Green Finance and Investment

Promoting Clean Urban Public Transportation in Kazakhstan, Kyrgyzstan and Moldova

SUMMARY REPORT OF PROJECT IMPLEMENTATION 2016-2019

OECD

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BETTER POLICIES FOR BETTER LIVES

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Foreword

This report presents the objectives, methodology, procedures and main findings of the project "Strengthening public finance capacity for green investments in the EECCA countries". The project, funded by the Organisation for Economic Co-operation and Development (OECD), was part of a collaboration under the GREEN Action Task Force, for which the OECD provides a secretariat.

The project, conducted between 2016-19, sought to help the partner countries achieve their environmental and climate-related objectives. In line with countries' transition to a greener path of development – in particular, by reducing the energy and carbon intensity of their economies – the technical assistance also aimed to contribute to socio-economic advancement. The project included three country case studies in Eastern Europe, Caucasus and Central Asia (EECCA) region: Kazakhstan (implemented in 2016), Moldova (implemented in 2016-18) and Kyrgyzstan (implemented in 2018).

The following ministries were the OECD's main counterparts in the respective country projects: Ministry of Energy of Kazakhstan; Ministry of Agriculture, Regional Development and Environment (previously, the Ministry of Environment) of Moldova; and Ministry of Economy of Kyrgyzstan. They were assisted in designing and costing of country-level green public investment programmes in line with good international practices. Together, the co-operation partners analysed how (scarce) public funds could be used to benefit the environment and citizens.

The focus of the respective investment programmes was discussed with, and eventually selected by, the partner ministry. In all three countries, the programmes focused on reducing air pollution and greenhouse gas (GHG) emissions from the transport sector. Given limited preparation time and resources for implementation, the scope was narrowed in all three countries. It ultimately focused on improving the environmental consequences of public transport in large urban centres and became known as the Clean Public Transport (CPT) Programmes. The designed programmes help estimate overall implementation costs and, importantly, find sources (both national and international) for their financing.

The respective country reports – published in 2017 (Kazakhstan) and 2019 (Moldova and Kyrgyzstan) – outline the results of a scoping exercise for increasing an investment demand in public transport fleets. Each of the three country case studies summarises the results of a proposed stepwise approach to the CPT Programme implementation. The approach proposes two phases and – in the case of Kazakhstan and Moldova – two scenarios for the second (scaling-up) phase. It also identifies two cities to participate in the first (pilot) phase.

The scoping studies for the CPT Programmes involved four main activity areas and outputs: 1) an initial scoping and analytical stage; 2) a costing methodology; 3) a design aligned with international good practice; and 4) an analytical report and training. Activity areas 2) and 3) constituted the backbone of each country project. They aimed to demonstrate in practice how to use scarce public funds to incentivise the private sector to invest in clean and socially important projects.

The respective country reports relied on several elements. First, an extensive review of environmental legislation was undertaken, reflecting standards of the partner country and the European Union. This included, for example, technical regulations regarding public transport. Second, the reports reflected an extensive collection of primary and secondary data on environment, transport and public services. The stocktaking analysis considered the country's national green growth and climate change commitments and budgetary requirements. The reports also drew from several visits of the project team to the partner country. The team discussed various elements of the investment programme with experts from government offices and local public administrations in pilot cities. It also met consulted with representatives of various international and non-governmental organisations active in the country.

While this synthesis report is not comprehensive, it aims to highlight issues common to all three programmes. All three country case studies have similar objectives and approaches. This is true of the design of the programme, as well as its proposed implementation set-up. However, this synthesis is not a full-fledged comparative analysis of the target sectors (and associated opportunities and challenges) in the respective countries. This is partly due to the report's limited scope, but more due to the fact that each country project was specific and tailored to the partner country needs. Still, this report aims to lay out the main common features with regard to problem analysis, policy recommendations, etc.

The designed CPT Programmes built on previous work by the OECD in public environmental expenditure management, integrating the environmental sector into medium-term budgetary processes and on climate change economics. They also built on earlier OECD work on climate change economics.

More specifically, they use a programme costing methodology (called OPTIC) developed by the OECD, with support by Germany, and tested previously in Kazakhstan. The methodology is focused on climate-related investment programmes.

The project was implemented within the framework of the GREEN Action Task Force. The work in Kazakhstan was financially supported by the government of Kazakhstan. Meanwhile, activities in Moldova and Kyrgyzstan were supported by Germany's Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) through its 2014 International Climate Initiative (IKI).

The views expressed in this report are those of the authors and do not necessarily reflect those of the OECD or its member countries.

