.

On January 26, 2021, speaking at an expanded meeting of the Government of the Republic of Kazakhstan, the President instructed the Government to develop the Energy Balance of the Republic of Kazakhstan for the period until 2035. This document should take into account not only internal aspects - consumption, generation of maneuverable capacities, an increase in the share of environmentally friendly energy, but also plans for the development of our neighbors' energy systems. As we know, recently the Minister of Energy of the Republic of Kazakhstan presented this document to the President. However, we should note that, unfortunately, we, the RES business community, were not introduced to its content.

Moreover, the Ministry of Energy of the Republic of Kazakhstan was instructed to develop a National project for the development of the electric power industry. This is a new regulatory document in the System of state planning, which is actually a plan for the development of the industry.

Speaking at a meeting on the development of the electric power industry on May 26 this year, the President noted that the National Electric Power Project is an application document that should become the basis for the development of the industry for the next at least 5 years. At the same time, it was instructed to ensure the mutual alignment of the national project with the Low-carbon Development Strategy and carefully discuss them with international

and domestic experts. However, in this October, only 10 National projects were approved, where the issues of the development of the electric power industry were included in the National Project "Sustainable economic growth aimed at improving the welfare of Kazakhstanis" as its part.

The round table touched upon important topics and problems for the industry: the growing energy shortage, the needs of the economy for electricity, the impact of new directions in generation (RES with energy storage systems) and consumption (digital mining of cryptocurrencies) on the electric power industry, the need for new maneuverable capacities, the use of market mechanisms (demand management, balancing market), issues of attracting investments in the electric power industry, goals to achieve carbon neutrality and the readiness of both the government and business to transform in the industry.

#### For reference

The national project is a document that provides comprehensive interdepartmental cooperation and priority budget financing for the implementation of a set of measures aimed at solving tasks (projects), certain critically important for achieving National priorities, goals, objectives and strategic indicators and performances in a timely manner. National projects are approved by the decree of the Government of the Republic of Kazakhstan after approval by the Supreme Council for Reforms under the President of the Republic of Kazakhstan.



Of course, there are still a lot of factors that were not mentioned during the round table. Thus, it is necessary to insert external factors into the general equation for the development of the electric power industry, such as the introduction of a common electricity market of the countries of the Eurasian

Economic Union (2025), the introduction of a carbon footprint tax in the European Union (2023), Kazakhstan's obligations under the Paris Agreement (2030).

An important factor is the statement of the President of the Republic of Kazakhstan K.-J. Tokayev on November 19 as part of his trip

to Almaty on the prospects for development of nuclear energy, including the construction of nuclear power plants: "I think that eventually we will come to such a decision. We are already feeling the first signs of a shortage of electricity in Kazakhstan. Of course, there is no total shortage. The balance is





approximately zero. But the first signs are marked. Therefore, looking to the future, we will have to make inherently unpopular decisions about the construction of a nuclear power plant. But, as it's said, the role of a leader is to make unpopular decisions," – Kassym-Jomart Tokayev said.

How will our electric power industry solve the old problems inherited from the Soviet past and the new challenges dictated by the global conjuncture? How to build a common policy for all sectors of the economy? How structurally should the electric power industry change? What energy sources will the industry use to fuel our economy in the long term: coal, gas, nuclear energy? How much should

the share of renewable energy be in order to achieve all the country's obligations?

So it turns out that so far there are more questions than answers, and so far the situation in the electric power industry looks like an equation with several unknowns, which the Government must solve in the near future. As industry experts and observers of the whole process, so far we see only the tactics of "extinguishing fires" (we are urgently looking for gas for the Zhambyl GRES, urgently rushing the stations to finish repairs, attracting foreign investors to build large volumes of capacity, transferring our energy assets to them, etc.).

However, as before, we do not have a common vision – a strategy

for the development of the industry, at least for the medium term. This issue, especially now, when the system is working at maximum and can no longer cover the economy's demand for electricity, should be first on the agenda of the authorized state body, the system operator, development institutions and the business community.

Following the results of the round table, a proposal was put forward to initiate an appeal addressed to the President with justifications for the need to develop a Strategy for the development of the electric power industry that would correspond to the State Planning System and would be approved at the highest level.



### Results of auctions for the selection of renewable energy projects in 2021

Date of the auction	Company name	Type of renewable energy source	Auction price, tg/kWh (without VAT)	Installed capacity, MW
November 8	"Aksugidro" LLP	НРР	15.00	4.9
	"Altyn-Hydro" LLP		15.01	2
	Production cooperative "APC "Yntymak"		15.05	3.5
	"Europe Solar" LLP		15.19	1.4
November 9	"Burabai biogas & Fertilizers Factory" LLP	BioES	32.15	4.95
	"SAMP KAZAKHSTAN" LLP		32.14	0.2
November 10	"Hyperborea" LLP	WPP	14.08	50
November 11	_	HPP	_	100
November 12	"NextEcoEnergy" LLP	SPP	12.87	20

<sup>\*</sup> The auction was declared invalid.

Source: "Kazakhstan Electric Energy and Capacity Market Operator" JSC





### PROJECTED ELECTRICITY **SHORTAGE**

According to the System Operator of the NGS of Kazakhstan, there is an abnormal rate of electricity consumption in the country. In comparison with the same period in 2020, for 9 months, the increase in energy consumption was 7.2 percent, while in the Southern zone -11.8 percent, in the Northern zone – 5.8%, and in the Western zone – 6.6%. During the hours of maximum loads, power consumption in the Republic of Kazakhstan exceeds last year's values by 1,500 megawatts, which is comparable to the consumption of an entire region, for example, Almaty.

Power engineers expect that the deficit in the National Grid System of the Republic of Kazakhstan in October -December may amount to about 1.7 billion kilowatt-hours. This is due to the need for repairs at power plants, a lowwater period, which caused an insufficient level of reserves at

All these factors indicate an increasing likelihood of restrictions, especially in the southern regions. According to "KEGOC" JSC, the projected maximum consumption in the Southern zone is 4,350 megawatts, while generation covers only half of the needs -2,250 megawatts, provided that the Zhambyl GRES will operate in 4-block mode. The volume of transit from north to south is limited to 2,100 megawatts, and about 400 megawatts for balancing will have to be purchased from Russia at the peak price.

### **EMERGENCY AND UNSCHEDULED REPAIRS**

The situation is significantly aggravated by a shortage of generating capacities due to a large number of emergency and unscheduled repairs at power stations of the National Grid System. Thus, on October 14, 2021, with an interval of several hours at Ekibastuz GRES-1 and Ekibastuz GRES-2, large power units with a capacity of 500 MW were shut down. Also, a boiler with a reduction in generation by 150 MW was stopped in an emergency at the power plant of "EEC" JSC.

Thus, the total volume of emergency reduction of generation at the above three power plants exceeded 1000 MW.

In the conditions of the already existing power shortage, these emergency shutdowns at power plants led to unacceptable power deviations at the border with the Russian energy system, with the overload of interstate power transmission lines with the threat of a system accident.

**99** The beginning of the autumn-winter period in the electric power industry is always a test of the stability of the National Grid System. This year, the system has faced new challenges and "old sores". Due to sharp increase in electricity consumption explained by development of digital mining, there was a shortage of generation in the system, which was aggravated by the emergency failure of power units at key energy facilities of the country. To mitigate the situation, the system operator imposed restrictions on consumption, and together with the Ministry of Energy of the Republic of Kazakhstan, measures were taken to limit digital mining.



the HPP, and unresolved issues with the provision of fuel at the Zhambyl GRES.



### RESTRICTIONS IN GRIDS AND REPLACEMENT OF OUTGOING GENERATION

According to the legislation of the Republic of Kazakhstan, JSC "KEGOC" as a System Operator is obliged to ensure the reliability of the National Grid System of the Republic of Kazakhstan. With overplanned consumption, "KEGOC" JSC is forced to take measures to certain categories of consumers to comply with the consumption regime according to planned values, in accordance with the requirements of current legislation.

On October 5, 2021, as part of the fulfillment of the obligations imposed on the System Operator, the following measures were carried out to limit consumption according to the schedules agreed with local executive bodies: Restrictions in the grids of "AZHK" JSC – 75 MW (over 160 MW, over the range of 90 MW). Restrictions in the grids of "Kyzylorda REC" JSC – 31 MW (39 MW excess, over the range of 33 MW). Restriction of "Enegix" JSC are 68 MW (over 100 MW, over the range of 90 MW).

In addition, in order to minimize situations requiring consumer restrictions while reducing generation by power plants of the Republic of Kazakhstan, the Ministry of Energy, together with "KEGOC" JSC, has developed a number of measures aimed at meeting the consumers' needs for electricity and capacity. The measures include mandatory replacement of emergency generation by

power plants to eliminate the risk of disconnecting consumers (they will be put into effect at the end of October 2021). These norms of regulatory legal acts are designed to protect consumers from disconnection due to shortages caused by accidents at power plants. It will also encourage more efficient repairs at the stations.

If the above measure is insufficient and it is necessary to introduce consumer restrictions, additional amendments to the regulatory legal acts of the Republic of Kazakhstan provide for the priority restriction of consumers engaged in digital mining.

As a result of the measures promptly taken and the work carried out by "KEGOC" JSC on interaction with neighboring power systems, the situation in the power system is relatively stabilized.

### DIGITAL MINING HAS "EATEN" ALL THE RESOURCES OF THE SYSTEM

The excess of power consumption over its production was due to a sharp increase in consumption by consumers engaged in digital mining and increased accidents at power plants. According to the Ministry of Energy of the Republic of Kazakhstan, the increase in consumption of more than 7% in the country's energy system is directly caused by the emergence of cryptocurrency processing centers, or so-called mining farms. At the moment, the volume of consumption of mining farms is about 1000



megawatts of our resources, which is commensurate with the electricity generation of Ekibastuz GRES-2.

In order to preserve the reliable operation of the entire energy system, the Ministry of Energy, together with the system operator KEGOC, developed an order "On some issues of electrical installations of consumers engaged in digital mining activities." The document is aimed at identifying and limiting the work of so-called "gray" miners who work outside the law and who account for about half of the electricity consumption of mining farms. Such farms will have to shut down and go through legally established procedures.

At the same time, the Ministry of Energy of the Republic of Kazakhstan assured that mining farms officially registered in the country will not be discriminated. They will continue to work in the volume prescribed by their contracts, at the same energy prices.

However, according to the above order, during the peak evening hours, when there is maximum consumption and certain risks arise, the system operator will have the opportunity to limit the consumption of mining farms. In addition, new mining farms that want to work in Kazakhstan will have limited opportunities. Thus, the system operator has the right to consider applications and approve those that will consume up to 1 megawatt of energy. In total, if there is an excess of 100 megawatts of applications throughout Kazakhstan, the system operator will also have the right not to issue a permit to connect new farms.

At the same time, according to a study conducted by the University of Cambridge, in the fall of 2021, Kazakhstan ranked second in the world in cryptocurrency mining. After China recognized mining as an undesirable activity. Kazakhstan increased its share in the global hashrate (total operations) to 18%. It was outpaced only by the USA with 35.4%. Russia is in third place with 11%, and Canada is in 4th place with 9.6%. It is known that in September, the People's Bank of China issued a statement in which it attributed operations with cryptocurrencies to illegal financial activities and about 50 Chinese crypto farms transferred their activities to Kazakhstan.

AS A RESULT, KAZAKHSTAN'S SHARE OF MINING IN GLOBAL TURNOVER HAS TRIPLED SINCE THE BEGINNING OF THE YEAR. EXPERTS NOTE THAT THE MAIN REASON FOR THE RAPID DEVELOPMENT OF MINING IN THE COUNTRY IS THAT KAZAKHSTAN HAS ONE OF THE LOWEST ELECTRICITY PRICES IN THE WORLD, AND TODAY THERE ARE NO PROHIBITIONS ON MINING.

# Carbon neutrality a new challenge for the country's electric power industry

n December 2020, the President of the Republic of Kazakhstan, speaking at the summit on climate ambitions, dedicated to the 5th anniversary of the adoption of the Paris Climate Agreement, said that Kazakhstan planned to achieve carbon neutrality by 2060. In general, this task has become a global trend, which has been joined by almost all countries of the world. The European Union is committed to achieve carbon neutrality by 2050, and China has committed to reducing net GHG emissions to zero by 2060. The US rejoined the Paris Agreement in 2021 and announced that it would achieve zero emissions across the economy no later than 2050.

In order to fulfill this task, the Government of the Republic of Kazakhstan was tasked to develop a Strategy to achieve carbon neutrality by 2060. The developed document was presented at international conference "Ways to achieve the goals of the Paris Agreement and carbon neutrality of Kazakhstan" held on October 13 this year with the participation of the President.

This document sets out a comprehensive assessment of the changes and measures needed to adapt the national economy to a climate-neutral model in the future. It is emphasized that achieving ambitious climate goals is a huge challenge for Kazakhstan and for the whole world. A significant reduction in greenhouse gas emissions requires fundamental changes in production and consumption models, a rapid and effective transition from non-ecological burning of fossil energy resources to carbon-free technologies, large-scale introduction of "green" innovations in industry, transport, construction, agriculture and forestry, and waste management.

It is no coincidence that, speaking to the country's business community at the VIII Congress of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" at the end of September this year,

the President outlined the issue of achieving carbon neutrality as the main point of his speech: "Kazakhstan is one of the most energy-intensive countries in the world, 70% of the energy balance is coal-fired generation. The importance of the oil and gas sector does not need to be explained to anyone. At the same time, being a responsible member of the world community, Kazakhstan has announced its commitment to achieve carbon neutrality by 2060. Obviously, this will require deep structural, technological and economic changes. Everyone will be affected by these changes."

An important factor in this is the direction of Kazakhstan's exports, since fossil fuels and especially oil from Kazakhstan are mainly exported to OECD countries. At the same time, the European Union accounts for the largest share. And as is well known, from January 1, 2023, the EU carbon border adjustment mechanism (CBAM) will begin to operate, which will gradually impose a carbon footprint tax on imported goods exceeding certain benchmarks and originating from countries with less ambitious climate policies and lower carbon prices. Thus, achieving carbon neutrality is a challenge for the entire economy of the country.

In this case, the energy industry is at the forefront, where it is no secret that coal is the main source of energy. The share of greenhouse gas emissions from the use of coal in the country has practically not changed in 30 years, in 1990 it accounted for 65%, and in 2017 – 59% of all greenhouse gas emissions in the country. At the same time, we have 70% of electricity and 99% of heat produced by burning coal.

The Strategy of achieving carbon neutrality of Kazakhstan until 2060 clearly sets the vector of strategic actions, taking it as an axiom that in the medium term, the withdrawal of coal generation is inevitable and the natural question of its replacement arises. This makes it possible to replace existing

An important factor in this is the direction of Kazakhstan's exports, since fossil fuels and especially oil from Kazakhstan are mainly exported to OECD





outdated carbon-intensive equipment and infrastructure with modern lowcarbon and carbon-free technologies, such as gas-fired thermal power plants, at the initial stage, as well as the active and comprehensive introduction of renewable energy sources (RES). In other words, the Strategy concludes that decarbonization will be achieved by replacing existing worn-out equipment and infrastructure at the end of their economic life.

In order to find solutions, the team of Strategy developers applied an analytical approach to assessing the transition

by 2060. In the long term, the use of RES will be accompanied by energy conservation systems (for example, industrial-scale storage plants), which will allow regulating the supply of electricity and better integrating RES into the energy system.

These numbers seem a bit surreal today. As specialists in the electric power industry, we also understand that the country will need basic generation. What will be the base-load generation: still coal, nuclear or gas turbine – this is a separate issue, which I am sure will be hotly discussed in the near future at



to carbon neutrality, based on the use of a hybrid model consisting of three advanced, complex, interconnected economic and technological models (TIMES-KAZ, CGE-KAZ, SD-KAZ). At the same time, the models consider only 2 scenarios: the basic one is the lack of any technological or political changes to achieve carbon neutrality and the carbon neutrality scenario is when all economic policy measures are aimed at achieving the goal.

According to the Strategy, the simulation results showed that in the carbon neutrality scenario, a steady decline in the share of coal generation is expected until its complete disappearance by 2055. In 2060, in the carbon neutrality scenario, solar energy will account for up to 46% of all electricity generation and 56% of renewable electricity, while wind energy will account for 33% and 40%, respectively. In addition, at the abovementioned conference, the President announced an important indicator for development of renewable and alternative energy, the share of which will be 80% in the country's energy balance

different levels. However, one thing is obvious, that the Strategy of achieving carbon neutrality until 2060 allows us to take a different look at the prospects for the development of our country, where renewable energy will play an important role in the structure of the energy system.

THE STRATEGY ALSO GIVES A VERY **CORRECT MESSAGE FOR FOREIGN INVESTORS AND DOMESTIC BUSINESSES. IT IS NO COINCIDENCE** THAT IN THE CARBON NEUTRALITY SCENARIO, ALMOST 90% OF INVESTMENTS WILL BE DIRECTED TO THE RENEWABLE ENERGY SECTOR.

