



Sustainable Energy Connectivity in Central Asia



Funded by  
the European Union

International conference

“The prospects for introduction of “green” innovative energy efficiency technologies in the electric power industry of Turkmenistan”

SEIT building, 62 Bayram Khan st, Mary, 18 March 2024

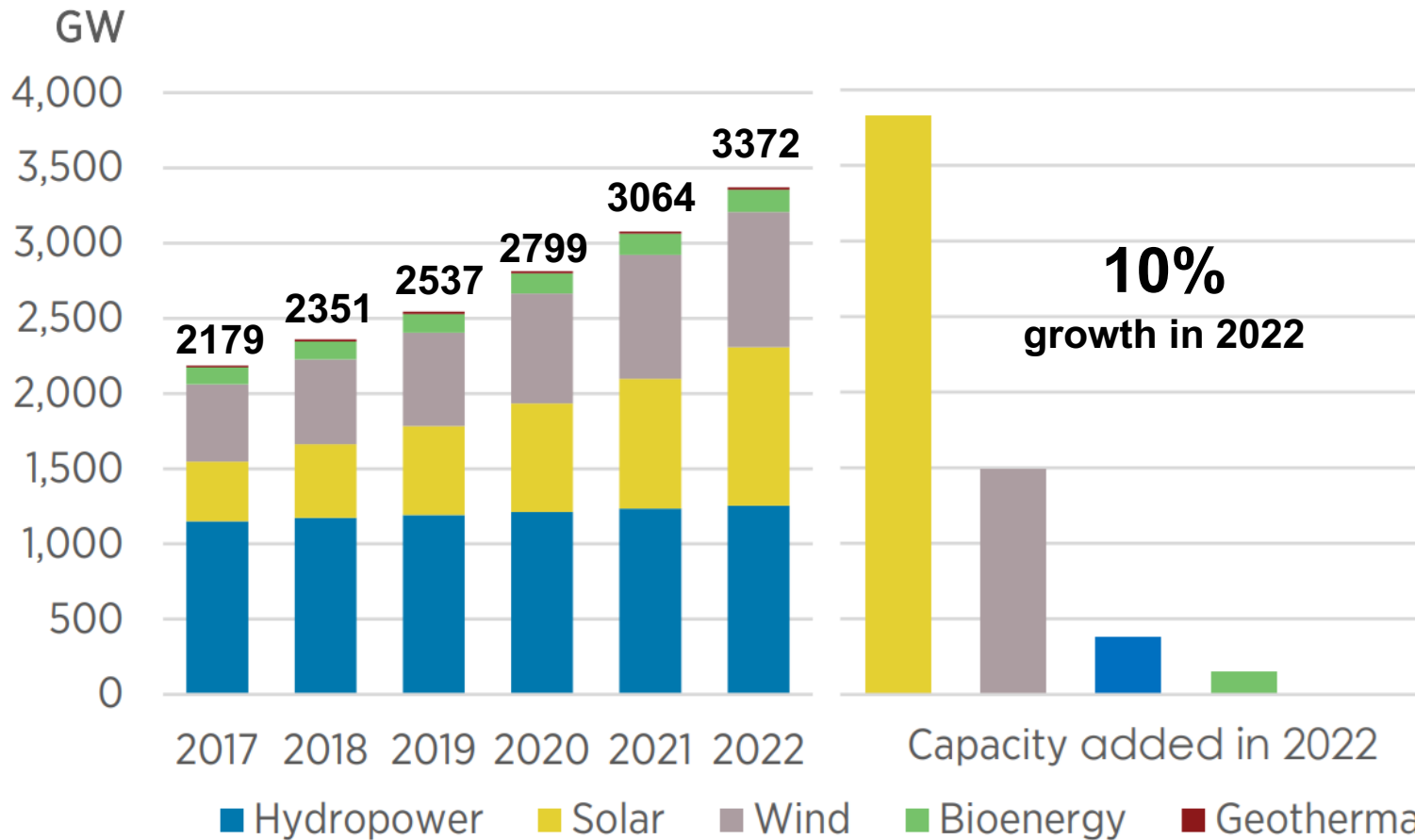
**Studying renewable energy development practices of the Republic of Kazakhstan.  
Balance of energy capacities of the Republic of Kazakhstan, main areas of renewable  
energy development as an electric power industry sector**