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Abbreviations and acronyms

ADB	Asian Development Bank
AIFC	Astana International Financial Centre
ANTA	National Agency of Road Transport (*Agenția Națională Transport Auto*)
BAU	Business as usual (scenario)
BMNT	(Austrian) Federal Ministry for Sustainability and Tourism (Bundesministerium für Nachhaltigkeit und Tourismus)
BMU	(German) Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (*Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit*)
BRT	Bus rapid transit (system)
CAREC	Regional Environmental Centre for Central Asia
CDM	Clean development mechanism
CHP	Combined heat and power (generation)
CNG	Compressed natural gas
COP	Conference of the Parties (to the UNFCCC)
CPT	Clean public transport (OECD project)
DGC	Dynamic generation costs
EBRD	European Bank for Reconstruction and Development
EECCA	Eastern Europe, Caucasus and Central Asia
EU	European Union
EUR	Euro (Eurozone currency)
GCF	Green Climate Fund
GEF	Global Environment Facility
GDP	Gross domestic product
GHG	Greenhouse gas (emissions)
GIZ	German Development Cooperation (*Deutsche Gesellschaft für Internationale Zusammenarbeit*)
IFI	International financial institution
IKI	International Climate Initiative (*Internationale Klimaschutzinitiative*) of Germany
INDC	Intended nationally determined contribution
IPPA	Investment Promotion and Protection Agency of the Kyrgyz Republic

IU	Implementation unit
JI	Joint implementation
JSC	Joint stock company
KGS	Kyrgyzstani som (national currency of Kyrgyzstan)
KPC	Kommunalkredit Public Consulting
KZT	Kazahkstani tenge (national currency of Kazakhstan)
LLP	Limited liability partnership
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
LUCF	Land-use change and forestry
LULUCF	Land use, land-use change and forestry
MAC	Maximum allowable concentration
MARDE	Ministry of Agriculture, Regional Development and Environment of Moldova
MDL	Moldovan leu (national currency of Moldova)
MoE	Ministry of Energy of Kazakhstan
MoEcon	Ministry of Economy of Kyrgyzstan
MoEnv	(former) Ministry of Environment of Moldova
MTEF	Medium-term expenditure framework
NCF	Net cash flow
NDC	Nationally determined contribution
NFEP&WM	(Polish) National Fund for Environmental Protection and Water Management
NGO	Non-governmental organisation
NPV	Net present value
OECD	Organisation for Economic Co-operation and Development
OPTIC	Optimising public transport investment costs (OECD model)
O&M	Operation & maintenance (costs)
PCM	Project cycle management
PE	Programming entity
PLN	Polish zloty (national currency of Poland)
PM	Particulate matter
PM	Prime Minister (Office)
PV	Photovoltaic
RSE	Republican state-owned enterprise
SAEPF	State Agency for Environmental Protection and Forestry (of Kyrgyzstan)
TSU	Technical support unit

UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar (US currency)
WB	World Bank
WHO	World Health Organization

Units, quantities and compounds

CO	Carbon monoxide
CO_2	Carbon dioxide
kg	Kilogram
km	Kilometre
kpvpd	Kilometre per vehicle per day
kt	Kiloton
m	Metre
mg	Milligram
mln	Million
MW	Megawatt
m^3	Cubic metre
NO_x	Nitrogen oxide
N_2O	Dinitrogen oxide
SO_2	Sulphur dioxide
t	Tonne
tCO_2	Tonne of CO_2
tCO_2e	Tonne of CO_2 equivalent
thous.	Thousand
tNO_x	Tonne of NO_x
µg	Microgram

Executive summary

Moving forward on energy-efficient local transport

The governments of Kazakhstan, Kyrgyzstan and Moldova have committed to the development of energy-efficient local public transport. This includes vehicles powered by cleaner fuels or technologies, such as compressed natural gas (CNG)/liquefied natural gas (LNG), liquefied petroleum gas (LPG), diesel Euro 5/6 and electricity. However, in many cases, their programmes are overly ambitious, costing is imprecise, timeframes are unrealistic, and budgets and sources of funding are not specified. In most cases, the institutional set-ups for implementation are not well designed.

With financial support from the OECD, the three countries embarked on a project known as the Clean Public Transport (CPT) Programmes. These programmes help estimate overall implementation costs and find sources to reduce the negative environmental consequences of public transport in large urban centres. This report synthesises the objectives, methodology, procedures and main findings of the three individual country reports into a single document.

Findings

Implementation in two phases will replace many long-depreciated vehicles

- In Kazakhstan, there will be 1 827 new urban public transport vehicles in 19 towns/cities (386 CNG and 1 441 LPG buses) after the scaling-up phase (Scenario 1), requiring an **investment of USD 179.47 million**. Assuming the more ambitious scaling-up phase (Scenario 2) is implemented, 21 towns/cities would have 2 783 new urban public transport vehicles (953 CNG and 1 830 LPG buses), requiring an investment of **USD 275.89 million.**
- In Kyrgyzstan, both phases will result in 1 363 urban, suburban and inter-city public transport vehicles – 1 158 CNG buses, 115 trolleybuses and 90 modern diesel buses. The investment costs are estimated at **USD 198.8 million**.
- In Moldova, the pilot and the scaling-up phase (Scenario 1) will provide 735 new urban and suburban vehicles (62 trolleybuses, 393 buses and 280 minibuses), requiring an investment of **USD 150.2 million**. Assuming the more ambitious scaling-up phase (Scenario 2) is implemented, Moldova would have 2 510 new urban, suburban and inter-city vehicles (62 trolleybuses, 1 456 buses and 992 minibuses with CNG, LPG and modern diesel engines) at an investment cost of **USD 498.6 million**.

