FOURTH BIENNIAL REPORT OF THE REPUBLIC OF KAZAKHSTAN TO THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE

FOURTH BIENNIAL REPORT OF THE REPUBLIC OF KAZAKHSTAN TO THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE

Nur-Sultan, 2019

Contents

LIST OF ABBREVIATIONS

7NC	7 National communication
ADB	Asian Development bank
APG	Associated petroleum gas
CNG	Compressed Natural Gas
CFCs	Perfluorocarbons
CO2	Carbon dioxide
COREX	Combined (integrated) cast iron production technology
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CS	Compressor station
CTF	Common tabular format
EBRD	European Bank for Reconstruction and Development
EC	Environmental code
EMR|	Extended manufacturer responsibility
ESCO	Energy Service Company
ETS	Emission traiding scheme
EU	European union
FEC	Fuel and energy complex
FS	Feasibility Study
GCF	Green climate fund
GDP	Gross domestic product
GHG	Greenhouse gases
GMN	Global MTCC (Maritime Technology Co-operation Centres) Network
GMP	Gas main pipeline
GVA	Gross value added
HFC	Chlorine fluorine carbon
HPP	Hydroelectric power station

HU	Housing and utilities
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product use
ITS	Intelligent Transportation System
JSC	Joint stock company
KMG	kazMunay gas
LLP	Limited liability partnership
LULUCF	Land Use, Land Use Change and Forestry
MEGNR	Ministry of Ecology,Geology and Natural Resources
MFA	Ministry of Foreign Affairs
MNE	Ministry of National Economy
MPP	Mining and Processing Plant
MSW	Municipal solid waste
NA	Not applicable
NDC	Nationally determined contributions
NMVOC	Non methane volatile organic compounds
NO	No data
NPP	Nuclear power plant
NQAP	National quota allocation plan
ODS	Ozone depleting substances
OECD	Organization for Economic Co-operation and Development
PA	Protected Areas
PS	Power station
RES	Renewable energy sources
RF	Russian Federation

RK	The Republic of Kazakhstan
RSE	Republican State Enterprise
SDG	Sustainable Development Goals
SME	Small and medium enterprises
SPIID	State program of industrial and innovative development
SPS	Solar power station
TPS, CHP	Thermal power station; for the purposes of this biennial report, also that CHP
UN	United Nations
UNDP	United Nations Development Program
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Program
UNFCCC	UN Framework Convention on Climate Change
WCAM	With current and additional measures scenario
WCM	With current measures scenario
WOM	Without measures scenario
WPP	Wind power plant

I. FOREWORD

Kazakhstan ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 4 May 1995 and became a party to it in August of that year.

On 12 March 1999, the President of Kazakhstan signed the Kyoto Protocol (KP) to the UNFCCC, and on 23 March 2000, the Government notified the UN Secretary-General of its intention to meet the commitments under paragraphs 2 (a) and 2 (c) of the UNFCCC under paragraph 2 (g) of the same article.

Kazakhstan ratified the Kyoto Protocol (KP) on 26 March 2009. On 17 September 2009, the KP officially entered into force for Kazakhstan. At the KC-7 in Marrakesh, Morocco, it was agreed that Kazakhstan, in accordance with Article 1, paragraph 7, of the Kyoto Protocol, was considered as a Party to Annex I to the UNFCCC for the purposes of the Kyoto Protocol, as it had submitted a notification in accordance with Article 4, paragraph 2 (g), of the Convention.

On 3 December 2011, Kazakhstan introduced into its Environmental Code two GHG regulatory mechanisms: quota allocation and carbon trading; Both entered into force on 1 January 2013. The GHG and Carbon Unit Trading Regulations were adopted.

The GHG allocation plan in 2013 covered 178 sites in three sectors (energy, oil extraction, gas and coal, chemical industry) and thus covered 55 per cent of GHG emissions in Kazakhstan. The historical method for allocation of quotas was applied: 2010 served as the basis for allocation of quotas.

The same approach was supported under the National Quota Allocation Plan 2014-2015. The national quota allocation plan for 2014-2015 covered 166 sites in the same three sectors.

On 20 July 2016, Kazakhstan signed the Paris Agreement (PA) and ratified it on 4 November of the same year; The PA entered into force for Kazakhstan on January 5, 2017. On 6 December 2016, Kazakhstan presented its NDC (Nationally Determined Contribution) which has to be achieved by 2030: a 15 per cent absolute economy-wide reduction in GHG emissions by 31 December 2030 compared to the (baseline) of 1990 as an unconditional target and a reduction of 25 per cent if additional international assistance is provided to support Kazakhstan 's efforts.

The new rules for national quota allocation plans were adopted on 15 June 2017 and entered into force on 1 January 2018. They provided for the introduction of indicators based on the best available technologies for quota allocation, and therefore the 2018-2020 National GHG Emission Quota Allocation Plan was based on the benchmarking method. The new plan covered 225 installations in six sectors (electricity, oil and gas, mining, metallurgy, chemical, processing for construction (Cement, lime, gypsum and brick)), and allocated a total of 485,909,138 units for three years (2018 - 2020) free of charge and reserved 35,273,634 more units for new facilities, carbon emissions trading and some other objectives specified in the new regulations.

Allocation of quotas is carried out on the basis of a historical or a benchmark approach. The operator of installation applies to the authorized body no later than August 1 of the year preceding the entry into force of the National Plan, indicating the method of allocation of quotas. If the operator does not apply, the allocation of quotas is carried out on the basis of a historical approach. The historical approach is also used in the absence of specific greenhouse gas emission factors for the type of product produced by operator of installation.

The medium-term and long-term goals of Kazakhstan to reduce GHG emissions were included in a number of strategic and policy documents of the country, such as the Concept of transition of the Republic of Kazakhstan to a "green economy", Concept of fuel and energy industries development until 2030, and the Strategic Plan of the Ministry of Energy for 2017-2021. The "green economy" Concept sets ambitious targets for reducing CO2 emissions: a 15 per cent reduction by 2030 compared to 2012 and a 40 per cent reduction by 2050. The Strategic Plan of the Ministry of Energy indicates the following measures to achieve the NDC under the Paris Agreement: (1) GHG Emission Management

System; 2) increasing the share of renewable energy sources in the energy balance of the country; 3) modernization of thermoelectric stations and boiler rooms; 4) implementation of projects on energy efficiency and energy saving.

To date, Kazakhstan has submitted three biennial reports. As a Party included in Annex I, Kazakhstan submits biennial reports: 1st BR in 2014, 2nd BR in 2015 and 3rd BR in 2017.

II. SUMMARY OF INFORMATION FROM THE NATIONAL GREENHOUSE GAS (GHG) INVENTORY ON EMISSIONS AND EMISSION TRENDS FROM 1990 TO 2017.

In the baseline year 1990, total GHG emissions in Kazakhstan excluding the LULUCF sector amounted to 385932.13 thousand tonnes of CO2-eq., and taking into account the LULUCF sector, 370180.76 thousand tonnes of CO2-eq. In 2017, excluding the LULUCF sector, total national emissions amounted to 353233.80 thousand tons of CO2-eq. and including the LULUCF sector 346154.86 tonnes CO2-eq, respectively. In general, taking into account all pools of LULUCF, for the whole period from 1990 to 2017, the LULUCF sector was dominated by absorption. In the reporting year 2017, total national emissions were 6.49% lower than the base year, taking into account the LULUCF sector, and 8.47% less than without the LULUCF sector.

GHG emissions for all sectors in Kazakhstan from 1990 to 2017 are presented in Table 2.0.

Table 2.0 - Greenhouse gas emissions for 1990-2017 by sectors in the Republic of Kazakhstan, thousand tons of CO2 equivalent

Years	Energy	IPPU	Agriculture	LULUCF	Waste	Total Emissions with LULUCF	Total Emissions without LULUCF
1990	317113,23	21012,38	44083,46	-15751,37	3723,06	370180,76	385932,13
1991	306714,53	20073,23	42265,79	-18933,68	3708,30	353828,17	372761,85
1992	281010,44	17614,13	42347,00	-22124,22	3466,35	322313,70	344437,93
1993	248818,35	13226,68	40033,74	-25356,88	3247,40	279969,29	305326,18
1994	212391,33	8566,47	31617,24	-26746	3137,51	228966,55	255712,55
1995	197258,20	9135,42	27050,61	-26904,04	3090,16	209630,36	236534,39
1996	185180,26	7763,509	21792,11	-29147,25	3050,20	188638,82	217786,07
1997	176666,28	10069,19	18636,39	-27591,66	3086,34	180866,54	208458,20
1998	175248,88	9250,29	17929,18	-31134,63	2951,57	174245,29	205379,92
1999	144047,05	10918,86	19469,23	-28186,21	2956,49	149205,41	177391,62
2000	176988,54	12714,49	20159,86	-26728,99	2899,00	186032,90	212761,89
2001	136226,18	13081,62	21130,87	-19969,67	2909,55	153378,55	173348,22
2002	152941,09	14201,3	22619,63	-14102,78	2872,73	178531,96	192634,74
2003	172182,87	15918,79	24340,72	-6074,099	2878,69	209246,96	215321,06
2004	179453,94	16078,67	25842,01	-7865,627	2931,45	216440,45	224306,07
2005	191364,65	16716,11	27274,22	-7281,77	2914,27	230987,48	238269,25
2006	214581,45	18549,75	28814,32	-5952,431	2983,54	258976,63	264929,07
2007	221074,59	19917,89	30198,15	-6843,172	3175,04	267522,50	274365,67
2008	224509,95	19083,31	30997,29	-7032,01	3205,64	270764,18	277796,19
2009	219858,93	17224,49	32120,34	-3922,064	3327,26	268608,96	272531,02
2010	248730,76	19992,11	32094,01	-7284,612	3478,54	297010,82	304295,43
2011	239724,79	21293,16	31158,02	-8525,814	3614,92	287265,07	295790,89
2012	247245,41	20603,84	30787,06	-8866,917	3699,23	293468,63	302335,54
2013	252145,28	22768,22	31150,49	-11373,34	3780,42	298471,06	309844,40
2014	266952,70	22854,48	31907,08	-9450,46	3914,97	316178,77	325629,23
2015	270498,56	24287,11	32548,79	-11621,21	4016,70	319729,95	331351,16
2016	273326,91	25458,04	33159,60	-7980,61	4090,80	328054,75	336035,36
2017	288813,08	26101,16	34268,39	-7078,94	4051,18	346154,86	353233,80
Emissions difference in 2017 relative to 1990	-9%	24%	-22%	55%	9%	-6%	-8%
Difference in 2017 rel. to 2016 in %	6%	3%	3%	-11%	-1%	6%	5%

2.1. Energy activities

Fuel combustion in the energy sector of Kazakhstan is the main source of national GHG emissions in the Republic of Kazakhstan. According to the IPCC classification of GHG emission sources, the 'Energy activities' sector includes the following categories: energy, manufacturing and construction, transport, other sectors, other sources and fugitive emissions. Figure 2.1 shows the contribution of each source category to total GHG emissions in the sector.

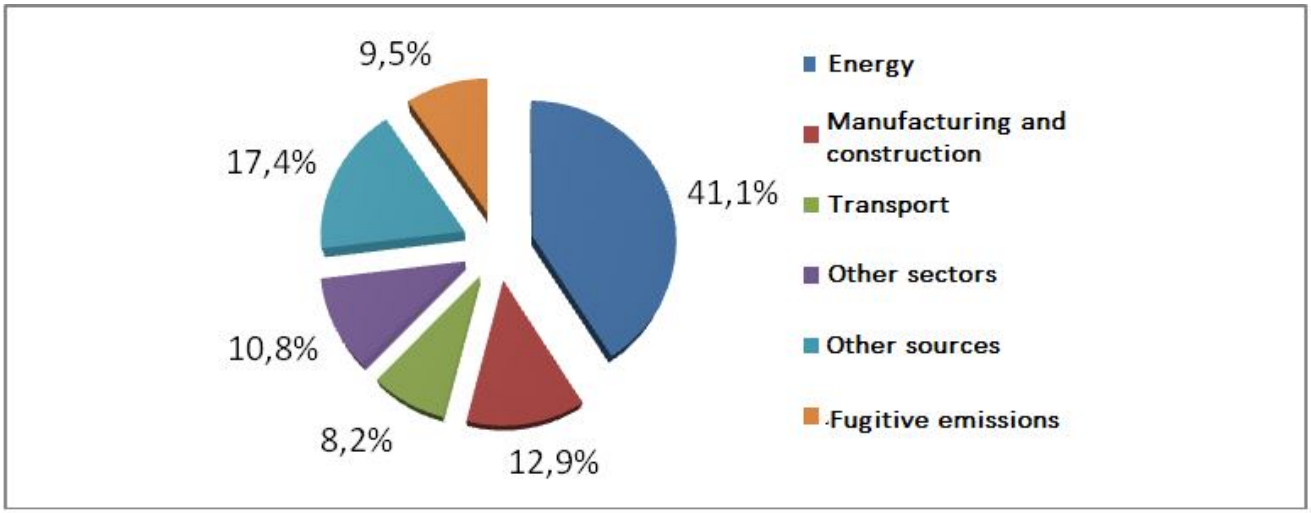


Figure 2.1. Share of GHG emission source categories in the 'Energy activities' sector in 2017

Kazakhstan mainly uses solid fuel (coal) (Figure 2.2.). In recent years, consumption of liquid and solid fuel has decreased due to gasification of settlements and transition of heat and power plants to gas.

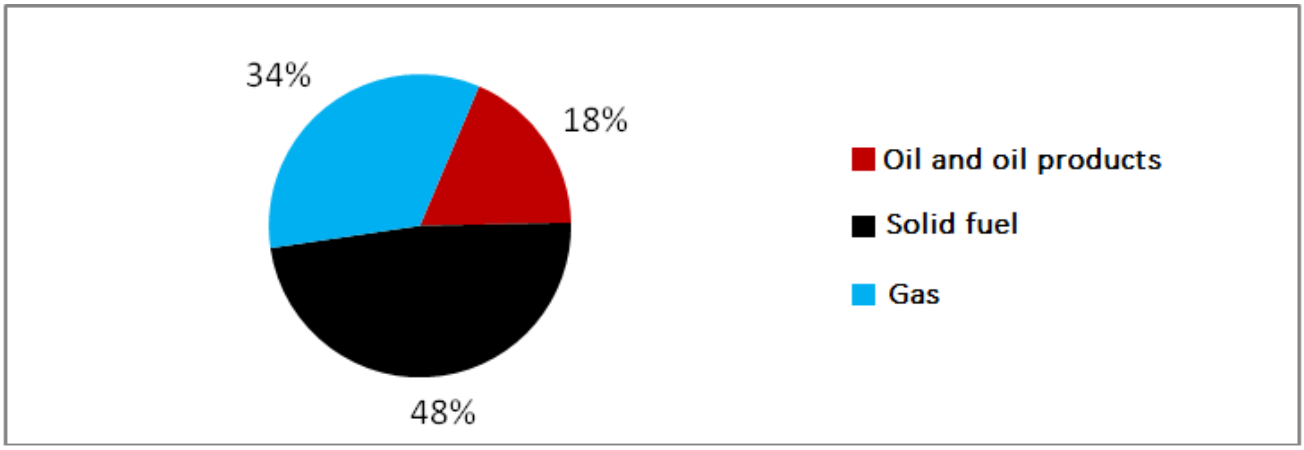


Figure 2.2. Structure of fuel consumption in the 'Energy' sector, 2017

The deep economic crisis of the 1990s in Kazakhstan resulting from the collapse of the old socialist economic system led to reduction in the consumption of energy resources and subsequent reduction in GHG emissions during the period from 1990 to 1999. Since 2000, the country's economy has been gradually recovering while fuel consumption and, accordingly, GHG emissions have been steadily increasing. Kazakhstan's maximum levels of GHG emissions in the 'Energy' sector were recorded in 1990, while the minimum ones - in 2001.

The dynamics of GHG emissions in the 'Energy' sector for 1990-2017 corresponded to the dynamics of fuel consumption during the same period. In 2017, GHG emissions in the 'Energy' sector amounted to 288.813 million tons of CO2eq, which is lower than the 1990 value by 8.9 % and higher than the 2016 value by 5.7 %. Emissions of CO_2 account for more than 89.5% of all GHG emissions. Methane and nitrous oxide emissions are insignificant.

The main source of emissions in the 'Energy' sector is the 'Energy industry' category, which includes heat and power generation, oil production and distillation, and solid fuel production (Figure 2.3.). Each year, GHG emissions in this category make up about a third of all emissions in the 'Energy' sector. In 2017, GHG emissions in this category amounted to 115.510 million tons of CO2eq, which is 16.7% lower than in 1990 and 6.2 % higher than in 2016. Combustion of secondary fuels like fuel oil, diesel fuel and oil refinery gas are showing an overall downward trend.

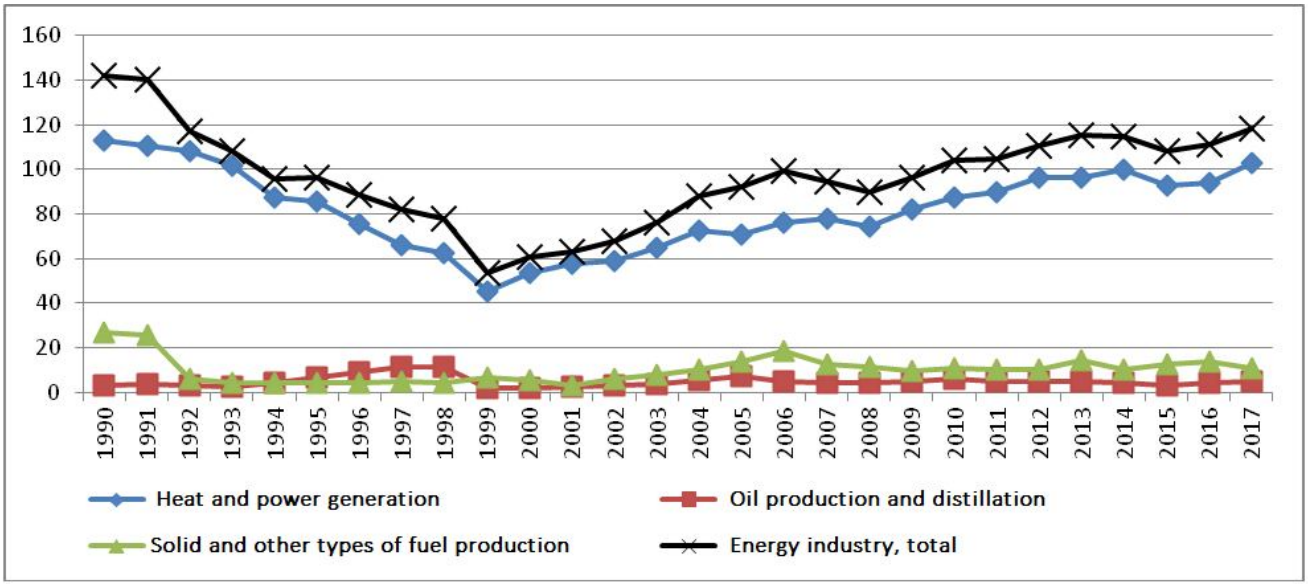


Figure 2.3. Greenhouse gas emissions in the 'Energy industry' category, million tons of CO2eq.

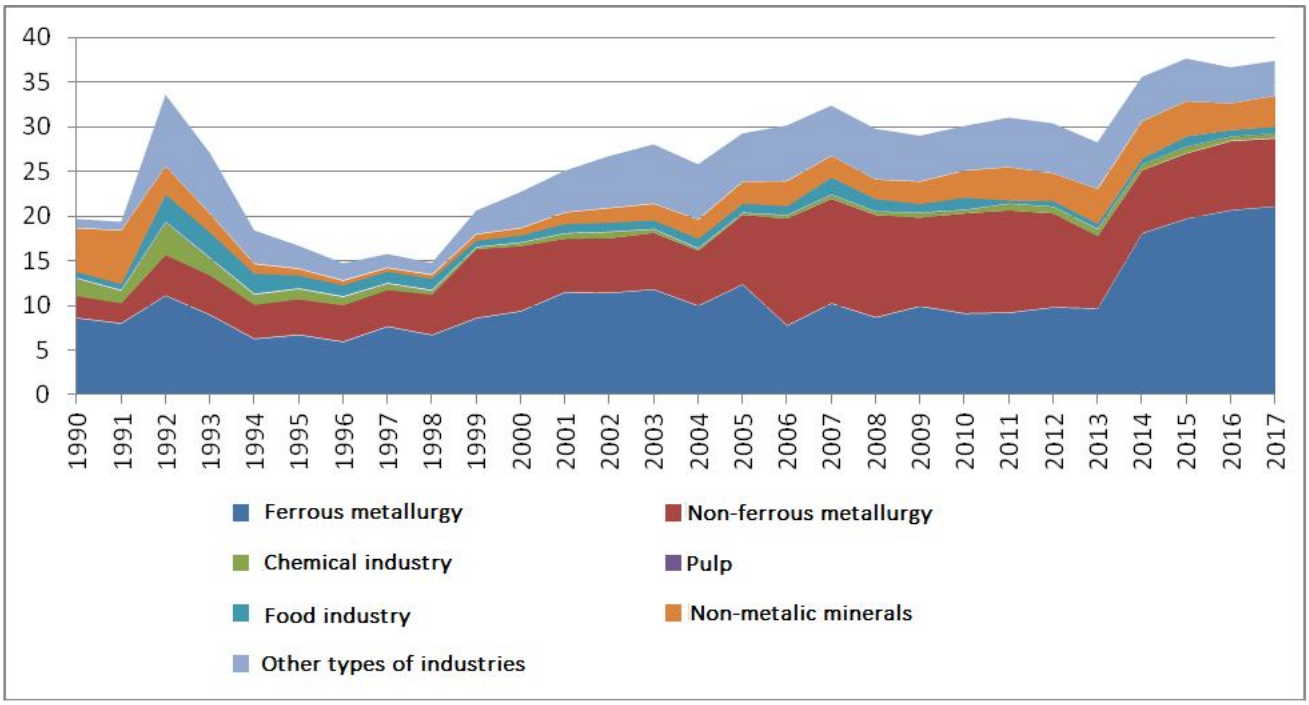


Figure 2.4. Greenhouse gas emissions in the 'Manufacturing and construction' category, million tons of CO2eq.

The 'Manufacturing and construction' category GHG emissions from fuel combustion for domestic and technological needs in all industries for 1990-2017 tended to increase indicating gradual growth of the country's manufacturing industry (Figure 2.4.). Coal is the primary fuel in this subcategory. In 2017, GHG emissions in this category amounted to 37.3 million tons of CO_2eq, which is 90.2% higher than the 1990 level and 1.9 % higher than the 2016 level.

The main sources of GHG emissions in this sub-category are the leading sectors of Kazakhstan's economy: ferrous (56%), non-ferrous metallurgy (20%), non-metallic minerals production and mining. The contribution of other industries to total GHG emissions in this category is insignificant due to the underdeveloped state of these industries in the Republic.

In 2017, GHG emissions in the 'Transport' category amounted to 23.7 million tons of CO_2eq. Greenhouse gas emissions have decreased by 9.8 % compared to the 1990 levels and by 4.9 % compared to the 2016 levels (Figure 2.5.). The sources of GHG emissions in this category are motor vehicles, off-road vehicles, railway transport, water transport, civil aviation and pipeline transport, i.e. the supply of fuel to the consumer by transporting oil, petroleum products or natural gas via pipelines.

Motor vehicles contribute the most to GHG emissions from this category. Their share in the entire transport category emissions amounted to 69.3% in 1990 and 85.9 % in 2017. Greenhouse gas emissions from motor transport in 2017 amount to 20.4 million tons of CO_2eq, while in 1990 they made 15.0 million tons of CO_2eq, that is, the emissions have increased by 5.4 million tons by 2017. In recent years, the increase of GHG emissions from motor vehicles has been moderate as cars in relatively good condition penetrate the domestic market. In addition, the government of Kazakhstan has taken additional measures to tax large-volume engines and limit the import of old cars.

The 'Civil aviation' sub-category has shown a steady increase in fuel consumption in recent years.

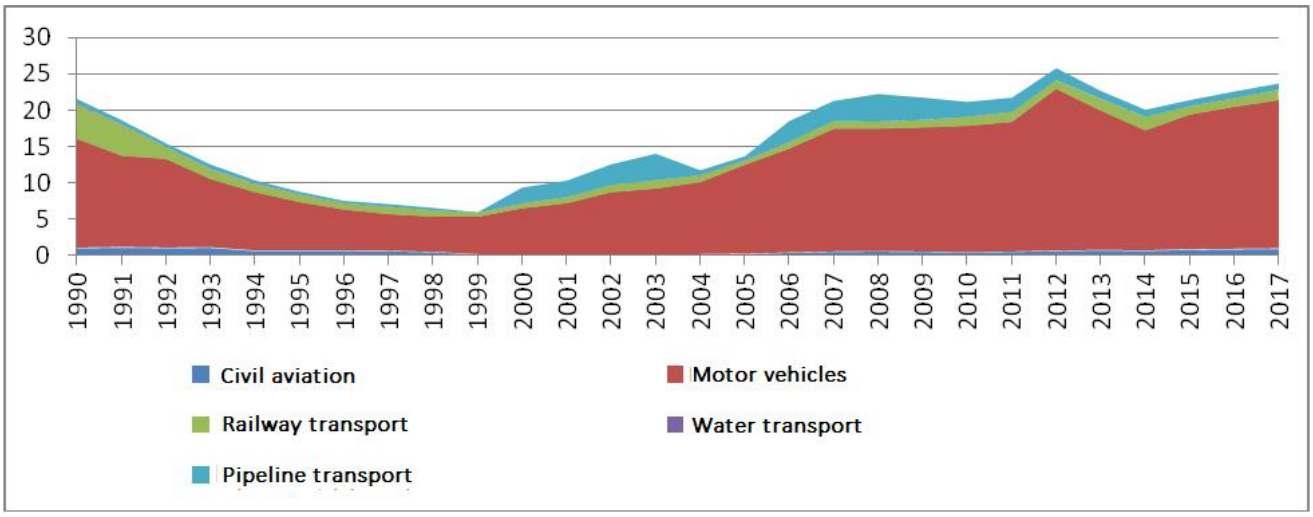


Figure 2.5. Greenhouse gas emissions in the 'Transport' category in 1990-2017, million tons of CO_2eq.

Greenhouse gas emissions in the 'Other sectors' category include emissions from fuel combustion in the commercial/institutional sector, housing sector and agriculture (Figure 2.6). The 1990-2017 dynamics shows a decrease trend in this category's GHG emissions due to a reduction in coal consumption and an increase in the share of natural gas due to the large-scale gasification of the country. This category's GHG emissions amounted to 31.3 million tons of CO_2eq in 2017, which is 1.7 times lower than the 1990 level and 12.4% higher than the 2016 level.

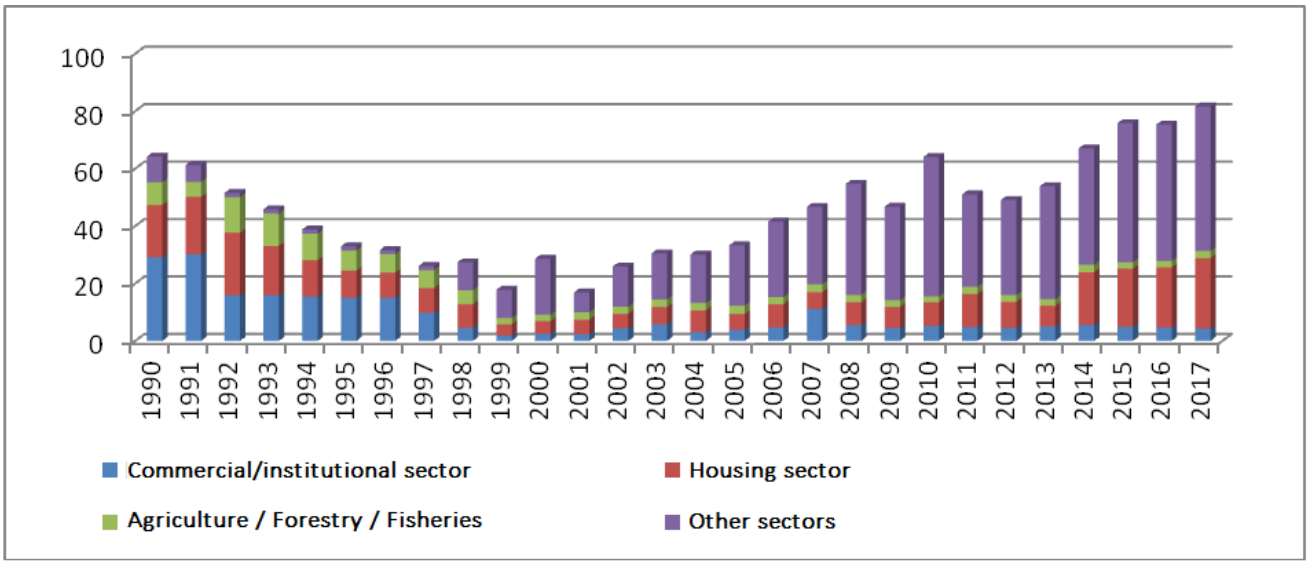


Figure 2.6. GHG emissions by 'Other sectors' and 'Other sources' categories, million tons of CO_2eq.

In 2017, methane emissions from coal mining amounted to 22,386 thousand tons of CO_2eq, which is 6.5% of the total 'Energy' sector emissions. Compared to 1990, this subcategory's emissions have decreased in 2017 amounting to 48.2%; however, they have slightly increased - by 0.7% - compared to the previous year. Figure 2.7 shows the dynamics of fugitive GHG emissions in CO_2

equivalent from coal mining and oil-and-gas sector of Kazakhstan. In 2001, the flaring ban resulted in a sharp decrease in emissions.

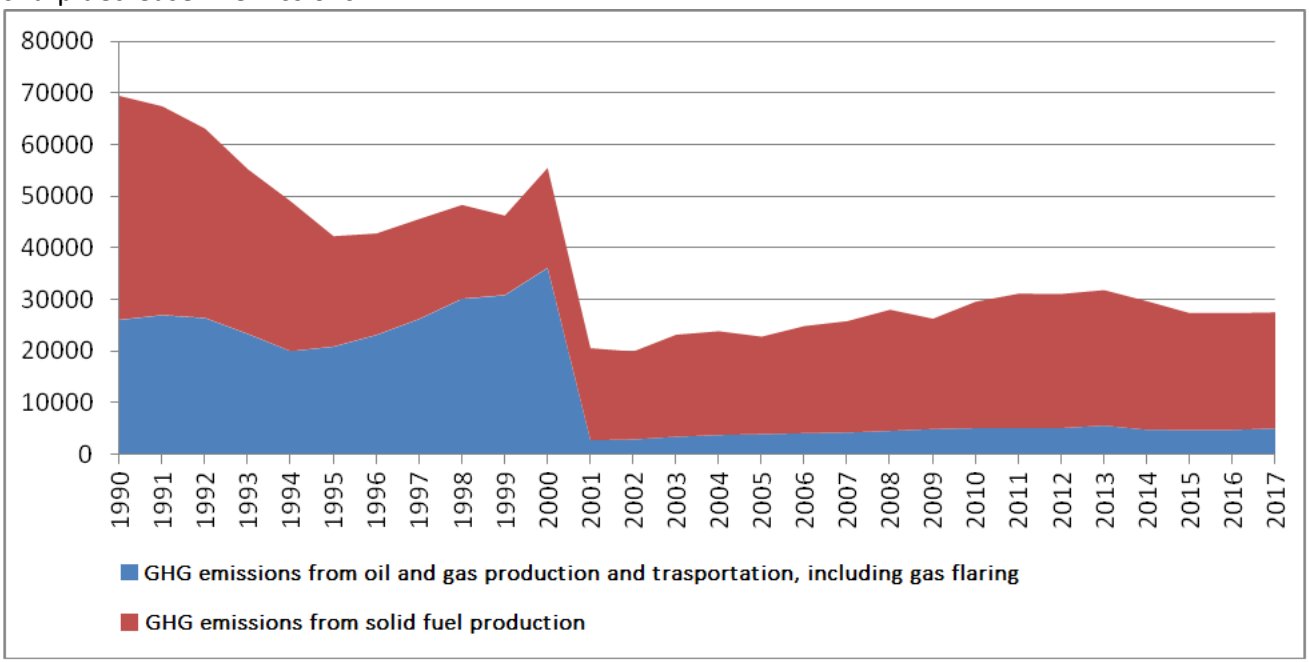


Figure 2.7. Dynamics of fugitive GHG emissions from solid fuel, oil and gas production and transportation related activities, thousand tons of CO_2eq.

