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Evaluation of Mitigation / Adaptation policy portfolios for Republic of Kazakhstan

KAZHIMINVEST

Authors: Dr. Lyubov Inyutina,
Yekaterina Salytuina MSc., Ayagoz Sultankulova MSc.
SRC KAZHIMINVEST

Co-authors: Anna FLESSA M.Sc.
National and Kapodistrian University of Athens-energy Policy and Development Centre

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ADB	Asian Development Bank
CMP	Conference Meeting of the Parties
CHP	Combined Heat and Power
CRF	Country Reporting Format
CIS	Commonwealth of Independent States
DNA	Designated National Authority
EU	European Union
EE	Energy Efficiency
IEA	International Energy Agency
IPCC	Intergovernmental Panel for Climate Change
GDP	Gross Development Product
GEF	Global Environment Facility
GWP	Global Warming Potential
GHG	Greenhouse gas
GOK	Government of Kazakhstan
HDI	Human Development Index
HPP	Hydro Power Plants
KazNIIEK	Kazakh Research Institute of Ecology and Climate
KZT	Kazakhstan Tenge (Currency)
KP	Kyoto Protocol
LULUCF	Land use, land-use change and forestry
MEP	Ministry of Environmental Protection
MINT	Ministry of Industry and Innovative Technologies
NAP	National Action Plan
RES	Renewable Energy Sources
OPT	Optimistic Scenario
PES	Pessimistic Scenario
RK	Republic of Kazakhstan
PFIID	Program of Forced Innovative Industrial Development
SBI	Subsidiary Body for Implementation
TPES	Total Power Energy Supply
TFC	Total Fuel Consumption
UNFCCC	UN Framework Convention on Climate Change
UK	United Kingdom
UNDP	United Nations Development Program
WMO	World Meteorological Organization

ASSESSMENT OF THE THREE DEVELOPED SCENARIOS FOR KAZAKHSTAN, THROUGH THE MULTI - CRITERIA METHOD AMS

General comments

Each scenario will be assessed for its performance under the criteria/sub-criteria of the AMS method which is the combination of three standard multi-criteria methods: the Analytical Hierarchy Process (AHP), the Multi-Attribute Utility Theory (MAUT) and the Simple Multi-Attribute Ranking Technique (SMART) (P.Konidari and D.Mavrakis, 2007; 2006). AMS is developed for evaluating climate policy instruments (PI) or relevant Policy Mixes (PM) and with suitable modification for evaluating their interactions as well.

Required data

The LEAP provides the following outcomes for all three scenarios:

Table 3: Total emissions for the country

Scenario	Total GHG emissions (in $MtCO_2eq$)		
	2000	**2020**	**2050**
BAU	143.7	386.1	945.6
Opt	143.7	335.8	763.4
Pes	143.7	372.4	988.8

Table 4: Emissions per sector for the country

Scenario	GHG emissions (in $MtCO_2eq$)		
Households			
	2000	**2020**	**2050**
BAU	0.7	16.4	37.7
Opt	0.7	14.6	26.4
Pes	0.7	17.5	42.4
Agriculture			
BAU	1.7	1.9	1.9
Opt	1.7	1.8	1.8
Pes	1.7	2.0	2.0
Non specified			
BAU	11.6	65.0	176.1
Opt	11.6	58.1	147.3
Pes	11.6	60.9	171.5
Industry			
BAU	5.2	16.0	43.2
Opt	5.2	14.7	35.0
Pes	5.2	16.2	56.2
Transport			
BAU	9.2	23.4	63.5

Opt	9.2	20.9	59.3
Pes	9.2	20.7	58.0
Electricity generation			
BAU	37.4	85.0	104.3
Opt	37.4	73.3	94.8
Pes	37.4	86.1	139.1
Heat Production			
BAU	38.5	44.2	59.6
Opt	38.5	37.6	50.7
Pes	38.5	40.6	54.8

