
# Improving the Efficiency of the Light-Duty Vehicle Fleet in Kazakhstan

## December 2019


# Content

# 1. Introduction

The transport sector is one of the essential economic sectors in Kazakhstan that provides its services in the implementation of interstate relations and thereby directly contributes to the economic growth of the country. In the structure of the country's gross domestic product, the transport sector was accounted for 7.9 per cent of GDP in the period 2010–2018.

Within the transport sector, the road transport sector is one of the actively developing sectors due to its mobility and the ability to access the most remote areas from the main transport routes of the country. Road transport in the structure of cargo and passenger transportation is steadily increasing its share. The transport of cargo and luggage by railways increased by 1.65 times from 2003 to 2018 reaching 334.0 million tons, while for road transportation this ratio is 2.42 and in 2018 the figure reached 3,193.9 million tons which 9.56 times higher than for railways. The turnover for the road transport has increased higher than for railway as well, 4.13 against 1.23. This shows that road transportation is taking more share of the transport sector. Passenger transportation is dominated by road transportation. All of the above shows that the market for road transport services is the most competitive in comparison with the markets for services of other types of transport in Kazakhstan. In addition, the road transport mode for many places in the country is the only available mode of transport.

In addition, road transport is the only available kind of transport for many places in the country.

**Table 1.1 – Dynamics of the main indicators of the transport sector**

| Indicator | 2003 | 2005 | 2010 | 2015 | 2018 |
|---|---|---|---|---|---|
| **Cargo and luggage transported, million tons** | **1687.5** | **1926.9** | **2468.4** | **3750.9** | **3739.7** |
| Railway | 202.7 | 222.7 | 267.9 | 341.4 | 334.0 |
| Road | 1,318.2 | 1,511.1 | 1,971.8 | 3,174.0 | 3,193.9 |
| Inland water | 0.5 | 0.8 | 1.1 | 1.2 | 1.1 |
| Marine | _ | 0.2 | 4.7 | 2.5 | 2.7 |
| Air, thousand tons | 24.2 | 20.7 | 28.9 | 17.2 | 19.7 |
| Pipeline | 166.1 | 192.0 | 194.0 | 214.6 | 188.2 |
| **Cargo turnover, billion tkm** | **352.3** | **392.9** | **472.3** | **587.4** | **504.3** |
| Railway | 147.7 | 171.9 | 213.2 | 267.4 | 182.2 |
| Road | 40.2 | 47.1 | 80.3 | 161.9 | 166.1 |
| Inland water | 0.07 | 0.09 | 0.08 | 0.03 | 0.00 |
| Marine | _ | 0.0 | 3.1 | 1.6 | 2.1 |
| Air, million tkm | 93.9 | 96.7 | 90.1 | 42.7 | 43.3 |
| Pipeline | 70.4 | 77.1 | 88.6 | 115.4 | 112.8 |
| **Passengers transported, million people** | **8,893.4** | **9,924.0** | **13,186.5** | **21,829.1** | **23,301.9** |
| Railway | 17.7 | 16.5 | 19.6 | 22.5 | 24.2 |
| Bus | 6,189.7 | 6,960.9 | 10,594.4 | 17,920.0 | 19,103.0 |

| Indicator | 2003 | 2005 | 2010 | 2015 | 2018 |
|---|---|---|---|---|---|
| Taxi | 2,532.5 | 2,814.8 | 2,489.5 | 3,824.7 | 4,125.6 |
| Trolleybus | 72.4 | 56.9 | 23.0 | 18.9 | 21.1 |
| Tramway | 79.7 | 73.2 | 56.5 | 37.0 | 21.5 |
| Inland water | 0.06 | 0.04 | 0.10 | 0.04 | 0.19 |
| Air | 1.3 | 1.7 | 3.4 | 5.9 | 6.2 |
| **Passengers turnover, million pkm** | **94,804.9** | **107,600.5** | **149,065.8** | **251,153.0** | **297,657.6** |
| Railway | 10,686.0 | 12,136.0 | 16,056.0 | 17,011.6 | 19,718.5 |
| Bus | 55,676.0 | 63,831.0 | 103,980.5 | 182,678.7 | 218,134.5 |
| Taxi | 25,148.0 | 27,820.0 | 22,232.1 | 40,038.5 | 48,013.1 |
| Trolleybus | 288.0 | 221.0 | 99.1 | 102.6 | 74.4 |
| Tramway | 352.0 | 327.0 | 225.5 | 167.9 | 82.1 |
| Inland water | 0.90 | 0.50 | 3.40 | 0.43 | 2.65 |
| Air | 2,654.0 | 3,265.0 | 6,469.2 | 11,153.3 | 11,632.4 |

*Source: Ministry of National Economy of the Republic of Kazakhstan Statistics committee*

Due to the vast territory of the country, with a low population density, road transport services are in increasing demand every year. The main share in the structure of ground communications in the republic falls on roads and railways. In 2018, the length of public roads was 96.246 thousand kilometers, of which 84.469 thousand kilometers were paved, while the length of railway lines was 16.635 thousand kilometers (see Table 1.2). In comparison with 1990, the length of roads in Kazakhstan increased by 9.76 thousand kilometers, including roads with a hard covering by 4.2 thousand kilometers. Thus, almost one-third of the new roads do not have a hard covering and the increase in the length of the roads largely was due to the construction of local roads with a single-lane traffic and a width of up to 4.5 meters (Mozharova, 2011).

**Table 1.2 – Characteristics of road transport infrastructure**

| | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2018 |
|---|---|---|---|---|---|---|---|
| Length of roads of common use, thousand km | 86,49 | 87,34 | 85,87 | 90,85 | 96,02 | 96,53 | 96,25 |
| Length of roads of common use with hard covering, thousand km | 80,26 | 82,48 | 81,33 | 82,82 | 85,96 | 86,24 | 84,47 |
| Density of roads of common use with hard covering, km per 1000 $km^2$ | 29,5 | 30,3 | 29,8 | 30,4 | 31,5 | 31.7 | 31,0 |

*Source: Ministry of National Economy of the Republic of Kazakhstan Statistics committee*

In recent years, emissions of pollutants in the Republic of Kazakhstan from automobile transport have reached more than one million tons per year and are constantly growing, which is associated with a rapid increase in the number of vehicles (Dzhaylaubekov, 2010). The problem of air pollution is most important for cities. In most large cities of the republic, the contribution of road transport to air pollution is 60% or more, and in Almaty – 90% of the total emissions.

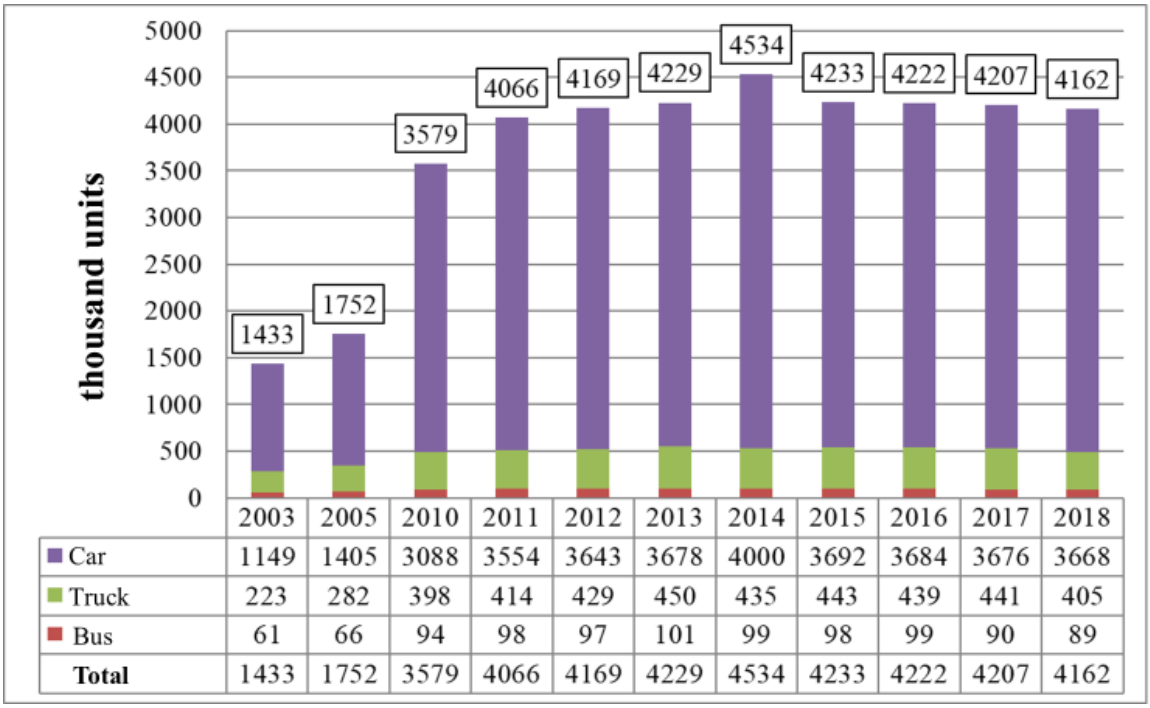
The source of emissions of harmful substances from vehicles is an internal combustion

engine (ICE), and the exhaust gases contain more than 200 toxic chemical compounds. In addition to the direct negative impact on human health, emissions from road transport have a greenhouse effect and an ozone-depleting effect on the Earth's atmosphere. Qualitative and quantitative indicators of the release of harmful pollutants with exhaust gases from vehicles during their operation depend on many factors, namely the type of fuel, the design, engine operating conditions and circumstances, the amount of work performed, the type and characteristics of vehicle movement, and others.

To fulfill the environmental safety objectives and international obligations of the Republic of Kazakhstan, relevant information on the actual emissions of pollutants and greenhouse gases into the atmosphere from automobile transport, emission forecasts and the impact of the adopted policies and measures on emissions in the present and in the future are of great importance.

