ICAT Kyrgyzstan Project

Deliverable :

Projections of GHG emissions for transport sector

Ministry of Natural Resources, Ecology and Technical Supervision of the Kyrgyz Republic

ICAT Initiative for Climate Action Transparency

Initiative for Climate Action Transparency – ICAT

Diagnosis/Scoping report containing the scope in activity 1

Deliverable #1 and 2 (Del. 5 and 6 according to workplan numbering): Reports of projections of GHG emissions for Transport sector , including methodology on GHG emissions projections)

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1. Develop a basis for forecasting emissions. Diagnostic report for the "Transport" sector.

Introduction

The Kyrgyz Republic is making significant efforts to modernize the transport sector, which is in line with national goals under the Nationally Determined Contributions (NDCs). In accordance with the Main Directions for the Development of the Road Sector for 2023-2030, the Concept [1]for the Development of Automobile Transport of the Kyrgyz Republic for 2020-2024, With the Main Directions of Development of Railway Transport for 2022-2026 and other projects, the Government of Kyrgyzstan is implementing measures to improve infrastructure, increase energy efficiency and reduce greenhouse gas (GHG) emissions. An important element of these efforts is the implementation of the ICAT initiative, which aims to increase the transparency of climate action and develop mechanisms for monitoring GHG emissions in the transport sector.

The purpose of this report is to analyze the current situation in the transport sector of the Kyrgyz Republic in order to determine the current status of data collection, data sources, relevant institutional mechanisms for data collection and processing, and to develop a forecast of GHG emissions up to 2050 in accordance with the linear interpolation methodology and GACMO.

1.1 Situation analysis: Transport of the Kyrgyz Republic

The transport sector of Kyrgyzstan plays a key role in the country's economy and up to 40 million tons of various cargo and up to 640 million passengers are transported annually.. About 98% of passenger and more than 96%[2] of freight transportation is transported by road, However, the intensive use of transport, especially motorised road transport, leads to significant GHG emissions.

1.1.1 Highways: According to the Ministry of Transport and Communications of the Kyrgyz Republic (MTC), the total length of motorways is about 34,000[3] km, of which 19,000 km are public roads. Public roads, according to their economic and administrative purposes, are divided into motorways of international importance with a total length of 4,326 [4]km, national importance - 5,335 km and local importance - 9,149 km. The length of public roads with hard surfaces is 7,580[5] km, including 10 km of cement concrete, 5,698[6] km of asphalt concrete and 1,871 km of black gravel. Roads with gravel surfaces - 9,388 km. There are still unpaved roads, the total length of which is 1,617 km.

Due to underfunding of the road sector, during the period from the moment the Kyrgyz Republic acquired sovereignty until 2005, the technical condition of public roads remained critical. Stabilization of funding for the road sector was carried out during 2005–2007.

From 2006 to 2010, the budget for construction, repair and maintenance of public roads and the road sector increased by 7.7 times, which made it possible to improve the condition of bridges, large pipes of various sizes, more than 630 km of roads with asphalt concrete and black gravel surfaces and more than 200 km of gravel roads.

The period from 2010 to 2020 is characterized by relative stability of both institutional and financial foundations, under established conditions of insufficient funding from the budget.

[1]https:// https://cbd.minjust.gov.kg/200412/edition/992545/ru
[2] https://cbd.minjust.gov.kg/159966/edition/1232114/ru
[3] https://cbd.minjust.gov.kg/159966/edition/1232114/ru
[4] https://cbd.minjust.gov.kg/159966/edition/1232114/ru
[5] https://cbd.minjust.gov.kg/159966/edition/1232114/ru
[6] https://cbd.minjust.gov.kg/159966/edition/1232114/ru

The further stable functioning of the road sector largely depends not only on the volume of funding, but also on the quality of the solution of the tasks set in achieving the goals of development of the road sector within the framework of the Main Directions for Development of the Road Sector of the Kyrgyz Republic until 2030.

As part of the modernization of the road sector, active development of infrastructure is underway, including the rehabilitation of international road transport corridors and the introduction of intelligent transport systems (ITS).

1.1.2 Automobile transport is the most important element of the transport system of the republic, the effective functioning of which creates the necessary conditions for the modernization and innovative development of the national economy, to ensure the satisfaction of the transport needs of the population, as well as for the integration of the Kyrgyz Republic into the world economic system. The strategic goal of the automobile transport industry is the full and high-quality satisfaction of the needs for freight transportation in all sectors of the economy, increasing the mobility of the population, ensuring the safety of passenger and freight transportation. In the highlands and due to the inaccessibility of the regions of the country, automobile transport is the main mode of transport in the Kyrgyz Republic. During the implementation of the Concept of Development of Automobile Transport of the Kyrgyz Republic for 2020-2024, it is expected to adopt a number of new regulatory legal acts, create conditions for the renewal of rolling stock, improve the infrastructure of automobile transport and reduce the harmful impact of automobile transport on the environment.

According to the Ministry of Transport and Communications of the Kyrgyz Republic, there are more than 1.4 million vehicles registered in the country, of which more than 70% are passenger cars, 20% are trucks, and 10% are buses and minibuses. Most of the vehicle fleet is outdated, which leads to increased GHG emissions and high fuel costs. About 60% of cars are over 15 years old, which reduces their fuel efficiency.

1.1.3 **Freight transport**: A significant portion of freight transport is carried out by road, which increases the load on the road infrastructure. The main freight transport activities are related to international trade and the mining industry.

1.1.4 **Passenger transportation** in Kyrgyzstan is carried out mainly by automobile transport. The main categories of passenger transportation are: Urban public transport - represented by buses, minibuses and trolleybuses, requires modernization due to the high wear and tear of the fleet. Intercity and international transportation - bus routes connect regions of the country and neighboring states, including Kazakhstan, Russia and Uzbekistan.

Rail transport accounts for a small share of passenger traffic, but remains in demand for travel between Bishkek and border regions.

1.1.5 **Public transport**: Some other major cities are replacing older fleets with gas-powered buses, reducing emissions and improving the environment. This is especially true for the capital of Kyrgyzstan, Bishkek, where public transport upgrade projects are being implemented. More than 1,000[7] gas-powered buses and 120[8] electric buses have arrived and are expected to arrive in 2023-2025, which helps reduce GHG emissions.

1.1.6 **Rail transport**: Within the framework of the Resolution of the Cabinet of Ministers No. 258, [9]it is planned to build and modernize railway lines, including the Balykchy - Kochkor -Kara-Keche project and the China-Kyrgyzstan-Uzbekistan railway. Work is also underway to electrify sections to improve energy efficiency, for example, the implementation of the project "Electrification of the Turksib -Rybachye railway section".

[7] Response to a request from the Department of Transport of the Bishkek City Hall to a written request for information

[8] Response to a request from the Department of Transport of the Bishkek City Hall to a written request for information

[9]https://cbd.minjust.gov.kg/159198/edition/1161056/ru

1.1.7 **Aviation** plays an important role in international transportation and tourism development. Kyrgyzstan has the Manas International Airport, as well as regional airports in Osh, Batken, Jalal-Abad and Issyk-Kul. Local air transportation is poorly developed, which limits the accessibility of remote areas. In the future, it is planned to modernize domestic airlines and develop small aviation to improve the transport connectivity of the regions. The main problems are the high cost of tickets, the lack of an aircraft fleet and the unprofitability of many domestic routes.

1.2 The modal mix of transport.

1.2.1 Automobile transport occupies a leading share in the sector's economy and includes more than 1.4 million vehicles. However, most of the vehicle fleet is outdated, which leads to increased fuel consumption and high GHG emissions. The development of the sector is aimed at modernizing roads, introducing gas-powered and electric vehicles, and improving cargo logistics.

Public transport in Bishkek and other large cities needs to be modernized. The municipal enterprise " Bishkek City Transport" (MP BGT) carries passengers on 60 routes. The number of rolling stock is 1,276[10] buses, of which 1,200[11] units go on the line daily. All buses run on gas fuel.
The planned introduction of electric buses and gas buses will lead to a reduction in operating costs and GHG emissions.