And the most important thing that the Strategy of achieving carbon neutrality leads us to is that a future with a zero balance of greenhouse gas emissions by 2060 in Kazakhstan is technically possible and economically feasible. Achieving this goal will require profound structural changes in the entire economy and, in particular, a fundamental transformation of the energy sector. 06

Source: Renewable Energy Association 'Qazaq Green'

### INFORMATION

**ON PRODUCTION** OF ELECTRIC ENERGY BY RENEWABLE **ENERGY FACILITIES** 

for 9 months of 2021

Installed capacity including: 1,922 MW Number of stations

power plants

601.3 MW

Number of stations

Small **HPP** 

280.9 MW

Number of stations



solar power

1,032.6 MW

Number of stations

48

bioelectric power plants

7.82 MW



power plants

1,183.2 million kWh

671.8 million kWh

solar power plants

1,379.4 million kWh

bioelectric e power plants

2.6 million kWh

The share of renewable energy generated in the total volume of electric energy production

3.9%

The increase in electricity generation by renewable energy facilities for 9 months of 2021 compared to 9 months of 2020 is



## At the end of 2021, it is planned

To put into operation – 22 renewable energy facilities:

- 13 wind power plants with a capacity of 259.65 MW
- 5 HPP with a capacity of 45.59 MW
- 4 SPP with a capacity of 76.95 MW

Installed capacity – 382 MW
The total amount of investments is 155 billion tenge

The total number of renewable energy facilities by the end of 2021 will be 138 with an installed capacity of about 2 GW





### **TALAN TOWERS** IS A COMPLEX

oriented on "green" technologies

99 Now Kazakhstan's megacities are being built up with glass buildings and bright offices. It is pleasant to note that a number of buildings equipped with "green" technologies is growing every day. One of the most beautiful and unusual buildings of the capital and the most eco-friendly building in Kazakhstan is the Talan Towers social and business complex. PP

### **THE BUILDING** THAT BECAME A BRAND

Talan Towers - is one of the most beautiful complex buildings built in the "golden square" on the left bank of the capital. The complex is located near the "Baiterek" monument, the presidential residence "Akorda", the building of the Senate and the Majilis. Moreover, governmental organizations, large Kazakhstani and international companies, cultural facilities, elite residential complexes and modern shopping malls are located within walking distance of the complex. The Talan Towers complex, harmoniously fitting into the style and dynamics of big city life, accommodates category "A" Talan Towers Offices, the luxury hotel The Ritz-Carlton Astana 5\*, exclusive residences The Ritz-Carlton Residences Astana and the Talan Gallery shopping gallery.

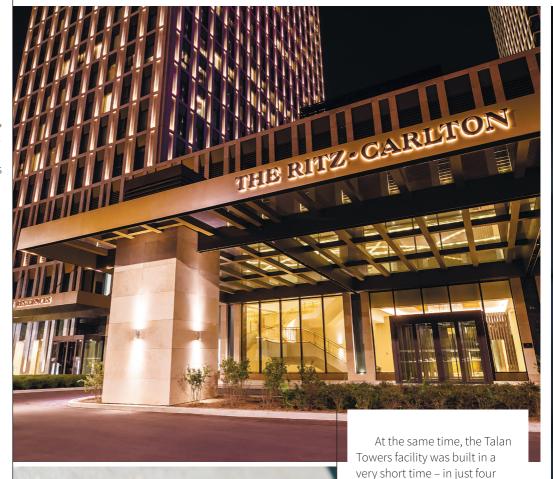


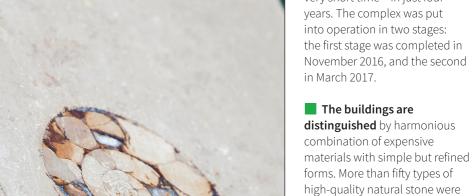
The Talan Towers complex, built on 16 Dostyk Street, was designed by the American architectural bureau Skidmore, Owings and Merrill. The bureau is known as the author of many famous architectural objects, such as the Burj Khalifa in Dubai, the Statue of Liberty in New York and Trump Tower in Chicago. More than a hundred companies took part in the implementation of the project. And now guests of the capital can admire the beauty and unusual appearance of the building.

### The Talan Towers complex covers an area of 120,000

**sq. m.** The shopping malls, appartments, hotel and offices in the Art Nouveau style – and all of the highest quality – demonstrate the high status of the complex.

Thus, there is a category
"A" Talan Towers Offices in
the thirty-storey tower. The
twenty-five-storey building
accommodates The RitzCarlton Astana 5\* Hotel and
The Ritz-Carlton Residences
Astana. These majestic buildings
are connected by a shopping
gallery.





One of the most important architectural decisions was the choice of facade material. For this purpose, a limestone was brought from Germany, consisting of the mineral dolomite, resistant to the harsh climatic conditions of the capital and providing excellent heat and sound insulation.

used in the decoration of the

complex.



### **UNIQUENESS OF ECO-FRIENDLY TALAN TOWERS**

Full-scale "green" technologies were envisaged when designing the Talan Towers. "Green" tents, energy-efficient elevators, energy-saving glazing, solar panels, rainwater reuse, charging for electric vehicles, changing rooms and showers for cyclists - all this has been introduced for the first time in one building in Kazakhstan.

In 2018, Talan Towers was awarded the gold level LEED certificate for buildings corresponding to the requirements of ecological construction.

LEED (Leadership in Energy and Environmental Design) is a world-famous certificate that determines the level of quality. This certificate is awarded only to the highest quality facilities that meet strict requirements, such as ecological construction, efficient use of water resources,

energy conservation and air purification, the use of ecological natural materials, innovation and design. LEEDcertified buildings bear a great responsibility for energy conservation, improving human health and efficient use of natural resources.















Despite the fact that Talan Towers, like our capital, is a very young building, it has its own history and awards. In 2017, it received an award at the Asia Pacific Property Awards as the best project in Kazakhstan in the categories Mixed-Use Development and Mixed-Use Architecture. In October 2017, at the Central Asian Commercial Real Estate Week, Talan Towers Offices was recognized as the best business center of "A" category in Kazakhstan. And, a month later, the complex received the prestigious Eastern Europe Real Estate Project Award. In 2018, as part of the Asia Pacific Property Awards, it was recognized as the best in the Interior and Mixed-Use Interior categories. On December 3, 2018 it was recognized as the best project in Asia in the Mixed-Use Interior category of the Asia Pacific Property Awards 2018–2019.

### TOUR OF THE TALAN TOWERS COMPLEX

Let's start with the lower floor – parking. The first level of two-level parking for 500 cars is for guests' cars, and the second level of stationary parking is for tenants and apartment owners. It is conveniently located relative to all parts of the building, and it can be accessed from two streets.

A "green" zone for electric vehicles, equipped with charging station free of payment. On P1-level there are the Tesla Superchargers equipped with two power stations. There are four such posts in the street parking lot at the hotel. This is the best of the units for high-speed charging of Tesla cars.

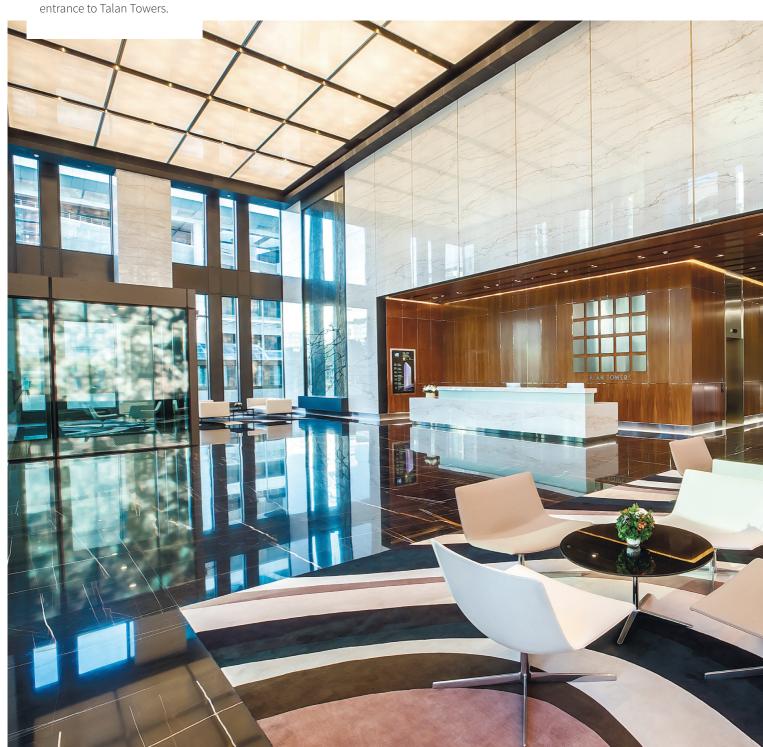




After the capital's cool weather you plunge into the warm lobby of the business center. The design of the hall is decorated with special light panels. Simplicity, conciseness and elegance, pleasant music, the aroma of natural flowers will pleasantly surprise you at the entrance to Talan Towers.

What amenities and opportunities does the multifunctional complex provide to its tenants?

Talan Towers – is an object that is also convenient for people with disabilities due to creation of an absolutely accessible and comfortable environment. Convenient wide doors for entry and exit, convenient door sill without steps, low location of the elevator control panel, special toilets – everything is done for the convenience of visitors.







This is a system created in order not to waste precious time spent on one stop and climbing up and down to each floor. When you touch the magnetic card on the control panel, the elevator opens, programmed in such a way that you will get to the floor you need.



Most of us spend at least nine hours in the office every day. It is no secret that factors such as the design of a building, corridor, hall, office, temperature, access to light, acoustics, sound insulation and air quality affect not only labor productivity, but also the health of employees.

In most cases, the air quality inside the office is significantly worse than outside. This is explained by chemical impurities of various construction and finishing materials, wall equipment, furniture and other substances that may contain toxic substances.

AND IN TALAN TOWERS
WE CAN BREATHE
DEEPLY. THE FILTER
SYSTEM REPEATEDLY
CLEANSES THE AIR,
AND THE FRAGRANCE
SYSTEM ALLOWS YOU
TO FEEL THE SUBTLE
AROMA IN THE ROOMS.





It is worth noting that the Talan Towers Executive Hub offices are located in the complex, which are located on the 12th, 22nd, 24th, 25th floors. Green walls are the best solution created to revitalize the space and give people peace of mind and inspiration. Unlike a traditional garden, such a wall takes up less space, requires 80% less water and use the library, lounge area. brings significant health benefits. Refreshes the air, suppresses noise Talan Towers has brought

and anxiety in the office space, increases creativity and lifts the spirits of tenants.

The library is an indispensable place for awakening new ideas, informal conversations and rest from work. Tenants of Talan Towers Executive Hub offices can move from one floor to another and

It has been said that

innovations not only to our capital, but also to the entire region. Although the concept of "green" buildings has been popular all over the world for more than twenty years, it is still a new world for us. Therefore, it is obvious that Talan Towers will become a benchmark and a motivational incentive for the development of this concept in the future.



### **TALAN TOWERS COMPLEX**

Talan Towers Offices – are international-level category "A" offices located in the business center of the capital. The level of service provided by the professional lynks property management team, developed infrastructure, security services, fire safety, modern parking turned Talan Towers Offices into a business center that meets all international standards.

The windows of The Ritz-Carlton Astana 5\* Suite Hotel offer sweeping views over the modern capital. The hotel's infrastructure consists of conference halls for business meetings, ceremonial and official events, restaurants with fine cuisine, a club lounge, as well as a spa and fitness center that will hit the taste of the most demanding guests.

The Ritz-Carlton Residences Astana is 27 luxury apartments, distinguished by a unique style, refined interior. Residence owners can take advantage of everything from concierge services to their own residence infrastructure.

**TALAN Gallery** is a shopping gallery with an area of 8000 sq. m, combining two towers of the Talan Towers complex. The most popular premium brands in the world are located here.

**Talan Towers** presented new products not only in Nur-Sultan, but also throughout the region. Although the concept of "green" buildings has been used all over the world for more than twenty years, it is still a rarity in our region. Therefore, Talan Towers is a building that other buildings will go for and an example for them.



# of cryptocurrencies in Kazakhstan





### Cryptocurrencies

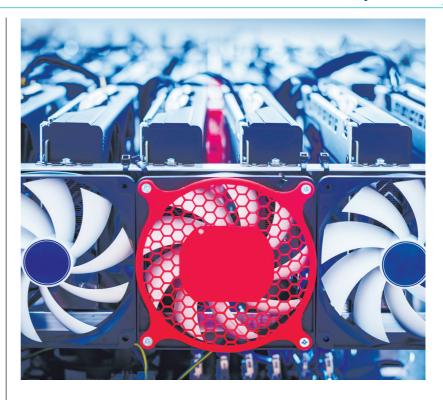
appeared as a reward for performing a set of complex cryptographic algorithms and forming chains in blocks.

### Blockchain

or distributed registry technology is a decentralized, reliable system for storing data in encrypted form.



Sapar Akhmetov, the Chairman of the Management Board of Kazakhstan Association of blockchain technologies



he global development of technologies of the IV Industrial Revolution, including the spread of the Internet, the availability of up-to-date information, the emergence of social networks and messengers are forming a new way of life, opening up wide opportunities for humanity.

Currently, two of the most promising technologies are developing rapidly in the world blockchain and artificial intelligence. Public has some understanding about artificial intelligence based on science fiction works, whereas only a small part of the population of our country has an understanding of blockchain technology.

Blockchain or distributed registry technology is a decentralized, reliable system for storing data in encrypted form. It ensures transparency, stability and data security.

The range of applications of blockchain technologies is expanding every day, including such important areas as medicine, public administration, sports, culture, finance. The use of blockchain technology in the financial sector

has become an impetus for the rapid development of cryptocurrencies.

Cryptocurrencies appeared as a reward for performing a set of complex cryptographic algorithms and forming chains in blocks.

The most famous cryptocurrency in the world – bitcoin, originates in 2008, when an unknown person or group of people under the pseudonym Satoshi Nakamoto published a description of the protocol and how bitcoin works. The first launch was made on January 3, 2009, during which the first block was made and the first 50 bitcoins were generated. The main feature of bitcoin and its key advantage is its limited issue - 21 million bitcoins. Due to this, demand is ensured and inflation is leveled.

Over the past 10 years, blockchain technology and bitcoin have transformed the global economy by providing an alternative perspective on financial services. A secure and inaccessible system with a limited issue began to attract an increasing number of investments. Now the cost of 1 bitcoin (as of 10/19/2021) is US\$62,700 and its dominance in the entire cryptocurrency market is 47.1%. Which means a huge interest

of institutional investors and major players in the production of the first cryptocurrency.

In Kazakhstan, in order to develop the crypto industry, the law "On Amendments and additions to some legislative acts of the Republic of Kazakhstan on the regulation of digital technologies" was adopted, which legalized digital mining of cryptocurrencies. This year, the President has signed the law on taxation of digital mining, which comes into force on January 1, 2022. Kazakhstan Association of Blockchain Technologies participated in development of this law.

The existing legislative regulation of the crypto industry and the inexpensive cost of electricity has led to the fact that Kazakhstan, according to the Cambridge Center for Alternative Finance, was ranked second in the world in terms of global computing power. As a result of the ban on the crypto industry in China, investors from China and other countries began to move to Kazakhstan, bringing with them advanced technologies and qualified personnel for the deployment of world-class data centers and the formation of local personnel.

However, bitcoin mining has a technological feature. As previously mentioned, solving complex cryptographic algorithms requires high-performance equipment that consumes electricity. The growing interest in mining increases the number of equipment and, as a result, the increase in electricity consumption. And our country is facing with a shortage of this element.

According to the Ministry of Energy of the Republic of Kazakhstan, a deficit is already being formed in the country, which needs to be filled at the expense of renewable energy sources (hereinafter – RES). According to Minister Magzum Mirzagaliyev, the Ministry has planned to increase the share of renewable energy in Kazakhstan from the current 3% to 6% by 2025 and 15% by 2030.

On the part of the Kazakhstan Association of Blockchain Technologies, we support this solution for generating additional electricity at the expense of solar, wind and gas power plants.

If you look at the international experience, such mining companies as Iris Energy, Greenidge Generation, Gryphon Digital Mining, specializing in green mining of cryptocurrencies, successfully conduct their activities with a zero carbon footprint. Major cryptocurrency mining players such as Marathon are deploying "green" data centers in Texas. If Kazakhstan wants to maintain a leading position in the production of cryptocurrencies and become an attractive center for crypto investors, it is important to increase the share of "green mining" in the country. However, we should remember that Renewable energy sources have their own characteristics – dependence on the weather, utilization of waste stations, the high cost of manufacturing



components, high prices for tariffs, an uneven schedule of electricity supply, requiring grid balancing. In this connection, it is too soon to declare confidently that RES will be able to replace the current power plants. Since a constant source of energy is needed to balance power grids throughout Kazakhstan.

In this regard, the Kazakhstan Association of Blockchain Technologies expresses its support in the President's initiative on the necessity of construction of nuclear power plant to provide the country with "green" and affordable electricity. This will help to make the country independent from carbon.