## 2. The dynamics of changes in the car fleet

The fleet of cars and trucks annually replenishes. In 2018, the total number of vehicles amounted to 4162 thousand units. A significant increase in the total number of vehicles occurred in 2014 when the car fleet reached a peak in the amount of 4000 thousand units. The reason was a temporary strengthening of the Kazakhstan tenge to the Russian ruble, which led to an increase in the number of vehicles imported from the Russian Federation.




| | 2003 | 2005 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Car | 1149 | 1405 | 3088 | 3554 | 3643 | 3678 | 4000 | 3692 | 3684 | 3676 | 3668 |
| Truck | 223 | 282 | 398 | 414 | 429 | 450 | 435 | 443 | 439 | 441 | 405 |
| Bus | 61 | 66 | 94 | 98 | 97 | 101 | 99 | 98 | 99 | 90 | 89 |
| **Total** | 1433 | 1752 | 3579 | 4066 | 4169 | 4229 | 4534 | 4233 | 4222 | 4207 | 4162 |

**Figure 2.1 – The dynamics of the number of road transport for the period 2003–2016**
*Source: Ministry of National Economy of the Republic of Kazakhstan Statistics committee*

According to the Ministry of National Economy of the Republic of Kazakhstan Statistics committee most of the vehicles operate on gasoline (3,513,990 units), diesel fuel (50,854 units) and more than 115,925 cars operate on mixed fuel. The share of the electric car is negligible in comparison with others, just above a hundred units.

**Table 2.1 – The dynamic of road transport by type of fuel in 2011–2018**

| Year | Gasoline | Diesel | LPG | Mixed (gasoline + LPG) | Electric |
|---|---|---|---|---|---|
| 2011 | 3,513,098 | 24,559 | 2127 | 13,876 | 154 |
| 2012 | 3,580,756 | 31,277 | 2753 | 27,908 | 132 |
| 2013 | 3,613,651 | 32,245 | 2781 | 29,473 | 132 |
| 2014 | 3,846,116 | 45,945 | 3868 | 46,429 | 134 |
| 2015 | 3,575,380 | 47,186 | 3060 | 66,640 | 145 |
| 2016 | 3,513,990 | 50,854 | 3310 | 115,925 | 115 |

| | | | | | |
|---|---|---|---|---|---|
| 2017 | 3,555,485 | 58,273 | 3639 | 169,221 | 723 |
| 2018 | 3,455,517 | 86,840 | 3751 | 236,101 | 703 |

*Source: Ministry of National Economy of the Republic of Kazakhstan Statistics committee*

The prevalence of gasoline and diesel cars today is associated with a fairly high level of technology development, relative simplicity in design, low fuel price and the development of fuel supply infrastructure. In the next two decades, reserves of technological improvement of combustion engines will remain with respect to further improvements in reducing fuel consumption and emissions of pollutants and greenhouse gases. It should be noted, the increase in the number of electric cars with a peak in 2017 amounted to 726 units. Barriers to the spread of this type include the high price of cars and the underdeveloped system of charging speakers in the country. Taking into account that price declines due to the development of technology, it is necessary to undertake measures to develop a system of charging columns.

In the last decade, the fleet of vehicles has gradually increased and appeared both new and used cars. The age distribution of vehicles presented for cars from 2010, 2014, and 2016. The share of new cars is lower than already used. Almost half of the cars purchased are over 15 years old, and most of these old cars are in rural areas.

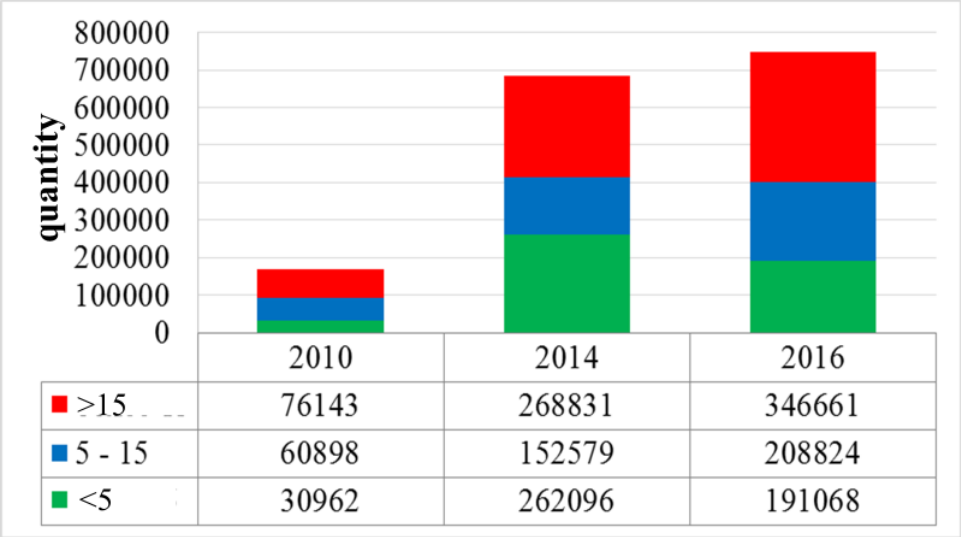



**Figure 2.2 – Distribution of cars in 2010, 2014, and 2016 to 2018, by car age**

Figure 2.3 provides a diagram for new car registrations. Acquisition of new cars had a significant increase from 2011 to 2014. The increase in vehicle purchases is based on the economic growth in the country from 2010 to 2014, which was driven by the devaluation of the ruble in Russia, while tenge remained its exchange value. As a result, the prices in Russia were lower than in Kazakhstan, which led to cars purchased in Russia being brought into Kazakhstan. Besides, there was a decline in case purchases until 2016. There are two reasons for the decrease between 2015 and 2016 – this is the devaluation of tenge in 2015 and observed vehicle market saturation after 2014.

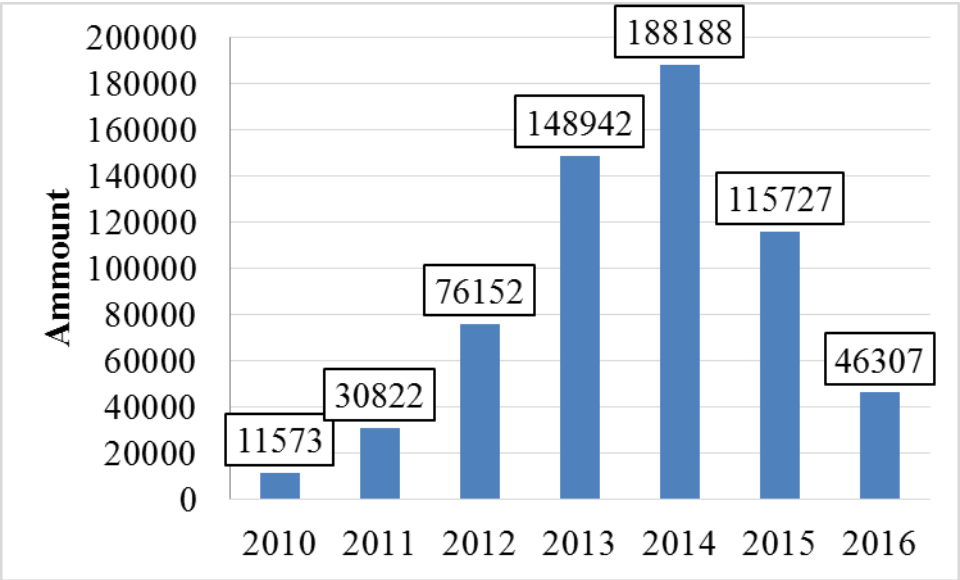



**Figure 2.3 – Registration of new cars from 2010 to 2016**

Among new cars, distribution by engine volume is presented in figure 2.4. The share of the cars with an engine less than 2 liters is more than half. This is due to the increase in the prices of fuel. Only exception is 2014 when the big inflow of cars from Russia occurred. In this year, a share of the cars with an engine of 2–3 liters increased. This shows that price is one of the crucial factors when buying a car.

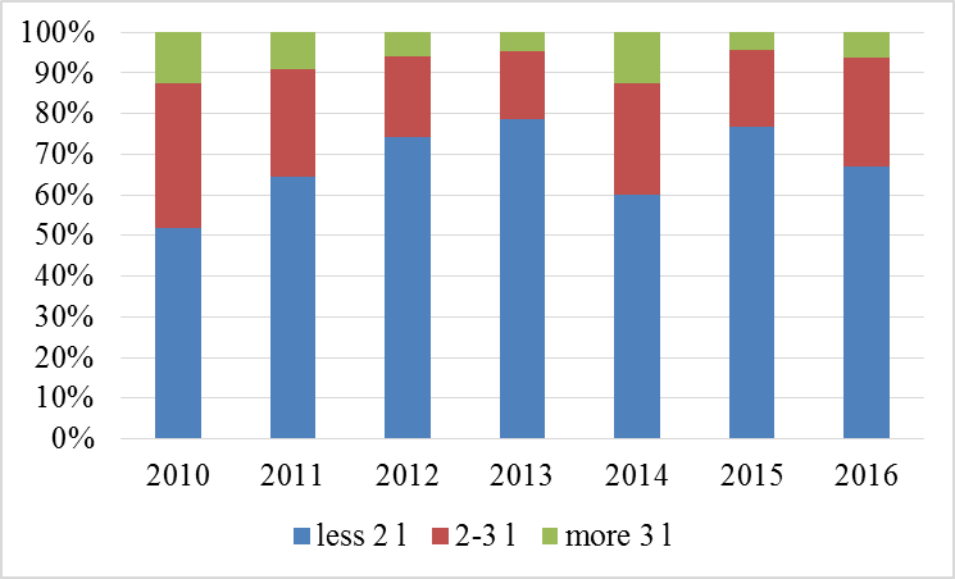



**Figure 2.4 – New car registration according to engine volume**

Figures 2.5 and 2.6 show new car registrations by fuel type. Most of the cars obtained are of gasoline type, and if we consider distribution by fuel type without gasoline it seems that there is an upward trend for hybrid energy sources among new cars. In 2016, the percentage of hybrid fuel cars reached 60% of all cars acquired.