2.2. Industrial processes and product use (IPPU)

Total greenhouse gas emissions in the 'Industrial processes and product use' sector in 2017 amounted to 26,101 million tons of CO_2eq, which is 24.2% higher than the 1990 level and 2.52% higher than the 2016 level. In 2017, the following greenhouse gases were released into the atmosphere: CO2 - 24.576 million tons, CH4 - 0.41 thousand tons of CO_2eq, N2O - 0.70 thousand tons of CO_2eq, CFC - 1548.89 thousand tons of CO_2eq, PFC – 640.13 thousand tons of CO_2eq. SF6 emissions amounted to 2,1 thousand tons of CO_2eq. This was due to the increase in metals production and commissioning of new plants for mineral commodities processing within the framework of the State program for industrial and innovative development of the Republic of Kazakhstan for 2015-2019. The mineral commodities processing accounts for the major part of such increase (84%); it should also be noted that the 1990 level of emissions from chemical industry (-44%) has not yet been attained (Table 2.1). In 1990, CO2 emissions amounted to 21.012 million tons of CO2eq, while CH4 emissions were 1.29 thousand tons of CO_2eq. There were no emissions of fluoride gases and nitrous oxide N2O in the base year. There are no emissions of sodium trifluoride (NF3) in Kazakhstan due to the absence of their sources.[1]

[1] National Report on the inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases of Kazakhstan for 1990-2017, 2018. Zhassyl Damu JSC (Kazakh Ecology and Climate Research Institute, KazNIIEK)

Table 2.1. IPPU sector GHG emissions

Sources of greenhouse gases, thousand tons of CO_2eq	Base year 1990	2017	Changes in % against 1990
Industrial processes	21,012.38	26,101.16	24.2
Mineral industry	6,133.00	11,284.76	84.00
Chemical industry	1,234.17	688.59	-44.21
Metals	13,642.85	12,796.71	-6
Non-energy products from fuels and solvent use	2.36	14.15	>100.00
Electronic industry	NO	NO	0.00
Product uses as ODS substitutes	NO	1548.9	>100.00
Other	NO	2.10	>100.00

According to Fig.2.8, industrial emissions fell in the early 1990s followed up by gradual increase from 1999 to 2006-2008. In 2009 and 2012, production experienced a slight decline, primarily in metal industry due to the global recession and fallen demand and prices for metals. Total greenhouse gas emissions for the 'Industrial processes and product use' sector show a positive trend and an average increase of 3.5%.

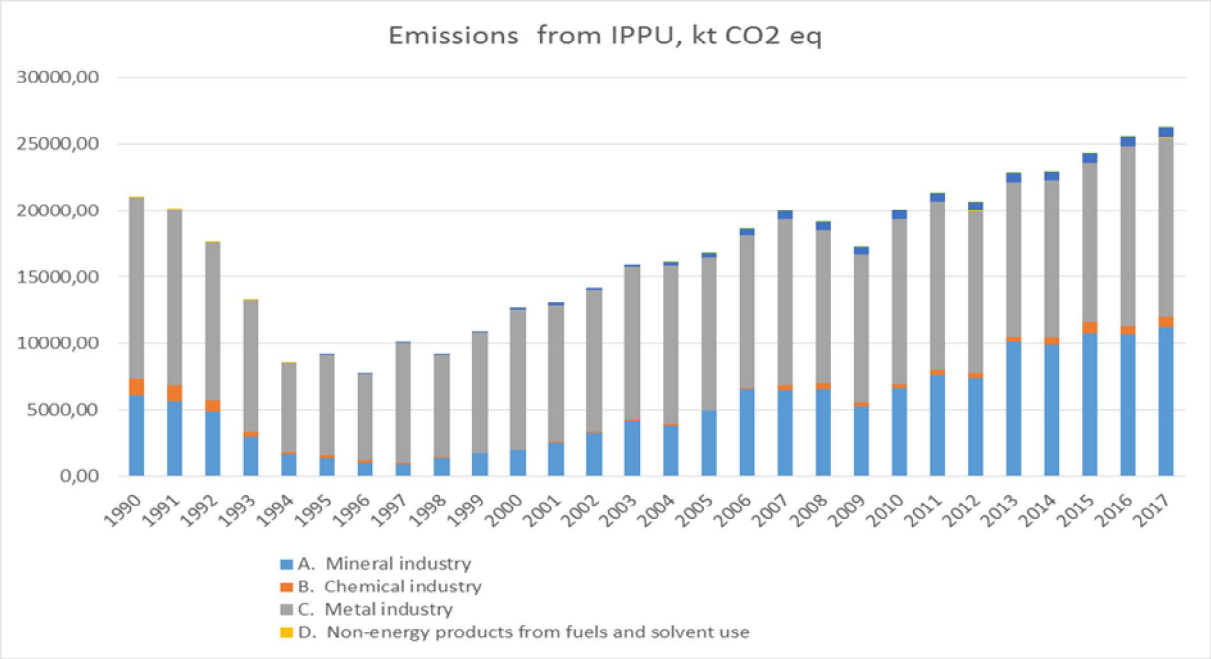
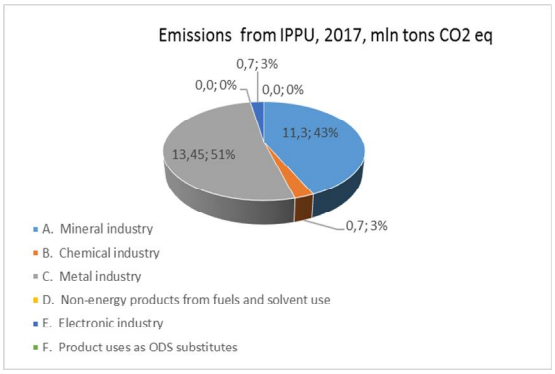


Figure 2.8. Dynamics of IPPU GHG emissions for 1990-2017, thousand tons of CO_2eq.

According to Fig. 2.8, metal industry has remained the major source of greenhouse gas emissions in industry for both the reporting year and previous years. Its contribution to the total IPPU greenhouse gas emissions amounted to 50% in 2017. The next major source of GHG emissions is the 'Emissions from mineral materials production' category that contributed 42% to GHG emissions from IPPU (Figure 2.9 a).

a)



b)

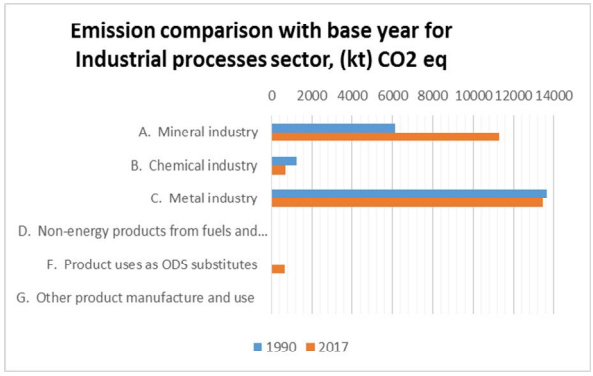


Figure 2.9. a) Contribution of IPPU GHG emissions in 2017
b) IPPU emissions increase against base year, thousand tons of CO_2eq.

Figure 2.9 b shows a comparative chart of the base year emissions and the latest 2017 inventory. The figure illustrates that mineral processing has doubled, while emissions from the metal industry have not yet reached the base year level.

There are three sources of greenhouse gas (GHG) emissions from the mineral commodities production in Kazakhstan: production of cement, lime, glass, other.

Total greenhouse gas emissions from the categories under 'Mineral products' in 2017 amounted to 11.3 million tons of CO_2eq that is equivalent to 11.3% of the total IPPU emissions and is 84% higher than the 1990 emissions.

Table 2.2. Emissions from mineral industry in 2017, kt CO_2

Mineral industry	**11,284.76**
Cement production	3,545.97
Lime production	803.51
Glass production	20.26
Other processes	6,915.02

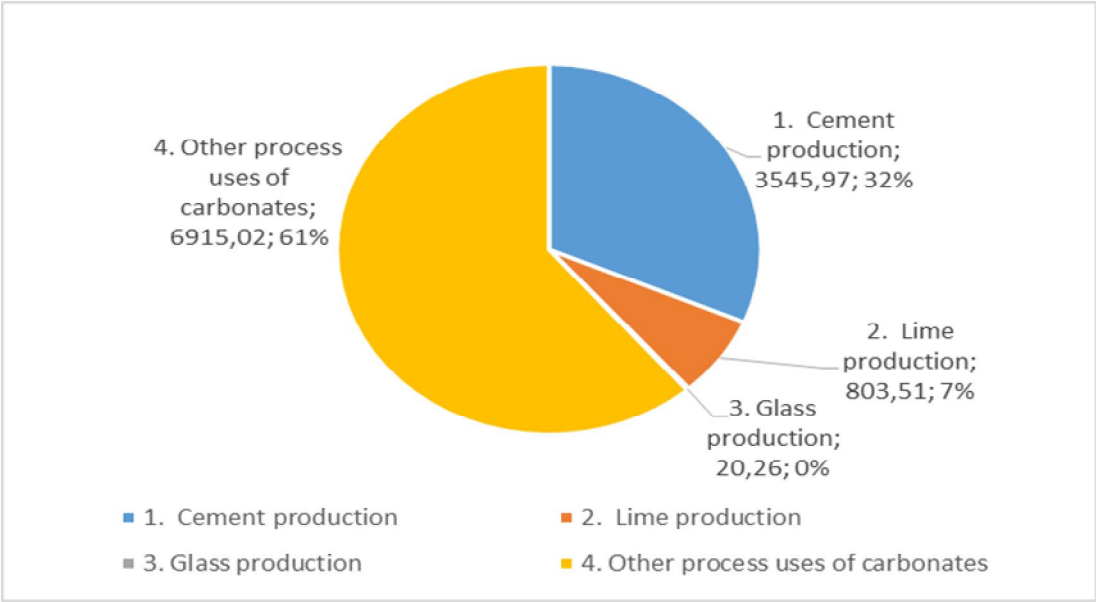


Figure 2.10. Greenhouse gas emissions from 'Mineral products' categories, thousand tons of CO_2eq; shares in %.

In chemical industry: manufacture of ammonia, nitric acid and calcium carbide results in CO2, N2O, NOx and CO gas emissions.

Table 2.3. Chemical industry emissions in 2017, thousand tons

	CO_2	N_2O	NO_x	CO
Chemical industry	**481.01**	**0.70**	**0.22**	**0.02**
Ammonia production	458.65	NO	0.22	0.02
Nitric acid production		0.70	NO	
Adipic acid production	NO	NO	NO	NO
Calcium carbide production	22.36		NO	NO

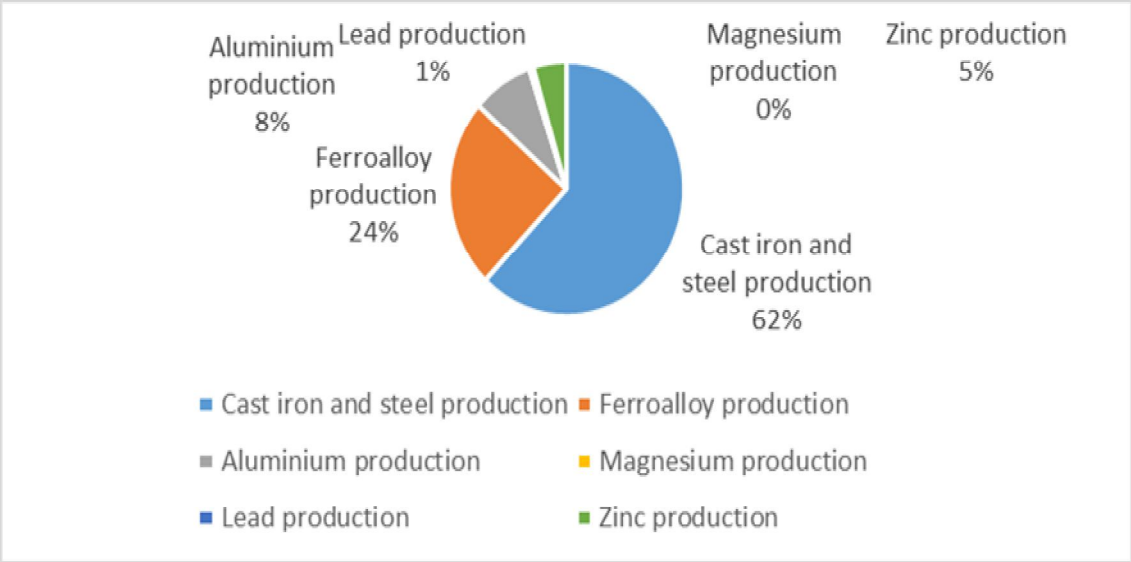
Distribution of emissions in this category in 2017: ammonia production emissions amounting to 458.65 thousand tons of CO2 (91%) and calcium carbide production emissions (9%). Therefore, Table 2.3 presents the dynamics of GHG emissions in the 'Chemical industry: ammonia production' category.

Emissions from the key source in metal industry – iron and steel production, - as well as emissions from aluminium production have been assessed against best practices (levels 2 and 3) for several years based on carbon balance, ratios and data directly from the factories. Where no data is available, emissions were calculated by level 1, however, using refined emission factors.

In 2019, metal industry, as in previous years, remains the largest source of GHG emissions in the sector. In ferrous metallurgy: production of cast iron, steel, furnace coke, ferroalloys (ferrochrome, ferrosilicon, ferrosilicochrome and ferrosilicomanganese); in non-ferrous metallurgy: production of aluminum, lead, zinc; magnesium is not produced. Metal industry activities results in emissions of CO2, N2O, NOx, CO, PFCs and NMVOC gases. In 2017, the emissions of 13,450 thousand tons of CO_2eq accounted for 51% of the total IPPU GHG emissions. A major part of such emissions consists of CO2.

Table 2.4. Emissions from metal industry in 2017, kt

	CO_2	CH_4	PFCs in CO2eq.	NO_x	CO	NMVOC
Metals	12,796.71	0.41	640.13	0.25	30.60	1.26
Cast iron and steel production of	8,346.19	0.38	NO	NA	NA	1.26
Ferroalloys production	3,278.96	0.03	NO	NO	NO	NO
Aluminium production	481.28		640.13	0.25	30.60	NA
Magnesium production	NA		NA	NA	NA	NA
Lead production	76.61		NO	NO	NO	NO
Zinc production	613.68		NO	NO	NO	NO
Other	NO	NO	NO	NO	NO	NO

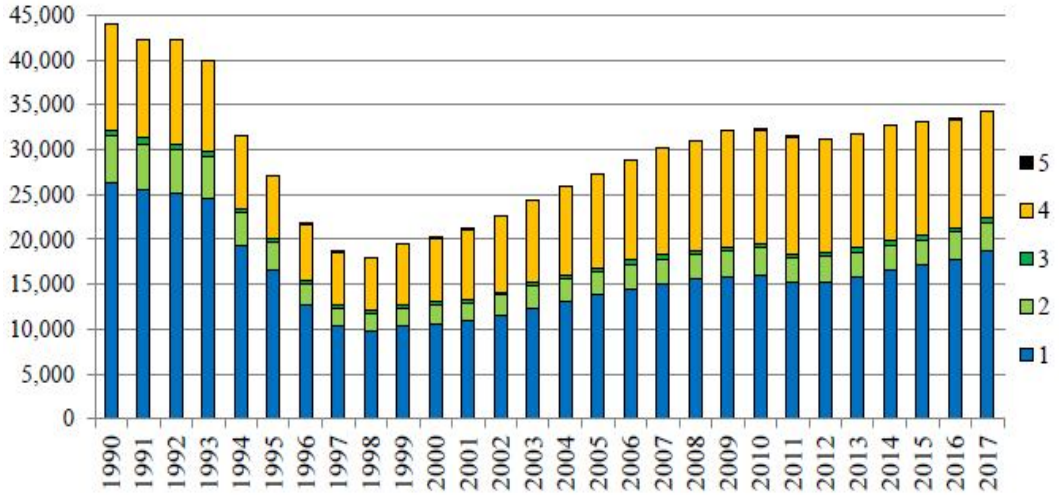


Cast iron and steel production remains the largest source of emissions compared to total emissions in the metal industry category (83,465.19 thousand tons of CO_2).

2.3. Agriculture, forestry and other land uses

2.3.1. Agriculture

Agriculture is one of the major sources of GHG emissions in Kazakhstan. Figure 2.11 shows the calculation of greenhouse gas emissions from the 'Agriculture' sector by activity categories in accordance with the IPCC classification. Total greenhouse gas emissions amounted to 34,268.39 thousand tons of CO2eq in 2017, which is a reduction compared to the 1990 level by 9,815.07 thousand tons (22%). The 2017 emissions increased by 1,108.79 thousand tons (3 %) compared to the 2016 level. The lowest emission values were recorded in 1998 (17,929.18 thousand tons).



1 – internal fermenration; 2 – manure management; 3 – rice cultivation; 4 – farmlands; 5 - carbonyl diamide application

Figure 2.11 Greenhouse gas emissions from 'Agriculture' sector activities for 1990-2017, thousand tons of CO2eq.

The overall reduction in greenhouse gas emissions is primarily due to a decrease in livestock population along with a significant reduction in acreage and standard amounts of mineral fertilizers. The livestock population decreased almost by half because of a grave crisis in the country during the period from 1990 to 1998. Since 1999, the livestock numbers have been increasing due to the improving economic conditions in the Republic, which leads to a steady growth of greenhouse gas emissions in the sector.

Methane (CH4) comprises the major share of greenhouse gas emissions in the sector - 19929.25 thousand tons of CO_2eq (58 %). Nitrous oxide emissions (N2O) amount to 14339.76 thousand tons of CO_2eq (42%), while the value of CO2 emissions from carbonyl diamide utilization is negligible (less than 0.01 %) (Figure 2.12).

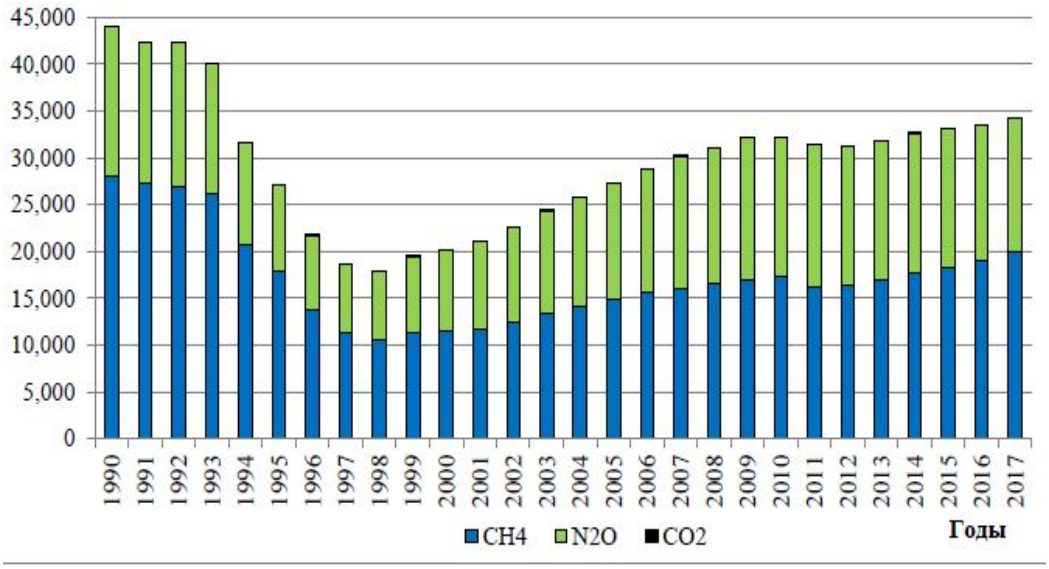
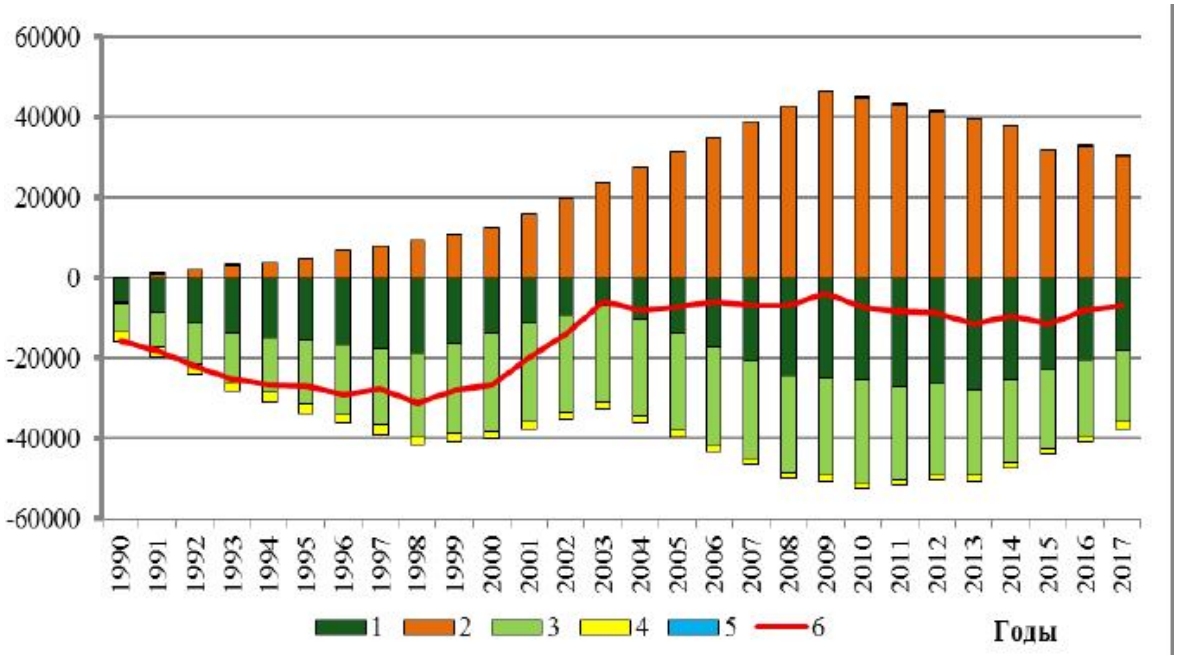


Figure 2.12. Greenhouse gas emissions from 'Agriculture' sector activities by gas type for 1990-2017, thousand tons of CO_2eq.

2.3.2. LULUCF

Farmlands contribute the majority of the LULUCF emissions due to intensive humus depletion from cultivated soils.



1 – forest, tree and shrub plantations; 2 - farmlands; 3 - natural pastures and hayfields; 4 - artificial reservoirs; 5-settlements; 6 - total absorption/emission

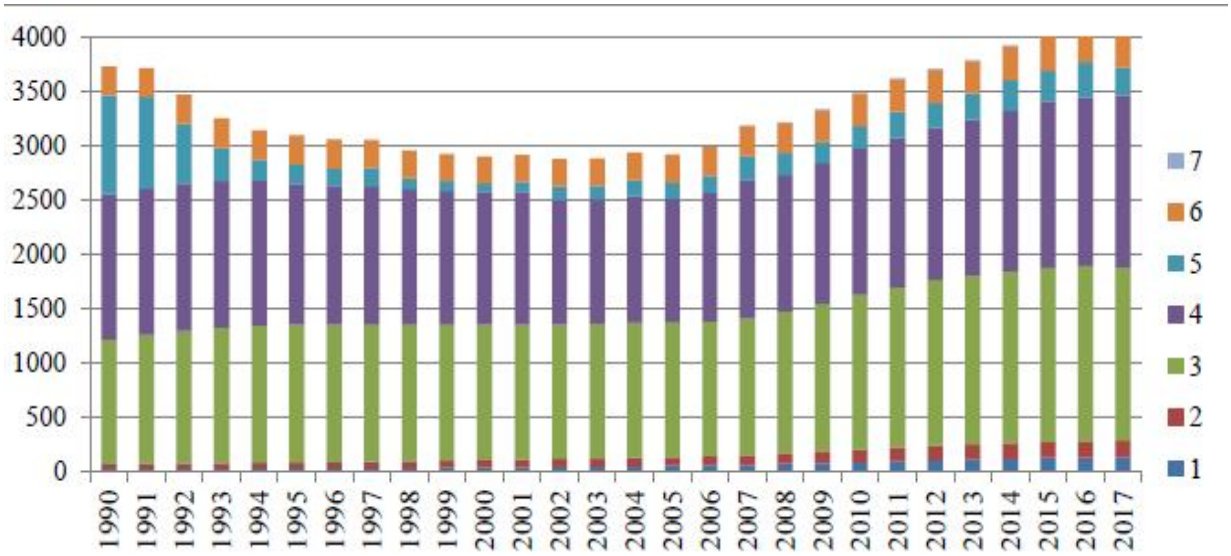
Figure 2.13. Annual values of CO2 absorption (-) /emission (+) for the key categories of land use in Kazakhstan according to calculations for 1990-2017, CO2 thous. tones/year

Overall, LULUCF remains a greenhouse gas sink due to the absorption by natural pastures and forestry.

2.4. Waste

The country produces 5-6 million tons of solid waste annually. About 3.2 million tons were produced within 8 months of 2018, of which about 330 thousand tons were processed and disposed making about 10.5% of the total volume of waste generated. For comparison, the volume of solid waste processing and disposal amounted to 9% in 2017 and 2.6% in 2016.

The country works on implementing separate waste collection, developing the waste processing sector and manufacture from recyclable materials attracting investments, particularly, via public-private partnership in order to increase the share of processed municipal solid waste (MSW).



1- MSW landfill in Astana; 2 - Solid waste landfill (SWL) in Almaty; 3 - MSW landfills, other cities of Kazakhstan; 4 -Municipal waste water; 5 - Industrial waste water; 6 - Nitrous oxide emissions from household effluent; 7 - Medical waste incineration

Figure 2.14. Overall greenhouse gas emissions dynamics in the 'Waste' sector in Kazakhstan for 1990-2017., thous. tonnes CO2- equiv

In 2017, officially operated municipal waste landfills (dumps) received 3.2 million tons of waste. Of these, 80.5% were subject to further landfilling, 5.8% — sorted and sent for further recycling, and 13.7% — disposed.
The waste sent for further landfilling consisted of the following: mixed municipal waste — 75.8%, industrial waste — 5.9%, construction waste — 5.9%, residual waste after sorting — 12.4%, and other waste.

2.5 Summary of procedures for information collection as well as changes in national procedures since the submission of the Third Biennial Report

The national system for estimating greenhouse gas emissions and removals in Kazakhstan includes institutional, legal and procedural mechanisms established to estimate anthropogenic emissions, sources and sinks of greenhouse gases based on the IPCC methodology.

During preparation of the Fourth Biennial Report, information and data on production volumes and activities resulting in calulation of anthropogenic emissions sources and sinks of greenhouse gases provided by public authorities, as well as publications and public sources of data, were used.

Receivement of data from State institutions is ensured by Order No. 107 of the Minister of National Economy of the Republic of Kazakhstan of 28 December 2018 "On approval of the list of information instruments".

III. CERTAIN QUANTIFIED ECONOMY WIDE TARGETS OF EMISSION REDUCTION

Table 2 of the CTF format, as well as table 3.1 below, describes the quantitative economy-wide emission reduction target under the United Nations Framework Convention on Climate Change (UNFCCC) and the quantitative target of the Republic of Kazakhstan under the Paris Agreement.

Table 3.1 Description of emission reduction target across the economy of the Republic of Kazakhstan.

№	*Sections*	*Information on the UN Framework Convention*	*Information on the Paris Agreement*
1	Base year	1990	1990
2	Target indicator of emissions reduction	15%	15% unconditional, 25 % conditional
3	Period to meet target	1990-2020	2021-2030
4	Covered gases and sectors	All gases and sectors excluding LULUCF	All gases and sectors including LULUCF
5	Global warming potential values as identified in relevant decisions adopted by the Conference of the Parties	Fourth evaluation report, decision 24/CP.19	Fourth evaluation report, decision 24/CP.19
6	Accounting approach for emissions and removals from land use, land-use change and forestry (LULUCF), taking into account any relevant decisions taken by the Conference of the Parties	Was not considered	Was considered
7	Use of international market-based mechanisms to achieve the emission reduction target, taking into account any relevant decisions taken by the Conference of the Parties, including a description of each source of international units and/or quotas under market-based mechanisms and the possible extent of the contribution of each of them	Is not considered	will consider the opportunity
8	Any other information, including relevant accounting rules, taking due account of any relevant decisions of the Conference of the Parties	Is considered	Is considered

IV. POLICIES AND MEASURES

This section provides information on Kazakhstan's actions to prevent climate change including policies and measures it has implemented or plans to implement since its previous Seventh National Communication (NC7 (2017)) or Biennial Report (2017) in order to achieve the target of reducing emissions across the economy.

4.1. Decision making

The country's decision-making process on climate policy is described in the previous Seventh National Communication. The following are the key changes to the earlier description of the decision-making process.

4.1.1 Establishment of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan

The Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan (hereinafter referred to as RoK MEGNR) was established by Decree of the President of the Republic of Kazakhstan No. 17 dated June 17, 2019,[2] "On measures for further improvement of the public administration system of the Republic of Kazakhstan."[3]

RoK MEGNR assumed the below functions and powers from the following agencies:

- Ministry of Energy: formulation and implementation of the national policy on environmental protection, solid waste management, protection, control and supervision of the rational use of natural resources;
- Ministry of Agriculture: utilization and protection of water resources, water supply, water disposal and forestry;
- Ministry of Industry and Infrastructure Development: state geological exploration and mineral resources replacement.

The Department of Climate Policy and Green Technologies was established within the structure of the RoK MEGNR to perform the following:

- Formulation and implementation of uniform national policy and arranging the development of the climate and the Earth's ozone layer protection program.
- Achievement and implementation of the ultimate goal and provisions of the United Nations Framework Convention on Climate Change (UNFCCC) and other international agreements and protocols on climate change and the Earth's ozone layer.
- Implementation of the national policy on international cooperation in the field of climate change and protection of the Earth's ozone layer.
- State regulation of emission and removal of greenhouse gases and ozone-depleting substances.
- Ensuring green growth in the region via technology transfer, knowledge sharing and financial support to international development institutions.