I would like to emphasize that blockchain technology does not necessarily require such a large



amount of electricity. So, at the moment, the number of blockchains based on the Proof-of-Stake consensus algorithm is growing, functioning like a deposit in a

bank, which are 99% more environmentally friendly

and hundreds of times more energy efficient due to a

different principle of operation. In this regard, I would

like to dispel the myths about the unequivocal harm to

nature from cryptocurrencies. Globally, the situation around the crypto industry is developing positively. El Salvador has accepted bitcoin as a legal payment instrument. The price of bitcoin is moving to new highs. Exchange-traded funds (ETFs) for bitcoin are being launched in the USA. Governments of all countries are studying and developing their own

digital versions of national currencies. The National Bank of Kazakhstan is also planning to test the digital tenge. In the USA and Europe, cryptocurrencies are allowed, and this industry is developing by leaps and

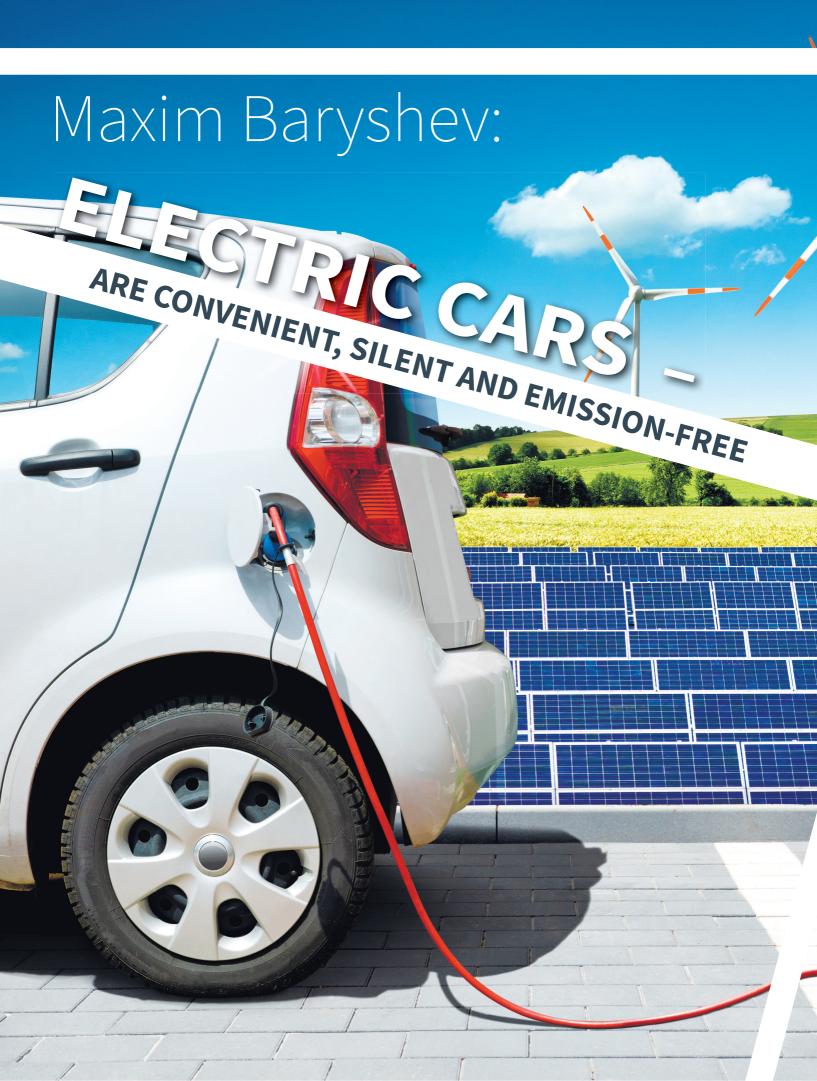
KAZAKHSTAN NEEDS TO USE THE RAPID **DEVELOPMENT OF THE INDUSTRY IN THE COUNTRY** TO CREATE THE INFRASTRUCTURE OF THE CRYPTO INDUSTRY (EXCHANGES, EXCHANGERS). ACCORDING TO OUR ASSOCIATION, THE MAIN ADDED VALUE IS FORMED DURING TRANSACTIONS. IN THIS REGARD, WE HAVE BROUGHT A PROPOSAL TO THE GOVERNMENT TO LAUNCH A PILOT PROJECT FOR CREATION OF CRYPTO EXCHANGE WITH PARTICIPATION OF NATIONAL BANK THE REPUBLIC OF KAZAKHSTAN AND THE GOVERNMENT OF THE REPUBLIC OF KAZAKHSTAN WITHIN THE PREMISES OF ASTANA INTERNATIONAL FINANCIAL CENTER. THE PROJECT IS SCHEDULED TO BE LAUNCHED IN 2021.

In addition, the Association is working on translating key books on blockchain technology into Kazakh for further distribution of books among universities and schools on a free of charge basis. Together with Astana HUB and the IT community, work is underway to hold a project competition for socially important areas.

Summing up the above, it seems advisable not to miss the leading positions in the industry, measured at US\$2.5 trillion (according to the CoinMarketCap service). The introduction of any restrictions will mean the loss of significant tax revenues to the budget and the prospects of Kazakhstan becoming a Eurasian economic hub.

From an energy point of view, it cannot be excluded that investors who have come to Kazakhstan for a long time will be interested in the construction of renewable energy sources. However, this takes time, and the Kazakhstan Association of Blockchain Technologies suggests that the Government jointly develop a Roadmap for the development of renewable energy in the field of cryptocurrency mining.

Digital mining and the crypto industry have become one of the energy consumers in Kazakhstan, creating a trend towards the development and application of modern technologies in electricity generation. Thus, the ban on digital mining will only lead to a temporary relief of the problem with the shortage of energy resources, an increase in illegal mining, as well as a general decrease in the investment attractiveness of the country. **3** 









**)** What is the state and prospects for the development of the electric vehicle segment in our country, what has already been done in this direction and on what points should efforts be concentrated - this and much more in an interview of our correspondent with Maxim Baryshev, the chairman of the Regional Council of the National Chamber of Entrepreneurs "Atameken" in Almaty, the founder of "Uchet" group of companies.



Such benefits and other indulgences really motivate people to purchase ecofriendly transport.

- Maxim Anatolyevich, the issue of "greening" of our economy has become one of the most important on the agenda. As you know, today transport accounts for a significant portion of emissions and pollution, especially in large cities. You are an active protagonist of the development of the electric vehicle fleet in our country. How relevant, timely and feasible is the task of switching to electric vehicles in our country?
- My personal motivation to become "eco-friendly" was the strongest hurricane that occurred in the foothills of Medeo in 2011, which felled many trees. After this incident, I planned the construction of an eco-office and changed my car to an electric car, because I realized that the human impact on the environment was enormous and the natural disaster that occurred near Almaty was to some extent a consequence of human carelessness.

Also, an electric charging station was installed near our eco-office so that other electric vehicles could be charged. Charging is carried out from solar energy, as solar panels are installed on the roof of the office, which generate energy not only for the building, but also for charging stations. The urgency

of switching to electric transport is obvious - the absence of harmful emissions from recycled fuel. I would like to draw special attention of cyclists and scooters who ride along the roads to the fact that they breathe exhaust gases that are particularly harmful to the respiratory tract. Global warming is also an important factor in my personal ecoinitiative, it is not for nothing that almost 200 countries signed the Paris Agreement in 2015. And an increase in the average temperature by 1.5 degrees will lead to man-made disasters. According to the International Labor Organization, such an increase in temperature can lead to a reduction in working hours on the planet by more than 2% in 2030. It seems that the figures are insignificant, only 1.5 degrees and 2%, but for the labor market, this is a loss of US\$2.4 trillion. As a result, 132 million people will be below the poverty line.

There is an urgent need to switch to electric vehicles to preserve your health. The switching to electric cars will be possible with affordable prices for the electric cars in our country. The cost of an electric car should not exceed 10 million tenge. Moreover, a state program should be developed to stimulate the switching to electric traction, and then the switching to electric transport will become quite real and feasible. Developed Western countries and China have long stimulated the transition to electric cars with state subsidies. If over the next 30 years, the number of electric cars reaches the half number of all cars, this will reduce global carbon dioxide emissions into the atmosphere by 1.5 gigatons per year, which is comparable to the emissions of the whole of Russia in 2017.

- Recently, you organized the First Kazakhstan online conference on the development of a fleet of environmentally friendly cars Kazakhstan Electro Drive and within its framework spoke on the topic of international experience in supporting the development of an electric vehicle fleet. What support measures exist in Kazakhstan today and to what extent do they

### correspond to international best practices? Which country is the leader in the development of this segment today?

- Since March 16, 2020, the Council of the Eurasian Economic Commission has decided to set the rate of import customs duty in the amount of 0% of the customs value of the Single Customs Tariff of the Eurasian Economic Union for certain types of motor vehicles with electric motors. The zero rate is effecive from January 1, 2021 (on the territory of the Republic of Kazakhstan) until December 31, 2021 inclusive and is applied when importing electric vehicles to the EAEU by both legal entities and individuals.

By the order of the Minister of Ecology, Geology and Natural Resources of the Republic of Kazakhstan dated May 13, 2021, the recycling fee for all vehicles (cars, trucks, buses) with electric motors, with the exception of vehicles with a hybrid power plant, is zero.

Moreover, a project was developed to make additions to the "Rules for the use of communal paid parking lots (car parks, parking lots) of the city of Almaty" to expand the list of categories of persons entitled to free use of parking spaces in paid parking lots in Almaty. The list included electric vehicles. To date, these changes have not yet been adopted. The document was in open discussion until April 12, 2021.

Such benefits and other indulgences really motivate people to purchase eco-friendly transport. For our city, the problem of ecology is one of the most important, and the akim, the President, and the citizens themselves often talk about it. It is also worth adding that in many large cities of Europe, the USA and Asia, parking companies-operators install universal paid chargers for electric vehicles at their own expense. Every 10-15 parking spaces are equipped with charging stations, which only increases the popularity of electric cars.

Also, passenger cars equipped exclusively with electric motors are not taxed on vehicles, since the transport tax is calculated from the engine volume. EV owners in Kazakhstan have such advantages.

Regarding the city of Almaty, electric vehicles are provided with free travel on the Shymkent GC, as well as free parking on the Kok-Tobe.

According to the global trend, Norway became the leader in the growth of the electric car market in 2020, overtaking other Scandinavian countries, as well as China. In general, Europe is a leader in this industry. The USA is the largest exporting country of electric cars around the world.

The measures taken in our country to stimulate the electric car market are quite effective, but we

cannot limit ourselves to this list. For example, in Germany and France the purchase of electric vehicles is subsidized by the state, which makes buying a car much more affordable.

- An important issue in the development of the electric vehicle segment is the development of appropriate infrastructure. These are both electric gas stations and the necessary service for servicing electric vehicles. The lack of infrastructure development (apart from the price) is probably one of the factors pushing consumers away from electric transport today. How to change this situation? What initiatives are being implemented in this regard, including at the regional level?

 Today many owners of electric cars install charging stations right at home and charge cars at night, like cell phones. Also, at the moment, the construction of charging stations at conventional gas stations, in shopping malls and other publicly accessible locations has begun. If we take the example of European countries, there are separate parking spaces for electric vehicles. These parking lots are equipped with charging stations.

At the moment, Kazakhstan lacks a full-fledged infrastructure for charging electric vehicles not only in the city, but also on intercity routes. This infrastructure is simply necessary for full-fledged travel within the country. At a minimum, fast charging stations are needed along the routes between the cities of Nur-Sultan, Almaty, Shymkent, Turkestan and other major cities of the country.

Thus, at our Kazakhstan Electro Drive conference, the Vice-President of the Automobile Business Association of Kazakhstan Anara Makasheva spoke. She noted that Kazakhstan already has a roadmap for the development of infrastructure for electric vehicles and hybrids, suggesting a set of measures that will encourage citizens to purchase environmentally friendly transport. The roadmap will provide benefits to consumers at the EAEU level.

And Vice-Minister of Ecology, Geology and Natural Resources of the Republic of Kazakhstan Akhmetzhan Primkulov noted during his speech at Kazakhstan Electro Drive that this is a relevant and timely issue for Kazakhstan. That is why the new Environmental Code of the Republic of Kazakhstan came into force on July 1. It assumes stricter requirements on emissions and climate change. After all, according to him, the main source of emissions in Kazakhstan is vehicles operated for over 10 years. The Vice-Minister also noted that the transition of the population to electric transport is an important moment in the fight against climate

change. He added that together with the operator of the EPR, work is being carried out to install charging stations for electric vehicles in the cities of Kazakhstan in accordance with international standards. 52 ECS have already been placed in Nur-Sultan, 50 ECS – in Almaty. They are mainly located near administrative and socially significant facilities, shopping malls and in densely populated areas.

- Transport for own needs and transport for public needs are slightly different segments. A private driver, as they say, will think seven times before buying an electric car, and for im/her the issues of ecology and air pollution will probably not be in priority. For such buyer, the price, costs and procedure of registration (importation), taxation, maintenance, availability of refueling, work in the climatic conditions of our country, fuel endurance are important. For municipalities, after all, the issues of ecology and pollution are acute perhaps this can explain the purchase of electric buses in Nur-Sultan. How do you think is it possible to expand the possibilities of using the fleet of electric vehicles for public

start? - At the end of the day, the maintenance of electric vehicles is much cheaper than cars with internal combustion engines. There is no need to change the oil, filters, no need to refuel. For five years of operation of my electric car, I changed only the cabin filter. This is very economical for users compared to cars with internal combustion engines. There are nuances on public transport. For example, a good example of ecofriendly transport is a trolleybus. But

due to the complexity of laying and

needs? Maybe that's

where we need to

### **Today electric cars**

in Kazakhstan are much more expensive than a regular car, which, of course, does not contribute to the popularization of this transport.



maintaining infrastructure, trolleybuses cannot be everywhere. Electric buses and electric taxis that travel around our cities are a new eco-friendly direction in public transport. Its purpose is not to pollute the public space in the city with emissions. Convenient, noiseless, no emissions – it is these principles that should be followed to develop public transport and urban space. Public electric transport saves fuel, reduces air pollution, and will also become a living example of the popularization of EV among the population. Therefore, I think that all public transport should be converted to eco-friendly fuels.

As to the issue of infrastructure.
 Today, the gas stations that we see, for example, in Nur-Sultan are powered by electricity received from traditional coal generation. Moreover, purchased electric buses for public needs are charged according to the same principle. Don't you think

the whole point of switching to electric cars will be lost? Maybe we should initially lay down the principle of powering such gas stations by renewable energy sources?

that in case of this scenario,

- Electricity is generated from both renewable energy sources (hydroelectric, wind, solar) and nonrenewable (coal, gas). Electricity generation from renewable sources is increasing in Kazakhstan every year. By 2060, Kazakhstan should reach carbon neutrality. The process of development of electric transport and the transition to



renewable energy are implemented in parallel. Moreover, the cost of 1 kW of energy from renewable energy is decreasing every year. I think it will be cheaper to build renewable energy generators within 10 years than coal-fired or gas-fired power plants.

- An important component is the development of production and local content. We agree with your opinion that Tesla is unlikely to allow the production of electric vehicles of its brand in our country. Nevertheless, we are all well aware of the attempts of our automakers to produce electric vehicles. Do you think this experience is successful? What can be the competitive advantages of Kazakhstan in this area?
- Since the 1950s, deposits of nickel and cobalt were discovered in Northern and Eastern Kazakhstan. They are used in the production of batteries, in particular batteries for electric vehicles. It is quite possible that in this shallow deposit both nickel and cobalt can be mined in an open pit. This will allow the production of batteries in Kazakhstan and their disposal, including for other countries. I would like to note that it is necessary to develop the production of batteries, and not the export of raw materials, as this means higher margins, added value and jobs created, as well as foreign exchange earnings from the sale of batteries. Therefore, I think it is necessary to build a plant in Kazakhstan for the production of batteries for EV.

- The last question is about prices. If we compare electric cars and cars operated with traditional fuel, are the electric cars competitive now? Is there a tendency to reduce their cost? How much does it cost to maintain such a car? And, if it's alright with you, a personal question: what kind of car do you drive yourself?
- Today electric cars in Kazakhstan are much more expensive than a regular car, which, of course, does not contribute to the popularization of this transport. Of course, I would like their cost to be no more than 10 million tenge. To increase the attractiveness, the import customs duty rate is now equal to 0% of the customs value of the Single Customs Tariff of the Eurasian Economic Union.

The price of EV remains high and unaffordable for most of the population, because now the demand for such cars exceeds the supply and many order electric cars a year in advance. I think prices will gradually begin to decline when the mass production of EV is established by the leaders of the automotive industry, who have already started producing or developing their electric cars.

I have a Tesla Model X. I think that the maintenance of electric vehicles is much cheaper than cars with internal combustion engines. Fuel economy, no need to change the oil. As I said, for five years of operation of my car, the only thing I changed was the cabin filter.

Thank you for the interview!





### Kazakh-German University

trains personnel for transition to carbon neutrality

### Alexey Kobzev,

Project Manager for Renewable Energy and Climate Change at the Kazakh-German University (DKU)

### Dana Zhunissova,

Project Specialist (Junior) of Institute of Natural Resources of the Kazakh-German University (DKU)



**??** The climate agenda is closely connected to the development of the energy industry. To help combat the effects of climate change, the countries are undertaking and approving a number of ambitious climate goals, including the transformation of the energy sector. Kazakhstan has consistently demonstrated its commitment to achieving the declared energy and climate goals, including support for the development of renewable energy and decarbonization of the energy sector. We are all aware that a new reality is coming, which requires urgent action to move to a more sustainable energy sector. 99

### EXPEDITION OF YOUNG SPECIALISTS TO RES FACILITIES IN KAZAKHSTAN

For reference, on October 31, 2021, the UN Climate Change Conference – the 26th session of the Conference of the Parties of the UN Framework Convention on Climate Change (UNFCCC COP-26) started in Glasgow. On November 1, 2021, in his speech at this conference, Prime Minister of the Republic of Kazakhstan Askar Mamin noted that in order to fulfill its international obligations under the Paris Agreement to reduce greenhouse gas emissions, Kazakhstan intends to reduce greenhouse gas emissions by 15% by 2030; aims to increase the amount of energy from renewable energy sources to 15% and from environmentally friendly sources to 38%; plans to reduce the share of coal generation from 70% to 40%; increase the carbon dioxide absorption potential by planting over 2 billion trees by 2025; adopted a new Environmental Code; and will soon

finalize the development of a strategic document to fulfill the commitment to achieve carbon neutrality by 2060. The transition to carbon neutrality will provide a path to sustainable energy.

Due to comprehensive measures to decarbonize the economy, increase energy efficiency in all sectors of the economy, carbon capture and storage technologies and other innovations, electrification, widespread use of renewable energy source and environmentally friendly sources, effective management of water, land and, in general, natural resources and capacity-building of specialists, Kazakhstan will achieve its goals in this direction.





In addition, Kazakhstan is ready to act as a Regional climate hub for combining efforts for sustainable development in Central Asia. This center will facilitate the attraction of "green" financing, technology transfer, innovation and knowledge exchange in the region. It is important to note that at the Glasgow Summit, Kazakhstan adopted a Declaration on the Protection of Forests and Land Use and a Commitment to youth education and involvement. We are confident that on the way to achieving these ambitious goals, our activities and accumulated experience would help attract students and young professionals, train international-level personnel for strategic management in the field of renewable energy and energy efficiency and integrate solar, hydro and wind generation into energy systems, as well as develop the necessary training programs and practical expeditions taking into account the analysis of the renewable energy market in Kazakhstan and Central Asia.