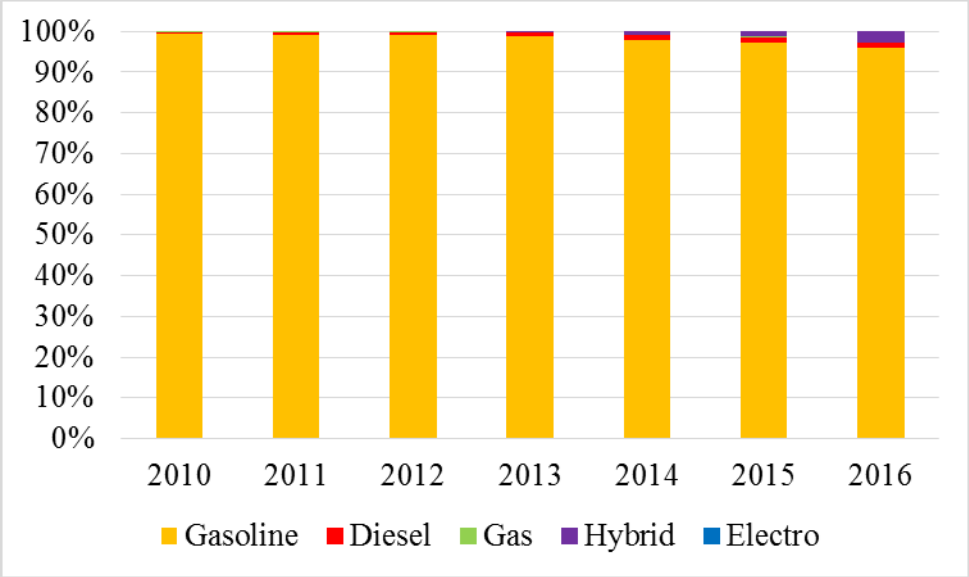



**Figure 2.5 – Vehicle fuel distribution among new cars**

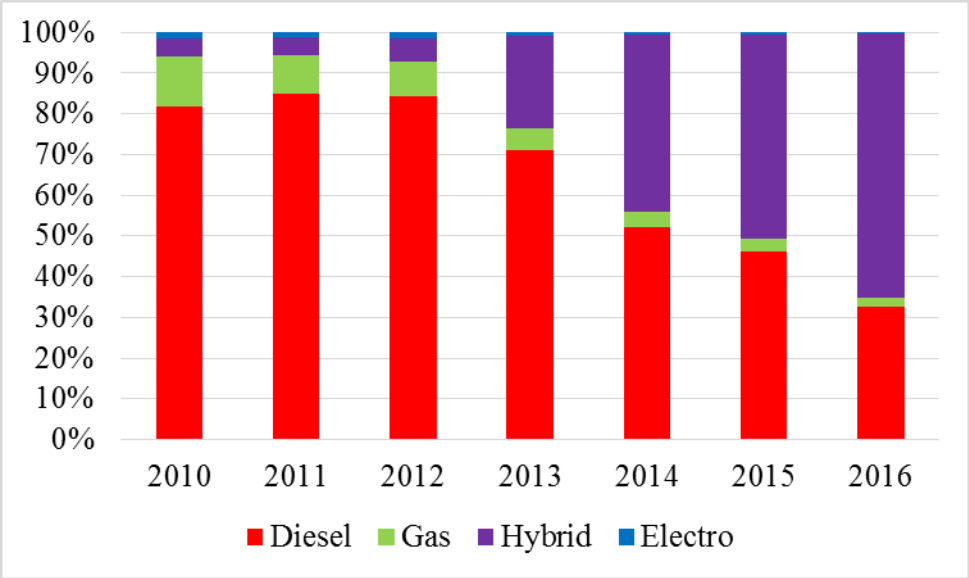



**Figure 2.6 – Vehicle fuel distribution among new cars without gasoline**

In 2010, the share of diesel cars totaled more than 90% of all non-gasoline fuel cars among new cars. However, since 2012 there is a growth in the purchase of hybrid cars with a gasoline engine, and in 2016 gasoline and hybrid cards came to more than 80% of non-gasoline fuel.

# 3. Legislation, policies and measures in road transport

This chapter presents legislation, existing and planned policy and measures (P&M) regulating the road transport sector in Kazakhstan affecting the fuel use.

## 3.1. Legislation in the field of road transport

### Law "On Transport in the Republic of Kazakhstan" No. 156, dated September 21, 1994

The law "On Transport in the Republic of Kazakhstan" defines the basis for legal, economic and organizational activities of the transport in Kazakhstan (Law №156, September 21, 1994). The law establishes a system of state regulations and management of transport activities through legal support, licensing, technical regulation, taxation, lending, financing and pricing, investment, unified social and scientific and technical policy, control and supervision of transport enterprises' compliance with the legislations of the Republic of Kazakhstan (RK). The law requires that vehicles meet the requirements for energy efficiency, safety of human life and health, the environment, established technical regulations in the field of transport, have a roadworthiness certificates, and be registered. Under the law, vehicles that do not meet the safety requirements cannot be imported, sold and operated. The authorized body should control the criteria of vehicles intended for movement along the roads in the RK. The criteria, currently in force by order of Minister of Investment and Development of the Republic of Kazakhstan (RK) dated March 26, 2015 No. 342 (MID Order 342 2015), include standards of overall dimensions, masses, axial loads of vehicles and emissions standards. The standards for pollutants from vehicle emissions are given in Annex 1. It should be noted that these standards were not presented in previous versions of the standards before 2015.

### Law "On Road Transport" No. 476-II4 dated July 4, 2003

The law[1] regulates the relations arising between carriers, passengers, consignors, consignees, other individuals and legal entities in the field of road transport. The law indicates that environmental safety issues in road transport are regulated by regulatory legal acts of the Republic of Kazakhstan.

### Law on Road Traffic No. 194-V5 dated April 17, 2014

The law[2] establishes the legal basis and general conditions for the functioning of road traffic and ensuring its safety in the R K. With regard to reducing environmental impact, the Law introduces the concept of sustainable transport. Sustainable transport means vehicles that reduce the level of negative environmental impact in the process of traffic. Sustainable transport should ensure: (1) the accessibility, mobility and operation of all types of transport to maximize the satisfaction of the transport needs of their users at the lowest cost, as well as the competitiveness of the economy and balanced regional development; (2) minimization of emissions and waste, as well as minimal impact on the occupied territory and measures to

[1] http://adilet.zan.kz/rus/docs/Z030000476_.
[2] http://adilet.zan.kz/rus/docs/Z1400000194.

reduce noise. Sustainable transport includes bicycles and green vehicles.

## 3.2. Strategic documents in road transport sector

### The Transport Strategy until 2015

The Transport Strategy until 2015 was approved on April 11, 2006, by the Decree of the President of the RK No. 86; it expired in 2010. The goal of the strategy was to advance the development of the transport and communications complex, which is able to fully meet the needs of the economy and population in transport services. The main objectives of this strategy for the transport industry were to ensure the economic growth of the country, integration into the global transport and communications system, the creation of a network of modern highways that allow for the implementation of continental and transcontinental transit in the North-South and West-East directions.

Among the expected results in the Transport Strategy related to the efficiency of fuel use is the decrease in the technogenic and negative ecological impact of transport and **the decrease in the share of transport in environmental pollution by 2.5 times**. Policies that were to reach these results included;

- limiting and phasing out imports of vehicles that do not meet environmental requirements via the development of monitoring systems and the application of economic incentives;
- transition to international standards for the environmental safety of vehicles, including transit traffic;
- the development of a monitoring system and increasing the responsibility of contracting and engineering and consulting structures for violating environmental requirements and causing damage.

### Program for the Development of Transport Infrastructure in the RK for 2010–2014

On September 30, 2010, the Government of the RK approved the "Program for the Development of Transport Infrastructure in the Republic of Kazakhstan for 2010–2014" (it was expired in 2014). The purpose of the program was the development of the transport and communication complex, as well as the transport and logistics system that can fully meet the needs of the economy and the population in transport and logistics services.

This program contains SWOT analyzes by mode, including for road transport (see table 3.1 below).

