Multi-year Expert Meeting on Enhancing the Enabling Economic Environment at All Levels in Support of Inclusive and Sustainable Development, and the Promotion of Economic Integration and Cooperation, 6th session
30-31 October, 2023

Informal session 2: Domestic challenges in green structural transformation

Kazakhstan: domestic constraints for green industrialization (challenges, opportunities and solutions)

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The 2021 Global Carbon Atlas (http://www.globalcarbonatlas.org)

Territorial Per GDP ($kgCO_2$/GDP)

Rank	Country	$kgCO_2$/GDP
1	Mongolia	1.29
2	Trinidad and Tobago	1.03
3	Turkmenistan	0.91
4	Libya	0.77
5	South Africa	0.64
6	Bahrain	0.61
7	Kazakhstan	0.59
8	Ukraine	0.58
9	Venezuela	0.57
10	Russian Federation	0
11	Uzbekistan	0
12	Iran	0
13	Oman	0
14	Vietnam	0
15	China	0

Territorial ($MtCO_2$)

Rank	Country	$MtCO_2$
	Australia	391
17	United Kingdom	347
18	Italy	329
19	Poland	329
20	Vietnam	326
21	France	306
22	Taiwan	283
23	Thailand	279
24	Kazakhstan	277

Territorial Per capita (tCO_2/person)

Rank	Country	tCO_2/person
1	Qatar	36
2	Bahrain	27
3	Kuwait	25
4	Trinidad and Tobago	24
5	Brunei Darussalam	24
6	United Arab Emirates	22
7	New Caledonia	19
8	Saudi Arabia	19
9	Oman	18
10	Australia	15
11	Mongolia	15
12	United States of America	15
13	Kazakhstan	14
14	Canada	14
15	Palau	13

Kazakhstan ranked 24st in carbon dioxide emissions among 221 countries, 13th in emissions per capita, and 7th in carbon intensity of GDP.

However, Kazakhstan's contribution to global carbon dioxide emissions was only 0.77% in 2021.

Kazakhstan looks bad in global climate rankings.

Kazakhstan is one of the most energy-intensive and carbon-intensive economies in the world.

There are many reasons behind the challenges, limitations and opportunities of green development.

National specifics that determine the challenges, limitations and opportunities for greening the economy

Territory (9th largest in the world by area)

- Huge area in the center of Eurasia (more than 2.7 million km²)
- Largest landlocked country in the world
- 2/3 of the territory is arid. In Kazakhstan, global warming is more intense than the world average. The average rate of increase in surface air temperature in Kazakhstan was 0.32°C per 10 years.

Population (62th place in the world in terms of population)

- 19,9 million people as of September 1, 2023
- average growth rate over the past decade 1.58 % per year
- average population density less than 7,25 people / km2

Economy (42nd place in the world in terms of GDP)

- small capacity domestic market
- rich in energy and minerals
- dominated by energy-intensive export-oriented industries, which provide the main state budget revenues
- 41.3% of the population lives in rural areas with poorly developed infrastructure in areas with a sharply continental climate, far from industrial centers

15-25% reduction in GHG emissions by 2030 (compared to 1990)

Among top 30 developed countries globally by 2050

Green Economy Concept to 2050 (Action Plan for 2021-2030)

Carbon neutrality by 2060 (a long-term decarbonization strategy in 2023)

Renewable energy targets: 3% by 2020, 15% by 2030, and 50% by 2050

Green finance – AIFC (green taxonomy by December 2021)

A unified System of State Planning (KZ 2050 platform) – tracking progress

How did Kazakhstan survive the COVID-19 pandemic?

- **In the 2000s, economic growth was ensured by the influx of FDI in oil and gas production, ore mining and the production of ferrous and non-ferrous metals:**
  - average GDP growth rate was 10%
  - poverty reduced from 47% to 5.5%
  - unemployment fell from 10.4% to 5.4%
- At that favorable time, an off-budget National Fund was created from direct tax revenues from export-oriented companies in the extractive sector, primarily from oil and gas exports for development purposes in the interests of future generations. It was also provided that in crisis years the Government could use part of the funds for anti-crisis measures by transferring NF funds to the State budget.
- Each time it becomes more and more difficult for Kazakhstan to overcome external crises due to dependence on raw materials, since the Government focuses only on anti-crisis measures through transfers from the National Fund.
- **Real GDP has declined after every economic crisis, but the COVID-19 pandemic has hit the economy harder than any previous one. GDP in 2020 decreased by 2.5% compared to the previous year.**
- Anti-crisis measures of the Government in 2020 included:
- exemptions and deferments on taxes and social payments for microbusinesses and SMEs,
- expansion of preferential lending to SMEs,
- cash payments for more than 4.5 million people who lost income due to restrictive measures.
- In 2021, 58% of savings ($2.5 billion) were withdrawn from the National Fund to pay pensions, benefits, conduct research, and maintain prisoners), making it impossible to finance important projects from the point of view of long-term development.
- **Currently, the National Fund's savings have approached the level of the minimum balance (30% of GDP). If crises continue, these funds may be enough to support economies for no more than two years.**

In 2022, Kazakhstan was influenced by internal and external shocks

Almaty tragedy: mass protests associated with a sharp increase in prices for natural gas motor fuel (2 times), the Government sent in allied troops and suppressed the unrest, firearms were used.

- The result is that Nazarbayev's regime was overthrown, political transformations and the implementation of a new economic policy were launched.

The tense geopolitical situation following the Russian invasion of Ukraine has led to reduced oil production and supply chain problems.

Result:

- inflation reached 20.3% at the end of 2022
- the GDP growth rate was lower (3.2%) than a year earlier (in 2021 it was 4.3%).

The structure of the national economy is not complicated. The main source of revenue for the State budget is the oil and gas sector, which accounts for more than 50% of Kazakhstan's exports.
For this reason, the Government cannot ignore the demands of companies, which are the main sources of government revenue.

- The national economy remains vulnerable to unpredictable fluctuations in world energy prices. In 2022 (for the first time since 2014), Kazakhstan's current account became surplus and amounted to $8.5 billion due to rising oil prices.
- FDI is not diversified and remains in the extractive sector, which employs only 3% of the country's working population. The average salary in the extractive industries is 2-4 times higher than the average salary in the economy as a whole. The extractive sectors lack the potential to create new jobs due to the capital intensity of the sector.
- Over the past 10 years, entrepreneurs have been reinvesting less and less profit into their business; fixed assets are becoming obsolete both physically and morally. Job growth is provided by low-productivity industries and the public sector.

Macroeconomic indicators of Kazakhstan

	Macroeconomic indicators	2018	2019	2020	2021	2022
1.	GDP (Billion USD)	179.3	181.7	171.1	197.1	225.3
2.	Growth (%)	4.1	4.5	-2.5	4.3	3.2
3.	GDP per capita (USD)	9 812.5	9 812.5	9 121.7	10 369.9	11 476.6
4.	Unemployment (%)	4.9	4.8	4.9	4.9	4.9
5.	Inflation (%)	5.3	5.4	7.5	8.4	20.3
6.	Budget deficit (surplus) as a percentage of GDP	-1.3	-1.8	-4.0	-3.0	-2.1
7.	Gross foreign direct investment inflows (Billion USD)	24.3	24.4	17.2	23.8	28.0
8.	Average annual exchange rate of US dollar, tenge	344.71	382.75	412.95	426.03	460.48
9.	Average annual price for Brent oil, USD per barrel	71.1	64	42.3	70.4	99.8
10.	Share of oil and gas in exports, %	62	57.8	50.5	51.5	55.6
11.	Current Account Balance (Billion USD)	-0.05	-7.0	-11.0	-2.6	8.5
12.	Current Account Balance as a % of GDP	-1	-3.9	-6.4	-1.3	3.9
13.	External Gross Debt (Billion USD)	158.8	159.5	164.0	164.1	160.5
14.	External Gross Debt (including intercompany debt) as a % of GDP	93.1	87.8	95.8	83.1	71.6
15.	External Government Gross Debt (Billion USD)	12.3	13.3	15.2	18.4	15.6

Refinancing rate of the National Bank of the country

- In response to rising inflation, the National Bank of Kazakhstan significantly tightened its monetary policy.
- In 2022, the National Bank increased the base rate by 6.5 percentage points to 16.75% in response to double-digit inflation, which reached 20.3% in December 2022 compared to the previous year.
- Typically, the National Bank increases the base rate in increments of 0.5 percentage points. A more significant increase in the base rate occurred after a significant devaluation of the tenge in 2015.
- The policy of the National Bank this year led to a decrease in inflation from 18.1% in March to 13.1% in August 2023. However, the National Bank intends to maintain a tighter monetary policy to achieve an inflation target of 5% by 2025.