- In order to transfer public transport to alternative fuels, 1,000[12] buses were purchased at the expense of the republican budget; the first batch of 500[13] buses arrived in 2023. The second batch arrived in April-May 2024.
- In December 2023, 124[14] large-capacity, 10.5-meter-long, gas-powered buses arrived in Bishkek through the European Bank for Reconstruction and Development, and 95[15] 12-meter-long buses are expected to arrive in 2025.
- In April 2024, 17 buses arrived via the German Development Bank, which serve express route No. 153 "12th microdistrict - Manas Airport". Also, in the first quarter of 2025, 68[16] buses arrived, these buses will also be launched on express routes.
- The Asian Development Bank is expected to deliver 120[17] electric buses in 2025, and a contractor is currently upgrading two depots.

Arriving buses go out on their routes and serve city residents.

1.2.2 Rail transport is represented by a network of 424 km, which limits its economic role. Projects are underway to electrify and expand railway lines, including the construction of the China-Kyrgyzstan-Uzbekistan railway.

[10] Response to a request from the Department of Transport of the Bishkek City Hall to a written request for information
[11] Response to a request from the Department of Transport of the Bishkek City Hall to a written request for information
[12] Response to a request from the Department of Transport of the Bishkek City Hall to a written request for information
[13] Response to a request from the Department of Transport of the Bishkek City Hall to a written request for information
[14] Response to a request from the Department of Transport of the Bishkek City Hall to a written request for information
[15]
[16] Response to a request from the Department of Transport of the Bishkek City Hall to a written request for information
[17] Response to a request from the Department of Transport of the Bishkek City Hall to a written request for information

1.2.3 Air transport plays an important role in international transportation and tourism development. Despite the growth in passenger traffic, the infrastructure requires modernization, including the transition to more environmentally friendly aviation technologies. Climate policy considers measures to reduce the carbon footprint through improving the fuel efficiency of aircraft and the introduction of alternative types of aviation fuel.

1.2.4 Water transport in Kyrgyzstan is practically undeveloped. The only significant water route is the Issyk-Kul Shipping Company, which is currently bankrupt. However, the potential for developing water transport on Lake Issyk-Kul remains high. The development of environmentally friendly water transport – such as electric boats and solar catamarans – could not only revive the sector, but also contribute to the development of ecotourism in the region.
The transport sector actively attracts foreign investment and loans for the development of infrastructure and the introduction of new technologies, which makes it one of the priority areas of Kyrgyzstan's economic policy.

1.3 Infrastructure of the Transport sector

The city road network includes main and local streets that provide connections between residential areas, industrial zones and business centers. Bishkek, as the largest city in the country, experiences serious pressure on the transport system, which leads to traffic jams and increased GHG emissions. The introduction of intelligent transport systems (ITS), modernization of public transport and development of cycling infrastructure are key areas for the development of the city's transport infrastructure.
Rural roads play an important role in the country's economy, providing access to remote regions and agricultural farms. However, more than 60% of rural roads are in poor condition, which reduces the availability of transport services and increases operating costs. Government programs are aimed at repairing and building new roads, especially in mountainous areas.

State roads are the main transport corridors connecting regions and providing transit transportation. The road sector development program for 2023-2030 provides for the modernization and expansion of international motor transport routes. Municipal roads are roads within cities and towns that are under the jurisdiction of local authorities. Most municipal roads require major repairs and expansion, especially given the growing number of cars.

Private roads – mainly lead to mining and agricultural enterprises. The development of private road infrastructure is stimulated through public-private partnerships (PPP), which allows attracting investments to improve transport accessibility.

- Modernization of the road network – expansion of highways, improvement of the quality of road surfaces.
- Development of alternative modes of transport – construction of bicycle paths, development of pedestrian infrastructure.
- Electrification of public transport – introduction of electric buses, construction and modernization of trolleybus routes.
- Sustainable development of rural roads – improving transport accessibility of rural settlements.

Thus, the development of transport infrastructure in the Kyrgyz Republic is a key area of state policy aimed at increasing population mobility, improving the quality of roads and reducing GHG emissions.

1.4 Current status of data, main sources of the "Transport" sector

Information from different sources on identical articles, sometimes even from the same department, does not always coincide, and the existing information support does not allow us to determine the source with the most reliable information. Therefore, all sources of information were ranked by reliability. The highest rank of information reliability is given to official publications of the National Statistical Committee and other ministries, departments and organizations, and then information from national experts along with data obtained by calculation, and the last is data from the media. The inventory of greenhouse gas emissions in the transport sector is carried out mainly on the basis of fuel and energy balance (FEB) data, which is compiled by the National Statistical Committee of the Kyrgyz Republic according to approved methods for conducting statistical observations.

1.4.1 Needs and gaps in the Transport sector.

The following main sources of information are used to analyze the activity data (AD) in the Transport sector of the Kyrgyz Republic:

- **The National Statistical Committee (NSC)** [18]is the key body providing data on the fuel and energy balance (FEB), transport sector statistics and related areas.
- **Government bodies responsible for fuel and energy management and transport** include various ministries and agencies that regulate fuel supply and transport flows.
- **Agency for State Registration of Vehicles under the Cabinet of Ministers of the Kyrgyz Republic** [19]– ensures the registration of vehicles and registration data.
- **The State Agency for Civil Aviation of the Kyrgyz Republic (SCA)** [20]is a key source of information on aviation activities, including data on aviation fuel consumption.
- **International data sources** – UN, EuroStat, International Energy Agency (IEA), World Bank (WB), International Monetary Fund (IMF) and others.
- **Data obtained through measurements, surveys and archival research** – includes fuel monitoring, surveys and other forms of empirical analysis.
- **Expert opinions and calculations of national specialists** provide additional analytical information and clarifying assessments.

1.4.1 Air transport

The collection and analysis of activity data in the aviation sector of the Kyrgyz Republic faces serious difficulties. At present:

- The NSC KR has virtually no data on aviation activity. Previously, the NSC provided information on the total consumption of aviation fuel without dividing it into domestic and international transportation, but even this data is now unavailable.
- The only source of information remains the State Agency of Civil Aviation (SAA). In 2021, SAA provided data on fuel consumption in the category "Civil Aviation", but such information is not published on a regular basis.

1.4.2 Road transport

Collecting data on road transport also faces significant challenges:

[18]https://stat.gov.kg/ru/
[19]https://tsvs.gov.kg/
[20]https://caa.kg/ru

- The NSC does not maintain detailed records of fuel use by vehicle categories, such as:
    - Passenger cars (with and without catalytic converters);
    - Light trucks (with and without catalytic converters);
    - Heavy trucks and buses;
    - Motorcycles.
    - Off-road transport

The situation with data on **rail and water transport** is similar to the problems described above. Rail transport, being one of the key segments of transportation in the country, does not provide detailed information on fuel consumption by locomotives. Access to such data is extremely limited, which makes it difficult to accurately assess emissions and resource efficiency.
Water transport, in turn, is practically absent as a significant category. There are no navigable rivers or access to the sea in the Kyrgyz Republic, so inland navigation and sea traffic do not generate activity. This makes the water transport sector insignificant in terms of emissions and fuel consumption, and also explains the lack of statistical data in this area.

In the fuel and energy balances (FEB) of the NSC, the data are presented in a generalized form, which allows collecting data on the category "1 A 3B Road transportation", but which does not allow applying higher methods (Tier 2 and Tier 3) for possible increase in the accuracy of calculations. This also applies to other subcategories of the transport sector. Some of the necessary information is not taken into account by statistical authorities and is only available in organizations. Some of the necessary information is missing or has a large uncertainty. There is a discrepancy between the forms of official statistical accounting and the requirements of the inventory. Work on improvement has already begun with the fuel and energy balance, but it will take a long time to complete.

Gaps have been found in the available NSC data that reduce the quality of the analysis. In particular, there is no information for 1991–2004, with the exception of individual overview reports for 1995, 1997, 1999, and 2001. Such gaps are due to the fact that statistical studies were previously conducted at intervals of several years, rather than on an annual basis.

Recommendations for improving the data collection system

To improve the quality of activity data in the "Transport" sector, it is necessary to:

- **Strengthening the digitalization of reporting** – implementation of automated systems for collecting and processing data in accordance with the recommendations of the Intergovernmental Panel on Climate Change (IPCC).
- **Development of a system of regular surveys** – conducting surveys of vehicle owners, monitoring traffic flows, analyzing fuel consumption based on sample surveys.
- **Expanding cooperation with international organizations** – using advanced methods and data provided by international agencies.
- **Increasing transparency and accessibility of data** – creating open databases with up-to-date information on fuel consumption and emissions in the transport sector.