**Table 3.1 – SWOT of road transport**

| **Strengths** | **Weaknesses** |
|---|---|
| 1) The developed of competition in transportation;<br>2) High efficiency and mobility in comparison with other modes of transport;<br>3) The share of road transport in the total volume of transported passengers by all modes of transport is 99%;<br>4) The share of road transport in the total volume of transported goods by all types of transport is 87%;<br>5) The agreements between the Governments of countries on international transport;<br>6) Development of transit corridors;<br>7) Wide geographical coverage;<br>8) There is no alternative to road transport for the transport of passengers and goods for short and medium distances;<br>9) The ability to provide round-the-clock services;<br>10) Roads for individual regions are the only transport connection. | 1) High wear and tear of the technical condition of vehicles;<br>2) High level of road accidents;<br>3) Low qualification and transport discipline of drivers;<br>4) High level of harmful emissions into the atmosphere;<br>5) Weak pre-trip control of drivers;<br>6) Not meeting the safety requirements of most irregular carriers;<br>7) Insufficient control over the transshipment of cars. |
| **Opportunities** | **Threats** |
| 1) Improving the quality of transport and road services;<br>2) Introduction of environmentally friendly technologies;<br>3) Introduction of digital tachographs to improve the safety of road transport;<br>4) Introduction of energy-saving technologies, increase of economic efficiency of works;<br>5) Increasing the level of multimodal, container, piggyback transport;<br>6) Development of transport logistics systems;<br>7) Building new infrastructure, reconstruction and modernization of the existing one;<br>8) Introduction of a centralized dispatch control system;<br>9) Development of new and revision of existing standards with their harmonization with international requirements;<br>10) Licensing of the activities of road hauliers. | 1) Increased accidents due to high physical depreciation of vehicles;<br>2) Decrease in speed of transportations because of excessive accumulation of vehicles on streets of large cities;<br>3) Ecological hazard in places of large congestion of vehicles;<br>4) The decrease in the number of Kazakhstan carriers in the international transport services market due to the creation of artificial barriers in other countries. |

The program paid attention to such measures as energy efficiency and energy saving. It was assumed that in road transport, the reduction of specific energy costs by 2015 would be achieved through:

1) improvement of the technical condition of the road network of interurban bus routes and long-distance transport of goods of at least 5%;

2) updating the fleet of trucks and buses with more economical stock at the level of the requirements of environmental standards of ecological stage-4 of at least 3%;

3) expanding the use of highly efficient multimodal and other modern transport processes at least 2%;

4) increasing the technical and operational indicators for the use of vehicles that directly affect the reduction in the specific costs of fuel (mileage utilization coefficient, load capacity utilization factor, passenger capacity, technical availability of the stock) at least 4%.

As a result of implementing these measures, the energy intensity of vehicles can be reduced by no less than 14%.

**Concept for A Transition of the RK to Green Economy**

One of the key documents on the strategic development of Kazakhstan is the "Concept for a Transition of the RK to Green Economy" dated May 30, 2013, No. 577. The Concept describes an approach to the implementation of energy-saving and energy efficiency measures in the transport sector. It was determined that for the transport sector it is necessary to organize work in several main areas as defined below:

1) Providing the optimal composition of the transport fleet through monitoring and ensuring compliance with the requirements related to fuel efficiency for new vehicles appearing on the market;

2) Developing alternative types of transport and related infrastructure, in particular, for electric vehicles and gas-fueled vehicles;

3) Ensuring the use of high-quality fuel;

4) Developing an incentive program for the recycling of vehicles to facilitate the renewal of the fleet in a shorter timeframe (for example, in the form of rewards for the disposal of old vehicles and the purchase of new, more environmentally friendly cars);

5) Improvement of the system of traffic flow management ("smart traffic control system");

6) Transportation management (transport infrastructure that enables efficient use of all types of transport, increases accessibility and quality of group passenger transportation).

**The Program "Energy Saving 2020"**

On August 29, 2013, the Program "Energy Saving 2020" was approved by the Decree of the Government of the RK No. 904. (It has been invalidated since July 25, 2016). The objectives of the program include reducing fuel consumption in the transport sector. One of the directions of the program was the creation of energy-efficient transport by 2020 with the following parameters: (1) reduction of fuel consumption by road, rail, and air transport by 30%; (2) renewal of the

vehicle fleet of the RK to 50%. According to the implementation plan of the program following measures are included in the field of road transport:

1) Introduction of Euro standards for road transport: 2013 – Euro-3; 2014 – Euro-4; 2015 –Euro 5; 2020 – Euro-6;

2) Inclusion in the development programs of the territories of measures to develop an energy efficient transport infrastructure;

3) Development of the use of solar panels on urban passenger buses;

4) Working out the issue of marking the energy efficiency of tires;

5) Development of proposals to stimulate the purchase of fuel-efficient vehicles;

6) Working out the issue of cancellation of customs duties on cars with hybrid, gas and electric motors;

7) The introduction of the possibility of turning to the right of vehicles in the pilot mode in the cities of Astana and Almaty with a red traffic light;

8) Study of the issue on the use of energy efficient tires on public vehicles.

### 3.3. Policies and measures in the road transport sector

This section discusses the policies and measures adopted in Kazakhstan in the automotive sector with respect to improving the environmental situation, namely reducing emissions of both greenhouse gases and pollutants.

**Improving transport processes and infrastructure**

***Increased use of multimodal transport processes***

One of the measures leading to reducing the environmental impact of vehicles is the expansion of the use of multimodal transport processes. This measure was introduced in the Transport Infrastructure Development Program in the RK for 2010–2014.

Multimodal transport processes lead to an increase in transportation efficiency by reducing the cost of transportation and transshipment of goods, improving the use of vehicles and equipment based on reliable performance monitoring, precise coordination of cargo delivery and transshipment operations, and the ability to monitor the location of the cargo along the route on regular basis. Improving transportation efficiency in turn leads to savings and the rational use of fuel and energy resources.

The development of this measure was received in the Program of the President of the RK "The Plan of the Nation – 100 Concrete Steps"[3] approved on May 20, 2015. It indicated the need to integrate Kazakhstan into international transport and communication flows and launch a project to create a multimodal transport corridor – the Eurasian Transcontinental Corridor, which will allow unhindered transit of goods from Asia to Europe (step 65).

In order to develop trans-Caspian multimodal transport in the Caspian Sea, a project of

[3] http://adilet.zan.kz/rus/docs/K1500000100.

building a ferry complex in the port of Kuryk was implemented. In August 2018, took place the launch of a car ferry terminal[4] for servicing freight vehicles.

**Development of alternative modes of transport and related infrastructure**

The development of alternative modes of transport and related infrastructure, for electric vehicles and gas vehicles in particular, was announced as a measure in the Concept for transition of the RK to Green Economy. This measure improves the environmental situation.

In 2019, 696 electric vehicles were registered in Kazakhstan. According to the Union of Automobile Industry Enterprises of Kazakhstan "KazAvtoProm", there are only about 200 electric cars in the republic directly. According to experts, Kazakhstan motorists are in no hurry to change cars for two reasons: (1) the cost of electric cars, and (2) the lack of developed infrastructure for their operation, first and foremost, charging stations.

In June 2019, the head of Tesla, Elon Musk, promised on Twitter to build high-speed charging stations for Tesla cars in Kazakhstan this year. And the coordinator of UNDP / GEF projects and the Government of the R K on energy efficiency, Alexander Bely, does not exclude that one of the joint projects will be the introduction of requirements for the mandatory construction of charging stations for electric cars in underground parking lots into building codes.

In order to expand the use of natural gas as a motor fuel, in November 2018, the Government of the RK approved an Action Plan to expand the use of natural gas as a motor fuel for 2019–2022. It supports the implementation of 11 measures that will lead to the following objectives:

(1) updating buses and special vehicles to use compressed and (or) liquefied natural gas as motor fuel in an amount from 3,300 units in 2019 to 12,000 units in 2022;

(2) the need for compressed natural gas and (or) liquefied natural gas as a motor fuel for vehicles in the gasified regions of Kazakhstan from 135 million $m^3$ in 2019 to 500 million $m^3$ in 2022;

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

**Improving the traffic management system ("Intellectual traffic management system")**

Intellectual traffic management systems can be deployed at different levels of traffic. For example, at the city level, the intellectual traffic management system is specialized software and an interconnected complex of high-tech equipment for organizing and managing traffic. The main purposes of the system are (1) Optimization of traffic at regulated traffic lights in order to reduce transport delays; (2) Reducing the time spent on the trip; (3) Achieving an improvement in operational speed of public transport. The intellectual traffic control system uses data continuously received from vehicle detectors and makes the necessary calculations in real-time. Thus, the system solves the global problem of traffic optimization, responding to the current

[4] http://www.traceca-org.org/ru/strany/kazakhstan/transportnyi-i-logisticheskii-sektor-respubliki-kazakhstan/.

transport situation.

The Resolution of Astana city local administration dated May 4, 2016, No. 108-891 approved the Rules for the implementation and operation of automated traffic control systems[5],

The goal of introducing automated traffic control systems is ensuring transport accessibility for capital city residents, including increasing the capacity of the road network, reducing accidents, and increasing the efficiency of public transport.

Objectives of automated traffic control systems include:

1) Improving operational efficiency of the transport system by (a) increasing the throughput of traffic flows; (b) reducing delays associated with the use of various modes of transport;

2) Enhancing convenience and comfort along the way by (a) increasing transport accessibility of public transport; (b) increasing the reliability of the travel time of the planned section of the track; (c) increasing general and personal safety of road users;

3) Ensuring road safety by (a) increasing the safety of road users; (b) reducing the number of traffic accidents.

In October 2017, during the meeting of the Government of the RK, the Minister for Investment and Development, Zhenis Kasymbek, reported on the ongoing work on digitalization of the mining industry and digital technologies in transport and logistics. According to the Minister, an intelligent transport system (ITS) is being created as a part of digitalization of transport and logistics. One of the components of the system involves special automated measuring tools (SAMT) installed on the main automobile transport corridors, which provide non-contact weighing of vehicles in motion, monitoring and accounting for intensity, and exclude unreasonable stops. In 2017, it was planned to launch 10 SAMT, and by 2020 – about 46.

In May 2018, during the government meeting, the Minister spoke about the work on the implementation of the Intellectual Transport System (ITS)[6]. According to the ministry, the economic effect of the introduction of ITS will be about 380 billion tenge. According to the toll system – 30 billion tenge annually (210 billion tenge until 2025), by special automated measuring instruments until 2025 – 44.7 billion tenge, by the road asset management system – 110 billion tenge, by E-freight – 15 billion tenge.

Based on international experience, eight basic components (four at the republican level, and four at the regional level) of the intellectual transport system were identified. A mobile application will be developed for using RFID tags for contactless debit of funds while traveling, and video cameras, weather sensors and information boards will be installed to inform drivers.

Another component is represented by special automated measuring tools (SAMT) for weighting vehicles in motion, accounting for intensity, and electronic registration of travel permits. In 2018, it is planned to launch 12 SAMT, and the general goal by 2020 is to launch 46 units in total.