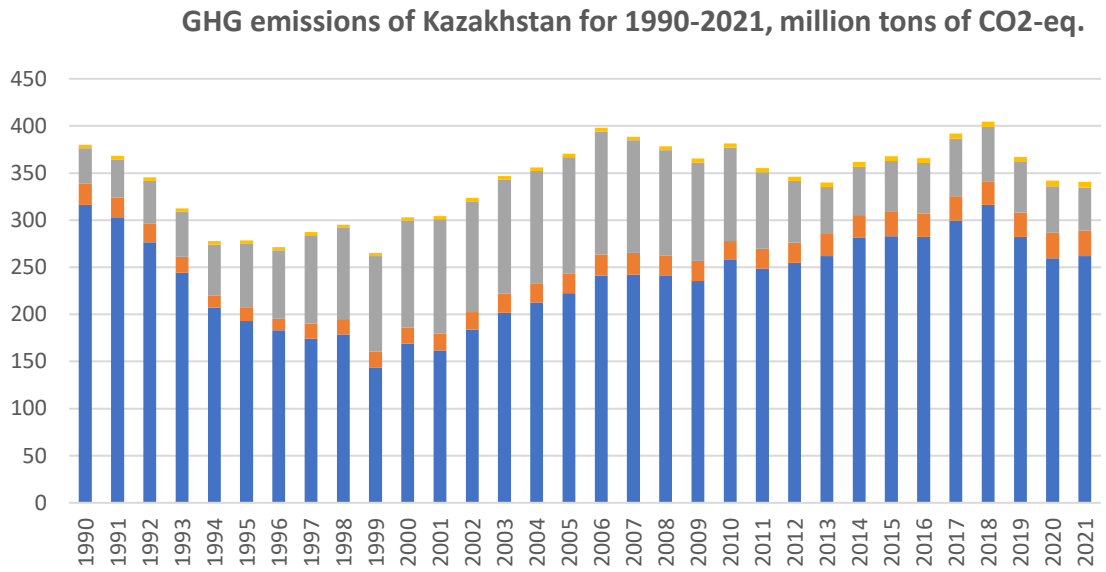
Investment difficulties

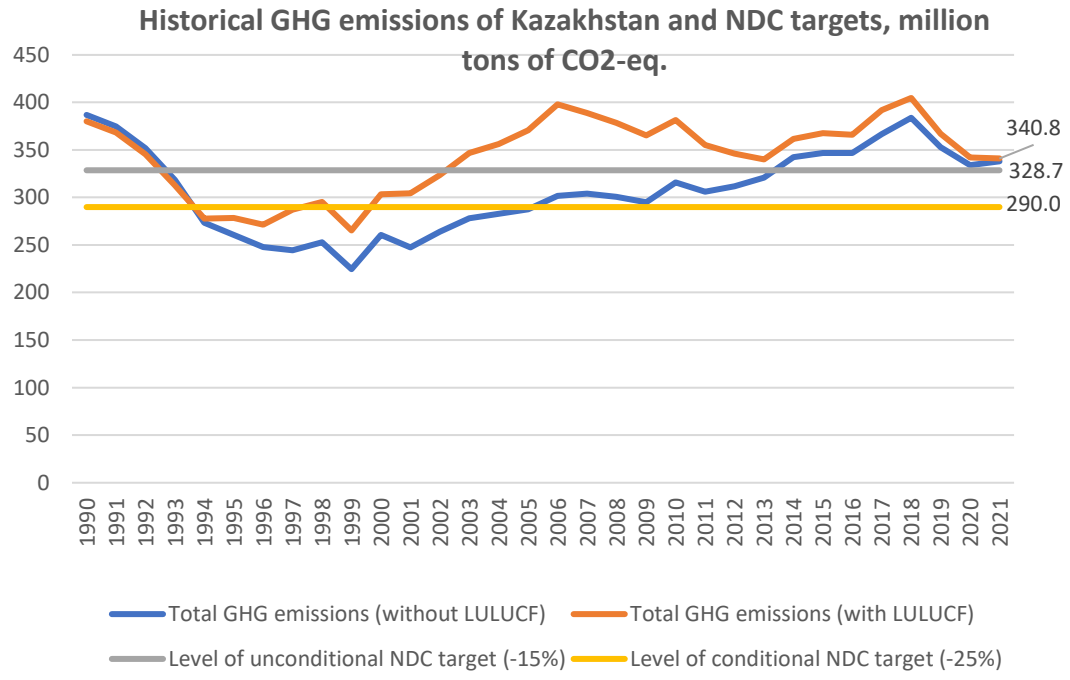
- Other sectors of the economy are chronically experiencing a shortage of available investment resources;
- credit resources for business are very expensive.
- Over the last 10 years, entrepreneurs have been reinvesting less and less profit into their business, which leads to significant depreciation of production assets.
- They cannot offer the working population new high-quality jobs with sufficiently high salaries. Labor productivity in many industries is not growing, wages have frozen at the 2013 level.
- And prices continue to rise all the time.

Kazakhstan is a net exporter of energy resources

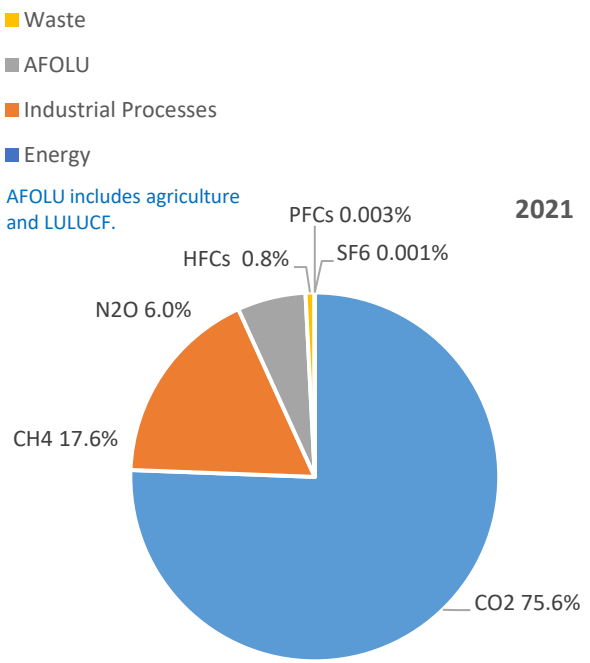
- In 2022, Kazakhstan produced 6,811,546.5 TJ, of which:
- exported 55.8%
- 43.9% represents total primary energy consumption (TPEC).

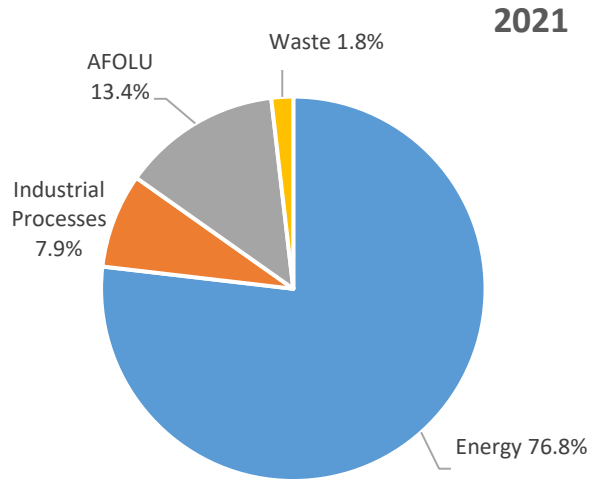
- Coal-fired power plants are the backbone of the industry. 68% of electricity is generated from coal, 20% from natural gas, 7.8% from large hydroelectric power plants, 3.2% from solar, wind and small hydroelectric power plants.
- Given the capital intensity of power plant construction, Kazakhstan does not plan for early decommissioning of coal-fired thermal power plants. Replacement of coal capacities may take place as they are naturally eliminated.





55.7% of direct GHG emissions in Kazakhstan are directly related to coal (excluding emissions from transportation). Of these, 88% are emissions from fuel combustion, and 12% are fugitive emissions from fuel.



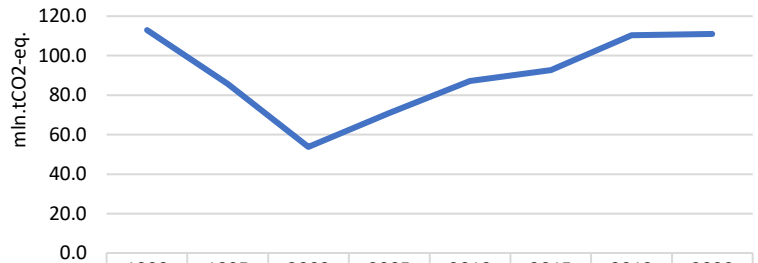


About 77 percent of GHG emissions are linked to fuel extraction, processing, transport, storage and combustion. The source of 13% of GHGs is agriculture. LULUCF has changed from a net sink to a net emitter due to the increased loss of soil humus in crop production. Industrial processes account for less than 8% of GHG emissions.

Change in the sectoral structure of GHG emissions in Kazakhstan, $ktCO_2$ eq.

