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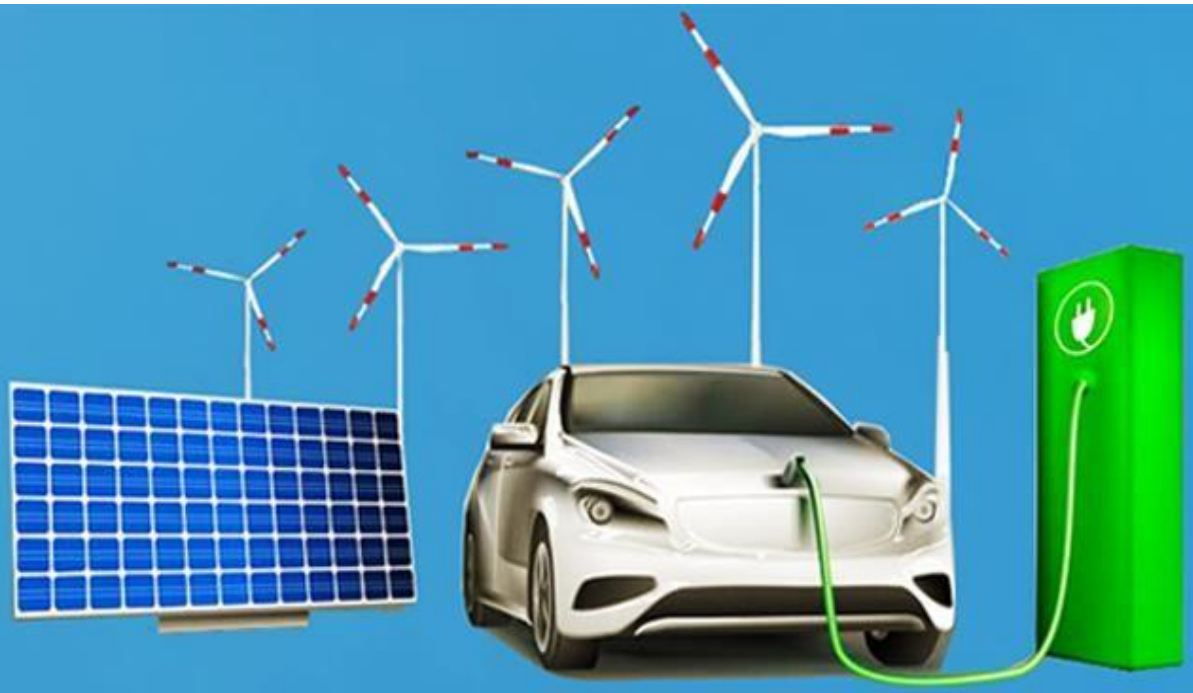

FINAL REPORT

DEVELOPMENT OF A FEASIBILITY STUDY, COST-BENEFIT ANALYSIS TO DETERMINE THE MOST APPROPRIATE POLICY FOR THE TRANSITION TO ELECTRIC MOBILITY IN THE KYRGYZ REPUBLIC

RFP 2020-96

Bishkek, Kyrgyz Republic, 2021

GLOSSARY

EA – Enabling Activities
EFCO2 – CO2 Emission Factor
EGR – Exhaust Gas Recirculation
EV – Electric Vehicle
EMC – Electromagnetic Compatibility
FSP – Full-Sized Project
GEF – Global Environment Facility
GGF – Green Climate Fund
GGGI – Global Green Growth Institute
IEC – International Electrotechnical Commission
IMC – In Motion Charging
KYRSEFF – Kyrgyz Sustainable Energy Financing Facility
MSP – Medium-Sized Project
NO_x – Nitric Oxide
OC – Opportunity Charging
ONC – Overnight Charging
PM2.5 – Particulate Matter of 2.5 Microns
RFID – Radio Frequency Identification
SCR – Selective Catalytic Reduction
SO_2 – Sulfur Oxide
TTW – Tank-To-Wheel (Direct Emissions)
UEMI – Urban Electric Mobility Initiative
UNIDO – United Nations Industrial Development Organization
USD – United States Dollar
VTPI – Victoria Transport Policy Institute
WTT – Well-To-Tank
WTW – Well-To-Wheel (Direct + Indirect Emissions)
A – Ampere

ADB – Asian Development Bank
FFS – Fuel Filling Station
AIS – Automated Information System
BTD – Bishkek Trolleybus Department
GDP – Gross Domestic Product
RES – Renewable Energy Sources
WHO – World Health Organization
GWP – Global Warming Potential
GOST – International Standard
GDM – Gas Distribution Mechanism
SRS – State Registration Service
PPP – Public-Private Partnership
HPP – Hydroelectric Power Plant
ICE – Internal Combustion Engine
EAEU – Eurasian Economic Union
EU – European Union
EEC – Eurasian Economic Commission
JK – Jogorku Kenesh
kV - kilovolt
kWh – kilowatt-hour
CC – Capital Costs
CNG – Compressed Natural Gas
KR – Kyrgyz Republic
IDA – International Development Association
IBRD – International Bank for Reconstruction and Development
MWh – megawatt-hour
IMF – International Monetary Fund
IEA – International Energy Agency
ME&F – Ministry of Economy and Finance
VAT – Value Added Tax
NLA – Normative Legal Act
NGO – Non-Governmental Organization
SCC – Social Cost of Carbon
UN – United Nations

OTRK – Public Broadcasting Corporation

OECD – Organization for Economic Cooperation and Development

GHG – Greenhouse Gases

RTR – Road Traffic Regulations

UNDP – United Nations Development Programme

EIC – Electrical Installations Code

RKDF – Russian-Kyrgyz Development Fund

RF – Russian Federation

REW – Russian Energy Week

HS – Health Status

Media – Media Outlets

CIS – Commonwealth of Independent States

SNiP – Building Codes and Regulations

CO_2 – Carbon Dioxide

MTTP – Medium-Term Tariff Policy

USA – United States of America

EAEU CN of FEA – Eurasian Economic Union's Commodity Nomenclature of Foreign Economic Activity

CB – Carbon Black, Technical ("Black") Carbon

FS – Feasibility Study

UTD – Urban Transport Department

CS – Charging Status

FFPP – Fund for Financing Project Preparation

CCF – Center for Climate Financing

SDG – Sustainable Development Goals

NCV – Net Calorific Value

ECS – Electric Charging Station

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KEY FINDINGS

Current situation in the electric transport sector

- Despite the fact that the development of the electric transport sector is one of the national priorities, there is no clear vision for the development of the electric transport sector in the country. In addition, public awareness of the benefits of using electric vehicles is also low.
- The main reasons that electric cars are unpopular in Kyrgyzstan are the lack of charging stations and underdeveloped infrastructure.
- According to the SRS data as of 01 January 2021, there are only 100 electrically-powered vehicles registered in Kyrgyzstan.

Barriers to the development of the electric transport sector

Legal and regulatory barriers

- The installation of superfast charging stations requires at least 100 kW of power. In order to be able to connect to such power, it is necessary to obtain technical specifications. Pursuant to the legislation, technical specifications for connection of electric installations of consumers are issued in accordance with the Decree of the Government of the Kyrgyz Republic No. 169 dated 29 March 2018, according to which to connect electric installations to the power grid an individual or legal entity (applicant) must apply to the owners of the power supply company that has the appropriate license, as well as the power grids that are in the nearest distance. It should be noted that the fee for technological connection to power grids is not defined. Having analyzed the legislation, we can conclude that the process is quite complicated and requires revision and unification, as well as determination of all fees and charges.
- The legislation does not define the process for regulating and disposing of old batteries from electric cars. Although electric cars are considered to be environmentally friendly vehicles, the battery in them poses great threats to the environment. Since most electric cars in the KR are used cars, the average life of their batteries is 5 years, after which the batteries can no longer be used for cars. Their further disposal is not currently prescribed in the law, but with the increasing number of cars this problem will become more and more urgent.
- At the moment there is a 0% customs rate for the import of electric cars, which will increase to 15% from 2022. It is necessary to make a proposal to the EEC commission to extend the zero rate.
- Lack of preferential programs to finance the purchase of electric cars, in particular for taxi services.

Infrastructural and technical barriers

- The main reason for the low number of electric cars is the lack of a charging network across the country. It is inconvenient for the population to switch from a gasoline car to an electric car due to the inability to drive long distances. It is important for city dwellers to be able to travel outside the city and to Issyk-Kul. Since there are no charging stations, the use of electric cars carries the risk of being left without vehicles in the middle of the road.
- The study also showed that at the moment in the Kyrgyz Republic the service maintenance of electric vehicles is at a low level. However, since our economy is a market economy, with the growth in demand for such services, the supply will also increase both qualitatively and quantitatively
- Electricity deficit in the fall and winter period. At this time, Kyrgyzstan is facing an acute

shortage of electricity in the winter. An increase in the number of electrically-powered vehicles will lead to an increase in electricity consumption. This problem mostly concerns superfast charging stations, which require at least 100 kW of power. To avoid problems with the grid, it is recommended to install superfast charging stations near substations with free capacity. In addition, the calculations of electricity consumption when the number of electric cars is growing are not large.

Recommendations for the development of charging infrastructure

- The experience of other countries shows that the majority of electric vehicle owners (up to 80%) use slow or medium charging stations that do not need high power and are not expensive. Therefore, it is recommended to install slow and medium charging stations in the parking lots of business centers, shopping centers and street parking lots.
- It is recommended to install up to 5 superfast charging stations around Bishkek, which require at least 100 kW of power.
- To simplify the process of connecting superfast charging stations, at the first stage it is proposed to install them near substations with free capacity.
- Superfast charging stations are proposed to be installed and managed by distribution companies.
- For buildings under construction and high-rise buildings, it is recommended to amend building codes to require the installation of slow and/or medium-sized charging stations in parking spaces.

Recommendations for the development of the electric transport sector

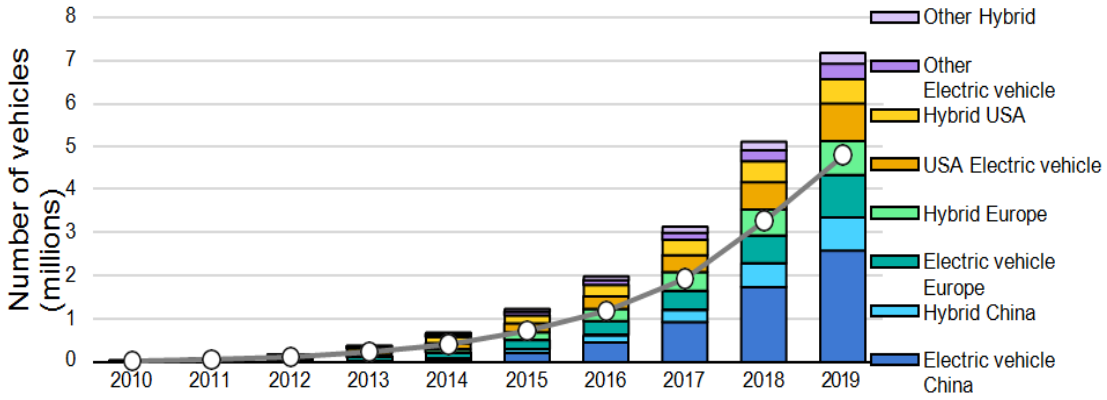
- Extension of zero customs rates for electric cars.
- Conversion of the state vehicle fleet to electric vehicles.
- Changes in construction standards and implementation of requirements by construction companies to install charging stations in parking lots in shopping malls and new buildings under construction.
- Procurement by the municipality of electric buses.
- Introduction of preferential loans for purchasers of electric vehicles.
- Development and approval of legislation for the disposal of old and defective batteries from electrically-powered vehicles.

1. INTRODUCTION

In recent decades, the global electric vehicle fleet has expanded significantly, thanks to supportive government policies of developed countries and technology advances.

Worldwide sales of electric vehicles exceeded 2.1 million in 2019, surpassing 2018, which was already a record year. At the end of 2019, the number of electric-powered vehicles in operation stood at 7.2 million.[1] Electric vehicles accounted for 2.6% of global vehicle sales and about 1% of the global vehicle fleet. Experts estimate such a large increase due to the political statements of Western states regarding their support for the electric vehicle sector. European governments have continued the transition from direct industry subsidies to regulation through the adoption of various documents, including requirements for zero-emission vehicles and fuel economy standards. The graph below shows the number of electric and hybrid vehicles in use.

Figure 1: Number of electric and hybrid vehicles in use



In 2019, the Kyrgyz Republic ratified the Paris Climate Agreement, under which the country committed to provide the UN with climate data transparently and develop a domestic climate change plan at the national level. Ratification of this agreement enables developing countries to receive international financial support to combat climate change.

The transport sector is one of the main sources of air and atmospheric pollution. According to calculations, the total emission of CO_2 by trucks is about 1 million tons per year - **995.7 thousand tons.**

Given today's technology, one of the main ways to reduce the abovementioned emissions is the active introduction and development of the electric transport sector. However, as the experience of foreign countries shows, it is impossible to develop this type of sector without an active, well-thought-out and clear state policy and support.

[1] https://www.iea.org/reports/global-ev-outlook-2020#the-global-electric-vehicle-fleet-expanded-significantly-over-the-last-decade-underpinned-by-supportive-policies-and-technology-advances

2. In-Depth Review of the Existing Legal, Economic and Financial Framework, Barriers and Potential Solutions

2.1. Electric Vehicle Market Analysis

In 2020, Kyrgyzstan, according to the "World Air Quality Report 2020" of the IQAir Swiss Agency, ranked eighth in the ranking of "The most polluted countries in the world in 2020 (PM2.5)"[2]. During the year, the city of Bishkek periodically came out on top during the heating period.

The analytical report of the Center for Environment and Development of AUCA Sabyrbekov R.A. presented three main sources of atmospheric air pollution in Bishkek:

1. Exhaust gases from motor vehicles;

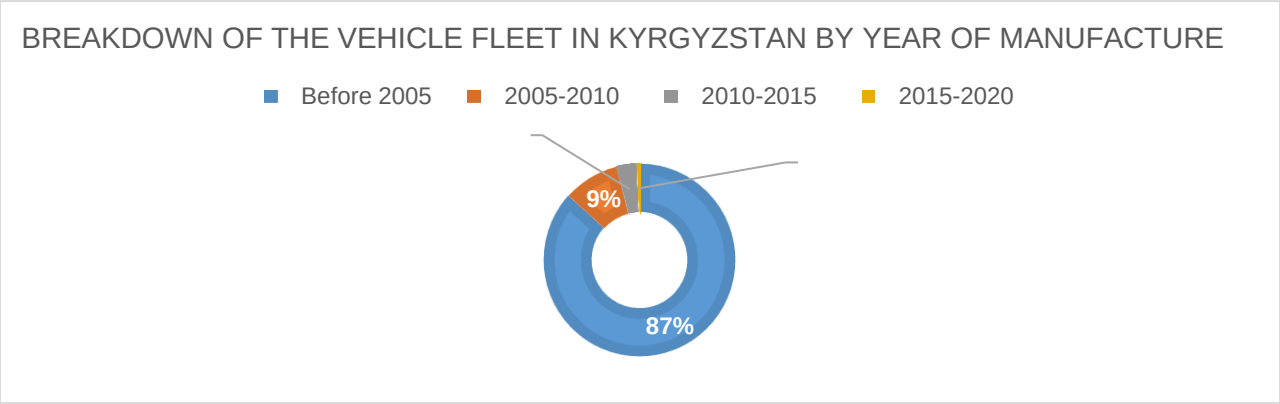
2. Pollution due to combustion for heating;

3. Pollution by dust and other solid particles.[3]

According to the WHO, air pollution is one of the most dangerous threats to human life and the environment. WHO estimates that 7 million deaths worldwide are caused by poor air quality.

The number of motor vehicles in Kyrgyzstan has been growing in recent years. The average annual increase in 2018 was 13% "and in 2018 the average number of cars per thousand inhabitants reached 450 cars, almost one-third more than in London or almost twice as many as in Amsterdam".[4] Also of great concern is the age of cars. Most cars in Kyrgyzstan are old, so their emissions are higher than those of newer models. There are about 1,080,000 cars in Kyrgyzstan, 93% (934,000 cars) of which were produced before 2005. Only about 35 thousand cars are fairly new – of 2010-2015 manufacture year.

Figure 2. Breakdown of the vehicle fleet in Kyrgyzstan by year of manufacture



[2] IQAir "World Air Quality Report 2020"/Region&City PM2.5 Ranking/https://www.iqair.com/world-air-quality

[3] Sabyrbekov R.A. Analytical Report. Sources of Air Pollution in the Cities of Kyrgyzstan, AUCA Center for Environment and Development (CED). Bishkek, 2018

[4] Sabyrbekov R.A. Analytical Report. Sources of Air Pollution in the Cities of Kyrgyzstan, AUCA Center for Environment and Development (CED). Bishkek, 2018

As of 1 January 2021, according to the SRS data, there were **100 electric vehicles** registered in Kyrgyzstan, which is 0.01% of the total number of vehicles in the Kyrgyz Republic. This figure is negligible and does not contribute to the independent development of the market. Also only in Bishkek city there are 2 public slow charging stations for electric vehicles. One is located in the parking lot of Globus supermarket. This is a stationary charging station, floor-standing, with two outlets, one can ask for a cable from the administration or use one's own, power 7kW/32A, single-phase with alternating current, slow charging port Type 2 (Mennekes), freely available to customers of the shopping center. The brand could not be ascertained.

The second station is located in Koisha Hotel at 203 Kievskaya Street, Bishkek. It can only be used by clients of the hotel. The charging type is individual J-1772, stationary, with one outlet, CHAdeMO slow charging port, power 7kW/16A, single-phase with alternating current. Charging time is 4-6 hours. Made in the USA, the brand could not be ascertained. Ordered from the USA, the purchase cost was $500, additional $200 for shipping. It is used for two years and there are no problems with maintenance or repair, that is, with proper use, there are no problems with operation.

In Kyrgyzstan today, each owner of an electric car has his own portable charger (charging mode presumably Mode 1/Mode 2) and uses it individually, at home. Basically everyone has American-made portable charger. They maintain, repair, and, if necessary, remodel/adapt it by themselves.

There are no fast charging facilities in the country at the moment. There are no specialized service stations for electric vehicles. Since the vast majority of electric vehicles imported into the Kyrgyz Republic are of the Nissan brand, the Nissan Center (service center) in Bishkek employs specialists in repairing electric cars.

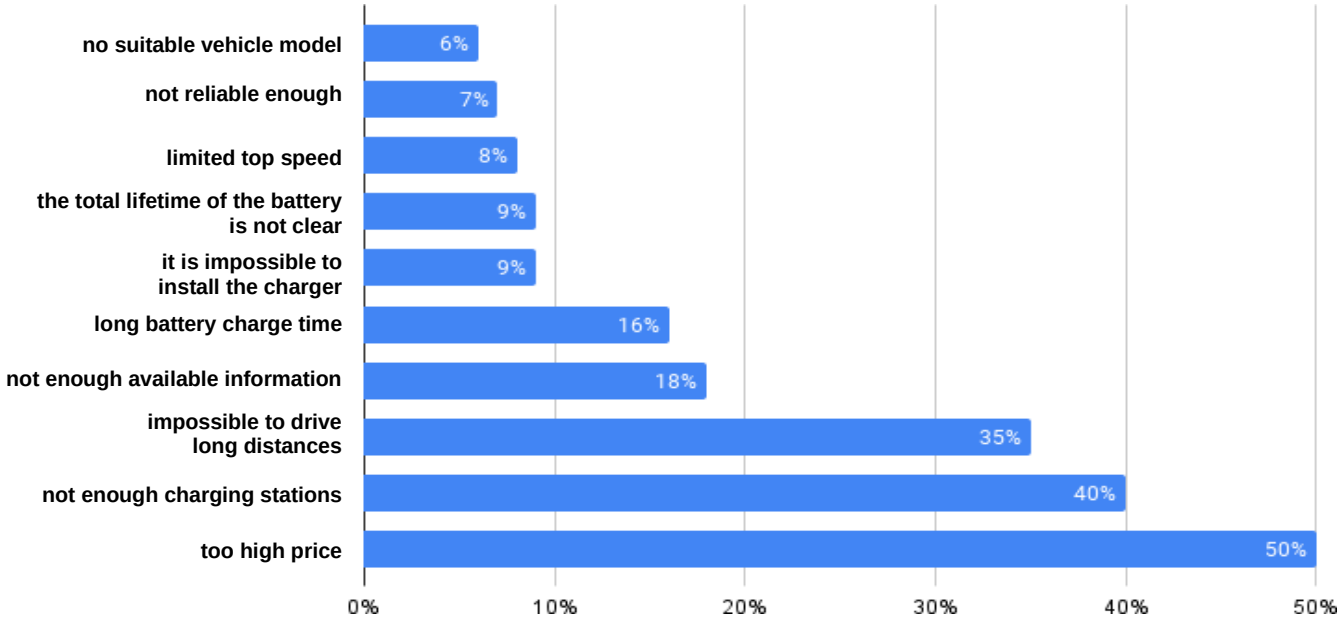
A trend can also be noted in the development of electric vehicle purchase and logistics channels from the USA and China, despite the relatively low demand for electric vehicles. Thus, the business itself contributes to the development of the use of electric vehicles and their chargers. As of 17 January 2021, the Bishkek car market offered about 40 units of electric vehicles in stock and about 10 options to order from the USA and China.

The leader of sales is the Japanese brand Nissan Leaf, but there are also offers of Chinese electric vehicles. It is possible to order used cars from the USA, such as Tesla Model S, BMW i3, and Fiat 500II. Prices, depending on the brand and year of manufacture, range from $7,500 to $34,000.

- For example, prices for Nissan Leaf Electro CVT manufactured in 2011-2012 range from $7,500 to $8,800.
- Nissan Leaf Electro (Japan) manufactured in 2013 – $9,900-$11,700; average price – $11,000.
- BYD E6 Electro (China) manufactured in 2018-2020 – $25,450-$35,000; average price – $27,700.
- BAIC EV400 (China) manufactured in 2020 – $25,600; average price – $28,500.
- JAC EV260 (China) manufactured in 2019 – $18,500.
- Rowe ERX5 EV400 (China) manufactured in 2017 – $20,000.

Nissan Leaf is in the greatest demand among car enthusiasts of the Kyrgyz Republic, followed by Chinese brands BYD, BAIC. Traditionally car enthusiasts of Kyrgyzstan prefer cars of Japanese and German manufacturers because of their quality, unpretentiousness and comfort. In choosing electric vehicles, along with quality and convenience, practicality will play an important role. Electric vehicles are a product of Smart Technology, and as with other IT products, users will focus on design and functionality. Battery capacity, distance on one charge, recharging speed, software and IT functions, ease of use and maintenance will be decisive in choosing electric vehicles.

Figure 3. Main barriers to the introduction of electric vehicles in the Kyrgyz Republic



Source: study under the ADB project

A survey of 1,000 people in Bishkek was conducted in late 2019 and early 2020 regarding their attitudes and ability to purchase an electric vehicle. The clear reasons why survey respondents would not purchase an electric vehicle are related to the high purchase price of an electric vehicle, the lack of charging stations, and the perceived inadequate driving range of an electric vehicle (the main reasons are shown in the following chart).

Inadequate range and lack of (fast) charging stations are interrelated factors, as shorter distance ranges can be accepted if there are a large number of fast or ultra-fast charging stations in the country.

2.2. Legal Framework

Brief overview

Table 1. Brief overview of the legal framework

Type of regulation	**Current regulation**	**Recommendations for improvement**
Customs duties	0% until the end of 2021	Submit to the EEC a draft proposal to extend the zero customs rate
Fee for registration (re-registration) of an electric vehicle	0% for electric vehicles 50% discount for hybrid vehicles	None

Current tariff for charging electric vehicles	1.58 KGS per kW	The tariff is unfavorable for fast charging station business Charge payment not by kWh, but by the minute
Regulation for connection to higher power	It is necessary to obtain technical specifications	Simplify and unify the process of obtaining technical specifications
Sale of electricity while charging a car	It is necessary to obtain a license	Temporary provision to simplify obtaining permits for those persons who will sell electricity through charging stations
Building codes, SNiP	None	It is necessary to amend building codes and introduce requirements for the installation of slow or medium charging stations in parking lots in buildings under construction
Insurance	The law "On Compulsory Civil Liability Insurance of Motor Vehicle Owners".	None
Disposal of old batteries	Procedure is not defined	It is necessary to approve the procedure for the disposal of old and defective batteries from electric vehicles
PPP	Law of the Kyrgyz Republic "On Public Private Partnership"	
Leasing	Law "On Financial Leasing"	None
Renting	Civil Code of the Kyrgyz Republic	None

2.2.1. Current Information on State Regulation of the Electric Vehicle Sector

Article 3 of the Law of the Kyrgyz Republic "On Motor Transport" No. 154 dated 19 July 2013 defines an **electric vehicle** as a vehicle driven by one or more electric motors powered by an independent source of electricity (batteries, fuel cells, capacitors, etc.), without an internal combustion engine.

Also, the Decree of the Government of the Kyrgyz Republic No. 407 dated 23 June 2017 approved the relevant Procedure for issuing electronic vehicle passports (vehicle chassis passports) and electronic passports for self-propelled vehicles and other types of equipment. This Procedure defines a vehicle passport (vehicle chassis passport) as a passport issued for motor vehicles intended for movement on public roads, having an internal combustion engine with a working volume of more than fifty cubic centimeters or an electric motor (electric motors) with a maximum (total) power of more than four kilowatts and (or) maximum design speed of more than fifty kilometers per hour, and trailers for them (passport issued for a vehicle chassis in case the chassis is delivered to consumers). The introduction of unified forms of the vehicle passport (vehicle chassis passport) and a passport of self-propelled vehicles and other types of equipment as well as organization of electronic passport systems is provided for under the Agreement between the Governments of the Customs Union Member States within the EAEU signed on 15 August 2014 in Moscow, Russia.

The fee for the initial registration of motor vehicles imported into the territory of the Kyrgyz Republic is 5 percent, and for its re-registration – 0.3 percent of the average market value of the motor vehicle determined by the tariff schedule approved annually by the head of the authorized body for the implementation of state policy on archiving, registration of population and motor vehicles, special technological machines, driving staff, acts of civil status as agreed upon with the authorized body in the field of antimonopoly regulation of the Kyrgyz Republic.

However, the fee for the registration (re-registration) of a hybrid motor vehicle that uses more than one energy source to drive leading wheels is **50 percent less** than the fee for the registration of vehicles mentioned above, and owners of motor vehicles with electric motors are completely **exempt from paying the registration (re-registration) fee**.

2.2.2. Customs Duties on the Import of Electric Vehicles and Charging Stations

In accordance with Article 257 of the Tax Code of the Kyrgyz Republic, vehicles driven only by an electric motor classified in the commodity heading of the EAEU CN of FEA 8703 80 000 2, as well as equipment for charging vehicles powered by an electric motor classified in the commodity headings of the EAEU CN of FEA 8504 40 30, 8504 40 55, 8504 40 90 are exempt from VAT on imported goods.

The import duty rate for vehicle electric charging equipment (as a percentage of the customs value in either euro or U.S. dollars) is 0%, and there is no export duty. VAT is not charged (according to Article 257 of the Tax Code of the /Kyrgyz Republic, see above). Also, vehicles powered only by electric motor are not subject to taxation.

Zero rate will be valid until 31 December 2021 inclusive and will be applied to the import of electric vehicles into the EAEU from third countries by both legal entities and individuals in accordance with the Decision of the EEC Council No. 29 dated 16 March 2020.

2.3. Current Electricity Tariff Policy. Electricity Tariffs for Electric Transport

The Decree of the Government of the Kyrgyz Republic No. 188 dated 27 March 2020 approved the Mid-Term Tariff Policy of the Kyrgyz Republic for Electricity and Thermal Power for 2020-2022 (MTTP). The Annex to the MTTP approves the electricity tariff for the "Electric Transport" consumer group at the level of 1.58 KGS/kWh (excluding taxes).