[2] http://adilet.zan.kz/rus/docs/U190000017U
[3] http://ecogeo.gov.kz/ru

RoK MEGNR is the country's central executive body coordinating environmental protection, nature management, protection, control and supervision of the rational use of natural resources and supervision of the national policy on green economy development. Zhassyl Damu JSC (subordinate to RoK MEGNR) functions as the national competent body responsible for the system of assessment of anthropogenic emissions from sources and removals by sinks of greenhouse ozone-depleting gases. Zhassyl Damu JSC maintains the inventory based on the data of the Committee for Statistics under Ministry of National Economy and acts upon requests.

4.1.2. National planning system

Decree of the President of the Republic of Kazakhstan No. 827 dated June 18, 2009 № 827 "On the national planning system in the Republic of Kazakhstan"[4] ceased to be enforced based on Decree of the President of the Republic of Kazakhstan No. 681 dated May 5, 2018, "On amendments to some decrees of the President of the Republic of Kazakhstan and revocation of some acts of the President of the Republic of Kazakhstan." [5]

The abolished system of national planning (NPS) was a complex set of interrelated components consisting of principles, documents, processes and participants of national planning ensuring the development of the country for the long-term (over 5 years), medium-term (from one year to 5 years) and short-term (up to 1 year) periods.

4.1.3. Kazakhstan-2050 Strategy and the Concept for transition of the Republic of Kazakhstan to green economy

Strategy[6] for development of the Republic of Kazakhstan until 2050. 'Kazakhstan-2050 strategy: new political course of the established state' - address to the nation by the President of Kazakhstan - Leader of the Nation underpins the development of all strategic documents and programs by the Government, ministries and agencies.

Kazakhstan-2050 Strategy defines the transition to low-carbon green economy one of the strategic objectives and declares the target penetration of alternative and renewable energy in the country's total energy consumption as at least 50%.

The Concept for transition of the Republic of Kazakhstan to green economy[7] was adopted in order to achieve the tasks envisaged in the Strategy for transition to green economy. The Concept was approved by Decree of the President of the Republic of Kazakhstan No. 577 dated May 30, 2013. The Council for[8] Transition to green economy under the President of the Republic of Kazakhstan was established in order to monitor and evaluate the implementation of the Concept for transition of the Republic of Kazakhstan to green economy by the President's decree No. 823 dated May 26, 2014.

Additional information is available in the Seventh National Communication of the Republic of Kazakhstan.

[4] http://adilet.zan.kz/rus/docs/U1800000681#z124
[5] http://adilet.zan.kz/rus/docs/U090000827_
[6] http://adilet.zan.kz/rus/docs/K1200002050
[7] http://adilet.zan.kz/rus/docs/U1300000577
[8] http://adilet.zan.kz/rus/docs/U1400000823

4.1.4. Governance in the Industrial Processes and Product Use sector

Ministry of Industry and Infrastructure Development coordinates the industry sector not related to energy in compliance with decree of the government of the Republic of Kazakhstan No. 936 dated December 29, 2018. It is a public body governing industry and industrial development, mining and metallurgy complex, local content development, engineering, coal, chemical, pharmaceutical and medical industry, consumer goods industry, woodworking and furniture industry, construction and construction materials manufacture, safety of machines and equipment and safety of chemical products in accord with the industry focus; export controls; industrial safety; energy saving and energy efficiency; etc.[9].

The joint order of the Minister of Industry and Infrastructure Development of the Republic of Kazakhstan No. 639 dated August 12, 2019, "On some issues of transportation of ferrous and non-ferrous metal scrap and waste" was issued to impose a 2-year **ban** on exporting scrap and waste of ferrous and non-ferrous metals, pipes, rails, components of previously used railway tracks and rolling stock **out** of the Republic of Kazakhstan by motor transport.

4.1.5. Strategic documents

The Strategic development plan until 2020 approved by Decree of the President of the Republic of Kazakhstan No. 922[10] dated February 1, 2010, which had been in effect on the date of NC7 submission, was revoked by Decree of the President of the Republic of Kazakhstan No. 636 dated February 15, 2018, "On approval of the Strategic development plan of Kazakhstan until 2025 and revocation of some decrees of the President of the Republic of Kazakhstan."

The Strategic development plan until 2020 identified climate change as one of the key factors determining the trends emerging currently in the world economy. The document also notes the urgent need to implement measures both to reduce anthropogenic emissions of greenhouse gases and to address regional challenges including the water availability and quality issue, which are becoming more acute due to global warming.

The approved Strategic development plan of the Republic of Kazakhstan until 2025 sets tasks for accelerated qualitative economic growth and improvement of living standards in the country. Moreover, the qualitative growth of the economy should occur while minimizing the negative human impact on nature. At the same time, the UN Sustainable Development Goals will remain an important benchmark.

The Strategic plan until 2025 defines, among others, "Policy 6. Green economy and environmental protection." The green economy and environment policy focuses on improving the quality of natural resources, developing alternative energy sources, adapting to climate change, as well as decarbonizing and improving the energy efficiency of the economy. The policy's key outcomes will be improved living standards, environmental safety, reduction of environmental risks and environmental deficits, sustainable development and competitiveness.

The following objectives have been identified for the implementation of this policy:

- Task 1. Achieving the goals of the Paris Agreement.

[9] http://miid.gov.kz/ru/pages/polozhenie-o-ministerstve
[10] http://adilet.zan.kz/rus/docs/U100000922_

- Task 2. Identifying funding sources and accounting of green finance and investment attraction
- Task 3. Encouraging investment in green technologies
- Task 4. Decarbonization of the economy
- Task 5. Increasing the efficiency of water use and protection of water resources
- Task 6. Development of renewable energy sources, upgrading of traditional energy sources
- Task 7. Biodiversity conservation
- Task 8. Development of low-waste economy
- Task 9. Production and consumption waste management

4.2. Policies and measures, and their effects

This chapter outlines the amendments in policies and measures described in NC7, which have led to the reduction of greenhouse gas emissions in the fuel combustion and fugitive emissions sector in the Republic of Kazakhstan.

4.2.1. Cross-sectoral policies and measures

Adoption of policies and measures affecting the reduction of GHG emissions was a key and essential action to mitigate climate change.

Environmental code

Adoption of Environmental Code No. 212[11] dated January 9, 2007, became the first step of shaping the national legislation on greenhouse gas regulation.

Since the adoption of the Environmental Code of Kazakhstan in 2007, it changes gradually, which indicates the need for further improvement of environmental legislation to create the proper environment for achieving Kazakhstan's strategic goals[12].

Paragraph 17 of the National action plan[13] for implementation of the Address[14] of the President to the Nation dated January 10, 2018, “New opportunities for development under the fourth industrial revolution” (further referred to as the National Plan) contained the objective to present the draft of the new edition of the Environmental Code of the Republic of Kazakhstan to the Majilis (Lower House) of the Parliament of the Republic of Kazakhstan in December 2019.

The draft Code should take into account the features and diversity of existing tools and mechanisms for efficient environmental protection in the practice of advanced countries. In addition, the country has adopted (or is to adopt) a number of international obligations that can be fulfilled only upon amendments and supplements to the national environmental legislation. The new Environmental

[11] http://adilet.zan.kz/rus/docs/K070000212
[12] http://aeok.kz/predlagaem-prinyat-uchastie-v-razrabotke-novogo-ekologicheskogo-kodeksa-respubliki-kazahstan/
[13] http://adilet.zan.kz/rus/docs/U1800000633
[14] http://adilet.zan.kz/rus/docs/K1800002018#z0

Code of Kazakhstan should be progressive, comprehensive, systematic, meeting modern challenges in the field of environmental protection, and it is to create a more efficient and transparent system of state regulation and governance[15].

The new Code is to be governed by the basic principles of environmental legislation of the OECD countries. The key principle states that the natural resource user shall operate and incur the costs. The Government of Kazakhstan supervises all decisions related to the regulation of GHG emissions in Kazakhstan in accordance with article 16 of the Environmental Code of the RoK.

Voluntary National Review on Sustainable Development Goals

Additionally, Kazakhstan presented its first Voluntary National Review on Sustainable Development Goals (SDGs) on July 16, 2019, in New York, USA, at the forum dedicated to the review of the 2030 Agenda for Sustainable Development. The SDGs have been integrated into national programs and strategies including the Kazakhstan-2050 strategy and the Strategic Development Plan of the Republic of Kazakhstan until 2025.

4.2.2. Market mechanisms of GHG emissions reduction and removals

On December 3, 2011, articles 94-1 to 94-12 enacting the key provisions on state regulation of emissions and removals of greenhouse gases were added to [16] Chapter 9-1 "State regulation of emissions and removals of greenhouse gases" of the Environmental Code in accord with Law of the Republic of Kazakhstan No. 505-IV "On amendments and supplements to some legal acts of the Republic of Kazakhstan on environmental issues."

Emissions trading is a key tool to mitigate climate change and reduce industrial greenhouse gas emissions in a cost-effective way. The tool is usually developed based on Cap and Trade and is applied in the EU and US. Kazakhstan launched its Emission Trading System (ETS) in January 2013.

Three National Allocation Plans (NAP) for GHG emissions have been adopted in Kazakhstan since the launch of ETS:

- NAP 2013[17] was adopted on December 13, 2012
- NAP 2014-2015[18] was adopted on December 31, 2013
- NAP 2016-2020[19] was adopted on December 30, 2015

In February 2016, Kazakhstan suspended ETS in terms of trading GHG emission allowances until 2018 due to certain distortions in the system, defects that required remedy.

The 'Rules of allowances allocation for greenhouse gas emissions and generation of reserves of the assigned amount and volume of allowances under the National Allocation Plan for greenhouse gas emissions' were approved the Government Resolution No. 370 on June 15, 2017[20]. According to these

[15] http://adilet.zan.kz/rus/docs/K070000212
16 http://adilet.zan.kz/rus/docs/Z1100000505
[17] http://adilet.zan.kz/rus/docs/P1200001588
[18] http://adilet.zan.kz/rus/docs/P1300001536
[19] http://adilet.zan.kz/rus/docs/P1500001138
[20]http://energo.gov.kz/assets/old/uploads/files/2017(1)/06/%D0%BF%D0%BE%D1%81%D1%82%20370%20%D0%BE%D1%82%2015.06.17%20rus.pdf

rules, GHG emission allowances are allocated by installations with reference to the baseline or GHG emission factors taking into account the commitments to limit and/or reduce GHG emissions.

4.2.3. NDC and Paris Agreement

On December 12, 2015, Paris Agreement was adopted at the 21st session of the UNFCCC Conference of the Parties held in Paris from November 30 to December 13, 2015. After signing the agreement on August 2, 2016, Kazakhstan ratified it on December 6, 2016. On September 28, 2015, Kazakhstan announced its INDC -Intended Nationally Determined Contribution - indicating that the nation intends to achieve the 15% unconditional reduction in greenhouse gas emissions against the 1990 levels by 2030.

4.2.4. Policies and measures in the fuel combustion sector

Reduction of the GDP carbon intensity is a key principle of green transition under Kazakhstan's concept of transition to green economy. Since the fuel combustion sector is responsible for the bulk of GHG emissions in Kazakhstan, policies and measures in the fuel combustion sector directly influence the reduction of energy intensity and the carbon intensity of GDP.

Reduction of Kazakhstan's GDP energy intensity

Low-carbon economic development provides for a significant reduction in greenhouse gas emissions against the gross domestic product, transition from hydrocarbon fuel and energy resources combustion to renewable energy sources (solar energy, wind energy, small hydro power plants), reduction of energy consumption and subsequent reduction of greenhouse gas emissions in the manufacturing industry and housing and utilities sector (energy saving). The targets on the GDP energy intensity reduction have also been set in the concept for development of the fuel and energy complex of Kazakhstan until 2030.

Table 4.1 Reduction of GDP energy intensity of Kazakhstan against 2008

Year / Targets	Concept for transition of the Republic of Kazakhstan to green economy
2015	-10% against the 2008 level
2020	-25% against the 2008 level
2030	-30% against the 2008 level
2050	-50% against the 2008 level

Energy saving and energy efficiency

The Law[21] "On energy saving and energy efficiency" (No. 541) was adopted on January 13, 2012. For additional information, please see NC7.

[21] http://adilet.zan.kz/rus/docs/Z1200000541

Concept for development of fuel and energy complex of Kazakhstan until 2030

The "**Concept for development of fuel and energy complex of the Republic of Kazakhstan until 2030**" was approved under No. 724 on June 28, 2014. The concept of FEC development takes account of the objective of active integration of renewable energy sources and alternative energy sources in the energy balance, energy and resource conservation, and enhancement of energy efficiency. As for the quantitative targets for GHG emissions, the Concept reiterates the targets for the GDP energy intensity reduction specified in the Concept for transition of the Republic of Kazakhstan to green economy.

Strategic plan of the Ministry of Energy for 2017-2021

Major short-term policies and measures in the fuel combustion sector are determined by the Ministry of Energy of Kazakhstan as reflected in the Strategic plan of the Ministry of Energy of the RoK. The "Strategic plan of the Ministry of Energy of the Republic of Kazakhstan for 2017-2021" No. 571 was approved on December 28, 2016. This plan aims at improving the quality of the environment, ensuring the transition of the Republic of Kazakhstan to low-carbon development and green economy to meet the needs of present and future generations.

Strategic priority 2 - "Improving the quality of the environment" - defines the below measures to achieve the nationally determined contributions to limiting and reducing greenhouse gas emissions across the economy of Kazakhstan as declared in accord with the Paris agreement under the UN Framework Convention on Climate change (UNFCCC):

1) regulation of greenhouse gas emissions and removals via a market mechanism - the emissions trading system (ETS);

2) increasing the share of renewable energy sources in the country's energy balance;

3) retrofitting thermal power plants and boiler houses;

4) implementation of energy efficiency and energy saving projects.

4.2.5. Policies and measures in the heat and power generation sector

The Concept for development of the fuel and energy complex sets a number of objectives, and some of them may reduce greenhouse gas emissions directly or indirectly. They include development of renewable energy sources and their integration into the power grid; reduction of equipment wear; increasing power reserve and the capacity of power transmission equipment; development of cycling gas generation in the Western power zone to ensure power output to the Southern and Northern power zones and address the demand for peak capacity of North and South; improving energy efficiency in the Republic of Kazakhstan.

Table 4.2 Anticipated outcomes in electric power industry

Description	2020	2030
Share of wind and solar power stations in power generation	3%	10%
Share of gas-fired power plants in power generation	20%	25%
Reduction of carbon dioxide emissions in electric power industry	2012 level	-15 % (against 2012 level)

Target indicators for the renewable energy sector development

The "Rules of formation and utilization of reserve fund" [22](No. 361) were approved on July 29, 2016, in accord with subparagraph 9-2) of Article 6 of the Law of the Republic of Kazakhstan "On support for the use of renewable energy sources." This fund is formed by the Billing Center for the Support of Renewable Energy Sources. The Center's funds are held in a special bank account and are used only to cover cash gaps and debts of the Billing Center owed to energy-generating organizations that use renewable energy sources due to default or delayed payment by "conditional consumers" for the supplied electricity produced by renewable energy facilities.

"Target indicators for the renewable energy development" (No. 478) were approved on November 7, 2016 in accordance with subparagraph 5-2) of article 6 of the Law of the Republic of Kazakhstan "On support for the use of renewable energy sources".

The forecast capacity of the renewable energy sector by 2025 is 2,615 MW according to the National Energy Report[23] of 2019.

Table 4.3. Target indicators for the renewable energy sector development

No.	Indicators	Development targets for renewable energy sector by 2020	The National Energy Report forecast by 2025
1.	Share of electric power generated by renewable energy facilities in the total power generation until 2020	3%	-
2.	Total installed capacity of renewable energy sources until 2020 including:	1,700 MW	2,615 MW
1)	Wind farms	933 MW	1,200 MW
2)	Solar power plants using photovoltaic solar energy converters	467 MW	1,100 MW
3)	Hydro power stations	290 MW	300 MW
4)	Biogas plants	10 MW	15 MW

Law "On support for the use of renewable energy sources"

On July 4, 2009, Kazakhstan adopted the Law "**On support for the use of renewable energy sources**." This law provides support for the use of renewable energy sources as one of the tools for meeting the country's international commitments to reduce GHG emissions.

"Fixed tariffs for supply of electrical energy produced by renewable energy sources" No. 645 were approved on June 12, 2014 in accordance with subparagraph 7-2) of Article 5 of this law.

Table 4.4 Fixed tariffs for electric power supply from renewable energy sources

No.	Renewable Electricity Generation Technologies	Tariff, KZT/kWh (excluding VAT)
1	Wind power plants, excluding the EXPO-2017 wind farm with 100 MW capacity	22.68
1-1	EXPO-2017 wind power plants with 100 MW capacity	59.7

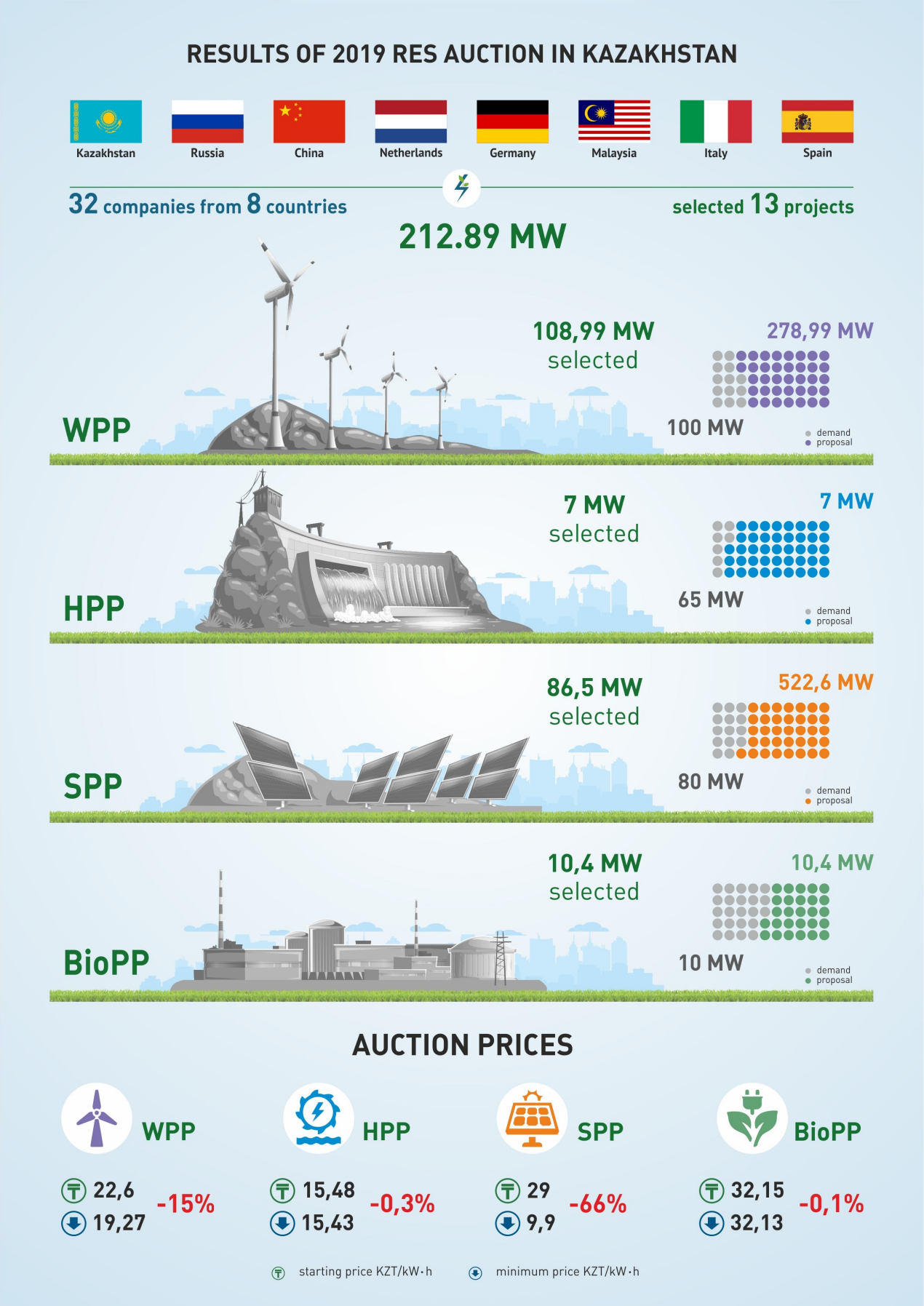
[22] http://adilet.zan.kz/rus/docs/V1600014210
[23] http://www.kazenergy.com/ru/analyst/190/

2	Photovoltaic solar energy converters, excluding the fixed tariff for solar power plant projects using photovoltaic modules based on Kazakhstani silicon (Kaz PV) to convert solar radiation	34,61
3	Small hydropower plants	16.71
4	Biogas plants	32,23

In 2017, the Law was amended to provide for auctions to reduce the cost of electricity among new renewable energy projects (excluding the existing ones with fixed tariffs). The auction bidding mechanism was introduced in 2018. Kazakhstan Electricity and Power Market Operator JSC (KOREM JSC) was assigned the auction operator following Order No. 280 of the acting Minister of Energy dated August 7, 2017[24]. Organizing and conducting auctions, KOREM JSC cooperates with the Ministry of Energy of the Republic of Kazakhstan and the single purchaser of electric power produced by renewable energy facilities – Billing Center for RES LLP.

[24] https://vie.korem.kz/

Figure 4.1 Renewable energy auctions results infographics for 2018-2019



Targeted assistance to individual consumers

The «**Rules of providing targeted assistance to individual consumers**»[25] No. 161 were approved on November 28, 2014 in accordance with subparagraph 10-7) of Article 6 of the Law of the Republic of Kazakhstan «On support for the use of renewable energy sources» dated July 4, 2009.

For detailed information, please see NC7.

Guidelines for renewable energy facilities' placement planning

The "Guidelines for renewable energy facilities placement planning"[26] (No. 345) were approved on July 27, 2016, in accordance with subparagraph 5-1) of Article 6 of the Law of the Republic of Kazakhstan "On support for the use of renewable energy sources" (No. 345).

In 2019, the Ministry of Energy of the Republic of Kazakhstan initiated a number of amendments to the legislation on renewable energy support incentivizing the development of small-scale renewable energy projects (up to 200 kW) for households, farms and small and medium-sized enterprises. Incentives include subsidies, facilitation of grid connectivity, etc. In addition, a number of measures were proposed to improve the investment environment for large-scale renewable energy projects of MW class (extension of PPA validity term, etc.)

For detailed information, please see NC7.

Development of nuclear power generation

The Concept for development of the fuel and energy complex of Kazakhstan until 2030 envisages development of nuclear power generation. The main development goal of the nuclear industry is to build a full cycle of nuclear fuel production with moderate increase in production volumes and expansion of uranium channels. Study and implementation of a nuclear power plant construction project is a key objective of the sector. The network infrastructure of nuclear power plants with the capacity of up to 1000 MW is to be constructed and connected by 2030.

In September 2017, information was released that the development of feasibility studies for the Nuclear Power Plants (NPP) project by Kazakhstan was already under way and the decision on construction was to be taken after the completion of the works.

On April 3, 2019, the President of the Russian Federation Putin, during a meeting with the President of Kazakhstan Kasim-Zhomart Tokayev, offered assistance in the construction of the nuclear power plant. The next day, Deputy Minister of Energy of Kazakhstan Magzum Mirzagaliyev said that there is no concrete solution to the construction of the nuclear power plant. In case of choice of NPP construction, the decision will be made according to the legislation after public hearings and coordination with local executive bodies.

On June 20, 2019 at the reporting conference to the population, Energy Minister Kanat Bozumbayev said that the issue of construction of a nuclear power plant in Kazakhstan will be decided by referendum. He drew attention to the fact that research on the possibility of construction of nuclear power plants was carried out earlier, and will be carried out in the future. He stated that today there is no decision, at any level of power, on the construction of a nuclear power plant.

Development of coal bed methane power generation

The Concept for development of the fuel and energy complex of the Republic of Kazakhstan until 2030 envisages development of coal-bed methane power generation. Within the framework of

[25] http://adilet.zan.kz/rus/docs/V1400010083
[26] http://adilet.zan.kz/rus/docs/V1600014155

transition to green economy, coal generation is to remain the prevailing source of energy until 2030 under the chosen course of diversification of generation; however, its share in the overall structure of electricity generation will be prevented from significant increase.

For detailed information, please see NC7.

4.2.6. Policies and measures in the oil-refining sector

Strategic priority 2 - "Development of oil and gas and petrochemical industries" - notes that retrofitting and upgrading projects are being implemented at oil refineries to be completed in 2017-2018 within the framework of the industrialization roadmap aimed at quality improvement and compliance with European standards for domestic oil products,

In 2018, the Atyrau, Pavlodar and Shymkent refineries completed the retrofits. This allowed enhancing the refineries' capacities by 20% increasing the refinery yields to 80-90%. As a result, the output of oil products compliant with K4 and K5 environmental classes has grown in Kazakhstan. Thus, the output increase for gasoline made 70%, diesel fuel - 20%, and aviation fuel - 2.4 times[27].

4.2.7. Policies and measures in the transport sector

Energy efficiency in transport

«Energy efficiency requirements for transport» (No. 389) were approved on March 31, 2015, in accordance with subparagraph 6-7) of Article 5 of the Law of the Republic of Kazakhstan "On energy saving and energy efficiency." They determine the standard indicators of transport energy efficiency. The requirements apply to railway, road, maritime, inland waterway, air and urban rail transport imported and produced after adoption of these requirements.

For detailed information, please see NC7.

Alternative modes of transport and related infrastructure

Development of alternative modes of transport and related infrastructure, - in particular, for electric vehicles and gas vehicles, - was stated in the Concept for transition of the RoK to green economy. In 2019, 696 electric vehicles were registered in Kazakhstan. The cost of e-vehicles and lack of developed charging stations infrastructure impede wider implementation of electric mobility. [28]

The Action plan[29] on expanded use of natural gas as motor fuel for 2019-2022 was adopted in November 2018 in order to boost utilization of natural gas. The Plan sets the following indicators:

(1) upgrading buses and service vehicles to use compressed and/or liquefied natural gas as motor fuel from 3,300 vehicles in 2019 to 12,000 vehicles in 2022;

(2) the demand for compressed natural gas and/or liquefied natural gas as motor fuel for motor vehicles in the gasified regions of the Republic of Kazakhstan from 135 million m3 in 2019 to 500 million m3 in 2022;

(3) construction of gas-filling compressor stations and (or) cryogenic filling stations in the gasified regions of the Republic of Kazakhstan from 31 items in 2019 to 100 items in 2022.

[27] https://inbusiness.kz/ru/news/kak-minenergo-reshaet-voprosy-s-nebolshimi-npz
[28] https://kursiv.kz/news/avto/2019-06/gonka-za-trendom
[29] http://adilet.zan.kz/rus/docs/P1800000797

Improvement of traffic management system

Smart traffic management system can be deployed at different traffic levels. The main objectives of the system are optimization of traffic on regulated traffic lights in order to reduce traffic delays; reduction of trip time; and increase the operational speed of public transport. Astana akimat (capital city municipality) resolution No. 108- 891 dated May 4, 2016 approved the «Rules for the implementation and operation of automated traffic control systems»[30]. The purpose of automated traffic management systems implementation is to ensure transport accessibility for the residents of Nur-Sultan, increase the road network capacity, reduce accidents and improve the efficiency of public transport. Objectives of automated traffic control systems:

1) enhance the operational efficiency of the transport system by: (a) increasing the capacity of traffic flows; (b) reducing travel delays on routes using different modes of transport;

2) increase the trip convenience and comfort by: (a) improving accessibility of public transport; (b) reliability of route scheduling; (c) overall and individual safety of road users;

3) ensure road safety by: (a) improving the safety of road users; (b) reducing the number of road accidents.

In May 2018, Minister for Investment and Development Zhenis Kassymbek made a speech at the government session describing the operation of the Smart Transport System (STS)[31]. According to the Ministry, the economic effect of STS implementation will amount to KZT 380 billion. At the subnational level, STSs will be implemented in four areas: photo and video recording system, passenger traffic monitoring and electronic ticketing system, traffic management system, and parking management system.

Generally, the smart transport system implementation and digitalization of transport sectors will allow for achieving the following indicators: reduction of accidents by 8-10%; travel time reduction by 20%; information availability improvement by 70%; and harmful emissions reduction by 24%.

Comprehensive development plan for the gas-engine fuel market of the Republic of Kazakhstan until 2020

The "**Comprehensive development plan for the gas-engine fuel market of the Republic of Kazakhstan until 2020**" No. 433 was approved on June 25, 2015, in accordance with subparagraph 5), paragraph 2 of section 3 of the "Concept for development of the gas sector of the Republic of Kazakhstan until 2030." All provisions of this plan aim to increase utilization of gas in transport.

For detailed information, please see NC7.

KazTransGas JSC[32]provides a major contribution to the transition of transport. KazTransGas JSC has set a priority objective to transition Kazakhstan's vehicles including state, municipal and personal transport to compressed natural gas (CNG). The company claims that new infrastructure has been created in the Republic for the purposes of this transition, which will be consistently upgraded in the near future. A dedicated subdivision was established within KazTransGas JSC to achieve the objective.

[30] http://adilet.zan.kz/rus/docs/V16ABW01029
[31] https://kapital.kz/economic/68811/chto-dast-intellektualnaya-transportnaya-sistema.html
[32] http://www.nomad.su/?a=4-201406180017

KazTransGaz Onimderi LLP[33]. According to the information from the company's website, 85 million m3 of CNG were sold at the KazTransGas group CNG stations before 2017.

International aviation

According to the Kyoto Protocol reporting manual, the Parties included in Annex I shall, in accord with paragraph 2, Article 2 of the Protocol, state the actions they have taken to support/implement decisions by ICAO and IMO on limitation or reduction of emissions of greenhouse gases from aviation and marine bunker fuels.

The International Civil Aviation Organization (ICAO) is a specialized agency of the United Nations (UN) tasked with assisting States in achieving the greatest possible degree of uniformity of rules, standards, procedures and organization in the field of civil aviation. This organization was created based on the Chicago Convention (Convention on International Civil Aviation) prepared and signed by 54 states in 1944. Kazakhstan ratified the Chicago Convention in 1992. ICAO works with all its stakeholders and industry groups to build consensus on international civil aviation standards and recommended practices in support of safe, efficient, reliable, economically sustainable and environmentally responsible civil aviation. Kazakhstan, as a member of ICAO, has obligations to comply with these requirements for the application of ICAO Standards and Recommended Practices[34].

According to the ICAO[35] environmental report released in February 2019, international aviation contributed 1.3% to global anthropogenic CO2 emissions. While the percentage of CO2 emissions from global aviation has not changed significantly since 1992, CO2 emissions have increased along with increases in global CO2 emissions from other sectors.

In order to minimize the adverse impact of international civil aviation on the global climate, ICAO develops policies, develops and updates Standards and Recommended Practices (SARP) on aircraft emissions and conducts advocacy activities. These activities are carried out by the Secretariat and the Committee on Aviation Environmental Protection (CAEP). In carrying out its activities, ICAO also cooperates with other United Nations bodies and international organizations.