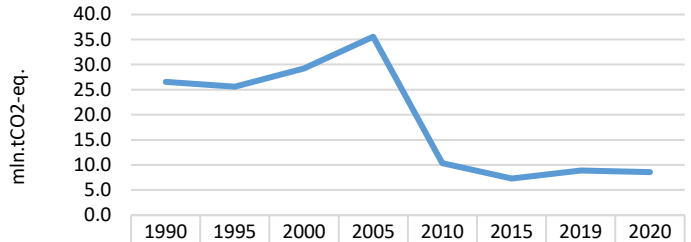
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (base year)	2018	2019	2020	2021	Change from base to latest reported year, %
Energy	316244,5	316162,8	282377,4	259502,4	261932,5	-17,2
Industrial processes and product use	22737,4	24535,8	25792,8	27031,4	27083,9	+19,1
Agriculture	43861,0	37856,2	39101,9	41419,5	42845,4	-2,3
Land use, land-use change and forestry[5]	-6496,2	20668,2	14366,8	8127,2	2714,4	+141,8
Waste	3839,97	5281,9	5418,6	6017,7	6261,5	+63,1
Total (including LULUCF)[5]	380186,6	404504,8	367057,5	342098,1	340837,7	-10,4
Change from base year, %		+6,4	-3,5	-10	-10,4	

Electricity and heat production



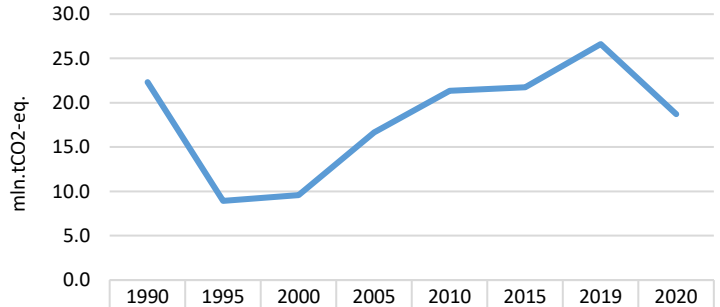
	1990	1995	2000	2005	2010	2015	2019	2020
Electricity and heat production	112.9	85.6	53.8	70.9	87.2	92.7	110.4	110.9

Oil and gas production and processing



	1990	1995	2000	2005	2010	2015	2019	2020
Oil and gas production and processing	26.6	25.6	29.2	35.5	10.4	7.3	8.9	8.6

Transport



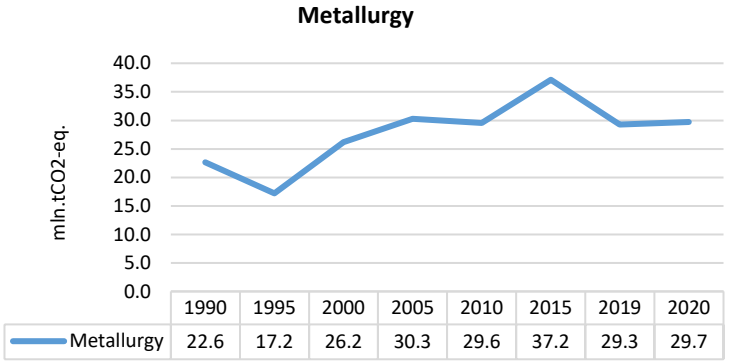
	1990	1995	2000	2005	2010	2015	2019	2020
Transport	22.3	8.9	9.6	16.6	21.4	21.7	26.6	18.7

The industry's contribution to national net GHG emissions has increased over 30 years from 29.6% to 31.6%. In absolute terms, emissions decreased by 1.7% due to changes in the structure of the sector's "fuel basket":

- the share of oil and petroleum products consumption decreased;
- the share of natural gas has increased;
- losses in heating networks and high-voltage power lines have decreased;
- consumption accounting has improved.

The almost threefold reduction in GHG emissions in the sector is associated with an improvement in the technological cycle of the entire process of production, transportation, storage and processing of hydrocarbon raw materials. This made it possible to apply emission factors recommended for developed countries, which are significantly lower than those applied to oil and gas refining equipment in the 1990s. In addition, gas flaring was legally prohibited in the oil and gas production sector (except for the technologically necessary volume), so the main volume of associated gas is reinjected into the reservoir to increase recovery. Methane is classified as a pollutant for which emissions companies pay environmental fees to the state budget. Moreover, companies in the oil and gas sector pay for methane emissions at a rate of 0.8 MCI (monthly calculated indicator) per ton of methane, while other stationary sources pay at a rate of 0.01 MCI per 1 ton.

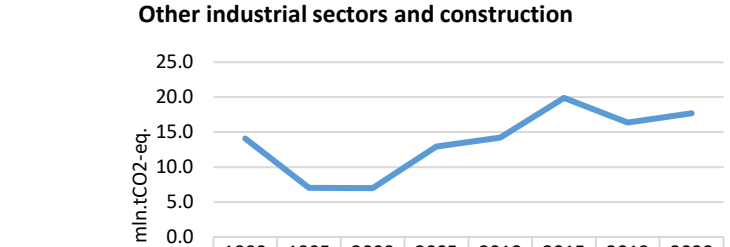
The increase in GHG emissions from transport is associated with a general increase in the production and consumption of motor hydrocarbon fuels (diesel, gas, etc.). However, not all modes of transport have proportionally increased their share of total emissions. The greatest growth occurred in automobile transport, primarily due to an increase in the number of cars by 2.9 times. The fleet has shrunk, but flights have increased. The share of rail transport emissions decreased by 4 times (from 24.3% to 6% of total transport emissions), mainly due to electrification, as well as a significant decrease in the volume of freight transported by rail. The share of shipping in total transport emissions decreased from 0.5% to 0.02%, i.e. 25 times. The share of pipeline transport emissions in total transport emissions increased from 3% to 7.3%, i.e. almost 2.5 times.



	1990	1995	2000	2005	2010	2015	2019	2020
Metallurgy	22.6	17.2	26.2	30.3	29.6	37.2	29.3	29.7

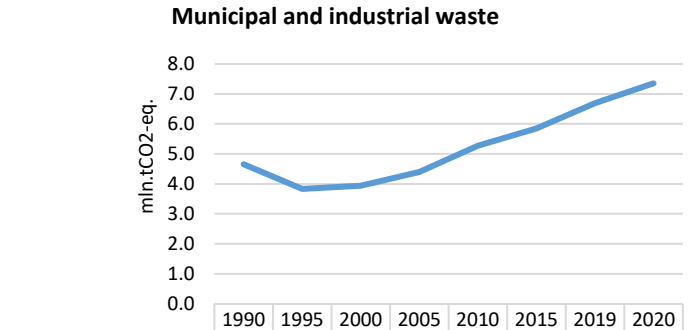
Both ferrous and non-ferrous metallurgy have increased their emissions due to:

- the commissioning of new metallurgical plants;
- increasing their capacity from 2011-2019.



	1990	1995	2000	2005	2010	2015	2019	2020
Other industrial sectors and construction	14.1	7.1	7.0	12.9	14.2	19.9	16.4	17.7

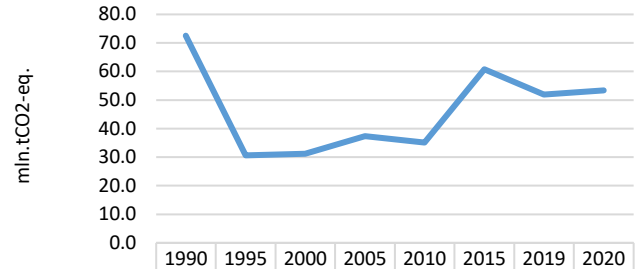
Over the past 20 years, the ongoing construction boom in Kazakhstan has caused an increase in the production of cement, limestone and dolomite.



	1990	1995	2000	2005	2010	2015	2019	2020
Municipal and industrial waste	4.6	3.8	3.9	4.4	5.3	5.8	6.7	7.4

The urban population and household incomes have increased. This led to an increase in the amount of solid household waste and landfill methane. Improved provision of water supply and sanitation to the housing sector has led to an increase in CH4 and N2O emissions from household wastewater. The number of households using septic tanks has increased, which becomes a source of methane. Reduced production volumes in the food, chemical and oil industries have reduced methane release.

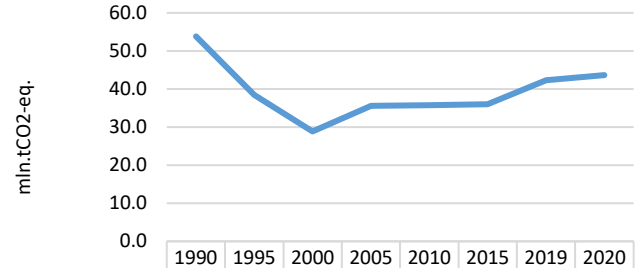
Coal mining and processing



	1990	1995	2000	2005	2010	2015	2019	2020
Coal mining and processing	72.5	30.6	31.2	37.3	35.1	60.8	51.9	53.4

Several closed mines of the Karaganda coal basin have been mothballed (the leakage of coal mine methane has been stopped).

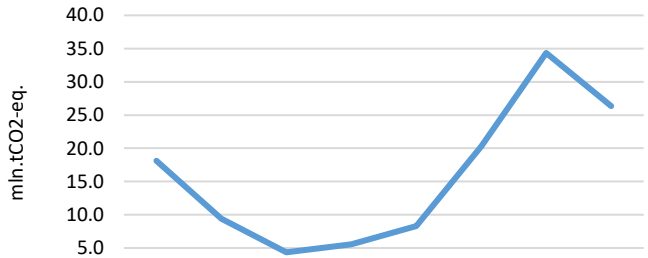
Agriculture, forestry, fisheries



	1990	1995	2000	2005	2010	2015	2019	2020
Agriculture, forestry, fisheries	53.8	38.4	28.8	35.5	35.8	36.0	42.3	43.7

Emissions of nitrous oxide from the mineralization of organic matter in the soil have increased, i.e. due to the deterioration of the quality of cultivated soils in the country.
The overall reduction in emissions occurred mainly due to a decrease in the number of farm animals from 1990 to 2020: cattle by 2.5 million heads, sheep by 19.5 million heads, pigs by 3 million heads, poultry by 16, 6 million heads. However, nitrous oxide emissions from the mineralization of organic matter in the soil have increased in the sector (due to the deterioration of the quality of cultivated soils in the country).