Scenarios emphasise large buses run on electricity and natural gas

- As a rule, priority is given to large (over 10-m long) buses over minibuses. Electricity (possibly generated by renewable sources) and natural gas are preferred to petroleum gas or diesel fuels.

Public subsidies will be needed to support the transition to cleaner vehicles

- Public financial support (subsidies in the form of a grant) will be necessary to help public transport operators (both municipal and private) upgrade to a modern and environmentally friendly fleet.

The programme is expected to meet targets for reducing greenhouse gas and air pollution emissions

- Estimates for decrease in CO_2 emissions compared to baseline:
  - Kazakhstan: 68 367 tonnes/year (27.2%)[1]
  - Kyrgyzstan: 68 506 tonnes/year (47.3%)
  - Moldova: 73 944 tonnes/year (42.2%)
- Estimates for decrease in NO_x emissions compared to baseline
  - Kazakhstan: 1 724 tonnes/year (83.5%)
  - Kyrgyzstan: 1 236 tonnes/year (86.4%)
  - Moldova: 1 444 tonnes/year (83.5%)
- Estimates for decrease in $PM_{2.5}$ emissions compared to baseline
  - Kazakhstan: 50 tonnes/year (98.2%)
  - Kyrgyzstan: 29 tonnes/year (98.7%)
  - Moldova: 35 tonnes/year (98.8%)
- Estimates for decrease in SO_2 emissions compared to baseline
  - Kazakhstan: 39 tonnes/year (83.3%)
  - Kyrgyzstan: 27 tonnes/year (99.6%)
  - Moldova: 29 tonnes/year (88.9%)
- Estimates for decrease in CO emissions compared to baseline
  - Kazakhstan: 315 tonnes/year (56.1%)
  - Kyrgyzstan: 307 tonnes/year (94.0%).
  - Moldova: 301 tonnes/year (76.3%)

The programme can achieve public service objectives

- Purchasing modern (brand-new) vehicles would increase reliability and comfort. Extending/improving service delivery outside of cities would increase outreach in Kyrgyzstan and Moldova. This would be in line with the country's transport strategies and programmes (municipal and national).

The programme can support socio-economic development

- By modernising the urban, suburban and inter-city transport fleet, the CPT Programme will contribute to the socio-economic development of municipalities and, ultimately, of the country.
  - Better public transit can improve mobility, which fosters productivity (access to jobs, markets) and social inclusion (access to hospitals, schools) especially for low-income groups.

- The programme could also stimulate the domestic market to produce, or at least assemble, modern buses and trolleybuses. Public grants for private and municipal public transport operators could help purchase new vehicles rather than modernise/convert engines of used (depreciated) vehicles. This approach could also create jobs.

Potential obstacles to implementation

Technical issues

- non-existent infrastructure (e.g. public transport networks, availability of cleaner fuels/sources of power)
- insufficient or not applied technical and quality standards (both vehicles and fuels)
- distorted pricing signals (no support for cleaner fuels, technologies or behaviour)

Institutional issues

- lack of capacity and experience in the public sector

Psychological issues

- status quo lock-up and related difficulties in changing mindsets.

Recommendations

- Strengthen institutions that prepare and implement programmes.
- Strengthen technical regulations in transport:
  - Strengthen (diesel) engine emission norms and bring them closer to European standards.
  - Strengthen (diesel) fuel standards.
  - Strengthen technical inspection standards.
- Introduce adequate pricing signals.
- Increase support to producers of clean buses.
- Adjust the fare system for urban public transport.
- Improve inter-ministerial co-operation in implementation of the transport strategy.
- Change public tenders for providing public transport in urban centres.
- Encourage energy efficiency in public transport.

Conclusions

Getting beyond tools: The designed CPT Programmes are more than technical tools and associated costs. They are roadmaps to bring forward a greener path of development.

Turning obstacles into opportunities: The CPT Programmes include only a limited amount of hard infrastructure investments. Therefore, obstacles can be turned into opportunities relatively quickly.

Planning beyond annual cycles: Fiscal policy should look beyond annual budgetary cycles. Environmental benefits, in particular, need time to materialise, and need to be planned sufficiently in advance. In other words, the programme should adopt medium-term expenditure frameworks.

Improving regulations and policies: Improving the regulatory framework and creating policy structures take time. However, these are critical to building transport services that are energy-efficient, environmentally friendly and economically viable.