Table 5: Other environmental effects for the country under each scenario

Scenario	Million Metric Tons CO_2 eq.		
	2000	2020	2050
Environmental effects (Carbon Monoxide (CO)- Nitrogen Oxides (NOx)- Non Methane Volatile Organic Compounds- Sulfur Dioxide)			
BAU	1.8	5.8	48.9
Opt	1.8	4.6	27.6
Pes	1.8	4.62	28.1

Table 6: Water Use

Scenario	Km3		
	2000	2020	2050
Agriculture			
BAU	14.1	9.7	5.6
OPT	9.7	12.4	12.2
PES	5.6	17.1	16.9

Assignment of grades

Criterion 1: Environmental performance
Direct contribution to GHG emission reductions: For this sub-criterion, the outcome of LEAP for the total expected GHG emissions in year 2020 are used (Table 3). The scenario with the fewer amounts of emissions has the best performance for this sub-criterion.
(the assigned grades are BAU- 386.1;OPT- 335.8; PES-372.4)

Indirect environmental effects: The total amount of the total environmental effects provided by LEAP (Table 5) is used to assess the sub-criterion.
(the assigned grades are BAU- 5.8;OPT- 4.6; PES-4.62)

As a next step, the 2020 data is entered in ClimAMS (with negative value) to calculate respectively the direct effect on GHG emissions and indirect environmental effects.

Criterion 2: Political acceptability

Each scenario is evaluated against each of the five sub-criteria of this criterion.
For ***cost efficiency*****:** For the first sub-criterion the mean CEI for each sector was calculated depending on the policy instruments that were under each scenario. Each value was multiplied with the respective amount of GHG emission reductions that were estimated by LEAP outcomes. The reductions were calculated against those of the BAU scenario for each sector.

Concerning adaptation, due to no available data these were not calculated for Kazakhstan. Additionally, there were no specific measures for the described sectors in the respective previous session about the adaptation needs of the country that could be taken into consideration. The total values are inserted in ClimAMS, but as positive ones.

The policy portfolio with the lowest total cost is the one with the best performance for year 2020.

Table 7: Mean CEI for each sector depending on the policy instruments of the BAU scenario

Mitigation					
Scen.	**Sector**	**Technological options**	**Policy Instrument**	**CEI**	**Mean CEI**
BAU	buildings	-	-	-	
	Industry	-	-	-	
	Transport	-	-	-	
	Energy	Promotion of RES technologies	Regulatory standards /2010, Law No. /2009	-0.75	(-0,75-0,75)/2= -0,75
		Energy management	Regulatory standard (law on electricity/2010).	-0.75	

Table 8: Mean CEI for each sector depending on the selected policy instruments of the OPT scenario

Mitigation					
Scen.	Sector	Technological options	Policy Instrument	CEI	**Mean CEI**
OPT	Buildings	EE technologies	Performance standards (Law No 541/2012; GOK Decree No.	-5.75	(-5.75-2.5-2.5-1.5)/4= -3.063
		Energy efficiency lighting	Performance standards (Law No. 541/2012).	-2.5	
		Energy efficient appliances	Performance standards (Law No. 541/2012).	-2.5	
		EE technologies	Building Isolation requirements (Law No 541/20102; regulation 1181/2012)	-1.5	
	Industry	Energy efficiency technologies	Voluntary agreements (Law No.541/2012).	0	(+4+1.25-4-0.25-0)/5=0.2
		Promotion of RES and EE technologies	Tradable permits/carbon trading (Law No505/2011).	-0.25	
		Energy Management	Performance standards ISO 50001(Law No 541/2012; GOK Decree NO.1129/2010).	-4	
		Best technologies for decreasing air pollution	Technological or design standards Law No.541/2012;GOK Decree No.127/2010)	+1.25	
		Support to research	Law No 541/2010.	+4	
	Transport	Energy efficiency	Fuel switch (promotion of gas and biofuel)	+0.25	(0.25-0.5-0.25+0.25+0.5)/5= -0.05
		EE vehicles	Fuel quality standard s Euro-3 (GOK Decree No1048/2010).	-0.5	
		EE vehicles	Subsidy(proposed)	-0,25	
		Energy efficiency	Behavior change-proposed (GOK	-0.25	