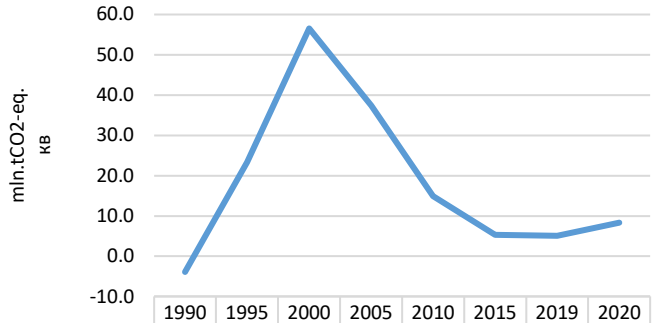
Households



	1990	1995	2000	2005	2010	2015	2019	2020
Households	18.1	9.4	4.4	5.6	8.3	20.3	34.4	26.4

Population growth and an increase in its well-being led to an increase in the construction of individual housing construction, which increased household fuel consumption for heating needs. Gasification of populated areas makes a certain contribution to the reduction of GHG emissions, but this has not yet made it possible to reduce greenhouse gas emissions in the category against the backdrop of an increase in the number of housing constructions. In 2020, due to the pandemic, construction work in the country slowed down and froze, including due to high import dependence on construction materials.

Forestry and other land uses (LULUCF)

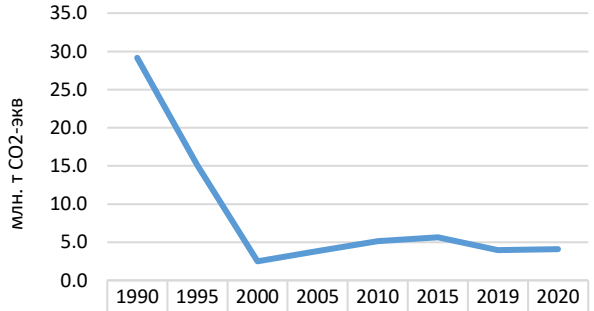


	1990	1995	2000	2005	2010	2015	2019	2020
Forestry and other land uses (LULUCF)	-3.9	23.3	56.6	37.4	14.9	5.3	5.1	8.4

In the mid-1990s, LULUCF turned from a sink sector (-3.9 million tons of CO2-eq.) into a source of emissions, and this continues to be the case in 2020 (+8.4 million tons of CO2-eq.).
This happened due to the fact that cultivated lands emitted 5.6 million tons of CO2-eq. in 1990, and 31.9 million tons of CO2-eq. in 2020. The difference is +26.3 million tons of CO2-eq. The reasons are (1) a violation of agricultural technologies for cultivating the land, which led to the depletion of soils and, accordingly, to a decrease in their ability to absorb and retain carbon, and (2) a tenfold reduction in the use of fertilizers (mineral and organic) by farmers due to the high cost.
The remaining categories of land use showed an increase in CO2 absorption:

- Forests absorb an additional 8.6 million tons of CO2-eq. through the introduction of part of forested pastures into forest lands and reforestation measures;
- Pastures began to absorb 3.1 million tons of CO2-eq. more by reducing the load of livestock on pastures;
- Settlement lands increased absorption by 2.4 million tons of CO2-eq.

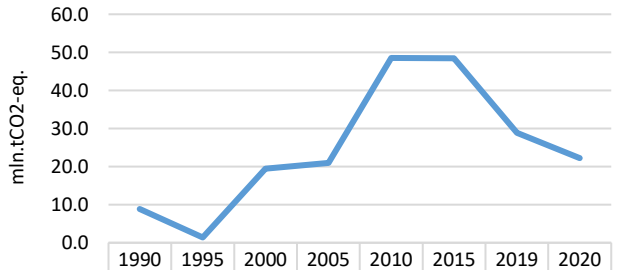
Services (commercial and government)



	1990	1995	2000	2005	2010	2015	2019	2020
Services (commercial and government)	29.2	15.1	2.5	3.8	5.2	5.6	4.0	4.1

The decrease is due to the transition of commercial and public buildings from fuel combustion to district heating, as well as changes in the methodological approaches of the Bureau of National Statistics for the formation of the fuel and energy balance in this category.

Other fuel consumption



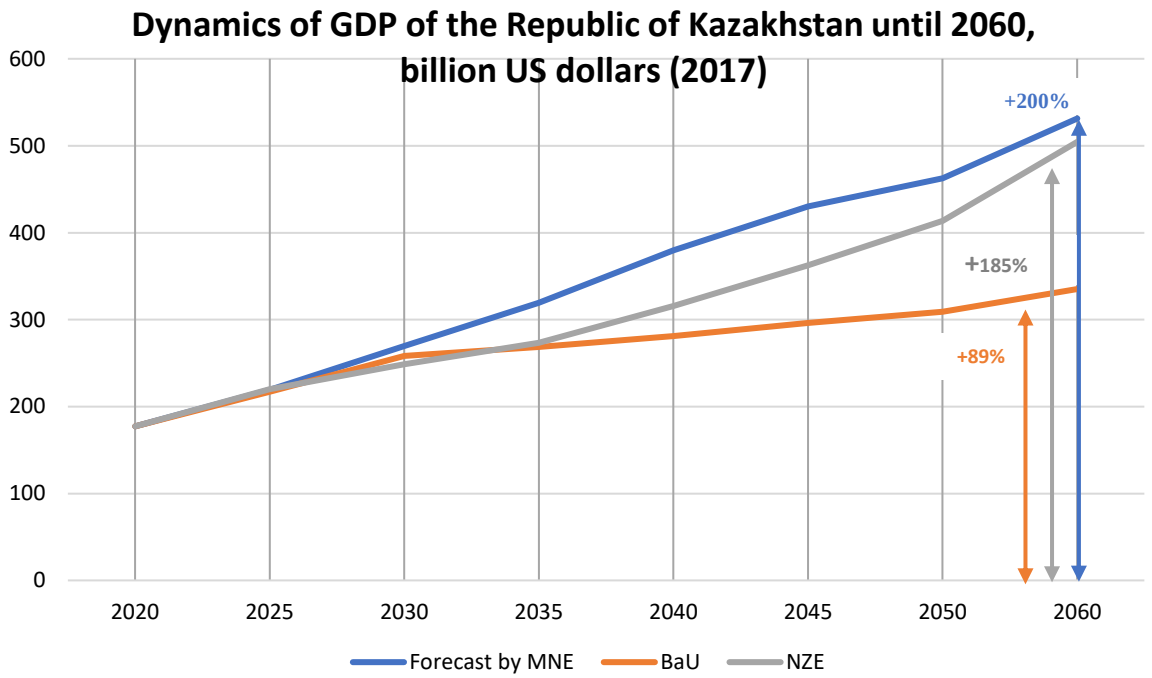
	1990	1995	2000	2005	2010	2015	2019	2020
OTHER FUEL CONSUMPTION	8.9	1.4	19.5	21.0	48.5	48.5	28.9	22.3

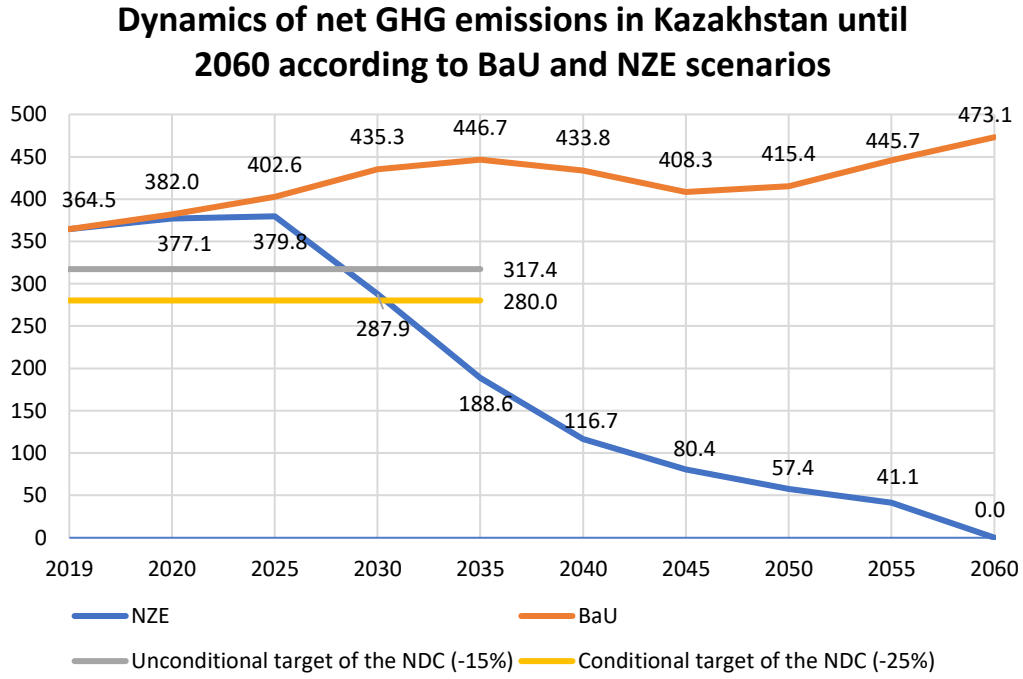
Burning of unidentified fuels (mostly liquid motor fuel) was redistributed among consumers between industries after the Bureau of National Statistics improved the reporting form for business entities. The remaining fuel consumption comes from stationary sources: government administration, defense and mandatory social security.