Despite the pandemic, the renewable energy sector around the world shows a high growth rate, but this is still not enough. According to the results of a study by PwC Kazakhstan "The renewable energy market in Kazakhstan: potential, challenges and prospects", despite the fact that the first milestone was successfully completed, and in Kazakhstan the growth of renewable energy amounted to 3% in electricity production in 2020, respondents noted a number of challenges, such as revision of the legislative framework taking into account the current development of renewable energy, lack of balancing capacities and uncompetitiveness of established tariffs, financial risks of investors, expensive accumulative technologies, insufficient incentives for the development of microgeneration and other problems arising during operation of facilities and connection of renewable energy sources to the National Grid System of the country. We can observe how the topic and popularity of renewable energy and alternative energy sources has developed over the past decade, as well as the declining cost

of electricity generation costs. This implies the paramount importance in increasing the potential of existing specialists and training new personnel.

What could be better than the knowledge gained in practice? In our case, knowledge obtained during the educational expedition "Renewable Energy Trip 2021" (hereinafter - RE Trip 2021) to renewable energy facilities to study the best practices of using renewable energy sources in Kazakhstan. We would like to note that this is the fourth trip organized by the Kazakh-German University (DKU) with the support of international and regional partners, public and private institutions. This year, DKU carried out this expedition jointly with the Ministry of Energy of the Republic of Kazakhstan and with the support of the project of the United States Agency for International Development (USAID) "Power Central Asia", the Regional Environmental Center of Central Asia, significant assistance was provided by "Qazaq Green" Association.

The main purpose of the trip was to visit renewable energy facilities in Kazakhstan, which allowed the participants to study solar, wind and hydroelectric power plants in practice, better understand their technical and technological features, prepare cases of best practices on renewable energy and discuss existing challenges and opportunities for the introduction of new renewable energy in the framework of informational meetings with the management and leading engineers at the stations, as well as expedition participants – specialists from Central Asian countries.

More than 140 applications from Central Asia participated in the competition. As a result of careful selection, the commission members selected 16 winners from 4 Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan), including undergraduates of the DKU educational program "Strategic Management of Renewable Energy and Energy Efficiency". The main selection criteria were education and experience in the field of renewable energy and further application of the knowledges obtained during the trip in writing theses, dissertations and scientific papers. The expedition was led and accompanied by DKU employees Alexey Kobzev and Dana Zhunisova.

One can agree to a certain extent with the Roman orator and educator Quintilian, who said that "practice without theory is more valuable than theory without practice," because the beginners and practitioners were able to comprehensively enrich themselves with practical knowledge by applying mastered theory and education and

discuss with managers, engineers and like-minded people.

The route of the trip consisted of two parts: the Southern and Northern route through Kazakhstan. The South of Kazakhstan included a visit to the Nurgisa 100 MW Solar Park, Merken HPP-1 and -2, and Burnoye Solar 1 and 2 SPP. The northern part of the expedition in Kazakhstan consisted of a visit to the Nura SPP, Saran SPP, the First WPP near Yerementau, the Renewable Energy Landfill and the NURIS PI, as well as the Astana EXPO-2017 WPP and the Flower of the Almighty Mosque with zero energy consumption in Nur-Sultan.

At the beginning of the expedition, on October 4, a round table was held on economic mechanisms to support the development of renewable energy in Kazakhstan (the role of the



government and international organizations), followed by a trip and a visit to the 100 MW Nurgisa 100 MW Solar Park near Kapshagai. Energy production at this plant in 2020 amounted to 160,123,774,800 kWh, and the SPP conditionally reduces CO<sub>2</sub> emissions into the atmosphere by 150 thousand tons per year. A total of 303,048 polysilicon solar panels with a capacity of 330 watts each have been installed. This facility uses the experience of Singapore and China in the development of solar and wind energy, as the project is implemented by a subsidiary of Singapore's Eneverse Kunkuat PTE LTD. This company is also planning to implement five renewable energy projects: 2 SPP and 3 WPP.

The next day, the participants visited Merken HPP-1 and HPP-2. Small hydroelectric power plants are located on the Merke River in the Zhambyl region. Small (0.5 MW and 1.5 MW), but necessary sources of electricity for the settlement. The cost of electricity close to market prices, short payback periods and insignificant impact on the environment can attract investments in the development of small hydroelectric power plants.

The very first SPP in the history of our country "Burnoye Solar" met the participants with windy weather, and the representatives of the station with a warm smile and joy shared their experience and knowledge accumulated over 6 years of operation of the facility, answering all the questions of the participants. Two types of photovoltaic modules are used at the SPP: monocrystalline (manufactured by Germany "Solar World") and polycrystalline (manufactured by



China "Jinko Solar"). The total capacity is 100 MW. These SPP make a significant contribution to the increase in electricity generation in the southern energy-deficient region of the country.

Inspired young and practicing specialists continued the expedition and flew to Nur-Sultan and next visited the Nura SPP in the Akmola region. This is the first foreign project of the Hevel GC with a capacity of 100 MW, implemented on the principle of a full cycle using Russian and foreign equipment. Here, the participants learned more about existing innovative technologies, such as integrated solar tracking systems (uniaxial trackers), heterostructural two-sided solar modules of Russian manufacture, which thanks to the back side provide additional energy generation and the use of "smart" inverters to convert direct current from solar modules to alternating and process control via WiFi network.

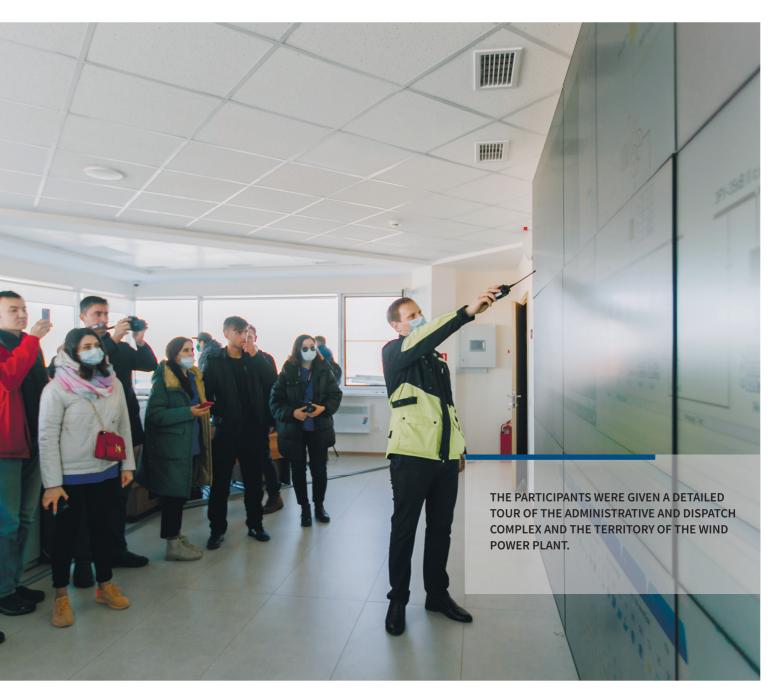
SPP "Saran" in the Karaganda region became the next point of visit in the route of the expedition. This project was implemented by an international team of experts and investors from Germany, Slovakia and the Czech Republic. Evgeniy Grebennikov, CEO of "SES Saran" LLP, welcomed the participants and told about the existing legislative framework in the Republic of Kazakhstan, the history and construction of one of

the most powerful SPP in the country, about the conducted analyses of the region and the payback of such projects and the relevance of choosing a profession in the field of renewable energy. The installed capacity of the SPP is 100 MW. Innovative technologies are used at the facility – glass-glass solar panels, a Barrier system along the fence. The company also contributes to the development of human capital and the city of Saran. It should be noted that Schneider Electric inverter stations are used here with the use of "smart" solutions that can automatically detect breakdowns and check the availability of spare parts in stock and order them. The generated electricity is supplied to the common grid and thereby reduces the shortage of electricity. Annual electricity generation is about 160 million kWh.

Then it was the turn of the "First WPP" near the city of Yerementau. The capacity of the Yerementau WPP is 45 MW, the volume of electricity production amounted to 159 million kWh in 2020. 22 wind power plants manufactured by Fuhrlaender Wind Technology (Germany) with a capacity of 2.05 MW each are installed at the site of the wind farm. The wind farm significantly contributes to the reduction of greenhouse gases, the engineering and technical staff consists of local specialists, it is planned to expand it to 300 MW,







and the station is located in the most favorable place according to experts.

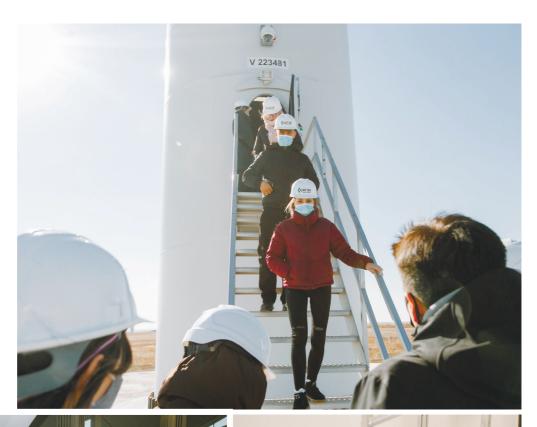
The next point of visit was the landfill of renewable energy sources of "NURIS" PI. This is a good place for innovations in the field of renewable energy and energy efficiency for young people and everyone. Here you can see how photovoltaic panels, solar collectors, hybrid wind generators, ground heat pump, as well as see an energyefficient Shell Yurt house with autonomous energy supply based on renewable energy sources.

The "Astana EXPO-2017" WPP was remembered by everyone for an interesting discussion and a

developed infrastructure. WPP in the Kostomar settlement, Akmola region with a capacity of 100 MW with 29 wind turbines manufactured by Vestas (Denmark) was implemented by "TSATEK Green Energy" LLP. It is worth noting that all installed wind generators are adapted to the cold climatic conditions of the region, and these turbines also use a full-cycle converter, which contributes to the best integration into the national energy system and has a full-scale converter system. The participants were given a detailed tour of the administrative and dispatch complex and the territory of the wind power plant.

IN CONCLUSION, THE PARTICIPANTS VISITED THE WORLD'S FIRST MOSQUE WITH ZERO ENERGY CONSUMPTION "ALLANYN GULI – THE FLOWER OF THE ALMIGHTY" IN NUR-SULTAN.

The uniqueness of the mosque lies in the fact that this mosque uses only renewable energy sources. It is surrounded by solar panels, the total area of which is 1.2 thousand square meters. They provide electricity, and all the surplus can be sold to the city.





#### FEEDBACK FROM PARTICIPANTS

- An informative trip that allowed us to analyze the existing renewable energy facilities in the territory of the Republic of Kyrgyzstan, it is very important to adopt the experience of the



of renewable energy systems (the total volume of electricity

to RET rip 2021, it was possible to visit renewable

We are confident that Renewable Energy Trip contributes to the development of competencies of specialists and students, professional development and dissemination of knowledge in the field of energy efficiency, renewable energy and alternative energy sources. Next year we plan to add a large number of power plants, including outside Kazakhstan, and enrich the program of the trip with discussions of new forms and methods of energy production and storage, including hydrogen energy, pumped storage stations, a structure for the development of electric transport.



### **ENVIRONMENTAL CODE**

OF THE REPUBLIC OF KAZAKHSTAN



## THE FIRST PRINCIPLE IS

THE POLLUTER
PAYS AND
CORRECTS

It implies pollution prevention and control measures, but also responsibility for recovery from environmental damage. Thus, the state should create such conditions under which it is more profitable for nature users to take measures to prevent negative impacts on the environment than to pay environmental fines. In a word, the mechanism of "prevention". In addition, the polluter who has caused environmental damage is obliged to restore the environment to its original level.

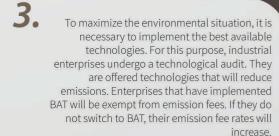


THE SECOND
PRINCIPLE IS
NEW APPROACHES
TO ENVIRONMENTAL
IMPACT ASSESSMENT

THE THIRD
PRINCIPLE IS
THE INTRODUCTION
OF THE BEST AVAILABLE
TECHNOLOGIES (BAT)
AND ECONOMIC
INCENTIVES

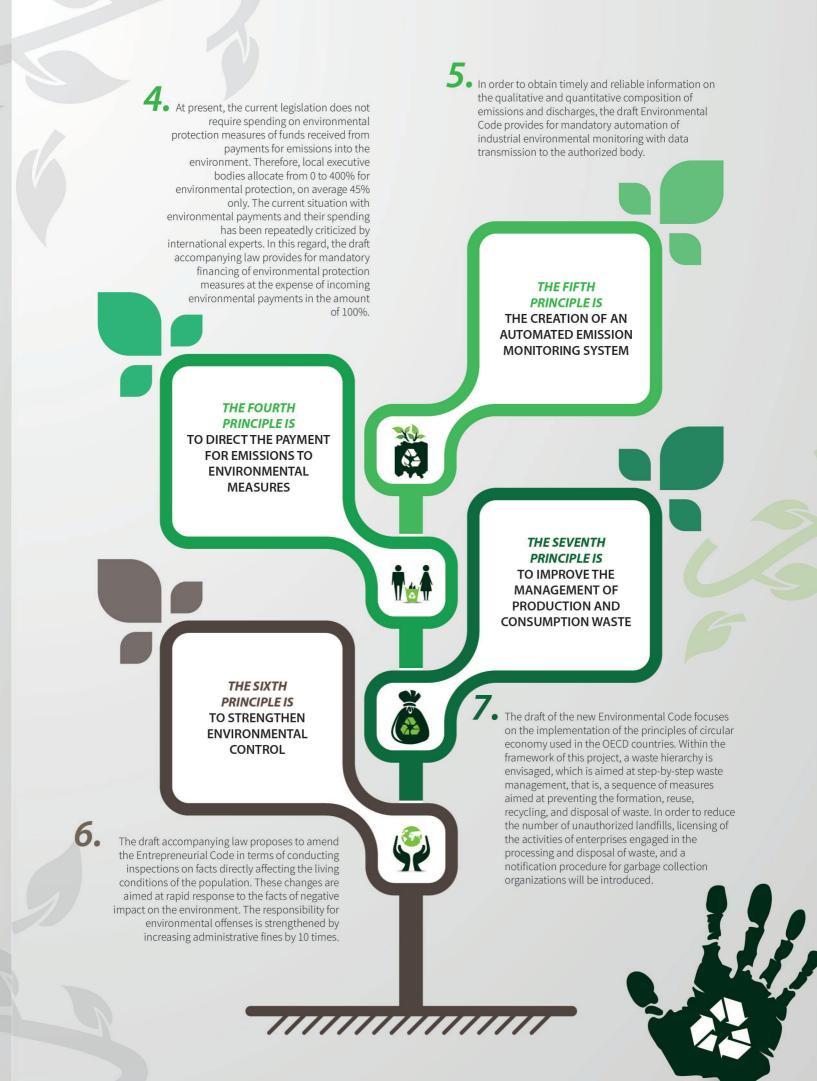


2. According to the current Environmental Code, the requirement to pass the environmental impact assessment procedure (EIA) applies to almost all, that is, 19 thousand enterprises. Such an approach is ineffective and impractical. Therefore, the new Environmental Code proposes to apply this requirement only to 2.6 thousand enterprises of the "first category", which account for 80% of emissions. At the same time, the public participates in all stages of the EIA.











Prospects for the creation of coalbed methane

# extraction industry in Kazakhstan



Coalbed methane is a hydrocarbon, the main component of natural gas. Coalbed methane is contained in coal beds. It is formed as a result of biochemical and physical processes during the transformation of plant material into coal. It is the cause of explosions in coal mines, which in certain conditions lead to disasters.







Chingiz Cherniyazdanov, Deputy Chairman of the Management Board for business development, Kazakh Institute of Oil and Gas



Aidos Temirkhassov, Director of the Upstream projects Department, Kazakh Institute of Oil and Gas



Alexander Logvinenko, 1st category Development Engineer, Kazakh Institute of Oil and Gas

he developed earth depths and promising coal basins concentrate a significant part of the world's coal resources, as well as their complementary rock methane, the scale of which is commensurate with the gas resources of traditional deposits of the world. In this regard, such basins should be considered as methane coal basins, subject to complex phased development, with advanced large-scale production of methane.

CBM (coalbed methane) is a cost-effective and expedient alternative type of energy. This type of energy is justified not only from an economic point of view, but, first of all, ensures the safety of life and environmental stabilization.

Coal beds are considered collectors and a significant source of methane because they store six to seven times more methane than conventional gas collectors do. CBM is found in three different forms: free gas, dissolved gas in bound coal water, and absorbed gas on the solid surface of coal. Despite the huge number of CBMs; it has features that distinguish it from other traditional oil and gas formations. This is due to the low porosity and permeability of coal beds.

Methane is the cleanest source of energy, does not contain harmful impurities, such as nitrogen and sulfur compounds. For example, every year the coal mines of the Karaganda region emit more than 300 million cubic meters of methane into the atmosphere. According to the data of the coal department of "ArcelorMittal Temirtau" JSC, only 17 million cubic meters were disposed annually in 2015-2020. Degassing of coal deposits will

significantly reduce the number of accidents at mines and emissions of harmful substances into the atmosphere.

The production of CBM is economically feasible to solve the problems of local gas supply, the construction of power plants to provide electricity, switch motor vehicles / special equipment from diesel to gas engine fuel.

#### **GLOBAL EXPERIENCE** OF CBM MINING

As follows from the BP statistical report (Fig. 1), the ten leading countries account for 91% of the world's proven coal reserves (the CIS countries - Russia, Ukraine and Kazakhstan – collectively control 27%). At the same time, practical experience should be taken into account, which indicates that the largest amount of gas is contained in semibituminous and bituminous coal. According to the International Energy Agency (IEA), the global production of CBM can reach 200 billion cubic meters by 2035. In the future, by 2050, the volume may reach 1 trillion cubic meters/ year, or 30-40% of the world's natural gas production. At the same time, methane reserves in North America amount to 85 trillion cubic meters, in the CIS countries - 112 trillion cubic meters, in China – 34 trillion cubic meters, and in the countries of the Pacific region – 13 trillion cubic meters. At the meeting of the US-Russian Working Group on Cooperation in the Field of energy, more detailed forecast estimates of CBM reserves were given. In 2005, "Gazprom promgaz" JSC gave its estimate of resources in Russia, the volume of which amounted to 49 trillion cubic meters. According to various estimates, the total reserves of CBM in Kazakhstan amount to ~ 1.1–1.7 trillion cubic meters.