			Decree No.1404/2010)		
		Energy efficiency	Performance standards (transport management, speed limits) – Planned - Proposed	+0,5	
	Energy	Promotion of RES technologies	Feed-in Tariffs(raft regulation)	-0.25	(-0.25+0.75+1.25-0.25-0.75)/5= - 0.15
		Promotion of RES technologies	Regulation standards Law No.165/2010; GOK Decree No.127/2010; No.922/2010)	-0.75	
		Best available Technologies for restricting air pollution	Technological or design standards (proposed); regulation No.127/2010)	+1.25	
		Promotion of RES and EE technologies	Tradable permits (Internal trading, Law No.505/2011)	-0.25	
		Energy management	register, performance Standards (Law No.541/2010)	-0.75	
Adaptation					
OPT	Agriculture	Irrigation systems, plantations	Subsidy -Proposed	+0,5	(0,5-1/6)/2=0.167
			Awareness	-1/6	
	Water management		Land management, regulation GOK Decree No.924/2010)	-1/6	-1/6=-0.167
	Forestry		Land management, forestation (GOK Decree No.924/2010)	+0,5	+0,5

Table 9: Mean CEI for each sector depending on the selected policy instruments of the PES scenario

Mitigation					
Scen.	**Sector**	**Technological options**	**Policy Instrument**	**CEI**	**Mean CEI**
PES	Buildings	EE appliances	Performance standards at home (Law No.541/2010)	-2.5	(-2.5-2.5-5.75)/3= -3.583
		Energy	Performance standards (	-2.5	

		efficiency lighting	Law No541/2010).		
		Energy management	Performance standards (law No541/2010).	-5.75	
	Industry	Best available technologies for restricting air pollution	Technological or design standards (GOK Decree No.127/2010.)	+1.25	+1.25
	Transport	Energy efficiency	Fuel switch (promotion of gas and biofuel), GOK Decrees No.127/2010;1129/2010)	+0.25	(+0.25-0.5)/2= -0.125
		EE vehicles	Fuel quality standards (Standards Euro-3, regulation No.1048/2010)	-0.5	
	Energy	Promotion of RES technologies	Feed-in Tariffs(draft regulation)	-0.25	(-0.25-0.25+-0.75+0.75+1.25)/5= -0.15
		Promotion of RES and EE technologies	Tradable permits (internal carbon trading), Law No. 505/2011	-0.25	
		Promotion of RES technologies	Regulation standards (regulation 2010)	-0.75	
		Energy management	register, performance Standards(proposed)	-0.75	
		Best available technologies for restricting air pollution	Technological or design standards (regulation regulation No.127/2010)	+1.25	
Adaptation					
	-	-	-	-	-

Table 10. Overall cost efficiency for the three scenarios

Scen	Mitigation/Adaptation Cost										Total
	Buildings		Industry		Non-Specified		Transport		Energy		
	M	A	M	A	M	A	M	A	M	A	
BAU	0	0	0	0	0	0	0	0	0.75	0	0.75
OPT	3.063	0	0.2	0	0	0.5	-0.05	0	-0.15	0	3.563
PES	-3.583	0	1.25	0	0	0	-0.125	0	-0.15	0	4.558

For "***dynamic cost efficiency***" – renewable energy technologies and energy efficient appliances and equipment are encouraged mainly in the OPT scenario. The other two scenarios perform badly in this sub-criterion since there are no policy instruments to promote these technologies. Research efforts for EE technologies are promoted in OPT scenario. The assigned grades: BAU – 4, OPT – 5 PES – 4.
For "***competitiveness***" - In the Republic of Kazakhstan a more favorable business environment is created in the OPT scenario due to the potential incorporation of RES feed-in-tariffs for RES promotion and EE technologies into national legislation.
OPT through emission trading attempts to support investments for RES and EE technologies. However, without defined priorities for JI projects and more incentives foreign private investors are not encouraged. Without policy instruments for the agricultural sector so as to face climate change impacts, there will be a need to restrict production or change types of products.
The competitiveness of the country in attracting investments for RES was very low in 2012. The assigned grades are: BAU – 4, OPT – 5 PES – 4.
For "***equity***"- Taking into consideration the need to compare the scenarios under a regional level the ratio GHG emission reductions in MtCO2eq to capita is calculated for each scenario. In the Opt scenario almost all sectors participate in contributing to emission reductions.