Seizing momentum: This report summarises the main proposals tailored to the target sector (such as technical regulations or pricing signals). However, it also includes overarching challenges (inter-ministerial co-operation or public tenders) that are largely shared by the three focus countries. Each country has a similar starting position, partly based on Soviet legacy. However, the first mover in the region can still enjoy advantages over the others, which provides a strong incentive to act immediately.

Note

1. The values reflect only emissions of the vehicles to be replaced (baseline value) and the new fleet (target value), not the total emissions from all public transport in Kazakhstan.

1. Country programme preparation and implementation

This chapter provides a brief background of the whole regional project, including both preparation (identification) and implementation (analytical) phases in Kazakhstan, Kyrgyzstan and Moldova. The first part contains a short overview of the countries' challenges with regard to their transition to sustainable and energy-efficient economies. This provides an important component of the (complex) justification of the project. In the second part, the chapter outlines the leading co-operation objectives and milestones in each of the three focus countries.

1.1. Common features of the projects

1.1.1. Project rationale and focus identification

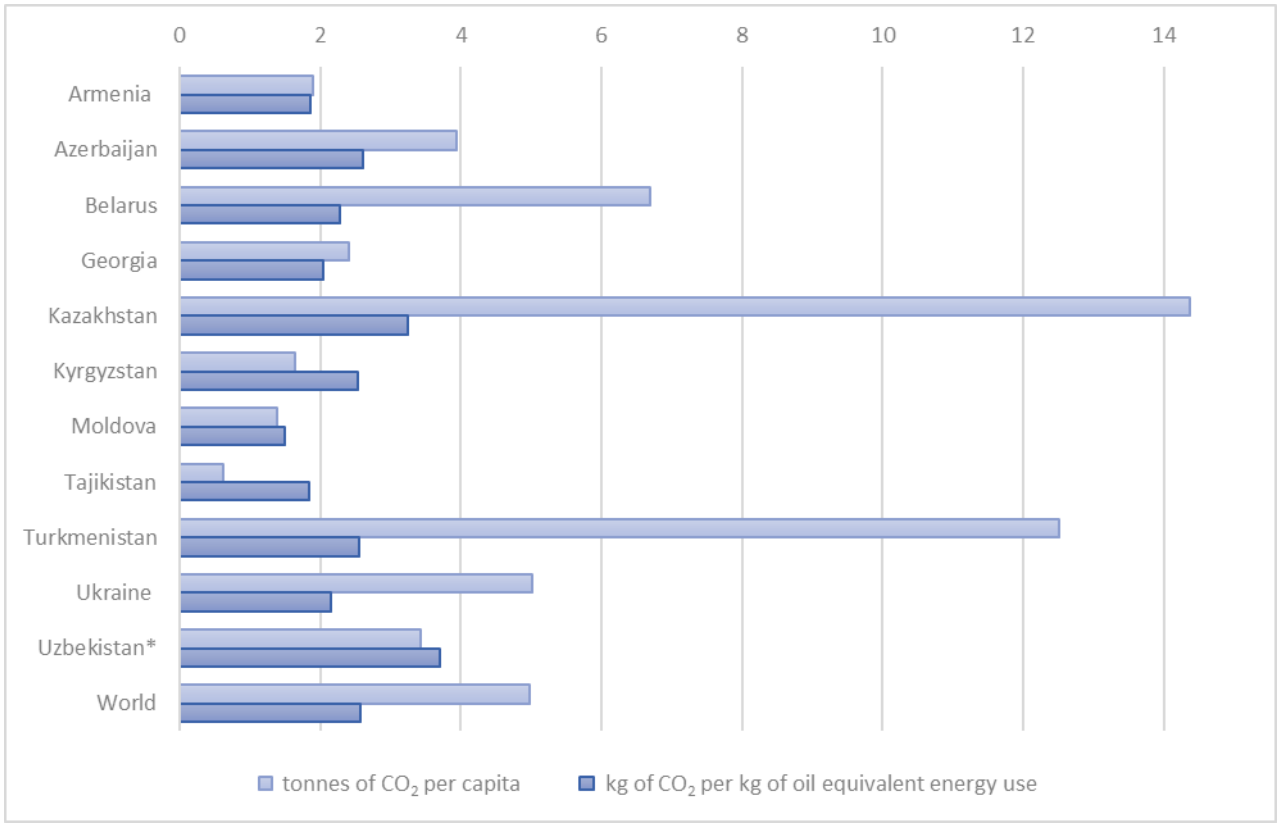
Since gaining independence from the Soviet Union in 1991, the national governments of Kazakhstan, Kyrgyzstan and Moldova have committed to promoting sustainable development. National policies, programmes and action plans have been developed and approved in the main sectors affecting the countries' economy and environment. These sectors range from energy, industry and transport to agriculture, forestry and waste.