An analysis of the current state of activity data in the Transport sector reveals significant information gaps, which reduce the accuracy of calculations and the ability to conduct detailed analysis. Particular difficulties are associated with air and road transport, where there is a lack of detailed data. The introduction of digital solutions, regular surveys and international cooperation will significantly improve the quality and completeness of the information needed for strategic planning and environmental monitoring.

1.5 Institutional organization for mitigation actions in the Transport sector, taking into account the data collection mechanism in the Transport sector.

To effectively reduce GHG emissions in the transport sector of the Kyrgyz Republic, clear interaction between various state, municipal and private structures is necessary.
There are currently no institutional mechanisms for conducting regular inventories. The inventory is carried out only within the framework of the preparation of national communications and biennial reports. Increased regularity is required, given the increased requirements for periodicity. It is also necessary to include climate indicators in many Programs and Strategic Development Plans of the country.
The main institutional participants in mitigation actions are:

- **The National Statistical Committee of the Kyrgyz Republic** is responsible for collecting and processing data on passenger and freight flows, registered vehicles and fuel costs.
- **The Ministry of Transport and Communications of the Kyrgyz Republic (MTC)** [21]is responsible for the development and implementation of state policy in the field of transport, including the introduction of environmentally friendly technologies and vehicles and implements infrastructure modernization programs.
- **State Agency for Environmental Protection and Forestry** – monitors emissions levels and the impact of transport on the environment.
- **City Halls - Municipal Administrations or Departments of Transport** - monitors the operation of public transport, route taxis and road conditions, develops local strategies for reducing emissions, including upgrading public transport and introducing intelligent transport systems (ITS).
- **The Ministry of Energy** coordinates issues of transition to alternative energy sources for transport, including the development of electric transport.
- **Private transportation companies and trucking associations** are implementing energy efficiency and emission reduction programs among commercial trucking companies.
- **International organizations and donors** such as ICAT, UNEP and the World Bank provide financial and technical support for the implementation of mitigation projects.

Effective coordination between these institutions will help create a sustainable and integrated system for managing GHG emissions in the transport sector, which will ensure the achievement of NDC goals and the fulfillment of the international climate commitments of the Kyrgyz Republic.

- Implementation of emission standards and fuel efficiency requirements for vehicles.
- Encouraging the use of public transport and the transition to low-carbon technologies.
- Development of infrastructure for electric vehicles and gas-powered transport.
- Improving the emission monitoring system in the transport sector.

1.6 Monitoring, reporting and verification system

There is a need to create a Centralized Coordinating System for Monitoring, Reporting and Verification (MOV) that operates on a permanent basis and meets international standards for the subsequent launch of the GHG emissions trading market.

Study of possibilities, creation of conditions and implementation in the Kyrgyz Republic of the international standard ISO 14064 (1-3) for the national system of Monitoring, Reporting and

[21]https://mtd.gov.kg/

Verification. Implementation of this standard in the Kyrgyz Republic within the framework of the national system of Monitoring, Reporting and Verification (MRV) will allow:

- Create a transparent and reliable GHG emissions accounting system – standardize monitoring and reporting processes, ensuring data accuracy and comparability.
- Increase confidence in reporting – Implementation of ISO 14064-3 on data verification will ensure independent verification of emissions information.
- Ensure compliance with international requirements – the use of ISO 14064 will help integrate the national MRV system into global climate initiatives, such as the Paris Agreement.
- Make it easier to attract investment into low-carbon projects – having clear standards for reporting emissions facilitates access to international climate finance.
- Develop competencies and digitalization – standardized MRV procedures will help in training specialists, increase the potential of specialists in this area and help in the automation of emissions accounting.

Thus, the implementation of ISO 14064 will provide Kyrgyzstan with effective climate data management, increase transparency of reporting and open up opportunities for sustainable development.

1.7 Emissions 1990-2020 by gas by source

In accordance with the assignment, an inventory of GHGs was carried out for 2021-2023, during which the current state of data collection, data sources, and institutional mechanisms were identified. The IPCC 2006 Inventory Software [22]V2.95 was used for data processing [23], which ensures the implementation of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Previously, an inventory was conducted for 1990-2020 using [24]the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 Guidelines) developed by an international group of experts (IPCC) on behalf of the United Nations Framework Convention on Climate Change (UNFCCC). An analysis has been conducted which has shown that for the Transport sector, in accordance with the IPCC 2006 Guidelines, the methodological approaches of Level 1 will be applied. This level is the most acceptable, since the available and accessible data on the sector guarantee the reliability and transparency of the GPI calculations in the transport sector. Higher levels require the availability of data that are not yet available in the Kyrgyz Republic. Obtaining such data is associated with financial costs and will require additional time. The Tier 1 method is entirely fuel-based, meaning that emissions from all combustion sources can be estimated based on the amount of fuel burned and average emission factors. Emission factors for the Tier 1 approach can be obtained for all relevant direct greenhouse gas emissions. The quality of these emission factors varies from gas to gas. For CO2, the emission factors are highly dependent on the carbon content of the fuel. Combustion conditions are of relatively little importance. Therefore, CO2 emissions can be estimated fairly accurately based on the total amount of fuel burned and the average carbon content of the fuel. However, emission factors for methane and nitrous oxide depend on combustion technology and transport operating conditions. Because of this variability, using average emission factors for these gases, which is necessary to account for the high variability in process conditions, introduces associated uncertainty. In Kyrgyzstan, national emission factors for GHGs are not available, so the default factors proposed by the IPCC 2006 methodology were used.

According to the IPCC Guidelines, the Transport category includes all types of passenger and freight transport, as well as motorcycles (if possible), with further breakdown by the types of catalysts used and by load capacity for road transport into light and heavy. International transport is separately

[22]https://www.ipcc-nggip.iges.or.jp/software/index.html
[23]https://www.ipcc-nggip.iges.or.jp/public/2006gl/
[24]

identified in the article 7A International Bunker. Military aviation flights are not included in the Transport category and were not taken into account.

In accordance with national conditions (the existing system of accounting for fuel in the fuel and energy balance), the category is divided into subcategories:

- Civil aviation;
- Road transport;
- Railways;
- Water transport.
- Off-road transport

A more detailed breakdown according to IPCC recommendations is not possible due to the lack of source data. For the category "Transport", emissions of the main greenhouse gases are taken into account.

The Transport category is the main source of GHG emissions in the Energy sector.

The volumes of economic activity in the transport sector and energy consumption indicators for the main subcategories of Transport are based on data from the National Statistical Committee of the Kyrgyz Republic (statistical collection “FEB”).

Greenhouse gas emissions in the transport sector are estimated based on data on emissions from fuel combustion in any device or mechanism that transports material objects, goods and passengers, including air transport, rail transport, road transport, water transport and other transport (off-road transport).

, the volumes of greenhouse gas emissions in the Transport sector, for example in 2023, amounted to 3506.316 Gg CO2, 0.963 Gg CH4 and 0.303 N 2 O.

The Transport sector is characterized by an absolute predominance of GHG emissions from the Road Transport category.

Categories	CO2	CH4	N2O
	Emissions (Gg)		
1.A.3 - Transport	3506,316	0,963	0,303
1.A.3.a - Civil Aviation	44,144	0,000	0,001
1.A.3.a.i - International Aviation (International Bunkers) (1)			
1.A.3.a.ii - Domestic Aviation	44,144	0,000	0,001
1.A.3.b - Road Transportation	3065,061	0,938	0,149
1.A.3.b.i - Cars	3065,061	0,938	0,149
1.A.3.b.i.1 - Passenger cars with 3-way catalysts			
1.A.3.b.i.2 - Passenger cars without 3-way catalysts			
1.A.3.b.ii - Light-duty trucks			
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts			
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts			
1.A.3.b.iii - Heavy-duty trucks and buses			
1.A.3.b.iv - Motorcycles			
1.A.3.b.v - Evaporative emissions from vehicles			
1.A.3.b.vi - Urea-based catalysts			
1.A.3.c - Railways	39,064	0,002	0,015
1.A.3.d - Water-borne Navigation	0,000	0,000	0,000
1.A.3.d.i - International water-borne navigation (International bunkers) (1)			
1.A.3.d.ii - Domestic Water-borne Navigation	0,000	0,000	0,000

1.A.3.e - Other Transportation	358,047	0,023	0,137
1.A.3.e.i - Pipeline Transport			
1.A.3.e.ii - Off-road	358,047	0,023	0,137

Table 1.7.1 GHG emissions by transport categories, 2023 year. Gg.