However, the Order of the State Agency for Regulation of Fuel and Energy Complex under the Government of the Kyrgyz Republic No. 2 dated 21 July 2020 approved the Instruction on the Application of Tariffs for Electricity and Thermal Power, according to which the application of tariffs for electricity supplied to electric transport (Group III) is based on the following principles:

- electricity is supplied to the "Electric Transport" consumer group at established tariffs, regardless of the type of input, the nature of the use of electricity, in the amount and in the manner determined by the authorized body;
- consumers in this group pay for the electricity consumed at the rate specified in paragraph 3 of Annex 1 to the MTTP (1.58 KGS/kWh, excluding taxes);

According to the above Instruction, the "Electric Transport" consumers (Group III) include the following end users:

- municipal trolleybus depots, as well as passenger transport companies that use electric vehicles (trolleybuses and electric buses) to carry out the corresponding passenger transportation services;
- public charging stations for electric vehicles.

Thus, when installing public stations for charging electric vehicles, the tariff for electricity to power them will be **1.58 KGS/kWh (excluding taxes)**.

Also, in accordance with Article 15 of the Law of the Kyrgyz Republic “On Licensing and Permit System in the Kyrgyz Republic”, such activities as production, transmission, distribution, sale, export and import of electricity are subject to licensing (except for production of electricity obtained from renewable energy sources, as well as production of electricity from any energy sources for own use at capacity up to 1000 kW).

Licenses for the sale of electricity are issued in accordance with the Provisional Regulation on licensing certain types of activities in the fuel and energy complex, approved by Decree of the Government of the Kyrgyz Republic No. 59 dated 3 February 2017. However, this Regulation is designed for issuing licenses for energy companies and is not suitable for charging stations. Consequently, it is currently **not possible for charging stations to take a charge for kilowatt-hours**.

2.4. Technical Specifications for the Installation of Charging Stations

The connection of electrical installations of consumers of electrical power in the Kyrgyz Republic is regulated by the following rules:

- Rules for the use of electrical energy, approved by the Decree of the Government of the Kyrgyz Republic No. 576 dated 22 August 2012;
- Rules for the technological connection of generating sources, electrical networks of electrical distribution organizations and electrical installations of consumers to electrical networks, approved by the Decree of the Government of the Kyrgyz Republic No. 169 dated 29 March 2018;
- Rules for the provision of technical specifications and the procedure for connecting to utility networks in the Kyrgyz Republic, approved by the Decree of the Government of the Kyrgyz

Republic No. 100 dated 10 February 2009 (for new facilities being commissioned or under construction).

It should be noted that in accordance with the Decree of the Government of the Kyrgyz Republic No. 169 dated 29 March 2018, Chapter 3 of the Electricity Use Rules approved by the Decree of the Government of the Kyrgyz Republic No. 576 dated 22 August 2012 "Technical specifications for connection of electrical installations of consumers of electric power" has become invalid. Thus, technical specifications for connection of electric installations of consumers are issued in accordance with the Decree of the Government of the Kyrgyz Republic No. 169 dated 29 March 2018, according to which, to connect electric installations to electric networks, an individual or a legal entity (applicant) must apply to owners of electric supply companies that have the appropriate license, as well as electric networks that are at the closest distance.

In accordance with the approved form, the application must specify the details of the applicant (full name, identity document), place of residence of the applicant (mailing address), documents of title to the connection object, as well as the requested power (kW), including for electric heating (kW).

Selection of the type of electrical network is carried out depending on the power to be connected:

- 0.23 kV power line with switched power of up to 10 kW;
- 0.4 kV power line with switched power of 3 to 50 kW, taking into account the possible construction of the power line;
- 6-10 kV power line with switched power of 50 kW to 2 MW;
- 35-110 kV substation at 6-10 kV with switched power of 500 to 10,000 kW;
- 35 kV transmission line with switched power of 1 to 20 MW;
- 35-110 kV substation at 35 kV with switched power up to 20 MW;
- 110 kV transmission line with switched power of 10 to 70 MW;
- from 220 kV electric network of the "National Electric Grid of Kyrgyzstan" Open Joint-Stock Company with switched power of 25 to 150 MW.

In this regard, the licensee must:

- determine the presence or absence of technical capability of technological connection within 20 working days from the date of receipt of the application for technological connection;
- accept preliminary requests for technological connection of electrical installations to its own electrical networks, regardless of the presence or absence of technical capability;
- inform the applicant about the distance to the connection point, in accordance with the requirements of paragraph 7 of these Rules, as well as inform other licensees about the electrical networks, if they can be used for technological connection according to the submitted preliminary request;
- inform the applicant that technological connection is carried out on a paid or free basis, in accordance with these Rules;
- enter into contracts for technological connection if technically possible;
- carry out measures for technological connection (with the exception of technological connection carried out according to an individual project);
- coordinate technological connection of power over 1,000 kW with the power supply organization, which has a higher voltage level, to the power grids of which this power is connected.

The applicant must pay the licensee a fee for technological connection and perform the activities specified by the contract for technological connection and technical specifications.

It should be noted that the fee for technological connection to power grids is not defined.

2.4.1. National Standards, Building Codes and Regulations for Electric Charging Stations

Approval and enactment of Building Codes and Regulations (SNiP) in the Kyrgyz Republic is carried out according to the order of the State Agency for Architecture and Construction under the Government of the Kyrgyz Republic.

In 2018, the State Design Institute for Urban Planning and Architecture developed and updated 15 SNiP for design and construction. However**, there are no clauses or articles applicable to electric charging stations in them**. The Strategy for the Development of the Construction Industry of the Kyrgyz Republic, developed for 2019-2030, also has no clauses on the development of charging infrastructure for electric vehicles.

The adoption of national standards, as well as technical specifications approved in accordance with the established procedure, would streamline the process of designing and constructing electric charging stations. Thus, it is necessary to make appropriate amendments to existing or develop new sets of rules and building codes aimed at regulating and simplifying the design and construction of charging infrastructure for electric vehicles, such as:

- GOST based on the international standard IEC 61851-1:2010 "Electric vehicle conductive charging system - Part 1: General requirements", to approve the standards of the relevant electric vehicle conductive charging systems;
- GOST based on international standard IEC 62196-1:2011 "Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles", to approve standards for plugs and other plug-in elements of charging stations;
- making appropriate changes in the NLAs (traffic regulations) on the placement and installation of signs and markings indicating parking and charging places for electric vehicles.

When adopting these international standards, it should also be taken into account that all structures in the installation of ECSs, their design, installation methods, insulation classes and degrees of protection must take into account the system nominal voltage of the Kyrgyz Republic, as well as environmental conditions in the Kyrgyz Republic.

It should be noted that at present such fundamental NLAs in the energy sector as the Electrical Installations Code (EIC), Safety Rules for Operation of Electrical Installations have lost force in accordance with the Law of the Kyrgyz Republic "On Normative Legal Acts of the Kyrgyz Republic" No. 241 dated 20 July 2009.

The safe and uninterrupted operation of the power system requires a clear description of the rules and regulations for each process and electrical installation. Deviation from such rules and regulations can lead to incidents and industrial accidents.

In this regard, it is also necessary to approve these rules by the relevant state body responsible for the development and implementation of state policy in the field of fuel and energy complex.

2.4.2. Insurance

Insurance of motor vehicles in the Kyrgyz Republic is regulated by the Law of the Kyrgyz Republic "On Compulsory Civil Liability Insurance of Motor Vehicle Owners" No. 192 dated 24 July 2015, as well as the Resolution of the Government of the Kyrgyz Republic No. 257 dated 19 May 2020 "On Approval of Acts in the Field of Compulsory Civil Liability Insurance of Motor Vehicle Owners".

Thus, in accordance with the aforementioned Law of the Kyrgyz Republic, the object of compulsory insurance is the property interests of vehicle owners associated with the obligation to compensate for harm caused to life and health or property of victims as a result of a traffic accident during the operation of vehicles.

In accordance with Article 5 of this Law of the Kyrgyz Republic, the obligation of compulsory insurance applies to owners of all motor vehicles used in the territory of the Kyrgyz Republic. In addition, the civil liability of owners of motor vehicles registered in accordance with the legislation of the Kyrgyz Republic and motor vehicles registered in other states are subject to compulsory insurance. Moreover, civil liability of the owner of a motor vehicle is subject to insurance for each unit of motor vehicles owned by him/her. Also, owners and (or) drivers of motor vehicles registered in another state, when entering the Kyrgyz Republic are subject to compulsory insurance, except for owners who have concluded an insurance contract in another state recognized in the Kyrgyz Republic in accordance with the conditions of the international treaty that has entered into force in accordance with the law, to which the Kyrgyz Republic is a party.

However, to date, there is a lack of mechanisms to monitor and enforce the law, with the exception of the decree of the Government of the Kyrgyz Republic No. 257 dated 19 May 2020. This Government Decree approved the Rules of Compulsory Civil Liability Insurance of Owners of Motor Vehicles, which define the procedure for exercising the rights and obligations of the parties under the contract of compulsory civil liability insurance of owners of motor vehicles.

2.5. Disposal of Old Vehicles and Batteries

Mandatory requirements to ensure the safety of the recycling of machinery and equipment in any process of manufacturing machinery, vehicles, electrical equipment or in the provision of maintenance and repair services for vehicles were regulated by the Law of the Kyrgyz Republic No. 280 dated 29 December 2008. However, with the accession of the Kyrgyz Republic to the EAEU, in accordance with the Law of the Kyrgyz Republic No. 69 dated 2 April 2015, it has become invalid.

Currently, within the EAEU, relevant technical regulations are being developed and discussed in working groups from EAEU member states.

In this case, the state policy in the field of production and consumption waste management and regulation of relations arising during the life cycle of waste, as well as state management, supervision and control in the field of waste management are determined by the Law of the Kyrgyz Republic "On Production and Consumption Waste".

Also, legal entities and individuals in carrying out their activities on issues related to production and consumption waste are guided by the Procedure for Production and Consumption Waste Management in the Kyrgyz Republic approved by Decree of the Kyrgyz Government No. 559 dated 5 August 2015, however, it should be noted that this procedure does not apply to radioactive waste management, biological and medical waste management operations.

It should be noted that on the territory of the Kyrgyz Republic there are also Interstate Standards which are adopted by Kyrgyzstandart:

- GOST 30773-2001 "Resource Conservation. Waste Management. Stages of the Technological Cycle. Basic Provisions";

- GOST 30772-2001 "Resource Conservation. Waste Management. Terms and Definitions";

- GOST 30775-2001 "Resource Conservation. Waste Management. Classification, Identification and Coding of Wastes. Basic Provisions".

These standards have adopted the terms and definitions in the field of waste management, as well as set the stages of the technological cycle of production and consumption waste, including the disposal of discarded, obsolete or decommissioned products that have lost their consumer properties.

When reviewing these NLAs, there were no separate references to any parts of electric vehicles or charging stations, however, a large number of terms that do not have clear definitions should be noted. For example, such terms as “municipal solid waste”, “industrial solid waste”, “toxic industrial waste”, “waste of toxic substances and materials”, “toxic production waste”, etc., which are not defined in any way in the NLAs.

Thus, the issue of the relationship of components of electric vehicles and charging stations to certain types of waste complicates the process of further handling during their disposal.

2.6. Current Legislation on Public-Private Partnership (PPP)

The Law of the Kyrgyz Republic "On Public-Private Partnership" determines the interaction between public and private partners on the issues of involving a private partner by a public partner in the design, financing, construction, restoration, reconstruction of infrastructure facilities, as well as in the management of existing or newly created infrastructure facilities and (or) provision of infrastructure services.

This law applies to industries such as:

- roads and railroads,
- airports,
- energy sector and provision of communication services,
- healthcare,
- education,
- housing,
- correctional facilities,
- municipal services,
- industrial infrastructure, etc.

The Regulation on the tender commission for public-private partnership projects, which determines the formation, activities and powers of the tender commission for public-private partnership projects, as well as establishes qualification requirements for its members, was approved by the Decree of the Government of the Kyrgyz Republic No. 111 dated 21 February 2020.

This tender commission shall be formed for each PPP project, shall be formed and approved by the decision of a public partner within two weeks from the date of approval of the tender documents and shall consist of at least five, but not more than eleven persons, including the chairperson, deputy chairperson and secretary of the tender commission. The number of members of the tender commission shall be odd.

The tender commission includes representatives of a public partner, a representative of the authorized state body for the coordination of PPP projects, a specialist with experience and knowledge of the relevant infrastructure facility, a specialist in economics and/or finance, a specialist in law, a representative of the local community which will be directly affected by the PPP project.

A state institution "Center for Public-Private Partnership" (PPP Center) has been established under the Ministry of Economy of the Kyrgyz Republic, which is a subordinate unit of the Ministry of Economy of the Kyrgyz Republic, performing managerial functions to promote PPP mechanisms in the Kyrgyz Republic. Government agencies, as well as any persons interested in promoting PPP projects may contact the PPP Center to determine what support will be required.

In addition, in order to financially support the preparation of PPP projects, the Government, with the support of the Asian Development Bank, has created the Fund for Financing Project Preparation (FFPP) approved by the Government Decree No. 147 dated 17 March 2014. The procedure for the formation, use and accounting of the Fund's resources is determined by the relevant Regulation. Thus, all funds of the Fund are accounted in the treasury system. The Fund's accounts accumulate allocated funds to support and finance PPP projects in the Kyrgyz Republic, and the use of the Fund's resources for purposes not stipulated by this Regulation is not allowed.

The Fund's resources are used to finance consulting services for the preparation of a PPP project, including the preparation of a package of tender documents and the development of a feasibility study (FS), support in the process of preparing a PPP project and conducting tender procedures, as

well as co-financing in the preparation of PPP projects financed from other sources. The Fund's resources are formed at the expense of the republican budget and funds of international and other organizations.

The use of the Fund's resources is carried out only for PPP projects submitted by a public partner, taking into account state and municipal PPP development programs, socio-economic development programs, industry development programs, other programs and plans for the development of the regions of the country, and are reimbursed by a private partner.

The funds for consulting services for the preparation of feasibility studies for eight projects for a total amount of 1.3 million US dollars, with a total project value of more than 79 million US dollars are allocated from the Fund for financing the preparation of PPP projects.

Also, Decree of the Government of the Kyrgyz Republic of No. 823 dated 2 December 2015 approved the Regulation on the procedure for providing a land plot for fixed-term (temporary) use to private partners as part of the implementation of an agreement on public-private partnership.

This Regulation establishes the procedure and conditions for the provision to private partners within the framework of the implementation of the PPP agreement for fixed-term (temporary) use of land plots owned by the state or municipalities (hereinafter referred to as the land plot), with the exception of lands of forest, water funds, lands of protected areas, reserve lands, lands of the border zone, lands of the State Fund for Agricultural Lands and Pastures.

Thus, the land plot is provided for the term of the PPP agreement, but not exceeding the terms established by the land legislation of the Kyrgyz Republic. The terms of use of the land plot may be extended in accordance with the legislation.

If a public partner decides to initiate a PPP project at the stage of its preparation, land management projects for allocation of a land plot and other land management documentation required in accordance with the land legislation for its provision for fixed-term (temporary) use shall be developed on the initiative (application) of a public partner. A public partner shall coordinate the documentation on land management with the authorized state bodies and (or) local government bodies.

Documented costs incurred by a public partner and (or) a private partner initiating the PPP project for the development (production) of land management documentation and its expertise shall be reimbursed by the successful tenderer for projects in accordance with the terms of the PPP agreement.

The procedure and terms of fixed-term (temporary) use of the land plot by a private partner shall be specified in the PPP agreement, and upon termination of the PPP agreement a private partner must vacate the land plot provided to it for the implementation of the PPP project.

2.7. Analysis of Alternative Law

The experience of foreign countries shows that the accelerated introduction of electric vehicles is not complete without a clear and effective state program and support. As part of this study, an analysis was made of the current government regulation of alternative law, namely leasing and renting, in order to identify opportunities for electric transport in a further study.

2.7.1. Leasing

Legal relations associated with leasing are regulated by the Civil Code of the Kyrgyz Republic, the Law of the Kyrgyz Republic "On Financial Leasing" No. 121 dated 23 July 2002 as well as other normative legal acts issued in accordance with them.

In accordance with the Law of the Kyrgyz Republic "On Financial Leasing", leasing is a set of economic and legal relations arising in connection with the implementation of the leasing agreement, including the acquisition of the leased asset. In this case, the leasing agreement is a contract under which the lessor undertakes to purchase the property specified by the lessee from the seller determined by the lessee and provide the lessee with this property for a fee for temporary possession and use. The type of investment activity aimed at investing own and/or borrowed funds of the lessor under a leasing agreement shall be a leasing activity.

In accordance with Article 3 of the Law of the Kyrgyz Republic "On Financial Leasing" the subject of leasing may be any non-consumable things, including: enterprises and other property complexes, buildings, structures, equipment, vehicles and other movable and immovable property used for business activities.

The leasing agreement shall be concluded in writing and is subject to notarization and state registration in cases stipulated by the legislation of the Kyrgyz Republic. Essential conditions of the leasing agreement are defined by this Law of the Kyrgyz Republic.

The rights to the subject of the leasing agreement, subject to state registration, shall be registered in the name of the lessor, and the lessee may be registered as a user of the subject of the agreement. The procedure and conditions for the registration of rights to the subject of the leasing agreement shall be stipulated by the parties in the leasing agreement. By agreement of the parties, registration of the rights to the subject of the leasing agreement in the name of the lessor can be entrusted by the lessor to the lessee. In this case, the registration documents shall necessarily contain information about the holder and the owner (user) of the property.

In case of termination of the leasing agreement and withdrawal of the leased asset by the lessor, the state authority which registered the rights to the subject of the leasing agreement for the lessee, at the request of the lessor, shall make a corresponding change in the entry on the owner (user).

Also, the parties have the right to carry out any types of insurance of the leased asset, as well as any other risks associated with the leasing agreement, in the manner prescribed by the legislation of the Kyrgyz Republic.

Payment for the use of the leased asset provided under the leasing agreement shall be made by the lessee in the form of lease payments payable to the lessor. Lease payments are compensation by the lessee to the lessor of all or most of the costs of acquisition of the leased asset, as well as other costs associated with delivery of the leased asset and bringing it in condition suitable for its intended use, and interest income of the lessor. In this case the amount, manner, form and periodicity of lease payments shall be established by the leasing agreement.

It should be noted that the lessee's obligations to make lease payments arise from the moment the

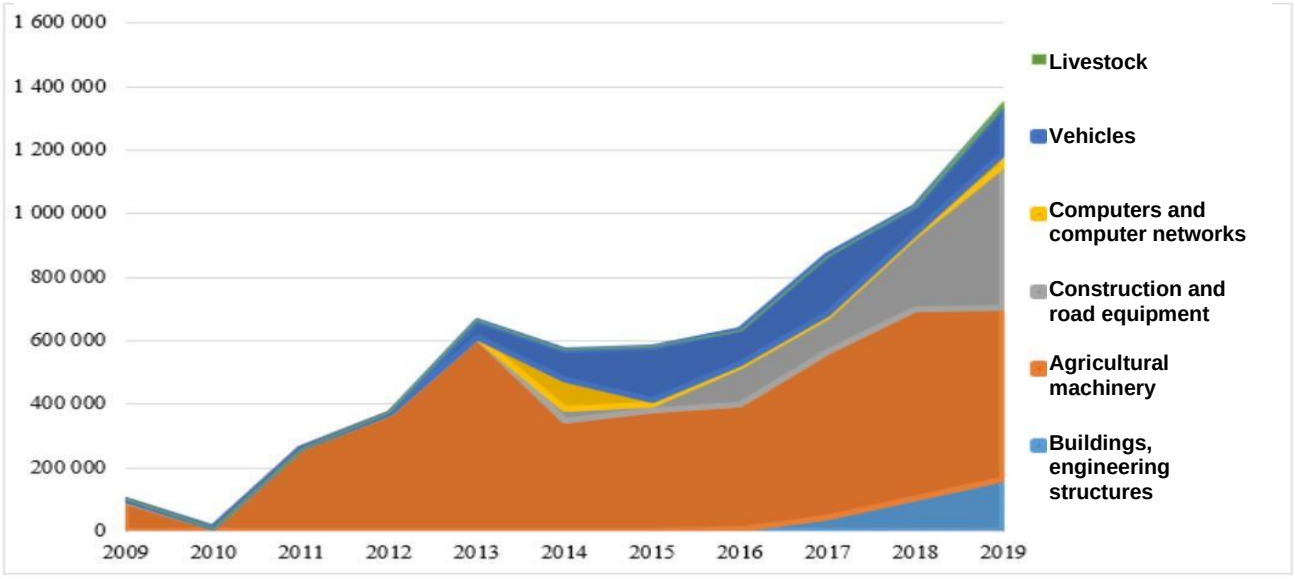
lessee starts using the leased asset, unless otherwise provided by the leasing agreement.

2.7.2. Current Status of Leasing in the Kyrgyz Republic

According to the analysis of the leasing market conducted by the RKFR, the volume of leasing operations in the Kyrgyz Republic is gradually increasing.[5]

Experts say that with Kyrgyzstan's entry into the Customs Union, the demand for leasing operations is gradually increasing.

Figure 4. Volumes of leasing operations



Source: RKDF

2.7.3. Renting

Legal relations associated with renting are regulated by the Civil Code of the Kyrgyz Republic, as well as other normative legal acts issued in accordance with them.

Renting a vehicle without providing services for management and technical operation shall be carried out by concluding a rental agreement for a vehicle without a crew. Under a rental agreement for a vehicle without a crew, the owner provides the renter with a vehicle for a fee for temporary possession and use without providing services for its management and its technical operation. The rental agreement for a vehicle without a crew must be concluded in writing.

During the entire term of a rental agreement for a vehicle without a crew, the renter is obliged to maintain the proper condition of the rented vehicle, including carrying out current and capital repairs, and must carry out the management of the rented vehicle, as well as its commercial and technical operation by his/her own means. In addition, unless otherwise provided by the agreement, the renter shall bear the costs of maintenance of the rented vehicle, its insurance, including its liability insurance, as well as the costs arising in connection with its operation.

Unless otherwise stipulated by the rental agreement for a vehicle without a crew, the renter has the

[5] http://www.rkdf.org/ru/analitika/informacionno_analiticheskie_materialy_fonda/razvitie_lizinga_v_kyrgyzskoy_respublike

right, without the owner's consent, to sublet the rented vehicle on the terms of the rental agreement for a vehicle with or without a crew. The renter is also entitled, without the owner's consent, to enter into transportation and other contracts with third parties on his/her own behalf, if they do not contradict the purposes of use of the vehicle specified in the rental contract, or, if such purposes are not specified, the purpose of the vehicle.

Liability for damage to third parties caused by the vehicle, its mechanisms, devices, equipment, shall be borne by the renter in accordance with the rules of Chapter 51 of the Civil Code of the Kyrgyz Republic.

Transport charters and codes may establish other peculiarities, in addition to those stipulated by this paragraph, of renting certain types of vehicles without provision of management and technical operation services.

Thus, within the framework of regulation, there are no obstacles for introduction of renting in the Kyrgyz Republic, but renting of vehicles is not widespread at this stage.

2.8. Analysis of Public Procurement Procedures

The entire process of public procurement in the KR is regulated by the Law of the KR "On Public Procurement". The Regulation on the Rules of Electronic Public Procurement and the Methodological Instruction for the Application of Benefits to Internal Suppliers (Contractors) are approved by Order of the Ministry of Finance of the KR "On Approval of Normative Legal Acts in the Field of Public Procurement" No. 175-p dated 14 October 2015 in order to improve the system of public procurement in the KR through the adoption of normative legal acts resulting from the new version of this Law of the KR.

As for the requirements for goods, works and services, in accordance with the legislation of the Kyrgyz Republic, only goods, works and services that meet the established technical and quality characteristics provided by national or international quality standards are allowed to participate in the tender. In addition, technical and quality characteristics of often purchased goods, works and services, ensuring their safety and functional use, as well as qualification requirements for suppliers (contractors) are established by the decision of relevant authorized state bodies or central authorities determined by the Kyrgyz Government.

Currently, according to the aforementioned NLAs, the process of electronic public procurement is carried out on the website http://zakupki.gov.kg.

Thus, for the procurement of electric vehicles for state or municipal needs, no amendments to the current legislation are required.

2.9. Overview of the Energy Sector in Kyrgyzstan

Kyrgyzstan's energy sector accounts for 4% of the country's GDP and 16% of production. 90% of the oil and petroleum products consumed are imported from Kazakhstan and Russia. Domestic production is more than 90% dependent on hydropower plants, as a result of which the country, especially in winter and during low-water periods, faces electricity shortages and is forced to buy it from neighboring countries. In 2018, the country consumed 4.2 million tons of oil equivalent, 48% of which was oil and petroleum products, 24% - electricity, and 17% - coal.[6]

According to the World Bank rating, Kyrgyzstan scored 58.6 points on connection to electricity supply and is in 143rd place, while the average score for the region is 75.6 points out of 100. This rating includes such components as procedures, time, cost and reliability index and tariff transparency.[7]

Thus, it can be concluded that Kyrgyzstan's energy sector is extremely dependent on imported petroleum products, which negatively affects the country's energy security. Also, power generation, especially in winter time, is insufficient. In case of active introduction of electric transport, the energy sector will face a great threat of power shortage.

Therefore, it is now imperative to work on the development and modernization of energy companies and the reduction of the energy deficit.

One solution is to increase electricity generation, but this is considered a long-term solution that requires reforming the entire sector.

[6] https://www.iea.org/reports/kyrgyzstan-energy-profile

[7] https://russian.doingbusiness.org/ru/data/exploreeconomies/kyrgyz-republic#DB_ge

The second solution is to increase the number of small hydropower plants. According to experts, the total hydropower potential of the Kyrgyz Republic is about 142 billion kWh. The country ranks third in the CIS after Russia and Tajikistan. The current percentage of utilization of hydropower potential is only 10%. Eight cascades of 32 hydropower plants can be built on the largest river Naryn.
Small hydropower plants can generate up to 5-8 billion kWh per year, wind power plants - 44.6 million kWh, solar power plants - 490.0 million kWh. However, the practical use of RES in Kyrgyzstan is less than 1%.[8]

One of the stumbling blocks for electric vehicles is a possible shortage of electricity, which would make it impossible to install powerful charging stations for electric vehicles in the north of the country. Therefore, the introduction of electric vehicles will require proper development of the energy sector so that the country can meet all of its energy needs.

Also, during a survey of filling stations on their readiness to install charging stations, it has been noted that they are all ready for the new technology, but only if the demand for electric charging increases. It has been also found that they do not have enough capacity to install fast chargers. As noted above, private companies need to obtain technical specifications to be able to connect to higher capacity.

2.10. Potential Demand for Electric Vehicles and Electricity Consumption

As part of a study of the electric vehicle market in Kyrgyzstan conducted by ADB, a forecast of three scenarios was made and the required amount of electricity to charge electric vehicles was calculated.[9]

The scenarios are based on the share of electric vehicles from newly purchased vehicles (not the stock of vehicles) according to IEA (International Energy Agency) scenarios. The number of newly purchased vehicles is based on the number of vehicles replaced and additional vehicles due to an increase in the number of vehicles. The scenarios are made for illustrative purposes in order to estimate their impact on the electric vehicle stock and the electric power sector.

Optimistic electric vehicle scenario: This scenario is based on the assumption that 30% of all vehicles sold in 2030 will be electric.

Moderate electric vehicle scenario: This scenario is based on the "new electric vehicle policy scenario" which aims to have a 15% share of EVs by 2030 instead of 30%. The same disclaimers apply as for the EV30@30 scenario.

Pessimistic electric vehicle scenario: By 2030, the share of new registered vehicles will be 7.5%. The following table shows some key results for the 3 scenarios as of 2030.