[5] http://adilet.zan.kz/rus/docs/V16ABW01029.
[6] https://kapital.kz/economic/68811/chto-dast-intellektualnaya-transportnaya-sistema.html.

Moreover, to ensure safety during the transportation of heavy, bulky, and dangerous goods, a system of dispatching and online monitoring of compliance with routes is being developed on the basis of the private financial initiative. The initiative will optimize the costs allocated for the maintenance and repair of routes. Since October 1, 2017, the phased introduction of system modules into trial operation and integration with the information systems of the ministry is underway.

At the regional level, ITS will be implemented in four directions: a photo and video fixation system, a passenger transportation and electronic ticketing monitoring system, a traffic control system, and a parking management system.

In general, the implementation of the Intellectual Transport System and the digitalization of the transport sectors will allow us to achieve the following indicators: decreasing the number of accidents – 8–10%; reducing travel time – 20%; increasing the availability of information – 70%; reducing of harmful emissions – 24%.

**Right turn of vehicles in pilot mode in the cities of Astana (now Nur-Sultan) and Almaty with a red traffic signal**

On November 2, 2018, Mayor of Astana Bakhyt Sultanov spoke about the pilot launch of allowing turns to the right under the red light of a traffic light. Answering a question during an online conference on dialog.egov.kz, Sultanov said that this decision is new for Astana road users. "It was decided to launch five sites for pilots. After the analysis, the possibility of increasing the number of such intersections will be considered," assured mayor[7].

**Introduction of Euro emissions standards for road transport**

On December 29, 2007, under the number 1372, the Technical Regulations on requirements for emissions of harmful (polluting) substances of vehicles launched into circulation in the territory of Kazakhstan (Regulations 2007) were approved by the resolution of the Government of the RK; they were expired in 2017. These Regulations defined the deadlines for the introduction of environmental standards for vehicles by phases. Since July 15, 2009, restrictions have been imposed on the import and production of cars on the territory of the country that do not meet the environmental standards of the environmental stage-2. This measure is aimed at improving the environmental situation in the major cities of Kazakhstan, improving the safety of road transport and creating conditions for the renewal of the car fleet in the country.

According to this Technical Regulations, the main technical requirements for the characteristics of fuel for motor vehicles are introduced in the following terms: (1) ecological class-2 from January 1, 2010; (2) ecological class-3 from January 1, 2014; (3) ecological class-4 from January 1, 2016. The specific emission standards for motor vehicles are introduced in the following terms: (1) ecological class-2 from July 15, 2009; (2) ecological class-3 from 1 January 2013; (3) ecological class-4 in relation to: vehicles imported in the RK from July 1, 2013;

[7] https://aqparat.info/news/2018/11/02/9040091-pravyi_povorot_na_krasnyi_akim_astany_ra.html.

vehicles of category M3, N2 and N3 with ICE operating on diesel fuel from January 1, 2015; vehicles produced in RK from January 1, 2014.

After the modernization of all three refineries in Kazakhstan, all gasoline was made to comply with Euro 4 and 5 standards. In the territory of the Customs Union, these standards are called K4 and K5. This ensures products have a lower content of sulfur and harmful carcinogens which benefits the overall environmental situation in the country[8].

**Increase of customs tariff for road transport**

On July 6, 2010, the Customs Code entered into force on the territory of Belarus, Kazakhstan and Russia, which marked the beginning of cooperation between the three states. Before this new code, the customs duty for the cars were 10% of the cost, but not less than 0.1 Euro per 1 $cm^3$ of the engine volume. The new customs duties were increased[9] (see table 3.2).

**Table 3.2 – Customs Duties from 2010**

| Name | Type | The duty rate (in percent of the customs value, or in EURO) |
|---|---|---|
| **Vehicles with an internal combustion engine with spark ignition and with reciprocating piston motion** | | |
| With a working volume of engine cylinders not more than 1000 $cm^3$ | new | 25, but not less than 1 Euro per 1 $cm^3$ |
| | more than 5 years | 2.5 Euro per 1 $cm^3$ |
| | more than 7 years | 1.4 Euro per 1 $cm^3$ |
| | from 5 to 7 years and other | 25, but not less than 0.45 Euro per 1 $cm^3$ |
| With engine working volume of 1000–1500 $cm^3$ | new | 25, but not less than 1.1 Euro per 1 $cm^3$ |
| | more than 5 years | 2.7 Euro per 1 $cm^3$ |
| | more than 7 years | 1.5 Euro per 1 $cm^3$ |
| | from 5 to 7 years and other | 25, but not less than 1 Euro per 1 $cm^3$ |
| With engine working volume of 1500–1800 $cm^3$ | new | 25, but not less than 1.25 Euro per 1 $cm^3$ |
| | more than 5 years | 2.9 Euro per 1 $cm^3$ |
| | more than 7 years | 1.6 Euro per 1 $cm^3$ |
| | from 5 to 7 years and other | 25, but not less than 0.45 Euro per 1 $cm^3$ |
| With engine working volume of 1800–3000 $cm^3$ | new | 25, but not less than 1.8 Euro per 1 $cm^3$ |
| | more than 5 years | 4 Euro per 1 $cm^3$ |
| | more than 7 years | 2.2 Euro per 1 $cm^3$ |
| | from 5 to 7 years and other | 25, but not less than 0.55 Euro per 1 $cm^3$ |

[8] https://forbes.kz/process/energetics/kazahstan_polnostyu_obespechit_sebya_benzinom_do_2032_goda/.
[9] http://www.eurasiancommission.org/en/act/trade/catr/ett/Pages/default.aspx.

| Name | Type | The duty rate (in percent of the customs value, or in EURO) |
|---|---|---|
| With an engine working volume of more than 3000 cm³ | new | 25, but not less than 2.35 Euro per 1 $cm^3$ |
| | more than 5 years | 5.8 Euro per 1 $cm^3$ |
| | more than 7 years | 3.2 Euro per 1 $cm^3$ |
| | from 5 to 7 years and other | 25, but not less than 1 Euro per 1 $cm^3$ |
| **Vehicles with reciprocating internal combustion piston engine with compression ignition (diesel or semi-diesel)** | | |
| With a working volume of engine cylinders not exceeding 1500 cm³ | new | 25, but not less than 1.2 Euro per 1 $cm^3$ |
| | more than 5 years | 2.7 Euro per 1 $cm^3$ |
| | more than 7 years | 1.5 Euro per 1 $cm^3$ |
| | from 5 to 7 years and other | 25, but not less than 0.4 Euro per 1 $cm^3$ |
| With a working volume of engine cylinders 1500–2500 cm³ | new | 20, but not less than 1.27 Euro per 1 $cm^3$ |
| | more than 5 years | 4 Euro per 1 $cm^3$ |
| | more than 7 years | 2.2 Euro per 1 $cm^3$ |
| | from 5 to 7 years and other | 25, but not less than 0.5 Euro per 1 $cm^3$ |
| With an engine volume of more than 2500 cm³ | new | 20, but not less than 1.68 Euro per 1 $cm^3$ |
| | more than 5 years | 5.8 Euro per 1 $cm^3$ |
| | more than 7 years | 3.2 Euro per 1 $cm^3$ |
| | from 5 to 7 years and other | 25, but not less than 1 Euro per 1 $cm^3$ |
| **Other types of vehicles** | | 20 |

From the table above it is seen that the new customs duties increased at least four times.

**Increase of primary registration fees**

In October 2015, the senators approved the bill "On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan on the Issues of Industrial and Innovation Policy", presented by the Minister for Investments and Development Asset Issekeshev.

The article 204 of the Environmental Code of the RK was expanded to "individuals and legal entities that operate vehicles and other vehicles that have negative impacts on the environment ... pay a fee for the initial registration of a vehicle in accordance with the Tax Code of the Republic of Kazakhstan". It will have to be paid by the owners of vehicles imported from the EAEU countries and others.

**Table 3.3 – Rates of primary registration fees**

| Vehicle category | Rate (monthly calculation index) |
|---|---|
| ***Category M1*** | |

| Vehicle category | Rate (monthly calculation index) |
|---|---|
| till 1 year | 0.25 |
| till 3 years | 50 |
| over 3 years | 500 |
| ***Category M2*** | |
| till 1 year | 0.25 |
| till 3 years | 240 |
| from 3 till 5 years | 350 |
| over 5 years | 500 |
| ***Category M3*** | |
| till 1 year | 0.25 |
| till 3 years | 240 |
| from 3 till 5 years | 350 |
| over 5 years | 500 |
| ***Category N1*** | |
| till 1 year | 0.25 |
| till 3 years | 240 |
| from 3 till 5 years | 350 |
| over 5 years | 500 |
| ***Category N2*** | |
| till 1 year | 0.25 |
| till 3 years | 240 |
| from 3 till 5 years | 350 |
| over 5 years | 500 |
| ***Category N3*** | |
| till 1 year | 0.25 |
| till 3 years | 240 |
| from 3 till 5 years | 350 |
| over 5 years | 500 |

**Introduction of vehicle scrappage fees**

On January 27, 2016, the Rules for the implementation of the expanded obligations of producers (importers)[10] were adopted. According to these rules, all cars imported into the country are subject to a vehicle disposal fee (See table 3.4).