The modeling results, obtained by an international team of experts in partnership with national experts as part of the GIZ project, sparked heated debate.

Notes: The first draft of the Strategy was submitted by the Government to the Ministry of National Economy for examination on October 10, 2021.
The MNE significantly changed the energy structure. In the new energy structure, a Nuclear Power Plant appeared. Previously the Model had not chosen NPP due to the price non-competitiveness of energy.

Achieving carbon neutrality and economic growth until 2060

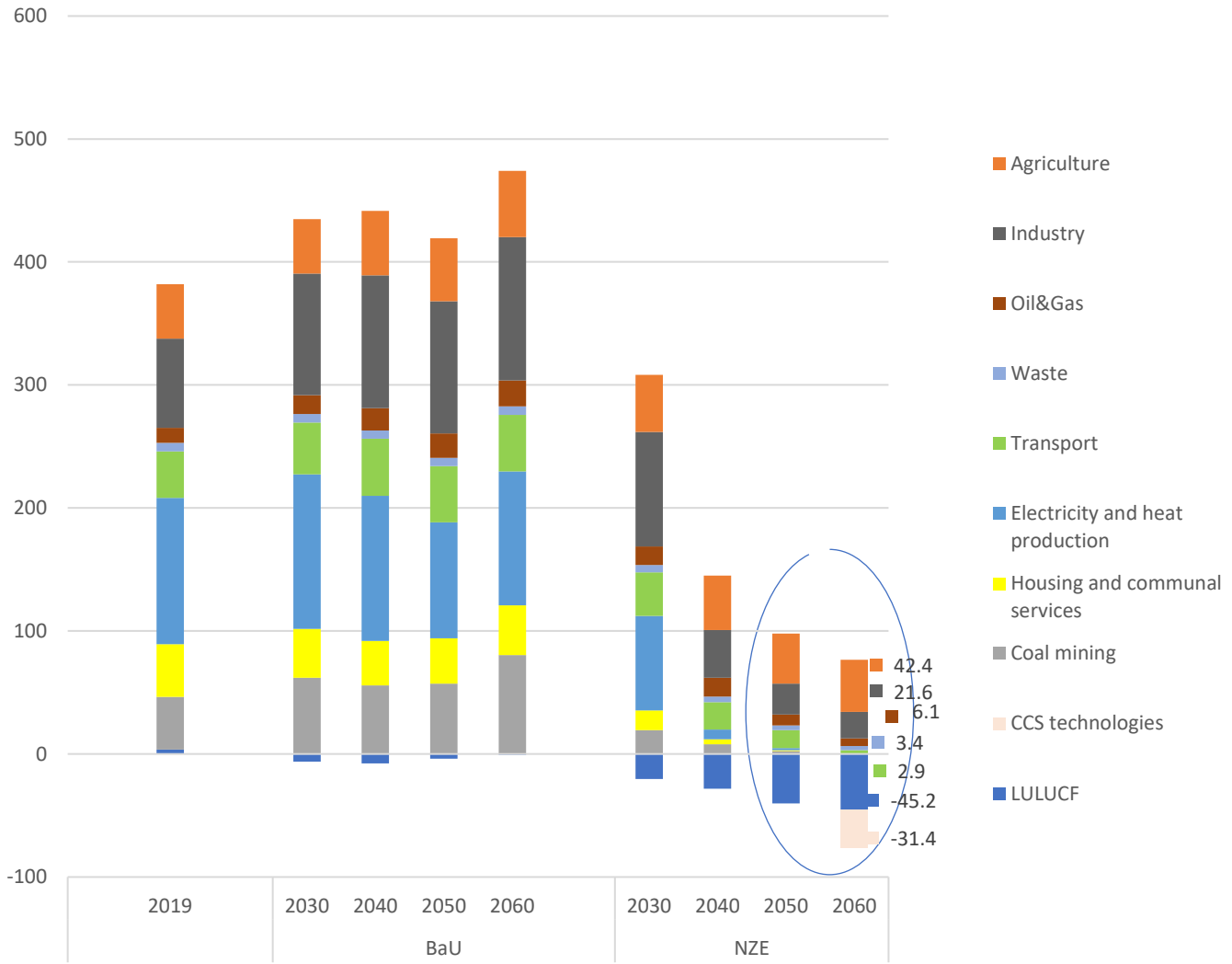




GDP: According to the BaU scenario, GDP is growing much slower than expected by the MNE (over the next 40 years, only by 89%). The expected losses from the **three main shocks to the economy** will amount to 3.7 trillion US dollars (compared to the expectations of MNE). **3 shocks are the impact of CBAM, a twofold decrease in prices for oil and other types of fuel until 2060 (according to the IEA), and the impact of climate change on agriculture.** The BaU scenario could be realized if time is lost to lay the groundwork for deep decarbonization in a timely manner between now and 2025. **The implementation of NZE scenario will reduce the expected total damage from the listed three shocks by 2.4 times until 2060.** In 2060, the GDP of NZE scenario will exceed the GDP of BaU scenario by 50% and amount to $504 billion (*For reference*: in 2020, GDP was $177 billion).

Reducing GHG emissions: To achieve carbon neutrality in 2060, Kazakhstan should strive to meet the conditional NDC target (-25%) in 2030. Compared to BaU scenario NZE scenario will prevent 9.3 billion tCO2-eq of greenhouse gases from entering the atmosphere during 2022-2060. This will be Kazakhstan's "contribution" to curbing the rise in global temperatures.

GHG emissions and absorption by economic sectors until 2060, mln. tCO2-eq.



The largest source of GHGs in 2060 will be **agriculture** with emissions of 42.4 million tCO2-eq. Emissions from **livestock** production will increase due to the increase in livestock numbers, but will be lower than in the BaU scenario.

The second major emitter will be **industry** (ferrous and non-ferrous metallurgy, production of cement and other mineral products). Emissions will amount to 21.6 million tCO2-eq., which is difficult to reduce. 3.9 million tCO2e associated with industrial fuels must be neutralized by CCS technologies.

In the electricity generation sector, 19 million tCO2-eq. compensated by CCS technologies.

Coal production stops, and emissions are reduced to "0."

The oil and gas sector will emit 6.1 million tCO2-eq.

In the housing and communal services sector and the services sector, direct emissions will be reduced to "0" through electrification, district heating, and the use of distributed RES.

In transport, emissions will be reduced by more than 10 times due to electrification and the use of hydrogen fuel.

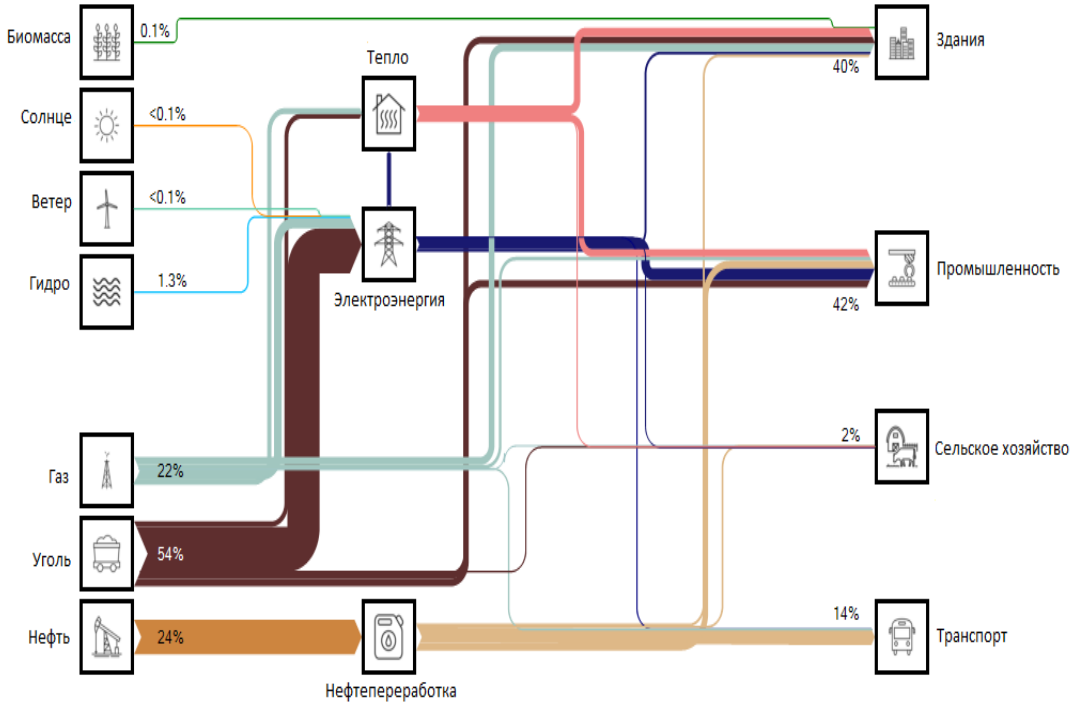
Crop production ceases to emit GHGs and increases its absorption capacity due to the 100% transition to organic farming.