To achieve global goals and promote sustainable growth in international aviation, ICAO is implementing a range of measures, including aviation technology improvements, operational improvements, sustainable aviation fuel and market-based measures (CORSIA-the Carbon Offsetting and Reduction Scheme for International Aviation).

On August 8, 2017, ICAO Secretary General Dr. Fang Liu met with Prime Minister of Kazakhstan Bakytzhan Sagintayev. Dr. Liu expressed appreciation for the recent commitments and achievements in improving safety at the local level and urged to consider participation in the Carbon Offsetting and Reduction Scheme for International Aviation. During the meeting, the Kazakh side made commitments regarding the allocation of resources for civil aviation for closer cooperation with ICAO in the field of assistance and capacity building, the development of its national action plan to reduce emissions and other goals of common interest for air transport[36]. Dr. Fan Liu urged to consider participation in the CORSIA System as early as possible.

As of now, Kazakhstan has not taken measures to participate in the CORSIA system.

[33] http://www.ktgo.kz/?page_id=4996
[34] http://aviation.miid.gov.kz/ru/pages/vzaimodeystvie-ikao-i-kazahstana
[35] https://www.icao.int/environmental-protection/Documents/ICAO-ENV-Report2019-F1-WEB%20 (1).pdf
[36] https://www.icao.int/Newsroom/Pages/ICAO-Secretary-General-promotes-aviation-development-priorities-during-high-level-mission-to-the-Republic-of-Kazakhstan.aspx

Marine bunkering

The International Maritime Organization[37] (IMO) was established based on the understanding that the international character of the shipping industry implies that activities aimed at improving the safety of maritime navigation will be efficient if carried out at the international level. The Conference convened by the UN in 1948 adopted the Convention establishing the International Maritime Organization (IMO). The Convention entered into force in 1958.

On March 4, 1994, the Cabinet of Ministers of the Republic of Kazakhstan adopted Resolution No. 244 "On accession of the Republic of Kazakhstan to international conventions adopted under the auspices of the International Maritime Organization (IMO) and to the IMO Convention"[38].

In 2018, IMO adopted its initial strategy to reduce greenhouse gas emissions from ships outlining a concept that reaffirms IMO's commitment to reducing GHG emissions from international transport and phasing them out[39].

IMO's Initial Strategy is to reduce total GHG emissions from international transport and reduce total annual GHG emissions by at least 50% by 2050 compared to 2008, while making efforts to phase them out.

At the UN climate change conference in Spain in 2019, IMO presented its latest efforts [40]on reducing greenhouse gas emissions from shipping. IMO's Initial Strategy contains a commitment to reduce GHG emissions from shipping as a matter of urgency and to eliminate them completely as soon as possible. The IMO Marine Environment Protection Committee (MEPC) has approved draft amendments aimed at strengthening energy-efficient design requirements for new ships. IMO reported on the continued success of two important projects, GloMEEP and the GMN global network for energy efficient shipping, which support developing countries in implementing IMO energy efficiency measures; and the initiation of a third project, GreenVoyage 2050, to support global efforts to demonstrate and test technical solutions to reduce greenhouse gas emissions in transportation.

Meanwhile, IMO's mandatory requirement to collect data on fuel oil consumption by ships is nearing the first full year of reporting; and the fourth IMO greenhouse gas emissions study has been launched to provide an updated list of greenhouse gas emissions from international transport.

Currently, Kazakhstan does not participate in these IMO initiatives.

4.2.8. Policies and measures in the pipeline industry

Concept for development of the gas sector of the RoK until 2030

Meeting the domestic demand for commercial gas in the interests of the country's economic development is the strategic priority of the gas sector development.

The "Concept for development of the gas sector of the Republic of Kazakhstan until 2030" No. 1275 was approved on December 5, 2014. The concept defines the vision and main approaches to the phased reform and comprehensive development of the gas sector of Kazakhstan.

For detailed information, please see NC7.

[37] http://www.imo.org/en/About/Documents/IMO%20What%20It%20is%20Russian.pdf
[38] http://adilet.zan.kz/rus/docs/P940000244_
[39] http://www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx
[40] http://www.imo.org/en/MediaCentre/WhatsNew/Pages/default.aspx

General scheme of gasification of the Republic of Kazakhstan for 2015-2030

Government of the Republic of Kazakhstan approved the **"General scheme of gasification of the Republic of Kazakhstan for 2015-2030"**[41] No. 1171, dated November 4, 2014 as part of the implementation of goals to deliver gas transportation infrastructure to all regions of the country**.** One of the objectives of the general scheme affecting emissions to the environment is the provision to create conditions for increasing the share of gas consumption in the fuel and energy complex. This scheme defines economically feasible strategic directions of gas supply to the country's consumers. The Law "On gas and gas supply" and the relevant Rules approved by the government of Kazakhstan shape the legal framework for the document.

Description	2015	2020	2025	2030
Natural gas production, billion m^3 / year	44.19	62.0	61.0	59.8
Commercial gas for distribution, billion m^3 / year	22.22	24.59	22,24	21.02

Construction of the "Sary-Arka" main gas pipeline

Completion of the 'Beineu-Bozoi-Shymkent' MGL created a technical opportunity to transport natural gas from the fields of Western Kazakhstan to Kyzylorda and southern region of the Republic of Kazakhstan, and subsequently, it became the basis for the feasibility study to supply domestic gas for gasification of Astana, as well as central and northern regions of Kazakhstan[42].

The proposed stages of the gas pipeline development include gasification of settlements in Karaganda, Akmola, North Kazakhstan oblasts and of Pavlodar and northeastern regions of Kostanay oblast in the future, with total coverage of up to 4.6 million people and a forecasted consumption volume of up to 3.6 billion m^3/year

In addition, this project provides a more complete transit capacity utilization of "Beineu-Shymkent" MGL, while MGL's long-term gas transit capacity is estimated at the volume of up to 15.0 billion m^3/year, and, in general terms, that might reduce gas transportation tariff.

In October 2019, the first stage of construction of the "Sary-Arka" main gas pipeline was completed. The new gas pipeline has been laid along the "Kyzylorda – Zhezkazgan – Karaganda – Temirtau - Nur-Sultan" route. The project is implemented by AstanaGas KMG JSC.

The total cost of construction of the first stage of the main gas pipeline is KZT 267.3 billion. The project is funded by Samruk-Kazyna JSC (parent group for AstanaGas KMG JSC) along with Eurasian Development Bank and Development Bank of Kazakhstan providing KZT 102 billion.

During the second stage, 276 km of gas pipeline is to be laid along the "Nur-Sultan - Kokshetau" route. This will require KZT 48.2 billion.

The third stage is to cover the construction of 177 km of the "Kokshetau - Petropavlovsk" gas pipeline route with a total cost of KZT 18.9 billion.

[41] http://adilet.zan.kz/rus/docs/P1400001171

[42]http://energo.akmo.gov.kz/page/read/KRATKAYA_SPRAVKA_po_proektu_stroitelstva_magistralnogo_gazoprovoda_SARYARKA_razrabotka_TEO_stroitelstva_MG_SARYARKA.html

The fourth stage will cover "Zhezkazgan" and "Temirtau" booster stations. The completion of all construction stages is scheduled for 2032 (information from the official website of AstanaGas KMG JSC).

4.2.9. Policies and measures in the housing and utilities sector

The existing policies and measures in the housing and utilities sector related to GHG emissions reduction are mainly indirect, that is, they take effect via increased energy saving and energy efficiency, and upgrades to housing and utilities facilities. While such policies and measures in the commercial sector are to be implemented mainly by energy service companies, the housing sector mechanism is envisaged for the residential sector. There is an ongoing public debate about a ban on coal combustion in the inner suburbs of cities. However, this issue is still under discussion. To some extent, this issue is being solved through the measures taken for gasification of settlements.

Energy service companies

The Law of the Republic of Kazakhstan «On Energy Saving and Increasing Energy Efficiency» introduces a concept of an energy service company (ESC), i.e. a legal entity that run energy saving and energy efficiency activities using its own and (or) attracted funds within the performance contracts, including with the involvement of contractors. ESC is an important tool to unlock the potential of energy efficiency through performance contracts that help successfully overcome market barriers.

Detailed information about energy service companies is available in NC7.

Housing stock upgrading

Indirect measures to reduce GHG emissions in the housing and utilities sector include the mechanism of housing stock upgrading described in Annex 5 to the National Program for Regional Development until 2020[43]. The program was approved on November 16, 2018, under No. 767.

This mechanism provides for the overhaul of the common property of condominium facilities. The overhaul with elements of thermal modernization is to ensure savings in heat consumption of up to 30 percent. Overhaul means repairing a building in order to extend its life cycle replacing, where appropriate, its structural components and engineering systems along with improving its operational performance.

4.2.10. Policies and measures in the industrial sector regarding fuel combustion

Emissions trading system is the key emission reduction policy for fuel combustion in the industrial sector. This policy is described in section 4.2.2 above.

4.2.11. Policies and measures in the fugitive emissions sector

According to IPCC, fugitive emissions are accidental or intentional release of greenhouse gases during extraction, processing and delivery of fossil fuels to the end-use site.

[43] http://adilet.zan.kz/rus/docs/P1800000767

Ban on gas flaring, development and implementation of gas processing development programs

After the prohibition of flaring, annual volumes of flared gas in Kazakhstan were reduced by more than 3.5 times, while gas production volumes continued to grow steadily. These indicators were achieved due to the systematic implementation of gas utilization programs, which existed under the former Law of the Republic of Kazakhstan "On oil" dated June 28, 1995.

For detailed information, please see NC7.

4.2.12. Policies and measures in the industrial processes sector

Kazakhstani Institute of Industry Development JSC, a subsidiary of the Ministry of Industry and Infrastructure Development, was reorganized into Kazakhstani Center for Industry and Export QazIndustry JSC following the Government's decree dated April 19, 2019. The company's objectives are to improve the processing industry competitiveness at the international level and to implement coordinated industry and innovation policy. Currently, the Kazakhstani Center for Industry and Export is developing the third five-year plan of the industrialization program, which will launch in 2020. The new five-year plan (2020-2024) will focus on intensive industrialization, increased production output and expanded range of processed goods. Progress in achievement of target indicators of the State program for industrial and innovative development of the Republic of Kazakhstan for 2015-2019 (SPIID) is monitored (increase in output volumes of the processing industry will grow by 43% against 2012; increase in labor productivity of the processing industry by 1.4 times; decrease in power intensity of the processing industry by 15%).

Institute of Electric Power and Energy Saving Development JSC (Kazakhenergoexpertiza), a subsidiary of the Ministry, has been assigned the Operator of the State Energy Register according to the Law of the RoK "On energy saving and energy efficiency" (2012) and the Energy Saving 2020 Program (March 2015). The Institute is also an implementer of Step 59 of the "Plan of the nation – 100 concrete steps" for industrial processes in implementing the energy saving potential, which deals with attracting strategic investors in energy efficiency area through an internationally recognized mechanism of energy service contracts. The legal framework has been created for energy service contracts.

4.2.13. Agriculture and LULUCF

According to the latest inventory report of the Republic of Kazakhstan[44], LULUCF greenhouse gas emissions have increased significantly. In particular, cultivated soils became the main LULUCF emitter due to humus depletion according to the updated calculations of the inventory report. These calculations became possible thanks to the updated methodology of calculation and data on the content of humus in cultivated soils from the Agrochemical Service under the Ministry of Agriculture of the Republic of Kazakhstan. According to the National report of the Republic of Kazakhstan on the inventory of anthropogenic emissions from sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol for 1990-2017, humus depletion amounts to about 1% per year,

[44] National report of the Republic of Kazakhstan on the inventory of anthropogenic emissions from sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol for 1990-2017 Zhasyl Damu JSC, 2019

and its most probable cause is the lack of mineral fertilizers in the soil[45]. Thus, policies to protect cultivated soils from humus depletion, such as subsidizing fertilizers for farmers, will be of great importance.

In the forestry sector, the key policies and measures affecting GHG emissions will be those aimed at limiting logging areas, fire control, afforestation and reforestation.

The Ministry of Energy of the Republic of Kazakhstan holds renewable (including bio power installations) capacity auctions in order to support renewable energy sources[46]. In 2018-2019, capacity tenders were conducted for 15 MW bio power installations. This policy is deemed promising in terms of reducing GHG emissions in agriculture. However, it is not yet clear which fuel these bio power installations will use - crop products or animal and bird manure. Therefore, it is currently impossible to assess the effects of biogas plants implementation.

The agriculture and LULUCF sector were provisionally divided into GHG sinks and GHG emitters for the purposes of analysis of applied policies and measures. Then, the key potential ways to increase GHG removals for sinks and the options to reduce emissions for emitters were considered. Based on the above, all policies and measures conducted in Kazakhstan in relation to those actions were defined. Square brackets refer to a document or piece of legislation related to a measure or policy.

Forests and pastures of Kazakhstan are the main sinks of greenhouse gases in agriculture and LULUCF. The main emitters are the cultivated soils of the Republic of Kazakhstan, as well as derivatives of fermentation products of large and small cattle, horses, birds and other animals [4]. For ease of analysis, we are considering sinks and emitters separately.

Sinks

The main sinks of greenhouse gases in LULUCF and agriculture are forests, pastures and hayfields. The annual contribution of forestry to GHG removal is about 18 million tons of CO2 equivalent, while pastures and hayfields contribute 15-20 million tons of CO2 equivalent. However, this indicator may lower significantly, if either the emissions from logging and forest fires reach prominent values, or the areas of pastures or hayfields shrink. For instance, annual emissions from logging may achieve 8 million tons of CO2 equivalent, while emissions from fires on 10 thousand hectares make about 0.7 million tons of CO2 equivalent[47-48].

Thus, policies and measures aimed at reducing forest fires and logging, as well as forest restoration and forest, pasture and hayfield expansions are the measures that reduce greenhouse gas emissions. Such measures include:

(a) Forest fire control:

- Approval of the Rules of fire control organization[49].
- Aerial protection of forest resources[50]

[45] Brock, Christopher, Uta Hoyer, Günter Leithold, and Kurt-Jürgen Hülsbergen. "The humus balance model (HU-MOD): a simple tool for the assessment of management change impact on soil organic matter levels in arable soils." *Nutrient cycling in agroecosystems* 92, no. 3 (2012): 239-254.

[46] On the approval of the Rules of organizing and holding auctions including bidder qualification requirements, contents and procedure applications, tender guarantees and their terms of payment and return, and closing and awarding procedure. Order of the Minister of Energy of the Republic of Kazakhstan No. 466 dated December 21, 2017. Registered by the Ministry of Justice of the Republic of Kazakhstan under No. 16240 on January 17, 2018.

[47] National report of the Republic of Kazakhstan on the inventory of anthropogenic emissions from sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol for 1990-2017 Zhasyl Damu JSC, 2019

[48] THE THIRD BIENNIAL REPORT OF THE REPUBLIC OF KAZAKHSTAN, *UNDP, 2017*

[49] On the approval of Rules of fire control organization. Order of the Minister of Internal Affairs of the Republic of Kazakhstan No. 446 dated June 26, 2017. Registered by the Ministry of Justice of the Republic of Kazakhstan under No. 15430 on August 3, 2017

These measures correspond to the law on fire safety rules in forests and the law on the rules of aircraft utilization for preservation and protection of forest resources.

b) Reduction of logging

- Prohibition of all types of cutting of saxaul plantations until December 31, 2023[51]
- Ban on all types of logging in the "Ertis Ormany" national forest reserve [52]
- Temporary ban on forest sanitation in coniferous forests of East Kazakhstan oblast[53]
- Establishment of new nature conservation territories[54][55]

These bans were introduced by acts of the Government of the Republic of Kazakhstan and the Chairman of the Committee for Forestry and Wildlife.

c) Forest expansion and restoration

- Funding forest regeneration and afforestation from the national budget.
- Natural reforestation[56]

The overall effect of these measures can be estimated as reduction of total greenhouse gas emissions across the agriculture and LULUCF sector (Table 4.5).

Emitters

The soils of cultivated lands of the Republic of Kazakhstan are the major LULUCF emitter. Emission is caused by humus depletion in the soils of the RoK[57]. Literature review has shown that insufficient amount of mineral fertilizers is the most probable cause of humus depletion[58]. Policies and measures to increase fertilizer inputs, such as fertilizer subsidies, can provide a significant contribution to the prevention of humus depletion and subsequent reduction of CO2 emissions.

Animal fermentation products produce about 18 Mt in carbon equivalent per year. Biogasification of fermentation products can be a measure to reduce this indicator according to the IPCC methodology. The Ministry of Energy has arranged capacity tenders for renewable energy sources. In

[50] On the approval of Rules of aircraft utilization for preservation and protection of forest resources. Order of the Minister of Agriculture of the Republic of Kazakhstan No. 18-02/64 dated January 30, 2015. Registered by the Ministry of Justice of the Republic of Kazakhstan under No. 10464 on March 17, 2015.

[51] On amendments to the order of the Chairman of Committee for forestry and Wildlife of the Ministry of Agriculture of the Republic of Kazakhstan No. 211 dated August 13, 2015, "On prohibition of logging in saxaul plantations at national forest fund sites"

[52] On amendments to the Order of the Chairman of Committee for forestry and Wildlife of the Ministry of Agriculture of the Republic of Kazakhstan No. 319 dated December 11, 2015 "On prohibition of all types of forest cutting at national forest fund sites" Order of the Chairman of the Committee for forestry and Wildlife of the Ministry of Agriculture of the Republic of Kazakhstan No. 17-5-6/97 dated April 9, 2019. Registered by the Ministry of Justice of the Republic of Kazakhstan under No. 18526 on April 16, 2019 (http://adilet.zan.kz/rus/docs/V1900018602)

[53] On amendments to the order of the acting Chairman of the Committee for forestry and Wildlife of the Ministry of agriculture of the Republic of Kazakhstan No. 287 dated December 22, 2016, "On prohibition of forest sanitation in coniferous plantations at national forest fund sites." Order of the acting Chairman of the Committee for forestry and Wildlife of the Ministry of Agriculture of the Republic of Kazakhstan No. 17-5-6/119 dated April 28, 2018. Registered by the Ministry of Justice of the Republic of Kazakhstan under No. 16908 on May 18, 2018

[54] On establishment of the Republican State Enterprise, "State national nature park "Tarbagatay" of the Committee for Forestry and Wildlife of the Ministry of Agriculture of the Republic of Kazakhstan" Resolution No. 382 of the Government of the Republic of Kazakhstan dated June 27, 2018.

[55] On amendments and supplements to the order of the acting Minister of Agriculture of the Republic of Kazakhstan No. 17-02/532 of October 19, 2012 "On approval of Rules of conducting inventory of forest crops, nurseries, areas covered by measures promoting natural forest restoration and reserved for natural regrowth in the state forest fund" order of the Deputy Prime Minister of the Republic of Kazakhstan - Minister of Agriculture of the Republic of Kazakhstan No. 46 dated January 26, 2018. Registered by the Ministry of Justice of the Republic of Kazakhstan under No. 16391 on February 20, 2018

[56] On the approval of the Action plan for implementation of the State program for development of agro-industrial complex of the Republic of Kazakhstan for 2017-2021 and amendments to the resolution of the Government of the Republic of Kazakhstan No. 1136 of December 30, 2015, "On the approval of the list of government programs and revocation of some resolutions of the Government of the Republic of Kazakhstan." Resolution of the Government of the Republic of Kazakhstan No. 113 dated March 13, 2017

[57] National report of the Republic of Kazakhstan on inventory. Zhasyl Damu JSC, 2019

[58] Brock, Christopher, Uta Hoyer, Günter Leithold, and Kurt-Jürgen Hülsbergen. "The humus balance model (HU-MOD): a simple tool for the assessment of management change impact on soil organic matter levels in arable soils." Nutrient cycling in agroecosystems 92, no. 3 (2012): 239-254.

2018-2019, contracts were signed for installations of 15 MW plants within 3 years. However, it is not yet clear which fuel these installations will use - fermentation products or crop products. This measure can significantly reduce emissions from the sector. Another measure may be to improve the quality of animal breeds in agriculture, as well as to improve the quality of food, which may lead to a decrease in the fermentation level. The above can include the following measures:

a) Support of renewable energy sources in agriculture (biogas production):

- Production of renewable energy sources using biogas plants

b) Improvement of breeds of large and small cattle and horses in agriculture

- Subsidizing livestock breeding under the state program for development of the agro-industrial complex of the Republic of Kazakhstan for 2017-2021[59][60]

Production of crops, such as wheat, rice, potatoes, cotton and others, is another prominent source of emissions. The key measures to reduce emissions from agricultural crops production include biogas generation and reduction the irrigation activities scope. Such measures in Kazakhstan include:

c) Reduction of energy intensity

- Technology transfer
- Transition to drop irrigation
- Prevention of soil degradation (prevention of humus depletion)[61]
- Reconstruction, restoration and overhaul of the collector network on irrigated lands and reconstruction of emergency water management systems[62].

d) Prevention of soil degradation and desertification

- Subsidizing mineral fertilizers[63].
- Afforestation of the Aral Sea bed with saxaul plantations.

Table 4.5 provides a summary of the policies and measures (implemented, adopted and planned) in the agriculture and LULUCF sector in the Republic of Kazakhstan, as well as an assessment of the effect of greenhouse gas emissions reduction in this sector.

[59] On the approval of the Rules of subsidizing for partial reimbursement of the expenses incurred by the agro-industrial complex actor in their investment activities. Order No. 317 of the acting Minister of Agriculture of the Republic of Kazakhstan dated July 23, 2018. Registered by the Ministry of Justice of the Republic of Kazakhstan under No. 17320 on August 29, 2018

[60] On approval of the State program of industrial-innovative development of the Republic of Kazakhstan for 2015-2019 and supplementing the Decree of the President of the Republic of Kazakhstan No. 957 dated March 19, 2010 "On approval of the List of government programs." *Decree of the President of the Republic of Kazakhstan No. 874 dated August 1, 2014*

[61] On the measures for further improvement of the system of public administration of the Republic of Kazakhstan. Decree of the President of the Republic of Kazakhstan No. 17 dated June 17, 2019.

[62] On support for the use of renewable energy sources *Law of the Republic of Kazakhstan No. 165-IV of July 4, 2009.*

[63] On approval of fixed tariffs. *Resolution of the Government of the Republic of Kazakhstan No. 645 of June 12, 2014*

Table 4.5. Summary table of policies and measures

No.	Actions on mitigation of climate change[e]	Sector(s) covered [b]	GHG(s) covered	Target and/or activity covered	Tool type [c]	Status of implementation [d]	Brief description [e]	First year of implementation	Implementing actor or actors	Estimate climate change mitigation (non-cumulative, (kt) CO2eq)		
										2017 [f]	2020	2030
1	**Forest fire control**		CO2			adopted			Ministry of Agriculture	250	250	300
2	**Logging volumes reduction**		CO2			adopted			Ministry of Agriculture	100	100	100
3	**Forest expansion and restoration**		CO2			adopted			Ministry of Agriculture	250	250	300
4	**Technology transfer (biogas production)**		CH4			adopted				9	200	1000
5	**Improvement of breeds of large and small cattle and horses in agriculture**		CH4 N2O			adopted			Ministry of Agriculture	0	10	30
6	**Reduction of energy intensity**		CO2			adopted	KZT100 bln for 2017-2021	2017	Ministry of Agriculture	-	-	-
7	**Fertilizer subsidies**		CO2			adopted				3,000	4,000	8,000
8	**Countering soil degradation and desertification**		CO2			adopted	KZT 20 billion for fertilizers annually		Ministry of Agriculture	150	150	150

4.2.14. Waste management sector

The waste management sector is an emitter of greenhouse gases in Kazakhstan. Measures that reduce GHG emissions in the waste management sector include waste recycling, i.e. re-use. According to the Concept for the transition of the Republic of Kazakhstan to green economy[64], Kazakhstan sets an ambitious goal of increasing the volume of waste recycling to 40% by 2030.

The ban on paper, plastic and glass disposal at Kazakhstan's landfills entered into force on January 1, 2019, according to the amendments to article 301 of the Environmental Code[65] of the Republic of Kazakhstan. Disposal of metal, tires and their fragments has also been banned. The ban on food and construction materials waste disposal will enter into force from January 1, 2021. Local executive bodies shall be responsible for the implementation of these amendments in the management of municipal solid waste (MSW) under the environmental code[66], articles 20 and 301. Their tasks will include the development of the waste management program, allocation of land plots for MSW and construction of MSW disposal facilities. The President of Kazakhstan noted in his Address the development of the system for monitoring and evaluating the progress (dynamics) on modern methods and technologies of solid waste disposal implementation in 2018[67].

According to the information from environmental supervision authorities[68], the ban on the disposal of various types of garbage translated into the following recycling volumes: collected and recycled tires: 2017 – 2,027 tons, 2018 – 30,300 tons; waste oils: 2017 – 4,198 tons, 2018 – 30 thousand tons; batteries: 2017 – 20,347 tons, 2018 – 20 thousand tons; antifreeze compounds: 2017 – 2,300 tons, 2018 – 3,400; glass waste: 2017 – 5,634, 2018 – 21,982; plastic waste: 2017 – 6,066, 2018 – 11,856 tons; waste paper and cardboard: 2017 – 45,025, 2018 – 62,034. The volume of collected recyclable glass containers amounted to 14,484 million pieces in 2017 and 20,284 thousand pieces in 2018.

The measures allowed for increasing the share of solid waste processing to 11.51% in 2018, while the same indicator in 2017 was 9%.

Local government (Akimat) of Nur-Sultan cooperates with Operator ROP LLP in implementing a pilot project for separate collection of solid waste, processing and disposal of organic (food) waste. Operator ROP LLP also coordinates the activities on car recycling in Kazakhstan.

Several regions plan to commission waste sorting lines at landfills in Kostanay (Tazalyk 2012 LLP), Zhitikara (Sotsservis LLP), Kyzylorda (60 thousand tons/year), Atyrau oblast (50 thousand tons/year), and the sorting line capacity in Karaganda is to increase to 200 thousand tons/year.

In Almaty region, two waste processing plants are to be built: WasteEnergyKazakhstan LLP with a capacity of 120 thousand tons per year and ZOR BIO LLP with a capacity of 100 thousand tons per year using the technology of biogas production from MSW for further power trading and commissioning

[64] Decree of the President of the Republic of Kazakhstan: On the Concept of transition of the Republic of Kazakhstan to green economy (as amended on September 10, 2019)

[65] The Environmental code of the Republic of Kazakhstan, Code of the Republic of Kazakhstan No. 212 dated January 9, 2007

[66] On amendments and supplements to some legal acts of the Republic of Kazakhstan concerning improvements in business regulation

[67] On the measures to implement the President's Address to the Nation dated January 10, 2018, "New Opportunities for Development under the Fourth Industrial Revolution", Decree of the President of the Republic of Kazakhstan No. 633 dated February 9, 2018

[68] Information on waste reduction, recycling and recycling. [Electronic resource]. Date of update: 1.11.2019. URL: https://egov.kz/cms/ru/articles/ecology/waste_reduction_recycling_and_reuse.

biocarbon and fertilizers manufacture. WasteEnergyKazakhstan LLP projected capacity is 8 MW (4 MW at Stage 1), while the same indicator for ZOR BIO LLP is 4 MW. These enterprises were awarded orders for bio power plant installation with a total capacity of 10 MW based on the renewable capacity auction by the Ministry of Energy [Bioenergy projects auction results][69]. A solid waste processing plant with a capacity of 100.0 thousand tons per years is to be constructed in Zhambyl oblast in 2018-2020. Akimats of Ust-Kamenogorsk and Semey consider the construction of complexes for mechanical and biological treatment of solid waste.

However, a number of regions of Kazakhstan are experiencing difficulties in enforcing the Environmental Code in terms of solid waste disposal, particularly in rural areas. Thus, several regions experienced a garbage collapse when companies refused to collect garbage due to the lack of recycling facilities. At present, the provisions of the Environmental Code are violated in a number of regions.

The impeding factors for waste recycling include underdeveloped infrastructure, poor culture of garbage separation among the population of Kazakhstan, lack of economic interest in garbage processing due to high investment needs and risks including, among others, dependence on local executive bodies.

Table 4.6. Climate change mitigation

No.	*Actions on mitigation of climate change*[e]	*Sector (s) covered* [b]	*GHG (s) covered*	*Target and/ or activity covered*	*Tool type* [c]	*Status of implementation* [d]	*Brief description* [e]	*First year of implementation*	*Implementing actor or actors*	*Estimate climate change mitigation (non-cumulative, kt CO2eq)*		
										2017 [f]	*2020*	*2030*
1	**Amendments to the Environmental Code (ban on paper, plastic and glass disposal)**		*CO2*			*Adopted*		*2019*	Minister of Ecology, Geology and Natural Resources of the RoK	*100*	*100*	*200*
2	**Amendments to the Environmental Code (ban on food and construction waste**		*CO2*			*Adopted*		*2021*	Minister of Ecology, Geology and Natura		*0*	*200*

[69] Electronic resource. Date of update: 1.11.2019.URL: https:/ / energy.media/2019/09/18/11962/.

	disposal)								l Resources of the RoK			

Social implications of policies and measures in the 'Waste management' sector

The social implications of the policies and measures adopted for waste recycling can have favorable effect on the environment and public health due to the reduction of volumes of disposed solid waste. Moreover, these measures can also have a positive economic effect as new waste processing plants will create new jobs and boost production of goods based on recycled waste.

4.2.15. Measures contributing to actions related to higher level of anthropogenic GHG emissions

The major industrial processes of Kazakhstan are concentrated in the mining and metallurgy, where SPIID (2020-2024) will focus on advanced industrialization, increased production output and range of processed goods. New competitive industries will ensure extended range and increased share of advanced processing products with high added value involving SMEs. Existing enterprises of the sector are to be retrofitted in order to reduce resource and energy intensity and increase labor productivity. Efforts will be made to develop innovations in technologies of extraction and complex processing of commodities, develop new products and actively involve the scientific and technical capabilities of the industry in innovative processes, as well as to provide the industry with qualified human resources. The current "Nurly Zhol 2015-2019" program (Decree of the President of the Republic of Kazakhstan No. 1030 dated April 6, 2015) will be developed to provide the necessary infrastructure for sectoral projects, expand and ensure the replacement of the mineral resource base. However, the dynamics of GDP growth due to the expected upgrade and optimization of infrastructure may lead to a decrease in specific GHG emissions per unit of cargo transported as a result of shorter transportation time within the country and improvement of roads, improvement of the electric power grid, increase in the network of gas stations, improvement of the housing and utilities infrastructure and heating, water supply and sanitation systems.

Vibrant development of mining and metallurgy contributes to the development of industry with a higher level of anthropogenic GHG emissions. On the other hand, the comprehensive plan for the mining industry development for 2014-2018 (May 28, 2014) and the plan for the development of rare and rare earth metals mining in the Republic of Kazakhstan for 2015-2019 (November 26, 2014) provide for the application of the best technology for advanced and clean processing reducing the harmful impact of the industry on the environment.