[8] https://ec.europa.eu/info/sites/info/files/omurbek_jenishbekov.pdf
[9]

Table 2. Scenarios for electric vehicles in the Kyrgyz Republic

	Optimistic scenario	**Moderate scenario**	**Pessimistic scenario**
Number of passenger electric vehicles	17,000	35,000	69,000
Share of electric vehicles in the share of the vehicle stock	3%	6%	13%
Electricity consumption by electric vehicles in MWh	37,000	75,000	144,000
Share of net power generation in 2018	0.4%	0.7%	1.4%

As can be seen from the analysis above, even under an optimistic scenario by 2030, the electricity demand for electric vehicles is very small, only 1.4% of net electricity generation in 2018. However, the problem may arise when charging a large number of electric vehicles during the peak period.

Based on the average electricity consumption, the distance for electric vehicles in Bishkek and the number of electric vehicles under the different scenarios, the maximum projected peak power demand for the optimistic scenario is 38 MW at 19:00-20:00 on weekdays in 2030. The following table shows the projected peak power demand based on the different scenarios.

Table 3. Projected consumption of electricity by electric vehicles

Scenario	2025		2030	
	10:00	19:00-20:00	10:00	19:00-20:00
Optimistic scenario	6 MW	11 MW	20 MW	38 MW
Moderate scenario	3 MW	5 MW	10 MW	19 MW
Pessimistic scenario	1 MW	3 MW	5 MW	10 MW

Bishkek has peak electricity needs from 07:00 to 09:00 and from 18:00 to 21:00. The available surplus at peak power consumption is very limited. Maximum peaks in winter are about 600 MW, which means that in 2030, vehicles during the evening will add about 6% of peak demand. The morning peak of electric vehicles shouldn't be a problem. The evening peak could be shifted to after 21:00 using smart meters, incentives to recharge vehicles later in the day, or bans for chargers to recharge electric vehicles at certain times. Charging electric vehicles after 21:00 is actually not a problem for the vehicle user as the vehicle still has enough time to be fully charged for the next day.

2.11. Overview of Existing Charging Stations

The main parts needed to use electric vehicles: battery, station software, connecting cable, charging stations and their maintenance.

There are two types of charging stations: personal (home) and public (commercial). Also, according to the functionality, today they are divided into three types: slow charging, fast charging and instant charging.

Slow charging: 3 kWh, charging time 6-12 hours. It is possible to charge from household mains and Type-2 charging stations.

Fast charging: 7 kWh – 20 kWh, 2-5 hours.

Instant charging: 43 kWh – 100 kWh and more, charging time 20min - 60min.

However, electric vehicle users note that in practice the charging time does not always coincide with the manufacturer's specified time. The charging speed is influenced by the air temperature - charging takes longer in cold weather, the size of the battery - the larger it is, the faster the charging. Usually up to 80% charging is faster, but the remaining 20% will take longer. That's why it's convenient for electric vehicle drivers to charge up to 80% in time. But that's assuming that the network of charging stations is extensive and available.

Personal type of charging stations is recommended for use in closed areas. There are stationary and portable types, with the ability to control power and those that can work without grounding. For example, in the mountains, charging comes from a generator. They can give a voltage of 16A (amperes) maximum and 32A maximum. They can be single-phase and three-phase.

Public type of charging stations are mostly commercial, installed in publicly accessible and open or enclosed areas. They are mostly installed at filling stations, in parking lots of shopping centers and residential buildings, on highways. They can be single-phase and three-phase. There are different types of access to the stations: key access, RFID access (automatic identification method) and free access. It is possible to install stations with 1, 2, 3 outlets and cable.

In terms of form the charging stations can be divided into three types: **floor, wall and portable**.

Charging stations are divided into several types according to the type of connectors for charging electric vehicles. The main standards for connectors are the CCS Combo charging port (Type 2 and Type 1) and the CHAdeMO port. Also the Tesla Supercharger, GB/T, Type 2 and Type 1 connector types are increasingly less but still being used. Nevertheless, the first two types are becoming predominant for all electric vehicle brands.

Table 4. Key points for selecting chargers

Electric power	Socket power	3.7kW-7.4kW single-phase	11kW-22kW three-phase		22 kW (AC) - 24 kW (DC)
	Charging mode	Mode 2 AC mains charging using protection system inside the cable with a power of up to 43kW	1-3-phase AC charging using a special connector, which implements a system for protecting and monitoring the charging progress up to 43kW		CHAdeMO DC fast charging up to 55kW
	Type of connector / socket	Household socket up to 2.3kW	Type2 (Mennekes) up to 22kW	Type 1 up to 7.4kW	CCS Combo CHAdeMO 22kW
Use	Station access method	Free access	Keyed access		Automatic identification via apps or card
	Load/use management	Cost optimization and service continuity	Optimization of charging time through voltage control		Administration of the charging station via connection to a voltage control server
	Network connectivity for remote monitoring and control of charging	Yes		No	
Installation	Mounting	Wall		Floor	
	Protection rating	Electronic	Mechanical IP54		Mechanical IK10
	Type	Design	Durability		Durability +

Today's main manufacturers of charging stations for electric vehicles with approximate prices per model of personal use:

- American General Electric (GEWattStation, $440)
- Charge Point USA (Home Electric Vehicle charger, $499)
- Siemens Germany (Versicharge 30, from $499)
- EVoCharge USA (EVSE 30 Amp, $525)
- Schneider Electric France (EV230WS Evlink, $548)
- Clipper Creek USA (HCS-40, $565)
- ENEL X USA (Juicebox Pro40A, $610)
- Leviton USA (EVB32-M8L, $795)
- Aerovironment USA (RS EV, $799)
- ABB Switzerland (EVLunic B W4.6, $2300)

The price for a personal battery charger is in the $400 to $5,000 range.

Prices for public charging stations range from $2,000 to $270,000, depending on manufacturer and features.

2.12. Findings

1. Thus, the electric vehicle sector is currently at an embryonic level of development, and the number of vehicles is not critical for the rapid development of this sector.
2. There are great risks of electricity shortages, which directly challenges the introduction of electric transport. Filling stations do not have the technical specifications for the installation of powerful charging stations. In this regard, the development of this sector is technically difficult.

2.13. Financial Institutions

Despite zero customs duties, prices for electric vehicles are higher than those for ordinary traditional vehicles, which is one of the significant barriers to buying electric vehicles. Therefore, an important component of the development of electric transport in the Kyrgyz Republic is concessional financing.

At the moment there is no separate structure in the Kyrgyz Republic that deals with the financing of electric vehicles. The KYRSEFF program has conducted a survey where it has been noted that at the moment the program does not provide financing for electric vehicles, but documents have been submitted for inclusion of this sector in Phase 3 of the program, and now it is too early to talk about funding opportunities, because the program is under consideration. Commercial banks have not developed separate products for this sector either, persons who want to buy an electric vehicle through financial institutions can apply to banks and receive loans as part of their usual lines and programs.

However, the experience of foreign countries shows that the provision of concessional financing for buyers of electric vehicles is a good impetus to increase sales.

The average interest rate on consumer loans for 2020 was 23.49%[10], which is a very high interest rate that makes buying a vehicle even more expensive and even more unattractive for the consumer. ***Accordingly, it is important to introduce concessional financing programs, which will be especially beneficial for taxi services.***

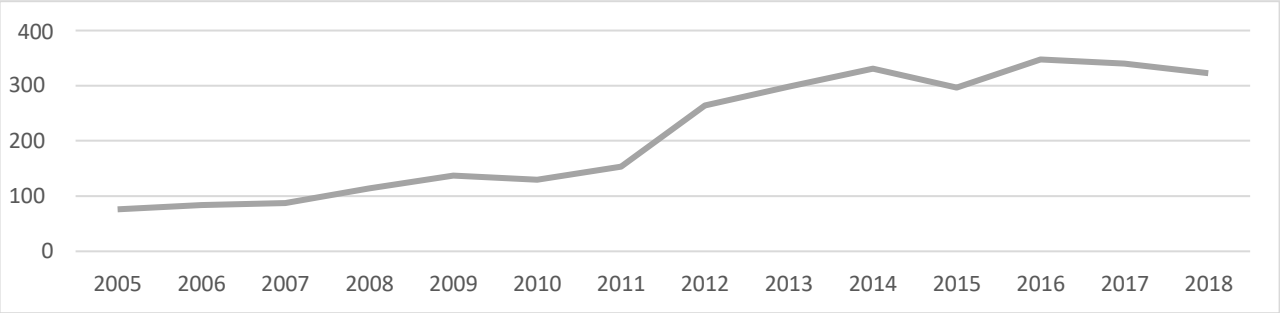
[10] https://www.nbkr.kg/index1.jsp?item=125&lang=RUS

3. Supply and Demand Analysis

3.1. Analysis of Public Bus Transport in Bishkek[11]

The share of public transport in Bishkek is gradually decreasing, while the number of passenger vehicles is strongly increasing. While Bishkek's population grew by only 28% from 2005 to 2018, the number of vehicles increased fivefold from 61,000 units in 2005 to more than 330,000 vehicles by 2018. This led to a significant increase in the density of passenger vehicles in Bishkek, about 330 vehicles per 1,000 residents (see Figure below).

Figure 5. Density of passenger cars in Bishkek (number of passenger cars per thousand citizens)



Source: http://www.stat.kg/ru/publications/publikaciya-socialnye-tendencii-kyrgyzskoj- respubliki/

Public transportation in Bishkek is provided by private minibuses (so-called "*marshrutki*"), electric trolleybuses operated by the Municipal Enterprise "Bishkek Trolleybus Department", as well as medium and large fossil-fuel buses operated by the Municipal Enterprise "Urban Transport Department". It is estimated that private minibuses carry 80-90% of passengers. The Bishkek Trolleybus Department (BTD) and the Urban Transport Department (UTD) operate about 180 operational trolleybuses, 52 of which were purchased recently (2018) with EBRD support, about 450 compressed natural gas (CNG) buses and diesel buses. About 40 private operators operate about 3,000 minibuses running around Bishkek. Most microbuses are old or very old (more than 15 years old).

The trolleybus network has been underinvested for many years, with partial replacement of equipment in the last few years. Replacements have not been made systematically in certain areas, there has been ongoing urgent maintenance. This means that all lines include still old equipment and investment is needed to upgrade them. In addition, voltage levels may not be sufficiently stable throughout the existing network, which limits the use of the latest generation trolleybuses.

[11] This analysis was taken from the ADB report "Electric buses for Bishkek", 2019

3.2. Analysis of Public Transport Technologies

The existing fleet of urban municipal buses consists of Euro II diesel, CNG EM and standard trolleybuses (with and without energy recovery). The trolleybus infrastructure has been partially renovated. Repairs were not carried out systematically on certain trolleybus lines, but ongoing urgent maintenance was carried out, that is, faulty and old equipment was replaced. Thus, all trolleybus lines will require further investment in order to continue operating in the future. The main specifications of the trolleybus infrastructure include a traction power supply system with substations, cable lines, overhead lines, as well as various fittings and masts. The latest generation trolleybuses may have difficulty operating on the current network as they require a stable voltage level.

The electric bus can also be used in cold climates. The need for electricity on cold winter days can be up to 40% higher than on a spring or autumn day without heating and air conditioning. This is largely due to the heating system, which needs to be optimized (high efficiency heating system, well-insulated double-glazed buses), as well as the temperature setting (maximum 16-18°C; bus driver can work in a jacket, passengers are also dressed in warm outerwear). Preheating buses before starting operation, as well as storing buses in sheltered areas at night, are important to reduce battery consumption and prevent batteries from becoming cold, which not only reduces driving range, but also affects battery capacity. In addition, during breaks at work, a driver must park the bus not in places exposed to wind and shade, but in the sun. Also, in snowy or icy conditions, electric buses may experience a reduction in the energy captured during regenerative braking. If the bus detects slippery conditions, regenerative braking is automatically disabled to avoid skidding.

3.2.1. Public Transport Technology Options

The technology options under consideration are based on new standard 12-meter city buses with low-entry, air conditioning and heating. The following technology options are being considered:

- Diesel Euro V;
- CNG EM;
- Conventional trolleybus;
- Night charging electric bus (slow charging electric bus);
- Fast charging electric bus.

3.3. Analysis of Urban Transport Modes

Table 5 below gives a brief overview of the different modes of urban transport.

Compared to a diesel bus, CNG installation has slightly higher capital costs and higher maintenance costs, but reduces energy costs due to low CNG prices. LNG buses have lower air pollution levels than diesel buses (especially PM2.5), but higher greenhouse gas emissions due to high energy consumption as well as methane slippage. Greenhouse gas emissions from liquefied natural gas (LNG) buses have long been underestimated due to too low energy consumption levels and because fugitive methane emissions are not taken into account. However, it is clear from the table below that CNG buses are not the solution to global warming.

Conventional trolleybuses require air wiring for the entire route. Such buses are currently in use in Bishkek. An important financial point concerns the investment needed to upgrade the infrastructure for trolleybuses. The risks and/or problems of trolleybuses are that they depend on a constant power supply and have very limited flexibility in use, i.e. they cannot operate outside the overhead wiring area.

Table 5. Main characteristics of urban transport[12]

Parameter	Value				
	Diesel	**CNG bus**	**Trolleybus**	**Overnight charging electric bus**	**Fast charging electric bus**
CC for a bus	$120 000	$140 000	$150 000	$300 000	$250 000
Service cost excluding tires	0.05 $/km	0.06 $/km	0.05 $/km	480 kWh	220 kWh
Power consumption	44 l/100 km	49 kg/100 km	0.04$/ bus-km	0.03 $/km	0.03 $/km
PM2.5 emissions	0.07 g/km	0.01 g/km	1.3kWh/ 100 km	1% of CC	1% of CC
NO_x emissions	9.24 g/km	4.84 g/km	0 g/km	0 g/km	0 g/km
TTW (tank-to-wheel) GHG emissions	1173 g/km	1 457 g/km	0 g/km	0 g/km	0 g/km
WTW (well-to-wheel) GHG emissions, incl. CB	1492g/km	2014 g/km	167 g/km	152 g/km	139 g/km
Bus service life	14 years	14 years	16 years	16 years	16 years

12

CC: capital costs; GHG: greenhouse gases; TTW: tank-to-wheel (direct emissions); WTW: well-to-wheel (direct+indirect emissions); WTT: well-to-tank; CB: carbon black, technical ("black") carbon; NCV: Net calorific value; EFCO_2: CO_2 emission factor; GWP: global warming potential; EGR: exhaust gas recirculation (exhaust gas recombustion system); SCR: selective catalytic reduction.

Overnight charging electric buses have large battery packs that are charged overnight. The batteries of such buses cannot be quickly charged; the battery should be enough to last all day without recharging. Slow charging is the "oldest" electric bus technology, as previously the batteries could not receive a high power charge. More than 300,000 of these buses are in operation. If the battery pack is too large, this can come at the expense of passenger capacity (100 kWh battery weight of approximately 1 ton), as the rear axle will be overloaded.

The main advantages of such buses are route flexibility, ease of operation and relatively simple charging devices with bus charging implemented during off-peak periods of electricity consumption at night. The main disadvantages of slow charging electric buses are the high cost of investment in buses, the large weight of the bus due to the large number of batteries on board, the wider use of buses by such devices (due to the increased weight of the bus) and the risk of not being able to meet the required range and, therefore, not being fully operational. Electricity consumption of a bus will depend on heating and AC use as well as driving conditions, load factor, and driver. Over the years, a battery reduces its ability to hold energy, i.e. the health status/charge status (HS/CS) of batteries is initially 100% and then drops to about 80% within 8 years. This means that mileage with a fully charged battery will slowly decline. Operators can get around this problem by using newer units on longer routes and older electric buses for shorter routes.

As a rule, the manufacturer claims that with a 350 kWh battery installed (typical for night charging buses), the driving range is more than 300 km. This may be true for a new bus on a standard route. However, this is not the battery size required to provide safe, reliable and continuous operation for several years.

Fast charging electric buses can be recharged from 20-80% of battery charge in 30 minutes or less. The batteries in such buses can receive a powerful charge. Buses are typically charged overnight and once or twice during the day, depending on use. Possible charged electric buses are also fast charging units. Possible charging is mostly done at the end of the bus route, waiting for the next turnaround to begin. Buses are thus partially recharged every 20-30 km (depending on the length of the route), allowing the use of smaller batteries. However, they can only be used on routes equipped with a charger, and they require space and sufficient time (5-10 minutes) at the end of the routes. Another version of fast charging electric buses are buses that charge quickly for 15-30 seconds while passengers get on and off the bus. This system is mainly used for bus rapid transit systems with large articulated buses and requires a means of charging at every 2nd-4th station. The charging capability is automated (generally with a pantograph).

For Bishkek, the most flexible and cost-effective option is quick manual charging of the electric bus, with charging done once, and if necessary, twice a day. Recharging during the night should only take place outside of peak power consumption. Typically, recharging will take place at the bus depot, meaning the bus returns to the bus depot during off-peak transit periods of 15-30 minutes, for example when switching drivers.

Because the bus stations are relatively centrally located, the various bus lines end in close proximity to the bus stations, and buses can be brought back to the park without significant loss of time or distance traveled. Another option is to install some chargers at the end of routes where buses wait during off-peak operating periods. Initially, bus routes could be selected for electrification that end near one of the bus stations.

Electric buses are cost-competitive with organic alternatives. This is primarily due to the very low price of electricity. The cheapest alternatives are clearly electric buses with fast charging, followed by conventional trolleybuses. Hybrid trolleybuses and overnight-fueled electric trolleybuses have a 20% higher total cost than fast charging electric buses and standard trolleybuses (this is based on using only the current trolleybus network; expanding the network would significantly increase the cost of conventional trolleybuses).

A quick estimate of the economic value of emissions is made by assigning monetary costs to PM2.5, NO_x, SO_2 and CO_2 and noise emissions. The economic value of air pollutants for Kyrgyzstan is taken from the IMF (International Monetary Fund) publication, and the value of noise pollution from the Victoria Transport Policy Institute meta-study, and updated to 2019 dollar prices. The pollutant values calculated by the IMF are based on local levels of pollution at the ground level and the health effects and costs caused by this type of pollution in Kyrgyzstan. This is based on population exposure to pollution and how elevated pollution increases mortality risks, using the World Health Organization's dose-response functions for concentration.

The greater risk of mortality, or more precisely, the value of premature death, is estimated economically based on stated studies and preferences conducted by the OECD. The external costs of global warming are expressed through the social cost of carbon (SCC). The latter is an estimate of the economic damage associated with increased CO_2 emissions. Estimating the economic damage of CO_2 emissions is complex and very dependent on discount rates. The value of the SCC is based on the ADB data (2017). The following table shows the values used for this report.

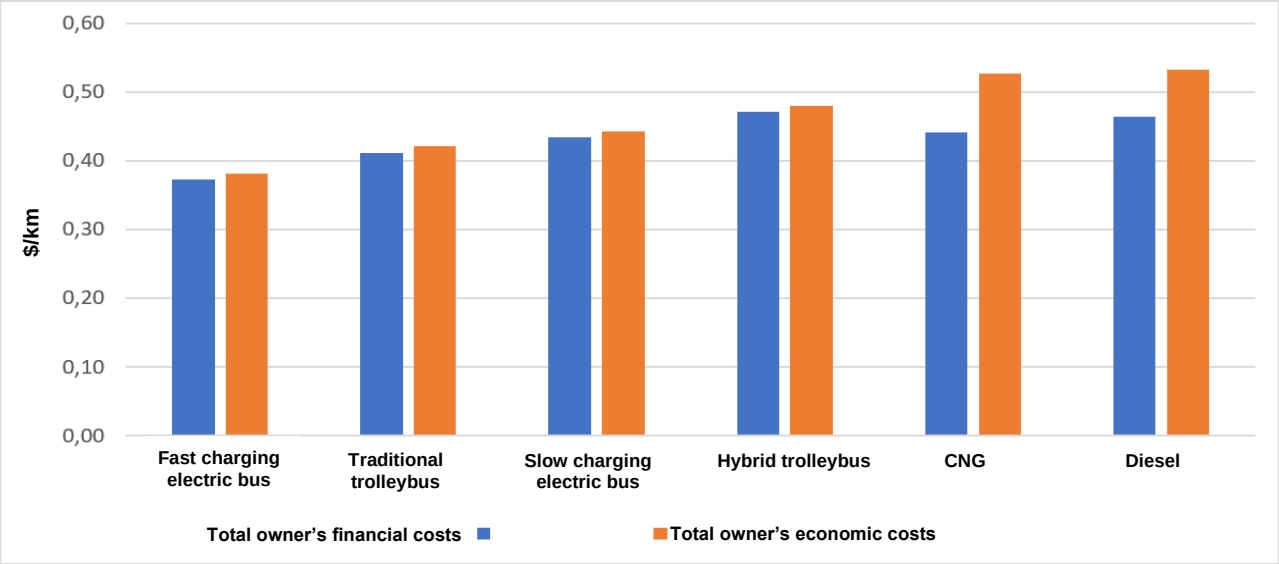
Table 6. Economic cost of emissions in Kyrgyzstan (in 2019 dollar prices)

Emissions	**Economic cost**
PM2.5	34,200 USD per ton
NO_x	250 USD per ton
SO_2	1,180 USD per ton
CO_2	40 USD per ton
Noise	Noise-related costs of electric buses are $0.002/km lower compared to diesel buses

Source: Grütter Consulting calculations based on IMF (2014), ADB (2017) and VTPI (2017) data

The following graph shows the financial and economic indicators of the total cost for the owner of various bus technologies.

Figure 6. Financial and economic cost for the owner of bus technologies in Bishkek (in 2019 dollar prices)



Note: The total cost for the owner only includes the difference between technology and partial operating costs of the bus company.

Source: ADB report

As can be seen from the chart above, the best choice for urban transport is a fast charging electric bus.

3.3.1. Comparison of Traditional Vehicles and Electric Vehicles

In terms of maintenance and ownership costs, an electric vehicle has a number of advantages. It has fewer moving parts, no oil, no timing, no spark plugs or glow plugs and many other "classic parts", and the brakes wear out much slower due to the regeneration mode of electric motors (analogous to engine braking in a classic vehicle). Below is a cost analysis of traditional vehicles and electric vehicles.

3.3.2. Calculation Methods

All particular cases are not taken into account: AI95, propane gas, butane, diesel, etc., but the average price of gasoline is taken. Prices as of February 2021. Electric vehicles assembled in a garage, or ultra-high consumption electric vehicles in the off-road category are also not taken into account. The comparison is made in the mass market of the most common vehicles. General vehicle ownership costs, such as repair costs, washing, fines, taxes, parking, etc., have not been taken into account, since they are currently the same for both internal combustion engine vehicles (ICE) and electric vehicles.

The advantages for electric vehicles include free parking in metropolitan areas and shopping malls, but this too is not taken into account, as it is local and temporary in nature. It is also a plus that video recorders and navigators are already installed in electric vehicles at the factory.

To select the tariff for electricity consumption, the lower threshold was taken, i.e. up to 700 kW - 0.77 KGS, since the cost of 1 kW over 700 kW costs 2.16 KGS. As for the operation in winter, the average value for the Kyrgyz Republic is also taken into account - 20% of the days in a year are winter. For the most severe winter operation, the cost of heating the cabin and warming the battery reduces the distance by 2 times, and therefore increases consumption by 2 times. For internal combustion engines, winter consumption is 10% more than summer.

Also, when calculating the total service life was taken as 7 years, since during this time the battery for used electric vehicles wears out. However, it should be noted that this approach is quite conservative due to the fact that the battery life of a new vehicle is much longer. In a comparative analysis, the costs of such popular vehicles in Kyrgyzstan as Toyota Camry 50, Honda Fit, Lexus 470, Honda Stepwagon, Nissan Leaf (used electric vehicle) and BYD Tang EV600 (new Chinese electric vehicle, which is in the Kyrgyz Republic) were calculated.

Table 7.Comparison of vehicle ownership costs

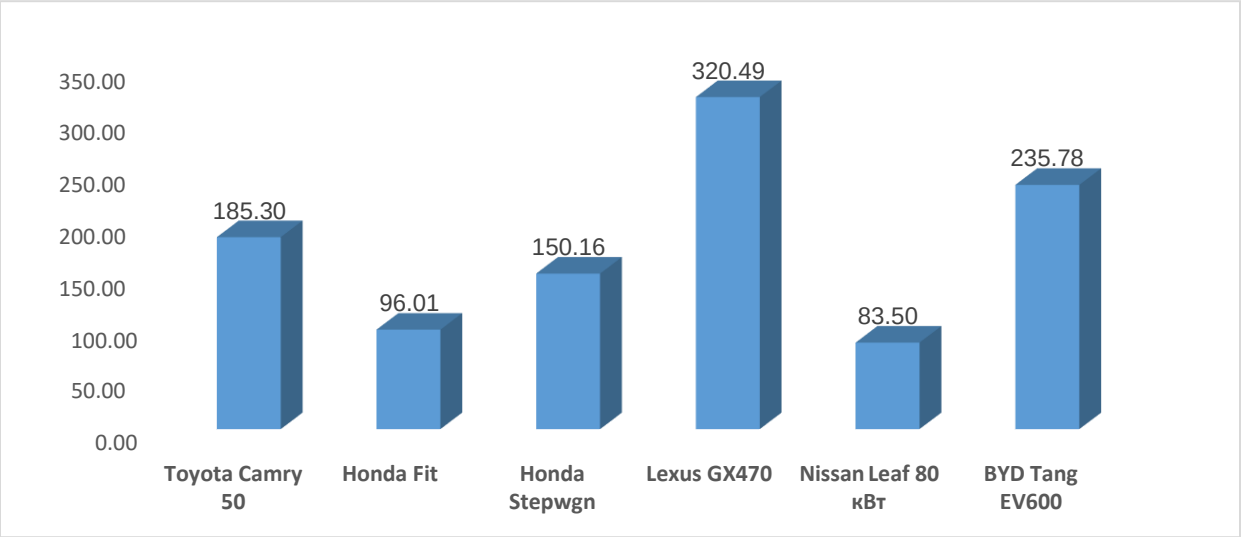
Popular vehicle brands	Fuel costs per 9 thousand km in the city				Changing ICE oil every 9 thousand km	Replacing oil/cabin filters	Replacing brake pads every 20 thousand km	Replacing fuel filter + cleaning nozzles every 40 thousand km	Replacing spark plug every 60 thousand km	Changing oil in automatic transmission on every 50 thousand km	Replacing tire every 50 thousand km	**All expenses excluding depreciation**	Depreciation	**Total costs**
	AI92 1liter =36 KGS	AI 95 1liter= 38 KGS	Diesel 1liter= 37 KGS	Gas 1liter =25 KGS										
Toyota Camry 50 (13 liters per 100 km)	13*36 = 468 KGS 1km= 4.68 KGS	13 * 38 = 494 KGS 1 km = 4.94 KGS	13 * 37 = 481 KGS 1 km = 4.81 KGS	13*25 = 325 KGS 1 km = 3.25 KGS	4.5liters*450 KGS=2025 KGS (5*30 synthetic)	300KGS/ 400KGS	4*1200 KGS= 4800KGS/ 20 thous.km *9thous.km +30% cost of work	5000KGS/ 40thous. km*9 thous.km +50% cost of work	2000KGS per set/60 thous.km* 9 thous.km +50% cost of work	8liters*450 KGS/ 50 thous.km* 9thous.km	4*7000KGS /50thous.km *9thous.km			
	42120	44 460	43 290		2 025	700	2 808	1 688	450	648	5 040	**56 649**	72 000	**128 649**
Honda Fit (7 liters per 100 km)	7*36 = 252 KGS 1km= 2.52 KGS	7*38= 266 KGS 1 km = 2.66 KGS	7*37 = 259 KGS 1 km = 2.59 KGS	7*25 = 175 KGS 1km= 1.75 KGS	3.5liters*350 KGS=1575 KGS (5*30 synthetic)	250KGS/ 350KGS	4*650= 2600KGS/ 20thous.km *9 thous.km +30% cost of work	3000KGS/ 40thous.km * 9thous.km +50% cost of work	1500KGS per set/60 thous.km* 9 thous.km +50% cost of work	6liters* 450KGS/ 50thous. km*9 thous.km	4*3500 KGS/50 thous.km* 9 thous.km			
	22680	23 940	23 310		2 175	600	1 170	1 013	338	486	2 520	**31 611**	32 786	**64 397**

Honda Stepwgn (12 liters per 100 km)	12*36 = 432 KGS 1 km = 4.32 KGS	12 * 38 = 456 KGS 1 km = 4.56 KGS	12 * 37 = 444 KGS 1 km = 4.44 KGS	12*25 = 300 KGS 1 km= 3 KGS	4liters * 450 KGS=1800 KGS (5*30 synthetic)	300KGS/ 400KGS	4*1100=4400/20 thous.km* 9thous.km +30% cost of work	4000KGS/ 40 thous. km*9 thous.km +50% cost of work	2000 KGS per set/6 thous.km* 9 thous. km+50% cost of work	8liters* 450KGS/ 50thous. km*9 thous.km	4*7000 KGS/50 thous.km* 9 thous.km			
	38880	41 040	39 960		2 500	700	2 574	1 350	450	648	5 040	**53 222**	43 714	**96 936**
Lexus GX470 (20 liters per 100 km)	20*36 = 720 KGS 1 km= 7.2 KGS	20 * 38 = 760 KGS 1 km = 7.6 KGS	20 * 37 = 740 KGS 1 km = 7.4 KGS	20*25 = 500 KGS 1 km= 5 KGS	6.8liters* 600KGS= 4080 KGS (5*30 synthetic)	650KGS/ 750KGS	4*1500= 6000/20 thous.km* 9thous.km +30% cost of work	7000KGS/ 40thous.km * 9thous.km + 50% cost of work	3000KGS per set/60 thous.km* 9thous.km +50% cost of work	8liters* 450KGS/ 50thous. km*9 thous.km	4*10000 KGS/ 50thous.km *9thous.km			
	64800	68 400	66 600		4 080	1 400	3 510	2 363	675	648	7 200	**86 476**	47 536	**234 011**
Nissan Leaf 80 kW battery capacity 24kWh	Power reserve on one charge			Once every 30,000 km, it is necessary to change the oil in the gearbox. 1liter=1500KGS 1.3liters*1500=1950KGS 1950/3.3=591KGS			4*1200 = 4800/20 thous.km* 9 thous.km +30% cost of work	not required	not required	not required	4*7000 KGS/ 50 thous.km* 9 thous.km		935000 KGS/ 7 years	
		100km (1kW=0.7 -2.4 KGS)	150 km (1kW= 0.7 - 2.4 KGS)											
		1kW = 4.1km 1km = 0.24 kW 1km=0.17 KGS- 0.59KGS	1 kW = 6.25 km 1 km = 0.16 kW 1 km= 0.1KGS- 0.4KGS											
		4 000	2 500	600			2 808	0			5 040	**11 698**	60 107	**71 805**

BYD Tang EV600 battery capacity 82.8 kWh			300 km (1kW= 0.7KGS-2.4KGS) 1 kW = 3.6 km 1 km = 0.28 kW 1km= 0.2KGS-0.67KGS	Once every 30,000 km, it is necessary to change the oil in the gearbox. 1liter=1500KGS	4*1500= 6000/20 thous.km* 9 thous.km +30% cost of work	not required	not required	not required	4*8000 KGS/50 thous.km* 9 thous.km		3230000 KGS / 7 years	
			4 000	800	3 510				5 760	**14 070**	207 643	**221 713**

Thus, as can be seen from the table above, the purchase and maintenance of electric vehicles is cheaper as compared to conventional ICE vehicles.