Zhaxylyk Tokayev,  
International consultant, SECCA

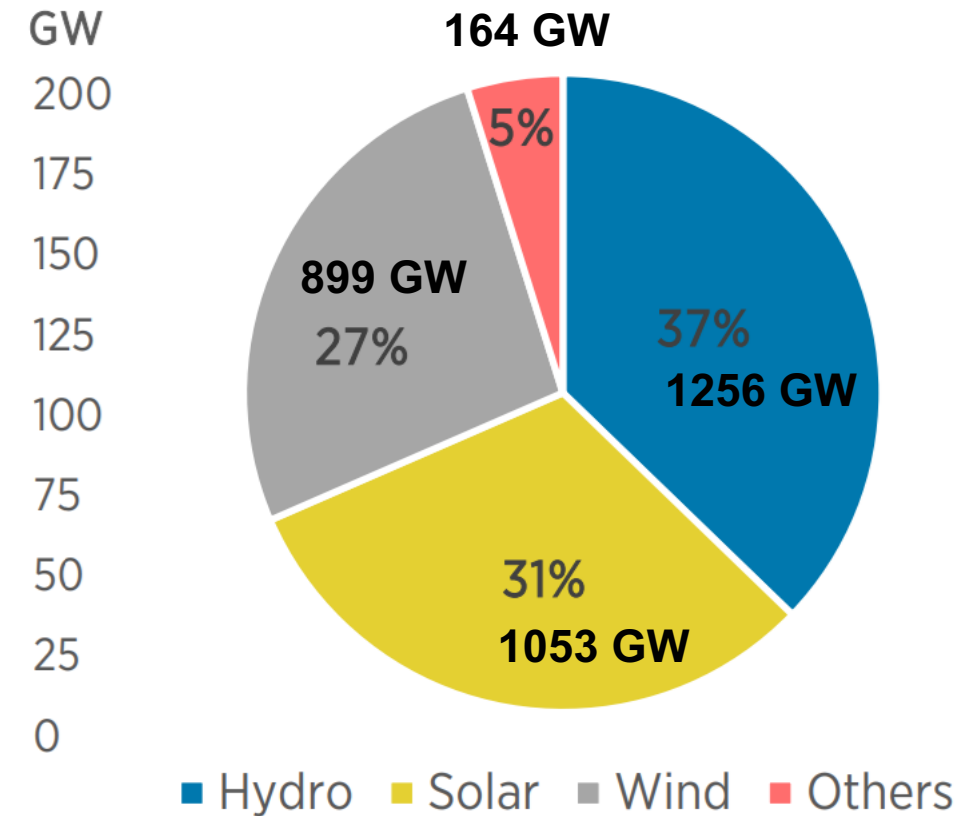


# Renewable energy in the world

## Growth in renewable energy capacity

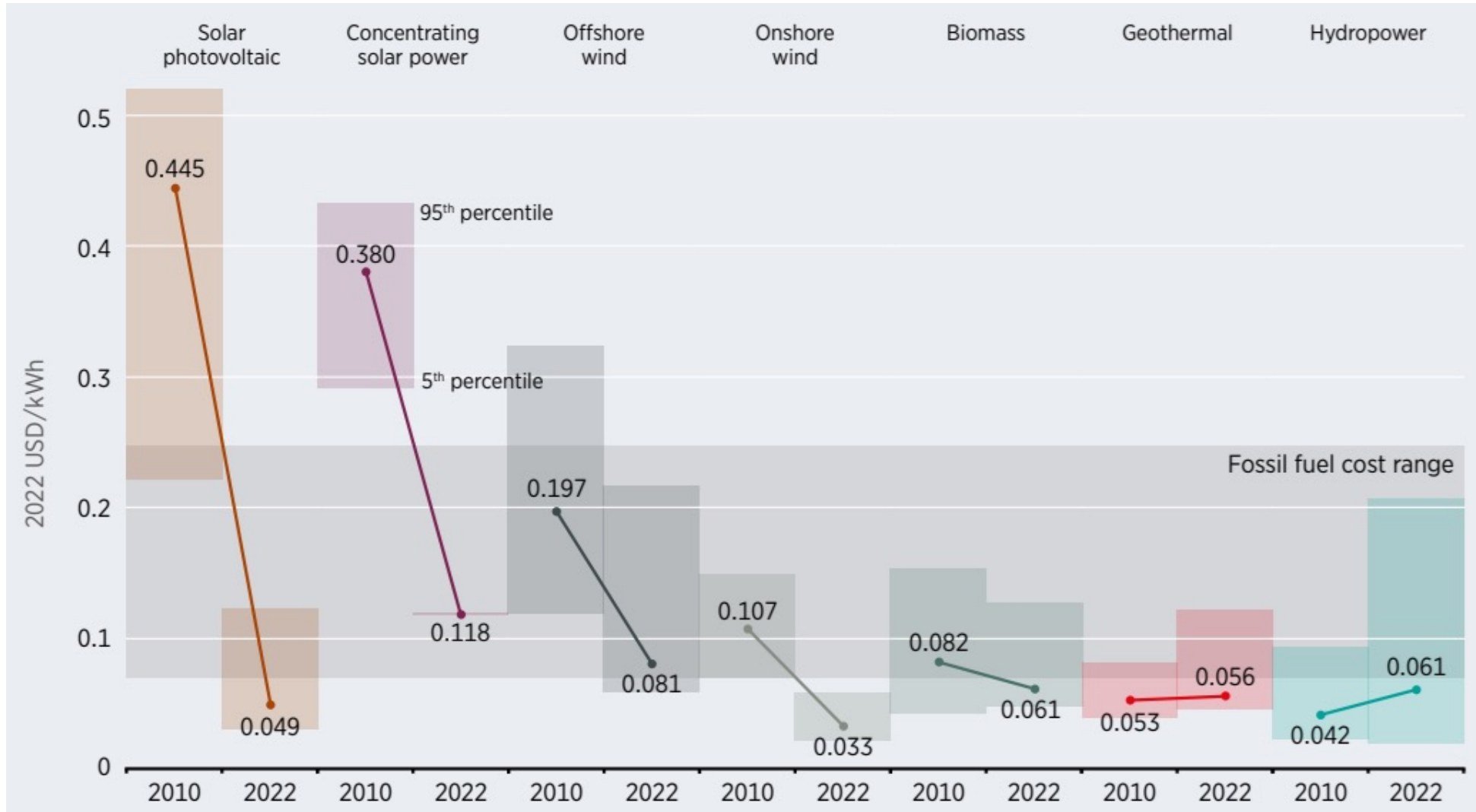


## By type, 2022

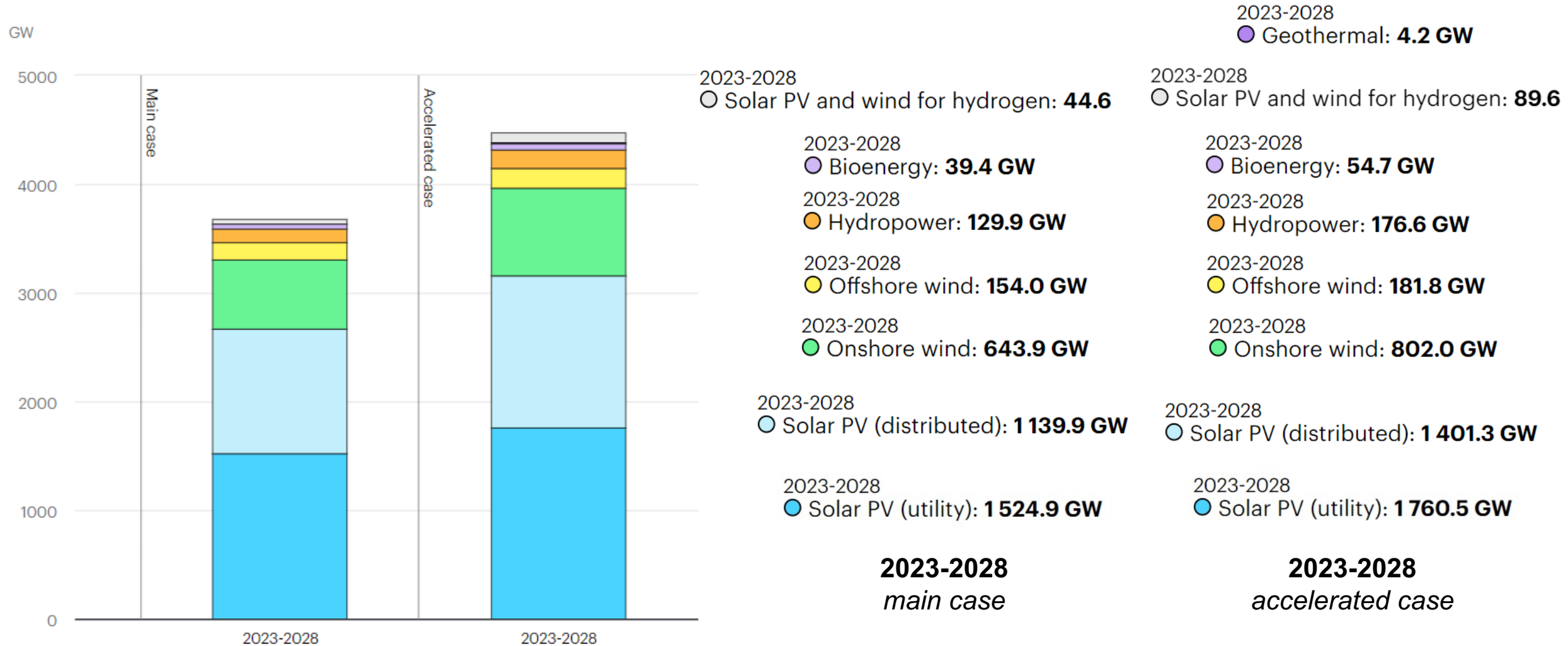




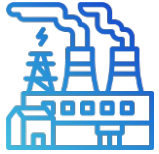
# Global weighted average cost of electricity from newly commissioned renewable energy technologies



# Increasing renewable energy capacity by adding technologies, main and accelerated cases, 2023-2028



# Current state of the electric power industry



Power plants **220**

Maximum load **16,6 GW**

Available capacity **20,4 GW**

Generation at maximum load **15,1 GW**



REC **19**

3 owned by the state

16 privately owned

Average transmission loss **11,2%**  
(5.1 billion kWh)

High level of wear of main equipment **65%**

A large number of small energy transmission organizations **133**



Electricity generated **112,8 billion kWh**

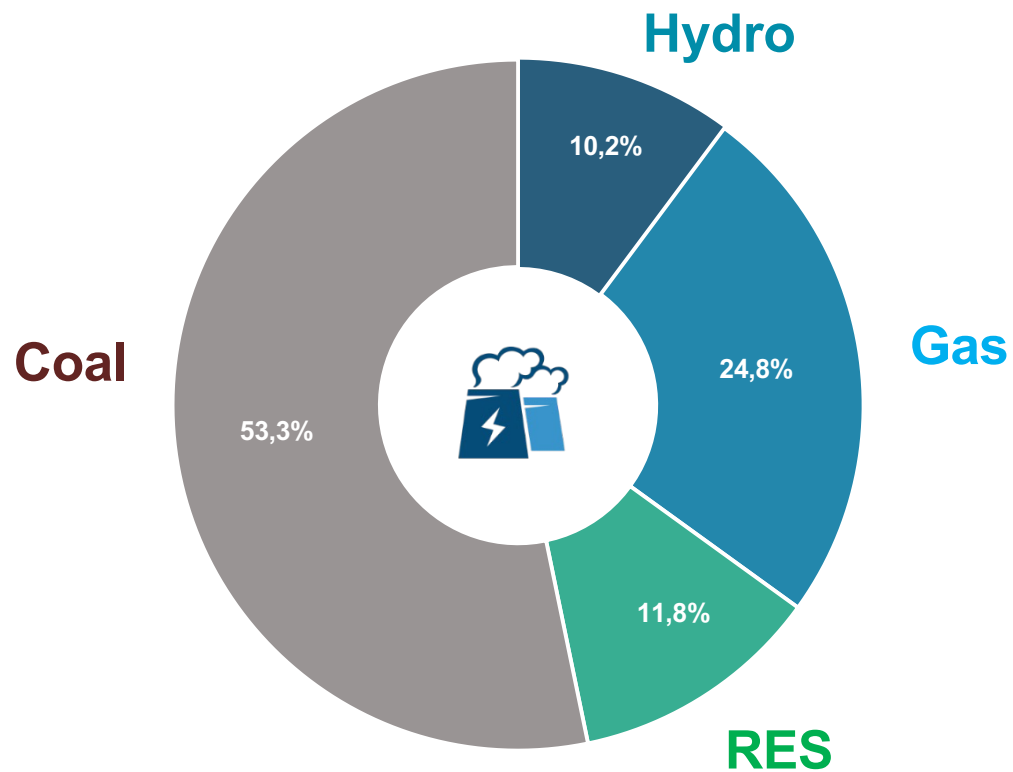
Electricity consumed **115,1 billion kWh**

Electricity imported **3,4 billion kWh**

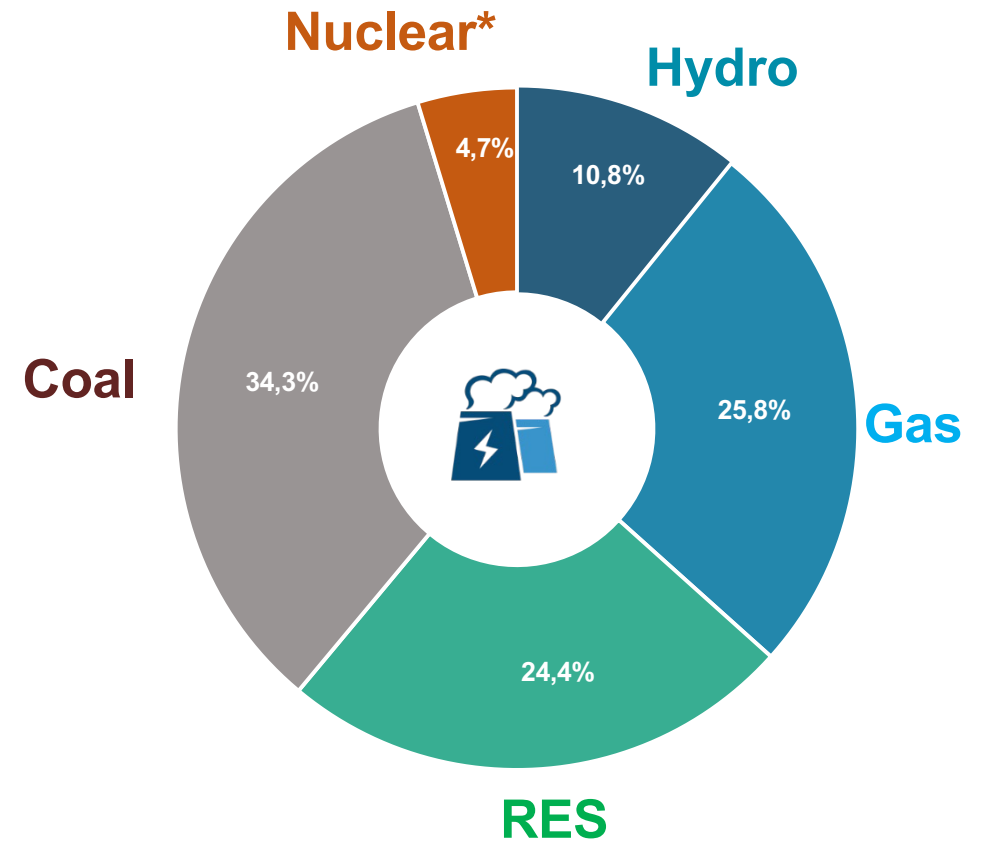
Electricity exported **1,4 billion kWh**