V. PROJECTIONS AND OVERALL EFFECT OF POLICIES AND MEASURES

5.1. Combustion and fugitive emissions sector

5.1.1. GHG emission scenarios

The model of Kazakhstan's energy system on the basis of TIMES tool (The Integrated MARKAL-EFOM System), which uses the approach of detailed technical and economical process description of power industry (bottom-up), was used in the scenario without measures, with measures and the scenario with additional measures for forecasting GHG emissions and assessing the overall effect of the fuel combustion and fugitive emissions sector. TIMES is a tool for technical and economic model engineering of energy systems, which allows for scenario analysis of the development dynamics of the energy system for mid and long-term periods.

Three scenarios of greenhouse gas emissions were developed to assess the impact of all policies and measures. All scenarios assume GDP growth of an average of 3.7% by 2020 and 4.2% after 2020.

This paper looked at the following scenarios of the development of Kazakhstan's energy system:

1) scenario without measures (WOM);

2) scenario with current measures (WCM);

3) scenario with current and additional measures (WCAM).

5.1.2. Common assumptions for all scenarios

Common assumptions used for all scenarios are as follows:

- emissions trading system is neglected (National Allocation Plans for 2013, 2014-2015, 2016-2020):
- oil production reaches its peak (115 million tons per year) in 2035;

Gasification of the country is progressing in line with the forecast gas balance of Kazakhstan from April 21, 2014 till 2030 (2015 – 22.22 bcm, 2020 – 24.59 bcm, 2025 – 22.24 bcm, 21.00 – bcm)

5.1.3. Scenario without measures (WOM)

This scenario reflects the possible variation of greenhouse gas emissions in a situation where no measures are taken to reduce them. Further economic growth is enabled by cheap coal as fuel for energy production. This scenario assumes that greenhouse gas emissions depend on the overall rate of GDP and population growth. This scenario is based on the following assumptions:

- all processes leading to improved energy efficiency in the process of optimization based on the achievement of reduced cost are neglected;
- no new existing or planned power plants that lead to a reduction in GHG emissions, i.e. gas, on renewable and alternative energy sources are put into operation;
- gasification of heat and electricity producing facilities is limited (no more than 20% for a power plant and no more than 25% for natural gas-fired boiler plants).

5.1.4. Scenario with current measures (WCM)

This scenario includes adopted and planned measures and policies aimed directly at reducing greenhouse gas emissions or have indirect impact on reduction of GHGs:

- all new or existing processes and processes leading to energy efficiency improvement are taken into account;
- gasification of heat and power plants (CHP and TPP) is set at 20% and 25% in 2020 and 2030 respectively. For boiler plants, gasification shall be at least 25% of natural gas-fired thermal power generation;
- 1,700 MW total capacity of renewable energy sources by 2020 (WPP – 933 MW, SPS – 467 MW, HPP – 290 MW, Biogas plants – 10 MW);
- by 2025, 2,615 MW total capacity forecast in the National Energy Report 2019 (WPP – 1,200 MW, SPS – 1,100 MW, HPP - 300 MW, biogas plants - 15 MW);
- by 2030, RES amounting to a value higher by the difference between RES in 2025 and 2020;

5.1.5. Scenario with current and additional measures (WCAM)

This scenario includes possible measures and policies that are directly aimed at reducing GHG emissions:

- 1,700 MW total capacity of renewable energy sources by 2020 (WPP – 933 MW, SPS – 467 MW, HPP – 290 MW, Biogas plants – 10 MW);
- by 2025 RES capacity will double compared to the scenario with current measures;
- by 2030, RES capacity will double compared to the scenario with current measures.

Table. 5.1. Scenario assumptions

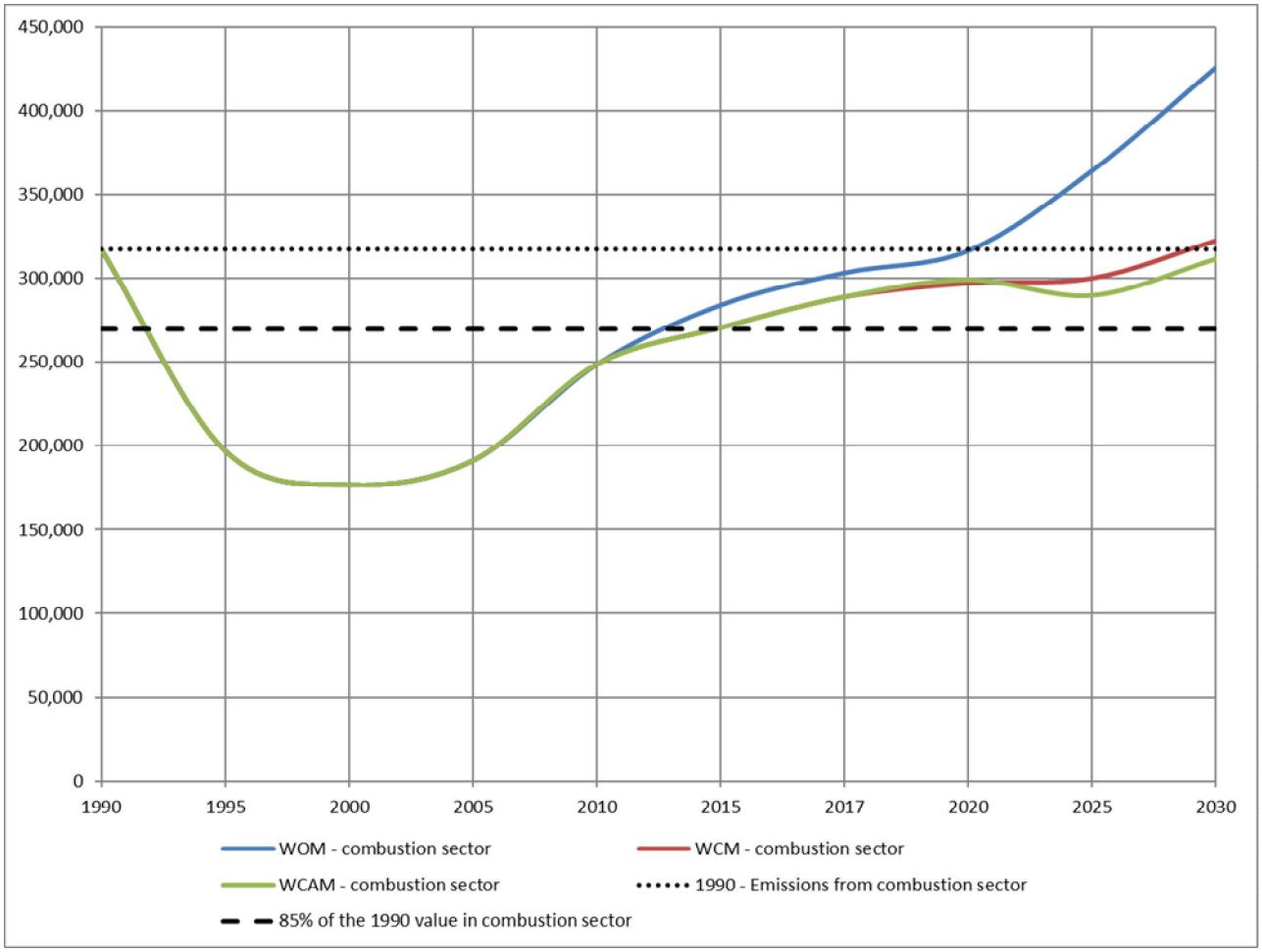
Assumptions	**Scenario without measures (WOM)**	**Scenario with current measures (WCM)**	**Scenario with current and additional measures (WCAM)**
Common assumptions for all scenarios			
Emission trading system is neglected			
NAP2013	X	X	X
NAP2014-2015	X	X	X
NAP2016-2020	X	X	X
Crude oil production			
Peaks by 2035 - 115 million tons	V	V	V
Gasification of the country is progressing in line with the forecast gas balance of Kazakhstan from April 21, 2014 till 2030			
2015 – 22.22 bcm	V	V	V
2020 – 24.59 bcm	V	V	V
2025 – 22.24 bcm	V	V	V
2030 – 21.00 bcm	V	V	V

Assumptions	Scenario without measures (WOM)	Scenario with current measures (WCM)	Scenario with current and additional measures (WCAM)
Assumptions for scenarios			
All processes leading to improved energy efficiency are optimized to achieve reduced cost	X	V	V
All new existing or planned power plants leading to the GHG reduction (renewables and alternative energy sources)	X	V	V
Gasification of power generation facilities - around 20% by 2025 and 25% by 2030	X	V	V
Gasification of heat generation facilities - 25% or more	X	V	V
Target indicators of renewables sector development by 2020: Electric power generation - 3% of the total Total capacity of RES – 1,700 MW WPP capacity - 933 MW SPP capacity - 467 MW Hydroelectric PP - 290 MW	X	V	V
Target indicators of renewables sector development by 2025: Total RES capacity – 2,615 MW WPP capacity – 1,200 MW SPP capacity – 1,100 MW Hydroelectric PP - 300 MW	X	V	V
By 2030, RES capacity amounting to a value higher by the difference between RES in 2025 and 2020;	X	V	V
• by 2025 RES capacity will double compared to the scenario with current measures; • by 2030 RES capacity will double compared to the scenario with current measures;	X	X	V

5.2. Projections of GHG emissions in fuel combustion sector

Scenarios without measures, with measures and with current and additional measures are based on technical and economic modeling in the processes associated with fuel combustion and fugitive emissions All three scenarios are shown in figure 5.1. The blue line in the graph represents GHG emissions level in 1990, and the red line represents 85% of the 1990 emission level and illustrates Intended Nationally Determined Contributions (INDC) by 2030. The black line shows the level of the energy sector in 1990.

Figure 5.1. Scenarios of GHG emissions from energy sector



	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
WOM - combustion sector	317.1	197.3	177.0	191.4	248.7	284.0	303.3	316.5	364.2	425.6
WCM - combustion sector	317.1	197.3	177.0	191.4	248.7	270.5	288.8	297.0	299.9	322.3
WCAM - combustion sector	317.1	197.3	177.0	191.4	248.7	270.5	288.8	299.0	289.7	313.5
1990 - Emissions from combustion sector	317.1	317.1	317.1	317.1	317.1	317.1	317.1	317.1	317.1	317.1
85% of the 1990 value in combustion sector	269.5	269.5	269.5	269.5	269.5	269.5	269.5	269.5	269.5	269.5

As can be seen from figure 5.1, emissions in the energy sector in the scenario without measures grow throughout the forecasting period and reach the level of 1990 (power production) around 2018. The main source of emissions in the combustion and fugitive emissions sector is the «Energy industries» sector.

Impact of adopted or planned policies and measures to reduce GHG emissions varies from year to year. Thus, until 2020, the major reduction of GHG emissions is associated with gasification of enterprises in the electricity and heat generation sector. In 2025 and 2030, the greatest effect is associated with increasing energy efficiency of existing technologies, introducing new technologies, gasification of electricity and heat generation sector, and meeting the targets indicators of renewable energy sector development. In the scenario with measures and additional measures, despite increased capacity and renewable energy generation, emissions remain below 1990 levels until 2030, however, higher than minus 15% of the NDC level.

Table 5.2. Historical data and forecast of emissions broken down by GHG types

MT CO2eq	Historical data, Inventory					Scenario without measures				
Gas types	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
CO_2	245.6	153.7	120.9	167.3	217.6	253.0	271.6	285.5	330.7	388.9
CH4	70.4	42.9	55.6	23.3	30.2	29.9	30.5	30.0	32.4	35.5
N20	1.1	0.7	0.5	0.8	1.0	1.1	1.1	0.9	1.1	1.3
HFC	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
PCF	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Total	317.1	197.3	177.0	191.4	248.7	284.0	303.3	316.5	364.2	425.6
MT CO2eq	**Historical data, Inventory**							**Scenario with measures**		
Gas types	1990	1995	2000	2005	2010	2015	2020		2025	2030
CO_2	245.6	245.6	153.7	120.9	167.3	217.6	241.0	258.7	268.8	272.9
CH4	70.4	70.4	42.9	55.6	23.3	30.2	28.5	29.0	27.3	26.1
N20	1.1	1.1	0.7	0.5	0.8	1.0	1.0	1.1	0.9	0.9
HFC	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
PCF	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Total	317.1	317.1	197.3	177.0	191.4	248.7	270.5	288.8	297.0	299.9
MT CO2eq	**Historical data, Inventory**							**Scenario with additional measures**		
Gas types	1990	1995	2000	2005	2010	2015	2017	2020	2025	2030
CO_2	245.6	245.6	153.7	120.9	167.3	217.6	241.0	258.7	271.1	264.9
CH4	70.4	70.4	42.9	55.6	23.3	30.2	28.5	29.0	27.0	23.9
N20	1.1	1.1	0.7	0.5	0.8	1.0	1.0	1.1	0.9	0.8
HFC	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA	NO, NA
PCF	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Total	317.1	317.1	197.3	177.0	191.4	248.7	270.5	288.8	299.0	289.7

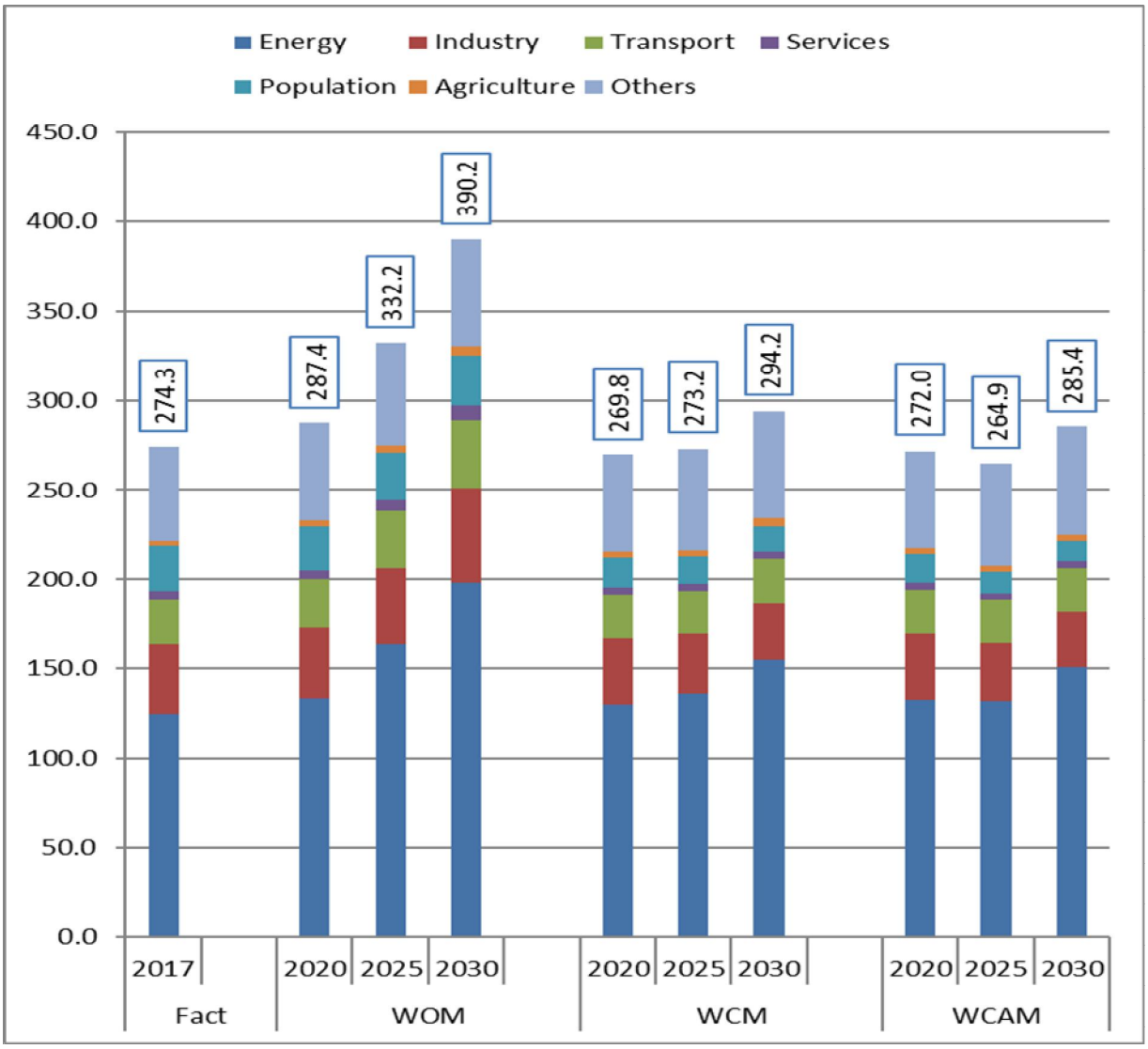
The next table presents aggregated impact of current and additional measures.

Table 5.3. Aggregated impact of current and additional measures in the fuel combustion and fugitive emissions sector

	Emission values, million tons CO2 equivalent		
	2020	2025	2030
Scenario without measures	316.5	364.2	425.6
Scenario with measures	297.0	299.9	322.3
Impact of taken measures	19.5	64.3	103.4
Scenario with additional measures	299.0	289.7	313.5
Impact of additional measures	-2.0	10.2	8.7

Figure 5.2 shows GHG emissions by sector.

Figure 5.2. Shares of CO2 emissions from fuel combustion by sector, Mt CO2eq

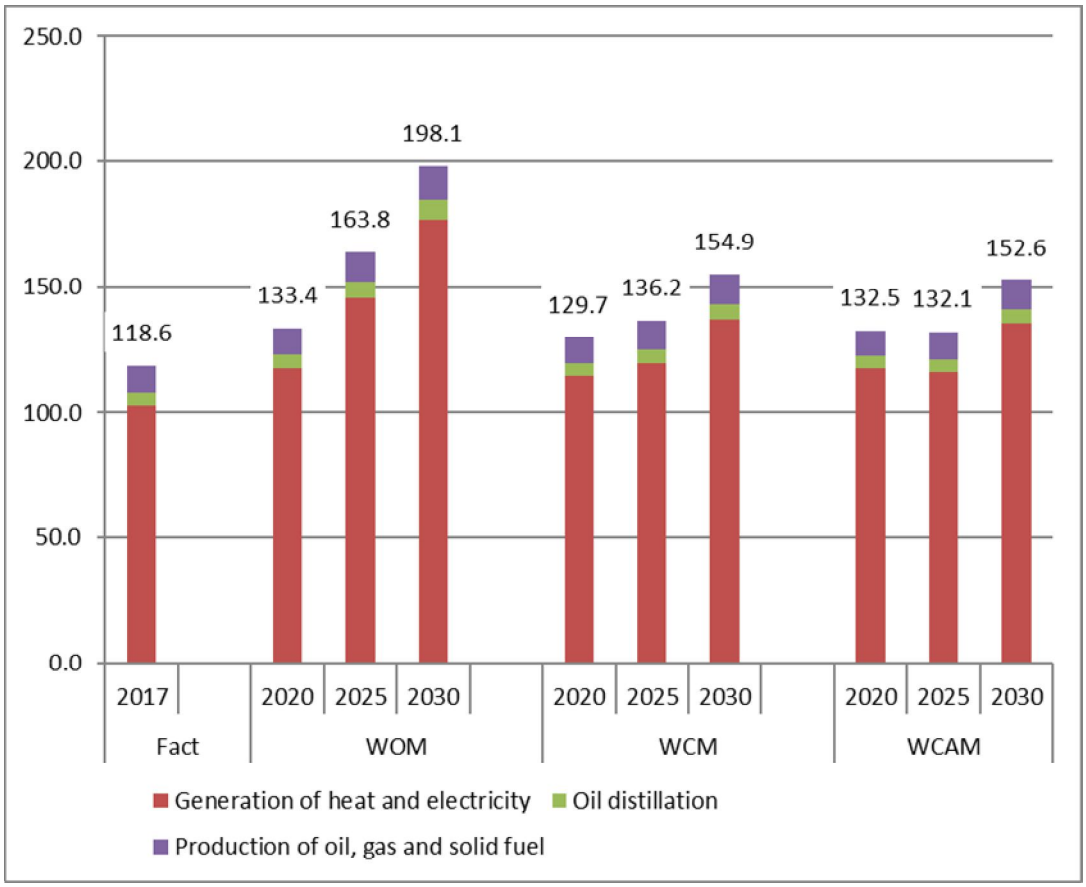


	Actual	WOM			WCM			WCAM		
	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Energy	124.5	133.4	163.8	198.1	129.7	136.2	154.9	132.5	132.1	152.6
Manufacturing	39.2	39.6	42.9	53.0	37.1	33.3	31.9	37.1	32.7	31.1
Transport	24.9	26.9	31.5	37.8	24.6	24.0	24.7	24.7	24.0	24.5
Services	4.5	5.0	6.4	8.2	3.9	3.6	4.4	3.6	3.4	4.0
Population	25.7	25.2	26.5	27.9	17.0	15.4	14.2	16.7	12.1	10.7
Agriculture	2.6	3.0	4.0	5.2	3.1	3.4	4.3	3.1	3.4	4.3
Other sources	52.8	54.4	57.1	59.9	54.4	57.1	59.9	54.4	57.1	59.9
	274.3	287.4	332.2	390.2	269.8	273.2	294.2	272.0	264.9	287.2

5.2.1. 'Energy industries' sector

The energy industries include enterprises associated with generation of heat, power, oil refining, and production of solid and other fuels. Contribution to reducing emissions from the heat and power generation sector is the most significant in all scenarios.

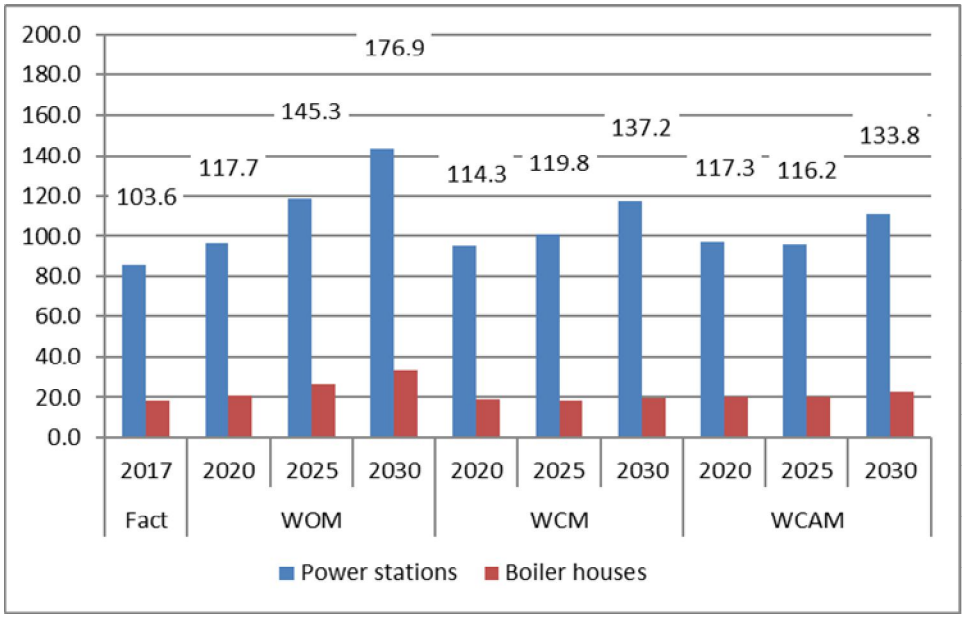
Figure 5.3. Emissions from the energy industries sector



	Actual	WOM			WCM			WCAM		
	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Generation of heat and electricity	102.8	117.7	145.2	176.8	114.5	119.8	137.1	117.4	116.2	135.4
Oil distillation	5.0	5.3	6.5	7.8	5.0	5.2	5.6	4.9	5.0	5.3
Production of oil, gas and solid fuel	10.8	10.4	12.1	13.6	10.2	11.2	12.2	10.1	10.9	11.9

GHG emissions from energy industries are crucial in terms of the impact on overall emissions reduction. Obviously, the current measures and the expected growth of the economy lead to emissions increase as a response to the economic growth. With additional measures, emissions slightly fall since additional capacities translate into additional electric power replacing coal-generated capacities along the way. GHG emissions decrease across the three subsectors of the energy industries sector in the scenario with measures and show an additional small decrease in the scenario with additional measures.

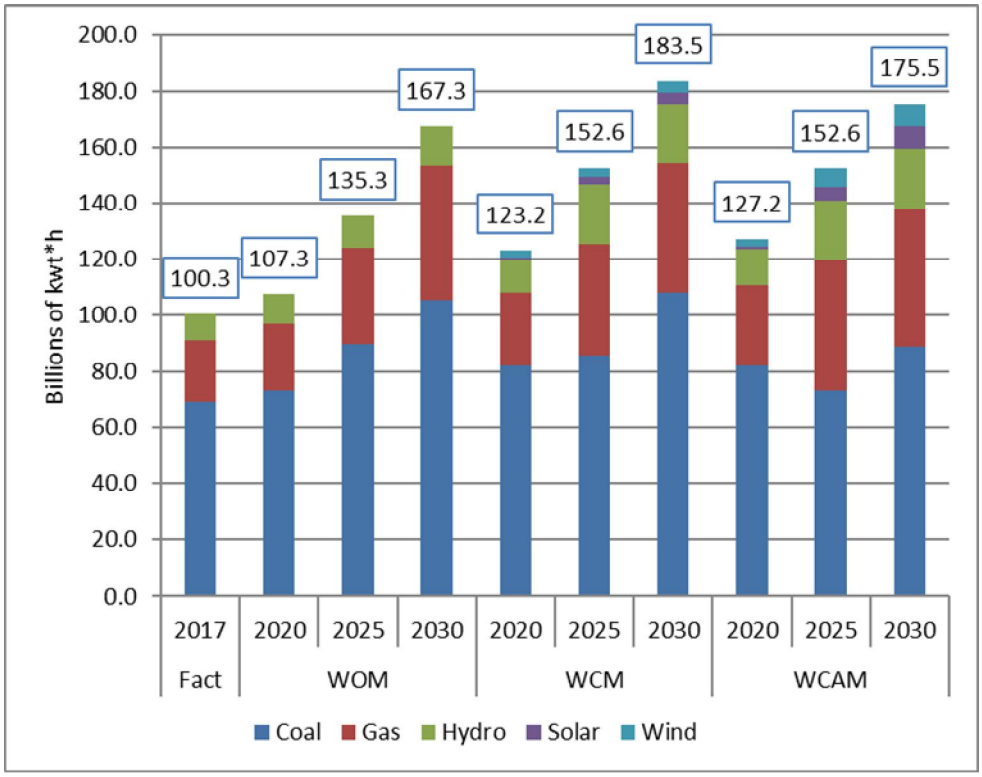
Figure 5.4. Emissions from power plants and boilers, MT CO2eq



	Fact	WOM			WCM			WCAM		
	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Power plants	85.3	96.6	118.6	143.8	95.0	101.1	117.4	97.0	95.8	110.8
Boilers	18.3	21.1	26.7	33.1	19.3	18.7	19.8	20.3	20.4	24.6
	103.6	117.7	145.3	176.9	114.3	119.8	137.2	117.3	116.2	135.5

The figure shows that emissions from boilers and power plants in the scenario with current and additional measures tend to increase in dynamics, while emissions across the scenarios decrease. This is due to the commissioning of new power plants that generate only electricity, stabilization of heat generation from CHP and increasing demand for heat that is covered by increasing boiler capacities.

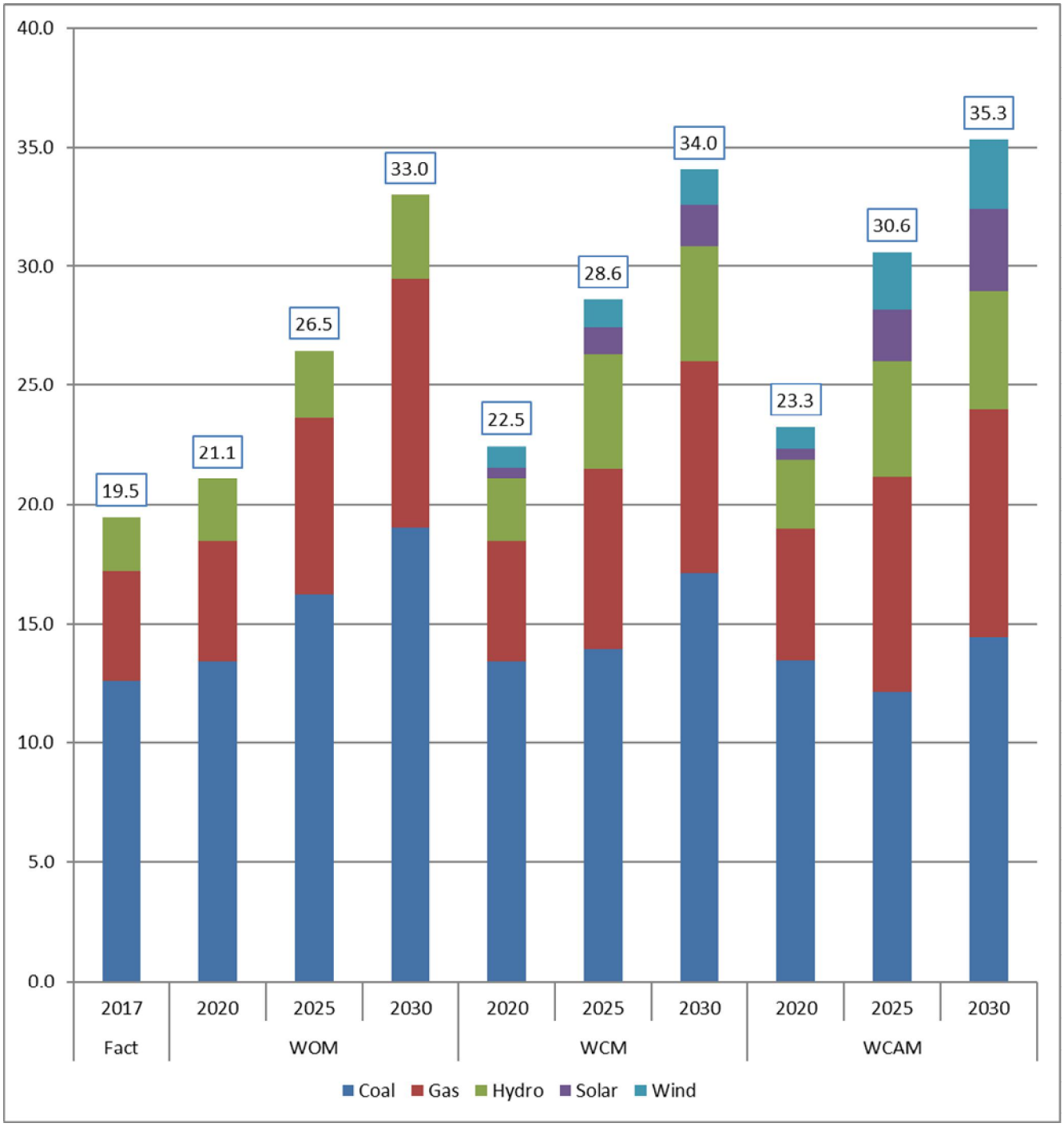
Figure 5.5. Generation of electricity by type of power plants, billion kWh



Billion kWh	Actual	WOM			WCM			WCAM		
	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Coal	69.4	73.3	89.7	105.2	82.1	85.9	107.9	82.4	73.3	89.0
Gas	21.7	23.5	34.1	47.8	25.9	39.3	46.1	28.4	46.0	48.5
Hydro	9.1	10.5	11.5	14.3	11.6	21.5	21.5	12.7	21.5	21.9
Solar	0.0	0.0	0.0	0.0	1.1	2.5	3.9	1.1	5.0	7.8
Wind	0.0	0.0	0.0	0.0	2.6	3.4	4.1	2.6	6.8	8.3
	100.3	107.3	135.3	167.3	123.2	152.6	183.5	127.2	152.6	175.5

In scenarios with measures and additional measures, electricity generation is higher than in the scenario without measures. Capacities from hydropower, solar and wind power cover additional amounts of required electricity. These additional volumes of electricity are used for new technologies that consume more electricity than the traditional ones.