Figure 7. Vehicle maintenance costs including depreciation



3.3.3. Sales and Service

During interviews with car dealers who bring electric vehicles to Kyrgyzstan, it has been revealed that at the moment there are no specialized centers to service electric vehicles. New vehicles imported into Kyrgyzstan come with a factory warranty of 3 years. Used vehicles are sold without any warranty coverage. Dealers have said that service centers will be opened if the number of vehicles is large enough. The current number of vehicles is economically unprofitable to open service centers.

3.4. Analysis of Current Technical and Other Relevant Possibilities to Serve Both Electric Vehicles and Fast Charging Stations

As noted earlier in the report, there are three types of chargers. The most powerful chargers - superchargers consume more than 100 kWh. Ordinary lines will not be able to withstand such a load, so the charging provider needs to obtain technical specifications. After analyzing all the possibilities, the team of experts came to the conclusion that the best and most economical way to install superfast charging stations is to install them **near substations that have free capacity**.

First of all, it is necessary to provide superfast charging stations in Bishkek, Osh, and connect Issyk-Kul region. Most of the vehicles are concentrated in Bishkek, and now the issue of air pollution is also in the forefront. Many residents of Bishkek go to Issyk-Kul for vacation, so if Issyk-Kul region is not connected, the transition to electric vehicles will not be appropriate for an ordinary resident of Bishkek, since every summer residents will not be able to get to Issyk-Kul on their own. In Bishkek it is recommended to install regular public slow chargers in the parking lots of shopping and business centers. As a first step, it is necessary to install 5 superchargers. A map of proposed charging locations is shown in Annex 1 to this report.

On the highway Bishkek-Issyk-Kul it is recommended to install 5 supercharges. The reason is the high altitude. When climbing to a higher altitude, the battery of an electric vehicle consumes more energy, and, accordingly, the battery will run down faster. It is also necessary to install at least 8 charging stations along the Issyk-Kul water area. In Issyk-Kul regiont, it is also proposed to install fast chargers in the cities of Balykchy, Cholpon-Ata, and Karakol and in the villages of Grigorievka and Bokonbaevo, as shown on the map below.

Another critical area for connection is the Bishkek-Osh highway, which is considered a difficult route with two high-mountain passes. As noted above, the battery discharges faster than usual at altitude, so it is proposed to install chargers there after the successful launch in the main cities, as a second step. Naryn and Talas regions are proposed to be connected after superfast chargers have been successfully launched in all other regions of the country.

3.5. Identification of Potential Public-Private Partnerships (PPPs) to Service Electric Vehicles and Charging Infrastructure

Since it is recommended to install superfast electric charging stations near substations, two ways to own and operate charging stations are suggested.

First option

The installation and maintenance of charging stations will be carried out by the distribution company to whose substation the charging stations will be installed. In this scenario, in most cases, charging stations will be state-owned, and they will be managed by state-owned distribution companies.

Second option

Public-private partnership. It is also proposed to open charging stations near substations, but they will be managed by private businesses.

Below is a comparison table of superfast charging stations.

Table 8. Comparison table of superfast charging stations

	ABB Terra 54 HV	**Wall Charge Complex**	**NKR-ADC**	**G-CHARGE DC**
In specialized electric charging stations (Supercharger), as well as on the intercity highway				
Charging mode	DC fast charging, + Type-2 AC medium charging	DC fast charging, + Type-1 and Type-2 AC medium charging	DC fast charging, + Type-1/2 AC medium charging	DC fast charging, + Type-2 AC medium charging
Types of connection ports	CCS, CHAdeMO and AC Type2 (Mennekes) socket	Type1 (J1772), Type2 (Mennekes), CCS Combo 1/2, CHAdeMO	CCS, CHAdeMO and AC Type1/2	CCS1/2, CHAdeMO, AC Type2
Charger capacity	CCS - 50 kW 125 A CHAdeMO - 50 kW 125 A Type 2 (Mennekes) - 22 kW 32 A	CCS Combo 1/2 – 60 kW up to 200 A CHAdeMO – 60 kW up to 200 A Type 2 (Mennekes) - 45 kW 63 A Type 1 (J1772) – 19 kW 80 A	CCS+CHAdeMo - 82 kW 200 A Type 1/2 AC - 22 kW 32 A	CCS+CHAdeMo 50-100kW 100-200A, Type 2 AC - 22 kW 32 A
AC input voltage	400V +/- 10%, 50 Hz, 3P+N+PE	380V +/- 10%, 50 Hz, 3P+N+PE	260-530V +/- 10%, 50Hz/60Hz	305-520V AC, 40-65 Hz, 3P + PE
Maximum power consumption and currents	112A, 77 kVA	…	…	…

DC output voltage	150V – 920V (HV)	up to 550V	150 ~ 500V/150 – 750V/150 – 1000V	50-500V
Cable length	6 m	6.5 m	4 m	6 m
Operating temperature range	-35 °C to +55 °C	-50°C to +50°C	-20°C±60°C	-25ºC to +65ºC
Electromagnetic compatibility (EMC)	Class B according to EN 61000-6-3:2007	…	…	…
Protection rating	IP-54 and IK-10 (cabinet) / IK-8 (touchscreen)	IP 65/IK 10	IP 54/IK 10	IP54/55
Operating height	up to 2000 m above sea level	…	up to 2000 m above sea level	…
Protocol updates from the Server	Available	Available	Available	Available
Number of vehicles that can be charged at the same time	up to 2	3 + 1 optional	up to 3	2
Weight	325 kg	180 kg	185 kg	…
Mounting	Freestanding cabinet	Wall-mounted (on mounting plate) Optional: Floor-mounted + € 200	Freestanding cabinet	Freestanding cabinet
Warranty	24 months	12 months	24 months	24 months
Charger installation	The charger is installed by the service team	The charger is installed by the service team	The charger is installed by the service team	The charger is installed by the service team
Charging station manufacturer	Holland	Ukraine	China	Turkey

According to the analysis and negotiations with the manufacturers of charging stations, it is proposed to use the superfast chargers from **ABB Company**. This company is European, the main advantage of which is the low price in comparison with other European manufacturers, also the company has good experience in the production of charging stations and works on the constant improvement of its products. Besides, ABB has its official representative office in Almaty, which makes operation much more convenient, because their employees can come in case of an accident or any malfunction and carry out maintenance.

A business plan for launching charging stations was developed. The calculation was based on information that was obtained from ABB experts and local technical experts. The ABB charging station was taken as the basis, as their operation in the Kyrgyz Republic is considered to be the safest and most stable.

Capital costs include the purchase of the charging station, necessary spare parts and installation costs and amount to 4,302 thousand KGS for 1 charging station. Operating costs consist of the cost of renting space, office, dust filters, salary costs and payment for electricity. Detailed calculation of business plan indicators is given in Annex 2.

According to calculations, this project will pay for itself in 6.5 years, provided that 10 superfast charging stations are installed.

4. Cost-Benefit Analysis

4.1. Calculation of CO_2 Emission Reduction Potential

4.1.1. Passenger Vehicles

According to SPUTNIK.kg article "What vehicles are popular in Kyrgyzstan: brands, prices, age, color and fuel type"[13] dated 02 December 2019, the best-selling brands in 2019 were TOYOTA, HONDA, MERCEDES-BENZ, DAEWOO and LEXUS. Statistics on active ads for the sale of vehicles[14] by year of manufacture: before 1990 - 12%, before 2000 - 32%, before 2010 - 46%, after 2010 - 12%. Statistics by fuel type: gasoline - 79%, diesel - 14%, hybrids - 6%, electricity - 1%.

According to the Vehicle Certification Agency, an executive agency of the UK Department for Transport[15], set up to improve vehicle safety and protect the environment, the average carbon dioxide emissions for each mode of (used) transport are shown in Table 9.

Table 9. Carbon dioxide (CO_2) emissions by vehicle model, fuel type and year of manufacture

Manufacturer	Model	Engine capacity	Fuel type	CO_2, (in grams/person/km)			
				2001	2005	2010	2015
TOYOTA	Avensis	1798	Gasoline	195	187	160	140
TOYOTA	Avensis	1998	Gasoline	210	219	192	120-124
TOYOTA	Corolla	1598	Gasoline	192	189	-	-
TOYOTA	Camry	2164-2995	Gasoline	232-270	233-263	-	-
TOYOTA	Prius	1497	Hybrid	-	104	104	89-101
TOYOTA	Land Cruiser	2982-4461	Diesel	253-405	250-387	238-270	213-250
HONDA	Accord	1850-2254	Gasoline	203-224	143-214	148-209	138-170
HONDA	CR-V	1973	Gasoline	229-235	215-221	173-195	119-177
HONDA	Jazz	1198-1339	Gasoline	-	-	125-128	111-120
HONDA	Civic	1686	Diesel	-	134	139	99-103
HONDA	Insight	995	Hybrid	80	80	101-105	96-99

[13] Sputnik.kg. What vehicles are popular in Kyrgyzstan: brands, prices, age, color and fuel type /02.12.2019 updated 17.11.2020/ https://sptnkne.ws/F77D

[14] Online car market in the Kyrgyz Republic/ https://www.mashina.kg/

[15] Vehicle Certification Agency website/Online CO_2 emissions calculator/https://carfueldata.vehicle-certification-agency.gov.uk/search-new-or-used-cars.aspx

MERCEDES-BENZ	A-Class	1498-1595	Gasoline	172	172-184	139-162	128-133
MERCEDES-BENZ	B-Class	1796	Gasoline	-	-	168-170	137-144
MERCEDES-BENZ	C-Class	1595-1998	Gasoline	224-232	250-270	149-169	148
MERCEDES-BENZ	A-Class	1992-2143	Diesel	139-156	156-162	116-149	108
MERCEDES-BENZ	B-Class	1461-1992	Diesel	-	-	148-165	108
MERCEDES-BENZ	C-Class	2143	Diesel	164-181	153-166	175-178	109-139
DAEWOO	Matiz	796	Gasoline	161	144-161	-	-
DAEWOO	Korando	2874	Diesel	258	-	-	-
LEXUS	RX	1998-3456	Gasoline	311	288	264	181-189
LEXUS	RX400 - 450	3456	Hybrid	-	-	192	127

Source:https://carfueldata.vehicle-certification-agency.gov.uk/search-new-or-used-cars.aspx

The amount of carbon dioxide emissions depends on the size, weight, load, fuel used, age and condition of the vehicle. Due to the introduction of new environmental legislation in neighboring countries, the removal of catalysts from vehicles of the Kyrgyz Republic for the purpose of sale has become more frequent, which accordingly changes the calculated average carbon dioxide emission standards for the worse.

The weighted average volume of CO_2 emissions of passenger vehicles by year according to market share is as follows:

- gasoline engine – 194.5 g/km,
- diesel – 179.4 g/km,
- hybrid – 109 g/km.

Therefore, to reduce the emission of 1 ton of CO_2, it is necessary to replace 5,141 vehicles/km with a gasoline engine or 5,574 vehicles/km with a diesel engine. And since they are offered on the market in the ratio of 79%, 14% and hybrids - 6%, it is necessary to replace an average of 5,396 vehicles/km.

The abovementioned source[16] also contains information on the zero carbon dioxide emissions of electric vehicles manufactured since mid-2013: BMW i3, CITROEN C-Zero, MITSUBISHI i-MiEV, NISSAN E-NV200, NISSAN Leaf, PEUGEOT iOn, RENAULT Fluence Z.E., RENAULT Zoe, SMART fortwo cabrio, TESLA Model S, VOLKSWAGEN UP, etc.

[16] Vehicle Certification Agency website/Online CO_2 emissions calculator/https://carfueldata.vehicle-certification-agency.gov.uk/search-new-or-used-cars.aspx

During the study we interviewed 90 drivers of private vehicles (50), service vehicles (20) and taxis (20). The drivers were asked the following questions: average mileage per day, vehicle brand, engine capacity, fuel type, ownership type, number of working days (see Annex).

Median values of daily mileage were: 50 km/day - for private vehicles, 120 km/day - service vehicles and 120 km/day - taxis. Calculations of CO_2 emissions per year were made taking into account the number of working days on average - 247 days for private and service vehicles, for taxis the average number of working days per year - 330 days (see Table 10).

Table 10. Calculation of the number of vehicles to reduce 1 ton of CO_2 emissions per year by types of vehicle ownership, average mileage per day and per year

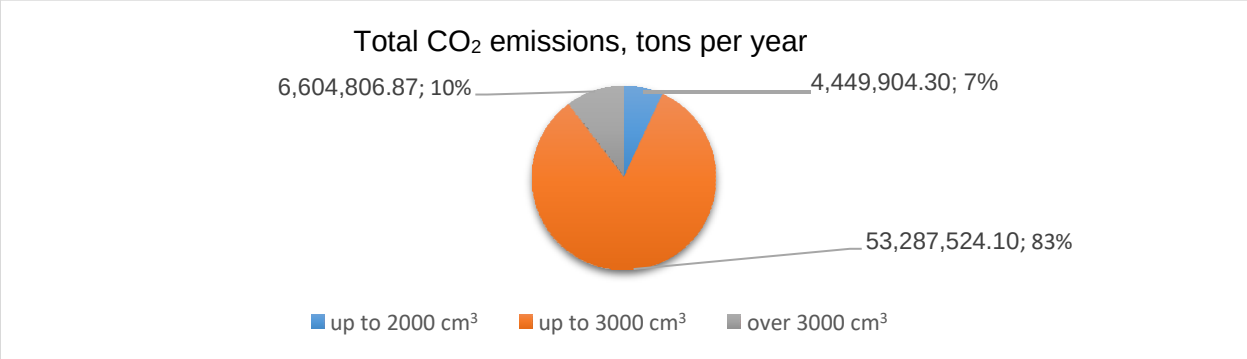
Ownership type	Engine capacity	Fuel type	Average mileage per day	Average mileage per year	Average CO_2 emissions (g/km)	CO_2 emissions of 1 vehicle per year, tons	Number of vehicles to be replaced for reducing 1 ton of CO_2
Private	up to 2000cm^3	Gasoline	40	9 880	160.7	1,59	0,63
Private	up to 3000cm^3	Gasoline	60	14 820	267.5	3,96	0,25
Private	from 3000cm^3	Gasoline	30	7 410	192	1,42	0,7
Private	up to 2000cm^3	Diesel	40	9 880	184.3	1,82	0,55
Private	up to 3000cm^3	Diesel	60	14 820	231.1	3,42	0,29
Service	up to 3000cm^3	Gasoline	95	23 465	267.5	6,28	0,16
Service	Cargo/ passenger transportation	Gasoline	170	41 990	280	11,76	0,085
Taxi	up to 2000cm^3	Gasoline	120	39 600	160.7	6,36	0,16
Taxi	up to 3000cm^3	Gasoline	70	23 100	267.5	6,18	0,16
Taxi	up to 2000cm^3	Diesel	120	39 600	184.3	7,30	0,14
Taxi	up to 3000cm^3	Diesel	70	23 100	231.1	5,34	0,19

Owners of vehicles with more than 3,000 cm^3 tend to be more solvent and, if electric vehicles are popularized as a means of reducing air pollution, may be more mobile in their decision to purchase an electric vehicle, then replacing 7 of these gasoline-powered vehicles would reduce CO_2 emissions by about **10 tons per year**.

Since most of **taxis** in Bishkek run on gasoline fuel with an engine capacity of less than 2000 cm^3, the replacement of 1 unit of taxi will reduce carbon dioxide emissions by an average of **6.36 tons per year** or replacement of 0.16 units of taxis with minimum engine capacity will reduce carbon dioxide emissions by 1 ton per year.

According to the data provided by "Unaa" State Institution under the SRS KR (electronic database AIS "Vehicle Register"), we calculate the average emission of CO_2 by passenger vehicle in the Kyrgyz Republic:

Figure 8. Total CO_2 emissions per year by passenger vehicles registered in the Kyrgyz Republic, tons



More than 1 million passenger vehicles emit an average of more than 104.39 million tons of carbon dioxide into the atmosphere each year.

4.1.2. Buses/Minibuses

Minibuses in Bishkek are mostly represented by different models of MERCEDES-BENZ Sprinter. According to the Russian website avtomarket.ru, the average CO_2 emission of this model of minibuses manufactured in 2012 is 213 g/km.[17] The coefficient is calculated for an average vehicle load.

Further calculations also use the CO_2 emission factors from the UK Department for Environment, Food and Rural Affairs (Defra) for average passenger load[18]:

minibuses – 266.1 g/person/km

buses (diesel) – 107 g/person/km

[17] Avtomarket.ru https://avtomarket.ru/catalog/commercial/Mercedes/Sprinter/56479/ Information website

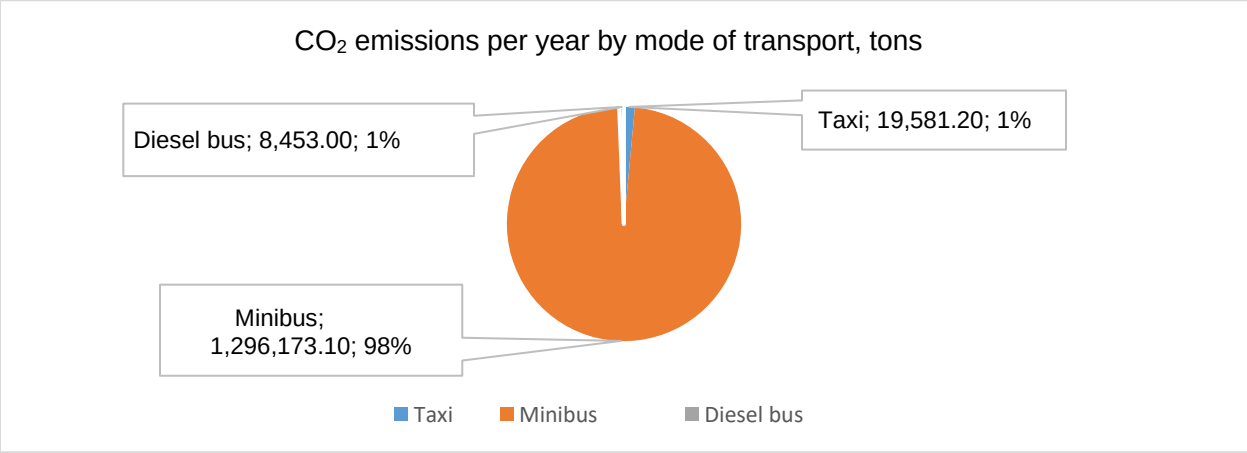
[18] "2008 Guidelines to Defra's GHG Conversion Factors: Methodology Paper for Transport Emission Factors/ page 20-21

Table 11. Information on urban passenger transport in Bishkek

Type of public transport	Total number/daily on the route	Average route length	Passenger turnover per year, mln passenger-kilometers[19]
Minibuses	3000/2200[20]	18 km	4871[21]
Buses	477/135[22]	9-29 km	79
Trolleybuses	165/76[23]	10-12 km	223,8

Based on the data in Table 11 and data on CO_2 emissions, we calculate emissions by modes of passenger transport.

Figure 9. Total CO_2 emissions of passenger vehicles per year, tons



If the average 1 **minibus** emits 266.1 g/person/km=0.0002661 tons/km of carbon dioxide, then the ban on their operation for passenger transportation within the city of Bishkek will reduce CO_2 emissions by 26.61 tons per year from each unit. At the moment there are more than 2,200 units on the route every day, their complete replacement with electric-powered passenger vehicles will reduce carbon dioxide emissions by **more than 1.296 million tons per year**.

[19] National Statistical Committee. Stat.kg. 1.05.04.05. Passenger turnover of all modes of transport, Bishkek, 2019 (The total volume of passenger turnover of Bishkek for 2019 is taken)
[20] Anarbaeva Saltanat. Study of factors influencing the transport infrastructure of the city and suburban areas. With the support of Soros-Kyrgyzstan. November, 2018
[21] Ryzhov A.Yu. Minibuses and transport policy. Examples of Bishkek and Makhachkala/Urban Studies and Practices, Vol.1 #1, 2016, 55-69 https://cyberleninka.ru/article/n/mikroavtobusy-i-transportnaya-politika-primery-bishkeka-i-mahachkaly/viewer
[22] Bishkek Passenger Motor Transport Enterprise, Bishkek Mayor's Office https://docs.google.com/spreadsheets/d/1SFWjikLFcyXBxUMHJAvFunpPZP- 7eSAETCSm1MinYQ8/edit#gid=1079517374
[23] Study on Improvement of Urban Transport in Bishkek, Kyrgyz Republic. JIKA, 2013

Replacing 1 city **bus** would reduce CO_2 emissions by 44.18 tons per year. In the case of complete replacement of 135 operating units with buses with electric motor, the total reduction in CO_2 emissions will be about 8,453 tons per year. According to statistics from the National Statistical Committee of the Kyrgyz Republic, total passenger turnover in 2019 was 13,135.1 million passenger-kilometers, of which 10,490.2 million passenger-kilometers were accounted for by buses and minibuses (79.86%). At the end of 2019, a total of 40,417 buses and 3,409 cargo-passenger vehicles (minibuses) were registered in the country - a total of 4,626 vehicle units. That is, on average, 13,135,100,000/46,826=280,508.7 passenger-kilometers per bus (minibus) per year. Subsequent calculations can be based on this indicator. The average emission of carbon dioxide by 1 passenger vehicle is equal to (107+266.1)/2=186.55 g/person/km. Of course, the assumptions made will seem too rough, but on a national scale with annual emissions in millions of tons, they are not so significant.
According to the statistical data for 2020, provided by "Unaa" State Institution under the SRS KR, let us calculate the volume of CO_2 emissions by regions.

Table 12. CO_2 emissions by buses and minibuses registered in the Kyrgyz Republic by regions and Bishkek and Osh cities

City/region	Total number of passenger vehicles, units	Average passenger turnover per year, mln passenger-km[24]	Total CO_2 emission per year, tons[25]
Bishkek city	14 419	4 044.7	754 530.4
Osh city	2 984	837.0	156 149.4
Chui region	12 428	3 486.2	650 343.5
Osh region	4 568	1 281.4	239 038.4
Talas region	1 266	355.1	66 248.4
Jalal-Abad region	4 173	1 170.6	218 368.5
Issyk-Kul region	4 574	1 283.0	239 352.4
Naryn region	1 215	340.8	63 579.6
Batken region	2 407	675.2	125 955.7
Total	48 034	13 474.0	2 513 566.3

Total CO_2 emissions from buses and minibuses throughout Kyrgyzstan are approximately 2.5 million tons per year.

[24] Calculated as 280508.7 passenger-kilometers per bus (minibus) per year (explanations on the same page above Table 2.5.2.6)
[25] Calculated as 186.55 gr/person/km per bus or minibus on average (explanation on the same page above Table 2.5.2.6)

4.1.3. Trucks

The official EU website reports that trucks, buses and tour buses account for about a quarter of CO_2 emissions from road transport in the EU and about 6 percent of total EU emissions[26].

In 2019, the total cargo turnover in the Kyrgyz Republic was 2,913.6 million ton-kilometers, including 1,841.9 million ton-kilometers by road (63.2%)[27]. Due to quarantine security measures, in 2020 this figure is 18% lower, so for further calculations we will refer to the figures of the previous year. According to the data provided by "Unaa" State Institution under the SRS KR (electronic database AIS "Register of Vehicles"), in the same year of 2019 there were 193,739 registered trucks. Let's calculate the average emission of CO_2 by trucks in the Kyrgyz Republic: 1,841,900,000/193,739=9,507.1 tons-km per truck per year on average.

To calculate the average CO_2 emissions per truck, we use data from the French Ministry of Ecology, Sustainable Development and Energy.[28] (332+750+409)/3=497 g/ton-km are the emissions of trucks with different types of cargo of 19, 7.5 and 12 tons gross weight.

Table 13. CO_2 emissions from trucks registered in the Kyrgyz Republic by regions and Bishkek and Osh cities

City/Region	Total number of registered trucks[29]	Average cargo turnover per year, mln ton-km	Total CO_2 emission per year, tons
Bishkek city	31 807	302.4	150 289.3
Osh city	14 924	141.9	70 516.5
Chui region	44 148	419.7	208 601.0
Osh region	58 658	557.7	277 161.3
Talas region	4 970	47.3	23 483.4
Jalal-Abad region	22 128	210.4	104 555.7
Issyk-Kul region	14 496	137.8	68 494.2
Naryn region	5 072	48.2	23 965.4
Batken region	14 528	138.1	68 645.4
Total	210 731	2 003.4	995 712.2

According to the calculations in Table 13, the total emission of CO_2 from trucks is about 1 million tons per year.