Table 11: Equity measurement

Scenario	Total amount of 2020 GHG emissions (Mt CO2-eq)	Reductions compared to BAU	Population in 2020(in millions)	Ratio reductions t CO2eq per capita
BAU	386.1	0	17.8	0
OPT	335.8	50.3	17.8	2,825
PES	372.4	13.7	17.8	0,770

For "***flexibility***" - The scenarios are compared towards the incentives and the options that they offer to target groups. The Opt scenario offers more options (subsidies and feed-in-tariffs) compared to the other two ones. So, BAU – 4, Opt – 5, Pes – 4.
For "***stringency for non-compliance***" - the scenarios do not foresee penalties, fees on another sanctions. So, all are assigned with 4.

Criterion 3: Feasibility of Implementation

The scenarios were evaluated against 3 sub-criteria.
For the "***implementation network capacity***", the scenarios have a poor performance. There is limited number of official reports regarding climate change policy issues for the country.
The following entities form the implementation network in Kazakhstan:
- Ministry of Environment Protection[1] ;
- Ministry of Industry and New Technologies[2];
- Ministry of Agriculture (Water resources Committee)[3];
-Ministry of Transport and Communication[4];

[1] www.eco.gov.kz/moos/

2 www.mint.gov.kz/

[3] www.minagri.kz/

[4] mtc.gov.kz/

-Ministry of oil and Gas[5];
-Ministry of Regional development (Agency on Housing Utilities and Construction[6]);
-- Agency on Natural Monopolies[7];
- Agency of National Statistics[8].
For implementing a stricter national climate policy the implementation network needs to be reinforced, educated and to increase its capacity building. The assigned grades are: BAU – 4, OPT – 3, PES – 3.

For "***administrative feasibility***", the scenarios have a poor performance. The existing policy portfolio is not characterized by readiness in achieving its tasks. First National Communication under the UNFCCC (1998), Second National Communication under the UNFCCC (2009), Third National Communication under the UNFCCC (under development), National Inventory Reports for the period 1990-2009 (2010). The preparation of a National Action Plan for Renewable Energy Sources is also delayed. The problems presented in the session about the "Main characteristics of the BAU scenario" reflect also the poor performance of current policy portfolio in this sub-criterion. The assigned grades are: BAU – 4, OPT – 4, PES – 4.

For "financial feasibility", the scenarios have again poor performance. The country has limited financial sources to implement any of the three policy portfolios. The grades are: BAU – 3, Opt – 5 and Pes – 4.

Results

Figure 46: Score of best aggregate performance.

Criteria	Env. Performance	Polit. Accept.	Feasibility Implementation
Env performance	1	0.2	2
Political. accept.	5	1	7
Feasible. Impl.	0.5	0.143	1
Column sum	6.5	1.343	10

Criteria	Env.Perf.	Polit./Accept.	Feas. Impl.	Row sum	Weight coefficient
Env.Perform.	0.154	0.149	0.200	0.503	0.168
Polit.Accept.	0.769	0.745	0.700	2.214	0.738
Feas/Implem.	0.077	0.106	0.100	0.283	0.094

[5] www.mgm.gov.kz/

[6] ads.gov.kz/

[7] www.arem.gov.kz/

[8] www.stat.kz/

Table 12: AMS results for each scenario

Criteria	Scenarios		
	BAU	**Opt**	**Pes**
Direct contribution to GHG emission reductions (0.833)	386.1	335.8	372.4
Indirect environmental effects (0.167)	5.8	4.6	4.62
Environmental performance (0.168) - A	**391.9**	**340.4**	**377.02**
Cost efficiency	0.75	3.563	4.558
Dynamic cost efficiency	4	5	4
Competitiveness	4	5	4
Equity	0	2.825	0.77
Flexibility	4	5	4
Stringency for non-compliance	1	1	1
Political acceptability (0.738) - B	**13.75**	**22.388**	**18.328**
Implementation network capacity	3	4	4
Administrative feasibility	4	4	4
Financial feasibility	3	5	4
Feasibility of implementation (0.094) - C	**10**	**9**	**12**
Total (A+B+C)	**415.65**	**371.788**	**407.348**

Comments

The results for each scenario are presented in the Table 12. The final grades demonstrate which of the three M/A policy portfolios has the better performance in responding to the climate change policy needs of the country taking into consideration the national framework.