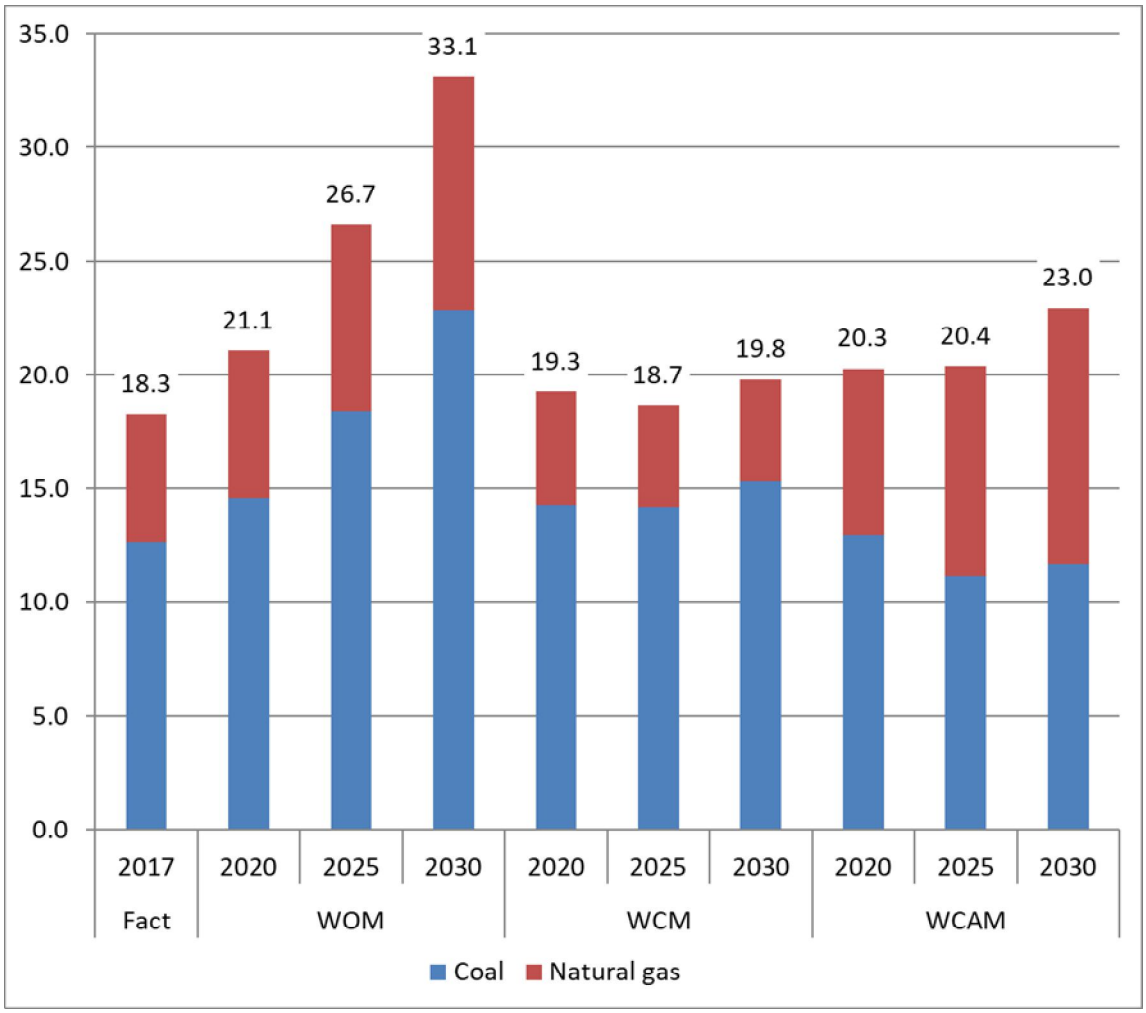
Figure 5.6. Installed capacity of power plants, GW



GW	Fact	WOM			WCM			WCAM		
	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Coal	12.6	13.4	16.3	19.1	13.4	13.9	17.1	13.5	12.1	14.4
Gas	4.6	5.0	7.4	10.4	5.0	7.5	8.9	5.5	9.0	9.5
Hydro	2.3	2.6	2.8	3.5	2.6	4.8	4.8	2.9	4.8	4.9
Solar	0.0	0.0	0.0	0.0	0.5	1.1	1.7	0.5	2.2	3.5
Wind	0.0	0.0	0.0	0.0	0.9	1.2	1.5	0.9	2.4	2.9
	19.5	21.1	26.5	33.0	22.5	28.6	34.0	23.3	30.6	35.3

Heat, as a type of energy, is crucial for Kazakhstan. Thermal energy is generated by CHPs and boiler plants; however, only the sector of heat generation by boilers will be considered here.

Figure 5.7. GHG emissions from boilers by fuel type, Mt CO2eq



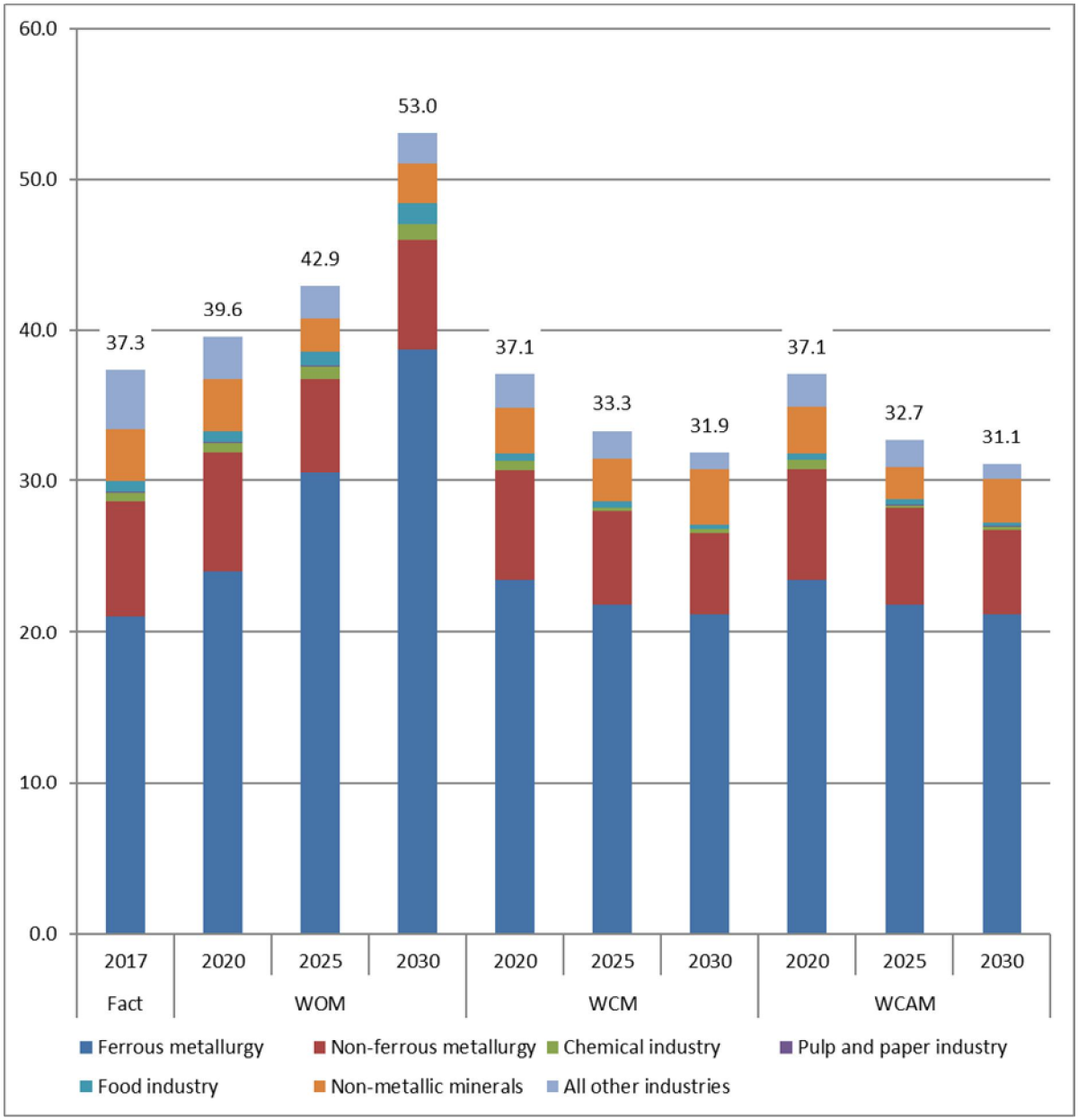
	Fact	WOM			WCM			WCAM		
	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Coal	12.6	14.6	18.4	22.8	14.3	14.2	15.3	12.9	11.1	15.0
Natural gas	5.7	6.5	8.3	10.3	5.0	4.5	4.5	7.4	9.3	9.7

GHG emissions are increasing in all scenarios. In the scenarios with measures and with additional measures, thermal energy is primarily generated using natural gas. Installed capacities of power plants are not sufficient to increase heating by 2030, therefore, the scenario with additional measures shows increased consumption of coal by 2030. This is due to the fact that the increased penetration of installed RES in the scenario with additional measures reduces the power levels of other types of power plants including CHP. This reduction in thermal energy from the CHP is covered by the capacities of coal-fired boilers.

5.2.2. Manufacturing

Manufacturing consumes the largest share of final energy in Kazakhstan considering the demand for large amounts of electricity and heat for manufacturing activities. The share of GHG emissions from manufacturing is about 12.9% in the sector of fuel combustion, or 37.4 Mt of CO2eq. GHG emissions are reduced in manufacturing due to reduction in production volumes, due to changes in technologies and the structure of fuel consumption, where possible. The graph below illustrates the GHG emissions from the main manufacturing activities in the country

Figure 5.8. Emissions from manufacturing activities, associated with fuel combustion, by scenarios



	Fact	WOM			WCM			WCAM		
	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Ferrous metallurgy	21.1	24.0	30.5	38.8	23.4	21.8	21.2	23.4	21.8	21.2
Non-ferrous metallurgy	7.6	7.9	6.2	7.2	7.3	6.2	5.4	7.3	6.4	5.5
Chemical industry	0.5	0.6	0.8	1.1	0.6	0.2	0.3	0.6	0.2	0.3

Pulp and paper industry	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food industry	0.7	0.8	1.0	1.4	0.4	0.4	0.3	0.4	0.4	0.2
Non-metallic minerals	3.4	3.4	2.1	2.6	3.0	2.8	3.7	3.1	2.1	2.9
All other industries	3.9	2.8	2.2	2.0	2.2	1.8	1.1	2.2	1.8	1.0

The major share of GHG emissions from manufacturing in 2017 comes from ferrous and non-ferrous metals, and non-metallic minerals. Chemical and other manufacturing sectors contributed a small share in 2017. However, the structure of GHG emissions across key industries changes over time. The process of iron and steel production mainly represents ferrous metallurgy, and most of the emissions come from smelting processes using blast furnaces and the production of sinter ore.

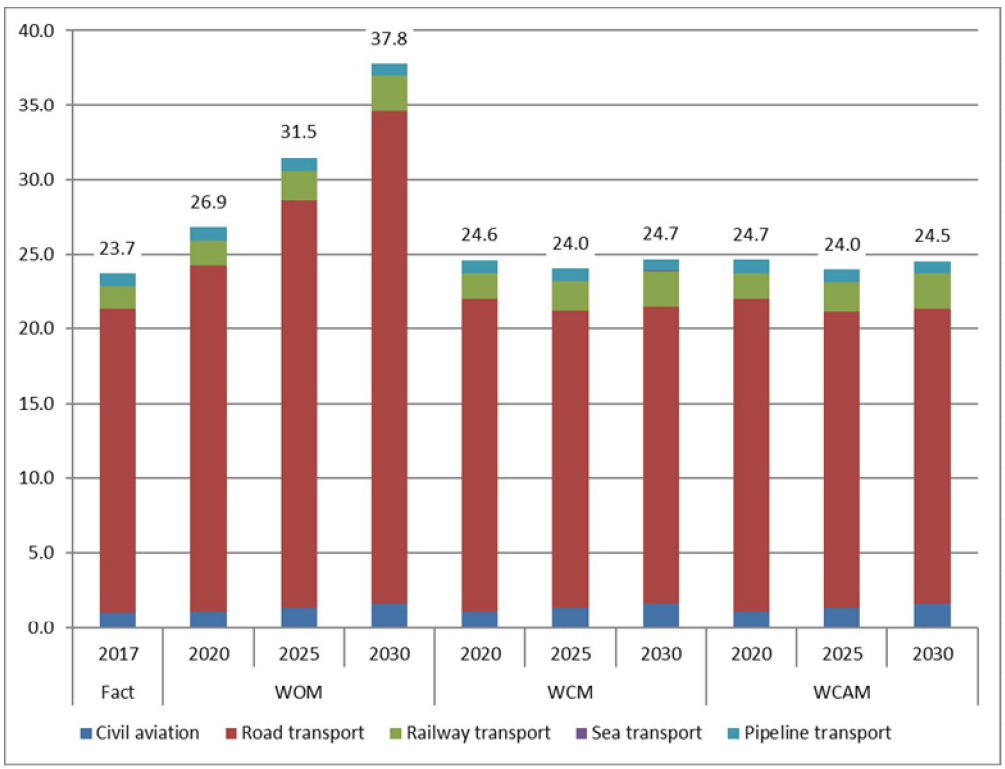
According to the energy balance, the production of iron and steel in the initial phase consumes heat energy (all types of heat) from industrial CHP. Under the scenario with measures in 2030, according to the technical and economic optimization, industrial boiler generation of thermal power for iron and steel production begins using blast furnace gas and high-quality coal as well as the heat from the COREX process. The key trends reducing GHG emissions in all scenarios are transition to the electric arc furnace process that consumes electricity and natural gas, and scrap steel recycling.

Non-ferrous metallurgy comprises production of aluminum, copper and "Other non-ferrous metals" process that takes into account all other energy consumption according to the energy balance. GHG emissions from aluminum production tend to decrease due to wider use of inert anode technology, decreasing use of the Hall–Héroult process and expanded use of aluminium scrap.

5.2.3. Transport

The transport sector has limited reduction potential due to high demand for transport services. GHG emissions are increasing in all scenarios. The main sources of emissions are automobiles and freight transport.

Figure 5.9. GHG emissions from transport, Mt CO2eq



	Fact	WOM			WCM			WCAM		
	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Civil aviation	1.0	1.1	1.3	1.6	1.1	1.3	1.6	1.1	1.3	1.6
Road transport	20.4	23.1	27.3	33.0	20.9	19.9	19.9	20.9	19.8	19.8
Railway transport	1.5	1.7	2.0	2.4	1.7	2.0	2.4	1.7	2.0	2.4
Sea transport	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipeline transport	0.9	0.9	0.9	0.8	0.9	0.9	0.8	0.9	0.9	0.8

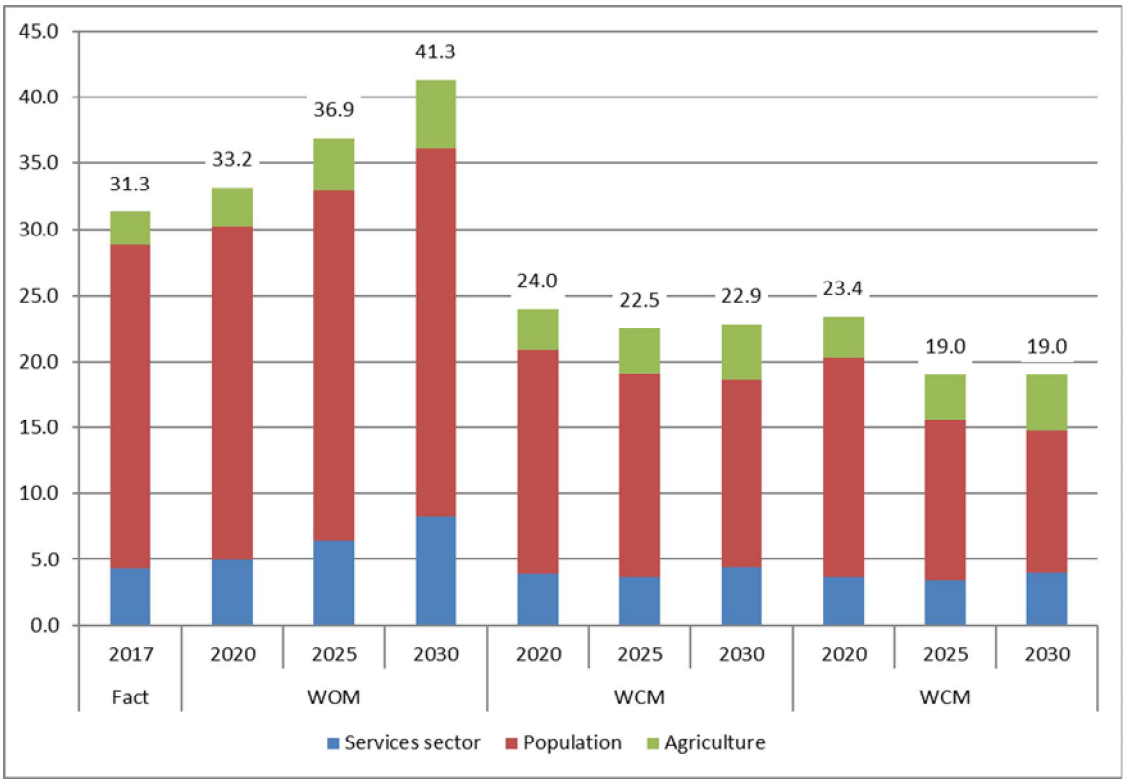
Emissions in scenarios with measures and additional measures are lower than in the scenario without measures due to the use of more efficient engines that consume less petroleum products. Hybrid or electric vehicles are not cost effective under current prices.

5.2.4. Population, services and agriculture

The bulk of greenhouse gas emissions from combustion in the agricultural sector are due to the consumption of fuel in agricultural operations.

The harsh continental climate leads to high energy demand for premises heating and water heating. Consumption of coal for household needs is widespread in the country. GHG emissions in the residential sector mainly originate from power services such as cooking, heating, hot water and others. In all scenarios with measures and additional measures, GHG emissions tend to decrease both across scenarios and in dynamics due to the greater share of electricity from RES by year in the scenario with additional measures.

Figure 5.10. Emissions from agriculture (combustion), service sector and population, by scenarios, Mt CO2eq

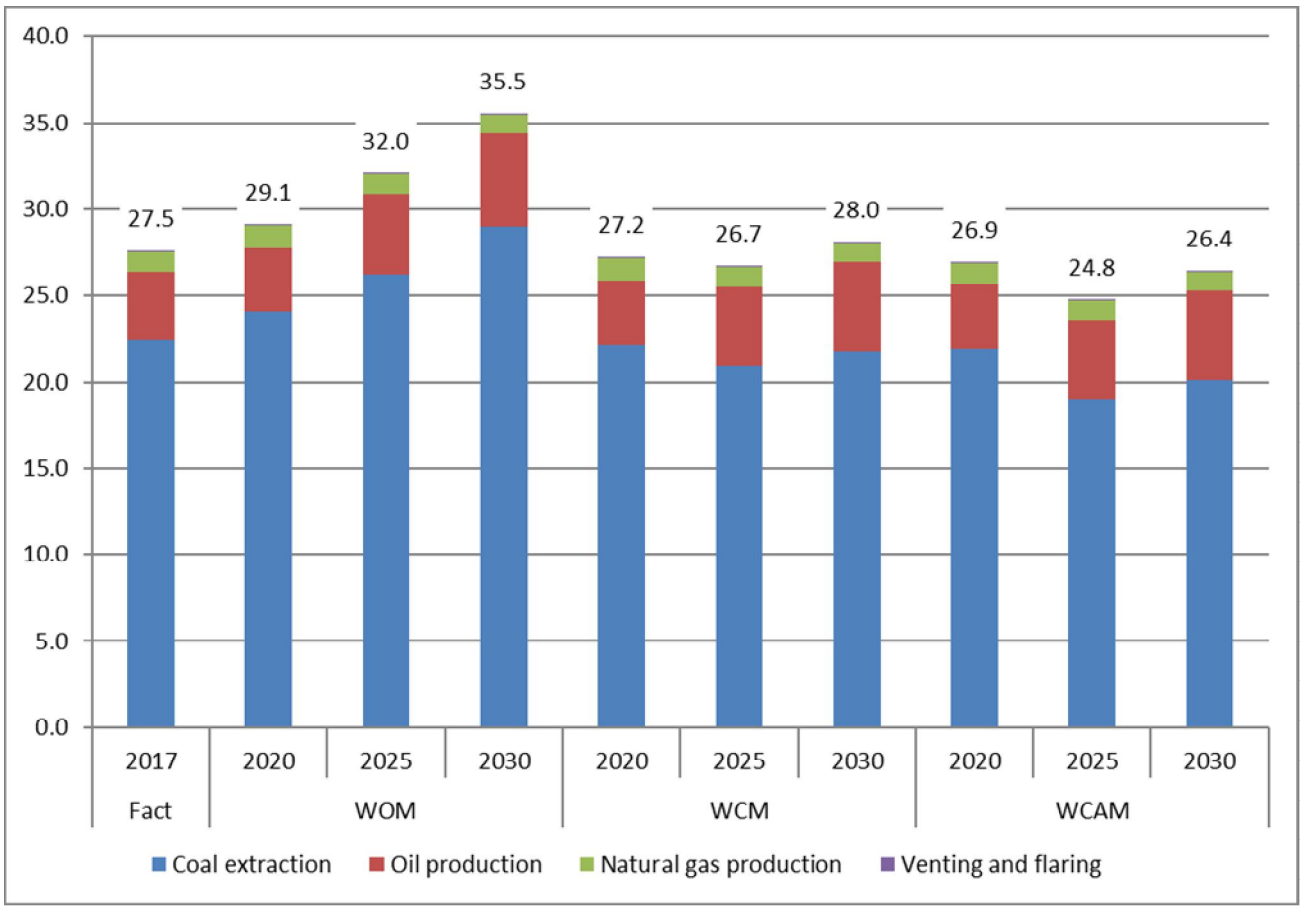


	Fact	WOM			WCM			WCAM		
	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Services sector	4.3	5.0	6.4	8.2	3.9	3.6	4.4	3.6	3.4	4.0
Population	24.5	25.2	26.5	27.9	17.0	15.4	14.2	16.7	12.1	10.7
Agriculture	2.5	3.0	4.0	5.2	3.1	3.4	4.3	3.1	3.4	4.3

5.2.5. Fugitive emissions

According to IPCC, fugitive emissions are accidental or intentional release of greenhouse gases during extraction, processing and delivery of fossil fuels to the end-use site. The figure below shows that the decline in coal consumption across the economy leads to a concomitant decrease in fugitive emissions. Thus, the reduction of volatile emissions is more a consequence of policies and measures in other coal-consuming industries.

Figure 5.11. Fugitive GHG emissions, Mt CO2eq



	Fact	WOM			WCM			WCAM		
	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Coal extraction	22.4	24.1	26.2	29.0	22.1	20.9	21.7	21.9	19.0	20.1
Oil production	4.0	3.7	4.7	5.4	3.8	4.6	5.2	3.8	4.6	5.2
Natural gas production	1.2	1.3	1.2	1.1	1.3	1.2	1.1	1.3	1.2	1.1
Venting and flaring	0.002	0.002	0.002	0.003	0.002	0.002	0.003	0.002	0.002	0.003

5.3. Projections and overall effect of policies and measures in the industrial processes sector

5.3.1 Projection of IPPU indicators growth

Linear regression model was used to predict IPPU greenhouse gas emissions not related to fuel combustion in scenarios with measures, without measures and with additional measures taking into account the design capacity of industrial installations in the Republic of Kazakhstan on the basis of Excel forecasting tools involving a set of historical data and expert forecasts of economic development and demand for products. The resulting model of projected emissions allows for a long-term scenario analysis.

According to the forecast of the Ministry of National Economy of Kazakhstan for 2020-2024,[70] Industrial GVA by 3% on average 2020-2024 (Table 5.4). Mining GVA for the forecast period will increase by 1.5% on average annually. Manufacturing GVA will grow within the range of 3.9-5% in 2020-2024. According to the report of the Committee for Statistics under RoK MNE on the demographic situation of the Republic of Kazakhstan for Q12019, the country's population amounted to 18 431.5 thousand people on March 1, 2019, including urban population of 10,721.5 thousand people (58.2%) and rural population of 7,710 thousand people (41.8%). Population growth will make 235.6 thousand people per year, or 1.3%[71]; over the past four years, this indicator has remained at the level of 1.55%[72].

Table 5.4 Averaged forecast of IPPU indicator's growth rates

Indicator, in % to the previous year	**Estimate**	**Forecast of the Ministry of Economy**					
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**After 2025**
Real GDP change	103.8	104.1	104.3	104.4	104.6	104.7	103.0
Population growth, %	101.3	101.5	101.5	101.5	101.5	101.5	101.5
Manufacturing	101.5	103.3	103.3	103.3	103.3	103.3	103.0
Processing industry	103.9	104.7	104.7	104.7	104.7	104.7	104.0
Chemical	101	101	102	102	102	102	102
Non-metallic minerals	103	102	102	102	102	102	102
Metals	100	101	101	101	101	101	101
Construction	102.0	103.3	103.3	103.3	103.3	103.3	103.0

[70] https://economy.gov.kz/ru/kategorii/prognoz-socialno-ekonomicheskogo-razvitiya-na-2020-2024-gody

[71] https://www.zakon.kz/4966206-o-demograficheskoy-situatsii-respubliki.html

[72] https://countrymeters.info/ru/Kazakhstan#population_forecast

Source: Forecast by the Ministry of economy for 2020-2024 (economy.gov.kz). Demographic forecast for the RoK (countrymeters.info)

According to the forecast of socio-economic development for 2020-2024, the chemical industry will continue to develop sectors of agrochemistry and industrial chemicals. The agrochemical sector development will be ensured through the implementation of priority production areas of compound fertilizers, potassium fertilizers and plant protection products. As part of the further development of the chemical cluster, projects for the extraction phosphoric acid production followed up by manufacture of feed phosphates and chemicals based on methanol and ammonia will be implemented. In particular, the chemical industry will implement plant construction projects to produce compound mineral fertilizers in Zhambyl oblast (design capacity of 1.4 million tons of fertilizers per year), anhydrous sodium carbonate in Kyzylorda oblast (200 thousand tons) and phosphorus trichloride and glyphosate in Zhambyl oblast (13,6 thousand tons of phosphorus trichloride and 10 thousand tons of glyphosate), as well as plant upgrades for the manufacture of mineral fertilizers in Mangystau oblast (342 thousand tons of fertilizers) and Zhambyl oblast (1.3 million tons). The projects implementation will contribute to an increase in the chemical industry output by an average of 5.3% per year. Further development of metallurgy will pursue expanding the range and increasing the share of advanced processing products with high added value, retrofitting of the existing enterprises of the industry in order to reduce resource and energy intensity, and increase productivity. Projects planned for the metallurgy industry:

– construction of mining and processing complexes based on the deposits of polymetallic ores Shalkiya (112 thousand tons of zinc, and 29 thousand tons of lead per year) and Masalskoe (1 million tons of rolled prod);

– construction of plants manufacturing complex alloys (600 thousand tons of alloys) in Karaganda oblast, large-diameter welded steel pipes in Almaty (100 thousand tons of steel pipes);

– expansion of the processing capacity of the Aktogai mining and processing complex (doubling the capacity of sulfide ores processing from 25 to 50 million tons) and ferrosilicium in Karaganda oblast (180 - 240 thousand tons).

Despite its high output volumes of ferrosilicon, YDD Corporation LLP uses a complex of gas purification systems and consumes electric energy instead of coal thus neutralizing its harmful emissions into the atmosphere and minimizing the negative impact on the environment.[73]

5.3.2 Projections of GHG emissions from IPPU

According to industrial production statistics, the index of industrial production in 2018 to the level of 2017 amounted to 104.5%. The volume of machine production - by 14.4%, production of coke and oil refining products - by 9.1%, production of chemical industry products - by 8.7% and production of basic noble and non-ferrous metals - by 8.2%. Figure 5.12 shows a graph of actual GHG emissions

[73] http://miid.gov.kz/ru/pages/otchet-o-realizacii-gosudarstvennoy-programmy-industrialno-innovacionnogo-razvitiya-2

under the Current Measures Scenario (WCM) in the Industrial Processes and Product Use category for 1990-2019 and a forecast up to 2030 by subcategory. As can be seen from the graph, the main influence on the growth of SG is the metallurgy sector and the production of mineral products. in 2019 emissions for the IPPU sector had already exceeded the base 1990 year by 25%.

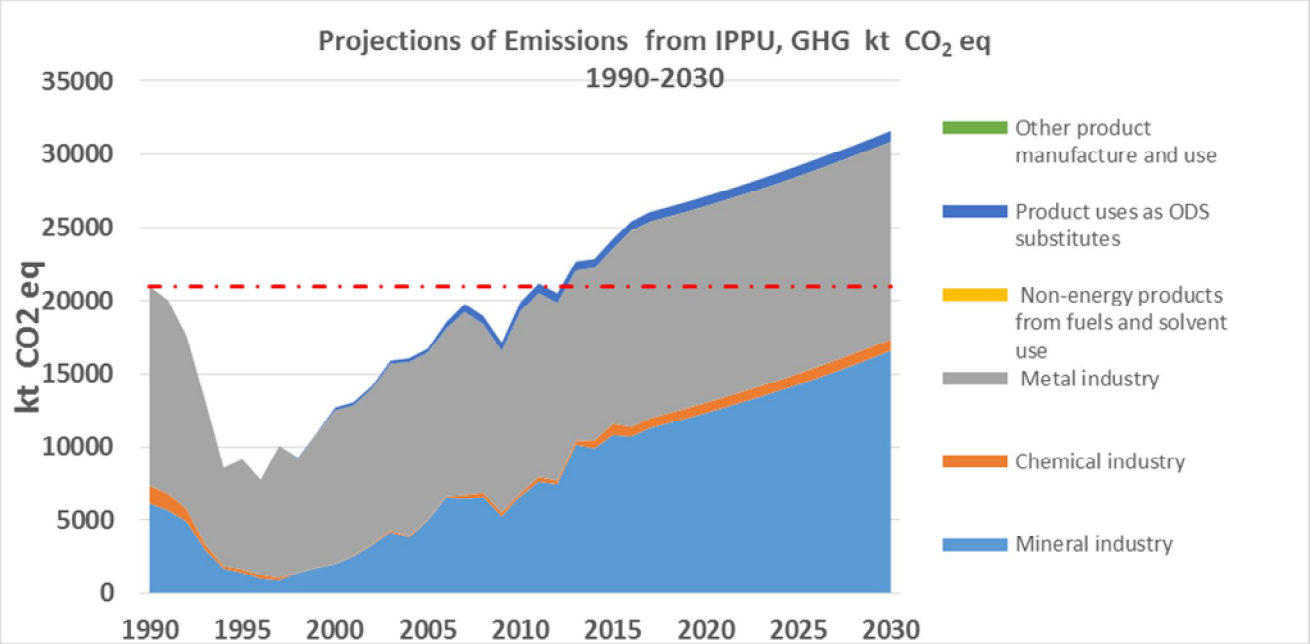


Figure 5.12. Forecast of IPPU GHG emissions until 2030 with current measures.