Below is table 1.7.2 with emissions in CO2 equivalent, Gg, as part of the category Energy.

Categories	CO2	CH4	N2O
	Emissions CO2 equivalent, (Gg)		
1 - Energy	9153,55	581,75	98,55
1.A - Fuel Combustion Activities	9125,34	161,77	98,55
1.A.1 - Energy Industries	3059,38	1,84	10,15
1.A.1.a - Main Activity Electricity and Heat Production	2097,89	0,74	8,07
1.A.1.a.i - Electricity Generation		0,00	0,00
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	2002,44	0,66	7,87
1.A.1.a.iii - Heat Plants	95,45	0,08	0,20
1.A.1.b - Petroleum Refining	961,49	1,10	2,09
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	0,00	0,00	0,00
1.A.1.c.i - Manufacture of Solid Fuels	0,00	0,00	0,00
1.A.1.c.ii - Other Energy Industries		0,00	0,00
1.A.2 - Manufacturing Industries and Construction	364,12	0,71	1,00
1.A.2.a - Iron and Steel		0,00	0,00
1.A.2.b - Non-Ferrous Metals		0,00	0,00
1.A.2.c - Chemicals		0,00	0,00
1.A.2.d - Pulp, Paper and Print		0,00	0,00
1.A.2.e - Food Processing, Beverages and Tobacco	138,50	0,09	0,12
1.A.2.f - Non-Metallic Minerals		0,00	0,00
1.A.2.g - Transport Equipment	2,14	0,00	0,01
1.A.2.h - Machinery		0,00	0,00
1.A.2.i - Mining (excluding fuels) and Quarrying		0,00	0,00
1.A.2.j - Wood and wood products		0,00	0,00
1.A.2.k - Construction	4,47	0,01	0,01
1.A.2.l - Textile and Leather		0,00	0,00
1.A.2.m - Non-specified Industry	219,01	0,61	0,86
1.A.3 - Transport	3506,32	26,96	80,33
1.A.3.a - Civil Aviation	44,14	0,01	0,33
1.A.3.a.i - International Aviation (International Bunkers) (1)			
1.A.3.a.ii - Domestic Aviation	44,14	0,01	0,33
1.A.3.b - Road Transportation	3065,06	26,25	39,61

1.A.3.b.i - Cars	3065,06	26,25	39,61
1.A.3.b.i.1 - Passenger cars with 3-way catalysts		0,00	0,00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts		0,00	0,00
1.A.3.b.ii - Light-duty trucks		0,00	0,00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts		0,00	0,00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts		0,00	0,00
1.A.3.b.iii - Heavy-duty trucks and buses		0,00	0,00
1.A.3.b.iv - Motorcycles		0,00	0,00
1.A.3.b.v - Evaporative emissions from vehicles		0,00	0,00
1.A.3.b.vi - Urea-based catalysts		0,00	0,00
1.A.3.c - Railways	39,06	0,06	4,00
1.A.3.d - Water-borne Navigation	0,00	0,00	0,00
1.A.3.d.i - International water-borne navigation (International bunkers) (1)			
1.A.3.d.ii - Domestic Water-borne Navigation	0,00	0,00	0,00
1.A.3.e - Other Transportation	358,05	0,64	36,39
1.A.3.e.i - Pipeline Transport		0,00	0,00
1.A.3.e.ii - Off-road	358,05	0,64	36,39

Table 1.7.2 GHG emissions by Energy categories, 2023 year. Gg.

Tables of GHG values in terms of CO2 eq. for 2021-2023 are attached in electronic Excel format for all categories of IPCC 2006 sources. (See Appendix).

2. Projecting future GHG emissions for the transport sector

Methodologically, the calculation of GHG emission forecasts is based on greenhouse gas inventory data, which allows the corresponding trends to be derived.
It should be noted that the development of the GHG emission forecast was carried out on the basis of and in continuation of the trends of national GHG inventory data for 1991-2023. Therefore, all forecast calculations were made on the basis of various data series of that period.

2.1 Building Basic Scenarios (Business as Usual)

The projection of future GHG emissions in the Kyrgyz Republic was based on the correlations between GHG emissions and GDP[25] at purchasing power parity. The GDP at purchasing power parity, reflects the growth of production in the country's economy. The GDP, when divided by population[26] gives the per capita GDP, which shows the standard of living of the individuals and household consumption.

[25] calculation by UNDP project expert
[11] https://population.un.org/dataportal/home?df=c072db1a-2d22-42b8-96f0-ff150e5b1881
[26]

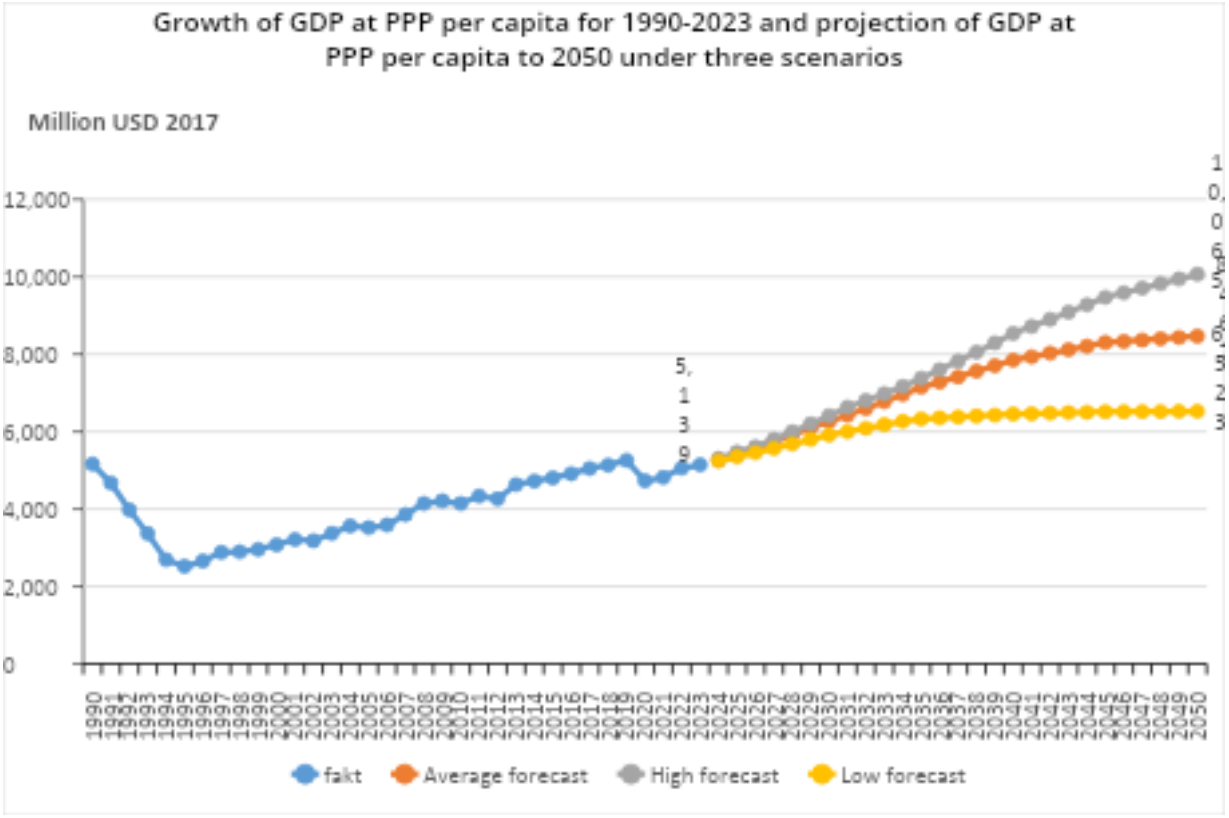

Figure 2.1.1 Trends of GDP with PPP per capita from 2023 to 2050 for Kyrgyzstan.

At the same time, calculations of values and modeling of changes in GDP at PPP were carried out according to three scenarios for the development of the country's economy: basic (medium), optimistic (high), and pessimistic (low) (Figure 2.1.1).

In developing future projections in the sector, the following were used:

- NGGI data from 1990-2023,
- data on GDP growth in PPP in the Kyrgyz Republic in US dollars for 2017 in projections up to 2050, presented by the UNDP project. The average level of GDP growth is taken as Business as Usual (BAU).