# Generation breakdown

2024



2035





# Balancing electricity market in Kazakhstan



## Need to introduce BEM

1. Systematic deviations by energy market actors, leading to significant deviations at the border with the Russian energy system.
2. Lack of financial responsibility for the imbalances created and economic incentives for balancing on the part of market actors,
3. Lack of interest of these actors in optimally planning the electricity generation-consumption schedule and participation in covering deviations
4. The balancing electricity market operates in a simulation mode without the procedure for real financial settlements of imbalances.

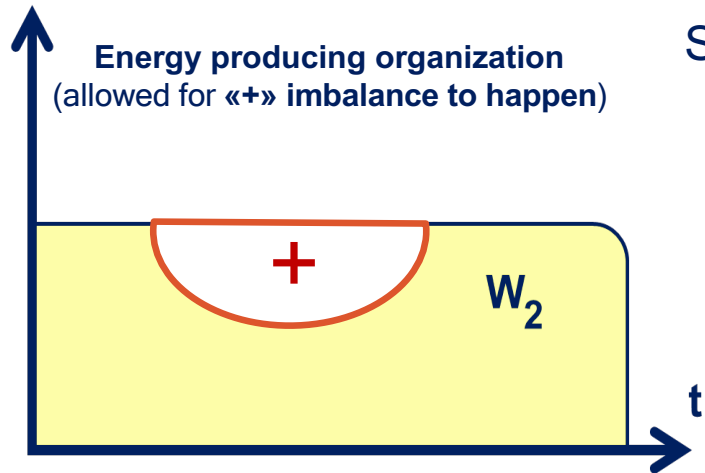
*Note: this mode lasts about 16 years*



## Advantages of introducing BEM

1. Targeted distribution of imbalance payments throughout the system (to make those who create imbalances pay).
2. Responsibility for deviations from daily electricity production and consumption schedules.
3. Creation of economic signals for market participants (so that they receive payment for participating in balancing).
4. Using the regulatory potential of existing power plants and consumers.

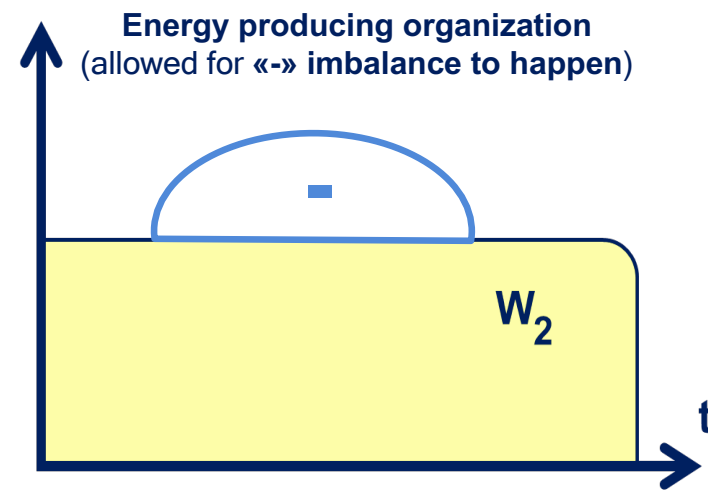
# Imbalance – difference between the planned and actual generation-consumption balance



Shortage of electricity leads to **positive imbalance**

In a general sense:

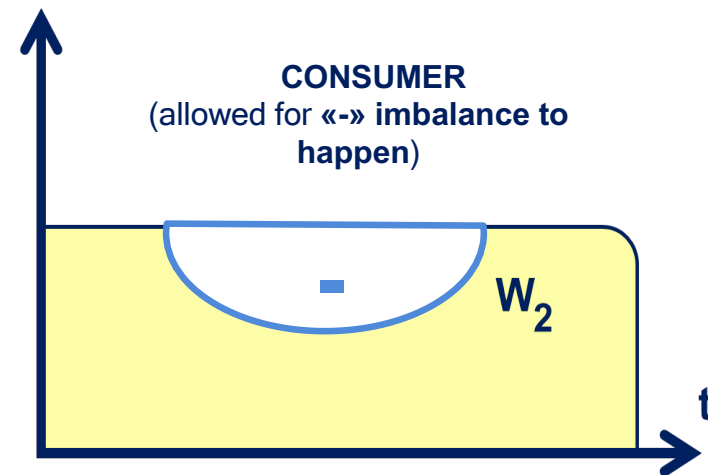
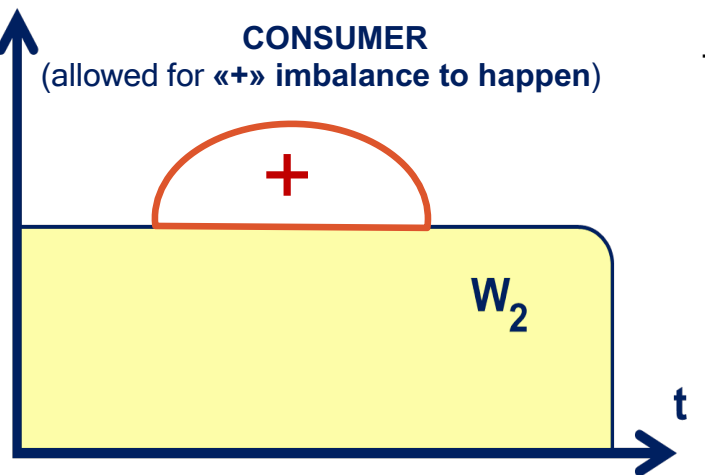
when an imbalance (resulting deviation) contributes to the excess of consumption in the system over generation, it is called a **positive imbalance**



Excess electricity leads to a **negative imbalance**

In a general sense:

when an imbalance (resulting deviation) contributes to the excess of generation in the system over consumption, it is called a **negative imbalance**