Taking timely measures under the SPIID has significantly reduced GHG emissions across sectors lowering the chemical industry emissions against the base year, however, expansion of the construction industry and increased demand for cement (clinker) leads to the growth rate of GHG emissions (Fig. 5.13 a,b).

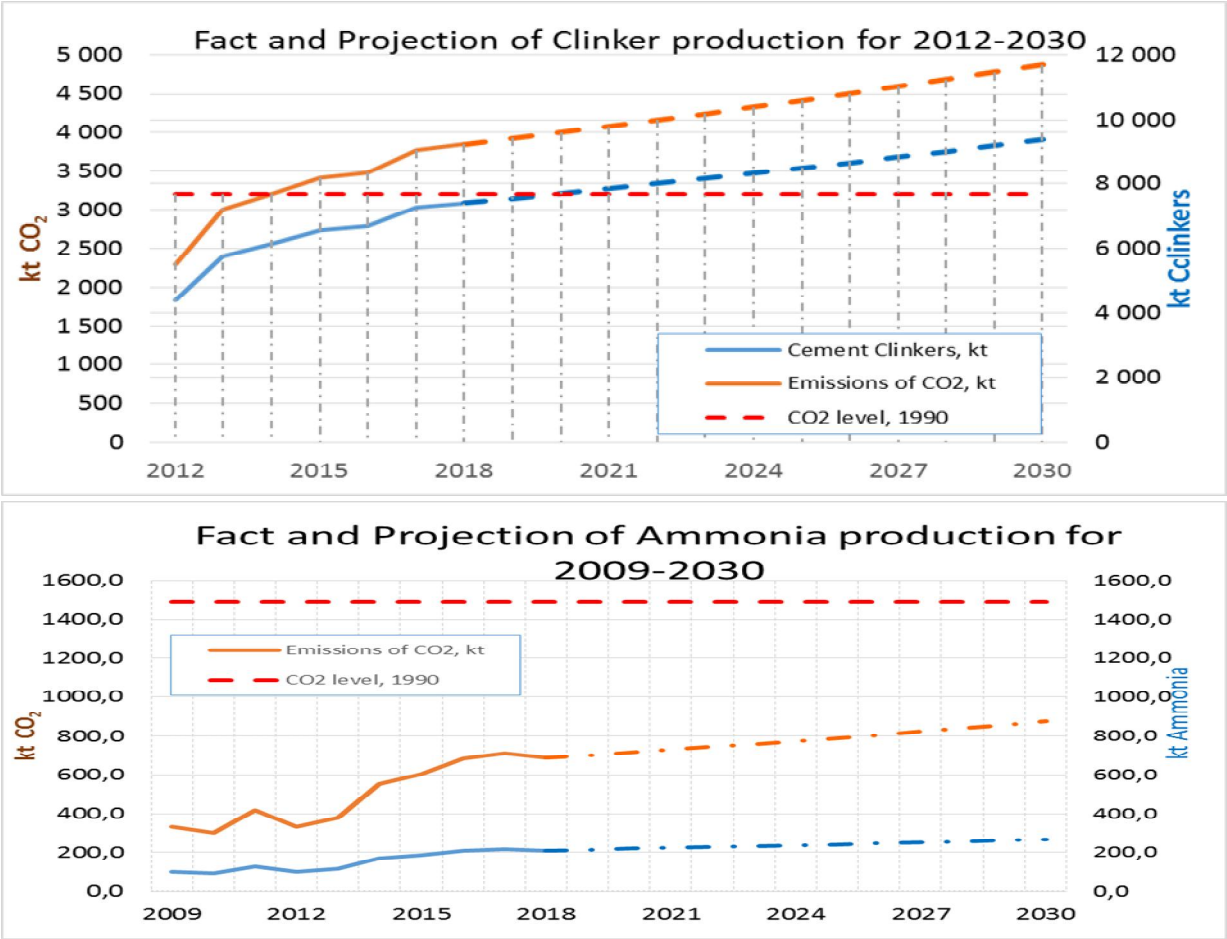


Figure 5.13. Forecast for (a) clinker and (b) ammonia production until 2030

Updated greenhouse gas projections under the scenario without measures (WOM) and the scenario with current and additional measures (WAM/WCAM) are shown in figure 5.14. Emissions under the scenario with current measures (WCM) are increasing during the forecast period. With the adoption of additional measures from 2020, there is an opportunity for reduction by 10% but emissions remain above the baseline across the horizon. As can be seen from the graph, emissions exceed WCM by 5% under the scenario without measures.

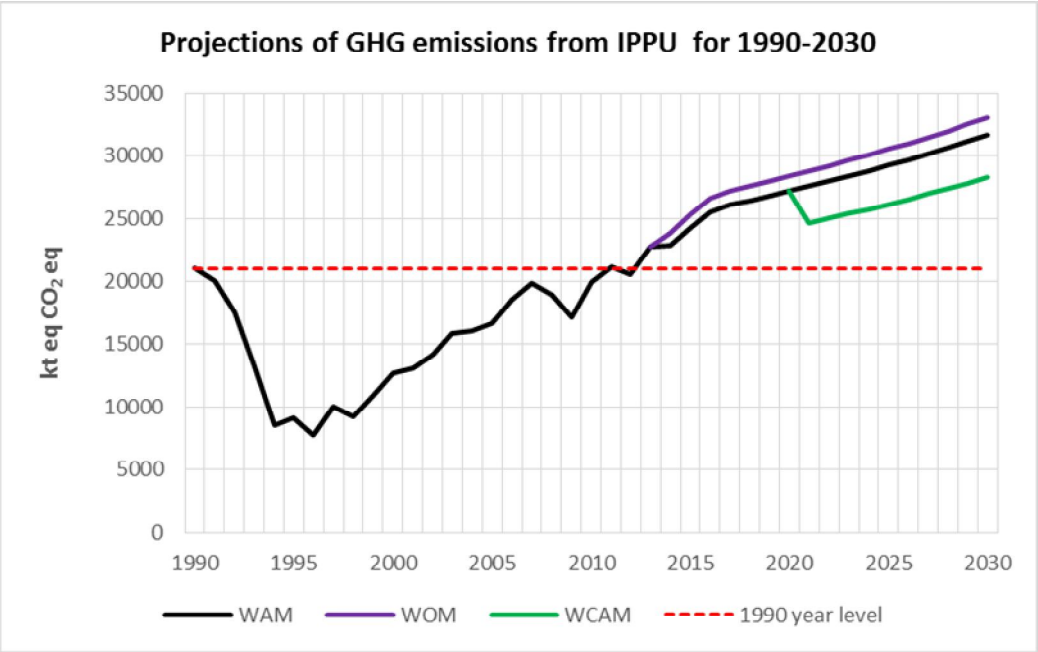
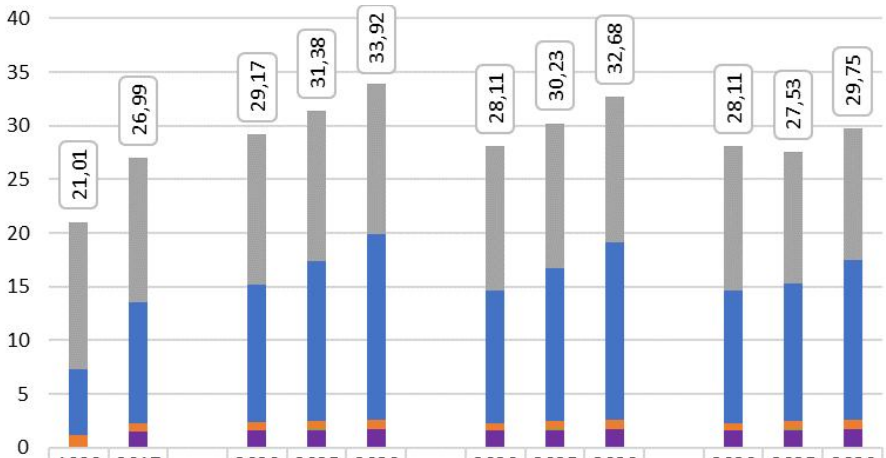


Figure 5.14 Scenario analysis: actual and forecast IPPU emissions for 1990-2030

Calculations estimating the impact of response measures (CTF Table.3) show that the policies and measures adopted by the RoK to reduce GHG emissions have partially reduced emissions in this category. In all scenarios, total GHG emissions exceeded the 1990 baseline. It is therefore necessary to reduce specific emissions in the industrial sector by switching to newer technologies in the combustion sector. The reason is that most emissions originate from smelting processes using blast furnaces and production of ore agglomerate. Thus, the scenario WCAM in the combustion sector of iron and steel production stipulate using the COREX process heat and transition to the electric arc furnace process consuming electricity and natural gas (also it taken into account in combustion sector), as well as steel scrap processing.

Figure 5.15 shows projected emission values for the industry/industrial processes sector by scenario.



	1990 Year	2017 Fact	2020 WOM	2025 WOM	2030 WOM	2020 WCM	2025 WCM	2030 WCM	2020 WCAM	2025 WCAM	2030 WCAM
Metal industry	13,64	12,80	13,99	14,03	14,06	13,45	13,49	13,52	13,45	12,17	12,20
Mineral industry	6,13	11,28	12,82	14,87	17,23	12,33	14,30	16,57	12,33	12,90	14,96
Chemical industry	1,23	0,69	0,74	0,79	0,84	0,71	0,76	0,81	0,71	0,76	0,81
Non-energy products from fuels and solvent use	0,00	0,01	0,01	0,02	0,02	0,01	0,02	0,02	0,01	0,02	0,02
Other product manufacture and use	0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Product uses as ODS substitutes	0	1,55	1,60	1,68	1,76	1,60	1,68	1,76	1,60	1,68	1,76
Industrial proceses	21,01	26,10	29,17	31,38	33,92	28,11	30,23	32,68	28,11	27,53	29,75

Figure 5.15 Projections of the IPPU emissions by scenario until 2030, million tons CO2eq.

5.4. Agriculture and LULUCF emissions

This report presents projections of GHG emissions from the Land Use, Land Use Change and Forestry (LULUCF) and agriculture sectors of the Republic of Kazakhstan until 2030.

Greenhouse gas emissions modeling for the LULUCF sector was provisionally divided into two parts: modeling GHG emissions in forestry (F) and the rest of the LULUCF sector excluding forestry.

Annual GDP growth of 3.5% before 2020 and 3% after 2020 was taken as a common assumption for all scenarios. This assumption was based on the updated expected GDP growth for the next 3 years according to the Government of the Republic of Kazakhstan.

Updated projections for 2020 and 2030 for LULUCF

The first part of this chapter outlines the overall results of LULUCF scenarios. They are followed by a more detailed description of the results and assumptions by the LULUCF subsectors.

Below are the summary results of the LULUCF sector calculations under three scenarios until 2030, as well as the emission levels in 1990 and 2017 (Fig.5.16).

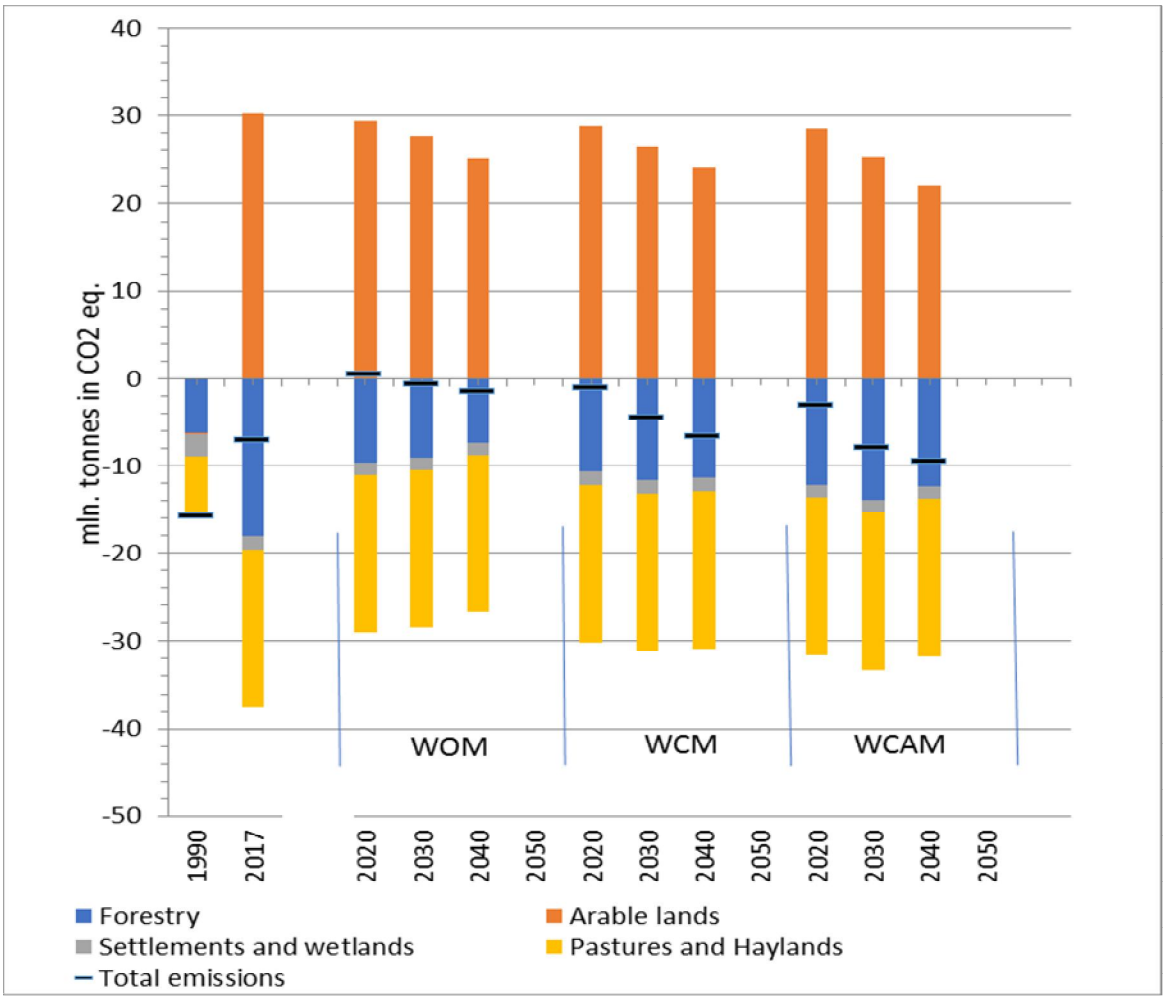


Figure 5.16. Projections of GHG emissions from LULUCF under various scenarios until 2030

Figure 5.16 shows that the 'Farmland' sector was a greenhouse gas sink in 1990, however, this status lowered significantly in the 2017 inventory due humus depletion. Increased use of mineral fertilizers in the scenario with measures and with additional measures may reduce emissions from this subsector.

Forestry may also contribute to the greenhouse gases removal in case of adoption of appropriate policies and measures. Thus, the difference between scenarios with additional measures and without measures can reach about 5 million tons of CO2eq. Table 5.5 shows the numerical values of emissions from the LULUCF sector illustrated by Figure 5.16.

Table 5.5. Projections of GHG emissions from LULUCF under various scenarios until 2030, Mt CO2eq.

	Actual emissions		WOM (without measures)			WM (with measures)			WAM (with additional measures)		
	1990	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030

Forestry	-6.182	-18.951	-9.6	-9.069	-7.33	-10.7	-11.7	-11.4	-12.2	-13.9	-12.3
Cultivated lands	-0.147	30.319	29.35	27.76	25.16	28.879	26.479	24.074	28.519	25.319	22.119
Settlements and wetlands	-2.64	-1.465	-1.465	-1.465	-1.465	-1.465	-1.465	-1.465	-1.465	-1.465	-1.465
Pastures and hayfields	-6.911	-17.941	-17.941	-17.941	-17.941	-17.941	-17.941	-17.941	-17.941	-17.941	-17.941
Total	-15.88	-7.1821	0.344	-0.715	-1.576	-1.227	-4.627	-6.732	-3.087	-7.987	-9.587

As can be seen from Table 5.5, the scenario with additional measures does not achieve the 1990 removal levels. According to the scenario with additional measures, removals will amount to about 60% of the 1990 level by 2030.

Forestry

Forestry GHG emission projections have been updated with the use of CBM-CSF3 (Carbon Budget Model of the Canadian Forest Sector) software.

Data on the areas occupied by the main tree species are updated based on the "Executive summary of the Committee for Forestry and Wildlife of the Ministry of Agriculture of the Republic of Kazakhstan."[74] In particular, the key forest-forming species areas increased by 3% in 2018 compared to the last inventory of the Forestry Committee in 2013.

The CBM CSF3 model included major tree species covering an area of over 3 million hectares, which is over 90% of the total stand. The model does not include the remaining tree species due to their abundance and small shares, which complicates the analysis significantly. A correction factor is introduced to account for the remaining wood species.

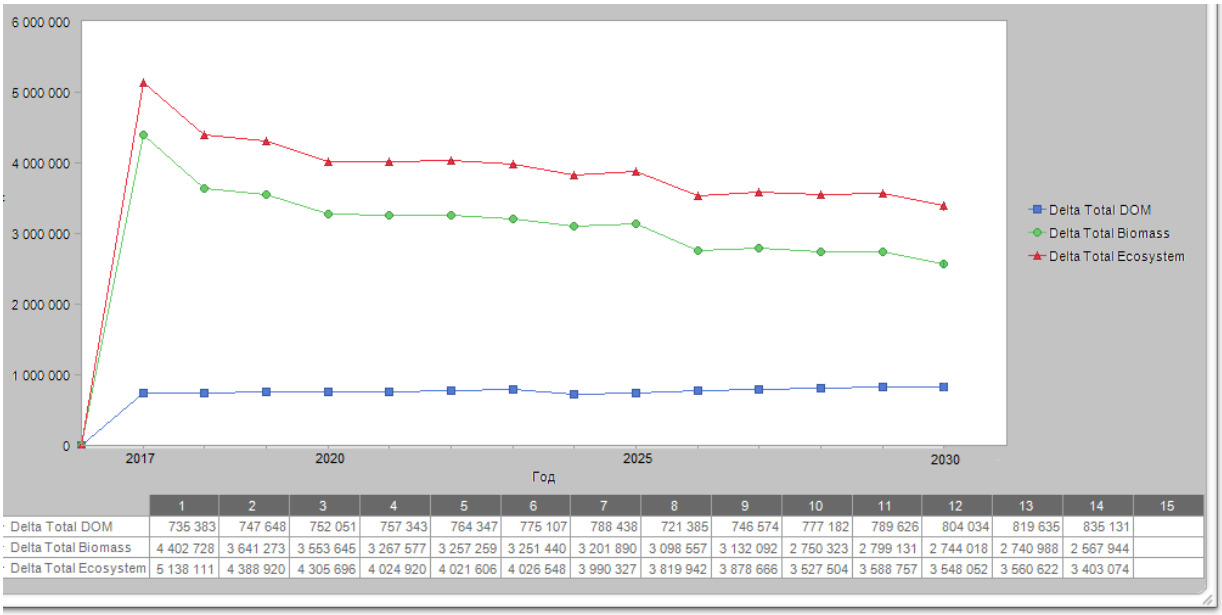
Figure 5.17 shows the outcomes of modeling until 2030. As can be seen from Figure 5.17, all three scenarios show a decrease in greenhouse gas absorption in the forestry sector due to forest aging.

The model for 2017 to 2030 was calculated without disturbances (fires, logging, new plantations, etc.) in order to compare the results of the simulations with the emission data from the last inventory of 2017.

According to the model, the change in the annual carbon content of the forest for 2017 (inventory) year amounted to 5138 thousand tons of C (carbon), while the inventory report shows the accumulation of 4928 thousand tons of carbon by forests for the same year. The difference of about

[74] Shvidenko, A. Z., Shchepashchenko, D. G., Nilsson, S., Buluy, Yu. I., 2006. Tables and models of growth and productivity rate of plantations of the main forest-forming species of Northern Eurasia.

200 thousand tons is explained by the fact that the model did not account for deforestation and fires of the inventory year or the dynamics of shrubs and saxauls. In case logging and forest fires are accounted for, inventory data and model data are almost identical. Figure 5.17 below shows the dynamics of annual carbon variation in forests of Kazakhstan according to the CBM-SF3 model.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Delta Total DOM	735 383	747 648	752 051	757 343	764 347	775 107	788 438	721 385	746 574	777 182	789 626	804 034	819 635	835 131	
Delta Total Biomass	4 402 728	3 641 273	3 553 645	3 267 577	3 257 259	3 251 440	3 201 890	3 098 557	3 132 092	2 750 323	2 799 131	2 744 018	2 740 988	2 567 944	
Delta Total Ecosystem	5 138 111	4 388 920	4 305 696	4 024 920	4 021 606	4 026 548	3 990 327	3 819 942	3 878 666	3 527 504	3 588 757	3 548 052	3 560 622	3 403 074	

Figure 5.17. Dynamics of annual carbon variation in the forests of Kazakhstan, tonnes of Carbon.

The red line shows the total dynamics of changes across the ecosystem. The blue line shows changes in dead organic matter, while the green line marks carbon variations in biomass.

Forestry of the Republic of Kazakhstan is considered an absorber of greenhouse gases. This analysis shows higher GHG removal values in CO2 equivalent compared to the previous biennial report. This was due to more accurate modeling and approximate simulation using the CBM SF3 software. Absorption increases due to the dry climate and relatively low precipitation conditions, where there is not sufficient time for dead organic matter to rot and emit greenhouse gases. Most of the accumulated carbon converts into soil carbon and underground biomass reserves.

Each hectare of coniferous, soft-wooded broadleaved or hard-wooded broadleaved species absorbs about 1.5 tons of carbon on average per year, which is equivalent to 5.5 tons of CO2 per year per hectare provided any disturbances are neglected. Removal levels are gradually falling due to the increase of the average age of forests and subsequent lower carbon dioxide absorption.

In developing scenarios for the purposes of this analysis, assumptions are made about the changes in the area of fires, areas of deforestation, and young plantations depending on the adopted or potential policies and measures aimed at reducing GHG emissions in forestry. Fires and logging are modeled in CBM-CFS3 as disturbances to predict the dynamics of carbon variations in forestry. The area of fires is decreasing every year according to the Forestry Committee. Therefore, fire areas in emission scenarios are assumed to lower against the previous biennial report of the RoK. Under the scenarios with measures and with additional measures, deforestation is assumed to be reducing slowly and moderately. Detailed assumptions made in the scenarios are presented in Tables 5.6-5.8.

Forecast without measures in forestry

The scenario without measures until 2030 assumes that the annual area of fires for the period of modeling will be 5 thousand hectares, and logging will be at the level of 50 thousand hectares. Introduction of new young stands will amount to 20 thousand hectares per year.

Below is a summary table of assumptions for the scenario without measures.

Table 5.6. Assumptions in the scenario without measures.

	2020	2025	2030
Young plantings, thousand ha	20	20	20
Fire affected area, thousand ha	5	5	5
Logging area, thousand ha	50	50	50

Forecast with measures in forestry

The scenario with measures assumes that the state would assist in financing this industry through programs including the expansion of protected areas, logging bans, fire control, afforestation and others.

The scenario with measures uses assumptions that the area of fires would amount to 2 thousand hectares per year. Introduction of young plantations and shrubs is assumed to increase to 30 thousand hectares, while deforestation area would go down to 35 thousand hectares.

Table 5.7 Forecast with measures. Assumptions in the scenario with measures.

	2020	2025	2030
Young plantings, thousand ha	20	25	30
Fire affected area, thousand ha	2	2	2
Logging area, thousand ha	45	40	35

Forecast with additional measures in forestry

The forecast with additional measures assumes a decrease in the area of fires. The introduction of young plantations will reach 30 thousand hectares by 2025 and will remain unchanged until 2030. The area of logging will shrink to 30 thousand hectares from 2025 to 2030.

Table 5.8. Assumptions in the scenario with additional measures.

	2020	2025	2030
Young plantings, thousand ha	20	30	30
Fire affected area, thousand ha	2	1.5	1
Logging area, thousand ha	35	30	30

Table 5.5 and Figure 5.16 show the outcomes of forest sector modeling as a share of total emissions.

Despite the fact that the forests of Kazakhstan are a sink, the overall trend reflects reduction of GHG removals due to the aging of the forest in general terms (Fig.5.17). Further potential measures in the forestry sector may include measures to increase and expand the protected areas, reduce the area of sanitary logging, prevent forest aging and maintain high rates of biomass growth. To achieve the

above goals, it may be necessary to cut down mature and over-mature trees and introduce young plantations instead.

Another measure to consider is involvement of international financial and compensation mechanisms for the afforestation of new territories.

Updated projections for 2020 and 2030 for LULUCF without forestry

This chapter contains greenhouse gas emissions projections for LULUCF without account for forestry sector. The primary emitter in this sector is the “Farmlands” sub-sector. Other sub-sectors show insignificant changes.

The following assumptions were used for this sector:

Land use sub-sectors 'Settlements', 'Pastures and haylands', 'Wetlands', 'Reservoirs', and 'Other agricultural lands' will absorb a fixed average GHG amount derived from the past 5 years at the level of 19,391 thousand tons in CO2 equivalent.

Thus, without forestry the LULUCF sector leaves us with the ‘Farmlands’ sub-sector.

The scenario without measures developed for 'Farmlands' assumes that humus depletion rate and the recovery rate of lands withdrawn from cultivation (fallow) will remain unchanged throughout the projection period. In the scenario without measures, cumulative emissions in LULUCF sectors without forestry (settlements, pastures and haylands, etc.) are to remain at the level of 25,121 thousand tons of CO2 equivalent.

Humus depletion is the main driver of significant emissions (around 30 million tons of CO2) from farmlands. Literature review has shown that humus losses occur due to mineral fertilizers deficiency in the soil including, among others, nitrogen fertilizers. According to the data of the Committee for Statistics of the Republic of Kazakhstan, the area treated with mineral fertilizers has been growing at a rate of 200 thousand hectares, or 1% per year, for the last 4 years. Assumption is that the constant treatment with mineral fertilizers prevents humus depletion in soils, and the increment in the areas treated with mineral fertilizers will remain at the level of 200 thousand hectares per year. The latter assumption stems from the current programs to subsidize fertilizers contributing to the current growth of fertilizer application in the agriculture of the Republic of Kazakhstan. The current increase rate (200 thousand hectares per year) of the area treated with mineral fertilizers is included in the scenario without measures. In the scenario with measures, the annual increase in the area of soils treated with mineral fertilizers will reach up to 300 thousand hectares per year, and the same indicator for the scenario with additional measures will make up to 400 thousand hectares per year.

Tables 5.9, 5.10 and 5.11 show calculations and assumptions in the scenarios with measures, without measures and with additional measures.

LULUCF emissions projections without measures are presented below showing the current trend.

Table 5.9. 'Farmlands' subsector emissions without measures

	2017	2020	2025	2030
Forecast areas treated with mineral fertilizers, thousand ha	2500	3100	4100	5100
Farmlands untreated with mineral fertilizers, thousand ha	18,899	18,299	17,299	16,299
Farmlands emissions in CO2eq, thousand tons	30,319	29,359	27,759	25,159

Emissions from other LULUCF subsectors without forestry in CO2eq, thousand. tons	-19,391	-19,391	-19,391	-19,391
Total LULUCF emissions without forestry in CO2eq, thousand tons	10,928	9,968	8,368	5,768

The forecast with measures assumes that the amount of subsidized fertilizers will increase by 1.5 times.

Table 5.10. 'Farmlands' subsector emissions with measures

	2017	2020	2025	2030
Forecast areas treated with mineral fertilizers, thousand ha	2,500	3,400	4,900	6,400
Farmlands untreated with mineral fertilizers, thousand ha	18,899	17,999	16,499	14,999
Farmlands emissions in CO2eq, thousand tons	30,319	28,879	26,479	24,079
Emissions from other LULUCF subsectors without forestry in CO2eq, thousand. tons	-19,391	-19,391	-19,391	-19,391
Total LULUCF emissions without forestry in CO2eq, thousand tons	10,928	9,488	7,088	4,688

Under the scenario with additional measures, the annual growth of areas treated with mineral fertilizers makes up to 400 thousand hectares per year.

Table 5.11. 'Farmlands' subsector emissions with additional measures

	2017	2020	2025	2030
Forecast areas treated with mineral fertilizers, thousand ha	2,500	3,700	5,700	7,700
Farmlands untreated with mineral fertilizers, thousand ha	18,899	17,699	15,699	13,699
Farmlands emissions in CO2eq, thousand tons	30,319	28,519	25,319	22,119
Emissions from other LULUCF subsectors without forestry in CO2eq, thousand. tons	-19,391	-19,391	-19,391	-19,391
Total LULUCF emissions without forestry in CO2eq, thousand tons	10,928	9,128	5,928	2,728

Updated projections for 2020 and 2030 for agriculture

The forecast of GHG emissions from agriculture is based on the dynamics of variations in the number of large and small cattle. Therefore, emissions were projected based on the poultry and livestock populations and their dynamics. Figure 5.18 below shows the overall dynamics in the agricultural sector.