Based on these figures, we can conclude that there is a significant potential for such projects in the CIS.

shareholders: Petro China, Sinopec and the Chinese Geological University.

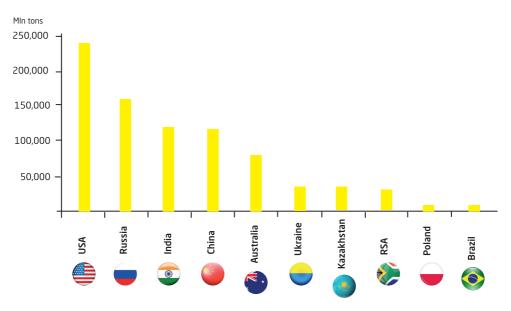


Figure 1. Proven coal reserves

Source: Statistical Review of World Energy 2011 // BP Global homepage

#### **USA**



Commercial mining of CBM was first carried out in the USA in the 1980s. Currently, the United States is a world leader in the exploration and production of unconventional hydrocarbons, including CBM. The development of the industry caused the introduction of strict regulations to ensure industrial and environmental safety of coal mining operations, as well as the effective introduction of new technologies in degassing coal beds. In addition, in order to attract investment in the exploration and production of CBM, a system of tax preferences was approved. Following the United States, countries such as Canada, the United Kingdom, China and India.

#### PEOPLE'S REPUBLIC OF CHINA

In order to develop research in the field of exploration and production of CBM, the Chinese Government organized the China United Coalbed Methane National Engineering Research Center Co., Ltd with state oil and gas corporations as In order to ensure the optimization of the cost of production and sale of CBM, legislative consolidation of tax preferences for settlements of companies investing in exploration and production of CBM has been adopted.

Also, the national operator Petro China Coalbed Methane Company Limited (hereinafter – PetroChina CBM), which is a subsidiary of the largest multinational oil and gas corporation of China Petro China, has been created to develop the exploration and production industry of the CBM.

Production indicators for the production of CBM PetroChina CBM:

- Proven reserves: 386 billion cubic meters;
- CBM production volume: 1.4 billion cubic meters/year;
- Methane content of coal: from 10 to 30 cubic meters/ton.



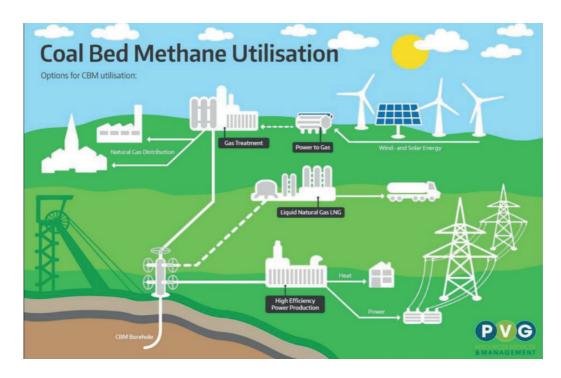


Figure 2. CBM recycling scheme

One of the features of CBM production is a relatively long (1–3 years) period of water extraction (pumping water from coal beds in order to reduce pressure), followed by full-fledged methane production. Fig. 3 shows that only in the second year after drilling the well, the production of CBM reaches the planned level.

#### **COALBED METHANE EXTRACTION TECHNOLOGIES**

There are two fundamentally different ways of CBM production: mine (Coal Mine Methane), obtained as a result of underground degassing of coal mines, and borehole (Coal Bed Methane), obtained by drilling wells and using CBM intensification

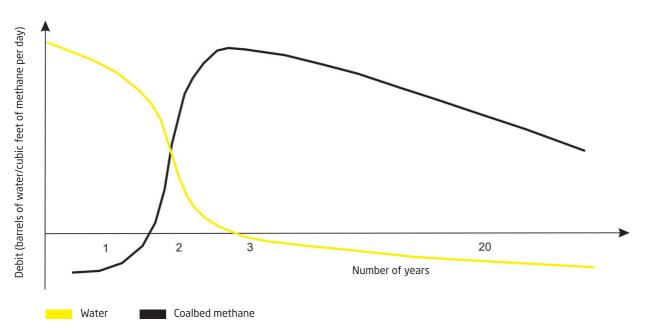


Figure 3. Dynamics of the methane production level when using the water pumping method

technology. On a global scale, coal methane has been used as an alternative energy source for several decades, turning from a problem related to the safety of miners into a valuable, high-quality and environmentally valuable energy carrier.

The essence of all CBM production technologies is the preliminary drilling of wells before the development of coal seams. As a result, the level of methane content decreases, which leads to a significant reduction in the risk of accidents. However, until the early 1970s, despite numerous studies and experiments, this method of removing methane was considered ineffective, and therefore was not widely used. This is due to the fact that the methane extraction process itself is more like oil extraction: it is necessary to use pumps to pump water out of formations. As a result, the pressure in the layers decreases, which leads to the release of gas from the pores of coal. A typical scheme for the extraction of CBM using hydraulic fracturing is shown in Fig. 4.

The concept of development of the gas sector gives fundamental priority to providing the population with natural gas through the gasification of the regions of the country.

The Karaganda basin is the most gas-bearing among the coal basins of Kazakhstan and one of the largest in the CIS. The coal – bearing strata extends to a depth of up to 3000 m. The anticipated methane resources in the basin are estimated from 850 billion cubic meters to 4 trillion cubic meters, which is comparable to the largest gas fields in the world. There is no exact data, because the reserves have not been proved. They can only be legitimized by geological survey. The conducted studies indicate the similarity of this site with the largest field in the USA – Black Warrior, where the production of CBM is 1.5 billion cubic meters/year.

The extraction of methane from the Karaganda coal basin is one of the opportunities to expand the fuel and energy balance of the Republic of Kazakhstan.



Figure 4. CBM mining technology using hydraulic fracturing

## RELEVANCE OF EXPLORATION AND PRODUCTION OF CBM IN KAZAKHSTAN

For the maximum possible and effective use of natural gas, the Government of the Republic of Kazakhstan considers CBM as an alternative and promising type of blue fuel in the concept of development of the gas sector until 2030.

The specific volume of natural gas in the energy balance of the world may be about 30% by 2030. In this regard, interest in non-traditional energy sources has been constantly increasing lately. If the trend to reduce the production of more affordable gas is continued; this will lead to transformation.

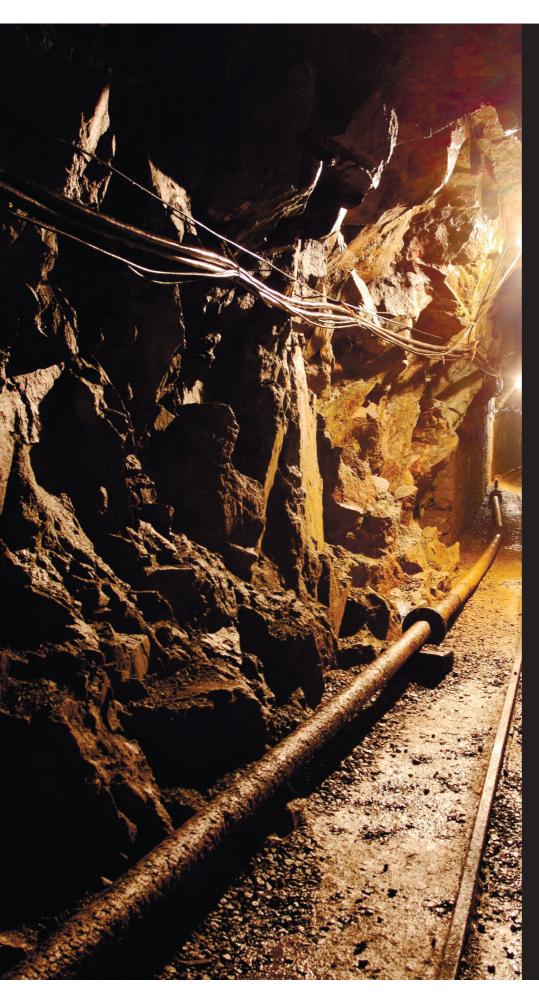
To date, residents of ten regions of the Republic of Kazakhstan have access to commercial gas, while commercial gas is supplied to a number of gasified regions only in regional centers and relatively large cities.

The long-term experience of coal mining in the mines of the Karaganda basin confirms the high explosiveness of coal beds due to the high methane content in coal beds, leading to numerous victims and destruction.

The oil and gas industry deals with exploration, production and processing of CBM; as a rule, coal-mining companies in the Karaganda region do not have the necessary technologies and qualified personnel for the development of such projects.

Currently, industrial and commercial mining of CBM is carried out in limited quantities, degassing is only the preparation of coal beds.

The analysis of international experience clearly demonstrates that the key factor in the development of CBM mining projects is combining efforts of research organizations and industry companies with the provision of state support in the form of tax preferences and simplification of procedures in the field of subsoil use.



#### "KING" JSC

The concept of development of the gas sector of the Republic of Kazakhstan until 2030 defines the vision and main approaches to the phased reform and integrated development of the gas sector of the Republic of Kazakhstan provides for the existing Kazakhstan's significant potential in terms of exploration and production of CBM, in addition to traditional gas resources. In pursuance of the updated Action Plan for the implementation of the instructions of the President of the Republic of Kazakhstan N. A. Nazarbayev on organization of CBM exploration and mining» approved in September 2016 by the Ministry of Energy of the Republic of Kazakhstan, "Kazakh Institute of Oil and Gas" JSC carries out work on geological exploration of the CBM within the framework of the innovative investment project "Extraction of methane from coal beds of the Karaganda coal basin".

"KING" JSC acted as a partner of "ArcelorMittal Temirtau" JSC in the implementation of an investment project for the extraction and processing of CBM. As of 2021, reserves are being determined, meetings are being held with leading domestic and international scientists and service companies dealing with the exploration and production of CBM, with modern technologies and experience in the exploration and production of coalbed methane. "KING" JSC offers projects in two directions: utilization of CBM by creating a GTPP (gas turbine power plant) with a capacity of up to 300 MW, utilization of CBM due to the construction of a plant for the production of gas chemistry (LNG, GTL and other products of gas chemical production). At the same time, "ArcelorMittal Temirtau" JSC plans to achieve a target of 1.5 billion cubic meters of CBM/year by 2027.

The development of the methane-coal deposit provides for the construction of more than 1,000 wells, 26 of them will be built as part of geological exploration in 2022–2024. Investments in the project amount to more than US\$100 million. The enterprise will reach the design capacity of 100 thousand tons of liquefied natural gas in 2025. All projects are planned to be implemented by attracting private

# DEVELOPMENT OF THE CONCEPT OF TRANSITION TO A "GREEN" ECONOMY THROUGH THE CONCEPT OF A "GREEN UNIVERSITY"



Maratbek Gabdullin, Acting Rector of the Kazakh-British Technical University, Candidate of Physical and Mathematical Sciences, PhD



KAZAKH-BRITISH TECHNICAL UNIVERSITY (KBTU) IS THE LEADER OF KAZAKHSTAN'S EDUCATION RECOGNIZED BY FOREIGN UNIVERSITIES AND PARTNERS.

## KAZAKH-BRITISH TECHNICAL UNIVERSITY WAS ESTABLISHED 20 YEARS AGO

"Kazakh-British Technical University" JSC ("KBTU" JSC) was established in accordance with the Decree of the President of the Republic of Kazakhstan. On August 3, 2001, the Decree of the Government of the Republic of Kazakhstan No. 1027 "On the establishment of the Kazakh-British Technical University" (KBTU) was issued.

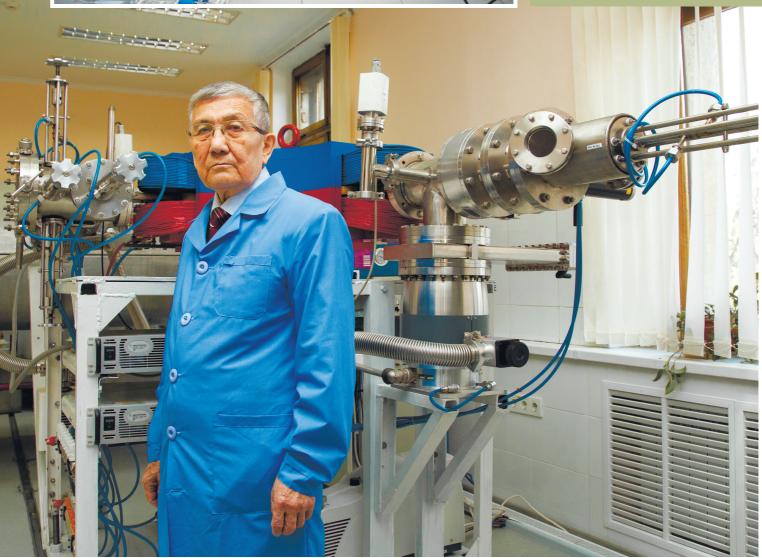
According to the QS EECA rating, KBTU is now among the top ten universities in Kazakhstan and Central Asia. KBTU students regularly become finalists of international Olympiads and competitions. The teaching staff of KBTU comprise leading foreign professors and graduates of the Bolashak program, industrial specialists, graduates of foreign universities and KBTU.

Most of KBTU's educational programs are accredited by international agencies: the "Finance" program has received international accreditation from the Association of Chartered Certified Accountants (ACCA); the only Master in Financial Analysis program in Kazakhstan and Central Asia officially recognized by the CFA (Chartered Financial Analyst) Institute of the USA, and has also been recognized by the international accreditation of CIMA (Chartered Institute of Management Accountants). KBTU confirmed the quality of its programs by receiving confirmation from the ACBSP International Accreditation of the KBTU Business School, which was extended in the 2019-2020 academic year. The University is the only university in the Republic of Kazakhstan and in the CIS that has ABET accreditation





the Republican competition
"Coalition for a Green Economy



of educational programs of KBTU IT specialties, and students of the IT faculty annually become prize-winners of international programming Olympiads ACM ICPC and other prestigious competitions.

It is worth noting the unique international School of Economics of KBTU, which is the only affiliated center of the University of London in Kazakhstan (UK) Teaching Center of Excellence University of London. Bachelor's degree students at the KBTU International School of Economics receive a double degree: KBTU and the University of London. KBTU expands the list of double-degree programs in new and existing specialties with leading universities of the Republic of Kazakhstan and abroad. Thus, the master's program "Bioinformatics" is being launched jointly with Al-Farabi Kazakh National University, foreign students in 2019-2020 from Shanghai Polytechnic University (PRC) studied under the master's program "MBA in Finance", undergraduates "Chemical Engineering of Organic Substances" were trained at the Ecole Nationale Supérieure des Mines de St-Etienne (France), and also entered doctoral studies based on scholarships of the Ministry of Education and Science of the Republic of Kazakhstan and the Ministry of Education of France at the same university.

KBTU is an affiliated member of Harvard Business School and the only representative of Kazakhstan in the international network on Microeconomics and Competitiveness, founded by Nobel Prize winner in Economics Michael Porter.

There are two-degree programs at the master's level in cooperation with USPTU (Russia). Since 2018, there has

been a joint master's program in oil and gas business with Italian partners: Eni corporate university, Turin Polytechnic University and Polytechnic University of Milan with the support of Eni Agip Karachaganak. Students, undergraduates and PhD student have completed a free internship at the Zohr field (Egypt). The annual internship in petrochemical companies abroad is completed at Rompetrol (Petromedia, Romania) by students of "chemical engineering of organic substances" in order to gain real experience and knowledge. To develop scientific research within the framework of the program of the two countries, China and Kazakhstan, on the initiative of Chinese President Xi Jinping, in 2018, KBTU opened a Kazakh-Chinese Center within the premises of the Chinese Petroleum University of Beijing.

THERE ARE EXCHANGE PROGRAMS FOR THE BEST STUDENTS FOR A SEMESTER OR A YEAR, 2+2 JOINT STUDY PROGRAMS FOR BACHELORS AND 1+1 FOR MASTERS, JOINT RESEARCH PROJECTS, ETC.

#### **KBTU - "GREEN UNIVERSITY"**

Today's world trend to preserve the environment is undeniable, and ecology plays one of the leading roles in achieving the goals of sustainable development of the world economy. The development and implementation of technologies that contribute to improving the environmental situation, improving workplace safety, the emergence of new types of economic activities with a focus on waste-free production and improving the quality of life are becoming relevant every day. Therefore, one of the main tasks is to form an ecological culture and









disseminate knowledge among the population and support all environmental initiatives that have been identified in the priorities of the United Nations for Sustainable Development (SDGs). In transition of the global economy to a "green" economy, energy and technology - to "green" technologies, higher education plays an important role in the formation of culture and environment in order to train a new generation of researchers and experts, as well as introduce developments in the field of

alternative energy and ecology.

Kazakh-British Technical University adheres to the UN SDGs and declares the concept of a "Green University", the purpose of which is to create a platform on the basis of the university in alliance with industry and international partner universities for accumulating knowledge, developing new technologies, organizing innovative activities, establishing strong ties with leading experts and government agencies, initiatives of which would lead to the

implementation and introduction of environmental culture among students, employees and dissemination of best practices in Kazakhstan.