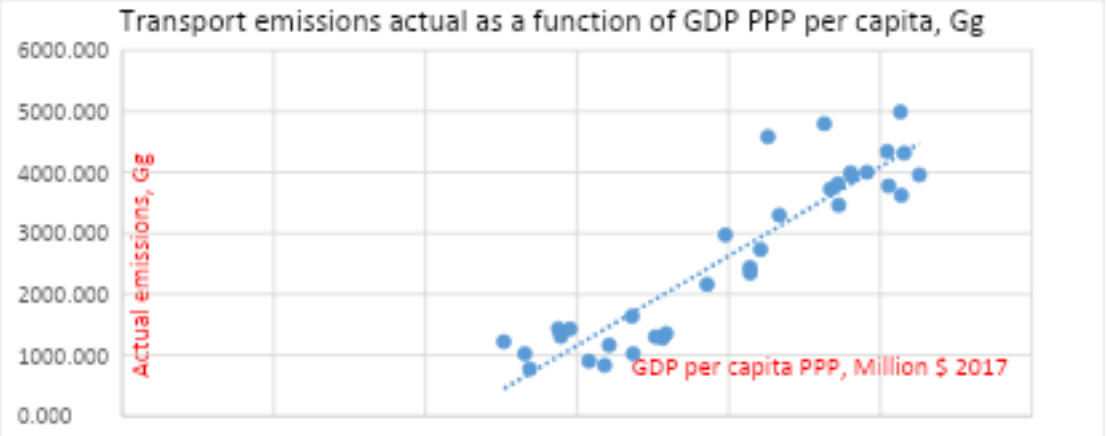

Figure 2.1.2 Graph of dependence of emissions in transport on growth of GDP per capita PPP BKO in the Kyrgyz Republic for the period 1990-2023

The constructed graphs of the correlation of emissions in transport from GDP (PPP) per capita, million US dollars, base period = 2017 in the Kyrgyz Republic for the period 1990-2023 made it possible to obtain a linear interpolation equation for calculating and constructing emission volumes for future years from 2023 and further to 2050. At the same time, a fairly high level of reliability was obtained at R = 0.8457. The future GHG emissions were estimated using the equation ,

Y = 1.4672x-3243.5

Where,

X = GDP (PPP) in millions $
Y = GHG emissions in Gg

A long series of transport emissions projections for the BAU up to 2050 was constructed. Below is a graph of the emissions projections for the BAU up to 2050 obtained on the basis of linear interpolation.

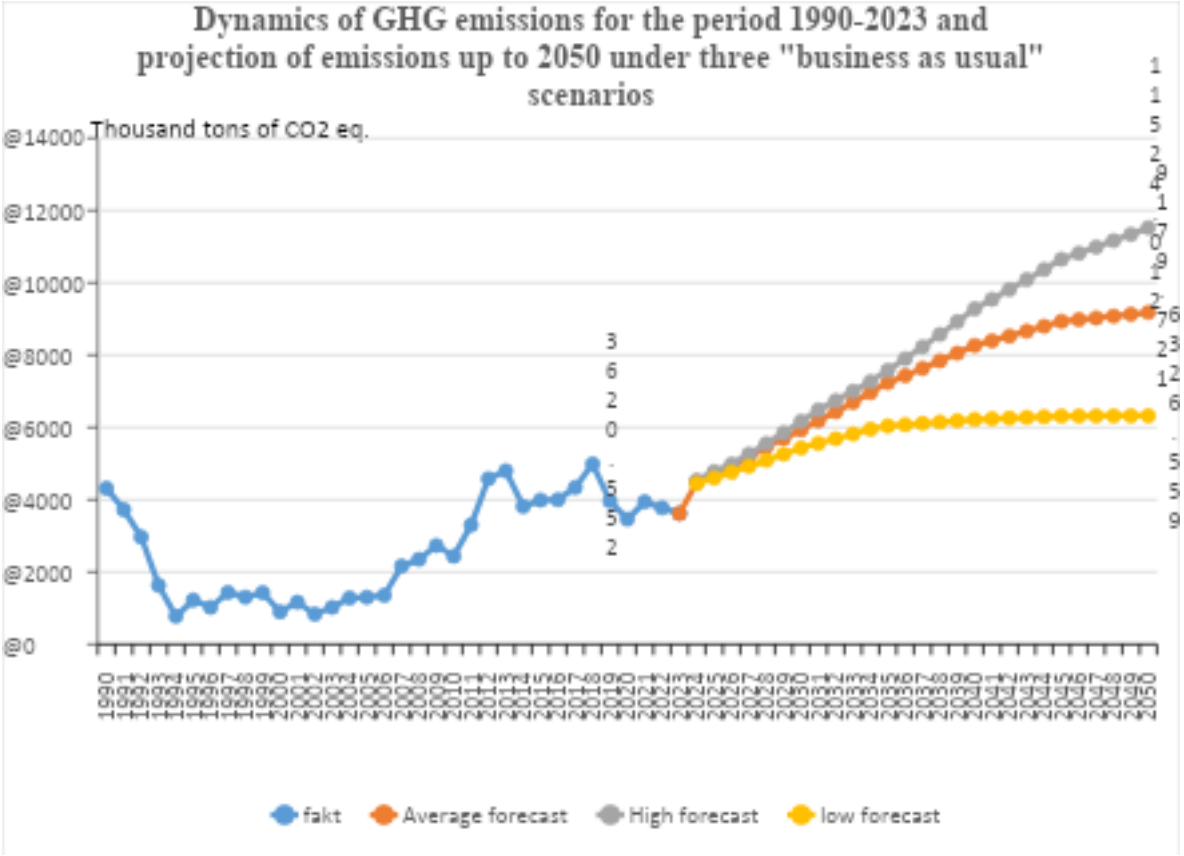

Figure 2.1.3 Projection of emissions in transport for BAU up to 2050.

2.2 Development of a BAU scenario for greenhouse gas emissions (by 2025, 2030, 2035, 2040, 2045 and/or 2050) in the transport sector (GACMO).

The GACMO tool was developed by the UNEP Copenhagen Climate Centre (UNEP-CCC). This version of the tool was developed within the framework of the Initiative for Climate Action Transparency (ICAT).

The GACMO tool allows countries to make a quick but accurate assessment of how different mitigation options affect GHG emissions. The tool is used to calculate the GHG emission reductions resulting from specific mitigation measures and to create a mitigation scenario based on specific mitigation measures compared to a business-as-usual (BAU) scenario.

This version of the GACMO tool includes seven spreadsheets of technical data that the user must review in a step-by-step approach. The tool's interface is designed so that the user moves from the first spreadsheet to the last spreadsheet in a logical order. Calculations and graph generation are performed automatically. This means that a user who has the data necessary to use the GACMO tool does not need to be familiar with the calculations themselves to use the tool, only with how to enter input data and interpret the results.

The GACMO tool also includes a number of default values that are already pre-loaded into the tool and that the user does not need to update unless the user has better input data and wants to make more precise estimates. All of these default values are visible and available to the user. The first set of default values are key mitigation parameters, such as the IPCC emission factor database (2006

IPCC Guidelines) and global warming potential (GWP). In the case of GWP, the GACMO tool uses by default the values of the Fifth Assessment Report published by the IPCC, as set out in the Modalities, Procedures and Guidelines (IPY) adopted in the Katowice Climate Package through Decision 18/CMA. However, previous GWP values are also available in the tool. The second set of default values are the mitigation potential parameters and the economic-financial parameters of each mitigation option and their corresponding reference option in the baseline situation. In this case, the GACMO tool by default uses average values calculated from relevant CDM projects available on the CDM website and summarized in the project pipeline developed at UNEP-CCC.
The basic data required to use the GACMO tool are energy balance data for a given year (considered the starting year), i.e. energy consumption data for the fossil fuel and electricity sectors in the country, as well as greenhouse gas emissions for other non-energy sectors for the same year (taken, for example, from a national greenhouse gas inventory report). Based on these data, GACMO estimates CO2 emissions from fuel combustion and sums up greenhouse gas emissions for the starting year, i.e. the year in which the data were collected (usually the latest year for which the required data are available). Then, by applying growth factors for each sector (these factors are country-specific and are estimated and entered into the tool by the user), the GACMO tool will project greenhouse gas emissions to construct a reference scenario (also called the baseline or business-as-usual (BAU) scenario), which includes calculations for the years 2025, 2030, 2035, 2040, 2045 and/or 2050.