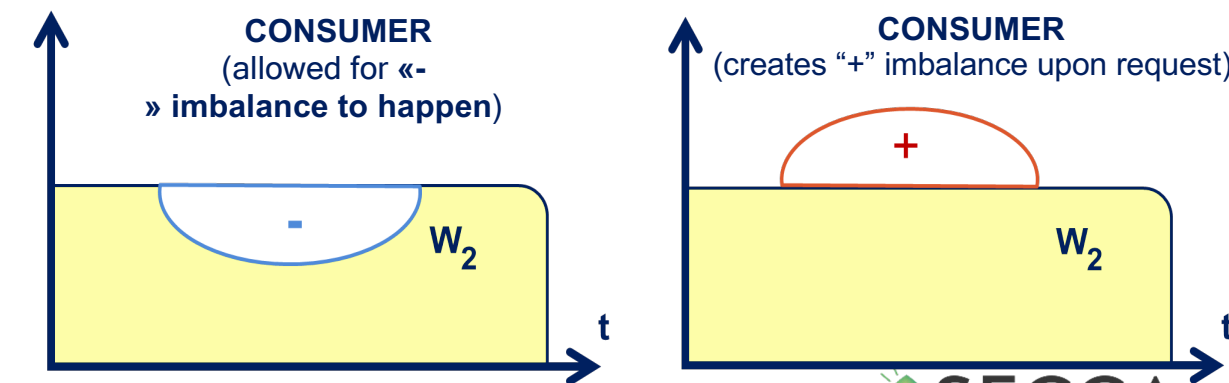
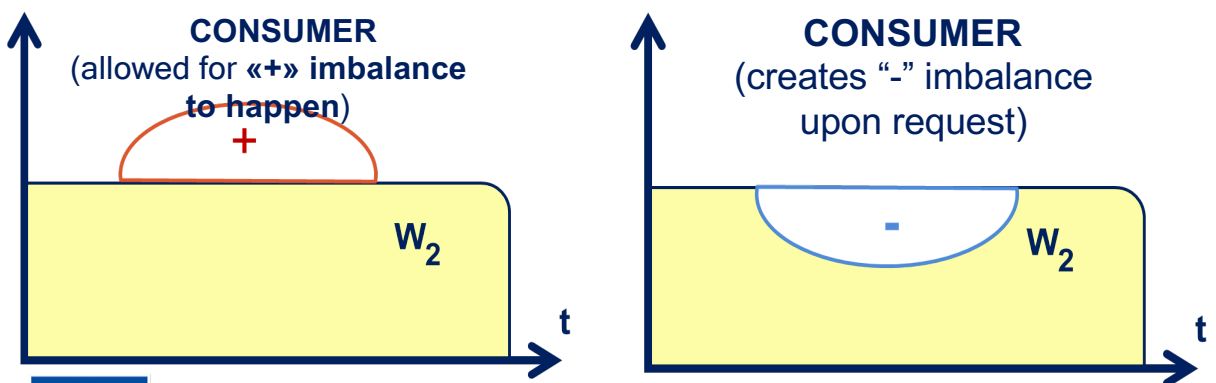
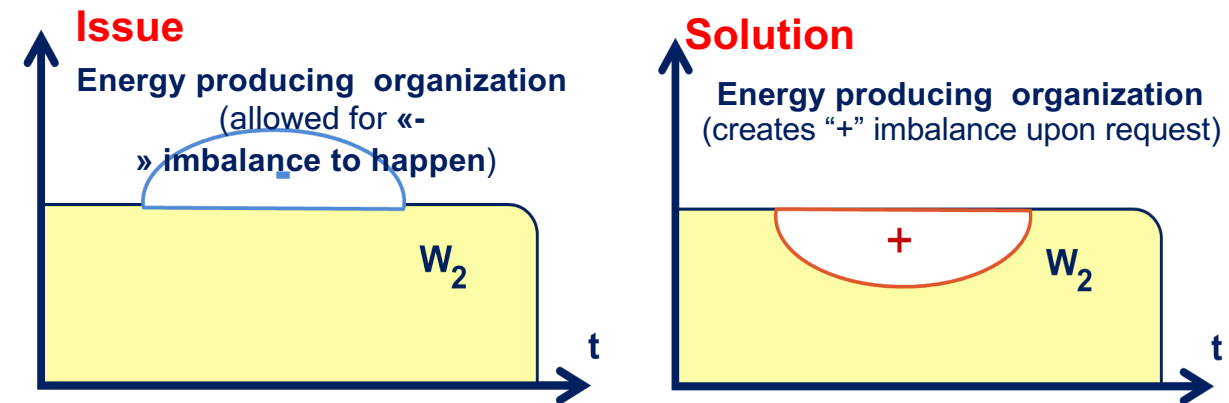
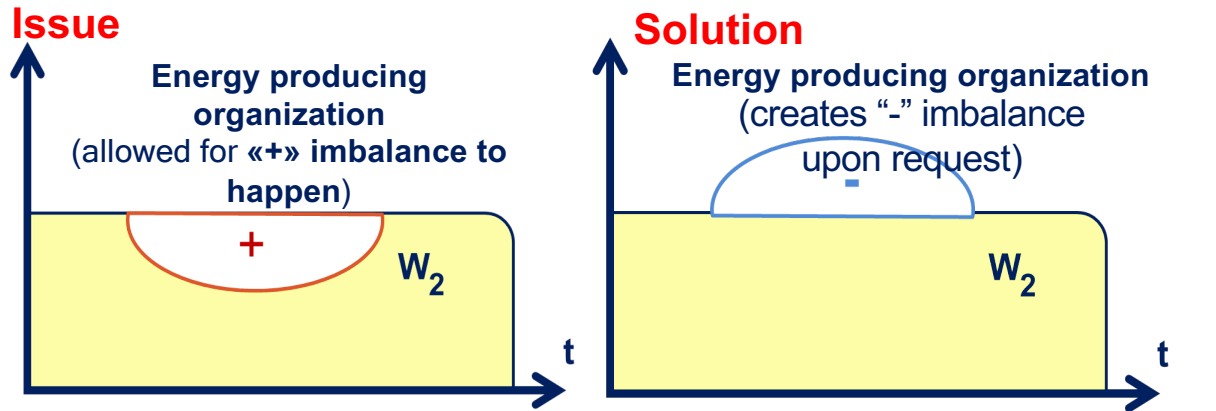




# Positive and negative imbalance

Positive

Negative



# ELECTRIC POWER INDUSTRY OF KAZAKHSTAN

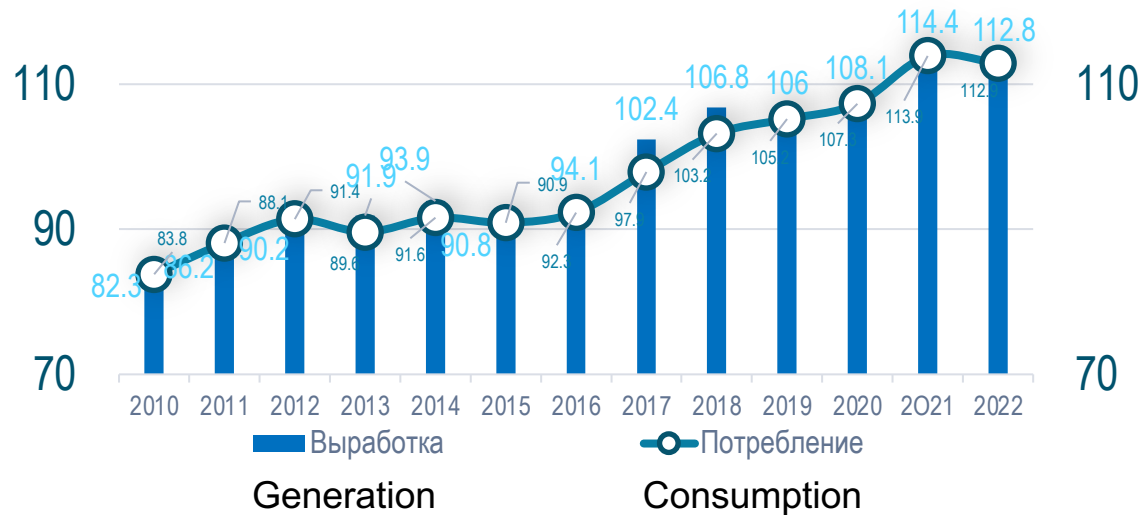


**213** power stations

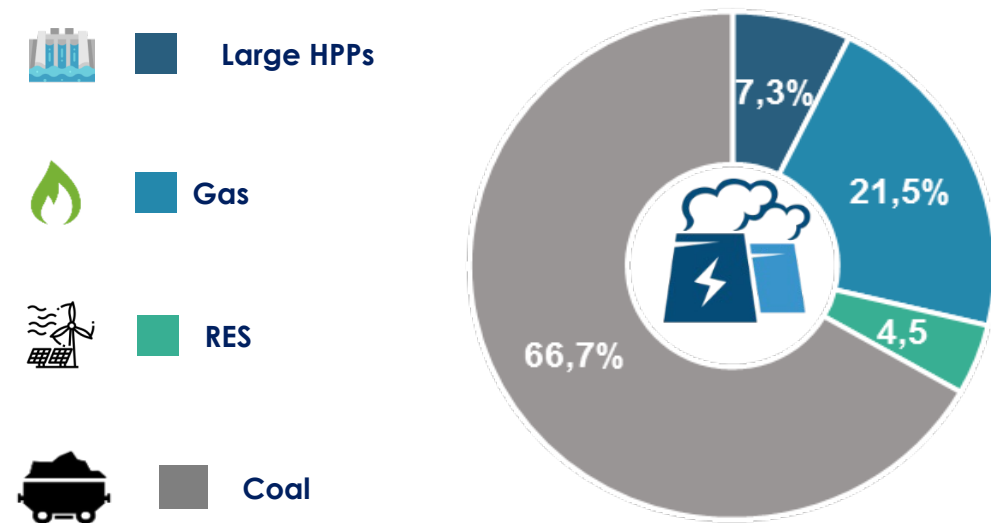


**24,77 GW** installed capacity

Dynamics of electricity generation/consumption in the Republic of Kazakhstan billion kWh.



Generation mix in the Republic of Kazakhstan



# ELECTRICITY GENERATION AND SHARE OF RES

## 1 Electricity generation, billion kWh

112,8

146

1,3 times

### FORECAST INDICATOR

### ELECTRICITY GENERATION

146 billion kWh

1,3 times

to the level of 2022

	2022	2023	2024	2025	2026	2027	2028	2029
Electricity generation taking into account economic needs, billion kWh	112,8	114,9	124,8	129,2	133,6	137,3	141,8	146

## 2 RES share, %

4,5

12,5

2,8 times

### FORECAST INDICATOR

### SHARE OF ELECTRICITY FROM RES

12,5 %

2,8 times

to the level of 2022

	2022	2023	2024	2025	2026	2027	2028	2029
Share of electricity from renewable energy sources in total generation, %	4,5	5	5,5	6	7	8	10	12,5



# ELECTRICITY GENERATION FROM RES

**144**  
facilities

with the total capacity of **2868,57 MW** (excluding large HPPs) as of March this year