The governments of Kazakhstan, Kyrgyzstan and Moldova committed to the development of energy-efficient local public transport. The Intended Nationally Determined Contributions (INDCs), presented at the 21st Conference of the Parties (COP21) in Paris in 2015, set ambitious targets of reducing greenhouse gas (GHG) emissions. By 2030, compared to 1990 levels, Kazakhstan and Moldova aimed to reduce emissions by 15-25%[1] and 64-78%[2], respectively. For its part, Kyrgyzstan sought to reduce GHG emissions by 11.49-30.89% compared to a business as usual (BAU) scenario by 2030 and 12.67-36.75%[3] below BAU by 2050.[4]

To meet climate change targets set through Nationally Determined Contributions (NDCs),[5] national governments in Eastern Europe, Caucasus and Central Asia (EECCA) put in place climate-related programmes and identify projects that can be supported with public funds. These programmes often include investment components. However, in many cases, the targets of these programmes are overly ambitious, costing is imprecise, timeframes are unrealistic, and budgets and sources of funding are not specified. In most cases, the institutional set-ups for implementation are not well designed.

Among the EECCA countries, the economies of Kazakhstan and Kyrgyzstan are carbon dioxide (CO_2) intensive (Figure 1.1). Kazakhstan takes second place (after Uzbekistan) with 3.24 kg of CO_2 (per kg of oil equivalent of energy use). With 1.49 kg, Moldova shows the lowest value among EECCA countries (as well as being below the world average of 2.57 kg). In CO_2 emissions per capita, Kazakhstan emitted almost triple the world average in 2014 (14.36 vs. 4.98 tonnes per capita). This is mainly because Kazakhstan reduced its per capita emissions in 1992-2014 by only 10% compared to reductions in Moldova and Kyrgyzstan of 75% and 34%, respectively.

Figure 1.1. CO_2 emissions and intensity in EECCA countries, 2014



Note: *2013 data.
Source: World Bank (https://data.worldbank.org).

Kazakhstan's energy sector contributes the largest share (82.1%) of total GHG emissions. Emissions from the transport sector are included in the energy sector, accounting for 8.4% of GHG emissions from that sector in 2014. With 88% of GHG emissions in the transport sector, the automobile transport sub-category forms a key part within the sector. The industrial production sectors, agriculture and waste management, as well as the land use, land-use change and forestry (LULUCF) sector, account for the remainder of emissions. From 1990 (base year) to 1999, total GHG emissions from the road transport sector declined rapidly, mainly due to the deep economic crisis in the country. Despite a significant increase since 1999 – almost reaching 1990 levels in 2007 – total GHG emissions in 2014 were only 80.5% (excluding LULUCF) of the total amount in 1990 (UNFCCC, 2016[1]).[6]

The energy sector also contributed the largest share of total emissions in Moldova – 68.1% without LULUCF – in 2015. Emissions from transport are included in the energy sector and accounted for 23.2% of GHG emissions from the energy sector. In absolute terms, GHG emissions (both overall and those from transport) decreased over the period. This was mainly due to the fall in gross domestic product and the decline in population. However, the transport sector's share in total emissions increased from 10.3% in 1990 to 15.8% in 2015. Emissions from road transport make up the bulk of GHG emissions from the transport sector. Road transport was responsible for 87.3% of transport emissions in 1990, but had reached 98.1% by 2015. The agriculture, waste management, and industrial

production sectors account for the remainder of the emissions (15.2%, 11% and 5.7% in 2015, respectively) (GoM, 2017[2]).

Kyrgyzstan's low emissions – in total values as well as per capita – are largely because hydroelectric power plants generate 90% of total electricity. Kyrgyzstan's GHG emissions in 2013, excluding the land-use change and forestry (LUCF) sector, were mainly from the energy sector (61.1%).[7] This was followed by agriculture (28.4%), industrial processes (5.7%) and waste (4.8%).[8] Emissions from the transport sector are included in the energy sector and account with other fuel combustion for approximately 71% of emissions within the energy sector (USAID, 2017[3]). While total GHG emissions in Kyrgyzstan decreased by 52% over 1990-2010, emissions in the transport sector only decreased by 32%. Still, transport contributed relatively little to the country's overall GHG emissions – 10% in 1990 and 15% in 2010. Within the transport sector, almost all GHG emissions can be attributed to road transport – 93% in 1990 and 99% in 2010 (GoK, 2016[4]).

Importantly, Kyrgyzstan, Kazakhstan and Moldova are classified as countries relatively vulnerable to climate change. This is especially the case in terms of water resources, health, agriculture and climate emergency situations. In 2017, they ranked 52nd, 67th and 124th out of 181 rated countries on the Germanwatch Global Climate Risk Index. Kyrgyzstan, for instance, ranked 11th for the number of fatalities per 100 000 inhabitants (Eckstein, D. et al., 2019[5]).