- We make assumptions: all the key country data, fuel prices and technical data that the GACMO tool needs as input for calculations.

GDP (current US$ million) = Gross Domestic Product (GDP) in the initial year, Population (thousands) = population in the initial year.

This sheet must be completed as shown in Table 2.1.1

Fuel prices for the entire future period & fuel physical-chemical properties													
	LPG	Gasoline	Bioethanol	Jet Fuel	Diesel oil	Biodiesel	Heavy Fuel Oil	Kerosene	Coal	Coke	Petroleum coke	Lignite	Natural Gas
Distillate price/crude oil price (litre/litre)	0,90	2,570		1,40	2,560		0,80	1,40					
Fuel price (US$/liter)	0,28	0,816	0,83	0,44	0,814	1,20	0,25	0,44					
Fuel price (US$/GJ)	11,08	24,560		12,5	21,875		6,4	12,3	4,2	4,2	4,2		3,1
Fuel density (t/m3)	0,54	0,750	0,76	0,80	0,840	0,88	0,98	0,80					(MJ/Nm3)
Fuel calorific value (GJ/t)	47,30	44,300	26,8	44,1	44,300	26,8	40,2	44,8	18,9	28,0	31,0	11,9	39,0

Electricity		
Electricity price and grid information	Grid 1	
US$/kWh	0,030	
Grid Emission Factor (tCO2/MWh)		
Combined Margin (CM) Solar & Wind	0,126	чем меньше тем больше гидро, если около 0,5 то микс гидро - солнце и т.д.
Combined Margin (CM) Other	0,1260	
Electricity grid losses & own consumption	5,3%	This value will be imported from step 2

Sector specific Emission factors (kg GHG/GJ)				
Sector	Emission factors	CO2	CH4	N2O
Power plant	Fuel oil	77,4	0,003	0,0006
	Diesel oil	74,1	0,003	0,0006
	Gasoline	69,3	0,003	0,0006
	Jet fuel	71,5	0,003	0,0006
	Kerosene	71,9	0,003	0,0006
	LPG	63,1	0,001	0,0001
	Natural gas	56,1	0,001	0,0001
	Coal	94,6	0,001	0,0014
	Lignite	101,2	0,001	0,0014
Industry	Oil	as above	0,002	0,0006
	Natural gas		0,005	0,0001
	Coal		0,010	0,0014
	Charcoal		0,200	0,0040
Residential	Oil	as above	0,010	0,0006
	Natural gas		0,005	0,0001
	Coal		0,300	0,0014
	Charcoal		0,200	0,0040

Global warming potentials:	SAR	AR4	AR5	GWP used	Unit	TAR
1 Ton CH4 =	21	25	28	28	Ton CO2	23
1 Ton N2O =	310	298	265	265	Ton CO2	296

Population and GDP in start year	2023	
Population (thousands)	7037,6	стат ком
GDP (Current MUS$)	13987,628	data.worldbank

Table 2.1.1 Assumptions

• Next comes the Energy Balance: This spreadsheet contains energy consumption data disaggregated by sector of activity for the starting year. The structure of the two tables Energy Balance in TJ – Energy Balance of Initial Year in Mt and Mm3 is the same. They include a list of energy use activity categories in column C. For each activity category that is relevant to the country's national context, the user must enter the quantity of each fossil fuel used for that specific category, expressed in the selected unit (TJ or Mm3/Mt). In case the activity category is not relevant to the national context, no data should be entered in the corresponding cell.
Once the user has entered the energy balance data in TJ, the GACMO tool automatically calculates the energy balance.
This sheet is filled with data as shown in Table 2.1.2.

Energy balance in TJ - Kyrgyzstan - Start year - 2023													
Fossil fuel energy balance in TJ	**LPG**	**Gasoline**	**Jet Fuel**	**Diesel**	**HFO**	**Kerosene and other**	**Total oil products**	**Coal**	**Lignite**	**Natural Gas**	**Coke**	**Petrocoke**	**Total energy (fossil)**
Unit	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ
Total all energy consumption	-	26 480	617	21 958	-	15 986	65 041	10 037	28 799	15 000	-	-	118 877
Fossil power plants						2 254	2 254	10 017	9 363	5 098	-	-	26 732
Final sector consumption	-	26 480	617	21 958	-	13 732	62 787	20	19 436	9 902	-	-	92 145
Industry - steel							-	-	-	-	-	-	-
Industry - chemical						13 117	13 117	-	-	-	-	-	13 117
Industry - non metallic mineral							-	-	-	-	-	-	-
Industry - food processing and beverage						465	465	-	-	1 828	-	-	2 293
Industry - construction						44,44	44	-	8	3,36	-	-	56
Industry - mining							-	-	-	-	-	-	-
Industry - machinery							-	-	-	-	-	-	-
Industry - non ferrous metals							-	-	-	-	-	-	-
Industry - paper and pulp							-	-	-	-	-	-	-
Industry - transport equipment						12,1	12	-	11,9	-	-	-	24
Industry - textile and leather							-	-	-	-	-	-	-
Industry - miscellaneous						8,08	8	-	2 162	-	-	-	2 170
Transport - road		26 479,8		21 431,2			47 911	-	-	-	-	-	47 911
Transport - rail				527			527	20	-	-	-	-	547
Transport - domestic air			617				617	-	-	-	-	-	617
Transport - navigation		-		-			-	-	-	-	-	-	-
Households				-			-	-	15 528	7 331	-	-	22 859
Services				-		85	85	-	1 700	736	-	-	2 521
Agriculture & Fishery				-			-	-	26	3	-	-	29
Non energy - chemical feedstocs				-			-	-	-	-	-	-	-

Table 2. 2 .2 energy balance, Tj

• Greenhouse Gas Balance: This spreadsheet includes GHG emissions data disaggregated by activity sector for the initial year. CO2 emissions from fuel combustion are estimated automatically by the GACMO tool. CH4 and N2O emissions from fuel combustion and emissions from non-energy sectors must be filled in by the user. Here we can compare in the Total column the transport category adds up to 3507 kilotonnes of CO2 emissions, which corresponds to the inventory result for 2023 shown in Table 1.7.2

Table 2.2.3 CO2 Balance 2023 year, kt CO2eq

CO2 Balance - Kyrgyzstan - Start year - 2023													
Unit : ktCO2-equivalents	LPG	Gasoline	Jet Fuel	Diesel	HFO	Kerosene and other	**Total oil products**	Coal	Lignite	Natural Gas	Coke	Petrocoke	**Total**
Ton CO2/Toe (IPCC):	2,64	2,90	2,99	3,10	3,24	3,01		3,96	4,24	2,35	4,53	4,20	
Total	**0**	**1 835**	**44**	**1 626**	**0**	**1 149**	**4 654**	**950**	**2 914**	**841**	**0**	**0**	**9 360**
Fossil power plants	0	0	0	0	0	162	162	948	948	286	0	0	2 343
FINAL CONSUMPTION	0	1 835	44	1 626	0	987	4 492	2	1 967	555	0	0	7 017
Industry - steel	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry - chemical	0	0	0	0	0	943	943	0	0	0	0	0	943
Industry - non metallic mineral	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry - food processing and beverage	0	0	0	0	0	33	33	0	0	103	0	0	136
Industry - construction	0	0	0	0	0	3	3	0	1	0	0	0	4
Industry - mining	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry - machinery	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry - non ferrous metals	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry - paper and pulp	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry - transport equipment	0	0	0	0	0	1	1	0	1	0	0	0	2
Industry - textile and leather	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry - miscellaneous	0	0	0	0	0	1	1	0	219	0	0	0	219
Transport - road	0	1 835	0	1 587	0	0	3 422	0	0	0	0	0	3 422
Transport - rail	0	0	0	39	0	0	39	2	0	0	0	0	41
Transport - domestic air	0	0	44	0	0	0	44	0	0	0	0	0	44
Transport - navigation	0	0	0	0	0	0	0	0	0	0	0	0	0
Households	0	0	0	0	0	0	0	0	1 571	411	0	0	1 983
Services	0	0	0	0	0	6	6	0	172	41	0	0	219
Agriculture & Fishery	0	0	0	0	0	0	0	0	3	0	0	0	3
Non energy - chemical feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0

- Growth: This spreadsheet includes the expected growth in energy consumption for different sectors of activity over different time periods, see Table 2.2.4.