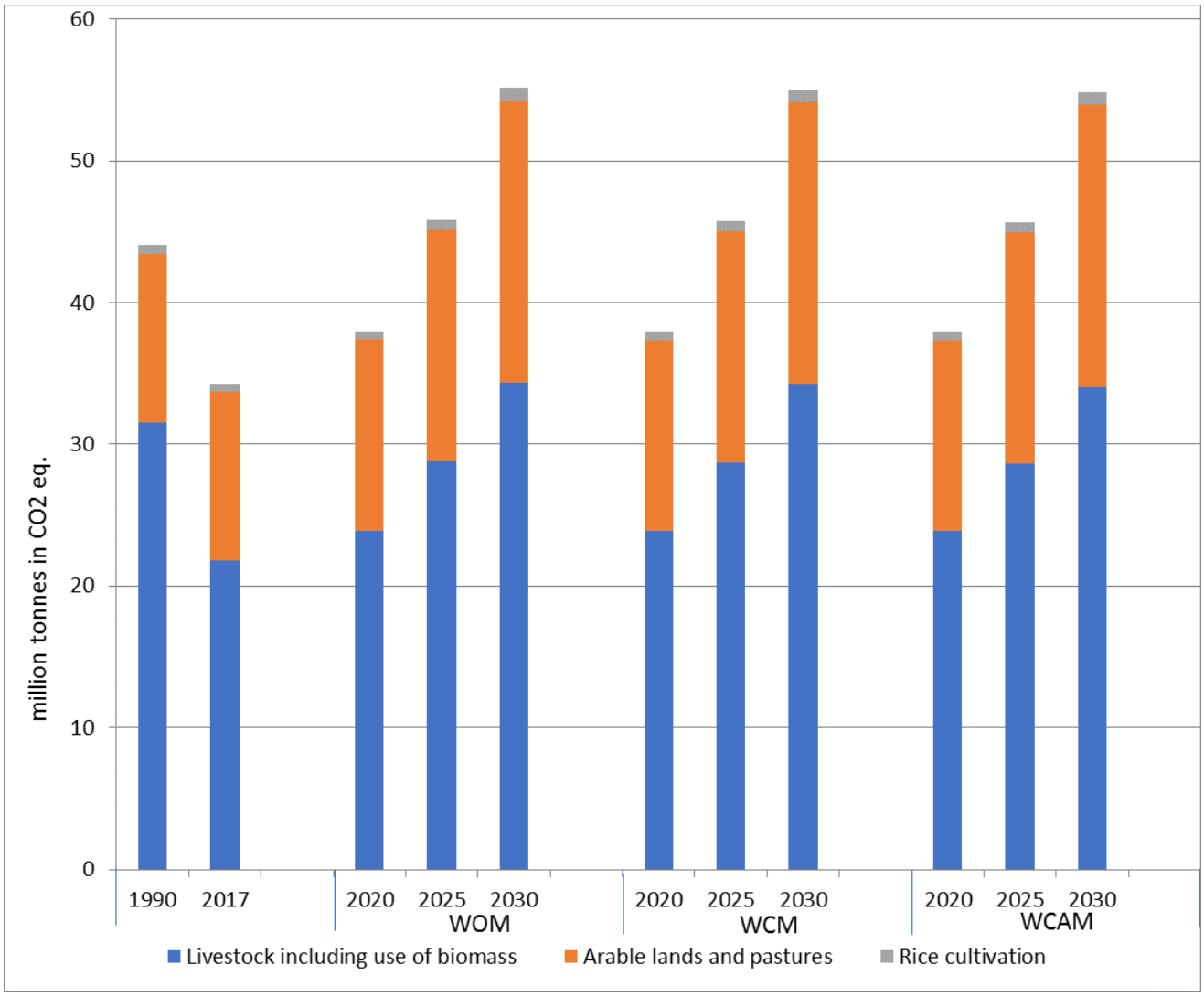


Figure 5.18. GHG emissions in agriculture under various scenarios until 2030, million tons of CO2 equivalent.

Dynamics of livestock and poultry population was analyzed for 6 years from 2011 to 2017. The dynamics of the poultry and livestock population growth will remain the same as during the period from 2011 to 2017 looking as follows (per year): cows +6%, non-dairy cattle +1.% , sheep +0.7%, goats -2%, swine -5%, camels +2%, poultry + 3%, horses + 7% per year.

Table 5.12. Livestock population projection

Annual average livestock population, thousand animals	2017	2020	2025	2030
Large cattle	6,764	7,547	9,042	11,043
Dairy large cattle	3,362	4,042	5,358	7,171
Non-dairy large cattle	3,402	3,505	3,684	3,871
Sheep and goats	18,329	18,543	18,910	19,326
Camels	193.1	204.9	226.2	249.8
Horses	2,416	2,960	4,151	5,822
Swine	815	698	541	418
Poultry	39,913	43,614	50,561	58,614

The following are projections of emissions from various subsectors of agriculture. Reduction in emissions is assumed in scenarios with current measures and with additional measures due to the use of biogas facilities in agriculture.

Scenario without measures

In the scenario without measures emission projections in the following three tables are based on changes in livestock population

CH4 emissions from manure storage and use systems

Table 5.13. Methane emissions from manure management systems

CH_4 emissions from manure management systems, thousand tons	**2017**	**2020**	**2025**	**2030**
Dairy large cattle	15.53	18.68	24.76	33.14
Non-dairy large cattle	3.96	4.084	4.29	4.51
Sheep and goats	2.15	2.18	2.22	2.27
Camels	0.35	0.37	0.41	0.45
Horses	2.64	3.23	4.53	6.36
Swine	4.08	3.49	2.71	2.09
Poultry	0.4	0.44	0.51	0.59
Total	29.12	32.48	39.44	49.42
Methane emissions, kt CO_2eq	728.2	812.1	986	1,235.4

Direct N2O emissions from manure storage and use

Table 5.14. Nitrous oxide emissions from manure management systems

	2017	**2020**	**2025**	**2030**
Direct N_2O emissions from manure management systems, kt	7,29	7.97	9.34	11.21
Emission of N_2O, kt CO_2eq	2,161	2,364	2,770	2,325

Table 5.15. Methane emissions from internal fermentation

CH_4 emissions from internal fermentation, kt	**2017**	**2020**	**2025**	**2030**
Dairy large cattle	343.04	412.42	546.70	731.68
Non-dairy large cattle	209.42	215.76	226.78	238.29
Sheep and goats	136.33	137.93	140.66	143.75
Camels	8.9	9.41	10.42	11.53
Horses	43.49	53.28	74.72	104.79
Swine	1.02	0.87	0.67	0.52
Total	742.2	829.7	999.95	1,230,06
Methane emissions, kt CO_2eq	18,555	20,742	24,999	30,764

Projections of nitrogen compounds emissions from farmlands and pastures.

The projection of emissions from farmlands and pastures is based on the assumption that the amount of fertilizers added to soils will grow proportionally with GDP, i.e. by 3% per year.

Table 5.16. Nitrous oxide emissions from farmlands and pastures

	2017	2020	2025	2030
Direct N_2O emissions from farmlands and pastures, thousand tons	40.08	45.08	54.85	66.73
Emission of N_2O, kt CO_2eq	11,944	13,435	16,346	19,887

Table 5.17. Methane emissions from rice cultivation

	2017	2020	2025	2030
Methane emissions from rice cultivation, kt	21.95	24.69	30.04	36.54
Methane emissions, kt CO_2eq	548.75	617.27	751	913.71

Scenario with measures

At present, a number of biogas facilities operate in Kazakhstan.

Lugovskoye Stud Farm in Zhambyl oblast processes waste from swine breeding complex and generates 1.93 million m^3 of biogas per year.

Karaman-K LLP processes cattle waste to generate 800 thousand m^3 of biogas per year.

Bagration Peasant Holding generates around 146 thousand m^3 of biogas per year from cattle waste.

Volynskiy 0.3 MW

Kurminskaya 1 MW

Karasu 0.3 MW (Kostanay)

The scenario with measures assumes an increase in the number of biogas plants among farms. In addition to reduction in CH_4 emissions, cumulative emissions are expected to go down due to more rational use of fuel for heat and power generation.

Table 5.18. Reduction of emissions due to biogas plant operations

	2017	2020	2025	2030
Biogas production million m^3/year from existing and planned biogas plants	4	10	20	30
CO2 reduction resulting from optimal heat and electricity generation (tons of CO2/year)	8,000	20,000	40,000	60,000
Reduction of CH_4 emissions in CO2eq (tons of CO2/year)	4,800	12,000	24,000	36,000
Overall reduction, tons of CO2eq/year	12,800	32,000	64,000	96,000

Methane burning reduces greenhouse gas emissions in CO2 equivalent, since 1 kilogram of methane accounts for 22 kilograms of CO2. On the other hand, consumption of gas for heat and power generation instead of coal also reduces cumulative emissions. Reduction in CO2 emissions as a result of decrease in methane emissions and optimized use of gas for heating and power supply was estimated

in Jorgensen, Peter Jacob. *Biogas-Green Energy: Process, Design, Energy Supply, Environment.* Researcher for a Day, 2009

The effect of CO2 emissions reduction due to optimization of heat and power generation is subject to deduction from the fuel combustion sector too

In this scenario, cumulative emissions in the agricultural sector will result from the emissions under the scenario without measures minus CH_4 reduction in CO2 equivalent in the scenario with measures (table 5.19).

Table 5.19. Cumulative emissions in the scenario with current measures in agriculture accounting for biogas facilities

	2017	2020	2025	2030
Cumulative emissions of CO2, million tons	34.26	37.93	45.78	55.02

Scenario with additional measures

The scenario with additional measures assumes the commissioning of biogas plants in animal husbandry at the level of 1 MW per year

Table 5.20. Reduction of emissions due to biogas plant operations

	2017	2020	2025	2030
Large cattle population, thousand	6,183	6,546	6,908	7,271
Biogas generation from existing biogas plants, million $м^3$/year	4	16	46	86
CO2 reduction resulting from optimal heat and electricity generation (tons of CO2/year)	8,000	32,000	92,000	172,000
Reduction of CH_4 emissions in CO2eq (tons of CO2/year)	4,800	19,200	55,200	103,200
Overall reduction, tons of CO2eq/year	12,800	51,200	147,200	275,200

Total emissions in agriculture with additional measures will result from the emissions under the scenario without measures minus the reduction of CH_4 emissions in CO2eq in a scenario with additional measures.

Table 5.21. Cumulative emissions in the scenario with additional measures in agriculture accounting for biogas facilities

	2017	2020	2025	2030
Cumulative emissions of CO2, million tons	34.26	37.92	45.697	54.85

5.5. Updated projections for the 'Waste management' sector

The first part of this chapter outlines the overall results of the 'Waste management' sector scenarios. The growth of the RoK population was assumed as the key emissions driver in calculating emissions for the 'Waste management' sector. The assumed annual rate of population growth in Kazakhstan was 1.4% per year, and the amount of waste per capita remained constant. Another assumption was that emissions from industrial waste, medical waste incineration, as well as nitrous oxide emissions would remain at the 2017 level. Scenarios with measures and with additional measures are based on the adopted amendments to the Environmental Code providing incentives for solid waste (MSW) processing. The ban on paper, plastic and glass disposal from January 1, 2019, and on food waste disposal from 2021 will lead to a noticeable decrease in emissions from solid waste (MSW). According to the assumption made in the scenario with measures, the MSW emissions decrease will change from 15% in 2020 to 25% by 2030. Under the scenario with additional measures, the reduction of MSW emissions will make from 15% in 2020 to 30% by 2030.

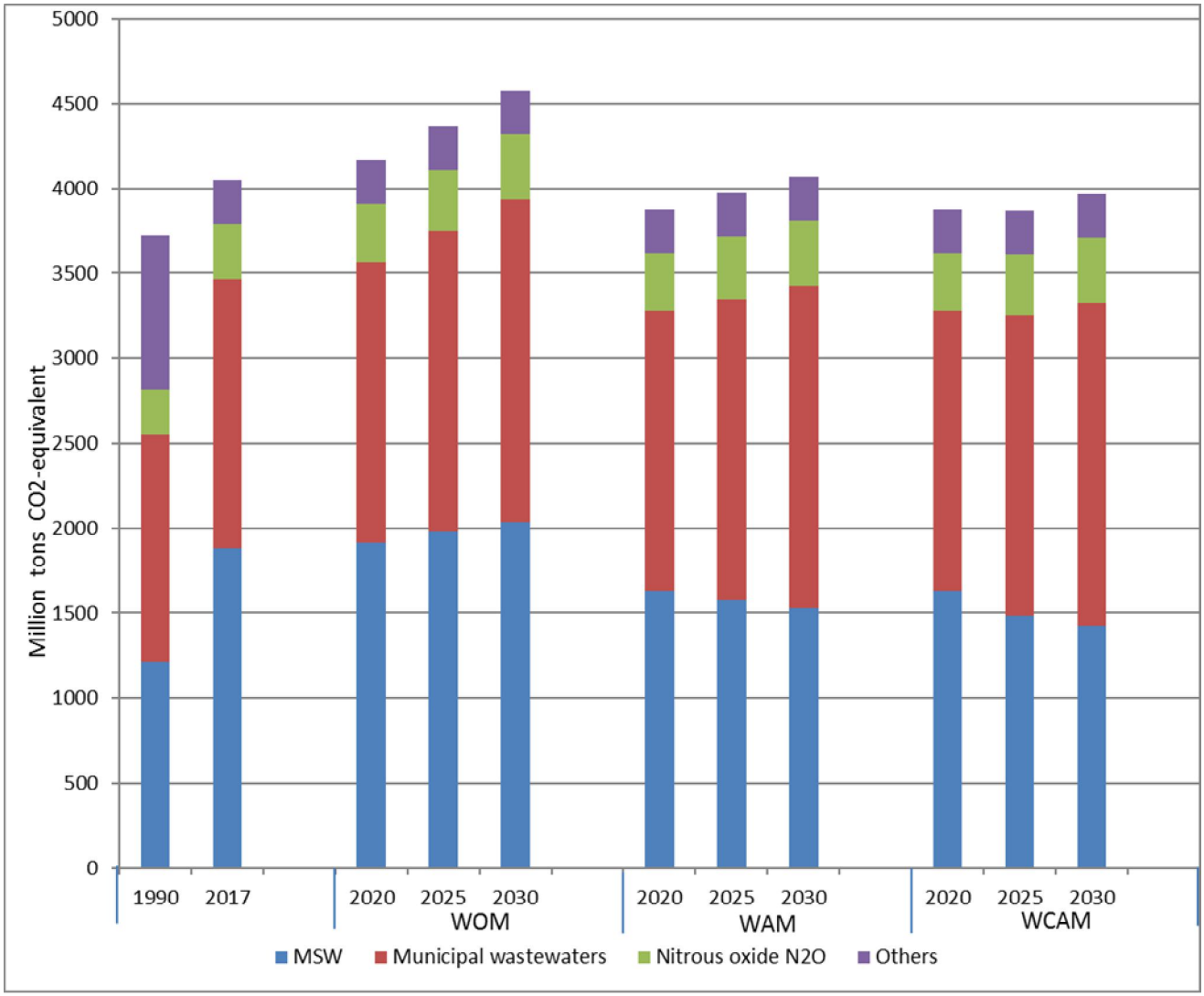


Figure 5.19. 'Waste management' sector GHG emissions under various scenarios until 2030

The above reflects summarized calculation results for the 'Waste management' sector under the three scenarios until 2030 along with the emission levels for 1990 and 2017 (Fig.5.19).

As seen from Figure 5.19, the 'Waste management' sector emissions exceed the greenhouse gas emissions for 1990, the inventory year 2017 and all three scenarios until 2030.

Thus, the difference between scenarios with additional measures and without measures can reach about 0.5 million tons of CO2eq by 2030. Table 5.22 shows the numerical values of emissions from the 'Waste management' sector illustrated by Figure 5.19.

Table 5.22. Projections of GHG emissions from the 'Waste management' sector under various scenarios until 2030, Mt CO2eq.

	Actual emissions		WOM (without measures)			WCM (with measures)			WCAM (with additional measures)		
	1990	2017	2020	2025	2030	2020	2025	2030	2020	2025	2030
Other (Industrial wastewater and medical waste incineration), thous. tons of CO2	908	257	257	257	257	257	257	257	257	257	257
Solid waste, thous. tons of CO2	1,213	1,881	1,917	1,977	2,037	1,629	1,582	1,528	1,629	1,483	1,426
Municipal waste water, thous. tons of CO2	1,338	1,582	1,649	1,768	1,895	1,649	1,768	1,895	1,649	1,768	1,895
Nitrous oxide emissions, thous. tons of CO2	263	330	339	364	390	339	364	390	339	364	3,890
Total, thous. tons of CO2	3,723	4,050	4,162	4,366	4,579	3,874	3,971	4,070	3,874	3,872	3,968

As can be seen from Table 5.22, the scenario with additional measures does not achieve the 1990 removal levels. Under the scenario with additional measures, emissions from the 'Waste management' sector will be approximately 5% higher than the 1990 levels by 2030.

VI. FINANCIAL RESOURCES AND TECHNOLOGY TRANSFER

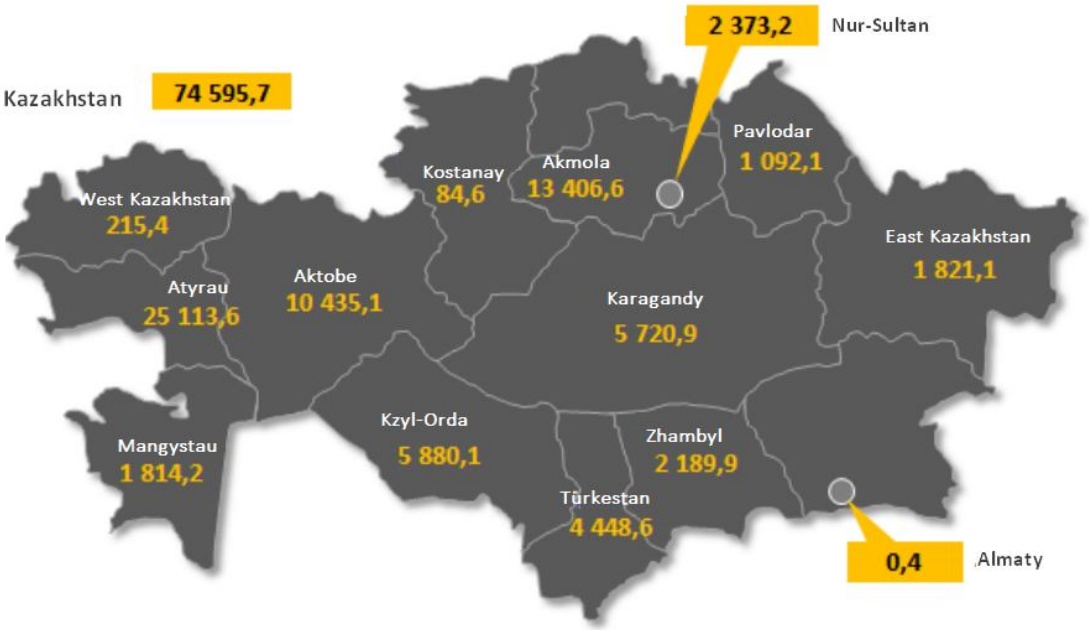
6.1. New and additional financial resources

In 2017, investments in the green economy of Kazakhstan amounted to KZT 32.5 billion. In 2018, this amount reached 80.2 billion, and a similar amount - 74.6 billion - was allocated during the first eight months of 2019[75].

Figure 6.1. Investments in environment protection, KZT bln

In January–August 2019, the heaviest investment was made in environmental protection in Atyrau oblast: KZT 25.1 billion (KZT 5.6 billion in the previous year), Akmola and Aktobe oblasts — KZT 13.4 billion and 10.4 billion respectively.

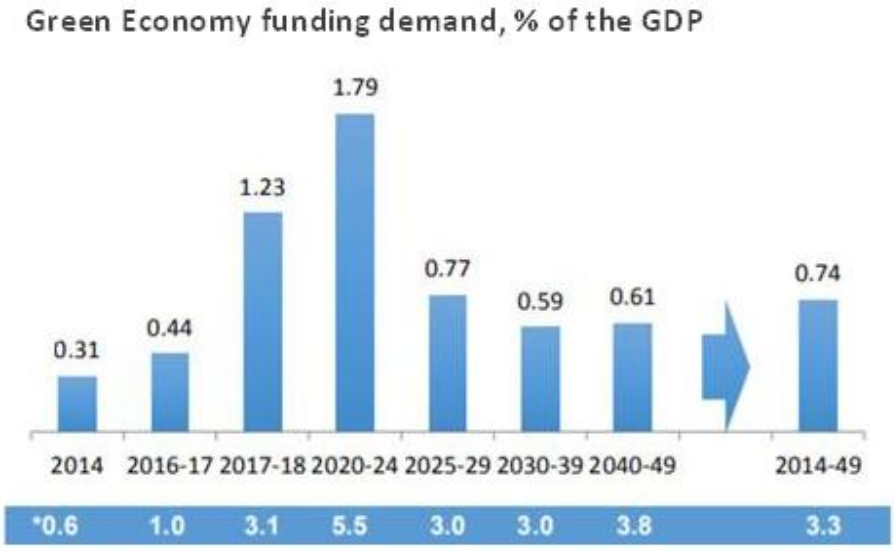
Figure 6.2 Investments in environment protection. January – August 2019 (KZT mln)



[75] Business and finance analytics portal Finprom.kz

At the same time, the average annual need for green economy funding amounted to USD 3.1 billion for 2017-2018, which is 1.23 % of GDP, [76]according to the Concept for transition of the RoK to green economy.

Figure 6.3. Green economy investment needs, % of GDP



*average annual funding demand for the period, billions USD, in 2010 prices
Source: Concept of transition of Kazakhstan to the Green Economy

Table 6.1. Investment needs by sector, USD

Key sectors	USD bln
Renewable energy and gas	52
Improving energy efficiency in housing and utilities sector, transport and industry	37
Improving efficiency of water management	14
Greenhouses	4
Introduction of advanced tillage methods in agriculture	4
Installation of dust and gas trapping equipment at power plants	4
Waste disposal program	4
TOTAL	119

[76] SAMRUK-KAZYNA Sovereign Welfare Fund. Green economy: realities and prospects in Kazakhstan

The Government of Kazakhstan cooperates closely with several international financial institutions, in particular, the European Bank for Reconstruction and Development (EBRD) and ADB, to elaborate an institutional framework for the development of renewable energy sources. Currently, the EBRD is the major investor in the green economy of Kazakhstan. The Bank's portfolio includes 25 projects in the country's energy sector. The total number of projects is 236 for a total investment amount of EUR 7.3 billion including 115 existing projects (EUR 2.7 billion), of which 43% focus on the energy sector. The EBRD has participated in Kazakhstan's largest solar (Burnoye solar power plant and its expansion project) and wind (Yereimentau wind power plant) projects in addition to funding renewable energy projects in Kazakhstan.

The latest renewable energy development project financed by the EBRD is the construction of the 14 MW Zadaria power plant in South Kazakhstan oblast. Urbasolar SAS, France, raised funds in the amount of approximately USD 12.7 million including USD 8.8 million from the EBRD and USD 3.9 million from the Foundation for environmentally sound technologies (FACT). Kaz Green Tek Solar, a specialized contractor, will implement the project. The power plant will be constructed in two stages over nine months, and its capacity will exceed 54,000,270 W of solar photovoltaic panels installed on an area of 30 hectares.

In October 2017, the EBRD received about USD 110 million from the Green Climate Fund (GCF), an international facility funded by 194 governments, which supports investment in emissions reduction and climate resilience initiatives in developing countries. The total expected investment under the Kazakhstan Renewables Framework supported by GCF and EBRD is USD 557 million including USD 214 million from the EBRD and USD 137 million from sponsors. The framework is expected to implement 8 to 11 renewable energy projects with a total capacity of 330 MW, which will reduce CO2 emissions by 12.9 million tons (GCF and EBRD, 2017)[77].

Table 6.2. The EBRD projects functioning in Kazakhstan from 2017 to 2019[78]:

Date	Name	Sector	Status	Financing
June 20, 2019	Kazakhstan Renewables Framework, Phase II	Energy	Approved	EUR 300 million
June 4, 2019	Gasification of Almaty oblast	Energy	Concept review done	KZT 10 billion
May 22, 2019	KAZREF – Zhanakorganskaya SPS-1	Energy	Signed	USD 7 million

[77] SAMRUK-KAZYNA SOVEREIGN WELFARE FUND. Green economy: realities and prospects in Kazakhstan
[78] https://www.ebrd.com/

March 19, 2019	KAZREF Universal Energy – Zhangiz Solar	Energy	Signed	USD 12 million
February 11, 2019	Solar power plant in Karaganda oblast	Energy	Signed	USD 26 million
November 6, 2018	KAZREF – Modernization of Karagandy Zharyk distribution networks	Energy	Approved	KZT 5 billion
October 1, 2018.	Modernization of the Beineu-Shymkent gas pipeline	Natural resources	Concept review done	KZT 130 billion
September 14, 2018	Sholakkorgan SPS	Energy	Financed	USD 42.5 million
August 29, 2018	Saran SPS	Energy	Financed	USD 52.7 million
August 29, 2018	KAZREF - M-KAT Green solar power plant	Energy	Refinanced	EUR 50 million
August 15, 2018	KAZREF - Nomad Solar solar power plant	Energy	Refinanced	EUR 23 million
December 29, 2017	Loan to Kazpetrol Group LLP for APG disposal	Natural resources	Signed	USD 80 million
February 17, 2017	Kyzyl Project	Natural resources	Financed	USD 140 million

In 2018, the EBRD supported four foreign investors in Kazakhstan in the field of renewable energy.

Table 6.3. Support to foreign investors in Kazakhstan in the field of renewable energy

Project title	**Project implementation**	**Loan amount**	**Co-financing amount**	**Venue**
Burnoye-2 SPS	United Green (Kazakhstan/United Kingdom)	USD 50 million	USD 10 million (Clean Technology Fund)	Zhambyl oblast
Zadaria SPS	Urbasolar (France)	USD 8.8 million	USD 3.9 USD	South Kazakhstan oblast
Baikonur SPS	United Green (Kazakhstan/United Kingdom)	USD 30 million	USD 10.4 million (Clean Technology Fund) USD 11.5 million (Asian Development Bank)	Kyzylorda oblast
Risen Solar SPS	Risen Energy (China)	USD 22 million	USD 5.8 million (Clean Technology Fund) USD 4.2 million (Green climate Fund)	Karaganda oblast
Nomad SPS	Total EREN (France), Access Infra Central Asia (UAE)	EUR 23 million (USD 27 million)		Kyzylorda oblast
Saran SPS	Joachim Goldbeck Holding (Germany)	USD 52.7 million		Karaganda oblast

Two projects on climate change of the European Commission totaling EUR 10.35 million have been implemented in Kazakhstan[79].

[79] Seventh National Communication and Third Biennial Report of the Republic of Kazakhstan to the UN Framework Convention on Climate Change

Table 6.4. European Commission projects on climate change

Project	Organization	Period	Amount
Energy saving and reduction of greenhouse gas emissions in Kazakhstan	EBRD	December 2013 - December 2019	EUR 3,250 million
Support for Kazakhstan's transition to green economy	UNECE, UNDP	April 2015 - November 2018	EUR 7,100 million

In 2017, UNDP Kazakhstan and Kazvodkhoz RSE under the Committee for Water Management of the Ministry of Agriculture of the RoK launched the joint project "Capacity development and awareness raising in irrigation water supply and drainage networks in Almaty and Turkestan regions", which is implemented within the framework of the "Restoration of irrigation and drainage" project between the Islamic Development Bank and the Government of the Republic of Kazakhstan.

Leveraging international cooperation, the project will contribute to the institutional and human capacity building of Kazvodkhoz RSE in the field of irrigation water supply practices, improved land use practices and raising farmers' awareness of sustainable land and water resources management methods. The project will develop economic and financial tools to improve the sustainability of the irrigation water supply industry and launch electronic billing and automation of irrigation water supply management processes.

Table 6.5. The Islamic Development Bank (projects portfolio)[80]

Project title	Loan amount	Timeframe
"Restoration of irrigation and drainage»	USD 143 million	September 9, 2017 – December 6, 2019
"Capacity building of the Committee for Water Management, Kazakhstan»	USD 9700	March 29, 2017 – December 6, 2019

[80] https://www.isdb.org/

The **OECD** project "Strengthening public finance capacity for green investments in the EECCA countries" promotes clean urban public transport. The expected outcome is an increase in urban public transport fleet by 1,827 units requiring an investment of USD 179.47 million (Phase 1). In Phase 2, the fleet is expected to grow by 2,783 units, which will require an investment of USD 275.89 million[81].

The program is expected to reduce greenhouse gas emissions and air pollution:

- Estimated CO2 emissions reduction against the baseline: 68,367 tons/year (27.2 %).
- Estimated NOx emissions reduction against the baseline: 1,724 tons/year (83.5 %).
- Estimated PM2.5 emissions reduction against the baseline: 50 tons/year (98.2 %).
- Estimated SO2 emissions reduction against the baseline: 39 tons/year (83.3 %).
- Estimated CO emissions reduction against the baseline: 315 tons/year (56.1 %).

6.2. Assistance to developing country Parties particularly vulnerable to adverse climate change impacts

Due to dynamic improvement of the state economic situation and recognizing its responsibility in international and regional relations, the Republic of Kazakhstan is ready to solve global and regional issues of sustainable development and to strengthen its role in the world arena. As a regional economic leader, Kazakhstan considers participation in international efforts to assist global development an essential component of its foreign policy.

According to the President's Decree dated January 31, 2017, “On approval of key areas of the RoK national policy for official development assistance for 2017-2020”, strategic priorities include “stabilization of socio-economic and political situation in partner countries, prevention of illegal migration, countering terrorism and extremism, establishment of neighborliness, strengthening international positions and positive image of Kazakhstan”[82].

Currently, Kazakhstan renders humanitarian aid and assistance for the development of Central Asian countries, and, to a much smaller extent, to Latin America and South-Pacific countries. In February 2017, the launch of a pilot project was announced within the framework of the national official development assistance system.

The project is aimed at strengthening economic independence of Afghan women and includes educating Afghan citizens in Kazakhstan in such highly demanded areas as public administration and healthcare, with a focus on maternal and child health The Ministry of Foreign Affairs is the leading public body of the Republic of Kazakhstan responsible for the implementation of this project. Apart from MFA, the project involves several divisions of the Ministry of Education and Science and the Agency for Civil Service Affairs and Anti-Corruption.

[81] https://www.oecd.org/
[82] Ministry of Foreign Affairs of the Republic of Kazakhstan

The promoted project features financial support provided by such partners as UNDP and Japan. Kazakhstan, for its part, is responsible for implementation, namely trainings, professional development, knowledge transfers, etc. This project complements the Kazakhstani initiative for educating 1000 Afghan students in Kazakhstani colleges and universities until 2020.

According to the Committee for Foreign Affairs, Defense and Security, over USD 350 million have been allocated for assistance to other countries.

6.3. Membership fees and voluntary contributions

Table 6.6. Mandatory membership fees paid by Kazakhstan to UNFCCC, %

2018	2019
0.186	0.186

Source: https://unfccc.int/resource/docs/2017/sbi/eng/07a01.pdf

Table 6.7. Mandatory membership fees paid by Kazakhstan to Kyoto Protocol, %

2018	2019
0.248	0.248

Source: https://unfccc.int/resource/docs/2017/sbi/eng/07a01.pdf

Table 6.8. Kazakhstan's voluntary contributions to UNEP, USD

2017	2018	2019
100,000	100,000	100,000

Source: https://www.unenvironment.org/about-un-environment/funding-and-partnerships/why-invest-us/your-contributions

Table 6.9. Kazakhstan's voluntary contributions to UN, USD

2016-2017	2018-2019
286,500	286,500

Source: https://undocs.org/en/ST/ADM/SER.B/973

6.4. Technology transfer

In June - September 2017, Kazakhstan hosted ***Astana EXPO-2017 "Future Energy"*** international exhibition. The Ministry of Energy selected 28 domestic developments in renewable energy, waste management and energy efficiency; they were displayed at the Kazakhstan pavilion during the EXPO. Kazakhstan is planning to implement the best technologies displayed at other pavilions of Astana EXPO-2017 in its economy. To that end, the Ministry of Energy has set up an expert working group

involving representatives of national companies and expert analysts. The group has made a list of 105 technologies divided into 4 areas: oil and gas (27); coal and nuclear industry (5); electric energy, energy saving and renewables (44) and environment protection (29). Business entities, universities and akimats will implement the technologies.

6.5. Challenges and gaps, and the related needs for finance, technologies and capacity-building

Adaptation measures in agriculture deserve more attention when financing and technology are attracted. Disaster prevention and preparedness activities remain outside the scope of climate finance. With regard to UNFCCC reporting, the national agency still needs support from the Global Environment Facility.