**Table 3.4 –Vehicle scrappage fees**

| Vehicle category | Coefficients for scrappage (basis rate is 50 MCI) |
|---|---|

[10] http://adilet.zan.kz/rus/docs/P1600000028

| | |
|---|---|
| LDV with electric engine, excluding hybrids | 3 |
| LDV with working volume till 1000 $cm^3$ | 3 |
| LDV with working volume 1001–2000 $cm^3$ | 7 |
| LDV with working volume 2001–3000 $cm^3$ | 10 |
| LDV with working volume more than 3001 $cm^3$ | 23 |
| Tracks till 2.5 tons | 3 |
| Tracks from 2.5 till 3.5 tons | 4 |
| Tracks from 3.5 till 5 tons | 5 |
| Tracks from 5 till 8 tons | 5 |
| Tracks from 8 till 12 tons | 6 |
| Tracks from 12 till 20 tons | 11 |
| Tracks from 20 till 50 tons | 17 |
| Buses till 2500 $cm^3$ | 6 |
| Buses from 2500 till 5000 $cm^3$ | 10 |
| Buses from 5000 till 10000 $cm^3$ | 19 |
| Buses over 10001 $cm^3$ | 20 |

**Introduction of scrappage program for the cars**

On November 21, 2016, a car scrappage program began to operate in Kazakhstan. At the first stage of the program, the necessity of collecting 10 thousand cars in Kazakhstan was determined. The program has started: at the beginning, it helped to collect over 5665 cars of 10 thousand expected only in 2016. The leader was Shymkent with 764 cars, followed by Kostanay – 688 cars, and third was Almaty with 496 cars. For the cars, depending on the safety and availability of aggregates, were given certificates with costs from 48 to 150 thousand tenge. It was said that in 2017 the total quota of Kazakhstan would be increased to 40 thousand cars[11].

[11] http://mk-kz.kz/articles/2017/06/27/v-kazakhstane-nachalas-vtoraya-stadiya-programmy-utilizacii-avtokhlama.html

## 4. The average annual vehicle-kilometers of the road transport

In Kazakhstan, there are no statistics available for the average annual miles driven. Tables below show the figures for average mileage in European countries and in Russia per vehicle category.

**Table 4.1 – Average annual miles driven per vehicle category in 15 EU countries in 2002 (Unit: km)**

| Country | Gasoline LDV | Diesel LDV | Gasoline light trucks | Diesel light trucks | Diesel heavy trucks | Buses | Two wheels |
|---|---|---|---|---|---|---|---|
| Austria | 16,641 | 18,156 | 25,000 | 25,000 | 67,891 | 41,573 | 4881 |
| Belgium | 14,319 | 22,774 | 20,000 | 35,000 | 63,275 | 23,210 | 7800 |
| Denmark | 20,410 | 21,413 | 18,253 | 15,000 | 38,714 | 60,040 | 3846 |
| Finland | 19,256 | 31,165 | 8500 | 16,000 | 55,000 | 70,000 | 3260 |
| France | 9950 | 15,059 | 16,500 | 25,000 | 59,719 | 39,550 | 4359 |
| Germany | 11,596 | 15,353 | 17,500 | 22,000 | 70,340 | 47,000 | 2420 |
| Greek | 16,689 | 16,054 | 13,000 | 20,000 | 40,225 | 16,904 | 5975 |
| Ireland | 20,388 | 14,977 | 25,000 | 27,000 | 35,989 | 48,136 | 11,955 |
| Italy | 9273 | 15,760 | 20,000 | 17,000 | 38,742 | 41,000 | 5088 |
| Luxembourg | 13,920 | 20,174 | 40,000 | 40,000 | 40,000 | 47,730 | 2189 |
| Netherlands | 10,841 | 15,087 | 35,000 | | 26,180 | 35,000 | 3980 |
| Portugal | 12,267 | 12,267 | | 15,000 | 26,683 | 30,220 | 477 |
| Spain | 9578 | 14,362 | 22,500 | 30,000 | 60,281 | 28,000 | 2428 |
| Sweden | 15,005 | 23,579 | 20,000 | 35,000 | 56,930 | 60,000 | 5995 |
| England | 13,729 | 15,644 | 17,000 | 16,500 | 60,000 | 60,000 | 3815 |

**Table 4.2 – Average annual miles driven per vehicle abroad[12], thousands km**

| Country | Average annual mileage, thousands km | | | |
|---|---|---|---|---|
| | Trucks | LDV | Motorcycles | Buses |
| Russia | 30,0 | 15,0 | | 60,0 |
| Belarus | | 1,2 | | 27,4 |
| Bulgaria | 29,8 | 7,2 | | 100,5 |
| Czech Republic | 34,6 | 6,1 | 0,8 | 32,8 |
| Denmark | 20,6 | 19,3 | 6,0 | 34,8 |
| Finland | 23,1 | 18,9 | 14,1 | 78,2 |
| France | | 14,1 | | 29,0 |
| Ireland | 16,5 | 24,4 | 11,0 | 66,8 |
| Israel | 33,1 | 17,2 | 16,8 | 65,8 |
| Italy | | 10,1 | 5,4 | 20,5 |

[12] Methodology for assessing the residual value of vehicles taking into account the technical condition. P-03112194-0376-98 (approved by the Ministry of Transport of the Russian Federation on 10.12.98). Average annual runs and runs since the beginning of the operation of vehicles.

| Country | Average annual mileage, thousands km | | | |
|---|---|---|---|---|
| | Trucks | LDV | Motorcycles | Buses |
| Netherlands | 182,8 | 14,3 | 4,1 | 49,2 |
| Norway | 10,8 | 14,4 | 17,9 | 12,0 |
| Austria | 29,5 | 9,2 | 0,3 | 48,6 |
| Sweden | 22,7 | 16,1 | 9,2 | 56,0 |
| Turkey | 15,3 | 6,4 | | 9,4 |
| UK | 27,5 | 16,4 | 6,7 | 30,8 |
| Germany | 29,6 | 12,7 | 3,9 | 42,2 |
| USA | 61,7 | 18,5 | 4,1 | |

The estimated annual mileage of light-duty vehicle fleet in Kazakhstan is 17,352 km.

Calculation of the annual mileage of the vehicle fleet in Kazakhstan was based on fuel consumption in the country. For reference, the gasoline fuel was selected, since majority of vehicle fleet has gasoline engines. The fuel consumption of gasoline in Kazakhstan in 2015 was 4,287,967 tons. For proper calculation, the unit should be changed to liters. The density of motor gasoline is 737.22 kg/$m^3$, consequently, 1 ton of gasoline equivalent to 1,356.45 liters. After fuel conversion, fuel consumption formed 5,816 million liters. The amount of vehicle fleet using on gasoline is 3,925,048 vehicles with average fuel consumption of 8.54 lge/100 km or 0.0854 lge/km. Dividing the total gasoline consumption by the average consumption allows calculation of the total mileage of the entire fleet – 68,107 million km. By dividing the total mileage by the number of cars, we get the average mileage equal to 17,352 km per unit of vehicles.

# 5. Fuel economy policies and fuel economy ex-ante projections for 2030: scenario analysis including GHG emissions

## 5.1. Scenario description

The Fuel Economy Policy Implementation Tool was developed by the International Energy Agency (IEA) as a part of the Global Fuel Economy Initiative event in 2015. FEPIT allows analyzing impact of different policy applications on vehicle fleet. This tool is expected to evaluate policy measures aimed at GFEI objective of 4.2 lge/100 km at 2030. FEPIT consists from four below different policies, which affect the vehicle fleet:

- fuel economy,
- $CO_2$-based tax registration scheme,
- tax scheme for the use of vehicles based on $CO_2$,
- fuel taxation.

**The first scenario is a policy-free scenario.** To estimate the fuel economy, it was decided to forecast fuel consumption using data from 2010 to 2015 to identify baseline trends before the adoption of fuel economy policies. Fuel consumption in 2015 is 8.54 l / 100 km. Calculation of the actual trends using data from 2010 and 2015 shows that the expected average fuel consumption in 2030 is 8.14 l / 100 km. Thus, we can say that with the help of existing laws and taxation policies, fuel economy will be improved 4.7% in 2030.

Fuel economy calculations were conducted by calculating the fuel consumption of the total vehicle fleet of the years 2012–2017 and comparing the calculated values with the calculated consumption values for these years based on data for 2010 and 2011 using the forecast calculated by FEPIT. Fuel economy obtained over this period is the result of enforcing regulatory measures in the transport sector.

The analysis of the database on the number of motor vehicles was supplemented by data on fuel consumption per 100 kilometers according to the brands of cars and their year of manufacture. According to the data obtained, the following structure of road transport and average fuel consumption in 2010–2015 were obtained (see Table 5.1).

**Table 5.1 – The structure of road transport and the average fuel consumption ( 2010–2015)**

| **Index** | **% of registered vehicles** | | **The average fuel consumption, lge/100 km** | |
|---|---|---|---|---|
| **Range, lge/100 km** | **2010** | **2015** | **2010** | **2015** |
| ICE < 8.0 | 42.06% | 45.44% | 7.11 | 7.03 |
| ICE 8.0–8.7 | 15.31% | 14.53% | 8.38 | 8.37 |
| ICE 8.7–9.5 | 10.94% | 10.22% | 9.00 | 9.00 |
| ICE 9.5–11.0 | 25.24% | 23.41% | 10.16 | 10.15 |
| ICE > 11.0 | 6.44% | 6.40% | 13.09 | 13.03 |
| Total: | 100.00% | 100.00% | 8.66 | 8.54 |

As can be seen, the structure of road transport for the period of 2010–2015 has changed to the predominance of lower levels of fuel consumption, and the average level of consumption by category also has an average downward trend.

**The second scenario of the FEPIT tool is fuel economy.** In this scenario, a threshold value is determined for average fuel consumption. This future goal for which it needs to adjust the measures and which should be achieved by changing technical characteristics of vehicle makes and other measures. The target of the Global Fuel Economy Initiative (GFEI) is 4.2 l / 100 km for new cars in 2030. Given the average fuel consumption of 8.54 l / 100 km in 2015, in order to achieve the GFEI indicator, it is recommended to improve this figure by 4.6% per year in Kazakhstan. This scenario does not show and does not explicitly include the policy on the inclusion of $CO_2$ taxation scheme based on registration and use of the car. It also does not explicitly include the scenario of taxation on fuel, it shows what the state policy should be regarding changing the average fuel consumption in order to achieve the savings target Fuels in the Global Fuel Economy Initiative.