References

Konidari P. and Mavrakis D., 2007. A multi-criteria evaluation method for climate change mitigation policy instruments, Energy Policy 35, pp. 6235–6257

Conclusions

This report concerns the development and assessment of three (3) climate change mitigation and adaptation policy scenarios for the Republic of Kazakhstan. Each of them is characterized by a different policy portfolio and is named after it as Business As Usual (BAU), Optimistic (OPT) and Pessimistic (PES).

All scenarios of this report take into consideration the following national objectives: i) more than 3% share of RES in the total energy mix by 2020. ii)As an Annex I Party, Kazakhstan has taken at the end of 2012 the 5% commitment to reduce its GHG emissions towards 1990 under the Kyoto Protocol for the period 2013-2020.

According to the national data provided by the Ministry of Environment Protection in the "National report on GHG Inventory for 1990-2009", issued in 2011, the UNFCCC database for the GHG emissions of Kazakhstan, the country has reduced its national emissions, in particular the GHG emissions of 2009 without LLUCF are 75, 3% compared to those of the base year 1990.Emissions per capita were 17.3 tons of CO_2 (2009).

BAU scenario

The BAU scenario concerns the time evolution of the already implemented mitigation and adaptation policy instruments (set into force before 31 December 2010) in Kazakhstan until the year 2050 and serves as the reference against which the outcomes of the other scenarios are compared.

The currently implemented mitigation policy has three main components:

- Penetration of RES in the national energy mix,
- Support to increase energy efficiency and energy saving;
- Formal GHG emission reductions through internal carbon trading/JI projects (non projects by this moment).

Concerning the adaptation policy, there are no relevant implemented policy instruments.

According to the outcomes of the model Long range Energy Alternatives Planning System (LEAP) for the BAU scenario in 2020 the GHG emissions are 386.1 MtCO2eq., the total primary energy consumption is 75.56 million toe (2020),it is increases 2,2 times compared to that of year 2009.The share of RES in the total energy mix by 2020 is 0,28 %.

OPT scenario

The OPT scenario concerns the time evolution of an enhanced Mitigation/Adaptation policy portfolio that Kazakhstan will implement during the time interval 2011 - 2050. It co insist with principles of "Green Economy Growth" path approved by GOK. This enhanced policy portfolio takes into account the policy instruments adopted after the 1st January of 2011 as well as plans of the country and supports: i) the introduction of efficient technologies in almost all sectors targeting to the maximum reduction of GHG emissions through the maximum exploitation of the potential of the country in energy efficiency and renewable energy sources and ii) the necessary infrastructure for the adaptation of the country towards the minimum – in size and extent - expected climate change impacts; iii) development of regulation to support Post-Kyoto.

The policy portfolio of this scenario includes legislation on EE improvements and RES support which will reinforce the implementation of the aforementioned policy components in BAU.

The adaptation policy instruments will meet adaptation needs in the agricultural sector and in water and forest management.

Based on the outcomes of the LEAP model the OPT scenario demonstrated 10,1% of RES share in total energy mix by 2020. In this scenario the total primary energy consumption is reduced by 7, 5% compared to BAU in 2020 (TPC=69,91million toe in 2020). This is due to the following reasons: i) there is limited information within the country regarding energy efficient technologies and practices that does not allow the achievement of the required amount of energy savings; ii) aged equipment and infrastructure are responsible for losses and without the necessary amount of investments there will be gradually higher losses; iii) there are not yet official reports concerning the estimation of the potential in energy savings per sector and activity.

The GHG emissions in 2020 are 335,8MtCO_2eq, which is less 50.3 MtCO2eq compared to those of the BAU scenario.