This sheet was filled out by the user based on:

- population growth = Annual growth rate (%) of the population,
- GDP growth = Annual growth rate (%) of GDP,
- growth of energy consumption = Annual growth rate for each activity category according to the formula:

$$\mathrm{CAGR} = \left(\frac{V_{\mathrm{final}}}{V_{\mathrm{begin}}} \right)^{1/t} - 1$$

CAGR = compound annual growth rate
V_{begin} = beginning value
V_{final} = final value
t = time in years

Selecting forecast growth factors.

When establishing growth factors for energy consumption for the future, three connections are possible in the GACMO system:

1. Using official opinions, providing profiles from ministries and other interested organizations.
2. Extrapolation based on historical data, if official estimates are not available.
3. If data is not available or is very unstable, their situation can be assessed by experts to the best of their knowledge.

This analysis uses a universal approach focused on the second and third approaches, based on the dynamics of energy consumption by transport categories, as well as on the experience and knowledge of experts.

1. Domestic air transportation

Analysis of historical data on fuel consumption in domestic aviation for the period 2018-2023 shows that the compound annual growth rate (CAGR) is calculated to be 2.2%. However, taking into account a slight decline in 2023 compared to 2022, an average growth of 2% is adopted for forecast calculations.

2. Road transport

The analysis of fuel consumption in the historical series of road transport activity data is as follows:
• Long-term growth has been observed since 1990, but it is unstable.
• In more stable periods, for example, from 2011 to 2023, the average growth **was 2%** per year.
• In recent years, there have been fluctuations:
o Since 2014, growth has been 0.3%.
o Since 2019, the growth rate has been negative - (2.2%).
o If we take into account the forecast data that will grow in road transport by linear interpolation in accordance with GDP at PPP, then we calculate growth in the periods 2023-2025, 2025-2030 and 2030-2035 of 13.3%, 4.83% and 4.1%, respectively.

For forecast calculations, an average growth of 2% was adopted, and from 2030, growth to 2.2%.

3. Rail transport

Analysis of rail transport showed:

• Since 2017, an average annual growth of 5.6% has been observed.
• However, in 2023, a decrease in consumption was recorded compared to 2022, which led to an average growth rate of 1.5% since 2018.
• Given these instabilities and fluctuations, as well as the projected GDP growth of 2.55 and 3.0% in the period 2023-2025 and 2025-2030, the decision was made to fix the growth at 2% for this sector.

4. Water transport

Water transport in Kyrgyzstan is not the last consumer of energy, because:

• The country has no access to seas and oceans.
• The only large body of water – Lake Issyk-Kul – is protected by environmental measures, and economic activity on it is minimal from the point of view of atmospheric restoration.
• In the future, even if transport activity on the lake increases, the possibility of using electric motors should be considered, which will lead to the absence of potential emissions. Then we assume equal growth – 0%.

Taking into account the projected growth of GDP at PPP per capita in the Kyrgyz Republic:
• For the period 2023–2025 – 2.55%.
• For the period 2025–2030 – 3.0%
for the forecast calculations for air transport, an average growth of 2% is adopted, and only from 2040 a cautious increase in growth of 2.2% is adopted. For the categories of road and automobile transport, the average growth rate of energy consumption is assumed to be 2% per year and 2.2% from the beginning of 2030 for road transport, which corresponds to the general economic dynamics of the country. For water transport, it is 0%.

5. Electric-powered transportation.

For electric-powered transport, unfortunately, there is no data on the scale of energy consumption. But analyzing the growth of electric transport in recent years, the established growth is 2% in 2023-2025 and with a subsequent transition to 1% over a 5-year period, with the exception of the periods 2035-2040 and 2045-2050.
Thus, the proposed factors for energy consumption growth in GACMO are based on the analysis of historical trends, projected macroeconomic indicators and specifications of industrial sectors of the Kyrgyz Republic.

Growth from the start year - Kyrgyzstan												
Growth and multiplication factors	**Annual % increase in the period**						**% increase from start year values**					
	2023 to 2025	2025 to 2030	2030 to 2035	2035 to 2040	2040 to 2045	2045 to 2050	2025	2030	2035	2040	2045	2050
Population growth	1,44%	1,38%	1,21%	1,13%	1,05%	0,91%	3%	10%	17%	24%	30%	36%
GDP growth	2,55%	2,96%	2,69%	1,90%	1,13%	0,40%	5%	22%	39%	53%	61%	65%
1. Energy												
1.A. Fuel combustion												
1.A.2. Manufacturing industries and construction												
Industry - fuel in steel	2,5%	2,5%	2,5%	2,5%	2,5%	2,5%	5%	19%	34%	52%	72%	95%
Industry - fuel in chemical	0,6%	0,6%	0,6%	0,6%	0,6%	0,6%	1%	4%	7%	11%	14%	18%
Industry - fuel in non metallic mineral	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%	4%	15%	27%	40%	55%	71%
Industry - fuel in food and beverage	4,4%	4,4%	4,4%	4,4%	4,4%	4,4%	9%	35%	68%	108%	158%	220%
Industry - fuel in construction	4,5%	4,5%	4,5%	4,5%	4,5%	4,5%	9%	36%	70%	111%	163%	228%
Industry - fuel in mining	4,9%	4,9%	4,9%	4,9%	4,9%	4,9%	10%	40%	78%	126%	186%	264%
Industry - fuel in machinery	2,9%	2,9%	2,9%	2,9%	2,9%	2,9%	6%	22%	41%	63%	88%	116%
Industry - fuel in non ferrous metals	0,0%	0,0%	2,0%	0,0%	0,0%	0,0%	0%	0%	10%	10%	10%	10%
Industry - fuel in paper and pulp	0,7%	0,7%	0,7%	0,7%	0,7%	0,7%	1%	5%	9%	13%	17%	21%
Industry - fuel in transport equipment	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0%	1%	1%	2%	2%	3%
Industry - fuel in textile and leather	5,3%	5,3%	5,3%	5,3%	5,3%	5,3%	11%	44%	86%	141%	211%	303%
Industry - fuel in miscellaneous	3,7%	3,7%	3,7%	3,7%	3,7%	3,7%	8%	29%	55%	85%	122%	167%
Industry - electricity consumption	1,5%	1,5%	1,5%	1,5%	1,5%	1,5%	3%	11%	19%	28%	37%	48%
1.A.3. Transport												
Transport - fuel in road	2,0%	2,0%	2,2%	2,2%	2,2%	2,2%	4%	15%	28%	43%	59%	78%
Transport - fuel in rail	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%	4%	15%	27%	40%	55%	71%
Transport - fuel in air	2,0%	2,0%	2,0%	2,0%	2,2%	2,2%	4%	15%	27%	40%	56%	74%
Transport - fuel in navigation	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0%	0%	0%	0%	0%	0%
Transport - electricity consumption	2,0%	3,0%	4,0%	4,0%	5,0%	5,0%	4%	21%	47%	79%	128%	191%

Table 2. 2.4 Growth , start year 2023

- BAU Energy Balances: This spreadsheet includes future energy balances for 2025, 2030, 2035, 2040, 2045 and 2050. The data in this sheet is automatically calculated by the GACMO tool, see table 2.2.5.