KBTU will continue to strengthen innovative and educational activities for the creation and implementation of joint projects and R&D with the attraction of funding and sets the following tasks:

- To involve KBTU teachers, staff and students in the implementation of the "Green University" concept
- To attract investments to improve the environmental infrastructure of KBTU
- To introduce innovative educational programs in the field of ecology and renewable energy and their support
- To attract new partners to the implementation of the "Green University" concept
- To reach the international level and disseminate the results of the "Green University" concept in Kazakhstan

In 2021, KBTU participated in the Republican competition "Coalition for a Green Economy and Development of G-Global", the purpose of which was to identify the best representatives of industry, educational institutions and business in the nomination "best green office", which create and disseminate environmental practices and resource-saving technologies. More than a hundred applications for ten directions participated in the competition, of which 30 winners were identified. Out of a hundred applicants, KBTU was recognized as the best in the nomination "best green office" in the field of education of the Republic of Kazakhstan. This award was given due to the fact that KBTU has been conducting scientific



work in the field of renewable energy sources for many years within the framework of the Scientific and Educational Center for Alternative Energy and Nanotechnology (REC AE&N), as well as through the introduction and use of new technologies at the university and the support of the concept of transition to "green" energy by the entire university community.

#### NANOTECHNOLOGY FOR THE "GREEN" ECONOMY

The Nanotechnology Laboratory was established at the Kazakh-British Technical University on May 2, 2011 under the leadership of Professor K. H. Nussupov on October 15, 2018, and was transformed into the Scientific and Educational Center for Alternative Energy and Nanotechnology. All three levels of educational programs operate within the facilities of the REC AE&N: the educational program (EP) of the doctoral program, effective since 2011, "Nanotechnology and

nanomaterials (by industry)", the master's program "Nanotechnology and nanomaterials (by industry)". The first admission of undergraduates was in 2018 and a new bachelor's degree program "Engineering Physics and technology of new materials", which was opened in 2021 on occasion of the anniversary. The actual admission of bachelors for this EP exceeded the admission plan. This indicates the right direction, the relevance of this educational program.

There are also unique developments in the REC AE&N. One of them is a unique multi-stage wind turbine (wind generator). A highly efficient wind turbine developed and designed in KBTU, for which a patent of the Republic of Kazakhstan, a patent of the European Union and a US patent have been obtained.

The US patent of the Kazakh inventor K. H. Nussupov on Accelerator Technology (Nussupov Kair Method and apparatus for the conveying and positioning of ion implantation targets, United States Patent. US 6,414,328 B1-Jul.2, 2002. – 22 p.) is listed as an "opposed patent" in US patents of such world-famous companies:

- Varian Semiconductor Equipment Associates, Inc. (US8698104; and US20110108742);
- Axcelis Technologies, Inc. (US6794664; WO2004090947A2; and WO2004090947A3);
- Twin Creeks Technologies, Inc. (US8044374; and US20100327181);
  - Vaxis Technologies Llc (US20110121207);
- Atomic Energy Council Institute Of Nuclear Energy Research (US6933511; and US20050104012) - famous scientists Kinzou Shinozuka (US6514146), Adam Alexander Brailove (US8089055);
- In Chinese patents (CN103268850A; and CN103268850B)

There are 14 patents in total. Completed projects in KBTU:

- 1. "Synthesis of thin diamond films in highfrequency discharge plasma at high substrate temperatures", supervisor: Ph.D., Professor K. H. Nussupov.
- 2. "Formation of structure and modeling of parameters of amorphous and crystalline SiCx films grown by physical and chemical methods for solar technology and nanoelectronics", supervisor: Ph.D., Professor N. B. Beisenkhanov.
- 3. Double-sided solar panels at the power plant in the SEZ IP "Alatau". Successful operation for three years. The invested funds paid off due to the generation of electricity.
- 4. Multistage wind power plant on the shore of Kapshagai Lake.
- 5. Solid films for various purposes (Sic, Si, Ti, TiN, Ta, TaN, W2N, Al, Cu).
- 6. Accelerator of light and heavy massseparated ions in KBTU.

The heavy-ion accelerator is being upgraded to synthesize nanostructures and create p-n junctions. Within the framework of grant funding, research projects are implemented, in which undergraduates and PhD students of the REC actively participate. To fulfill scientific goals and objectives, there are more than 20 types of large technological and research facilities for the synthesis and study of thin films. Authors annually publish their articles in highly rated journals and take active participation in conferences and forums.

Creation of multi-stage wind turbines is aimed at converting kinetic wind energy into electrical energy to obtain greater power compared to analogues.

The high efficiency of converting wind energy into electrical energy is achieved due to the modularity of the installation, in which wind

acceleration occurs on each module due to the process of capturing the initial wind flow, as well as ejection and the aerodynamic effect of Coanda by virtual necks and nested cone confusers. A system of truncated cones and virtual necks with optimal aerodynamic dimensions ensures the capture of air flow not only perpendicular to the base of these cones, but also from the side surface of these

In addition, for the 20th anniversary at the REC AE&N, on the initiative of KBTU students, a "Solar Tree" was created. This tree now adorns the facade of the university building. This is a tree with 0.5 kW solar panels, under the branches of which students can relax comfortably and charge their gadgets through special USB outlet. Under the tree there is a small box in which additional equipment (battery, charge controller and inverter) is stored. Decorative lighting with Edison lamps is provided on the tree, where you can feel safe in the dark and have a good time.

KBTU plans to sell such trees in the future to increase environmentally friendly energy sources and improve the landscape design of a modern technological city. The purpose of such projects is to use renewable sources of environmentally friendly energy as the main and additional sources for daily operation.

The availability of a modern, well-equipped material and technical base with equipped facilities for the educational process, laboratories for scientific research, a modern library stock, student dormitories and modern information infrastructure is a determining factor for achieving high performance in education.

KBTU is open to cooperation and prioritizes tasks related to strengthening the quality of scientific activity and access to the region of Central Asia, near and far abroad:

- Create professional Development centers and Research & Development centers
- Increase the share of international projects in cooperation with international companies and universities
- · Increase the number of international publications in highly rated journals
- · Participate in international networks of research institutes
- Increase the number of KBTU international researchers
- Strengthen international cooperation with industry and business
- Increase the number of projects in areas of international interest, including in the field of Sustainable Development Goals (SDGs), in particular, development of clean energy sources and ecology. 🥸

## **EMISSIONS OF THERMAL POWER PLANTS IN** THE CITIES OF KAZAKHSTAN

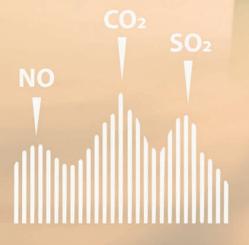
compared to the level of 1990 or up to 328 million tons

by **2030**.

However, today greenhouse gas emissions already exceed the level of 1990. According to the results of the last inventory,

emissions amounted to more than

400 million tons



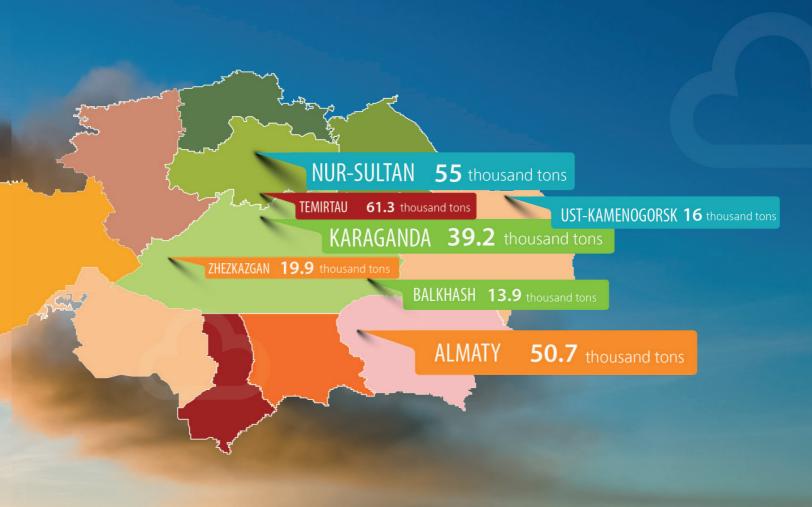
At the same time, the share of the electricity and heat production sector was

**27%** 

According to experts, total emissions in the country will continue to grow and reach the level of

435 million tons

by 2030, if appropriate measures are not taken



Total gross emissions into the atmosphere was

2.5 mln tons in 2020 in the RK

#### Of them:

37% (940 thousand tons) – coal-fired electric power industry

30% (760 thousand tons) - MMC

20% (520 thousand tons) – oil production

13% (320 thousand tons) – other industries

# 11 thermal power plants are the largest polluters and located

in 7 most polluted cities.

4 million people or about

25% population of the country

# **HYDROGEN? YES!**

# But there is a lot to think about



Assem Bakytzhan-Augustin,
Project Manager of Green Energy
GmbH in Kazakhstan and Poland

**99** As part of the 2015 Paris Agreement, 195 countries committed to limit global warming. This means that the world must drastically reduce its greenhouse gas emissions. According to the IPCC evaluation report. our carbon budget is 400 Gt CO2 if the warming *limit is < 1.5 °C and about* 1000 Gt CO, if our goal is < 2 °C. Limiting global warming to 2°C is the most widely recognized goal. This goal should lead to a deep decarbonization of all industries. ee



ecarbonization does not mean simply switching from fossil fuels to renewable energy sources. Decarbonization is the organization of our economy in such a way that it releases minimal or no CO2 into the atmosphere. The role of renewable energy in this process is, of course, huge, but this is not the only universal solution. There are many industrial processes and sectors that are difficult or impossible to electrify today. We need a fuel alternative to oil, coal and natural gas.

Hydrogen may become such an alternative. It is not an innovation in our economy. The

current demand for hydrogen worldwide is estimated at 80 million tons per year. It is mainly used as a raw material or reagent.

31 million tons are used for the production of ammonia, which is mainly used in the production of fertilizers. 36 million tons of hydrogen are used in petrochemistry.

12 million tons – in the production of methanol, 4 million tons – in metallurgy and 0.01 million tons – in the transport sector (IEA–2018 report).

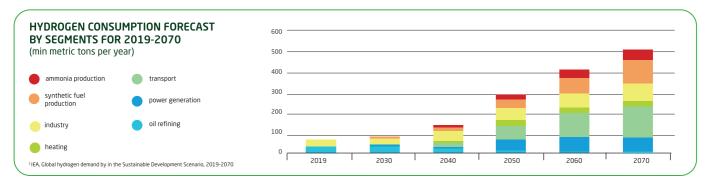
For our ambitious climate goals, it is interesting because it can potentially be used almost everywhere as a clean or relatively clean energy carrier, as well as serve as an energy

storage medium. The IEA agency predicts the growth of the global hydrogen market to 62 million tons by 2040 and its further growth in various segments.

Many countries and group companies have declared their carbon neutrality by 2050 and 2060. In their plans and strategies for decarbonization, they assign a huge role to green hydrogen. Great hopes are pinned on hydrogen. In order for pure hydrogen to actually help humanity achieve its goals, it must be technologically efficient, safe, and affordable in the required quantity, quality, and price. This article opens a series of papers on hydrogen. We will try

hydrodynamic and seismic risks. In addition, it is necessary to monitor constantly such storage for its integrity in order to avoid any leaks. The actual high cost of CCUS technology will surely decrease as it spreads and develops.

"Turquoise" hydrogen is the pyrolysis of methane, which decomposes into hydrogen and solid carbon. If electricity from renewable energy sources is used as an energy source, then we can talk about pure hydrogen, since there are no direct emissions of CO<sub>2</sub>. The remaining carbon can be used further in industry.



to cover such topics as the potential of hydrogen for the economy of Kazakhstan, the influence of hydrogen on the reformation of the global economy and politics, infrastructure issues, the use of hydrogen in various industrial sectors, etc. This article is an introductory, a kind of attempt to look at the chain "production storage and transport - use of green hydrogen", as well as analyze some of the difficulties (or obstacles) associated with this.

#### So, what is hydrogen?

**Hydrogen** is the simplest and most widely occurring chemical element in the universe. It consists of one proton and one electron. It has no color, no smell, no taste and is not poisonous to us. However, it is very flammable. In order to use the hydrogen, it must first be produced. That is, hydrogen is not an energy source, but it is an energy carrier. There are different processes for its production. Depending on these processes and the environmental friendliness of the final product, there is a certain code for labeling hydrogen by color.

Let's consider some of them.

"Gray" hydrogen is produced from natural gas by steam reforming. This process involves mixing natural gas with steam and in the process of this reaction, we get hydrogen and CO<sub>2</sub>. The complexity of this method lies in the fact that, firstly, in this process, about 10 kg of CO<sub>2</sub> is emitted into the atmosphere for every 1 kg of hydrogen. And secondly, 20–25% of energy is lost, in fact, it is easier to use natural gas directly.

The process of producing "blue" hydrogen is the same as in gray, but this method minimize CO<sub>2</sub> emissions by capturing and pumping CO2 into underground storage or further potential industrial consumption. In this case, about 1 kg of CO<sub>2</sub> per 1 kg of hydrogen is released into the atmosphere. However, there are also difficulties. For example, it is not possible to organize such storage facilities everywhere, since there are certain geological,

"Green" hydrogen is produced by electrolysis using electricity from renewable energy sources. Water is divided into its component parts: hydrogen and oxygen. This process is the most energy-intensive. It needs to provide a very large amount of "green" electricity and a sufficient amount of water.

It takes about 9 liters of purified water to produce 1kg of H<sub>2</sub>. This can become a problem in areas with water scarcity. Rystard Energy believes that almost 85% of the 206 GW green hydrogen production projects announced by 2040 should be built in regions with water scarcity, such as Spain, Chile and Australia. Therefore, desalination of seawater or brackish groundwater may be required - an energy-intensive process that requires additional renewable energy sources to ensure the environmental friendliness of hydrogen, which increases costs. According to the Advisian analytical company, the cost of desalination is US\$0.70-3.20 per cubic meter of purified water depending on the size and location of the plant.

"Green" hydrogen is considered pure hydrogen, since it has no direct emissions of CO<sub>3</sub> (just like "turquoise"). Greenhouse gases emitted during the production, supply and construction of components and materials for renewable energy sources and electrolyzers are not taken into account.

In addition to those described above, there are also such "colors" as brown - coal gasification. "Yellow" ("orange") hydrogen - produced by electrolysis, but based on atomic electricity. There are no direct CO<sub>2</sub> emissions in the latter, but its environmental safety and correspondence to the idea of sustainable development causes a lot of discussion.

#### **CHALLENGE 1 - price**

Comparing the prices of hydrogen within the framework of the described technologies, it should be mentioned that their price always varies based on location of production. This means a good location in relation to an energy source, whether it is fossil raw materials or renewable energy. In general, we can say the following: the cost of gray hydrogen is now slightly below 2 euros per kilogram. "Blue" hydrogen is slightly more expensive, about 2.5 euros/kg. "Green" hydrogen is now the most expensive: depending on the country, on average its price varies from 4 to 6 euros/kg. Its price depends not only on the volatility of electricity prices from renewable energy sources and the increase in prices for CO<sub>2</sub> emissions, but also on the costs and efficiency of the electrolyzer.

Alkaline electrolysis is the most mature technology of electrolysis, which was mainly used for the production of ammonia. This technology uses a liquid electrolyte that is mixed with potassium hydroxide for better conductivity. There are options for atmospheric alkaline electrolysis. However, there are also pressure systems in which the output pressure of hydrogen is < 40 bar. Many applications require pressurized hydrogen, and a higher output pressure saves costs and energy compared to using compressors. Pressurized hydrogen also responds better to changes in power consumption (e.g. from renewable energy sources). However, despite these advantages, it has slightly lower efficiency and more complex design and maintenance (DNV Energy Technologies Report 2021).

**Proton exchange membrane** (PEM) is characterized by a solid electrolyte (membrane) and a fast time reaction and is usually under pressure. It is about 30% more expensive than alkaline electrolysis, but the efficiency is the same. It is also expected that the service life of the stack will soon reach a level similar to alkaline electrolysis (70–80 thousand hours), and the systems are approaching 60 thousand hours. The proton exchange membrane is already being used on a MW scale with the largest installation in Canada with a capacity of 20 MW and is operated by Air Liquide (DNV Energy Technologies Report 2021).

**Solid Oxide Electrolysis** (SOE) – the technology is mainly known for its high operating temperature (500–900 °C), high efficiency and the use of steam instead of liquid water. The technology is commercially available, but still lags far behind the previous two in terms of scale and maturity. The service life is still limited to 20 thousand hours. The cost of this electrolysis is still not able to compete with the first two. In addition, the stack power is only a few kW. The unique advantage of this electrolysis is its ability to directly form syngas using the combined electrolysis of steam and CO<sub>2</sub>, as well as O<sub>2</sub> to produce a mixture of hydrogen and nitrogen using the combined electrolysis of steam and air. The latter option is advantageous to combine with ammonia production, which saves the cost of air separation plants for nitrogen production and uses waste heat for steam production (DNV Energy Technologies Report 2021).

**Anion exchange membrane** (AEM) is the least developed technology, which is still at the research and development stage. The system is commercially available, but its power is only 2.4 kW. The technology looks promising because it has a simple design, like a proton exchange membrane. But it does not require critical raw materials. (In a PEM electrolyzer, a proton (H+) is transferred across the membrane in a highly acid environment. Therefore, the PEM electrolyzer requires platinum group metals (PGM) as catalysts and expensive titanium bipolar plates to survive in a highly corrosive acid environment, while catalysts without PGM and steel bipolar plates are sufficient for efficient hydrogen production in the AEM electrolyzer.) The main problems are instability and limited service life. So far, the tests exceed only 2 thousand hours and show a high degree of degradation. Some improvements may lead to a service life of 5 thousand hours, but this will reduce its efficiency.

As confirmed by the DNV analysis, the main factors affecting the LCOH of green hydrogen are electricity consumption, investment costs and stack degradation.

If we consider the history of RE prices globally, then the downward trend is clearly visible, which, of course, is good news. The price of electrolyzers also shows a downward trend. In 2015–2019, their cost fell by 40%. Together with

#### Main parameters electrolyzer technologies, current and predicted

		•			
	Current 2030a	AE	PEM	SOE	AEM
LCOH <sup>b</sup>	€/kg	3.00 2.75	3.50 2.75	5.00 2.80	-
Capex (10MW)	€/kW	<1 000 500	<1 500 500	2 500 <1,000	_
Efficiency	kWh/Nm³	4.7 4.3	4.8 4.5	3.6 3.3	4.8 stack
Stack lifetime	hours	8 000 100 000	50 000  >80 000	20 000 >20 000	5 000
Pressure	bar	atm. or 40 70	40 70	atm.  20	35

a: Future predictions based on manufacturer indications, literature or FCH JU targets. b: Over a period of 20 years with 8,000 hours operation anually, an electricity price of 40 €/MWh, 3% O&M costs and a WACC of 8% (real). Lower electricity prices will reduce LCOH even futher.