**The third scenario is a $CO_2$ registration tax scheme.** Registration tax is paid once the car enters the market. The general idea of this scheme is to establish a registration tax according to the level of $CO_2$ emissions in a vehicle where higher fuel consumption or $CO_2$ emissions will lead to an increase in taxation for a vehicle. In addition, taxation can be improved by introducing a system of discounts and penalties. The system offers a discount for cars with lower $CO_2$ emissions. For Kazakhstan, it appeared that in 2015 the registration tax was 2915 US dollars per unit for automobile transport with an age of more than three years, which makes up the majority of cars. For subsequent years, the prognosis suggests in 2020 the level of registration tax would be at the level of 2015. The assumption for 2025 is that the level will be one and a half times higher than in 2015 and then it will double in 2030. There is anticipation concerning this increase which will be adjusted to reflect average spending levels for the established categories.

A usage tax is paid annually for each registered vehicle. As in the second policy, the proposition includes establishing the level of tax on use in accordance with the level of $CO_2$ emissions in the vehicle. In addition, for the system of taxation in circulation, a scheme of discounts and fines with a negative tax can be introduced. Negative tax is a discount for the vehicle owner. For Kazakhstan, it was established that the use taxes in 2015 were the values given in table 5.2.

**Table 5.2 – Usage taxes, US dollars per year**

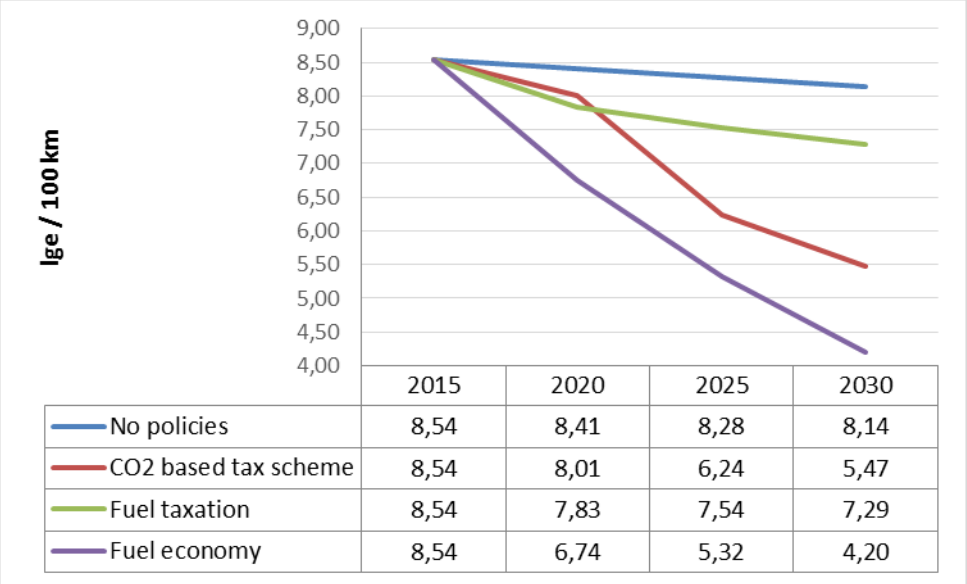
| Index | Utilization taxes, US dollars per year |
|---|---|
| ICE <8 lge/100km | 13.35 |
| ICE 8–8.7 lge/100km | 22.50 |
| ICE 8.7–9.5 lge/100km | 24.52 |
| ICE 9.5–11 lge/100km | 40.74 |
| ICE >11 lge/100km | 67.08 |

To obtain a tax by category, we took the average value of the engine volume for each category and calculated the tax using a specialized online resource[13]. For subsequent years, it was assumed that in 2020 the level of registration tax will stay at the level of 2015. In 2025, it is assumed that the level will be doubled compared to 2015 and tripled in 2030.

**The fourth policy is fuel taxation.** This policy includes excise and value-added tax on fuel purchased. As a result of this policy, the price of fuel can reduce fuel consumption. Considering the dynamics of fuel price growth and assuming that the price increase until 2030 will retain the same trend, it was found that in 2020 the price will be 43% higher than in 2015; in 2025 by 66% and in 2030 by 89% higher than in 2015.

## 5.2. Forecast of fuel consumption and $CO_2$ emissions

In this subsection, calculations are made for average fuel consumption and $CO_2$ emissions from road transport. According to the results, fuel taxation has the lowest effect. $CO_2$ tax schemes help to achieve the greatest effect, but the established levels in the scenario are not enough to achieve the established levels for fuel economy. The average fuel consumption and the specific $CO_2$ emissions by the scenarios is described below.

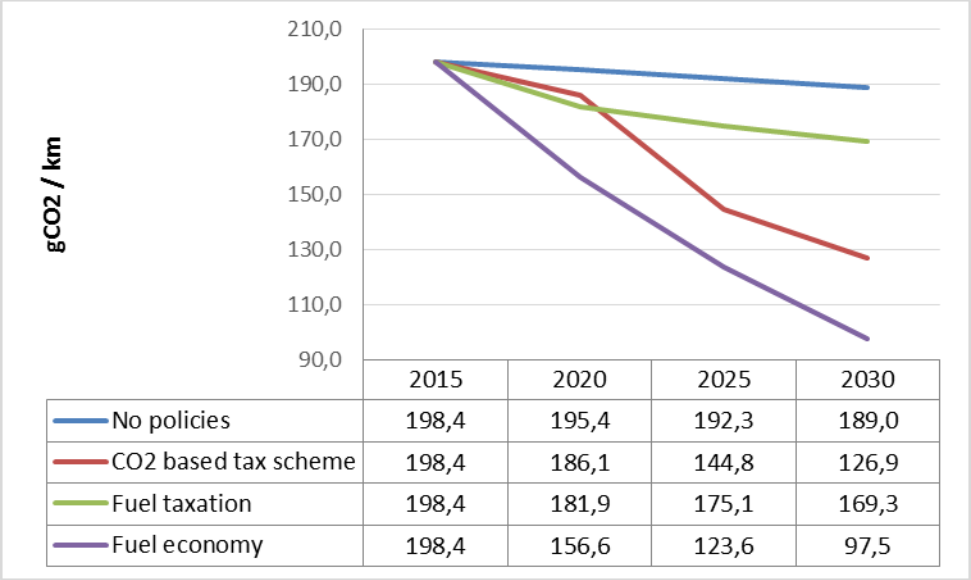



| | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| No policies | 8,54 | 8,41 | 8,28 | 8,14 |
| CO2 based tax scheme | 8,54 | 8,01 | 6,24 | 5,47 |
| Fuel taxation | 8,54 | 7,83 | 7,54 | 7,29 |
| Fuel economy | 8,54 | 6,74 | 5,32 | 4,20 |

**Figure 5.1 – Average fuel consumption in liters per 100 kilometers**

Scenario specific $CO_2$ emissions are as follows.

[13] http://nkregion.kz/info/distance/264-tnalog.html.




| | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| No policies | 198,4 | 195,4 | 192,3 | 189,0 |
| CO2 based tax scheme | 198,4 | 186,1 | 144,8 | 126,9 |
| Fuel taxation | 198,4 | 181,9 | 175,1 | 169,3 |
| Fuel economy | 198,4 | 156,6 | 123,6 | 97,5 |

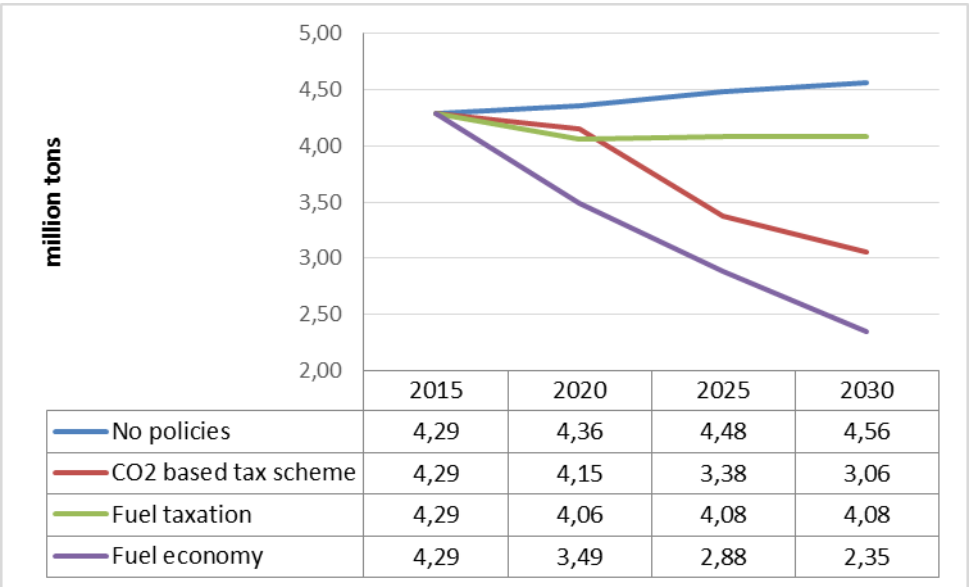
**Figure 5.2 – Specific $CO_2$ emissions, $gCO_2$ / km**

Assuming that the growth of the car park will increase in accordance with the projected population growth. According to UN[14] forecasts, the growth rate of the population of Kazakhstan until 2030 will be: 1.12% per year in the period 2015–2020, 0.87% per year in the period 2021–2025 and 0.69% per year in the period 2026–2030.