Solar

**1202,6 MW**  
**45 facilities**



Wind

**1394,6 MW**  
**57 facilities**



Hydro

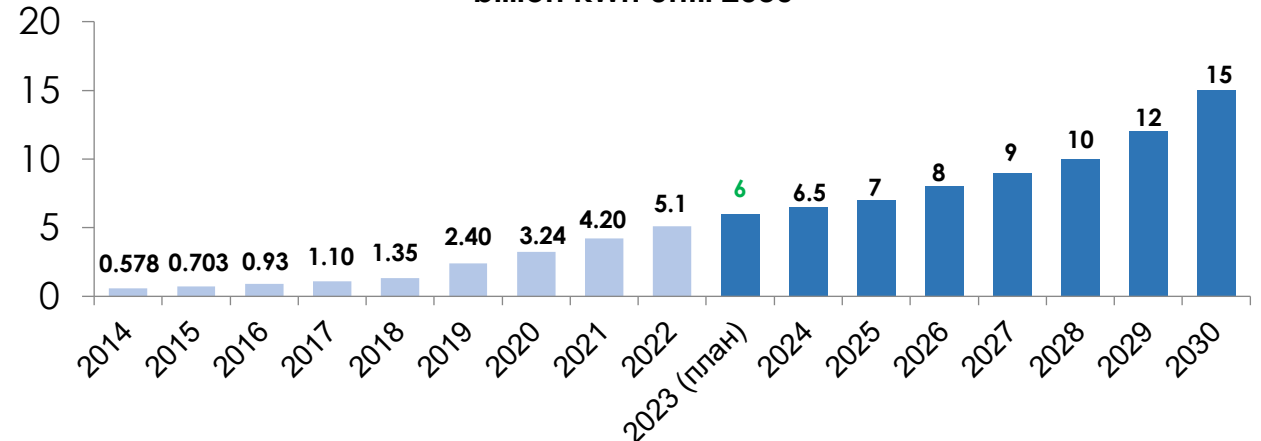
**269,6 MW**  
**39 facilities**



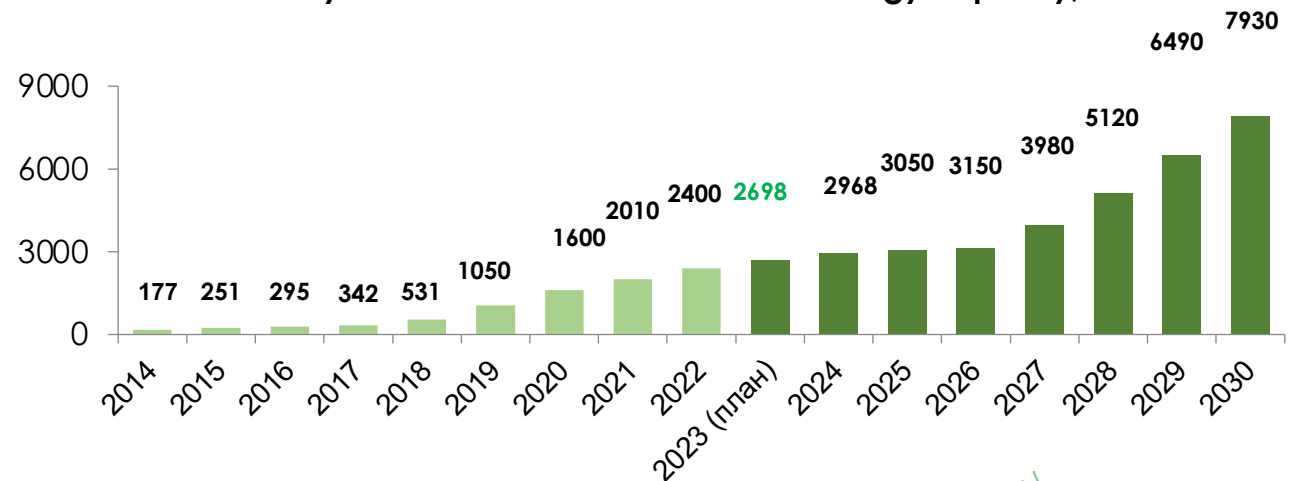
Bio

**1,77 MW**  
**3 facilities**

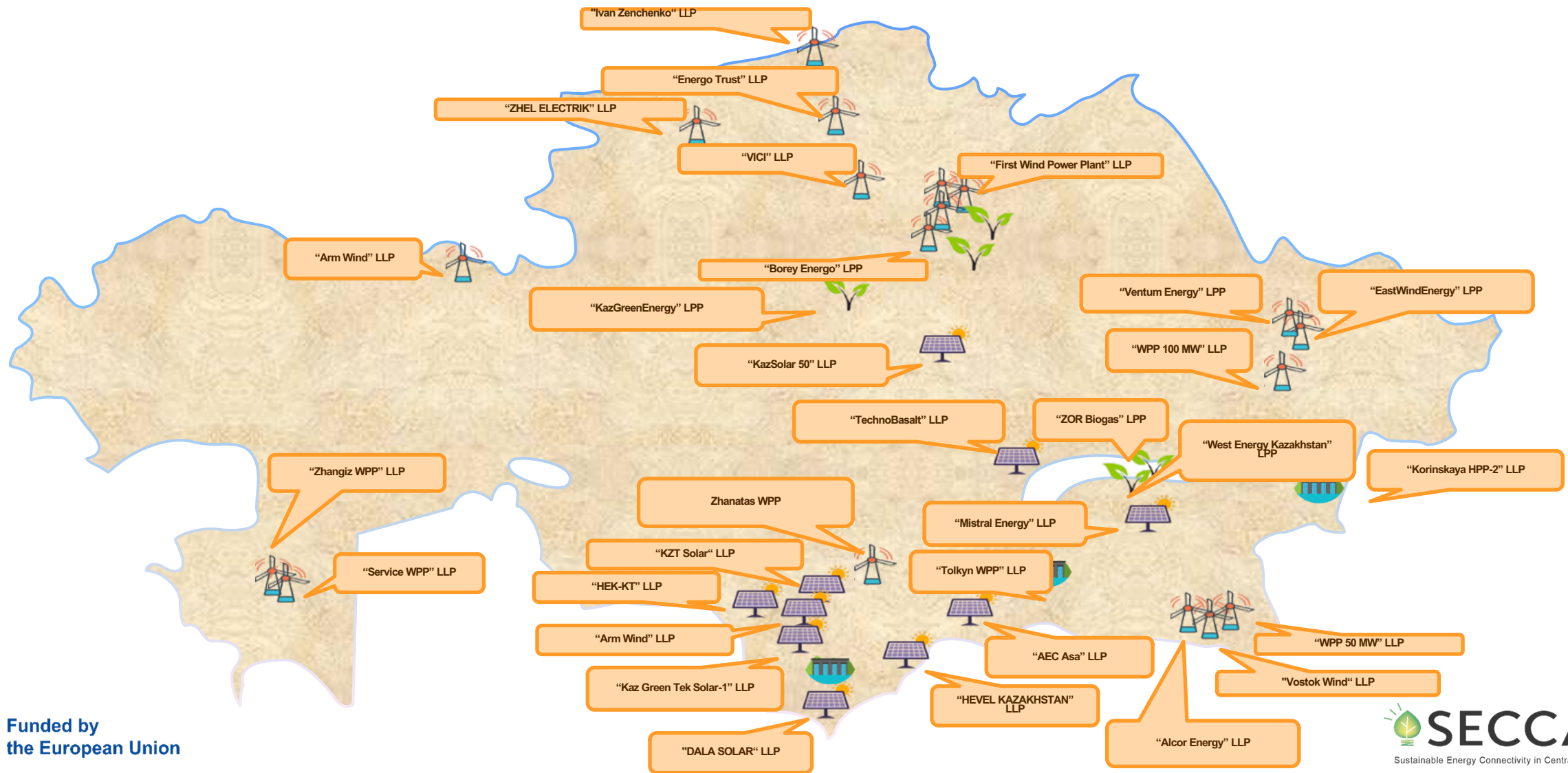
Volume of electricity generation from renewable energy sources, billion kWh until 2030



Growth dynamics of installed renewable energy capacity, MW



# MAP OF OPERATING RES FACILITIES





# RES IN KAZAKHSTAN

## The Republic of Kazakhstan

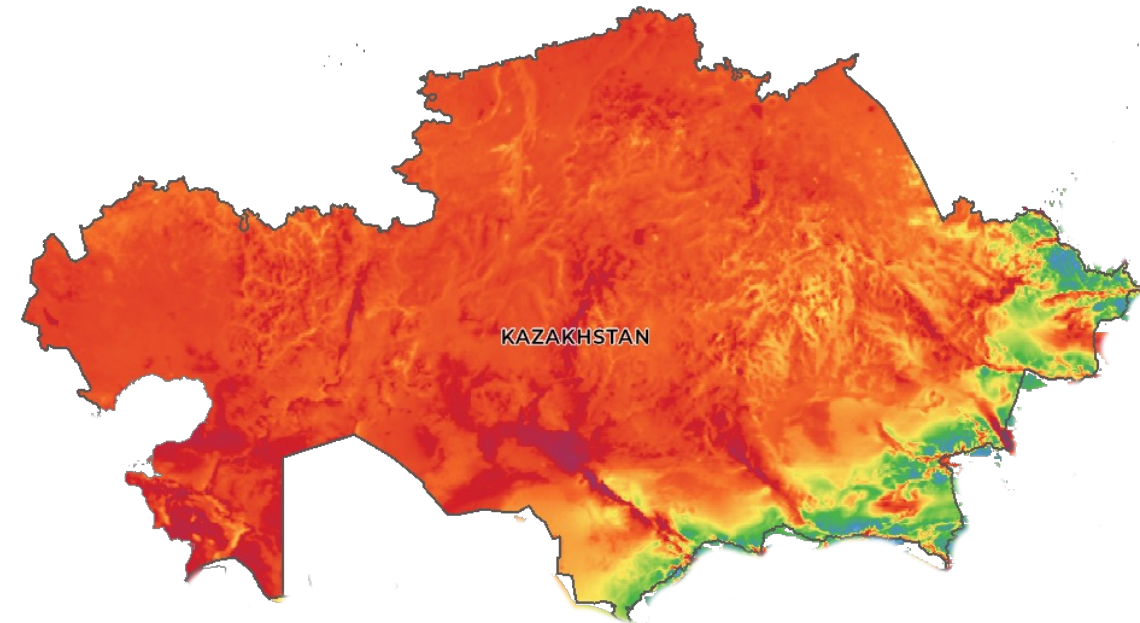
- occupies the 9th place in the world by area of territory
- significant potential of wind energy
- in the near future, it has every opportunity to take a leading position in the world in the development of wind generation, which will be:
  - as stable as possible;
  - evenly distributed (throughout the country);
  - minimally affect the growth of tariffs for end consumers.