1.1.2. Analytical work and main outputs

Since 2016, the OECD has joined forces with Kazakhstan, Kyrgyzstan and Moldova to analyse how a public investment programme could help the countries achieve their environmental (air pollution reduction) and climate-related (GHG emissions reduction) targets. The work primarily helped the three partner countries design a green investment programme that will be co-financed by public funds (subsidies in the form of grants). This aims to stimulate demand for green investments in the country.

Defining the focus of the programme was a political decision made by the OECD's main counterparts: the Ministry of Energy in Kazakhstan, the former Ministry of Environment in Moldova and the Ministry of Economy in Kyrgyzstan. They consulted extensively with the main stakeholders in the country, both governmental and non-governmental.

All three country green public investment programmes focused on encouraging low-carbon mobility through switching to modern public transport vehicles (buses, trolleybuses and minibuses). As one option, these vehicles would run on cleaner fossil fuels such as compressed natural gas (CNG)/liquefied natural gas (LNG), liquefied petroleum gas (LPG) and diesel Euro 5/6. As another option, their fuel/power would be generated by renewable resources (wind, solar, hydro).

The project contained four main activity areas and outputs:

- an initial scoping and analytical stage
- development of a programme costing methodology
- design of a programme in line with international good practices
- preparation of an analytical report and training.

First, a market analysis determined the need for public support in the target sector – i.e. public transport – given the programme's objectives.

The second and third activity areas constituted the backbone of the project. They aimed to demonstrate in practice how to use scarce public funds to incentivise the private sector to invest in clean and socially important projects.

As part of the second activity, a model was designed to support the analysis of the programme and its development. This Excel-based tool, Optimising Public Transport Investment Costs (OPTIC), helps convert the environmental and climate-related targets into finances needed to achieve them.[9] The model helps calculate total programme costs, both for the public financier and private sector investors. It also optimises the return on investment for service providers with the amount of subsidy required to stimulate the market, given the air pollution and GHG emission reduction targets. In other words, it identifies the optimal level of financial support for public transport operators to stimulate demand for cleaner transport vehicles and to achieve the intended environmental effects. The model is an analytical tool that can help the decision-making process become more objective and more transparent (see Section 2.2).

The final analytical reports (OECD, 2017[6]), (OECD, 2019[7]) and (OECD, 2019[8]), which are the major outcome of the three country projects, draw on several elements. They reflect an extensive review of environmental legislation, particularly that of the focus country and the European Union, as well as technical regulations regarding public transport. They are also informed by extensive primary and secondary in-country data collection in the areas of environment, transport and public services.

Box 1.1. Process of project implementation

In 2016-18, the project team[10] visited each country on several occasions (four-five visits per country). They discussed the investment programme with experts from government offices and local public administrations in the pilot cities (Kostanay and Shymkent in Kazakhstan, Chisinau and Balti in Moldova, and Bishkek and Osh in Kyrgyzstan). They also met with experts from various international organisations active in the country.

The meetings took several forms. Mostly, they were bilateral meetings. However, in each focus country, the project team organised two stakeholder meetings – kick-off and final – with the partner ministry.

The final stakeholder meetings achieved three goals. First, they introduced the prepared green public investment programme in the respective country.[11] Second, they presented in brief the outcomes of the market study (with a focus on clean fuels and technologies). Finally, they outlined the main elements to operationalise the programme (programme costing and financing, institutional arrangements, etc.).

The implementation of each country programme ended with a training workshop. This provided government officials and other relevant experts (with experience in environmentally- or transport-related public programmes) with practical insight into two key issues. First, it focused on the design and costing of medium- to long-term green public investment programmes (e.g. estimating costs, setting an optimal level of subsidy). Second, it examined implementation (appraisal and selection techniques, monitoring and evaluation processes, etc.). The OECD team presented how some European Union (EU) countries (Austria, Poland and the Czech Republic) implement similar programmes.

Originally, the workshop aimed to identify a relevant institution/department to train in programme preparation and implementation. Unfortunately, no country could identify the relevant implementing institution due to shortcomings in the capacity of relevant stakeholders. This problem was explained in the relevant sections of the programme development.

At the training workshop, the identified participants were interested in two issues:

- presentation and discussion of the particular programme
- presentation and discussion of the case studies of the programme preparation and implementation, especially in other countries.

Participants were especially interested in programme preparation. The trainings gave them a good opportunity to enhance their knowledge. However, they were not necessarily going to be involved in implementation. Thus, the training component related to implementation was always of less interest. In each case, the project team prepared for a longer training, but cut it short in response to requests from relevant ministries.

As an important part of both events, participants agreed on the next steps in project completion. They also outlined major (potential) challenges in programme design and implementation. These challenges include priority (legal, regulatory) policy actions needed to enable programme implementation.

1.2. Country-specific project implementation

1.2.1. Kazakhstan

The government of Kazakhstan expressed interest to continue working with the OECD on designing green public investment programmes that would support implementation of the Green Economy Concept of Kazakhstan and the associated Action Plan (EO PoK, 2013[9]). It recognised that previous experience in the EECCA region and other relevant (general) tools developed by the OECD[12] could be deployed to design other green public investment programmes, either at a national or local level in Kazakhstan.