PES scenario

The PES scenario concerns the time evolution of a Mitigation/Adaptation policy portfolio that the country will implement up to 2050 without exploiting fully the national potential in energy efficiency and renewable energy sources and by facing the worse expected impacts of climate change, taking into account the policy instruments adopted after 1st January 2011.

This scenario assumes less ambitious mitigation policy by limiting the possible technological options only to a selected number of sectors with the highest energy efficiency potential and the most promising for the country types of RES, development of JI projects and few regulation documents to support Post-Kyoto. The scenario considers the implementation of all policy instruments approved, but no additional ones apart from the national priorities.

Despite the huge needs of adaptation, there are no planned adaptation policy instruments.

The outcomes of LEAP for this scenario provide a 3,5% share of RES in the total energy mix of year 2020, and 2,07 times increase in the total primary energy consumption compared towards 2009 (*74.34 million toe per LEAP results).* GHG emissions in 2020 are 372.4 MtCO2eq (more than OPT, less than BAU, less 13.7 Mt CO_2 towards BAU scenario).

Assessment outcomes

Using the multi criteria method AMS, the three (3) policy portfolios were assessed against their environmental performance (amount of GHG emissions and secondary environmental effects), political acceptability (attitude of the involved entities (target groups) towards the relevant policy portfolio) and feasibility of implementation (applicability of the policy portfolio from the point of the governmental and national pertinent entities).

The BAU scenario drives to the largest amount of GHG emissions and to the lowest indirect environmental effects. The OPT scenario demonstrates lower GHG emissions and lower indirect environmental effects.

The OPT scenario has the best performance in political acceptability since it is the most cost effective for the target groups (residential, industrial, energy and transport sectors) compared to the other two policy portfolios. OPT encourage the introduction of innovative technologies, such as solar, biomass, wind, and promote the research. In BAU, innovations are not encouraged.

The implementation network (the governmental and national entities that will implement the policy instruments) does not provide the relevant information for climate change policy issues

in none of the three policy portfolios. It is copying with the currently implemented policy portfolio, but it fails to respond properly in the cases of OPT and PES.

This is justified by the fact that BAU includes a limited number and relatively simple policy instruments, but the other two scenarios have a larger number of policy instruments, the majority of which require a more capable implementation network.

Given the above, the Mitigation/Adaptation policy portfolio which characterizes the Optimistic scenario is the one that reaches the targets of the climate change policy of Kazakhstan in terms of obligations to Kyoto Protocol to reduce GHG emissions 5% towards 1990. In OPT scenario GHG emissions reduction achieved 7% in 2020. The success of this policy portfolio requires the demonstrated effectiveness of the implementation network and a more stringent frame for non-compliance.

In this report, the component of adaptation in climate change policy is not fully developed because the country hasn't set an adequate framework to reduce its vulnerability to climate change. Moreover, the design and assessment of relevant policy instruments require data related to the frequency of extreme events, low-income groups, biodiversity, the health sector, etc., which are not available at the moment.

In conclusion, the scenarios of this report were developed under the same assumptions for the evolution of GDP and population for the period 2011-2050.

Kazakhstan announced initiative of Green Bridge and is preparing for Expo 2017 to be held in Kazakhstan, also has ambition of becoming one of the top-30 most developed countries. By 2050 it is expected to create 450.000 jobs, the establishment of new industrial and service sectors. The shift will require increase of investments, more intensive in the period up to 2025. equaling 3-4 billion USD per year(or 1-2% of GDP).

The following measures in the sectors of economy are important:

a) water: improvement water piping infrastructure; improve irrigation effectiveness;

b) agriculture: decrease of land degradation by better financing mechanisms, including attractiveness of foreign investors;

c) energy demand(transport, buildings, industry): introduction of high technical standards for energy efficiency, improvement market conditions;

d) energy supply: further diversification of coal-based electricity sector, support RES, upgrade and retrofit of existing coal plants with modern efficient equipment; introduce more gas into electricity generation(improvement gas infrastructure); introduction of cleaning equipment, filters for energy sector and transport;

e) forestation increase; management of wastes improvement