### Legislative measures to support renewable energy in Kazakhstan

- 1 **At least 20 years**  
GUARANTEED PERIOD OF MANDATORY PURCHASE OF ALL GENERATED ENERGY
- 2 **Customs duties**  
EXEMPTION FROM PAYMENT DURING THE CONSTRUCTION PERIOD
- 3 **Sales tariff**  
PEGGED TO A FOREIGN CURRENCY



## Wind potential map



The climate in Kazakhstan is favorable for the construction of wind power plants due to the presence of wind corridors with a wind speed of more than 5 m/s, which is necessary for the operation of wind turbines. The Caspian region, central and northern Kazakhstan, as well as southern and southeastern Kazakhstan have the highest wind energy potential.

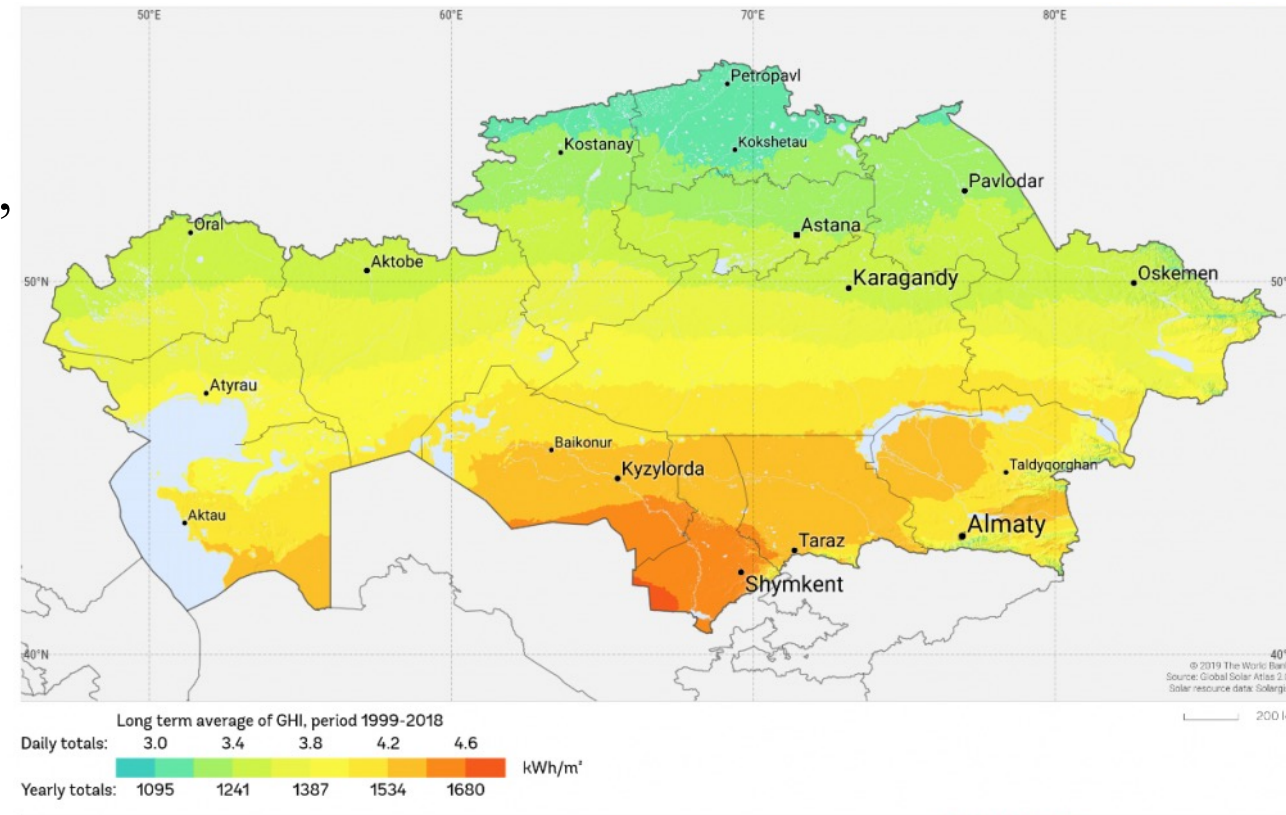
According to the Ministry of Energy of Kazakhstan, the country's wind energy potential is estimated at 920 billion kWh of electricity annually.



# SOLAR POTENTIAL MAP

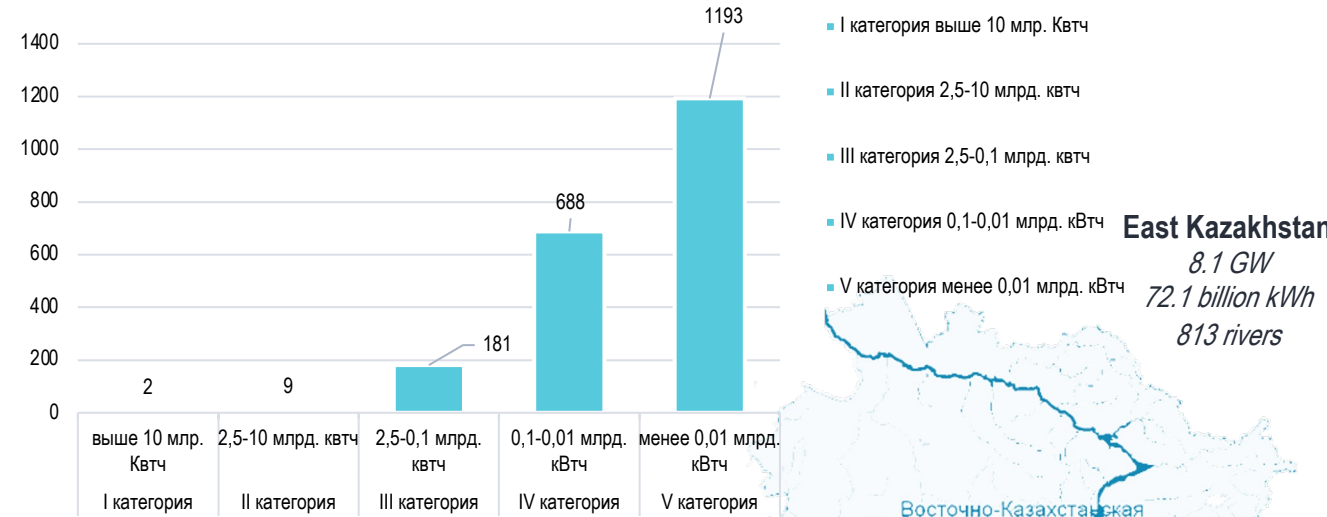
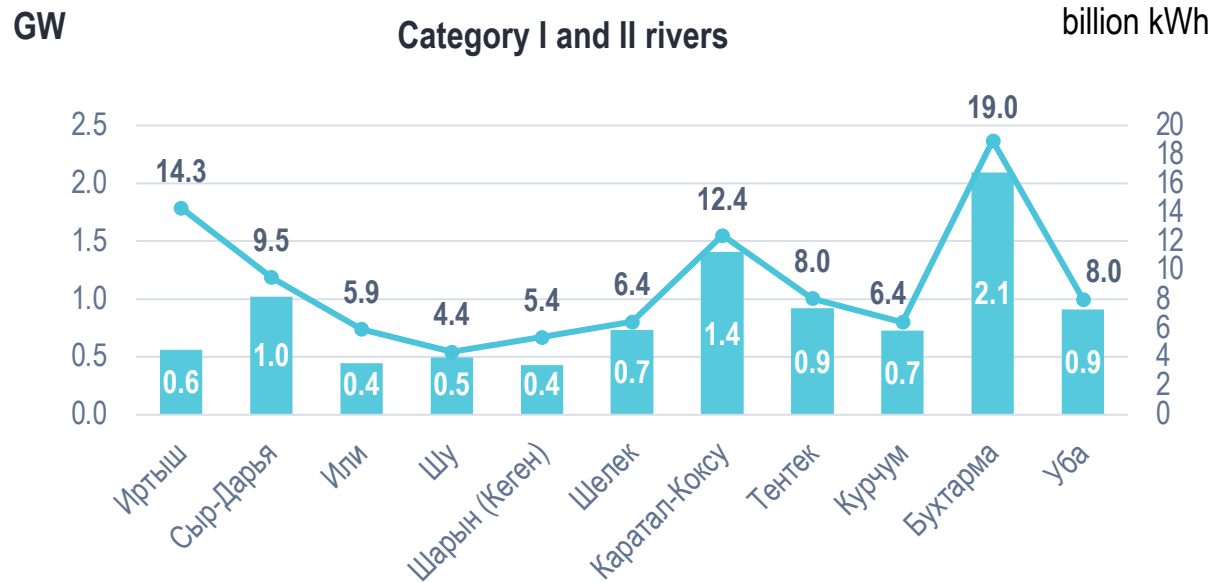
Solar energy has huge potential as a renewable energy source in Kazakhstan due to sparsely populated large territories and climatic conditions, especially in the south of the country, where the sun shines from 2,200 to 3,000 hours a year

In Kazakhstan, the solar energy potential is 2,5 billion kWh. The most preferred areas for solar generation are the Aral Sea region and the southern regions of Kazakhstan, experiencing a shortage of electricity.