The absorption of GHGs **by pastures and forest plantations** will increase. In general, **LULUCF** in 2060 will ensure the absorption of 45.2 million tCO2-eq.

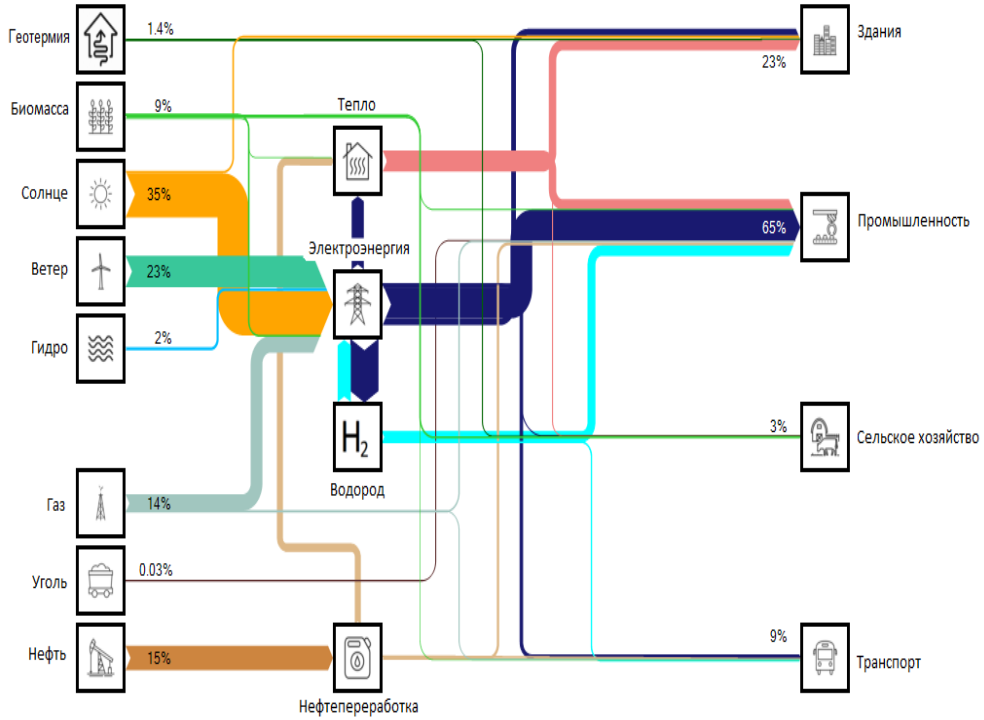
31.4 million tCO2-eq. will have to be compensated with CCS technologies that are not yet commercialized (they are expected to be available on the market by then).

Structure of Total Primary Energy Consumption and Structure of Final Energy Consumption

2017



2060



If in 2017 the TPES consisted of almost 99% of fossil fuels (53.7% - coal, 23.6% - oil, 21.5% - natural gas), then by 2060 the share of fossil energy resources will decrease by 3.4 times (coal use will be reduced to 0.03%, the share of oil will be reduced to 15%, gas – to 14%).

The share of RES in the TPES structure in 2060 will increase from just over 1.5% to 70.4%: the use of solar energy will be 35%, wind – 23%, biomass – 9%, the share of hydropower is limited due to limited water resources (we do not can increase it to more than 2%), the share of geothermal energy will be 1.4%.

In 2017, industry consumed 42% of **final energy consumption**, buildings consumed 40%, transport 14%, agriculture - 2%. In 2060, industry will consume 65%, buildings 23%, transport 9%, agriculture 3%.

Electricity production by type of primary fuel and energy resources, billion kWh

	Fact	BaU				NZE			
	2020	2030	2040	2050	2060	2030	2040	2050	2060
Coal	74.5	71.7	58.1	29.5	31.4	33.5	13.3	0.2	0.0
Gas and Hydrogen	21.6	44.3	58.1	80.4	100.8	39.8	70.7	78.6	102.6
heating oil	0.6	0.9	1.8	1.6	1.6	0.3	0.2	0.1	0.0
Hydro	9.5	11.5	19.0	25.0	19.1	23.2	25.4	25.4	19.5
Wind	1.1	1.0	6.0	8.6	10.6	21.0	97.3	173.3	201.7
Solar	1.3	1.3	2.3	4.8	8.2	12.6	48.8	157.6	283.5
Bio	0.005	0.0	0.0	0.0	0.0	1.6	1.6	3.2	4.5
Total	**108.1**	**130.7**	**145.3**	**149.9**	**171.8**	**132.1**	**257.3**	**438.3**	**611.8**

NZE Scenario:

The economy's demand for electricity will increase by about 6 times by 2060.

The policy of transition to carbon neutrality will determine the most efficient transition of end consumers of energy resources to renewable energy sources, as well as network electric and thermal energy, which will determine a more accelerated growth in electricity demand than in the BaU scenario.

By 2050, all coal-fired power plants must be decommissioned (natural retirement).

In the structure of electricity generation, **the share of renewable energy capacity, including large hydroelectric power plants, will increase from the current 11% to more than 83% in 2060.**

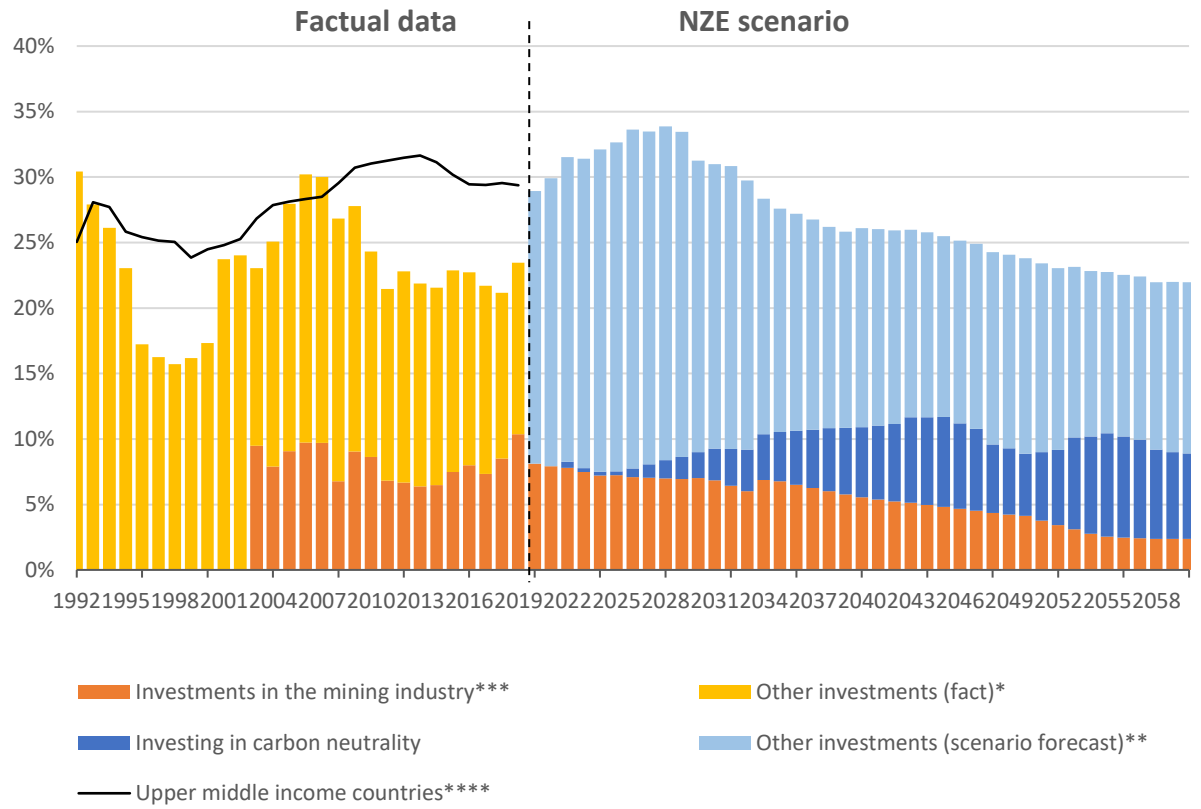
Need for investment

The economy's total need for investment during 2022-2060 in the NZE scenario is estimated at US$3.8 trillion (2017).

This exceeds the economy's needs in the base case by $1 trillion, including:
for decarbonization purposes – $666.5 billion;
$407.1 billion is an additional influx of investment into the economy, which will not appear in the economy if the country continues to develop according to the base scenario.