Comparison of current cost and efficiency and forecast for 2030 from DNV.

the reduction in the price of electricity, the price of green hydrogen decreased by 50% in the same period (Dentons report, December 2020). Experts continue to work on improving technologies to increase efficiency and reduce capital costs.

It may take years to develop large-scale production of "green" hydrogen, since in many countries energy from fossil sources is the lowest, since it is already produced at amortized power plants and/or is directly or indirectly subsidized by the government. Consequently, hydrogen produced from fossil fuels will play an important role in the formation of hydrogen as a significant energy carrier. It is clear that the world is not able to switch to expensive green hydrogen overnight, but at the same time, the declared decarbonization obligations must be fulfilled now. This implies a serious interest in blue hydrogen with current price more attractive compared to the price of "green" H<sub>2</sub>. Carbon dioxide capture technology (CCUS) and the costs of gas disposal are also not cheap. Therefore, there is a competition between blue and green hydrogens.

Analysts of the Aurora agency, who specialize in forecasting energy prices, tried to determine when green hydrogen will become competitive with blue. The condition was to achieve the green LCOH level of 2.5 euros/kg. In their model, they laid down four types of electricity supply to the electrolyzer: the so-called inflexible (or rigid) – electricity is only from the grid and operates at a load factor of 95%. Flexible - also electricity, only from the grid with the possibility of selecting consumption hours to minimize LCOH. Island - electrolyzer connected only to RES without a grid. And an electrolyzer powered by renewable energy

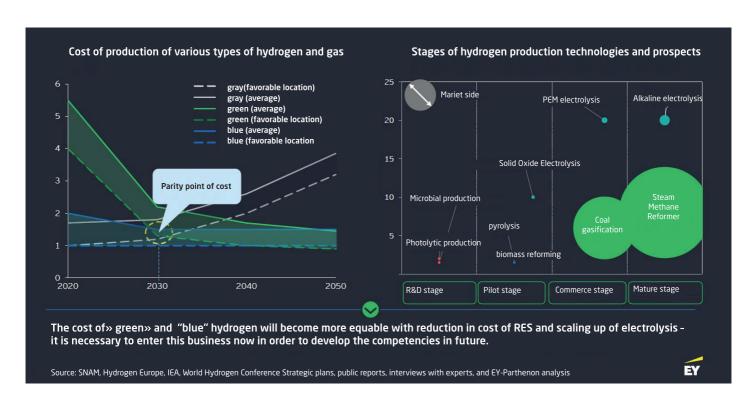
source, but with an additional connection to the grid. At the same time, it should be noted that the analysis includes European markets with their climatic, technical and market conditions.

The simulation result showed that electrolyzers will become cost-competitive compared to blue hydrogen only by the end of the 2030s. However, if electrolyzers become cheaper and more efficient, and renewable energy assets reach lower LCOEs, this period may be significantly shifted to the early 2030s. After 2025, hydrogen produced in island mode will be cheaper than electrolyzers connected to the grid. Electrolyzers connected only to the grid (with flexible and inflexible control) had the highest LCOH. This was due to high average electricity prices, high network costs and environmental charges. At the same time, depending on the country and its energy mix, there is in fact always a risk of direct CO<sub>2</sub> emissions.

The EY-Parthenon analysis also determines the parity point for 2030 and associates it with maturity of electrolysis technologies and a good location to a source of electricity from renewable energy sources.

#### **CHALLENGE 2 – storage and transportation**

The next important factor for the emerging new pure hydrogen industry is safe, economically and technically efficient storage and transportation. Basically, hydrogen can be transported in the same form in which it is stored: in the form of gas (GH<sub>2</sub>), liquid (LH<sub>2</sub>) or in solid and liquid carriers. For this purpose, both automobile, sea and railway tracks can be used, as well as gas pipeline systems. When deciding on the most efficient form and transport for hydrogen, it is



fundamentally important to take into account its special properties.

The hydrogen atom is small in size and it is very light, so it is more prone to leakage compared to methane. Hydrogen is also particularly prone to self-ignition in places of leaks and atmospheric vents. Therefore, flanged connections should not be used in hydrogen pipelines, and it should be stored in specially sealed containers. In addition, many metal materials, including steel, become brittle in the gaseous environment of hydrogen, so it can cause structural damage to the pipeline.

Hydrogen has a gravimetric energy density three times higher than gasoline. This means that 1 kg of hydrogen contains about three times more energy than 1 kg of gasoline. But at the same time, it has a very low volumetric energy density under normal conditions. This means that to obtain the same amount of energy as, for example, from natural gas, hydrogen requires d three times the volume<sup>1</sup>.

To get around this problem to some extent, hydrogen can be liquefied at very low temperatures. However, the liquefaction process is very energy-intensive: it consumes 25–45% of the energy of liquefied hydrogen. The cost of electricity is 10-14 kWh per 1 kg  $H_2$  and higher. In addition, constant cooling, effective insulation and high cold resistance of the material of the container in which the liquefied hydrogen is stored are necessary. Despite all this, there are always evaporation losses, which is also unsafe)<sup>2</sup>.

Storage of hydrogen in hydrides has a number of advantages compared to storage under pressure or in liquefied form, namely: energy costs are reduced, transportation is simplified, storage safety is increased. Hydrides increase the bulk density, as in the case of liquefied hydrogen, but do not require maintaining a low temperature. However, there are thermodynamic and kinetic limitations of the application. For example, when using magnesium hydride MgH<sub>2</sub>, hydrogen absorption does not occur at temperatures below 473 °K, and desorption occurs at high temperatures above 673 °K. Activation is required for the required rate of sorption and desorption<sup>2</sup>.

The above types of storage and the resulting conditions mean the need to re-equip and/or restructure the existing infrastructure, as well as the construction of more quantity of new transport resources. In addition, it is necessary to develop new quality certificates, norms, standards and rules for the transportation and construction of pipelines, tanks of large ships and trucks, as well as during their operation. And if we are talking about international export-import relations, then these are changes in international treaties.

#### **CHALLENGE 3 – Industrial use**

In order for pure hydrogen to become a driver of deep decarbonization of the economy, industry must switch to its widespread use in its production processes. We are talking, first of all, about those industrial sectors with processes which are impossible or difficult to fully electrify on the basis of renewable energy sources. Such a sector is, for example, the steel industry. If it were a country, its carbon dioxide emissions would rank third in the world. According to the World Steel Manufacturers Association, last year steelmakers produced more than 3 billion tons of CO<sub>2</sub>, which is 7–9% of greenhouse gas emissions generated by humans. At the same time, in physical terms, steel is the dominant material, and global demand for steel is estimated to increase to 2.5 billion tons per year by 2050. This means that the environmental burden may increase if we leave everything as it is3.

The most carbon-intensive process in this industry is the processing of iron ore into cast iron – the main ingredient of all types of steel. This is where hydrogen can be useful. This is due to the fact that it has the potential to be used as a primary raw material (replacing carbon in the form of coke as a reducing agent in the process of extraction of iron from iron oxide) and as an energy source (replacing fossil fuels at various heat-intensive stages of the iron and steelmaking process). Hydrogen-based steel production is, in fact, a low-carbon modification of the direct iron reduction (DRI) method, in which "sponge iron" is produced in a shaft furnace as a result of the reaction of hydrogen and iron ore. The DRI must then be melted in an electric arc furnace (EAF). The first steel produced using HYBRIT technology, that is, using 100% fossil-free hydrogen instead of coal and coke, is already being delivered to the first customer – Volvo Group<sup>4</sup>.

Despite the first positive experiments, the process of large-scale introduction of hydrogen-based steel production will not be so fast. This requires not only a number of political instruments, but, above all, huge investments on the production sites themselves. After all, we are talking about adapting or completely replacing the existing production process with a new hydrogen-based process. Such processes, investments, modernization do not happen in one day. Ernst & Young Parthenon experts estimated that DRI + green hydrogen technology will require 60–90% of additional costs, and the commercial stage can be reached only in 10–20 years. Some pioneers, like the Swedish HYBRIT, are preparing their demonstration plants by 2025–2030. However, a fully operational hydrogen steel plant on an industrial scale is expected no earlier than the mid-2030s.

 $<sup>^{1}</sup> Source: https://www.ffe.de/themen-und-methoden/ressourcen-und-klimaschutz/1092-beitragsreihe-wasserstoff-wie-wird-wasserstoff-transportiert.$ 

<sup>&</sup>lt;sup>2</sup> Source: article V. Fateyev, "Problems of hydrogen accumulation and storage", 2018.

<sup>&</sup>lt;sup>3</sup> Source: Metals, 2020, https://www.mdpi.com/2075-4701/10/7/972.

<sup>&</sup>lt;sup>4</sup> Source: https://www.hybritdevelopment.se/en/.

Such investments are very costly, and even the manufacturing giants say that they need the help from the government. And this assistance is not only in the form of certain preferences and qualitatively developed long-term concepts for a low carbon-free hydrogen economy, but also in the form of direct "initial investments". ThyssenKrupp recently estimated costs of about 10 billion euros with a green steel production plan of 10 million tons per year. Salzgitter assumes 3 billion euros for the production of 7 million tons per year.

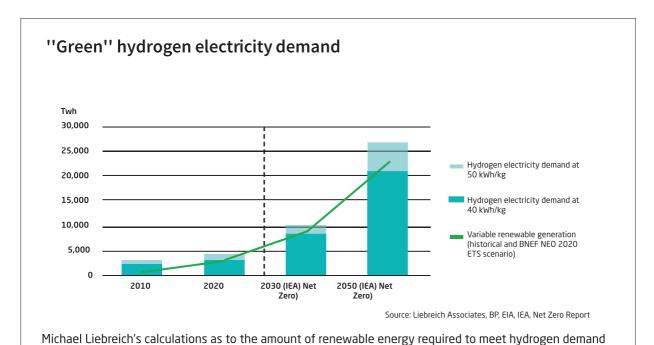
When switching to hydrogen-based steel production, the UK will need up to 25 TWh of hydrogen for the recovery process, plus another 3-4 TWh for rolling and indirect heating for the entire sector (source: TATA Steel webinar). This is more than the current hydrogen production in the UK, amounting to 27 TWh (including green and gray hydrogen). In other words, there is an urgent need to produce "green" electricity in much larger quantities only for the production of hydrogen and only for the "greening" of steel.

The founder of BloombergNEF (BNEF), Michael Liebreich, estimated that to replace the current annual global demand for gray hydrogen with green, all wind and solar energy currently installed around the world will be required. He also found that in order to meet the IEA's forecasts for hydrogen demand (the "net-zero" scenario for 2050), all wind and solar power plants that BNEF forecasts will be installed worldwide will need to be installed solely at the expense of green hydrogen (see the graph below).

through "green" H2. Photo: Liebreich Associates

In addition, the availability of green hydrogen remains an important issue. Any production needs to understand in advance what volumes of supplies, when, at what price it can count the volumes of that raw material or product on which the industrial/production process somehow depends. In what ways, in what form will it be most safe, as well as economically and technically efficient to deliver it to the point of consumption?

No one has answers regarding hydrogen to these questions. And yet, despite the above difficulties, and those that will be revealed along the way, one thing is clear: we are witnessing the formation of a global hydrogen economy. Heated discussions of experts and politicians are being held, national strategies are being written and adopted, analysts are making forecasts of future production and consumption volumes, "hydrogen valleys" are being created on the basis of cross-sectoral cooperation between producers, consumers and suppliers. We must not miss this opportunity. This is a chance for Kazakhstan not only to decarbonize the economy, but also to develop its own production of necessary equipment, components and services along the entire chain of "production - storage/transportation - use of hydrogen". To do this, it is necessary to conduct a deep and comprehensive analysis of the development potential of the hydrogen economy. It should include an analysis of the potentials of both pure and low-carbon hydrogen, both exports, taking into account the plans and intentions of neighboring and distant countries, and the domestic market, taking into account the problems of energy supply, the development of auto, rail and air transport, the needs and risks of high-emission sectors of industry and the possibilities of the scientific base.







**Timur Shalabayev,**Executive director Renewable Energy
Associations "Qazaq Green"

A dreary time... It's raining, the autumn clouds crowd the cars sneaking on the serpentine. Snow has already fallen in the mountains and foothills of the Altai area of the East Kazakhstan region, their white caps stand out clearly against the dull landscape. Nature is braced for a winter miracle to fall asleep to the howling winds and crackling Altai frosts. In contrast, the place of our destination is bubbling over with energy all year round – "Development Bank of Kazakhstan" JSC organized a press tour to the Turgusunskaya HPP at the end of October.



#### THE PLANT WITH A HISTORY

The Turgusun River, on which the hydroelectric power station is located, flows in the Zyryanovsky area of the East Kazakhstan region and joins Bukhtarma River – the right-bank tributary of the Irtysh River. The name of the river comes from the Mongolian language (Mong. "turgen us"), which means "fast river".

From the middle of the XVIII century, peasant serfs from Altai factories run to Turgusun; Old Believers were looking for Belovodye here – the legendary land of freedom mentioned in Russian folk legends. The development of the mining

industry in this area is associated with the reign of Peter the Great, when experts began to be sent here and mineral deposits were leased. Under the reign of Elizabeth Petrovna, the Tsar's Cabinet was created, which began to manage all the mines. In 1791, Gerasim Zyryanov discovered a large deposit near the city, which was later named in his honor. The first hydroelectric power station was built on the Berezovka River, which used Hungarian technologies. Thus, a settlement with a population of about five thousand people grew up.

At the end of the XIX century, on the eve of the opening of the Eiffel Tower, in the framework



Development Bank of Kazakhstan

of cooperation between Russia and France, Emperor Alexander III visited Paris. The Tsar's cabinet decided to transfer the Zyryanovsky mine complex to the French side in a concession for 60 years. The new management of the company "Zyryanovskoye Mining Company" retrofitted the non-automated equipment and put into operation powerful electric motors and pumps. This required a new source of energy. This is how the construction of a hydroelectric power station on the Turgusun River began, 7 km from the Kutikha settlement at an altitude of 941 m above sea level. Hungarian technologies were used in the construction of the plant, which was completed in 1902. It was equipped with three turbines.

In May 1902, torrential rains hit the region, the water over the crest of the dam rose by 45–50 vershkov (one vershok – 4.5 cm). On the night of May 24–25, the dam of the power plant was completely washed away by water. According to the report in Petersburg, that night the water rose by 78 vershkov. Work at the Zyryanovsky mine was terminated on June 1 already the French side terminated the contract and left the mine together with the brought equipment.

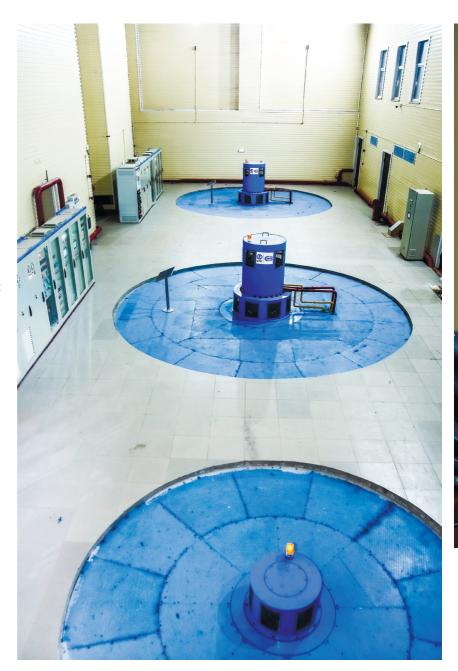
Later, the mine was leased to Austrian company, and in 1916–1918 an English company worked at the mine.

In 1932, the construction of the Turgusunskaya HPP was resumed and transferred to the Zyryanovsky Plant. In December 1935, the restoration of the station was completed. On January 1, 1936, the hydroelectric power station gave industrial current to the enterprises of Zyryanovsk. On July 15, 1957, it was liquidated due to putting of Altayenergo system into service.

So, the obstinate Turgusun River won its unrestricted flow for almost 60 years, until 2013 when the implementation of the new Turgusunskaya HPP-1 project began.

### SMALL HYDROELECTRIC POWER STATION FOR A BIG BUSINESS

The construction of the HPP was started in April 2017 and completed in 2021. The project was implemented by "Turgusun-1" LLP with the financial support of the "Development Bank of Kazakhstan" JSC. The capacity of the HPP is 24.9 MW, which will reduce the

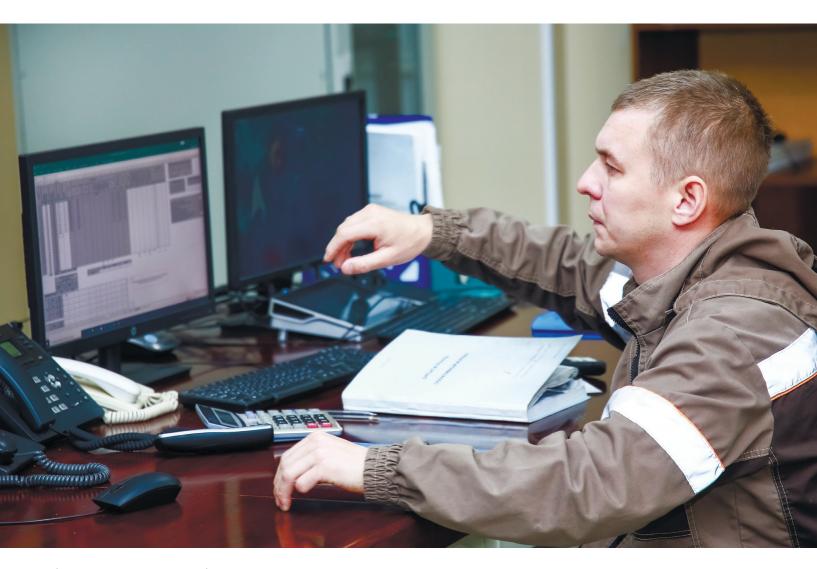


\*\*\*\*\*\*

shortage of electricity in the region by 79.8 million kilowatt hours per year, as well as reduce carbon dioxide emissions by 680 tons per year.