**Table 5.3 – Projected growth of number of car registrations**

| Index | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| The number of cars registrations | 3,856,500 | 3,982,500 | 4,158,700 | 4,304,200 |

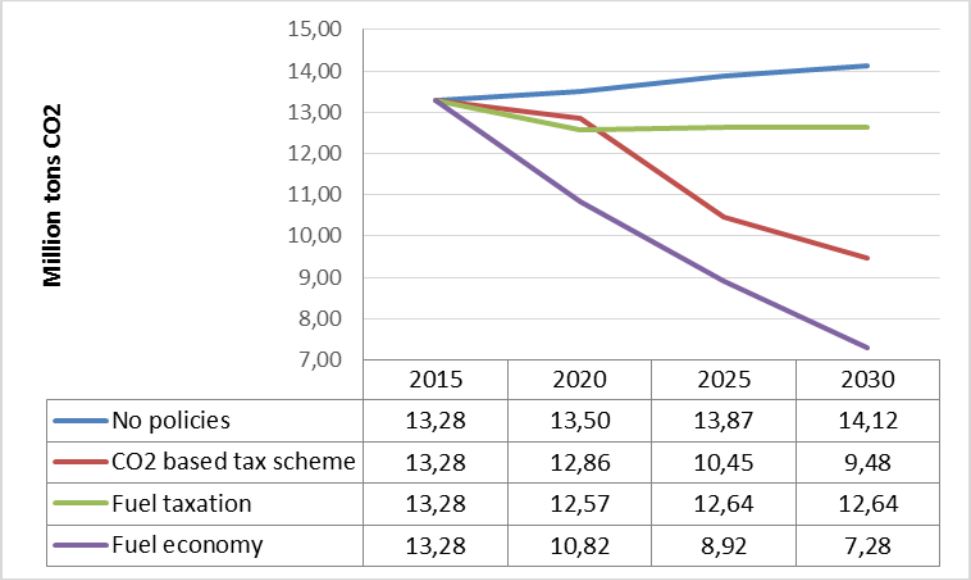
Using these assumptions, we obtain the following projected fuel consumption and $CO_2$ emissions.




| | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| No policies | 4,29 | 4,36 | 4,48 | 4,56 |
| CO2 based tax scheme | 4,29 | 4,15 | 3,38 | 3,06 |
| Fuel taxation | 4,29 | 4,06 | 4,08 | 4,08 |
| Fuel economy | 4,29 | 3,49 | 2,88 | 2,35 |

**Figure 5.3 – Fuel consumption by scenarios, million tons**

[14] https://population.un.org/wpp/




| | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| No policies | 13,28 | 13,50 | 13,87 | 14,12 |
| CO2 based tax scheme | 13,28 | 12,86 | 10,45 | 9,48 |
| Fuel taxation | 13,28 | 12,57 | 12,64 | 12,64 |
| Fuel economy | 13,28 | 10,82 | 8,92 | 7,28 |

**Figure 5.4 – $CO_2$ emissions, million tons $CO_2$**

## 6. Conclusion

The transport sector, especially the automotive sector, is crucial for the development of the country and directly contributes to its economic growth. The road transport sector is the only available mode of transport in most regions of Kazakhstan, due to the vast territory with low population density.

Pollutant emissions in the RK from road transport have reached more than a million tons per year and are constantly growing. The source of emissions harmful to human health is the internal combustion engine. In addition, emissions from road transport have a greenhouse and ozone-depleting effect on the Earth's atmosphere. Therefore, the study of the state of the transport sector, and in particular the automotive sector, is important for developing policies and measures in the field of mitigating the impact on the environmental situation in populated areas of the country and on the health of citizens. Actions are required in all possible directions of changing the current situation to improve it concerning the emissions of polluting and greenhouse gases from the automotive sector. It is important to refer to the fact that measures are being taken to improve the current situation in the country, and these measures are described in the relevant section of the report.

The approaches to the implementation of energy-saving and energy efficiency measures in the transport sector are highlighted in one of the key documents on the strategic development of the RK, namely, in the Concept for a Transition of the RK to Green Economy. It stated measures that, as the analysis of the current situation has revealed, are partially implemented.

According to statistics, most vehicles use gasoline because of the larger number of gasoline car models available in the market, their relative simplicity in design, lower fuel prices and the development of fuel supply infrastructure. In disregard of the fact that the same can be said about diesel vehicles, the share of diesel engines, despite the maturity of the technology used, remains insignificant (2.2% in 2018) compared to gasoline ones. This happens due to the facts that, first, historically diesel engines are considered noisy and difficult to maintain; secondly, diesel fuel is subject to gelling in cold temperatures which is of no small importance in Kazakhstan; and as a result of this, in the mass segment, the diesel cars make up a smaller portion of the market and are more expensive.

The acquisition of new cars can contribute to the improvement of environmental pollution in connection with the improvement of technology. Considering the dynamics of this parameter in the RK, it can be noted that the acquisition of new cars increased significantly from 2011 to 2014. The increase in car purchases was due to economic growth in the country in 2010–2013, and in 2014, this growth continued due to the devaluation of ruble in Russia, while in Kazakhstan, tenge remained at the same level for some time, which affected the difference in car prices in these two countries. In general, in the entire volume of new cars purchased, the share of cars with an engine of less than 2 liters is more than half. This is due to rising fuel prices. The only exception is the year 2014, when there was a large influx of cars came from Russia. At that moment, the share of cars with an engine of 2–3 liters increased. This shows that the price of vehicles and fuel is one of the factors in deciding whether to buy a car.

As part of the work, the annual mileage of cars in Kazakhstan was calculated. This calculation based on fuel consumption in the country. Estimated annual mileage of Kazakhstan car fleet is 17,352 km.

The Fuel Economy Policy Implementation Tool (FEPIT) was used to calculate fuel consumption and $CO_2$ emissions. It was developed by the International Energy Agency as part of the Global Fuel Economy Initiative event in 2015. FEPIT allows analyzing the impact of various policies on the fleet. This tool makes possible to evaluate policies aimed at achieving the GFEI goal of 4.2 liters per 100 kilometers by 2030. FEPIT consists of four different policies that affect emissions from the fleet: (1) Without policies; (2) fuel economy; (3) a $CO_2$-based tax scheme for registration and the use of vehicles; (4) fuel taxation.

According to the results, if no special policies and measures are in place to reduce the environmental impact, the average fuel consumption will change from 8.54 l / 100 km in 2015 to 8.28 l / 100 km in 2030 through natural improvement and renewal of the fleet. Without policies and measures, the estimated fuel economy will be 4.7% by 2030, and the annual rate of reduction in fuel consumption is 0.3%.

Analysis of the database on the number of cars was supplemented by data on fuel consumption per 100 kilometers by car make and year of manufacture. According to the data, the structure of road transport for the period 2010–2015 has changed towards the predominance of lower levels of fuel consumption, and the average level of consumption by vehicle category has a medium-term downward trend as well.

In this scenario, a threshold value for average fuel consumption is determined. This is a future goal for which it is necessary to adjust the figures and which should be achieved through changing technical characteristics of vehicles by the manufacturer and other measures. The Global Fuel Economy Initiative (GFEI) fuel economy target is 4.2 l / 100 km for new cars in 2030. Given the average fuel consumption of 8.54 l / 100 km in 2015, in order to achieve the GFEI indicator, the recommendation is to improve this indicator by 4.6% per year in Kazakhstan.

With the help of the scenario, a $CO_2$-based tax scheme during registration, and when using transportation means, the estimated fuel economy will be 36.0 by 2030; and the annual rate of reduction in fuel consumption will be 2.6%. Thus, this policy is the most effective among those considered for use in the country.

This policy is a separate tax or excise tax on fuel purchased. Based on the dynamics of rising fuel prices, and assuming that price increases until 2030 will maintain the same trend, levels were set the following way:

- in 2020 the price will be 43% higher than in 2015,
- in 2025 it is 66% higher than in 2015, and
- in 2030 – 89% higher than in 2015.

This scenario leads to a situation where the estimated fuel economy is 14.7 by 2030 and the annual rate of reduction in fuel consumption is 1.0%.

Among all the scenarios, the policy is a $CO_2$-based tax scheme when registering and when using vehicles.

## 7. Proposed action

Currently, work is underway to introduce amendments and changes to the Environmental Code of the RK. Based on the results of this work and understanding of the current situation in the transport industry, the following measures have been worked out to introduce the new version of the Environmental Code of Kazakhstan and other local regulatory acts:

- Entering an environmental adjustment factor for vehicle tax with an increase of two years after ten years. (The measure can be drawn up by amending the Tax Code of the RK);
- Introducing restrictions on the movement of vehicles in certain areas of cities or towns depending on the environmental class of the vehicle, at the discretion of local executive bodies depending on the environmental situation. (This measure can be drawn up by amending the Environmental Code of the Republic of Kazakhstan);
- Introducing a ban on the operation of a vehicle by day, depending on the vehicle number. For example, on odd dates it is allowed to drive vehicles with odd numbers, and on even dates with even numbers. Other variations are possible. (The measure can be drawn up by amending the Law on Road Traffic);
- The mandatory availability of a system of bicycle paths in the development of development plans for territories, cities and towns (a measure can be drawn up by amending the Environmental Code of the RK);
- Mandatory availability of dedicated bus lines on the main city streets. Permission to use these lines for electric vehicles (driver can hang a sticker on the windshield if applicable). It is possible to name these lines as ecological lines. (The measure can be drawn up by amending the Law "On Road Traffic" and the Environmental Code of the Republic of Kazakhstan);
- Introduce a requirement for new gas stations to have an electric charging column for electric vehicles. (The measure can be drawn up by amending the Environmental Code of the RK);
- Opportunity for local executive bodies to conduct a flexible tariff policy that will take into account the level of public transport use by the population. (The measure can be drawn up by amending the Environmental Code of the RK in terms of the competence of the MIO in the field of environmental protection).

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