Currently, there is high depreciation of fixed assets. A significant portion of investments in both scenarios is needed to replace physically and morally obsolete fixed assets by 2030. In the NZE scenario, those investments that in the BaU scenario would go to update and expand fixed assets in the fossil fuel extraction sectors are used for decarbonization projects.

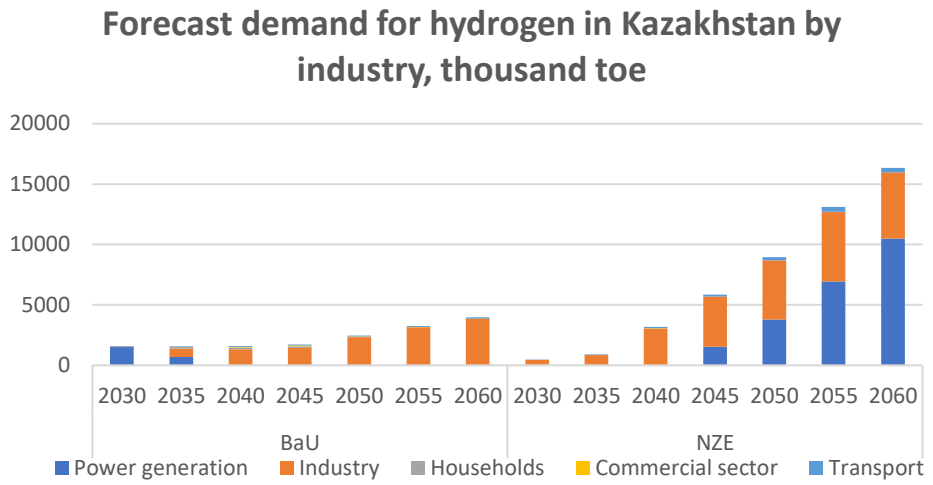
Investments in the economy need to be increased at a rate faster than GDP growth and brought to 34% of GDP by 2028.

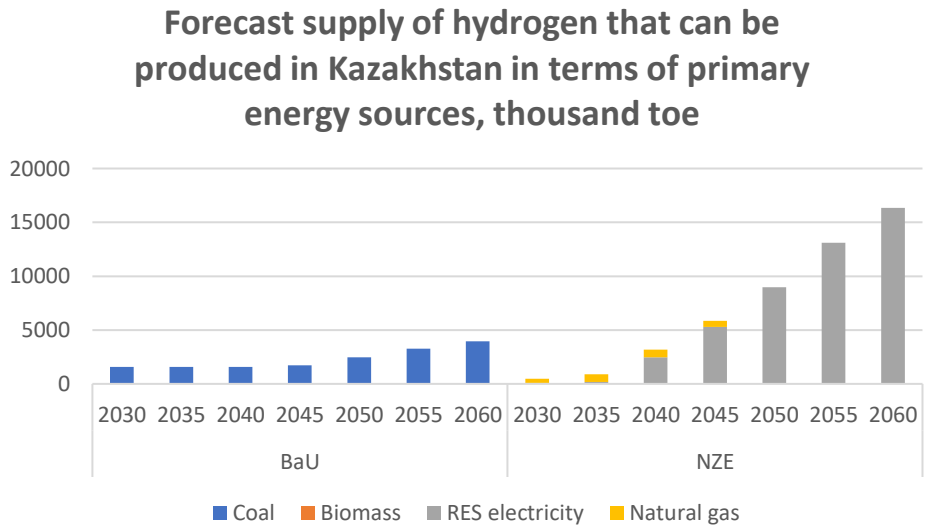


- Before 2003, total investment, including mining
- **Scenario forecast data may differ slightly from World Bank data due to differences in accounting for reinvested earnings
- *** Mining complex. From 2020 - scenario forecast
- **** GNP per capita per year between 4096 and 12695 US dollars

Hydrogen

NZE								
H2 consumption (demand for hydrogen fuel in the following sectors), thousand toe								
	2025-2030	**2031-2035**	**2036-2040**	**2041-2045**	**2046-2050**	**2051-2055**	**2056-2060**	**2021-2060**
Power generation	43,8	0,0	0,0	1534,9	3789,5	6936,6	10482,8	22787,6
Industry	399,5	856,2	3057,5	4169,3	4890,4	5748,9	5491,9	24613,6
Households	0,0	0,0	0,0	0,0	0,0	20,6	0,0	20,6
Commercial sector	0,0	0,0	28,7	0,0	0,0	0,0	0,0	28,7
Transport	39,9	49,7	97,2	154,4	284,5	408,6	369,3	1403,6
Total Demand	**483,2**	**905,8**	**3183,4**	**5858,6**	**8964,4**	**13114,8**	**16344,0**	**48854,2**
H2 production (possibility of hydrogen production from the following types of energy), thousand toe								
from coal	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
From Biomass	0,0	58,8	34,8	0,0	0,0	0,0	0,0	93,7
From RES	96,0	127,1	2428,7	5279,3	8964,4	13114,8	16344,0	46354,2
From Natural Gas	387,2	719,9	719,9	579,2	0,0	0,0	0,0	2406,3
Total Supply	**483,2**	**905,8**	**3183,4**	**5858,6**	**8964,4**	**13114,8**	**16344,0**	**48854,2**





One of the world's largest green hydrogen production projects

- In October 2021, the Government of Kazakhstan and the German company Svevind Energy signed a Roadmap for the construction in the west of Kazakhstan (close to the Caspian Sea coast) for one of the world's largest green hydrogen production projects.
- Svevind forsees five years of construction from 2026 to 2030 for a first 30GW of wind and solar PV, desalination, and 20GW of electrolyser capacity, as well as an ammonia plant in order to produce 2m tons of green hydrogen or up to 11m tons of green ammonia per year from 2031 on.
- Next to the Kazakh domestic market, the giga-project targets both Europe and China as potential buyers of massive amounts of green H2 and green ammonia.

Electricity production by type of primary energy resource, %

	Fact	BaU				NZE			
	2020	2030	2040	2050	2060	2030	2040	2050	2060
Coal-fired TPP and CHPP	68,9	59,6	46,2	25,7	24	41,6	21,4	5,3	0
Gas thermal TPP and CHPP	20	25	35	48,7	53,9	25	32,2	19,3	5,8
TPP on Petroleum products	0,05	0	0	0	0	0	0	0	0
Nuclear power plant	0	0	0	0	0	0	8,6	9,3	6,2
HydroPP, including	8,8	8,8	13,1	16,7	11,1	12,3	7,9	4,4	2,3
Large HPP	8,1	8,2	12,5	12,7	7,6	11,6	7,5	4,2	1,8
Small HPP	0,8	0,6	0,6	4	3,5	0,6	0,4	0,2	0,5
BioPP	0	0	0	0	0	0	0	0,6	0,6
WPP	1	0,8	4,1	5,7	6,2	12,5	16,8	29,7	45,1
SPP, including	1,2	0,4	1,6	3,2	4,8	8,6	12	29,4	37
Centralized SPP	1,2	0,3	1,2	1,8	2	7,2	7,6	23	27
Small-scale SPP	0	0,1	0,4	1,4	2,8	1,4	4,5	6,4	10,1
HydrogenPP	0	5,3	0	0	0	0	1	2	3,1
TOTAL	100	100	100	100	100	100	100	100	100
RES, including	3	1,9	6,3	12,9	14,5	21,8	29,3	59,9	83,2
Small HPP	0,8	0,6	0,6	4	3,5	0,6	0,4	0,2	0,5
BioPP	0	0	0	0	0	0	0	0,6	0,6
WPP	1	0,8	4,1	5,7	6,2	12,5	16,8	29,7	45,1
Centralized SPP	1,2	0,3	1,2	1,8	2	7,2	7,6	23	27
Small-scaleSPP (panels on buildings)	0	0,1	0,4	1,4	2,8	1,4	4,5	6,4	10,1

Source: ERI MNE RK, 2023

Note: Latest modeling results for the Strategy for Achieving Carbon Neutrality of Kazakhstan until 2060

About ESG transformation of investment practices in Kazakhstan,

- State investment policy provides for the integration of ESG principles into the practice of public and private investment.
- Large companies in Kazakhstan are trying to obtain international ESG ratings in order to appear attractive to international investors providing green (cheap) investments.
- However, everyone understands that many of them play Greenwashing and think that no one sees it.
- I believe that now is the right time to recommend that developing countries pay attention to developing national legislation to combat greenwashing and speed up their adoption. This will contribute to a fair fight between projects to attract green investments and government support.

the problems and opportunities of greening the energy sector in Kazakhstan

- 1. Phased phase-out of coal
- 2. Accelerating the development of renewable energy sources in Kazakhstan
- 3. Construction of nuclear power plants
- 4. Increasing water stress in the region

The decarbonization must not undermine energy security for development.

Discussions are ongoing. The Government is now starting to update the draft Roadmap for the implementation of NDCs until 2030, which was developed and presented in February 2021.

On the problems and opportunities of the transition to a circular economy

- Previously, the Environmental Code prohibited waste burning
- Contrary to the opinion of experts, the authorities made changes and held a tender to select a company that would produce electricity from solid waste by combustion.This tender has now been declared invalid. And this topic was closed. There is now hope for sustainable waste management in Kazakhstan.
- Measures to reduce GHG emissions from the waste management sector of municipal, industrial and wastewater are prescribed in the draft Road Map.
- Greening the economy should be implemented in three stages.