[26] Official website of the European Union / https://ec.europa.eu/clima/policies/transport/vehicles/heavy_en

[27] National Statistical Committee http://stat.kg/ru/statistics/transport-i-svyaz/

[28] CO_2 information for transport services Application of Article L. 1431-3 of the French transport code/The Medde (French Ministry of Ecology, Sustainable Development and Energy) has entrusted ADEME (Environment and Energy Management Agency)/page 78/ https://thepep.unece.org/sites/default/files/2017-06/Info_CO2_Methodological_Guide.pdf

[29] According to the SRS/Form 5/2020

4.2. Forecast for Electric Vehicle Growth and CO_2 Reduction

Forecast for electric vehicles growth by a linear trend

Figure 10. Forecast for electric vehicles growth

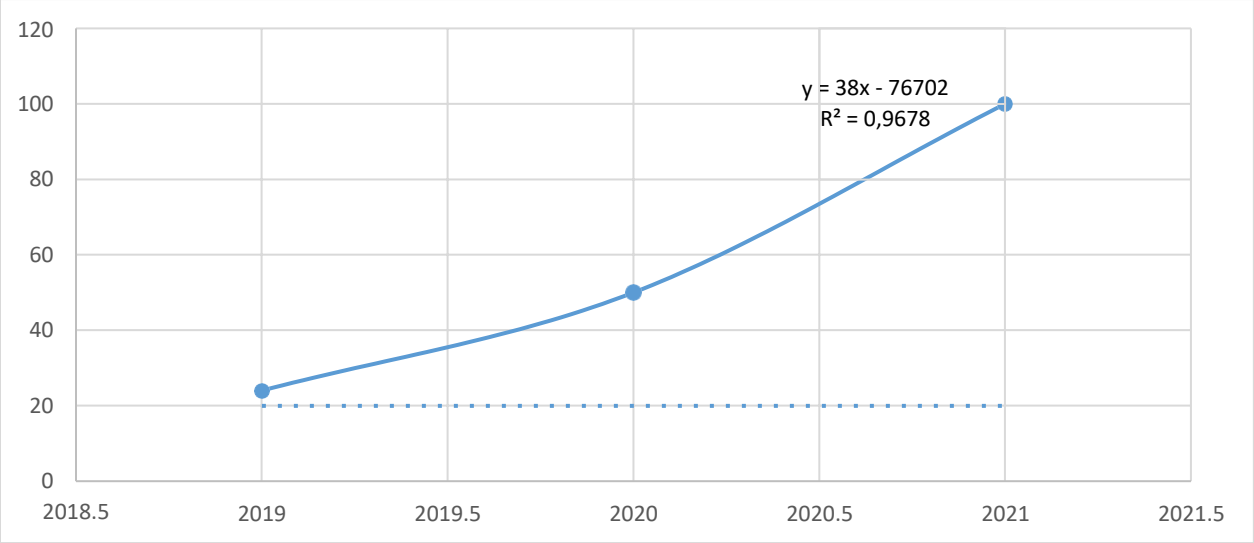


Table 14. Linear trend forecast

Actual data				Linear trend forecast								
t	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
x	24	50	100	134	172	210	248	286	324	362	400	438

Applying the linear trend forecast y=38*x-76702, with the coefficient of determination equal to R=0.96, we obtain that the increase in the number of electric vehicles is insignificant. In this case, the coefficient of determination shows that the impact of independent variable x explains the result indicator by 96%.

Assuming that 1,000 electric vehicles will be replaced each year instead of ICE vehicles, and considering the forecast growth of electric vehicles by a linear trend in the Kyrgyz Republic, according to the above calculations, we see a significant increase in the number of electric vehicles in the Kyrgyz Republic by 2030.

Table 15. Forecast of growth in the number of electric vehicles

Data				Forecast								
Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
				N=1	N=2	N=3	N=4	N=5	N=6	N=7	N=8	N=9
Number of electric vehicles	24	50	100	1134	2172	3210	4248	5286	6324	7362	8400	9438

The forecast is calculated by the formula y=38*t-76702+1000*N, where *t* is the year, N is the number of the forecast period.

Using this formula, it is not difficult to calculate the growth in the number of electric vehicles until 2050. Thus, the forecast figures say that in 2050 the number of electric vehicles will reach 30,198 units (t=2050, N=29).

Let's calculate the CO_2 emissions of one vehicle per year, we get the arithmetic mean value of 5 tons.

Table 16. Arithmetic mean value of CO_2 emissions

Ownership type	Engine capacity	Fuel type	Average mileage per day	Average mileage per year	Average CO_2 emissions (g/km)	CO_2 emissions of 1 vehicle per year, tons	Number of vehicles to be replaced for reducing 1 ton of CO_2
			Arithmetic mean value				
Private/ service/ taxi	By average engine capacity	Gasoline/ diesel	79,54545	22515	236	5,039091	0,301364

Table 17. Calculations of annual CO_2 emissions

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Number of electric vehicles	24	50	100	1134	2172	3210	4248	5286	6324	7362	8400	9438
CO_2 emissions of 1 vehicle per year, averaging 5.04 tons	120,96	252	504	5715,36	10946,88	16178,4	21409,92	26641,44	31872,96	37104,48	42336	47567,52

Average CO_2 emissions = number of electric vehicles * CO_2 emissions of 1 vehicle per year in tons

If there are about 9,500 electric vehicles by 2030, emissions will be reduced by about 47,800 tons. Based on the fact that an average vehicle with an internal combustion engine emits about 5 tons of CO_2 per year, by 2050 in Kyrgyzstan CO_2 emissions will be reduced to 152 thousand tons per year.

If we adhere to this principle, then, according to the Green Economy Concept in the Kyrgyz Republic, Kyrgyzstan will indeed become a green economy country.

For example, global sales of hybrid and electric vehicles in 2021 will amount to 16% of total sales of passenger cars against 11% in 2020 on the back of growing demand for electric vehicles, experts of the Oxford Economics (OE) British analytical company predict - this is the largest annual increase in the market share of electric vehicles throughout history. According to the OE, this share will reach 44% by 2030.

Euler Hermes estimates that 90.4 million new vehicles will be sold worldwide in 2020, of which 2.5 million will be electric vehicles (just under 3%). By 2030, it is projected that every second vehicle sold will be electric.

Chris Midgley, global head of analytics at S&P Global Platts, has said at the Russian Energy Week (REN) that by 2040 the number of electric vehicles in the world will exceed 400 million. For comparison, according to various estimates, in 2018 the number of electric vehicles amounted to about 5.5 million.

There is such an indicator as the parity point. When this point is reached, an electric vehicle and a vehicle with an internal combustion engine with the same technical characteristics will cost the same. In 2017, that point was projected to be in 2026. In 2018, the forecast shifted to 2024, and in 2019 it shifted to 2022. So, even comparing the forecasts, you can see how much this segment of the market has accelerated. If two years ago the prevailing opinion was that there would be few electric vehicles in the world, the current forecast is that by 2030 their share will be about 20% of the total number of vehicles.

Nevertheless, such a high (according to various sources, from 41.4 to 43.3%) increase in sales of electric vehicles is, of course, impressive, especially considering the fact that the electric vehicle market only fell in the first half of the year. The vast majority of automotive experts say that this is far from the limit, and further growth will occur exponentially. This will lead to the fact that next year the share of plug-in hybrids and electric vehicles in world sales may reach, according to various forecasts, 7–16%, and by 2030 even 44–48%.

4.2.1. Findings

- Over 1 million passenger vehicles emit an average of over 104.39 million tons of carbon dioxide into the atmosphere each year.
- Total CO_2 emissions from buses and minibuses throughout Kyrgyzstan are approximately 2.5 million tons per year.
- According to calculations, the total emission of CO_2 by trucks is about 1 million tons per year - 995.7 thousand tons.
- Total for the above categories (light, passenger, freight vehicles), excluding ownership and type of activity of their owners, CO_2 emissions are approximately 104.39+2.5+0.99=107.88 million tons per year.
- If there are about 9,500 electric vehicles by 2030, emissions will be reduced by about 47,800 tons. Based on the fact that an average vehicle with an internal combustion engine emits about 5 tons of CO_2 per year, by 2050 CO_2 emissions in Kyrgyzstan will be reduced to 152 thousand tons per year.

4.3. Amount of Investment Calculated per Ton of CO_2

At the moment, China offers cheaper cars - on the web portal, the price range is from $4,500 (used) to $15,000 for new minivans. But motor carriers warn of high barriers to exporting electric vehicles from China. Comparative prices for used electric vehicles are shown in Table 18.

Table 18.Main parameters of popular electric vehicle models

Main parameters	Nissan Leaf II[30]	Tesla S Long Range[31]	Mitsubishi i-MiEV Invite+[32]	Dongfeng M5 EV[33]
Country of manufacture	Japan (USA)	USA	Japan	China
Average selling price	€ 34 000	€ 86 990	€ 11 285	€ 25 200
Battery capacity	40 kW	381 kW	49 kW	57.7 kW
Autonomous drive range	385 km	610 km	150 km	353 km
Warranty	100 000 km	8 years	2 years	120000 - 150000 km
Cost including delivery from Russia	$ 41 200	$ 103 000	$ 14 000	$ 31 400

[30] Nissan Dealership in Russia. https://www.nissan.ru
[31] Automotive Internet Portal of Russia https://www.drom.ru
[32] Automotive Internet Portal of Russia https://mitsubishi.drom.ru/
[33] International Electric Vehicle Database, Marketplace and EV Compare Community https://evcompare.io/ru/cars/dongfeng/dongfeng-m5-ev/

The prices of Russian dealers can be taken as a basis, since Kyrgyzstan and Russia are in the same customs union, and prices in Kyrgyzstan are not very different from those in Russia. Delivery of a vehicle from Moscow to Bishkek before the 2020 quarantine cost from $590 to $1800.

Table 19.Calculation of costs (investments) for the purchase of new electric vehicles, calculated per 1 ton of CO_2[34]

Ownership type	Engine capacity	Fuel type	CO_2 emission of 1 vehicle per year, tons	Number of vehicles to be replaced for reducing 1 ton of CO_2	Electric vehicle model (similar in power)	Replacement costs per 1 ton of CO_2 [35]
Private	up to 2000 cm^3	Gasoline	1,59	0,63	Mitsubishi i-MiEV	$ 26,000
Private	up to 3000 cm^3	Gasoline	3,96	0,25	Nissan Leaf II	$ 10 300
Private	from 3000 cm^3	Gasoline	1,42	0,7	Tesla S Long Range	$ 72 000
Private	up to 2000 cm^3	Diesel	1,82	0,55	Mitsubishi i-MiEV	$ 7 800
Private	up to 3000 cm^3	Diesel	3,42	0,29	Nissan Leaf II	$ 12 000
Service	up to 3000 cm^3	Gasoline	6,28	0,16	Tesla S Long Range	$ 16 500
Service	Cargo/ passenger transportation	Gasoline	11,76	0,085	Dongfeng M5 EV (minivan)	$ 2 700
Taxi	up to 2000 cm^3	Gasoline	6,36	0,16	Mitsubishi i-MiEV	$ 2 300
Taxi	up to 3000 cm^3	Gasoline	6,18	0,16	Nissan Leaf II	$ 6 600
Taxi	up to 2000 cm^3	Diesel	7,30	0,14	Mitsubishi i-MiEV	$ 2 000
Taxi	up to 3000 cm^3	Diesel	5,34	0,19	Nissan Leaf II	$ 7 800
Average value (excluding market share of vehicles, etc.)						**$ 15 090**

[34] Note: when calculating the number of vehicles to be replaced to reduce the emission of 1 ton of carbon dioxide, annual data was taken as a basis. Consequently, the cost of replacement can be calculated taking into account their service life. Then the calculated indicator will be reduced by several times - the service life of an electric vehicle.

[35] Prices for electric vehicles are taken from Table 2.5.3.1 including delivery from Russia, Moscow.

Calculation of feasible investment per one ton of CO_2 when replacing with used electric vehicles offered in the market of Kyrgyzstan (Bishkek)

At the moment, more than 400 electric vehicles are offered in the Bishkek market (most of them - about 90% - on a by-order basis). The range of prices and models is shown in Table 20.

Table 20. Main characteristics of used electric vehicles in the motor vehicle market in Bishkek[36]

Electric vehicle model	Nissan Leaf	Nissan Leaf	BMW i13	Tesla Model S	BYD E6
Year of manufacture	2011	2013	2014-2015	2015-2016	2019-2020
Country of manufacture	Japan (USA)	Japan (USA)	Germany	USA	China
Average selling price	$9 125	$10 580	$15 700	$26 275	$26 200
Battery capacity	81 kW	81 kW	126 kW	126 kW	75 kW
Autonomous drive range	100-130 km	130-150 km	235-255 km	235-255 km	260 km

Table 21. Calculation of costs (investments) for the purchase of used electric vehicles, calculated per 1 ton of CO_2

Ownership type	Engine capacity	Number of vehicles to be replaced for reducing 1 ton of CO_2	Electric vehicle model				
			Nissan Leaf 2011	Nissan Leaf 2013	BMW i13	Tesla Model S	BYD E6
Private	up to 2000cm^3	0.63	$5 749	$6 665	$9 891	$16553	$16 506
Private	up to 3000cm^3	0.25	$2 281	$2 645	$3 925	$6 569	$6 550
Private	from 3000 cm^3	0.7	$6 388	$7 406	$10990	$18393	$18 340
Private	up to 2000cm^3	0.55	$5 019	$5 819	$8 635	$14451	$14 410
Private	up to 3000cm^3	0.29	$2 646	$3 068	$4 553	$7 620	$7 598
Service	up to 3000cm^3	0.16	$1 460	$1 693	$2 512	$4 204	$4 192
Service	transportation	0.085	$776	$899	$1 335	$2 233	$2 227
Taxi	up to 2000cm^3	0.16	$1 460	$1 693	$2 512	$4 204	$4 192
Taxi	up to 3000cm^3	0.16	$1 460	$1 693	$2 512	$4 204	$4 192
Taxi	up to 2000cm^3	0.14	$1 278	$1 481	$2 198	$3 679	$3 668
Taxi	up to 3000cm^3	0.19	$1 734	$2 010	$2 983	$4 992	$4 978
Mean value			**$2 750**	**$3 188**	**$4 731**	**$7 918**	**$7 896**

[36] Online car markets in the Kyrgyz Republic/ https://www.mashina.kg/ https://lalafo.kg/kyrgyzstan/avtomobili-s-probegom https://cars.kg/

4.3.1. Minibuses

Due to the fact that the largest volume of passenger turnover in Bishkek is carried out by minibuses, which causes, accordingly, the largest carbon dioxide emissions by this vehicle, special attention should be paid to their replacement.

The demand for transportation by minibus is quite high due to a number of advantages: frequency of movement, maneuverability, faster and cheaper option of public transport. That is, complete elimination of this type of public transport in the near future is unlikely. But their replacement by electric minibuses, if properly stimulated, may prove to be quite an attractive type of business, since the cost of a minibus with an electric motor is much lower than that of an electric bus.

There are currently no electric minibuses on the market in the Kyrgyz Republic. There are 19 electric passenger minibuses available to order: 14 used (2019) and 5 new. The number of passenger seats from 7 to 10 (+13 standing). Prices are significantly higher than for gasoline and diesel minibuses: from $32,700 to $119,000.
For calculations, we take the proposal of the Chinese manufacturer of minibuses ANKAI: $76,000 (excluding delivery from Khorog to Bishkek, installation of charging stations, etc.). Number of seats: 13 (there are more standing seats than in MERSEDES SPRINTER. See Figures 11, 12). Battery: 121.13 kW. Warranty: 150,000 km for the bus and 7 years for the battery.

Figure 11. ANKAI HFF6650GEV32 city electric bus (outside view)

Figure 12. ANKAI HFF6650GEV32 city electric bus (inside view)

Calculation of the cost of replacing **minibuses** to reduce the emission of 1 ton of CO_2: a total of about 2,200 minibuses operating within the city of Bishkek, respectively, the total CO_2 emissions per year is 1.296 million tons. Their complete replacement with 1,000 units of ANKAI HFF6650GEV32 electric buses, since the capacity is larger (not exactly specified) will be **$76 million**. Investments to reduce CO_2 emissions per 1 ton will be **$58.63**.

4.3.2. Buses

Due to the fact that the majority of passenger turnover both in cities of the Kyrgyz Republic and in intercity traffic is carried out by minibuses, they are the greatest cause of air pollution, which means that in the strategy under development it will be more appropriate not to replace but to expand the fleet of electric buses and gradually replace existing buses at the end of their service life.

The launch of the electric bus is the most relevant tool for reducing air pollution, since "in terms of the amount of emissions of poisonous substances into the environment, one passenger bus is equal to 343 passenger vehicles.[37] At the moment there is already a trend towards electric buses with fast recharging.

[37] Community of people and cars drive2.ru. https://www.drive2.ru/b/2415162/

Table 22. Analysis of types of electric buses

Parameter	Electric bus with slow charging[38]	Electric bus with fast charging	Electric bus with dynamic charging
Technology name	ONC (overnight charging)	OC (opportunity charging)	IMC (in-motion charging)
Electricity storage method	Overnight slow charging	Fast charging	Dynamic charging
Charging time	4-10 hours	20-30 minutes	not available
Charging place	terminus	terminus, at bus stops	when moving along the section of the contact network
Autonomous drive range	from 150 km	20-70 km	5-70 km
Average cost (USD)[39]	425 000	500 000	354 000
Passenger capacity	80	85	95
Electricity consumption per 1 km of run	2.2 kWh/km	2.1 kWh/km	2.7 kWh/km
Service life, years	12	12	10
Additional information	Requires diesel fuel for heating		The most economical mode of transport according to experts

[38] Online Journal. "Moscow Trolleybus"/25.08.2020/ prices for electric buses in rubles on average in 2018/ https://gre4ark.livejournal.com/752075.html

[39] Statistical Bulletin of the Bank of Russia, No. 2(297), 2018, p. 96 (ruble-dollar exchange rate for 2018)

Table 23. Main characteristics for popular models of electric buses

Parameter/Model of an electric bus	Bozankaya Sileo s12[40]	Solaris Urbino 1823	Ankai Latest 12M[41]
Country of manufacture	Turkey	Poland	China
Cost of an electric bus, Euro	$ 330 000	$ 625 000	$183 000[42]
Technology	ONC	OC	OC
Service life	12 years	12 years	180 000 km
Battery replacement cost (after 6 years)	$ 330,000	$ 220 000	-
Cost of 1 station to charge the battery	$ 47 000	$ 200 000	$91 000 (60 kW) $170 000 (120 kW)
Station installation costs	$ 12 000	from $ 112 000	$5 000
Battery capacity	225 kWh	226 kWh	326,73 kWh
Drive range	280 km	250 km	220-300 km
Passenger capacity, persons (seats)	up to 90 (39+51)	up to 137 (47+)	up to 90 (33)

Thus, the average price of an electric bus in US dollars at the exchange rate as of 15 March 2021 is (€280,000·0.84+€532,000·0.84+$183,000)/3=$379,333.

If we take into account that 135 buses with 8,453 tons of CO_2 emissions per year operate daily on the route in Bishkek (see Table 6), their complete replacement by electric buses will cost (excluding the cost of charging stations and spare batteries) **$51.21 million**. Investments to reduce CO_2 emissions per 1 ton will be **$ 6,057.5**.

In the CIS countries, testing of electric buses manufactured by OJSC Belkommunmash Holding Management Company and Likinsky Bus Plant with various recharging technologies at the request of the customer began in test mode: with night charging (6-8 hours), fast charging at terminuses (up to 18 minutes) and with dynamic charging (from trolleybus lines) with a supercapacitor[43] (free wheeling 20-50 km). The main characteristics are presented in Table 16. The cost of the charging station starts at $150,000[44].

[40] Fabian Meishner, Dirk Uwe Saue. Technical and economic comparison of different electric bus concepts based on actual demonstrations in European cities/Research Article/IET Electrical Systems in Transportation/8.03.2019

[41] Ankai's official website https://www.ankaiglobal.com/ https://english.ankai.com/, https://m.alibaba.com, correspondence with a company representative

[42] DAP Price in Khorgos, does not include ECE and OTTC certificate

[43] https://autoreview.ru/articles/gruzoviki-i-avtobusy/belkommunmash-predstavil-novyy-elektrobus

[44] The cost of the Belarusian electric bus was named. 15.09.2019./ https://upl.uz/economy/12486-news.html

Table 24. Main characteristics of electric buses made in Belarus and Russia

Parameter/Model of an electric bus	E433 "VITOVT MAX ELECTRO"[45]	AKSM-E321	E420 "VITOVT ELECTRO"	LiAZ-6274[46]
Country of manufacture	Belarus	Belarus	Belarus	Russia
Cost of an electric bus, $	≈ $475 000[47]	≈ $450 000[48]	≈ $450 000	$530 300[4950]
Technology	ONC, OC, Dynamic charging	ONC, OC, Dynamic charging	ONC, OC, Dynamic charging	OC, ONC
Service life	10 years	10 years	10 years	12 years
Battery capacity	160 kW	167 kW	180 kW	180 kW
Drive range	20-50 km	30-50 km	40-50 km	200-350 km
Passenger capacity, persons (seats)	153 (38)	88 (30)	86 (27)	85 (30)
Note on charging	Supercapacitor 34kWh. 500W charging recommended: charging time 6-7 minutes. Charging time at stations for electric vehicles 40 min-1.5 hours			Fast charging time - 15 minutes

Thus, the average price of an electric vehicle in US dollars is ($475,000+$450,000+$450,000+$530,300)/4=$476,325. Complete replacement of the bus fleet with annual CO_2 emissions of 8.453 tons at the calculated average cost of electric buses of Belarusian and Russian production would require **$64.3 million**. Then the required investment per 1 ton of CO_2 will be **$ 7,607.2**.

[45] Official website of Belkommunmash Holding Management Company / https://bkm.by

[46] https://bus.ru/buses/elektrobus/

[47] Vasily Matskevich, Media Polesye. Electric bus - an expensive pleasure/1 February 2018/ https://media- polesye.by/news/elektrobus-dorogoe-udovolstvie-44299/

[48] The cost of the Belarusian electric bus was named. 15.09.2019./ https://upl.uz/economy/12486-news.html

[49] Béla Liauve, V. Shtanov. Moscow authorities will buy 100 electric buses from Kamaz and GAZ/Vedomosti.ru/ https://www.vedomosti.ru/business/articles/2018/05/04/768659-moskovskie-vlasti-zakupyat-elektrobusov

[50] 33 million rubles at an average monthly rate of 62.23 in May 2018 https://ratestats.com/dollar/2018/05/

4.3.3. Findings

The amount of investment calculated per one ton of CO_2:

1. Replacing passenger vehicles with new electric vehicles will cost on average **$15,050**, for used cars: from **$2,750 - $7,918**.
2. Replacing 2,200 minibuses with 1,000 Chinese-made small city electric buses with the same number of seats but larger capacity will cost **$58.63/ton**.
3. When replacing 135 city buses with electric buses the investment to reduce CO_2 emissions will be from **$6,057.5** to **$7,607.2/ton**. It should be added that the current number of buses operating in the city of Bishkek is not enough to realize the entire volume of urban passenger turnover. Due to the smaller volume of passenger turnover the difference in the amount of investment in electric minibuses and electric buses turned out to be so significant. At the same time, the calculated amounts will have a tendency to decrease.

4.4. How Many Vehicles Need to be Replaced to Get a Real Return on Investment?

Replacement of vehicles of individuals and companies can be carried out only with the help of developed motivational systems, such as preferential loans, taxation, promotion of the social contribution of each participant in the transport movement to the preservation of the environment. The trend toward lower prices (up to $3,000) for electric vehicles[51] can also have an impact, with prices for electric vehicles and ICE vehicles predicted to be approximately the same by 2024[52], as well as the growth of powerful charging stations in convenient places with shorter waiting times.

The calculation of the required investment to reduce 1 ton of CO_2 is on average $12,810 as of 8 March 2021 for the purchase of a new electric vehicle, and from $2,750 to $7,918 for a used one. But these amounts can be quickly and significantly reduced: for example, on 10 March 2021 an offer appeared on Instagram page @autoexport.kg for the supply of new Chinese electric vehicles Jac (drive range 120-150 km) from $5,400 and Changan e-star from $7,000 (drive range 150-300 km) with a warranty of 120 thousand km.

[51] MITSURU OBE, Nikkei staff writer/January 25, 2021/ https://asia.nikkei.com/Business/Electronics/Nidec-chief-predicts-a-3-000- car-era-with-spread-of-EVs

[52] The Guardian/Electric cars 'as cheap to manufacture' as regular models by 2024/ https://www.theguardian.com/environment/2020/oct/21/electric-cars-as-cheap-to-manufacture-as-regular-models-by-2024

4.4.1. Service Vehicles

Replacing government service vehicles as one of the effective measures to reduce air pollution will have approximately the same investment volumes for a reduction of 1 ton of CO_2, as described above.

Tazabek.kg news portal reports: "There are 7,912 vehicles on the balance sheet of 66 government agencies, including the Executive Office of the President and Government, Jogorku Kenesh, ministries, state committees, state agencies and other state and municipal services"[53], most of them are located in Bishkek.

There are mostly executive-class cars on the balance sheet of the Administrative Office of the President and Government, the Executive Office of the President and Government (228 cars), Administrative Office of the JK KR (68 cars), Ministry of Foreign Affairs (120 cars). There are 416 cars in total. If we take the average mileage per day - 50 km, number of working days - 247 per year, average CO_2 emission of a vehicle under 3,000 cm^3 - 267.5 g/km, the total CO_2 emissions per year would be approximately - 1,374.3 tons per year. Replacement with Tesla S Long Range electric vehicles (with a maximum cost of $102,200) will amount to $42.520 million. Then the volume of investments to reduce 1 ton of CO_2 will be $30,940.13. This, of course, taking into account the fact that one of the most expensive electric vehicles was taken in the calculation.

Replacing the rest of the service public vehicles - 7,496 units - with electric vehicles with an average cost of €11,750, will cost $88.08 million. If we take the same baseline data: average mileage of 50 km per day, 247 working days, 267.5 g/km, the total CO_2 emissions per year will be 24,763.97 tons, and the investment to reduce 1 ton of CO_2 - $ 3,556.73.

It takes approximately **$111.15 million** to completely replace the state service vehicle fleet**, not including the installation of charging stations.**

4.4.2. Buses/Electric Buses

The service life of electric buses is longer than that of buses. Maintenance costs are lower, but it should be taken into account that the cost of an electric bus is about three times higher and battery replacement is high: 30% to 50% of the cost of a new electric bus.

The cost of transportation is up to 85% lower: if consumption of 40 liters of diesel fuel per 100 km at a price of 41.5-44.90 KGS/liter as of 13 March 2021 costs 1600-1800 KGS for a bus, electricity consumption for an electric bus of 90-100 kWh for the same 100 km with a tariff of 2.6 KGS per 1 kW (the maximum for the industry at the moment) would be 230-260 KGS, not including other expenses for engine oil, antifreeze, etc.

[53] Service vehicles: Which government agencies have the most vehicles assigned to them? – Tazabek/03/23/2020/ http://www.tazabek.kg/news:1596555?from=portal&place=last&b=1

4.4.3. Calculation of Charging Stations Payback Period

Savings for each 100 kilometers of electric bus mileage is at least 1450 KGS, at an exchange rate of 84.8 KGS to the dollar as of 8 March 2021 it amounts to $ 17,099.
Passenger turnover for 2019 amounted to about 79 million km with an average (conditional) load of 35 people, which means it will amount to 2.26 million km per year. Thus, ($533736.51*7)/($17.099*2.26*10000) = **9.7 years payback period** (not including time value of money) of 7 fully equipped places[54] with 10 charging stations without considering additional costs and income, for example from charging services for other types of vehicles.