Fossil fuel balance - 2025 - Kyrgyzstan													
TJ units	**LPG**	**Gasoline**	**Jet Fuel**	**Diesel**	**Fueloil**	**Kerosene and other**	**Total oil products**	**Coal**	**Lignite**	**Gas**	**Coke**	**Petrocoke**	**Total energy (fossil)**
Unit	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ
Total	-	**27 550**	**642**	**22 845**	-	**16 310**	**67 347**	**10 551**	**29 810**	**15 595**	-	-	**123 303**
Fossil power plants	-	-	-	-	-	2 369	**2 369**	10 530	9 842	5 359			**28 101**
FINAL CONSUMPTION	-	27 550	642	22 845	-	13 940	**64 978**	21	19 967	10 236	-	-	**95 202**
Industry - steel	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Industry - chemical	-	-	-	-	-	13 275	**13 275**	-	-	-	-	-	**13 275**
Industry - non metallic mineral	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Industry - food processing and beverage	-	-	-	-	-	507	**507**	-	-	1 992	-	-	**2 499**
Industry - construction	-	-	-	-	-	49	**49**	-	9	4	-	-	**61**
Industry - mining	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Industry - machinery	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Industry - non ferrous metals	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Industry - paper and pulp	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Industry - transport equipment	-	-	-	-	-	12	**12**	-	12	-	-	-	**24**
Industry - textile and leather	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Industry - miscellaneous	-	-	-	-	-	9	**9**	-	2 325	-	-	-	**2 334**
Transport - road	-	27 550	-	22 297	-	-	**49 847**	-	-	-	-	-	**49 847**
Transport - rail	-	-	-	548	-	-	**548**	21	-	-	-	-	**569**
Transport - domestic air	-	-	642	-	-	-	**642**	-	-	-	-	-	**642**
Transport - navigation	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Households	-	-	-	-	-	-	**-**	-	15 809	7 464	-	-	**23 272**
Services	-	-	-	-	-	89	**89**	-	1 786	773	-	-	**2 649**
Agriculture & Fishery	-	-	-	-	-	-	**-**	-	27	3	-	-	**30**
Non energy uses	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**

Table 2.2.5 BAU Energy Balances

Projected BAU Greenhouse Gas Balances: This spreadsheet includes future greenhouse gas emissions for 2025, 2030, 2035, 2040, 2045 and 2050. The data in this sheet is automatically calculated by the GACMO tool.

CO2 emissions from fuel combustion- 2025 - Kyrgyzstan													
ktCO2	LPG	Gasoline	Jet Fuel	Diesel	Fueloil	Kerosene and other	Total oil products	Coal	Lignite	Gas	Coke	Petrocoke	Total
Unit	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
Total	-	**1 909**	**46**	**1 692**	-	**1 172**	**4 819**	**998**	**3 017**	**875**	-	-	**9 709**
Fossil power plants	-	-	-	-	-	170	170	996	996	301	-	-	**2 463**
FINAL CONSUMPTION	-	1 909	46	1 692	-	1 002	4 649	2	2 021	574	-	-	**7 246**
Industry - steel	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Industry - chemical	-	-	-	-	-	954	954	-	-	-	-	-	**954**
Industry - non metallic mineral	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Industry - food processing and beverage	-	-	-	-	-	36	36	-	-	112	-	-	**148**
Industry - construction	-	-	-	-	-	3	3	-	1	0	-	-	**5**
Industry - mining	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Industry - machinery	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Industry - non ferrous metals	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Industry - paper and pulp	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Industry - transport equipment	-	-	-	-	-	1	1	-	1	-	-	-	**2**
Industry - textile and leather	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Industry - miscellaneous	-	-	-	-	-	1	1	-	235	-	-	-	**236**
Transport - road	-	1 909	-	1 651	-	-	3 561	-	-	-	-	-	**3 561**
Transport - rail	-	-	-	41	-	-	41	2	-	-	-	-	**43**
Transport - domestic air	-	-	46	-	-	-	46	-	-	-	-	-	**46**
Transport - navigation	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Households	-	-	-	-	-	-	-	-	1 600	419	-	-	**2 019**
Services	-	-	-	-	-	6	6	-	181	43	-	-	**231**
Agriculture & Fishery	-	-	-	-	-	-	-	-	3	0	-	-	**3**
Non energy uses	-	-	-	-	-	-	-	-	-	-	-	-	**-**

Table 2.2.6, CO2 emissions from fuel combustion

In the GACMO tool tab Results we see the table: BAU scenario emissions by sectors, including Transport which is given below:

BAU scenario emissions by sectors							
ktCO2e/year	2023	2025	2030	2035	2040	2045	2050
Total (including LULUCF)	**5 933**	**6 309**	**7 332**	**8 536**	**9 907**	**11 477**	**13 277**
Total (excluding LULUCF)	**16 893**	**17 269**	**18 292**	**19 495**	**20 867**	**22 436**	**24 237**
1. Energy	10 069	10 445	11 468	12 671	14 043	15 612	17 413
1.A. Fuel combustion	9 621	9 979	10 952	12 099	13 403	14 893	16 600
1.A.1. Energy industries	2 343	2 463	2 799	3 193	3 657	4 206	4 857
1.A.2. Manufacturing industries and construct	1 304	1 345	1 458	1 589	1 744	1 927	2 144
1.A.3. Transport	3 507	3 649	4 029	4 491	5 006	5 581	6 222
1.A.4.b. Residential	1 983	2 019	2 111	2 208	2 309	2 415	2 525
1.A.4.a. Commercial/institutional	219	231	261	295	334	378	427
1.A.4.c. Agriculture/forestry/fishing	3	3	3	3	3	4	4
1.B. Fugitive emissions from fuels	448	466	515	573	640	719	813
2. Industrial processes and product use	893	893	893	893	893	893	893
3. Agriculture	5 330	5 330	5 330	5 330	5 330	5 330	5 330
4. Land use, land-use change and forestry	-10 960	-10 960	-10 960	-10 960	-10 960	-10 960	-10 960
5. Waste	601	601	601	601	601	601	601

Table 2.2.7 BAU scenario emissions by sectors, including Transport

Also presented here is a graph of GHG emissions with the contribution of the Transport sector for 2023, 2025, 2030, 2035, 2040, 2045 and 2050:

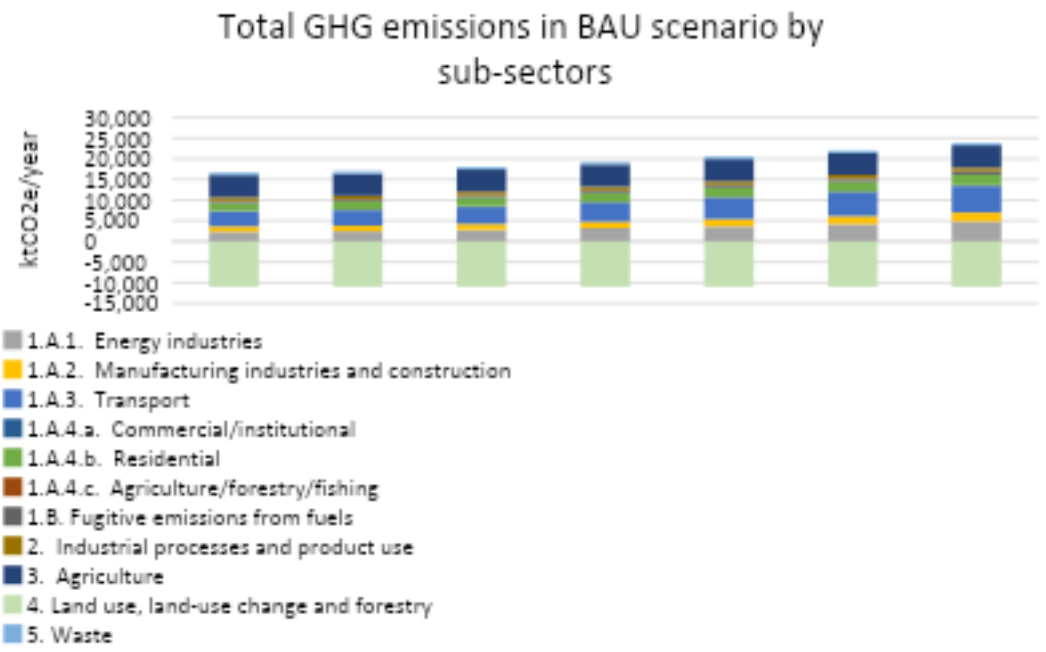

Figure 2.2.1 Total GHG emissions in BAU scenario by sectors, including Transport.

Conclusions

- The GACMO tool is a convenient and accessible way to calculate future projections of GHG emissions in the Energy and Transport.
- GACMO calculates projections of future GHG emissions for BAUs under one scenario: the baseline (average) for all sectors including Transport as well as mitigation scenarios.
- GACMO really simplifies and automates the process of calculating future projections, while reducing the influence of the human factor in the calculations and improving the quality of calculations.
- The GACMO tool requires minimal time for training and its subsequent use.

Besides GACMO tool, there are a large number of models that can be used to develop GHG emission projections and analyse the impact of mitigation measures (e.g. LEAP, TIMES, Prospects etc.). Each model can answer different research questions and provide numerical (quantitative) estimates of baseline emissions and the impact of mitigation measures on emissions. However, their use may be limited by high data requirements and the cost of licensing to conduct the estimates. In addition, some models require a high level of expertise to use software that may not be available in some countries and may take time to develop.

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