NDC update
Implementation Roadmap development

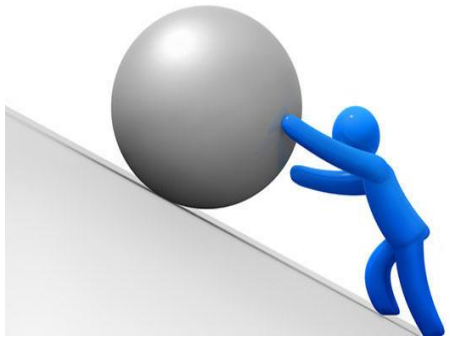
NDC Roadmap Informed by Macroeconomic Modeling

- **Process**: CGE and TIMES modeling to simulate the following scenarios for NDC implementation:
  - Scenario 1: Strengthen the ETS and introduce a carbon tax
  - Scenario 2: Strengthen renewable energy and energy efficiency policies
  - Scenario 3: Scenario 1 + 2 with circular economy policies

- **Recommendations**: 9 institutional and policy measures and 44 decarbonization measures in seven sectors (energy, agriculture and forestry, industry, utilities, coal industry, waste management, and transport)

Updated NDC (under consultation)

Unchanged | reduce GHG emissions by 15% by 2030 from the 1990 level



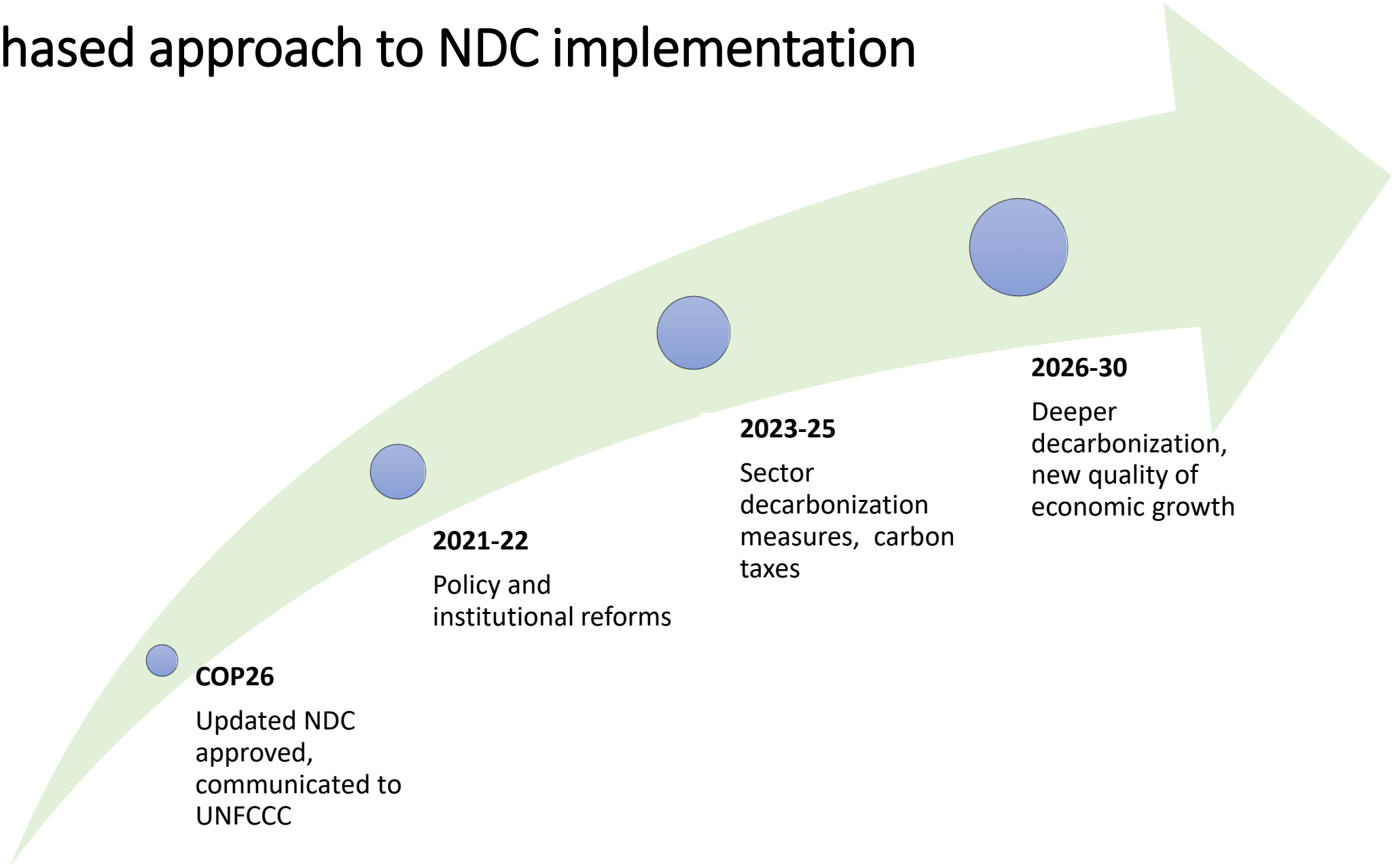
ETS controls only 40% of the total GHG emissions. Requires:

- tighter ETS caps
- improved ETS GHG emission regulation, trade, MRV
- carbon taxes in the non-ETS sectors from 2023
- renewable energy, energy efficiency
- circular economy measures (waste management)

USD 708 B

Significant investment over 2021-30, including USD 293 bn for decarbonization measures

A phased approach to NDC implementation



KEY POLICY AND INSTITUTIONAL ACTIONS IN 2021-23

Tighten ETS Caps

4th, 5th and 6th NAPs to reduce GHG by 72% in 2021-30

Introduce **carbon tax** for non ETS sectors

Enhance MRV for ETS

Improve EE

Energy intensity of GDP to reduce 38.1% over 2021-30

Introduce **green certificate system**

Increase RE for electricity demand from 3% to 24.1% over 2021-30

Prepare for increase in **energy prices/ tariffs**

Include **circular economy** in green economy concept update in 2021

Track progress of indicators and measures

Financing Updated NDC Implementation

Creation of Decarbonization Fund

Establishment of Mitigation Project Pipeline

Investment resources:

- Businesses (the private sector)
- Government (including carbon tax revenue)
- Households
- Investors through the Astana International Financial Center
- Concessional loans from Multilateral Development Banks
- International donors

2021-2030 Sectoral Decarbonization Measures (44)

Estimated US$ 44 B

Unit Cost Ranking/Sector	Energy (2021 - 2030)	Agriculture and Forestry (2021 - 2030)	Utilities (2021 - 2030)	Coal industry (2022 - 2026)	Industry (2021 - 2025)	Waste Management (2021 - 2030)	Transport (2021 - 2025)
<US$ 30.0/tCO_2 (#1-20)	**1** (#40)	**6** (#1, #2, #3, #5, #6, #14)	**4** (#4, #6, #7, #12)	**4** (#9, #10, #16, #20)	**5** (#11, #13, #15, #17, #19)		**1** (#8)
US$ 30.3-90.0/tCO_2 (#21-30)		**2** (#24, #30)	**2** (#22, #23)		**2** (#21, 25)	**3** (#26, #27, #29)	**1** (#28)
US$ 90.0-212.5/tCO_2 (#31-40)	**2** (#18, #32)		**3** (#31, 33, 36)	**2** (#37, 39)		**1** (#34)	**1** (#35)
>US$ 212.5/tCO_2 (#41-44)						**1** (#42)	**3** (#41, #43, #44)
Total	**3**	**8**	**9**	**6**	**7**	**5**	**6**

Fair and ambitious targets, taking into account national circumstances for the period 2021-2030

- The implementation of the Roadmap will allow by the end of 2030 (that is, over a 10-year period) to achieve the following indicative development goals:
  - to reduce the energy intensity of GDP by 38.9%;reduce the carbon intensity of GDP by 41.4%;
  - to reduce the average CO_2 emission factor per 1 kWh of generated electricity by 26.6%;
  - to reduce the share of coal generation in the structure of electricity production from 65.2% to 40.1%;
  - to increase the share of renewable energy sources from 3% (in 2020) to 24.1%;
  - to increase the share of gas-fired thermal power plants to 25%.

Challenges and opportunities for regional cooperation

1. **Cooperation between the countries of Central Asia, as well as Kazakhstan with China and Russia, is currently actively promoting in the field of trade. But there has been little progress in the area of water allocation and related problems.**

2. **Problem:** About half of Kazakhstan's river flow is generated in upstream neighboring countries, which every year take more and more water and dump dirty wastewater downstream.

3. In Kazakhstan itself and neighboring countries, a lot of water is withdrawn for irrigation needs. In this regard, cooperation in exchanging experience in the rational use of water resources for agricultural needs would be useful. Of particular interest is the experience gained by China within the framework of the Long-Term Green Great Wall Program. Not only regular training tours are useful, but also the replication of the best and most accessible technologies.

4. **Developed countries, in order to quickly adapt the rural population and farmers to the consequences of climate change, could help Kazakhstan with research, technological support and grants for the dissemination of knowledge and technology.**