The continued/renewed co-operation had already taken place as a part of an official OECD "Kazakhstan Country Programme 2015-2016". The Department of Green Economy at the Ministry of Energy of Kazakhstan (MoE) had become the main counterpart for this work.[13]

In this regard, the government of Kazakhstan (represented by its MoE) and the OECD (represented by the OECD Environment Directorate) signed an agreement. Together, they would implement a project that would contribute to the promotion of green growth and low-carbon development in Kazakhstan. It would also provide analysis and support to policy dialogue on key governance elements of the green economy concept in the country.

As its main objective, work aimed to help the MoE to design a green investment programme. This programme, to be financed by public funds, would seek to stimulate demand for green investments in the country. In preliminary discussions with the OECD, the ministry requested support for designing an investment programme to reduce air pollution from the transport sector.[14]

The first (i.e. pilot) phase of the investment programme identified two participating cities: Kostanay and Shymkent. Neither city was a “capital” of the country.[15] In a second phase,

the programme would cover the major urban centres (19 or 21 of 23 regional cities) in the country.

Over 2016, the project team visited Kazakhstan on several occasions. It discussed the investment programme with experts from government offices in Astana, Kostanay and Shymkent, as well as from various international organisations active in the country.

1.2.2. Moldova

Similar to the case of OECD co-operation with Kazakhstan, the (former) Ministry of Environment of Moldova (MoEnv) had requested the OECD to help design and cost a selected climate-related investment programme. This programme had two aims. First, it sought to increase the government staff capacity to prepare and implement such programmes. Second, it aimed to serve as a model for preparing other low-carbon investment programmes. The basis for this work was laid in 2011 with the targeted training on designing and managing environmental investment programmes provided by the OECD to Moldovan environmental experts.[16]

The main objective of this work was to assist the newly created Ministry of Agriculture, Regional Development and Environment (and before, the MoEnv) in two areas. First, the ministry wanted to design a green public investment programme in line with good international practices. Second, it needed to estimate its cost with the aim of stimulating demand for green investments in the country, both from the national budget and international financing sources.

During preliminary discussion, the MoEnv – as the MoE in Kazakhstan – suggested that the future investment programme focus on reducing air pollution from the transport sector.

There seemed to be a few important reasons for this choice. On the one hand, until then, the Moldovan government had done little in this sector. On the other hand, the government had launched – with support from the German Development Cooperation through GIZ – the preparation of a new Air Pollution Reduction Strategy, Law on Air and air regulations. They saw the project as a natural ally and a good practical contribution to their work.

Again, two cities were identified to participate in the first (i.e. pilot) phase of the investment programme. These were Chisinau (capital) and Balti. The latter is the second most populated city in Moldova and the only other one in the country with a public transport network. Contrary to Kazakhstan, in a second phase, the programme would cover the suburban areas of the two pilot cities, as well as inter-city connections.

From the end of 2016 to the beginning of 2018, the project team visited Moldova on several occasions. They discussed different elements of the investment programme with experts from government offices and local public administrations in Chisinau and Balti. They also met with experts from various international and national organisations active in the country.

1.2.3. Kyrgyz Republic

The selection of Kyrgyzstan as the third country was mainly influenced by a demonstrated high level of ownership of the Kyrgyz partners.[17] The delegation of Kyrgyzstan and the OECD initially discussed the project at the meeting of the GREEN Action Task Force on 25-26 October 2017 in Almaty. The OECD, which hosts the GREEN Action Secretariat, expressed its readiness to support Kyrgyzstan. Together, they could design a well-

functioning finance system to achieve efficient, inclusive and greener economic growth in the country.

As its main objective, work sought to help the Ministry of Economy (MoEcon) to design a green public investment programme in line with good international practices and estimate its cost. This, in turn, would aim to stimulate demand for green investments in the country, both from the national budget and international financing sources.

The focus of the investment programme was on reducing air pollution and GHG emissions from the public transport sector. Two cities were identified to participate in the pilot phase: Bishkek (the capital) and Osh (the second most populated city in the country). In the second phase, the programme would cover the suburban areas of the two pilot cities, as well as some indicative inter-city connections.

In the first half of 2018, the project team visited Kyrgyzstan on several occasions. They discussed different elements of the investment programme with experts from government offices and local public administrations in Bishkek and Osh. They also met with experts from various international and national organisations active in the country.

Notes

1. Kazakhstan's unconditional goal was 15% reduction of GHG emissions by 31 December 2030 compared to the baseline year 1990. Its conditional goal was 25% reduction of GHG emissions by 31 December 2030 compared to the baseline year 1990. The latter goal was subject to additional international investment, access to the mechanism for the transfer of low-carbon technologies, green climate funds and the mechanism of "flexibility" as a country in transition (GoK, 2015[10]).