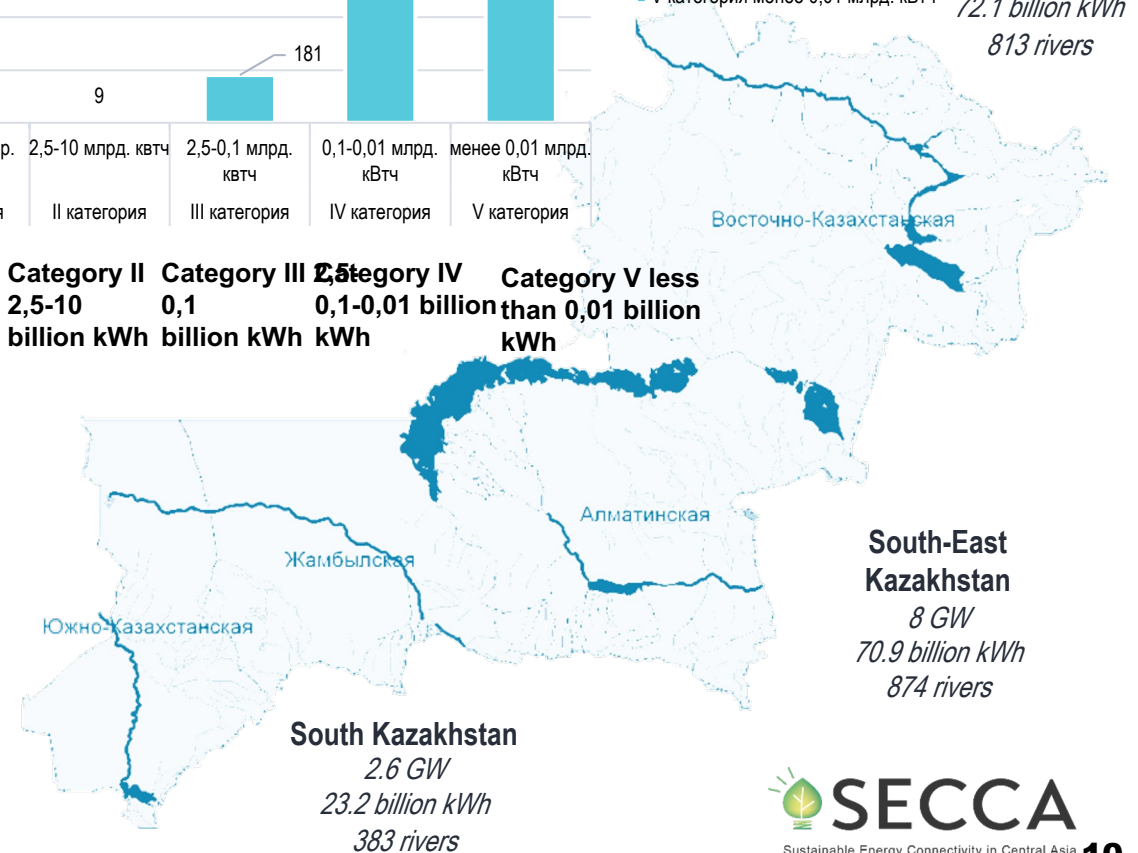


# INFORMATION AND CHARACTERISTICS OF KAZAKHSTAN'S HYDROPOWER POTENTIAL

Hydropotential	Number of rivers	Category I over 10 billion kWh	Category II 2,5-10 billion kWh	Category III 2,5-0,1 billion kWh	Category IV 0,1-0,01 billion kWh	Category V less than 0,01 billion kWh
South Kazakhstan	383	1	1	20	74	287
South-East Kazakhstan	874	-	5	89	340	440
East Kazakhstan	813	1	3	72	274	466
<b>TOTAL</b>	<b>2070</b>	<b>2</b>	<b>9</b>	<b>181</b>	<b>688</b>	<b>1193</b>

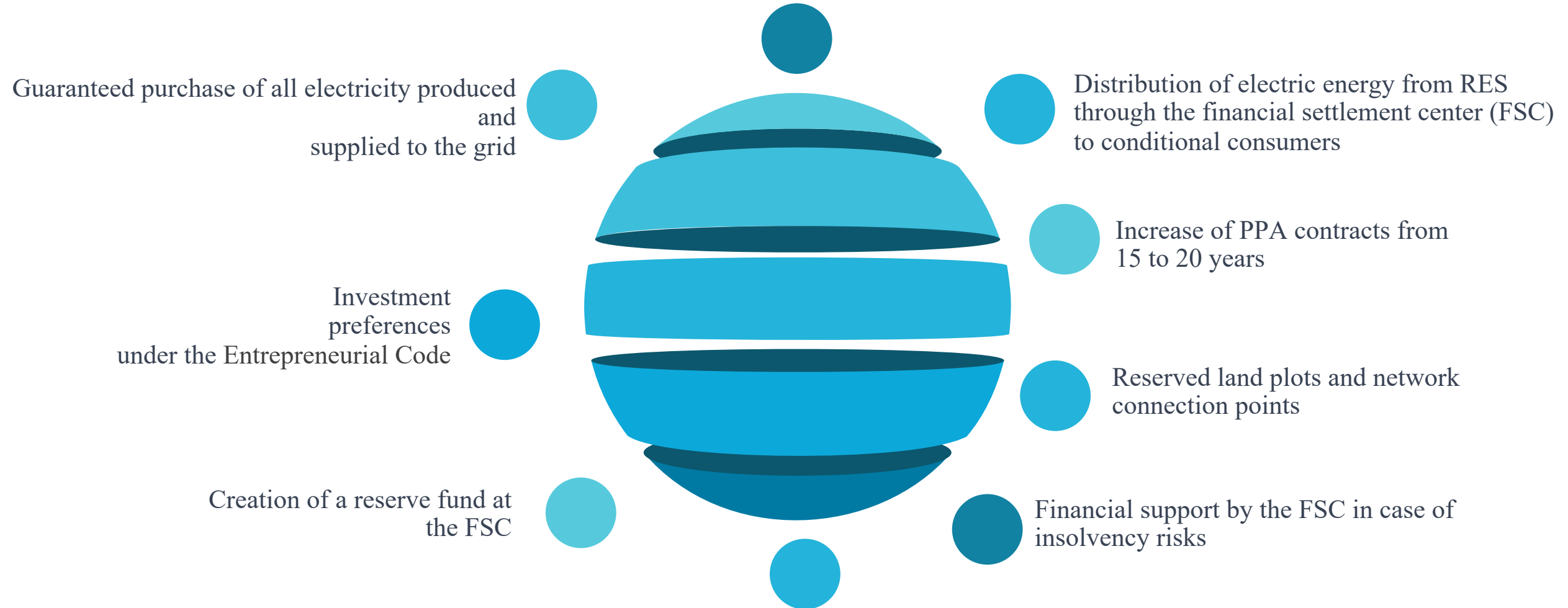


**Category I over 10 billion kWh** **Category II 2,5-10 billion kWh** **Category III 2,5-0,1 billion kWh** **Category IV 0,1-0,01 billion kWh** **Category V less than 0,01 billion kWh**



# PREFERENTIAL CONDITIONS FOR THE DEVELOPMENT OF RENEWABLE ENERGY IN KAZAKHSTAN

Agreement on integrating renewable energy facilities to the grid





# KEY INDUSTRY DEVELOPMENT INDICATORS BY 2050

**5 year** SCHEDULE

of organizing and conducting auctions for the selection of projects to construct renewable energy facilities

**50%** of production volume

share of alternative energy sources and renewable energy sources by 2050.

KEY INDUSTRY  
DEVELOPMENT  
INDICATORS BY  
2050

*Implementation of the  
strategy to achieve carbon  
neutrality of the economy of  
the Republic of Kazakhstan  
by 2060*