In total, construction of Turgusunskaya HPP gave job to about 500 people, who worked in hard-to-reach places and under extreme weather conditions, for example, the air temperature in winter reached 42 degrees below zero. However, its management is now fully automated. The current staff is 20 employees.

The total cost of the project is 13.39 billion KZT, while Development Bank of Kazakhstan



#### The launch of the Turgusunskaya HPP

makes a significant contribution to providing the East Kazakhstan Region with own stable power supply and to the whole National Electric Grid of the Republic

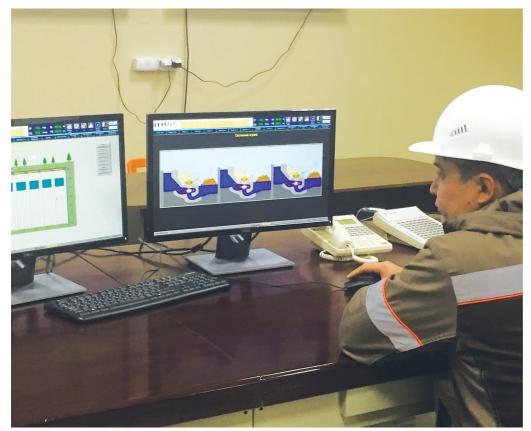
JSC carried out the deal structuring in the amount of 9.6 billion KZT in the following form: 5 billion in the form of a long-term loan for a period of 12 years was provided by the "Development Bank of Kazakhstan", 3.6 billion tenge in the form of leasing for purchase of equipment was allocated by a subsidiary of DBK - "Industrial Development Fund" JSC, 1 billion tenge in the form of a loan was provided by AOM Rail BV, part of DBK Equity Fund, a subsidiary of DBK managed by "Kazyna Capital Management" JSC. The remaining funds in the amount of 3.8 billion tenge are the borrower's own funds.

It should be noted that the "Development Bank of Kazakhstan" JSC is one of the first domestic financial institutions in the country that has begun to build up competencies in financing renewable energy projects, which has

sufficient experience in structuring "green" projects. The joint efforts of the "Development Bank of Kazakhstan" JSC and "Turgusun-1" LLP, which worked on the construction of the Turgusunskaya HPP, made a great contribution to increasing the share of RES in the country's energy balance.

In July 2021, the commercial commissioning of the Turgusunskaya hydroelectric power plant was carried out. Today, electricity output in favor of the buyer ("Financial Settlement Center of RE") amounted to 5.5 million kWh.

When implementing the project, modern technical solutions were used, such as Chinese-made equipment corresponding to the latest achievements in the field of hydroelectric power plant design. Three turbines of different capacities are installed at the station: one is 1.9 MW and other two are 11.5 MW each. This allows using not all



generating equipment of the station during the low-water period.

The launch of the Turgusunskaya HPP makes a significant contribution to providing the East Kazakhstan region and the National Electric Grid of the Republic of Kazakhstan with its own sustainable energy supply. During the construction of the hydroelectric power plant, in addition to the main hydroelectric and reservoir, it was possible to build related infrastructure facilities – access roads, power lines, bridges – which today have significantly improved the transport and information support of the region and created all conditions for the placement of energy-intensive, export-oriented industries.

## PROBLEMS OF THE RENEWABLE ENERGY INDUSTRY: SUN, AIR AND WATER

As part of the visit to Turgusunskaya HPP-1, an open dialogue took place with the management of the station and employees in charge of economic issues, issues of operation of the HPP and dispatching support of its work.

According to the management of the HPP, today low marginal tariffs are established for the implementation of hydroelectric power projects. Thus, for example, in case of auction for selection of HPP projects, the maximum auction price is 15.2 tenge per kWh. This does not correspond to the capital costs of the construction of the facility, therefore, auctions for hydroelectric power plants are unattractive for many investors. For example, the level of capital expenditures for Turgusunskaya HPP-1

amounted to about US\$2 million for 1 MW of installed capacity. This level of capital expenditures is approximately 2.5 times higher than that of solar power plant construction projects (the marginal tariffs for auctions for SPP in 2021 are 16.96 tg/kWh). At the same time, according to the HPP engineers, the efficiency of generating equipment is 60–80%, which is 3–4 times higher than that of solar power plants.

At the same time, the company has plans to expand the project and build a whole cascade of hydroelectric power plants on the Turgusun River. Thus, it is planned to build Turgusunskaya HPP-2 with a capacity of 43.8 MW with an average annual electricity generation of 127 million kWh and Turgusunskaya HPP-3 with a capacity of 90–120 MW with a dam height of about 100 m and electricity generation of about 350 million kWh.

Since the capacity of the Turgusunskaya HPP is less than

25 MW, this allows it to be attributed to small HPPs and renewable energy sources. As for all renewable energy facilities in Kazakhstan, a big problem is forecasting electricity generation, since renewable energy generation is variable and depends on changing weather conditions.

As is well known, the National Dispatch Center of the System Operator (NDC SO) ensures reliable functioning of the National Power Grid of the Republic of Kazakhstan, parallel operation of the National Power Grids of the Republic of Kazakhstan with neighboring countries. To do this, the NDC forms daily schedules of electricity production/consumption, draws up a balance and determines the operating mode of the power system. In turn, in order for NDC SO to make a daily schedule of electricity production/consumption, market entities (energy transmission companies and consumers) send a schedule of electricity production/consumption for their stations to the NDC on a daily basis. The situation becomes more complicated when stations have to give forecasts for weekends and holidays, and this is a period of 2 to 5 days.

At the same time, according to the operators of Turgusunskaya HPP-1, the daily forecasting is not suitable for such facilities – it is necessary to introduce an hourly planning time-frame. For example, while the delegations of journalists were talking about the work of the hydroelectric power station and carried out photo and video shooting, it started to rain, the snow that fell the day before melted in the mountains, the water level in the

storage increased by 60-80 cm with the margin of 10-15 cm. The dispatcher complained that another hour and he would have to call the NDC and start a second turbine to carry out an unscheduled water discharge. According to the current rules, facilities such as hydroelectric power plants are not allowed to drain water not through generating units. Therefore, at the end of the day, the facility will exceed the forecast output, which will lead to receiving "threatful warnings" from the System Operator for the prediction error, which may be 35%.

It seems that the solution to the problem with marginal tariffs for renewable energy auctions can be applying market pricing, when investors and bidders can independently submit prices based on their own financial estimates without setting a price ceiling. Such a measure would be a positive signal from the government for domestic and foreign investors in the medium term.

As for the transition from the daily planning of RE generation to hourly planning, this is an alternative measure that will entail more responsible planning and more accurate forecasts for electricity generation by renewable energy stations, which will reduce the negative impact on imbalances in the National Power Grid of the Republic of Kazakhstan. 🥨



Instead of a conclusion. The construction of hydroelectric power plant is a large and time-consuming process. Director of Turgusun-1 LLP Kalaubek Baymukhanbetov who has more than 30 years of experience in the hydropower industry and participated in the construction of large hydroelectric power plants, such as Moynakskaya HPP (300 MW) and Shulbinskaya HPP (702 MW), and the entire team who implemented the Turgusun-1 project, are real heroes. Thus, during the construction of the hydroelectric power station in 2018, the spring flood lasted three months, which, according to historical data, happened for the first time in the last 56 years. It seems that the river decided to show its restless disposition once again. The water level in the river was so high that it rose up to 6 m several times, and the construction pit of the hydroelectric power station was flooded eight times. Builders were often caught off guard by the famous East Kazakhstan frosts. The temperature at the site dropped to minus 50 degrees several times, stopping all work at the facility. Now it is already a part of the great three-century history of the taming of the obstinate river with the ancient name Turgusun, which was managed by the hydraulic builders of independent Kazakhstan.

At dusk, on returning to the regional center along the shore of the Bukhtarma Sea, as locals call it one of the world's largest manmade reservoirs, in the dark lighted with lights of houses, tourist bases and holiday homes, you can help but think about the scale of the country's hydropotential. To date, the country has adopted a Plan for development of the hydropower industry of the Republic of Kazakhstan for 2020–2030, a working group consisting of industry experts has been created under the Ministry of Energy of the Republic of Kazakhstan, measures are being taken to create an online map of the hydro potential of the Republic of Kazakhstan. All these activities are aimed at increasing the share of clean electricity for the growing needs of the country's economy.

After we passed the city of Serebryansk, the road stretched along a mountain serpentine, rain began to fall, which turned into abundant snow, covered with thick fog. I remembered the operator of Turgusunskaya HPP-1, who would experience problems during his night shift at the end of October due to these precipitations.

# Dynamics of reduction in SPP AUCTION PRICES KZT/kW\*h





# Dynamics of reduction in HPP AUCTION PRICES KZT/kW\*h





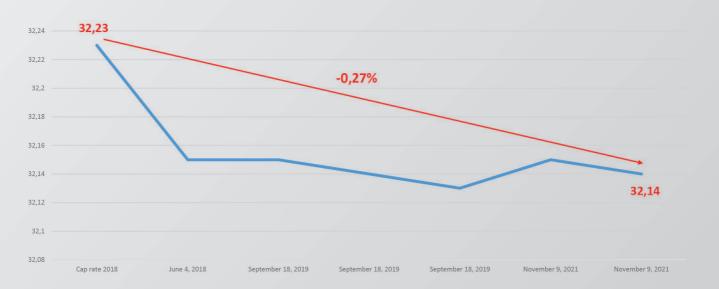
# Dynamics of reduction in WPP AUCTION PRICES KZT/kW\*h





# Dynamics of reduction in BioPP AUCTION PRICES KZT/kW\*h





# SOLAR POWER STATIONS



#### Burnoye Solar - 1 SPP

- ·Project capacity: 50 MW;
- \*Expected power generation: 73.18 million kWh;
- ·Location: Zhualy district, Zhambyl region;
- Area: 150 ha (substation + solar park)
- ·Investors: Samruk-Kazyna Invest, United Green LLP (Great Britain)
- •Financial Institutions: European Bank for Reconstruction and Development, Clean Technology Fund



#### Status

- ·Cost: USD 135 million
- Commissioned in April 2015



#### **Equipment:**

- •220/10 kV substation: Siemens, Alstom, Schneider Electric;
- Inverters: 32 Schneider Electric inverters;
- ·Solar panels: 192,192 SolarWorld modules.



#### Burnoye Solar - 2 SPP

- Project capacity: 50 MW;
- •Expected power generation: 78.9 million kWh;
- ·Location: Zhualy district, Zhambyl region;
- ·Area: 74 ha (solar park)
- ·Investors: Samruk-Kazyna Invest, United Green LLP (Great Britain)



#### Status

- •Cost: USD 77.7 million
- •Commissioned on June 4, 2018



#### Equipment

- •Extension of 220/10 kV substation: Siemens, Schneider Electric;
- Inverters: 16 Sungrow inverters;
- ·Solar panels: 185,174 Jinko Solar modules.

# in Kazakhstan



#### **Gulshat SPP**

- · Project capacity: 40 MW;
- ·Expected power generation: 57.9 million kWh
- ·Location: Gulshat village, Karaganda region;
- Area: 100 ha (substation + solar park);
- ·Investors: Risen Energy (China)
- •Financial Institutions: European Bank for Reconstruction and Development



#### Status

- ·Cost: USD 46 million
- \*Commissioned in February 2019



#### Equipment:

- +110/35 kV substation: TBEA
- ·Inverters: 530 string Huawei inverters
- \*Solar panels: 122,960 Risen Energy modules



#### Zadariya SPP

- Project capacity: 14 MW;
- · Expected power generation: 21.6 million kWh;
- ·Location: Arys village, Turkestan region;
- •Area: 30 ha
- Investors: UrbaSolar (France)
- •Financial Institutions: European Bank for Reconstruction and Development, Clean Technology Fund



#### Status:

- •Cost: USD 12.7 million
- ·Construction and installation work is underway;
- . Commissioning is planned in autumn 2019



#### **Equipment:**

- +35/10 kV Substation: Alageum Electric;
- Inverters: 6 SMA inverters;
- ·Solar panels: 50,000 Trinasolar modules.























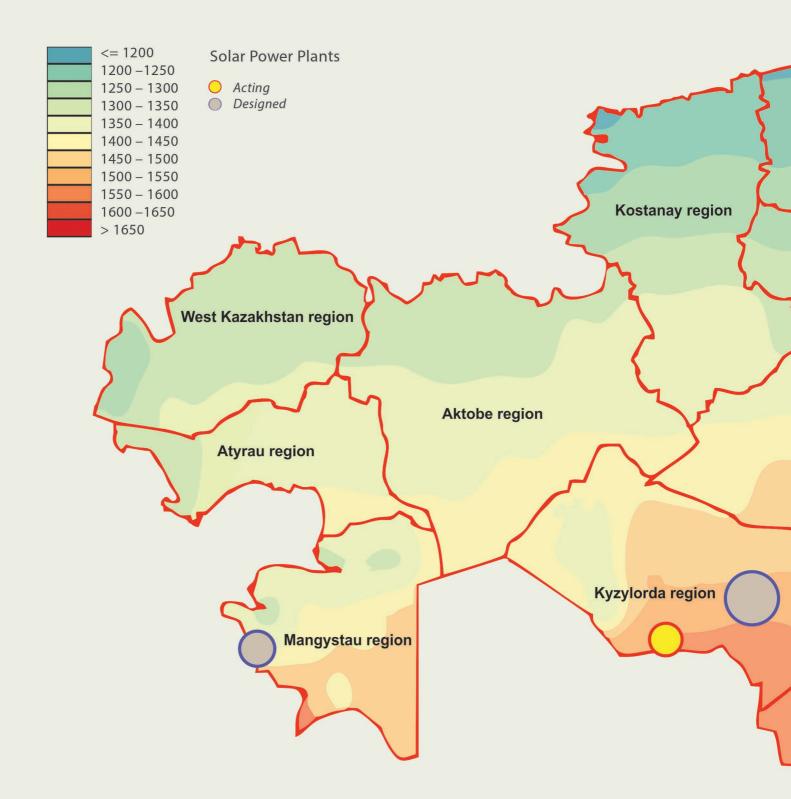




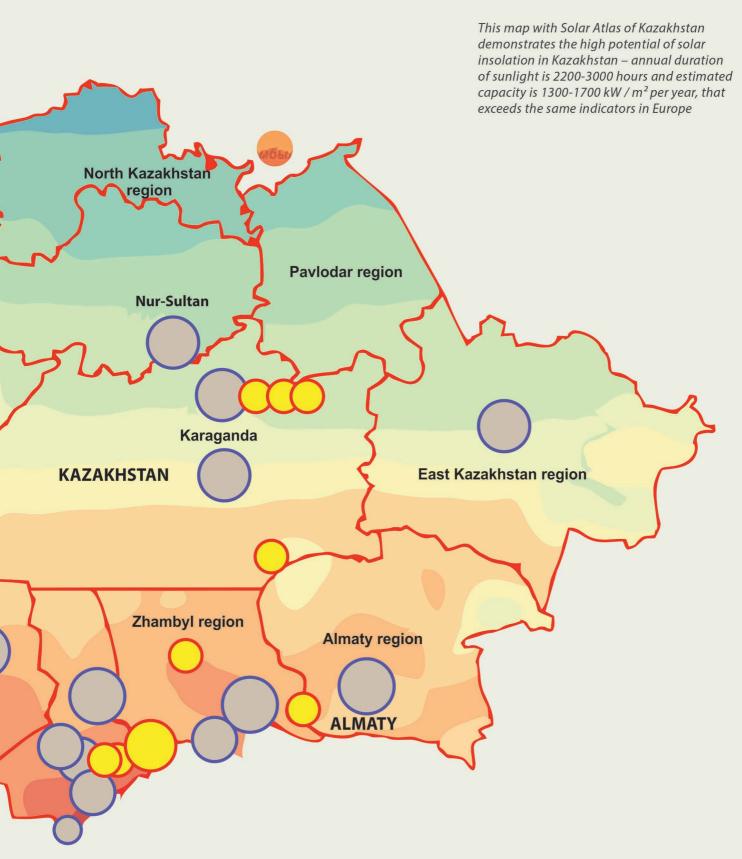


#### Solar Atlas of Kazakhstan

Total radiation on horizontal surface (source – NASA SSE), kWh / m<sup>2</sup>/ year



It is important to notice, that the effectiveness of helio collectors mostly depends on number of clear days per year, rather than on average annual temperature



Thus, responding to the most popular question – yes, in winter they work no worse than in summer, the daylight just shorter in winter

#### IMPLEMENTATION OF RENEWABLE ENERGY

# 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

# 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)



\* 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



# TEAM OF ASSOCIATION

PLATFORM FOR NATIONAL AND INTERNATIONAL PLAYERS IN RENEWABLE ENERY SOURCES

# 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



**NURLAN KAPENOV**Chairman of the Board of Directors



AINUR SOSPANOVA
Board Chairman —
Member of the Board of Directors



YERNAR BILYALOV Member of the Board



SANIYA PERZADAYEVA Independent Director



TIMUR SHALABAYEV
Executive Director



**ISLAMBEK SALZHANOV** Chairman of the Supervisory Board



KALIYA KHISSAMIDINOVA Member of the Board



VALERIY TYUGAY Member of the Board



**ARTYOM SLESARENKO** Independent Director



**ZHANAR NURLYBAYEVA** Manager



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



Contacts: Info.Kasachstan@kas.de +7 7172 92 50 13 +7 7172 92 50 31

https://www.kas.de/de/web/kasachstan/