Taxi

Taxi services are carried out by private entrepreneurs in their own or rented cars, often with an engine capacity of up to 2000 cc. A survey among taxi drivers showed that 100% of rented taxi drivers agree to purchase an electric vehicle at a preferential interest rate, but they could not name what would be acceptable for them.

4.4.4. Taxi Investment Ratios

According to a survey of taxi drivers, at the moment taxi rental is 400-600 KGS per day without subsequent redemption, and with redemption - 800-1000 KGS per day. The rental amount depends on the engine size and the technical condition of the vehicle. It is possible to calculate investment ratios without taking into account the costs of repairs, maintenance, charging, etc.

Table 25. Calculation of investment ratios when renting a taxi (used electric vehicles) without subsequent redemption for 5 years[55]

	Nissan Leaf 2011	Nissan Leaf 2013	BMW i13	Tesla Model S	BYD E6
Rent without redemption per day, KGS	600	600	600	600	600
Electric vehicle price, KGS[56]	773 800	897 184	1 331 360	2 228 120	2 221 760
Rent per year without redemption (330 days), KGS	198000	198000	198000	198000	198000

[54] According to the recommendation of the manufacturer of ANKAI electric buses: the optimal number is 1 charging station per 2 electric buses, then when replacing 135 buses, 7 charging stations are needed (not counting the charging of small city electric buses manufactured by the same company)
[55] The price in dollars is listed in Table 2.5.3.4.
[56] At the exchange rate as of 8 March 2021 - 84.80 KGS/USD

NPV (1%)	187 179.39	63 795.39	-370380.61	-1267 140.61	-1260780.6
NPV (5%)	83 436.38	-39 947.62	-474 123.62	-1370 883.62	-1364 523.62
NPV (10%)	-23 224.22	-146608.22	-580 784.22	-1477 544.22	-1471 184.22
NPV (12%)	-60 054.31	-183438.31	-617 614.31	-1514 374.31	-1508 014.31
IRR	8.82%	3.37%	-	-	-

Table 26. Calculation of investment ratios when renting a taxi (used electric vehicles) with subsequent redemption, for a period of 5 years

	Nissan Leaf 2011	Nissan Leaf 2013	BMW i13	Tesla Model S	BYD E6
Rent with redemption	800	1000	1000	1000	1000
Electric vehicle price, KGS[57]	773 800	897 184	1 331 360	2 228 120	2 221 760
Rent per year with redemption (330 days per year), KGS	264000	330000	330000	330000	330000
NPV (1%)	507 505.85	704 448.31	270 272.31	-626 487.69	-620 127.69
NPV (5%)	369 181.84	531 543.30	97 367.30	-799 392.70	-793 032.70
NPV (10%)	226 967.71	353 775.63	-80 400.37	-977 160.37	-970 800.37
NPV (12%)	177 860.92	292 392.15	-141783.85	-1 038543.85	-1 032 183.85
NPV (15%)	111 168.95	209 027.18	-225148.82	-1 121908.82	-1 115 548.82
NPV (25%)	-63 830.08	-9 721.60	-443897.60	-1 340657.60	-1 334 297.60
IRR	20.92%	24.47%	7.61%	-	-

[57] At the exchange rate as of 8 March 2021 - 84.80 KGS/USD

As noted above, on 10 March 2021 an offer appeared on Instagram page @autoexport.kg for the supply of new Chinese electric vehicles Jac (drive range 120-150 km) from $5,400 and Changan e-star from $7,000 (drive range 150-300 km) with a warranty of 120 thousand km.

Table 27. Calculation of investment ratios when renting new Chinese-made electric taxi vehicles with subsequent redemption for a period of 3 years

Model	Jac	Changan e-star
Rent with redemption, KGS per day	800	1000
Electric vehicle price, KGS[58]	457 920	593 600
Rent per year with redemption (330 days per year), KGS	264000	330000
NPV (5%)	261 017.48	305 071.85
NPV (10%)	198 608.93	227 061.16
NPV (15%)	144 851.43	159 864.29
NPV (20%)	98 191.11	101 538.89
NPV (25%)	57 408.00	50 560.00
NPV (35%)	-10 207.76	-33 959.70
IRR	33.33%	30.68%

4.4.5. Findings

Due to the fact that the electric vehicles available on the market are still high in price, the optimal interest rate to purchase electric vehicles on credit will be favorable for borrowers with an interest rate of **7% for a period of up to 5 years**. Further, with an increase in supply and a decrease in the price of new electric vehicles, the interest rate can be increased and the term shortened. EV demand sensitivity to interest rates is hard to predict.

[58] At the exchange rate as of 8 March 2021 - 84.80 KGS/USD

4.5. Analysis of Charging Demand

The Ukrainian website of ElectroVesti reports that in 2019 the number of standard and high power stations in Ukrainian cities increased to 2,719 units, and high power points to 533. Thus, as of 15 January 2020, the number of charging points was already 5902 (an average of 2.17 points per station). Of the total number of vehicles registered in Ukraine: 7012 are regular passenger vehicles and 530 are used for commercial purposes.[59] At the moment, the number of charging stations is already greater. A factory for the assembly of components for electric vehicles has already been opened in the Odessa region.

The materials of the VI All-Russian (XXXIX Regional) Scientific and Technical Conference cite the following statistics: “In Russia, the fleet of electric vehicles as of 1 January 2020 has 6.3 thousand vehicles, which is 0.014% of the total fleet of passenger cars in the Russian Federation. One of the main restrictions on the dynamics of demand for electric vehicles in our country is the low provision of their fleet with infrastructure - charging stations. As of 1 July 2018, there were about 170 charging stations in Russia, that is, there were about 0.068 stations per electric vehicle, while in the Netherlands this figure was 0.27 stations per electric car, in Germany - 0.22, in China - 0.17 and Japan - 0.14 (with an average value for the world - 0.14)".[60] Annex 2 considers the cost analysis for the installation of charging stations for ANKAI electric buses (for 10 seats).

Factors affecting the charging speed: power of the charging station, battery capacity, maximum power of the charge controller in the electric vehicle. The higher the capacity, the greater the drive range, but the longer it will take to fully charge.

"If we assume a direct correlation between battery charge and drive range, then when the low charge indicator lights up the electric vehicle is capable of driving an average of 20 km (12% of 170 km). Thus, a distance of 20 km can be considered the maximum distance between charging stations, at which the driver can be sure that the electric vehicle will be able to reach the nearest station when the low charge indicator lights up", - recommended by researchers. Given the relatively small area of Bishkek - 160 km^2 - and the longest street of the city - Baitik Baatyr - 22 km long, we present a preliminary scheme for the distribution of charging stations in Table 20.

If we take the coefficient, namely the number of charging stations per 1 electric vehicle in Japan is 0.14, then 140 charging stations will be needed for the first 1,000 electric vehicles. The rate of increase in the number of electric vehicles will depend on the incentive package, and, of course, on the number, capacity, and distribution of charging stations.

[59] The number of electric charging stations in Ukraine has reached almost 3,000: statistics/15.01.2020/ https://elektrovesti.net/69183_kolichestvo-elektrozapravok-v-ukraine-dostiglo-pochti-3000-statistika

[60] O.Yu. Malafeev, D.Yu. Ermilov. EVALUATION OF THE NUMBER AND INSTALLED CAPACITY OF CHARGING STATIONS OF ELECTRIC VEHICLES/ CURRENT PROBLEMS OF THE ELECTRIC POWER INDUSTRY/Nizhny Novgorod, 2020

4.6. Scalability Potential

Bishkek is the most densely populated city, and the number of vehicles per capita is higher than in other cities of the Kyrgyz Republic, accordingly, this critical situation requires immediate and decisive measures to improve air quality, primarily in the capital. Replacement of ICE vehicles with electric vehicles will undoubtedly cause a decrease in the price of old vehicles and their outflow to the regions, which may cause a sharp deterioration of the environmental situation in other cities of the country. Therefore, it is proposed to evenly introduce a program to replace ICE vehicles with electric ones in all major cities, regional centers of the Kyrgyz Republic, in particular, preferential loans for the purchase of electric vehicles for the provision of taxi services.

Table 28.Population of the Kyrgyz Republic by city and number of registered vehicles as of 31.12.2019

Locality name	Population, thousand people[61]	As % of the total number	Number of registered vehicles[62]	As % of the total number	Air pollution average (30.03.2021 9.50 am), US AQI
Total for the Kyrgyz Republic	6523,5	100%	1 253 461[63]	100%	-
Bishkek city	1049,3	16.1%	420 000[64]	33,5%	90 (max – 169)
Osh city	283,3	4.3%	84 772	-	21 (max – 85)
Jalal-Abad city	111,1	1.7%	17 554	1.4%	57 (max – 68)
Karakol city	80,9	1.2%	17 367	1.38%	-
Naryn city	40,6	0.6%	8 312	0,66%	-

[61] National Statistical Committee. Population of the Kyrgyz Republic as of 01.01.2020/ www.stat.kg

[62] Including trucks

[63] Form 5 of the SRS as of 31.12.2019

[64] Shabalin A. "What is the car fleet of Kyrgyzstan. Detailed and illustrated" / https://kaktus.media/doc/401360_chto_soboy_predstavliaet_avtopark_kyrgyzstana._podrobno_i_nagliadno.html/ 22.11.2019

Table 29. Volume of passenger turnover performed by all modes of transport for January-December 2019, Osh

Talas city	39,6	0.6%	6 689	0,53%	-
Batken city	19,1	0,3%	1 800	0,14%	-
Balykchi city	50,2	0,8%	11 326	0,9%	-
Tokmok city	66,3	1,01%	26 263	2,1%	106 (max-144)

The main part of calculations is made according to statistics for the largest city Bishkek, and **Osh city** is the second largest in terms of territory and population in the Kyrgyz Republic. Let us consider the statistics for Osh city in Tables 2.5.10.2 - 2.5.10.3. The volume of passenger turnover for 2019 (2020 is not taken into account, as due to the introduction of quarantine security measures, the figures differ strikingly from the annual average) from total passenger turnover by the same modes of transport as in Bishkek is:

Buses: 7.71%

Trolleybuses: 7.96%

Table 30. Transportation of passengers by all modes of transport in January-December 2019, Osh

	Thousand passenger kilometers		As a percentage of the corresponding period of the previous year	
	2018	2019	2018	2019
Total	403330,5	415030,4	105,7	102,9
Passenger road	388253,5	397222,9	104,5	102,3
Buses	367753,5	375722,9	104,6	102,2
Light motor vehicles	20500	21500	104,3	104,9
Trolleybuses	15077	17807,5	149,3	118,1

Source: Report "Socio-Economic Situation of Osh City in January-December" (2019)[65]

[65] Report "Socio-Economic Situation of Osh City for January-December" (2019)/ www.stat.kg

	Thousand people		As a percentage of the corresponding period of the previous year	
	2018	2019	2018	2019
Total	27638,2	29260,4	112,2	105,9
Passenger road	24333,2	24928,6	109,4	102,4
Buses	24114,2	24710	109,4	102,5
Light motor vehicles	219	218,4	107,8	99,7
Trolleybuses	3305	4332	137,5	131,1

As of 25 April 2018, the number of trolleybuses in Osh was 33 units[66]. Of these, 23 units arrived in 2017. In test mode, it would be possible to launch several electric buses with dynamic charging along the way. It uses the existing infrastructure; when laying routes to new areas, the contact network cannot be developed and installation of (expensive) charging stations is not required.

Source: Report "Socio-Economic Situation of Osh City in January-December" (2019)[67]

Minibuses also account for most of the city's passenger turnover in Osh. The introduction of dynamically-charged electric buses would significantly reduce their traffic and, consequently, the emissions of CO_2 and other harmful elements into the environment.

As for passenger transportation services performed by ***taxis*** in the city of **Osh**, the engine volume of cars is mainly up to 1000 cc. Motivation programs for the purchase of electric vehicles for passenger transportation services can be successful precisely in the purchase of inexpensive new electric vehicles. Especially since Japanese, Korean and Chinese companies are planning mass production of such electric vehicles in the coming year.

There is also a functioning network of trolleybus lines in the **city of Naryn** (4-5 units daily on the route), manufacture years 1984-2001[68]. The main volume of urban transportation is carried out by taxi services (payment for each passenger on a particular route). Minibuses are mainly used for intercity transportation.

[66] City Electric Transport/Osh/ www.transphoto.kg

[67] Report "Socio-Economic Situation of Osh City for January-December" (2019)/ www.stat.kg

[68] https://ru.wikipedia.org/wiki/Naryn trolleybus

4.7. Risks

Electric vehicles represent a completely different technology compared to vehicles with internal combustion engines. The risks involved in operating an electric vehicle are mostly related to the high-voltage electrical equipment which is a major part of a vehicle. Experts distinguish several risk factors directly related to vehicles themselves.

4.7.1. Risk of Thermal Runaway

Despite all the advantages of lithium-ion batteries, they are highly flammable. If such a battery overheats or is overcharged, thermal runaway can occur. Thermal runaway means a rapid and extreme increase in temperature. If a short circuit occurs in one of the battery cells, causing the cell to burst, it will cause the other cells to run up thermally. The result could be smoke, combustion, and even explosion. Such accidents have already happened during the operation of electric vehicles.

This risk is difficult to control, this type of risk can be reduced with the development of lithium-ion battery technology.

4.7.2. Possibility of Fire When Parking or Charging

When an electric vehicle is parked, it does not mean that it is completely "off". It is "on" and in a state of readiness to start moving, unlike traditional vehicles, which are completely off at such times. Therefore, there is a risk of the vehicle catching fire even if it is not moving.

Charging stations also have a risk of fire. All charging station cables must be in good condition, otherwise there is a high risk of fire or explosion.

4.7.3. Risks of Serious Injury in Case of Accidents

Since the design of electric vehicles is lighter than that of ICE vehicles, the risk of serious injury in an accident is higher. In order to increase a vehicle's range on a single charge, manufacturers try to make vehicles as light as possible.

4.7.4. Battery Disposal

Disposal of batteries that can no longer be used in electric vehicles is an important issue and at the same time a risk. Since the lithium-ion battery poses a great threat to the environment, the disposal of the battery must be handled responsibly. Therefore, in developed countries the government develops procedures for the use and accounting of lithium-ion batteries in order to minimize their possible harm to the environment.

To reduce this risk, it is proposed to keep records of all imported batteries for electric vehicles. It is necessary to introduce an electronic database to keep track of all batteries that have been imported into the territory of the Kyrgyz Republic. This system will make it possible to track the life of the battery and its current location.

5. Fiscal and Economic Incentives.

Proposed Government Policy

5.1. International Practice

Electric vehicles are a major technology for reducing air pollution in densely populated areas. The advantages of electric vehicles include zero tailpipe emissions, better efficiency than vehicles with internal combustion engines, and great potential to reduce greenhouse gas emissions when combined with the low-carbon energy sector. This is why so much attention and government support is given to developing this sector in the developed world today. Most countries use both financial and non-financial incentives to promote electric vehicles. Since the Kyrgyz Republic is not a manufacturer of electric vehicles, this report will only look at incentives for users. The main ways to promote electric vehicles are to provide subsidies for purchase and measures such as tax incentives. Other methods are to create conditions in which it becomes more profitable to use electric vehicles than to use ICE vehicles. Examples of such measures are providing free parking for electric vehicles in the city center, the ability to travel to the city on any day, free charging at public stations, etc.

The prices of electric vehicles are higher than the prices of conventional vehicles. Therefore, without financial incentives, it is difficult to convince the population to switch to electric vehicles. One of the main incentives to buy an electric vehicle is the provision of purchase subsidies, the amount of which may vary depending on the type of vehicle and battery capacity. Also, buyers of such cars are exempt from paying certain taxes. In Norway, for example, buyers of electric vehicles do not pay VAT on the purchase of such vehicles.[69]

[69] http://documents1.worldbank.org/curated/en/395811467991008690/pdf/104339-PUB-PUBLIC-ADD- doi-isbn.pdf

Table 31. Overview of possible policies for the introduction of electric vehicles

Type of policy	Aimed at	Example
Subsidies for the purchase of a vehicle	Increasing the number of electric vehicles	Austria, Belgium, Cyprus, Germany, France, Italy, various regions of Spain, Sweden, UK
Discount or exemption from vehicle registration fees	Increasing the number of electric vehicles	Tax exemption in Austria, the Netherlands; Denmark, Greece (also for hybrids), Portugal, Romania; Discount in Belgium, bonus in France due to low CO_2 emissions
Discount or exemption from tax on the use of vehicles	Increasing the number of electric vehicles	Tax exemption in Austria, Czech Republic (service electric vehicles); Netherlands, Ireland, Germany (first 5 years after purchase), Greece
VAT reduction	Increasing the number of electric vehicles	Austria
Favorable tax treatment for rental cars	Increasing the number of electric vehicles	Netherlands, England
Free parking spaces for electric vehicles	Increasing the number of electric vehicles	Selected cities in Italy, UK, Denmark, Netherlands
Subsidies for the installation of charging stations	Availability of charging stations	Netherlands, England

5.2. Possible Public Policy Options on Electric Vehicles for the Kyrgyz Republic

5.2.1. Zero Customs Duties for Electric Vehicles

Until the end of 2021, customs duties on imports of electric vehicles are zero. It is proposed to continue this policy and to extend the zero tariff on an annual basis.

However, the zero tariff for electric vehicles means that the state will not receive customs duties from electric vehicles. Calculations of the missed duties are shown in the table below.

5.2.2. Preferential Charging Rate for Electric Vehicles

According to the approved tariffs, the current tariff for charging an electric vehicle is 1.58 KGS per 1 kW. This tariff is preferential to encourage the purchase of electric vehicles. The current tariff for legal entities is 2.24 KGS per kW. This tariff is commercial, so the difference between the tariff for charging and the tariff for legal entities is subsidized by the state.

However, despite the incentive in the form of a preferential tariff, it is proposed to equalize the tariff with the tariff for legal entities. The main argument is the current critical state of the country's energy system. The preferential tariff is absolutely unprofitable for private HPPs and even more so for RES. Therefore, it is believed that the charging tariff should be increased.

Calculations for the difference between tariffs are given below.

5.2.3. Preferential Leasing for Buyers of Electric Vehicles

The leasing market in the Kyrgyz Republic is not developed, but the volume of leasing operations increases annually. Leasing is an attractive type of financing, as the collateral is the purchased property. According to the NBKR, the average interest rate on consumer loans is about 23.49%[70], which is an unattractive rate for people who are thinking about buying an electric vehicle. That is why it is proposed to introduce a preferential loan program for electric vehicle buyers. An acceptable interest rate is considered to be 7% per annum, and the currency is KGS. The term of the loan may vary depending on the needs of consumers and the capabilities of the bank. The proposed term is up to 5 years.

Calculations of under-received interest as a result of preferential financing are given in the Annex.

[70] https://www.nbkr.kg/index1.jsp?item=125&lang=RUS

Table 32.Estimating the fiscal calculations when applying the above policies to encourage electric vehicles

Estimating the fiscal calculations when applying the above policies to encourage electric vehicles											
Forecast indicators	**Unit**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Number of vehicles, Bishkek	pcs	370 000	388 500	407 925	428 321	449 737	472 224	495 835	520 627	546 659	573 991
Of these: number of electric vehicles	pcs	150	225	383	650	1 105	1 879	3 195	5 431	9 233	15 695
Share of electric vehicles	%	0,04%	0,06%	0,09%	0,15%	0,25%	0,40%	0,64%	1,04%	1,69%	2,73%
Average cost of customs clearance of vehicles running on liquid motor fuel (the average cost of a vehicle is 7.5 thousand dollars and the year of manufacture is 6-10 years ago)	USD	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750
Number of annually imported vehicles in Bishkek	pcs	15 000	18 500	19 425	20 396	21 416	22 487	23 611	24 792	26031	27 333
Of these: number of electric vehicles	pcs	55	75	158	268	455	774	1 315	2 236	3 802	6 463
1. Incentives for the import (customs clearance of electric vehicles) from the government	USD	96 250	131 250	275 625	468 563	796 556	1 354 146	2 302 048	3 913 481	6 652 917	11 309 960
KGS/USD exchange rate	KGS/ USD	85	85	85	85	85	85	85	85	85	85
1. Incentives for the import (customs clearance of electric vehicles) from the government	KGS	8 181 250	11 156 250	23 428 125	39 827 813	67 707 281	115 102 378	195 674 043	332 645 873	565 497 984	961 346 572

Forecast indicators	**Unit**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Electricity tariff for legal entities without VAT	KGS kWh	2,24	2,38	2,53	2,69	2,86	3,04	3,23	3,44	3,65	3,88
Electricity tariff for electric charging stations (superchargers) without VAT	KGS kWh	1,58	1,58	1,58	1,58	1,58	1,58	1,58	1,58	1,58	1,58
Price difference	KGS kWh	0,66	0,80	0,95	1,11	1,28	1,46	1,65	1,86	2,07	2,30
Average electricity consumption of 1 electric vehicle	kWh	80	80	80	80	80	80	80	80	80	80
Average number of electric vehicles charged per day at electric charging stations	pcs	7	9	11	13	17	22	27	32	37	41
Number of electric charging stations		7	10	15	25	29	35	41	47	53	59
Volume of electricity consumption by electric charging stations	kWh	1 430 800	2 628 000	4 818 000	9 490 000	14 395600	22 419 760	32 166 720	43 636 480	56 829 040	70 036 200
2. Electricity supply incentives from the government	KGS	944 328	2 105 343	4 582 547	10 539516	18 427794	32 739 246	53 133 737	80 964 353	117 741 822	161 218 242

Forecast indicators	**Unit**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Average rate on consumer loans by commercial banks of the Kyrgyz Republic	%	24,0%	23,0%	22,0%	21,0%	20,0%	19,0%	18,0%	17,0%	16,0%	15,0%
Preferential rate for financing the purchase of electric vehicles by state-owned banks	%	7,0%	6,9%	6,8%	6,7%	6,6%	6,5%	6,4%	6,3%	6,2%	6,1%
Rate difference	%	17%	16%	15%	14%	13%	13%	12%	11%	10%	9%
Average cost of an electric vehicle	USD	15 000	15 000	15 000	15 000	15 000	15 000	15 000	15 000	15 000	15 000
50% of car enthusiasts buy an electric vehicle on credit (number of electric vehicles purchased on credit)	pcs	28	38	79	134	228	387	658	1 118	1 901	3 231
3. Preferential financing of the import of electric vehicles from the government	USD	70 125	90 563	179 550	287 162	457 451	725 435	1 144447	1 794 611	2 794 225	4 313942
KGS/USD rate	KGS/ USD	85	85	85	85	85	85	85	85	85	85
3. Preferential financing of the import of electric vehicles from the government	KGS	5 960 625	7 697 813	15 261750	24 408759	38 883324	61 661 988	97 277 953	152 541 893	237 509 153	366 685 050

6. Communication Strategy

6.1. Strategy Purpose:

Raising awareness of the government, donors, partners, media, general public and beneficiaries about the ongoing benefits of ongoing benefits of electric vehicles and environmental protection.

6.2. Strategy Objectives:

(i) identifying clear information for the target audience and evaluating the delivery of information;
(ii) developing effective methods to disseminate key program messages to target audiences, such as newsletters, briefings, meetings, events, publications, etc.
(iii) preparing materials for the information and communication campaign: printed and non-printed materials;

Table 33.Key audience and communication tactics

Audience	**Characteristics**	**Communication purpose**	**Communication mechanisms/tactics**
Parliament (Jogorku Kenesh):	Jogorku Kenesh, the Parliament of the Kyrgyz Republic, is the highest representative body exercising legislative power and control functions within its authority. JK deputies closely monitor information on the progress of reforms in the education system, often become the main newsmakers on the topic with critical opinions.	1. Get support from JK deputies to promote reforms; 2. Be recognizable to Parliament as a project that solves important problems in the field of education; 3. Reduce possible criticism of the proposed measures;	Distribution of information materials (booklets) to the deputies of the relevant committee; Invitation to events, including as speakers; Publications in the media;

Media	Media in the Kyrgyz Republic: online publications, television channels, radio, print media.	1. Explain and raise media awareness of the benefits of electric transport;	Events with the media; Infographics; Newsletters; Publications;
Expert community /NGOs	The expert community and NGOs are the main sources of criticism of the activities of the ministry and the education system as a whole in the media and social networks.	1. Reduce possible criticism of the proposed measures; 2. Get support in promoting reforms at the level of the Government and the population of the Kyrgyz Republic.	Creation and active maintenance of a page in social networks (Facebook) Publications including information on key achievements of the project; Placement of videos and infographics.

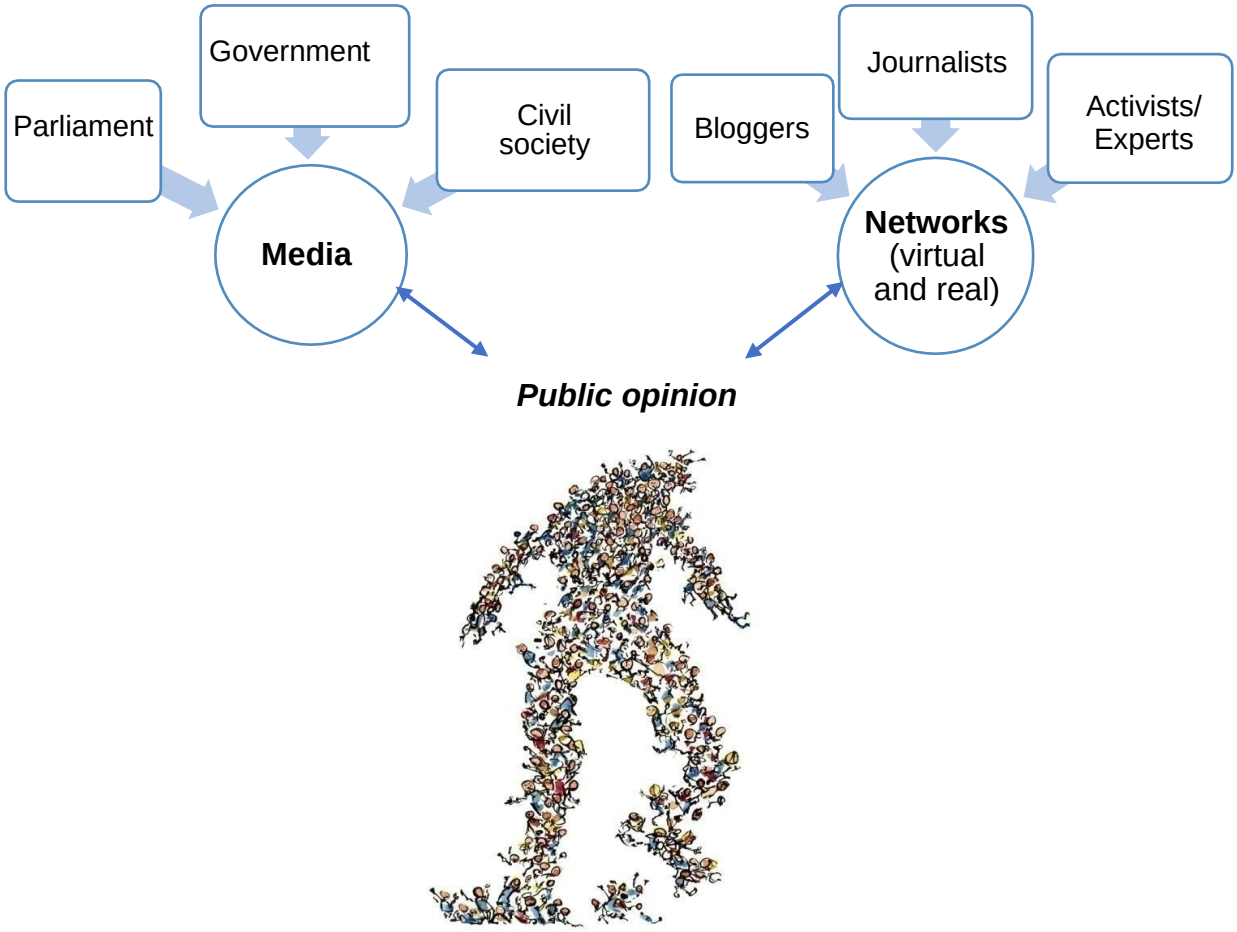
6.3. Content Analysis

Content analysis in the media showed that the topic of electric transport is very poorly covered. Content analysis covered the period from 2018 to the present. During this time, articles were mainly published about the pros and cons of driving electric vehicles and news from foreign countries.