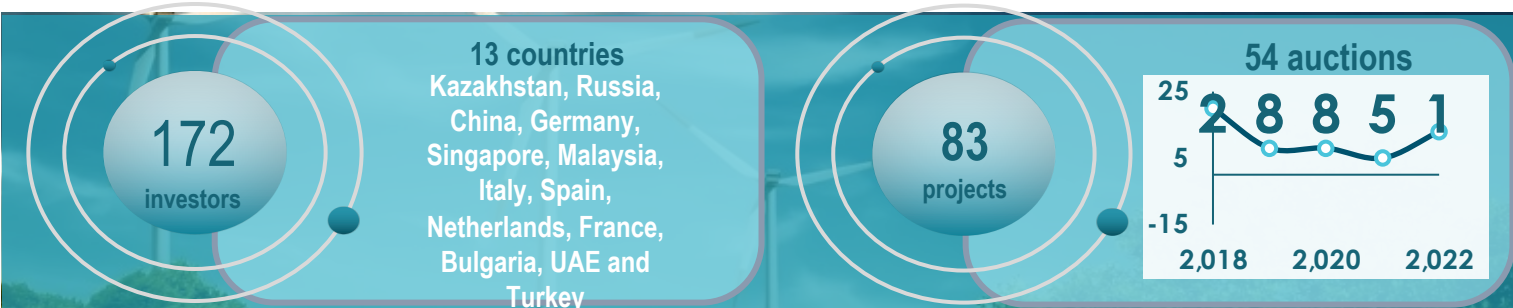
**7 GW** by 2030

of RES generating capacities are planned to be commissioned

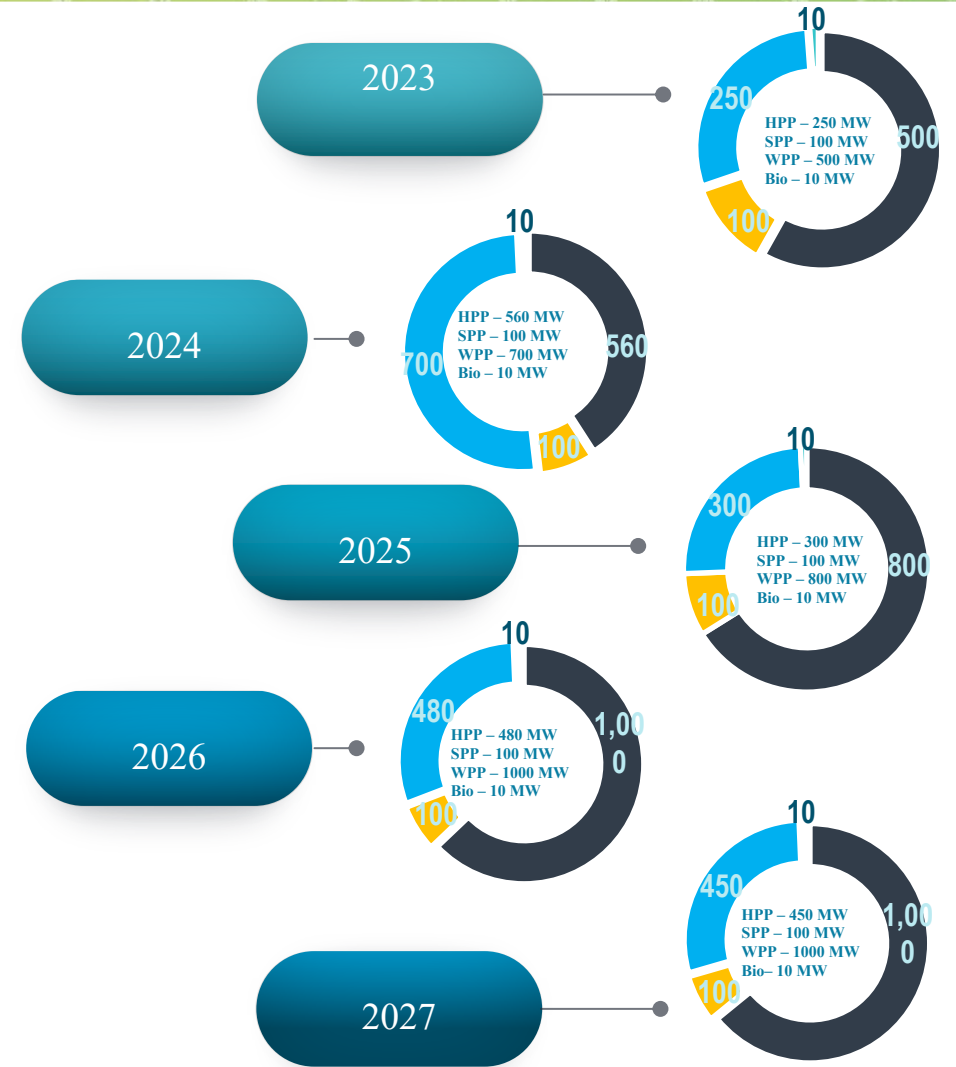
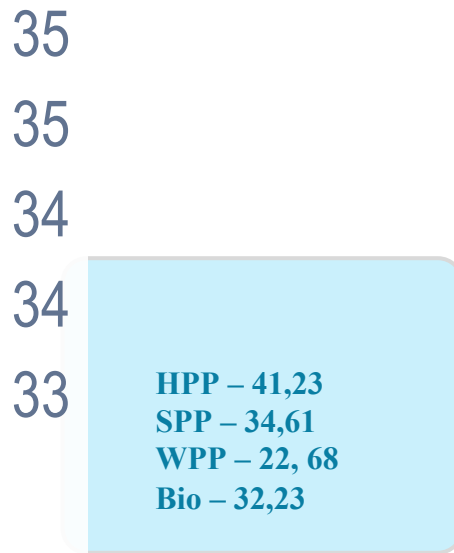
**15%** of total generation

share of renewable energy sources from total generation in the country in 2030

# AUCTIONS FOR THE SELECTION OF PROJECTS TO CONSTRUCT RES FACILITIES



AUCTION PRICES, KZT/kWh



# RES IN KAZAKHSTAN

For auctions in 2023, the maximum starting auction prices are:



SPP

34,61



WPP

22,68



HPP

41,23



Bio

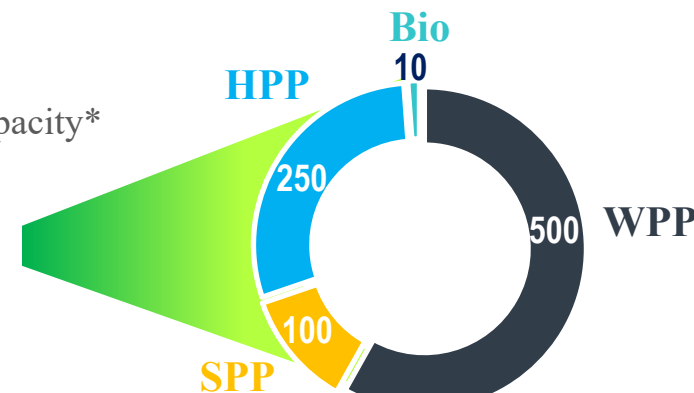
32,23

Based on the results of the 2023 auctions, the maximum reduction in the auction price was: SPP – 59.86%, HPP – 57.5%, WPP – 54.23%, BioPP – declared failed.

## 2023

volume of installed RES capacity\*

# 860 MW



\*Based on the results of the auction for the selection of renewable energy projects. According to the order of the Minister of Energy of the Republic of Kazakhstan No. 187 dated May 23, 2023



## HPP 250 MW

### 1) 206.01 MW - November 24,

For Northern and Southern zones

- 33.1 MW at 34.8
- 10.01 MW at 34.81
- 15 MW at 34.9
- 14.9 MW at 35.01
- 12.8 MW at 35.3
- 42 MW at 35.32
- 10.2 MW at 35.33
- 18 MW at 35.8
- 50 MW at 38.99

### 1) 31.9 MW – November 22,

For Northern and Southern zones

- 2.4 MW at 19.8
- 2.5 MW at 19.88
- 4.9 MW at 20.35
- 3.2 MW at 20.36
- 2.0 MW at 22.35
- 3.5 MW at 22.36
- 2.0 MW at 23.00
- 4.5 MW at 25.44
- 2.0 MW at 25.89
- 4.9 MW at 26.9



## SPP 100 MW

- 1) 20 MW - November 23, for the Western zone at 34.19
- 2) 20 MW - November 24, for the Southern zone at 17.38
- 3) 20 MW - November 27, for the Southern zone at 17.34
- 4) 20 MW - November 28, for the Southern zone at 14.5
- 5) 20 MW - November 29, for the Southern zone at 13.89



## WPP 500 MW

- 1) 10,001 MW - November 21, for the Northern zone at 10.38
- 2) 50 MW - November 20, for the Southern zone at 10.49
- 3) 50 MW - November 17, for the Southern zone at 11.78
- 4) 50 MW - November 16, for the Northern zone at 11.88
- 5) 50 MW - November 15, for the Northern zone at 12.33
- 6) 100 MW - November 14, for the Northern zone at 13.49
- 1) 100 MW - November 13, for the Northern zone at 10.5



## BioPP 10 MW

- 1) 10 MW  
November 30  
**Failed**

Repeated in Mar



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# AUCTIONS FOR RENEWABLES IN KAZAKHSTAN

Before the start of auction trading (hereinafter referred to as AT)

CD – calendar days  
ME RK – Ministry of Energy of the Republic of Kazakhstan  
FSC – financial settlement center

## Ministry of Energy of the Republic of Kazakhstan

- Publishes the auction trading schedule 90 CDs before the AT

## Ministry of Energy of the Republic of Kazakhstan

- Sends a list of AT observers of no more than 8 people

## Single purchaser (FSC)

- Confirms collateral 2 days before the AT

## KOREM

- Registers AT participants in the system no later than 5 CDs before the AT
- Uploads documents into the system according to the list
- Concludes agreements for participation in the AT (deadline 1 CDs before the AT)
- Conducts training on how to work in the trading system (according to the schedule)

Start

60-90 days

5-30 days

1-5 days

Auction

After AT

WD – working days  
EPO – energy producing organization  
KOREM – Kazakhstan operator of the electric energy and power market  
RES – renewable energy sources

## Single purchaser (FSC)

- Concludes agreements with the AT winner (application is accepted within 60 CDs after the inclusion in the list of RES EPOs)

## Ministry of Energy of the Republic of Kazakhstan

- Within 30 CDs includes winners in the plan for the placement of renewable energy facilities
- Within 5 CDs includes winners in the list of RES EPOs
- Publishes the names of auction winners within 30 CDs

## Single purchaser (FSC)

- Returns collaterals within 3 CDs to non-winning AT participants
- Collateral for the use of the agreement is provided by the AT winners within 30 CDs after signing the agreement

## KOREM - Auction

- Condition: at least 2 participants and the total volume of applications must be at least 130% of that stated in the AT schedule
- Opens an envelope with a collateral for the application



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