But the amount of information in the media is not enough to arouse the audience's interest in electric vehicles. Therefore, it is necessary to increase the amount of news about electric vehicles.

The formation of public opinion, acceptance/non-acceptance or open opposition to the implementation of the project is influenced by a number of opinions. The mechanism of public pressure is depicted in the following diagram:

Figure 13. Mechanism of public pressure



The following key audiences have been identified to implement the communication strategy:

Group 1: Population of the Kyrgyz Republic, car enthusiasts, novice drivers who are thinking about buying a car.

Group 2: Business companies with their own fleet of vehicles.

Group 3: Government agencies involved in the implementation of the project, Ministry of Economy and Finance of the Kyrgyz Republic, Ministry of Energy of the Kyrgyz Republic, GosStroy.

Group 4: Parliamentarians, Government Office, Jogorku Kenesh.

Group 5: Donors, development partners, NGOs, expert community.

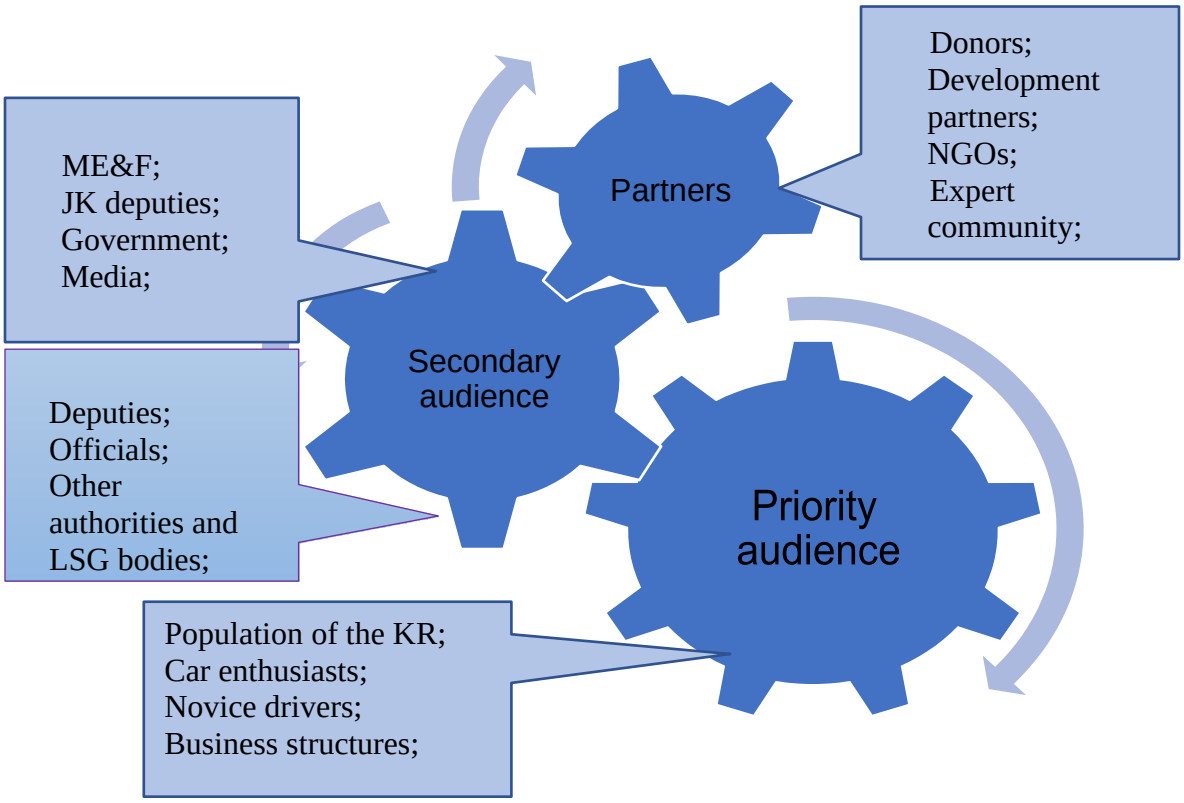
Group 6: Local communities.

Group 7: Media.

As part of the implementation of the strategy, separate information events and separate messages are provided for each of the groups.

The key audiences of the communication strategy can be visualized as follows:

Figure 14. Key audiences of the communication strategy



Considering the above, the main goals and objectives of the campaign include the following:

Developing effective messages for target audiences.

Development of awareness-raising media products (infographics, social videos, publications) that highlight the most pressing issues.

Identification and placement of media products in the most effective media channels.

Development of information materials/products to raise public and civil society awareness about the environment and the benefits of electric transport.

Main topics:

Pros of driving electric vehicles;

Negative impact of ICE vehicles on the environment of the city/country;

Efficiency of an electric vehicle.

Coordination group:

The coordination group is necessary for the prompt processing of information and coordination of content and materials of the information campaign.

Composition of the coordination group: UNDP experts, ME&F press service.

6.4. Principles for Implementing a Communication Strategy

Implementation of a communication strategy implies the involvement of a qualified company, or hiring a qualified specialist, to conduct effective two-way interaction with key audiences.

The basic principles of the information campaign to publicize the project activities are:

- Openness and transparency of information;
- Visibility of information;
- Availability of information to various segments of the population (for representatives of different nationalities: in Kyrgyz, Russian and Uzbek languages);
- Competence and readiness of presenters/speakers;
- Indication of the feasibility and rationality of the project.

The *key message* of the strategy is aimed at forming an opinion in society that electric vehicles are the most environmentally friendly mode of transport, the use of electric vehicles has a positive impact on the environment of the country and is more economical than using an ICE vehicle.

6.4.1. Key Messages

The following messages have been identified as key messages to convey to the public:

- *Ecology comes first*
- *Electric vehicle is easy to use and economical*

6.4.2. Communication Channels

The study showed that the population of the Kyrgyz Republic is little aware of what an electric vehicle is and what its pros and cons are. There are 100 electric vehicles in the country, and most of the population has never seen them and knows little about such vehicles.

For the most effective communication and acceptance of the project by the population of the country, *indirect communication* with key audiences is necessary, which will be the *main tool for the implementation of the communication strategy*. First of all, these are contacts with the population of the Kyrgyz Republic, the next group is the members of parliament and government agencies involved in the implementation of the project. Further groups of donors, development partners and NGOs will be involved.

The main messages of the campaign should be sent through two main and one additional channel:

Various events - round tables, training seminars, discussions;

Social networks - Facebook and Instagram will be used as social media platforms.

The media are proposed to be used as an additional third channel in case of availability of free financial resources. Media may include predominantly regional TV channels, radio, print media (Kyrgyz, Uzbek and Russian) and news websites (press releases and analytics). If funds are available, it is recommended to develop several short image clips about the project for broadcast on central television (for example, OTRK) and on regional TV channels.

6.4.3. Communication Activities

As a result of the analysis, the goals of external communication of the project are defined, as well as the most appropriate activities to achieve the goals of the project:

Creation of a pool of industry experts who are ready to give comprehensive comments on the need for the project;

Conducting roundtables with representatives of government agencies involved, members of parliament, donors, and development partners with detailed presentations on the project.

6.4.4. General Recommendations

Based on the results of the analysis of social networks and a survey of the population, it is recommended to use such principles of an information campaign as openness, transparency, accessibility, coverage of all parties involved, competence, preparedness and visibility.

It is important to openly discuss the pros and cons of using an electric vehicle, its impact on the environment, and the general global trend of switching from ICE vehicles to electric vehicles. It is also recommended to involve so-called influencers, bloggers, and public figures, who will popularize electric vehicles through their social media accounts. It is important to conduct the information campaign as openly and transparently as possible, using various information channels (discussions/meetings, the Internet, posters/banners, video newsletters via messengers, local TV channels and radio).

The following is recommended to achieve the goals of the project:

- Formation of a source of reliable and accessible information.
- Creation and filling of project pages in social networks.

Facebook and Instagram are the most popular social networks in Kyrgyzstan. It is necessary to create official representations so that anyone interested in the project can receive accessible and reliable information.

- Development of a strategy for communicating with users in social networks, including two key elements:

1. A set of rules of conduct and communication on the part of the communications specialist;
2. A well-designed plan for responding to different user behavior.

It is necessary to consider different scenarios of possible communication in order to have answers to all possible cases. It is necessary to consider:

1) responses to both positive and negative comments;

2) work with users who refuse to accept reasoned arguments;

3) work in crisis situations.

- Expert opinion in social networks.
- Speeches by experts who talk about the need to switch to electric transport.
- Interaction of the press service with journalists
- In order to provide timely and effective information support for the ME&F press service, it is recommended to engage an expert/firm from the media sphere.
- Visualization.
- Gathering and providing information for the preparation of "cards" and infographics, their

placement in social networks.

- Figures need to be presented not just visually, but CONVENIENTLY.
- Preparing posters reflecting planned events and answering the most frequently asked questions.
- Responding to negative publications.
- Development of rules for the behavior of employees in social networks, even from personal accounts, excluding insults to users.
- Preventing negative publications.
- Development of a long list of negative and provocative questions based on the analysis of the media and forums, in order, together with the project experts, to compile answers to them for publication on the project website and pages in social networks. Answers must be developed in a language understandable to the average user, with the interpretation of terms.

Note:

If negative information appears in one media outlet, a refutation should be posted there as well. Or you can give a comment to another competing media outlet.

It is useless to sue journalists.

Making a plan to respond to provocative comments and publications.

Monitoring and timely response to publications in the media that criticize the project or mislead by providing inaccurate information.

Tracking publications in social networks (group "Blacklist - we did not like it" in Facebook).

Figure 15: Scheme of actions when publishing negative information

6.5. Monitoring and Evaluation

As part of the implementation of the communication strategy, it is recommended to conduct weekly monitoring of publications in the media.

Monitoring reports should reflect the number and general tone (positive, negative, neutral) of analytical articles in newspapers and online publications, notes in online publications, radio and TV programs, infographics, video clips and interviews, the number and general content of positive and negative comments on publications about the project.

In addition, it is recommended to conduct a content analysis of the publications of the main experts/opinion leaders in social networks in order to trace the changes in their attitudes toward the topic of electric transport. The content analysis should reflect the extent to which the key messages of the campaign have been used, provide examples of the key counterarguments of opponents, and assess the overall tone of the publications. In general, the toolkit for maintaining

an official page in social networks makes it possible to track the popularity of publications in terms of the number of readings/comments/approvals, the influx and characteristics of the audience, user activity on the page, etc.

An effective way to evaluate the success of a campaign could be to conduct two professionally executed public opinion surveys, one before the campaign and one after. This would make it possible to assess changes in the awareness and attitudes of target audiences toward the topic of electric vehicles. Measuring public opinion before the information campaign can provide a more accurate picture of what the target audiences know about electric transport today, as well as adjusting the set of communication channels and tools of the campaign itself.

In addition, focus groups and in-depth interviews with industry experts will help give a complete picture of their awareness and/or changes in position before and after the information campaign.

6.5.1. Covering Information about Electric Vehicles

Figure 16. Covering information about electric vehicles

Messages and topics of messages:

- Pros of driving electric vehicles
- Switching to electric vehicles by many countries
- Impact on the environment

Target audience:

- Population of the KR
- Government and JK
- Media
- NGOs/Experts

Content:

- Information in the media
- Additional visual graphics
- Video stories
- Events with the media

Media:

- Social networks (Facebook, Diesel Forum, Instagram),
- Media publications
- TV news story

Number of produced materials:

- 8 media publications
- 2 news videos on TV
- 1 video clip
- 1 infographics
- 1500 brochures
- 2 events with the media

Monitoring and evaluation:

- Monitoring the reaction to all publications
- Media analysis
- Developing and responding to critical issues

6.5.2. Media Plan

Table 34.Media Plan

#	Action plan	Comments	Q-ty	2021	2022	2023	2024	2025
1	Coordination of the introductory report, strategy and media plan	Informing about reforms; Key messages	1					
2	Preparation of analytics and reform articles	On agreed topics	1					
3	Events with the media within the framework of the project	Media outreach and explanations	4					
4	Release of news stories	TV	5					
5	News agencies	Supportive and neutral	25					
6	Creation of social videos	Informative or social videos	2					
7	Infographics development	Development of clear and accessible infographics	5					
8	Work in social networks	Work in Facebook groups, Diesel forum, Instagram	Process					

6.6. Recommendations for Future UNDP Activities under the E-Mobility Initiative

In addition to the recommendations proposed within the terms of reference of the E-Mobility project in the state policy in the sphere of electric transport, the expert team also proposes the following projects for consideration and involvement of the UNDP team in the field of electric transport development:

6.6.1. Development of Clear and Standardized Regulation of Batteries from Electric Vehicles (Standardization, Disposal).

Despite the fact that electric vehicles are an environmentally friendly mode of transport, one of the main parts of a vehicle - the battery - at the end of its service life carries a great danger to the environment if not properly disposed of. Therefore, it is necessary to develop technical documents and NLAs for the proper disposal of batteries, as well as their standardization.

The European Union is currently updating its regulations regarding the use and standardization of batteries for electric vehicles. For the Kyrgyz Republic, which is on the verge of developing this sector, it would be important to obtain the best practices of European countries regarding the standardization and disposal of batteries and, based on the experience of other countries, to develop its own policy on batteries from electric vehicles.

Options for international donors:

- *Organization of study tours to Europe, where specialists from Kyrgyzstan will be able to learn how electric vehicles and batteries are regulated;*
- *Engaging international experts to develop local regulation;*
- *Technical and expert assistance in developing documents that will regulate the use of electric vehicles and their batteries.*

6.6.2. Development of the Electric Bike Delivery Network

During the pandemic, home delivery has become even more popular among the population. Supporting the electric bike delivery business model would contribute to business development and emissions reduction through the environmental friendliness of this mode of transport, and would also be a good advertisement for electric transport among the population.

Options for international donors:

- *Providing grants to delivery services to help them buy electric bikes, as well as charging stations for them;*
- *Active PR promotion of this type of service through the media and social networks;*
- *Joint organization of various contests and events to promote delivery on eco-bikes.*

6.6.3. Technical and Advisory Support to the Electric Vehicle Association

Kyrgyzstan has an Electric Vehicle Association, which promotes the sector and brings together all business people interested in the sector. UNDP programmes can, through collaboration with the private sector, accelerate the introduction of charging infrastructure, as well as improve the technical capacity of service providers.

Association members are currently working to develop and produce local charging stations. International donors can provide technical assistance in the development of the association's plans, as well as various campaigns to promote this mode of transport.

Options for international donors:

1. Technical support to the Association through the purchase of equipment and materials for the installation of charging stations, training and other types of education;

2. Conducting joint public campaigns, actions and events to popularize electric transport in the Kyrgyz Republic;

The above initiatives will be most in demand from the private sector and consumers, and in the future will be quite sustainable, according to experts of the Promotank team.

The experts also suggest the following sources of funding for activities related to the implementation of the above initiatives.

6.7. Funding Opportunities

1. Global Environment Facility (GEF)

Website: https://www.thegef.org

In most cases, the GEF provides funding to support government projects and programs. Governments decide on the executing agency (governmental institutions, civil society organizations, private sector companies, research institutions).

Eligibility Criteria:

All projects or programs must fulfill the following criteria to be eligible for GEF funding.

Eligible country: Countries may be eligible for GEF funding in one of two ways:

a) if the country has ratified the conventions the GEF serves and conforms with the eligibility criteria of each convention; or

b) if the country is eligible to receive World Bank (IBRD and/or IDA) financing or if it is an eligible recipient of UNDP technical assistance (specifically TRAC-1 and/or TRAC-2).

National priority: The project must be driven by the country (rather than by an external partner) and be consistent with national priorities that support sustainable development

GEF priorities: To achieve the objectives of multilateral environmental agreements, it is required that the GEF support country priorities that are ultimately aimed at tackling the drivers of environmental degradation in an integrated fashion. For this reason, the focal areas (Biodiversity, Climate Change Mitigation, Land Degradation, International Waters and Chemicals and Waste), which remain the central organizing feature in the GEF-7 Programming Directions, provide countries with the opportunity to participate in the following programs focusing on:

1) Food Systems, Land Use and Restoration;

2) Sustainable Cities; and

3) Sustainable Forest Management (for more details, see Annex A of the GEF-7 Programming Directions).

Financing: The project must seek GEF financing only for the agreed incremental costs on measures to achieve global environmental benefits.

Participation: The project must involve the public in project design and implementation, following the Policy on Public Involvement in GEF-Financed Projects and the respective guidelines

Types of Projects

The GEF provides funding through four modalities: full-sized projects, medium-sized projects, enabling activities and programmatic approaches. The selected modality should be the one that best supports the project objectives. Each modality requires completion of a different template.

Full-sized Project (FSP): means a GEF Project Financing of more than two million US dollars.

Medium-sized Project (MSP): means a GEF Project Financing of less than or equivalent to two million US dollars.

Enabling Activity (EA): means a project for the preparation of a plan, strategy, or report to fulfill commitments under a Convention.

Program: means a longer-term and strategic arrangement of individual yet interlinked projects that aim at achieving large-scale impacts on the global environment.

2. The Global Green Growth Institute (GGGI)

The Institute was established to support developing countries in achieving sustainable inclusive economic growth. Since its founding, the organization has made significant progress and has become one of the leading international organizations supporting green growth policy and investment.

One of the priority topics is sustainable transport. However, at the moment Kyrgyzstan is not in the list of participating countries.

3. Green Climate Fund

The purpose of the Green Climate Fund is to assist in reducing greenhouse gas emissions in developing countries (mitigation), as well as to assist in the process of adapting vulnerable communities to the inevitable effects of climate change, and to deliver a 50:50 balance between mitigation and adaptation allocations.

The GCF is expected to become the main multilateral financial mechanism to support climate action in developing countries.

Applications for projects must be submitted through the CFC office in Kyrgyzstan.

125/1 Toktogul Street, 3rd floor, office No. 7, Bishkek

Tel.: +996 312 975773, +996 312 975774

E-mail: info@cfc.kg

4. ADB Climate Change Fund

Website: https://www.adb.org/what-we-do/funds/climate-change-fund

The Climate Change Fund (CCF) was established in May 2008 to facilitate greater investments in developing member countries to effectively address the causes and consequences of climate change, by strengthening support to low-carbon and climate-resilient development. CCF plays a key role in mainstreaming climate actions in ADB's operations and is critical for achieving the climate targets under Strategy 2030's third operational priority of tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability.

The fund provides financing through: grant component of investments, technical assistance (stand-alone and piggy-back or linked to loan), and direct charge. The fund focuses on three areas:

- Adaptation
- Clean energy, sustainable transport and low-carbon urban development
- Reduced emission from deforestation and degradation and improved land use management

Project proposals are submitted by ADB user departments to the Climate Change Steering Committee through the fund secretariat. Project proposals are reviewed by the working groups (i.e., Adaptation and Land Use Working Group and Clean Energy Working Group) who provide the recommendations on the applications for the fund allocation to the CCSC. The CCSC approves the fund allocations to projects. In general, applications are reviewed in six batches and are due on 31 January, 31 March, 31 May, 31 July, 30 September, and 30 November. Direct charge applications are reviewed on ongoing basis.

4. UNIDO

UNIDO is a specialized agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability. The program supports projects that contribute to the development of a sustainable environment and are interested in the development of the electric transport sector.

Email: office.kyrgyzstan@unido.org

Tel.: +996 312880681

5. Urban Electric Mobility Initiative

The Urban Electric Mobility Initiative (UEMI) was launched by UN-Habitat, building on international activities in the areas of sustainable urban development, energy, mobility, and focusing on the equal access provision of urban basic services in Latin America, Asia and Africa. To date, this initiative does not implement any projects in Central Asia, however, they may be interested in this region in the future.

Website: http://www.uemi.net/

6. European Commission and Programs of the European Union

The EU, its member states (including the UK) and the European Investment Bank are together the largest donor of public climate financing to developing countries, providing €23.2 billion in 2019, a 6.9% increase over 2018. The total, excluding the U.K., was €21.9 billion, a 7.4% increase over the 27 EU countries in 2018.

They are also the world's largest providers of official development assistance (totaling €75.2 billion in 2019), with climate action increasingly being integrated into aid.

In Kyrgyzstan, the PERETO project is currently being implemented, which is one of six projects under the SWITCH Asia program in Central Asia launched in March 2020 in Tashkent, Uzbekistan. SWITCH Asia aims to support the implementation of the UN 2030 Agenda for SDGs and promote cooperation on climate change, mitigation and adaptation (Paris Agreement) in partner countries in Asia, including Central Asia.

https://ec.europa.eu/clima/policies/international/finance_en

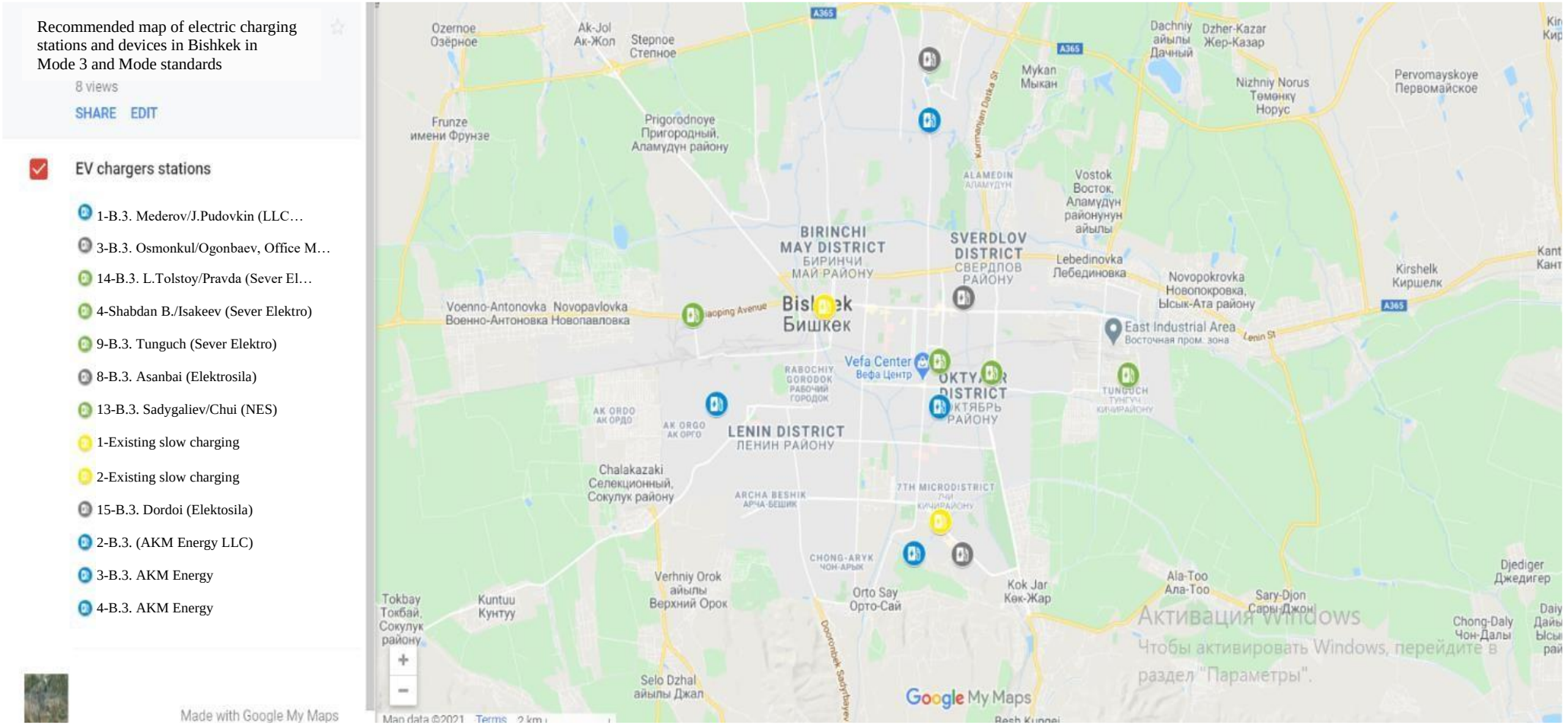
Note:

These organizations seem to be the most suitable in terms of their goals and objectives for submitting projects from UNDP. The Promotank expert team is ready to assist in the preparation of the relevant documents for submission.

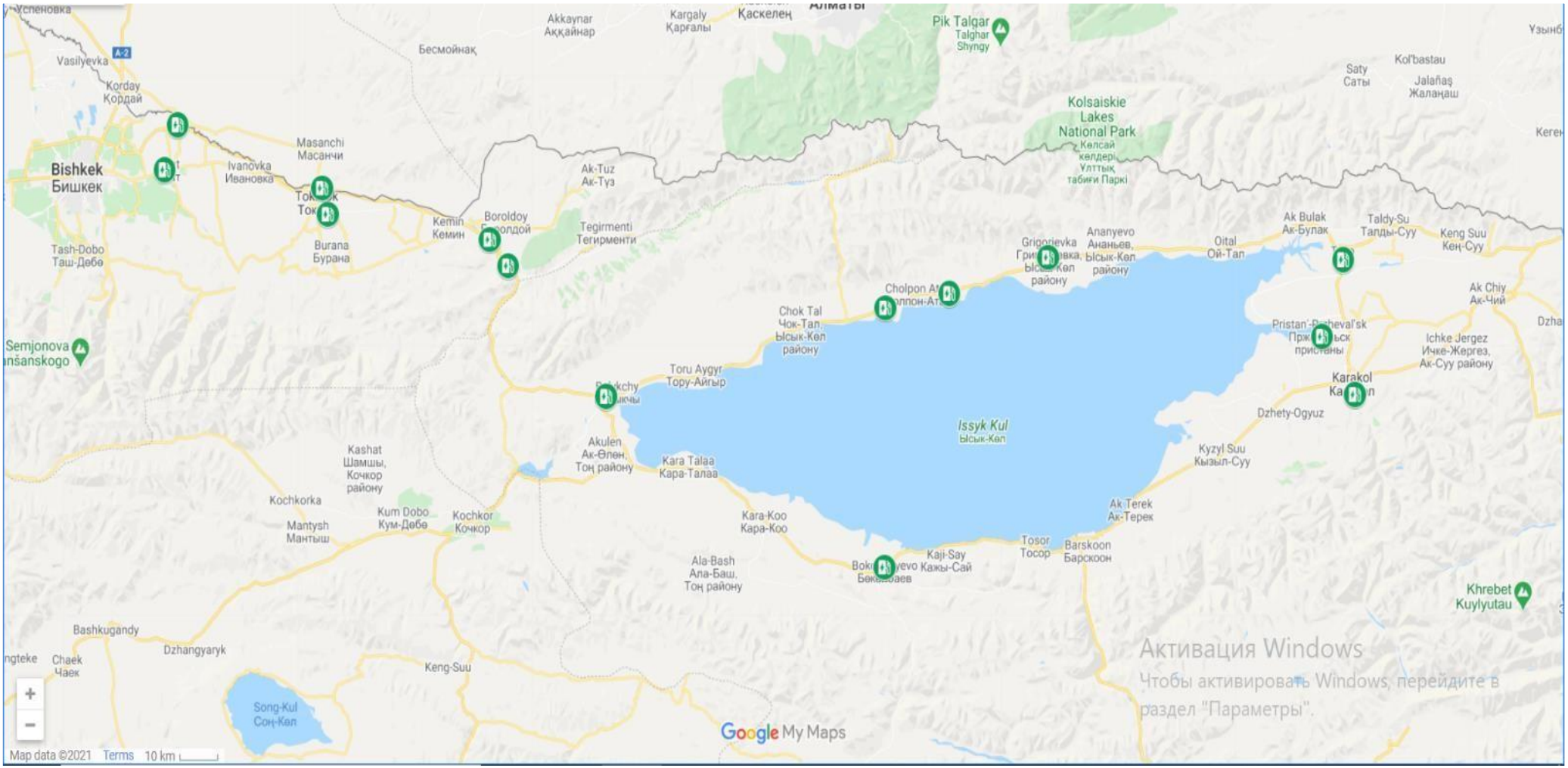
The above list of donors is a non-exhaustive list of sources of donor assistance for climate change and green economy funding. Deeper analysis requires additional time and resources.

Annex 1. Suggested Map for Installing Fast Chargers

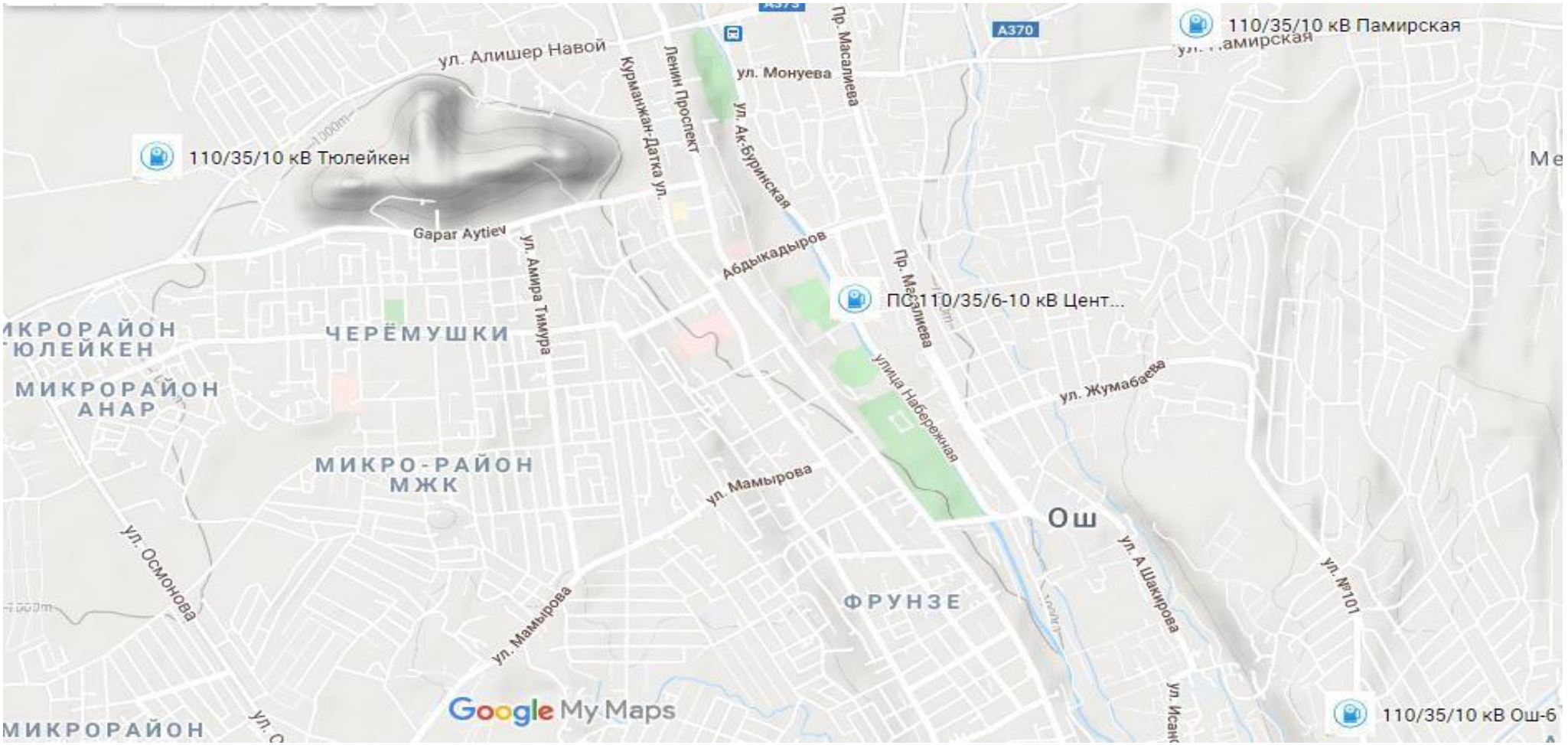
Bishkek



Bishkek-Issyk-Kul Highway



Osh city

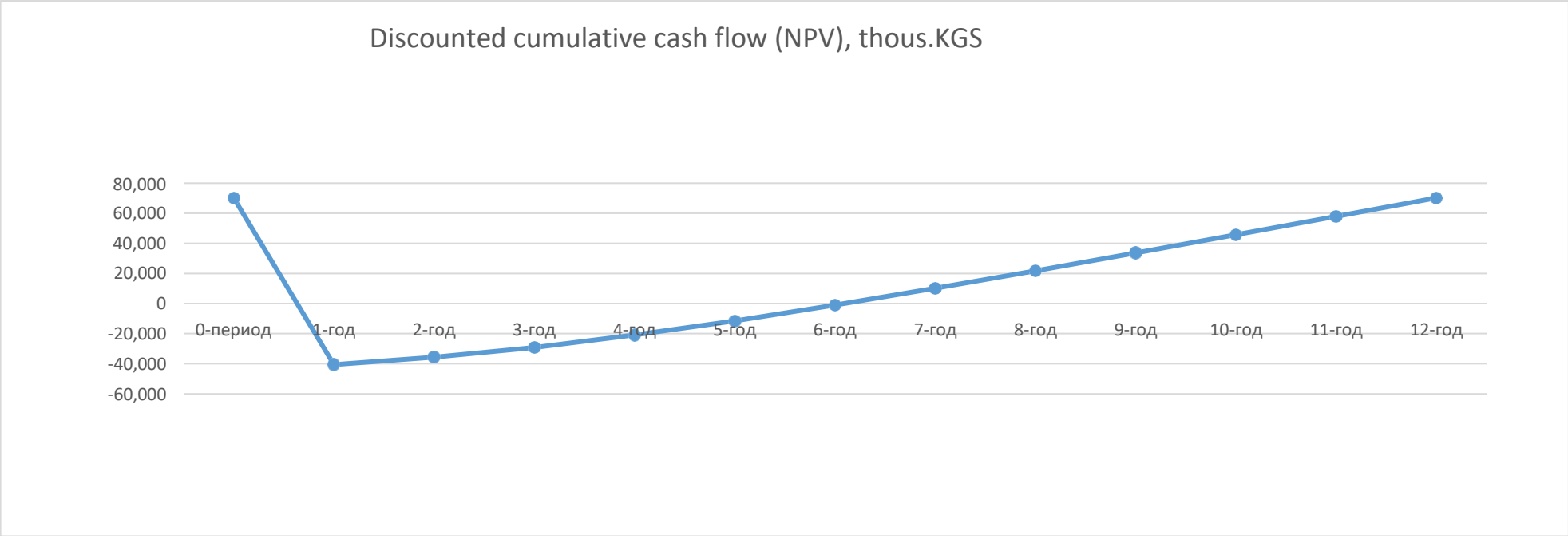

110/35/10 кВ Памирская
A370
ул. Алишер Навой
Курманжан-Датка ул.
Ленин Проспект
ул. Монуева
ул. Ак-Буринская
Пр. Масалиева
110/35/10 кВ Тюлейкен
Gapar Aytiev
ул. Амира Тимура
Абдыкадыров
ПС110/35/6-10 кВ Цент...
ЧЕРЁМУШКИ
МИКРОРАЙОН ТЮЛЕЙКЕН
МИКРОРАЙОН АНАР
МИКРО-РАЙОН МЖК
улица Набережная
ул. Жумабаева
ул. Мамырова
Ош
ул. Осмонова
ул. А Шакирова
ул. №101
ФРУНЗЕ
ул. Мамырова
Google My Maps
110/35/10 кВ Ош-6

Annex 2. Fast Chargers Payback Calculation

Scenario conditions:													
Discount rate	7.5%												
Planning period	12 years												
Indicators	Unit												
Initial investment	thous.KGS												
Number of charging stations	10 pcs												
Equipment per 1 unit	thous. KGS												
1. ABB Terra 124 DC	thous. KGS												
2. Additional materials for equipment installation (power supply, video surveillance, boards, filters)	thous. KGS												
Software per 1 unit	thous. KGS												
Indicators	**Unit**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**
Revenue side (Cash receipts)	**thous. KGS**	**10 584**	**15 120**	**18 144**	**22 680**	**25 704**	**30 240**	**33 264**	**36 288**	**39 312**	**42 336**	**45 360**	**48 384**
Tariff for the sale of electricity without VAT	KGS/min	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Charging time for 1 electric vehicle (full charge from 70 - 100 kWh)	60 min	60	60	60	60	60	60	60	60	60	60	60	60
Average number of charged electric vehicles per day at 1 station	pcs	7	10	12	15	17	20	22	24	26	28	30	32

Expenditure side (Cash outflows)	**thous.KGS**	**7 911**	**9 276**	**10 186**	**11 552**	**12 462**	**13 827**	**14 737**	**15 647**	**16 557**	**17 467**	**18 377**	**19 287**
Cost of electricity	thous. KGS	3 185	4 550	5 460	6 826	7 736	9 101	10 011	10 921	11 831	12 741	13 651	14 561
Purchase price of electricity without VAT	KGS/kWh	1,58	1,58	1,58	1,58	1,58	1,58	1,58	1,58	1,58	1,58	1,58	1,58
Average electricity consumption of 1 electric vehicle	kWh	80	80	80	80	80	80	80	80	80	80	80	80
Property rental	thous. KGS	1 122	1 122	1 122	1 122	1 122	1 122	1 122	1 122	1 122	1 122	1 122	1 122
Maintenance of the equipment	thous. KGS	520	520	520	520	520	520	520	520	520	520	520	520
Communication services, Internet, software license renewal	thous. KGS	936	936	936	936	936	936	936	936	936	936	936	936
Other office services (housing and public utilities) (Fix cost per 10 charging stations)	thous. KGS	30	30	30	30	30	30	30	30	30	30	30	30
Payroll fund (Fix cost per 10 charging stations)	thous. KGS	2 118	2 118	2 118	2 118	2 118	2 118	2 118	2 118	2 118	2 118	2 118	2 118
Operating profit	**thous.KGS**	**2 673**	**5 844**	**7 958**	**11 128**	**13 242**	**16 413**	**18 527**	**20 641**	**22 755**	**24 869**	**26 983**	**29 097**

Initial investment													
		1	2	3	4	5	6	7	8	9	10	11	12
Cash flow	thous. KGS	2 673	5 844	7 958	11 128	13 242	16 413	18 527	20 641	22 755	24 869	26 983	29 097
Accumulated cash flow	thous. KGS	-40355	-34511	-26554	-15425	-2 183	14 230	32 757	53 398	76 153	101022	128 005	157 102
Discounted cash flow	thous. KGS	2 486	5 057	6 405	8 333	9 224	10 635	11 167	11 573	11 869	12 066	12 179	12 216
Discounted cumulative cash flow (NPV)	thous. KGS	-40541	-35485	-29079	-20746	-11522	-887	10 280	21 854	33 722	45 788	57 967	70 183



Annex 3. Analysis of Studies Conducted

Survey of leading filling stations

As of 6 January 2021, three oil companies were surveyed: Partner Neft, Bishkek Petroleum and GPNA.

None of the filling station chains has charging stations for electric vehicles and does not plan to install them in the next 2 years. One network plans to install charging stations at 4 filling stations (2 in Bishkek and 2 on highways) in 3 years. None of the filling stations have free capacity to install charging stations, so they all need to increase capacity under the technical specifications of the electricity suppliers. The companies believe that electric vehicles will become common in our country within 5-10 years. The main reason that filling stations are not planning to install charging stations right now is the very small number of electric vehicles in the KR, and therefore installation is economically unprofitable for them. However, all of the companies noted that if there is demand for electric charging, they will start installing charging stations at their filling stations. All noted that demand breeds supply, and as soon as the number of such vehicles increases, companies are ready to invest in the installation of charging stations, but government assistance in installation would be helpful.

According to one filling station chain, the state should provide subsidies for public charging, provide free parking for electric vehicles, and install public charging stations. It has also been noted that it is necessary to create a PPP in this sector with the division of areas of responsibility. "The state, I think, should meet with business on taxation and electricity tariffs. Business, in turn, should develop this industry, invest in infrastructure, in new jobs, and raise the qualifications of employees. And in the end, all sides will benefit. "

The following conditions were named as the main conditions for the expansion of the electric vehicle market:

1. The market must be adequate to electric vehicles;
2. Technology must become more accessible and efficient;
3. The state must provide all necessary administrative, financial, tax and social conditions for all participants in the electrification and greening of the country's road transport sector.

All companies are very positive about the development of electric transport in our country, some have noted that help from the state would be to exempt from taxes (sales tax, VAT on imports of equipment and services for electric charging).

Taxi Services

An interview was conducted with the director of a taxi service Bi Taxi (ex-Namba Taxi). The company's fleet consists of about 2,000 cars, of which 300 cars are owned by the company. All own cars run on gas, the other cars run mostly on gas, some on gasoline. On average, 600 KGS are spent on fuel per day, and 50 USD are spent on car maintenance. For 1 shift, a taxi driver travels 150-200 km. For a taxi service, it is very difficult to say how long the wait for orders takes, but the peak hour is from 7:00-10:00 and 16:00-20:00. At this time, there are a lot of orders and, accordingly, the cars do not have time to charge (in the event that the taxi is electric).

However, at the moment there are no plans to switch to electric vehicles, the main reason being the expensive price of such vehicles (according to the director) and the lack of infrastructure (charging stations). It was also noted that electric vehicles take a long time to charge, they are not

durable and reliable.

It was also asked under what conditions the company would be willing to switch to electric vehicles. The company noted 3 factors: financial incentives from the government to buy electric vehicles, specialized parking for electric taxis with charging access, and providing vehicle owners with public fast chargers from the government.

The company has noted that if such conditions are created, they are ready to switch up to 40% of its fleet to electric vehicles.

The main problem with electric taxi, as noted above, is the high cost of such vehicles, so the company will be interested in switching to electric vehicles, if they are new and their cost does not exceed 12 thousand USD. Also, such vehicles should be roomy and comfortable.

However, in general, the company's attitude toward electric vehicles is not positive. According to the director, there are many barriers, so there are no prospects for the development of electric vehicles in the Kyrgyz Republic in the near future.

Interview with electric vehicle dealers, Zamir Chargynov (supplier of new electric vehicles from China)

Recently, Zamir Chargynov brought in three new electric vehicles that were assembled in a Chinese factory. The body of the vehicles is from Honda. The price of the vehicles is $22,000, the battery lasts for 400 km. The battery is designed for 5,000 charging cycles, after which it needs to be replaced. The company provides a 3-year warranty.

The main reason why Zamir got involved in electric vehicles is that they are the future. Fuel consumption is much less. So, if a gasoline vehicle spends 390 KGS per 100 km on average, then an electric vehicle spends 25 KGS per 100 km. Zamir also added that: “Using electric transport, we are developing our country, since electricity is generated domestically, and gasoline has to be imported”. In addition, it has been noted that the company can import different vehicles and prices may vary depending on the type of vehicle. For taxi services, it is possible to import vehicles costing 10-12 thousand USD.

According to Zamir, the electric vehicle market will develop in our country, and support from the government is needed in media coverage and popularization of electric vehicles. One of the important steps is considered to be the conversion of state service vehicles to electric ones. It is also necessary to introduce requirements for the installation of charging stations in new houses and parking lots for vehicles into the construction standards. According to Zamir, when the number of vehicles reaches 1,000, it will be a critical mass, which will give impetus to the development of service stations, specialists, opening representative offices and service centers.

Interview with the KyrSEFF program

The KyrSEFF program provides funding for projects to support energy efficiency and water conservation. They are very interested in the program for the introduction of electric vehicles in the Kyrgyz Republic. However, at the moment, Phase 2 of the project does not provide for the finishing of electric vehicles, but a clause on the financing of electric vehicles has been introduced into the Phase 3 of the project, therefore, as soon as Phase 3 is approved and begins its work, the program is open to cooperation and development of products that will support and develop the sector.

Survey of car dealers (the survey was conducted as part of the ADB study)

50 representatives of car dealers were interviewed, including those working in official dealerships such as Toyota, and involved in importing cars and selling them on the car market. The most famous electric vehicle models among car dealers are Tesla and Nissan Leaf.

The reasons for buying an electric vehicle are that the electric vehicle is a modern and new technology, followed by energy savings and no dependence on imported fuel. Environmental reasons, as well as lower costs cited by customers as the main reasons, are not among the main motives cited by car dealers. The main barrier identified by customers to buying an electric vehicle is obviously its cost. Car dealers see lack of EV styling and limited speed as another important barrier. Only after that the driving range and problems with charging are determined. However, car buyers do not see style and top speed as important barriers, with a focus on driving range and charging. In terms of driving range (most car dealers expect 300-400 km) as well as charging time at public chargers (most car dealers expect up to 30 minutes), car dealers' expectations are comparable to those of the public (i.e. potential customers or car buyers). With expected costs and willingness to pay, most car dealers consider the additional price of up to $3,500 for an electric vehicle to be reasonable. Only 26% of car dealers expect electric vehicles to cost the same or less than conventional vehicles. This is in stark contrast to customers, where 62% expect electric vehicles to be the same price or cheaper than conventional vehicles.

As for government policies to encourage electric vehicles, all car dealers agree that the government should encourage electric vehicles. The most cited policy is financial incentives for charging stations and for the purchase of electric vehicles. Financial incentives for charging stations have to do with increasing the number of public charging stations because it makes it more profitable to set them up. Government policy as determined by car dealers largely coincides with the views of the general public. What is interesting is that about 40% of the surveyed car dealers believe that only electric vehicles should be allowed to enter the city as a successful public policy, while only 5% of the general public support this policy. Summary data on car dealers' perceptions of the pros and cons of electric vehicles differ from their customers' perceptions. Car dealers focus more on technology and style, while car owners focus more on the environment and driving range. In terms of expectations about the performance and cost of electric vehicles, car dealers' expectations are not significantly different from car owners' expectations, except for the increasing price of electric vehicles, where car dealers believe that the additional cost of up to $3,500 for an electric vehicle is fair, while car owners expect electric vehicles to have the same or even lower price than conventional vehicles.

ANNEX 4. Survey of Motor Vehicle Drivers by Type of Activity, Engine Size, Fuel Type and Average Mileage per Day

(as of 1 March 2021)

Service vehicles	**Private vehicles**	**Taxis**
Up to 3000 cm^3	Up to 2000 cm^3	Up to 2000 cm^3
Service, 100 km, Sedan	Private, 10 km, Sedan	Taxi, 150 km, Honda Fit, 1.3 L, gasoline (rental)
Toyota Avensis, service, 1.8 L, an average of 100 km, gasoline	Private, from 15 to 40 km, Sedan	Taxi, 100 km, Passat, 1.8 L, gasoline
Service, 50 km, Hyundai Accent, 1.6 L, gasoline	Approximately 50-70 km, 2.0 L, gasoline; Honda CRV	Taxi, Toyota Avensis, 1.8 L, 180-200 km
Service, 100 km, Toyota Camry, 2.4 L, gasoline	15 km, 1.7 L; gasoline; Honda Stream	Taxi Honda Fit, 1.3 L, 100-150 km
Service, 200 km, Lexus RX 300, 3.0 L, gasoline	20-30 km, 1.8 L, gasoline; Toyota Wish	Daewoo Nexia, 1.6 L, 100-150 km
Service, from 60 to 100 km, Honda CRV, 2.4 L, gasoline, ~120 km per day	15 km; 1.7 L, gasoline; Honda Civic	Daewoo Matiz, 0.8 L, 100-150 km (rental)
Honda CRV, 2.4 L, service, gasoline, ~120 km per day	50 km, 1.5 L, gasoline, Lada	Taxi, 100 km, Honda Civic, 1.8 L, gasoline
	30 km, 1.7 L, gasoline Honda	Taxi, 80-100 km, Mazda 323, 1.2 L, gasoline
	Audi B3, 1.8 L, gasoline, on average 30 km	Honda Fit, 100 km (rental)
	Audi A4, 1.8 L, gasoline, on average 13-14 km	Taxi, 80-100 km, Mazda 323, 1.2 L, gasoline
	Golf 3, 1.7 L, gasoline, 30-40 km	Honda Fit, 100 km (rental)
	Private, Honda CRV, 2.0 L, 30-40 km	
	Private, 10 km, Toyota Corolla, 1.8 L, gasoline	
	Private, from 15 to 40 km, Toyota Corolla, 1.8 L, gasoline	

	Private, 20 km, Honda CRV, 2.4 L, gasoline	
	35 km, Mazda, 1.6 L, gasoline	
	Skoda Octavia, 55-60 km	
	Volkswagen Polo v, 1.6 L, gasoline, 50-55 km	
	Ford Focus 2, 1.6 L, gasoline, 48-43 km	
	Hyundai Accent 2, 1.5 L, gasoline, 45-50 km	
	Lada Priora 1, 1.6 L, gasoline, 45-50 km	
	Mitsubishi Lancer, 1.6 L, gasoline, 45-50 km	
	Kia Ceed 1, 1.4 L, gasoline, 45-50 km	
	Honda Fit, 1.3 L, private, gasoline, ~100 km per day	
Mileage: median – 95 km/day	**Mileage: median – 40 km/day**	**Mileage: median – 120 km/day**
Cargo/passenger	Up to 3000 cm^3	Up to 3000 cm^3
Service, 200 km, Crossover	Toyota Camry, 2 L, private, gasoline, >100 km per day	On average 70-80 km, 2.2 L, gas, Mercedes
Service, from 60 to 100 km, Truck	Honda CRV, 2 L, private, gasoline, ~40-50 km per day	
Mercedes Sprinter, 2.9 L, diesel, 200-500 km	Toyota Camry, 2 L, private, gasoline, >100 km per day	
Honda Stepwagon, 2 L, gasoline 150-200 km	Honda CRV, 2 L, private, gasoline, ~40-50 km per day	
Isuzu truck, 3.0 L, gasoline, 90-100 km	Private, 35 km, 2 L, Sedan	
Mercedes Sprinter, 2.7 L, gasoline, 80-110 km per day (water delivery)	15-20 km, 2.0 L, gasoline, Toyota	
Service minibus, Sprinter Mercedes, 2.7 L, 100 km	Nissan Cefiro III, 2.0 L, gasoline, on average 40-70 km per day	
	Private, 30 km, Crossover	
	20 km; 2.5 L; gasoline; Camry 50	

	BMW, 2.8 L, gasoline, 100-200 km	
	Toyota Camry, 2.5 L, gasoline, on average 50-70 km per day	
	Subaru Legacy, 2.5 L, gasoline, on average 120-140 km per day	
	Private, 20 km, Honda CRV 2002, 2.4 L, gasoline	
	Private, 30 km, Minivan, 3.0 L, gasoline	
	Private, 30 km, Lexus RX 300, 3.0 L, gasoline	
	Toyota Camry V, 2.4 L, gasoline, 48-53 km	
	Volvo XC90, 2.5 L, gasoline, 50-55 km	
Mileage: median – 170 km/day	**Mileage: median – 60 km/ day**	**Mileage: median – 70 km/day**
	From 3000 cm^3	
+5 verbally surveyed with range of mileage from 100 km to 200 km per day	20-50 km, 3.0 L, gasoline; Lexus RX	+3 verbally surveyed with range of mileage from 40 km to 100 km per day
	8 km, 4.7 L, gasoline, Lexus 470	
	Lexus 470 GX, 4.7 L, gasoline, on average 30-40 km per day	
	Nissan Patrol 2011, 5.6 L, gasoline, on average 50-60 km per day	
	Mitsubishi Pajero, 3.2 L, diesel, on average 20-50 km per day	
	Toyota 4Runner 2014, 4.0 L, gasoline, on average 30-40 km per day	
	Mileage: median – 30 km/day	
Total: 20 vehicles	**Total: 50 vehicles**	**Total: 20 vehicles**

Annex 5. Costs of Installing Charging Stations for ANKAI Electric Buses

(for 10 seats)

No	Project unit	Project name/ specification	Unit	Quantity	Price ($)	Subtotal ($)	Remarks
1	Civil Engineering Unit	Ground hardening	m²	1500	11.90	$17857.14	Concrete structure
2		Cable trench	M	50	158.73	$7 936.51	
3		Charger base	m²	35	63.49	$2 222.22	Brick structure
4		Parking limit	set	20	47.62	$952.38	
5		Rain shed	m²	210	71.43	$15000.00	Light steel color plate, support column is square steel structure
6	Charging unit	180 kW double gun charger	set	10	34285.71	$342857.14	
7		Connection cable YJV3*150mm²+2	M	1	85.71	$85.71	The AC input cable is determined according to the location of the transformer. This budget only provides the price per meter.
8	Surveillance/ Security	Video Surveillance	set	1	4761.90	$4761.90	
9		Charge monitoring	set	1	1587.30	$1587.30	
10		Fire facilities	set	1	3174.60	$3174.60	
11	Power distribution unit	2500 kVa substation	set	1	134920.63	$134920.63	The grid connection fee is not included.
12	Other	Other facilities such as signs, office equipment, and station lighting.	set	1	2380.95	$2380.95	
13	Total price					$533736.51	
The above quotation is for reference only, and the final price is subject to the signed commercial contract							

Annex 6. CO_2 Emissions of Trucks by Type, Indicating the Energy Sources Used, (*gram/ton·km)*

Description (according to the nature of the vehicle and the type of transport provided indicating the energy source[s] used)	CO_2
Light-weight commercial vehicle with a GVW of 3,5 tonnes - Express (mail, courier services) - Road diesel	1,889 g CO_2 / t.km
Light-weight commercial vehicle with a GVW of 3,5 tonnes - Express (parcels) - Road diesel	1,068 g CO_2 / t.km
Straight truck with a GVW of 19 tonnes - Express - Road diesel	332 g CO_2 / t.km
Semi-trailer truck with a GCW of 40 tonnes - Parcel delivery - Road diesel	175 g CO_2 / t.km
Straight truck with a GVW of 19 tonnes - Parcel delivery - Road diesel	332 g CO_2 / t.km
Semi-trailer truck with a GCW of 40 tonnes - Parcel delivery (refrigerated) - Road diesel/non-road diesel	178 g CO_2 / t.km
Straight truck with a GVW of 19 tonnes - Parcel delivery (refrigerated) - Road diesel/non-road diesel	302 g CO_2 / t.km
Straight truck with a GVW of 7,5 tonnes - Miscellaneous goods - Road diesel fuel	750 g CO_2 / t.km
Straight truck with a GVW of 12 tonnes - Miscellaneous goods - Road diesel fuel	409 g CO_2 / t.km
Semi-trailer truck with a GCW of 26 tonnes - Large volumes - Road diesel	156 g CO_2 / t.km
Semi-trailer truck with a GCW of 35 tonnes - Car carrier - Road diesel	189 g CO_2 / t.km
Semi-trailer truck with a GCW of 40 tonnes - Miscellaneous goods/long-distance - Road diesel	84,0 g CO_2 / t.km
Semi-trailer truck with a GCW of 40 tonnes - Miscellaneous goods/regional - Road diesel	83,0 g CO_2 / t.km
Semi-trailer truck with a GCW of 40 tonnes - Large volumes - Road diesel	93,1 g CO_2 / t.km

Source: CO_2 information for transport services Application of Article L. 1431-3 of the French transport code/The Medde (French Ministry of Ecology, Sustainable Development and Energy) has entrusted ADEME (Environment and Energy Management Agency)/page 78/ https://thepep.unece.org/sites/default/files/2017-06/Info_CO2_Methodological_Guide.pdf