2. Moldova's unconditional reduction target varies between 64-67% depending on the scenario selected. A scenario of self-sufficient power system development had a reduction target of 64%, while a scenario of imported electricity had a 30% reduction target. The reduction targets have been set for the January 2021 – December 2030 emission budget. The conditional target is set at 78% (GoM, 2015[11]).

3. The country's unconditional mitigation target is to reduce GHG emissions in the range of 11.5-13.8% compared to BAU by 2030, and by 12.7-15.7% below BAU by 2050. The conditional target is to reduce GHG emissions in the range of 29.0-30.9% below BAU by 2030, and from 35.1-36.8% below BAU by 2050. These latter targets are subject to international support available to the country (including low-cost financial resources, technology transfer and technical co-operation) (GoK, 2015[10]).

4. For INDC submissions, see https://www4.unfccc.int/sites/submissions/indc/Submission%20Pages/submissions.aspx.

5. According to the climate pact, the INDC becomes the (country's first) NDC upon its ratification of the Paris Agreement. However, countries may request not to convert their INDCs into NDCs upon ratification. They can also revise the submitted INDC and offer a different plan/roadmap to reduce the GHG emissions.

6. Kazakhstan has made voluntary commitments to retain GHG emissions in 2020 at a level not lower than 15% below the base year level. Therefore, GHG emissions can grow up to 5.5% from the current level, as long as they do not exceed the committed target.

7. The high contribution of the energy sector notwithstanding, the Kyrgyz Republic has significant potential for unconventional and renewable energy sources. These include solar, hydropower and geothermal energy and biogas; wind power is not economically feasible. However, from the late 1990s until 2005, the percentage of the energy generated by hydropower stations, as well as the energy generated by burning of fossil fuels, remain practically constant (GoK, 2016[4]).

8. See CAIT 2.0 WRI's Climate Data Explorer at: www.climatewatchdata.org/countries/KGZ.

9. More specifically, it had been envisaged to use a programme costing methodology developed by the OECD, with support by Germany (again, through its IKI), and tested previously in Kazakhstan (OECD, 2017[6]). From 2011 to 2012, the OECD supported the Ministry of Environmental Protection of Kazakhstan in designing a public investment programme for energy efficiency measures in the residential sector. As part of the "Climate-smart public spending at the national level in Kazakhstan" project, the OECD developed a methodology for climate-related investment programmes. It included, among others, an Excel-based model to assess the costs of the programme and environmental impacts.

10. Given the complexity of the project, an international consulting company was needed to support project implementation. An international tender – which the OECD organised from October 2015 to February 2016 – was won by a consortium of Kommunalkredit Public Consulting (KPC) from Austria and SST-Consult from Poland. Subsequently, a 29-month implementing contract was signed in March 2016.

11. This also considered the latest developments, such as large-scale administration reform in Moldova that included a substantial personnel reshuffle.

12. Examples include *Good Practices for Public Environmental Expenditure Management in Transition Economies* (UNECE/OECD, 2003[12]), or the *Handbook for Appraisal of Environmental Projects Financed from Public Funds* (OECD, 2007[13]).

13. The "Memorandum of Understanding Concerning a Country Programme between the Government of the Republic of Kazakhstan and the OECD" was signed on 22 January 2015 by the Prime Minister of Kazakhstan, Mr. Karim Masimov, and the OECD Secretary-General, Mr. Angel Gurria. The memorandum included environment as one of the substantive areas of co-operation between Kazakhstan and the OECD.

14. However, given the large number of different types of investments that can be made within this area, the programme scope needed to be further clarified before the work on its design actually started.

15. Given the concentration of investment projects supported by different international financing institutions in Astana and Almaty, the project team decided to consider other cities. However, MoE made the final decision.

16. Training had the official title "Environmental programmes as part of medium-term expenditure planning".

17. Originally, Ukraine was also considered to be a suitable candidate.

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2. Description of green public investment programmes and their costing methodologies

This chapter outlines the main elements and approaches to designing and implementing public investment programmes with priority environment and climate-related targets. The design phase presents an overall structure and operating instructions of an OECD support tool called the Optimising Public Transport Investment Costs (OPTIC) model. For implementation, it presents possible strategies and ways to set optimal co-financing levels from the public purse. The chapter concludes with examples of good practices from the EU countries in achieving cost-effective and transparent public environmental spending targeted at domestic transport sectors.

2.1. Green public investment programmes

2.1.1. Objectives and main elements

The green public investment programmes aim to contribute to national objectives related to the country's climate change mitigation efforts; to air pollution reduction in main urban areas; and, ultimately, to countries' transition to a greener economy.

In practice, this overall objective will be accomplished by supporting investments (i.e. creating a demand) for a needed replacement of outdated (depreciated) diesel-powered urban public transport vehicles (both municipally owned, as well as private ones).

The designed Clean Public Transport (CPT) Programmes incorporate multiple objectives:

- reduce greenhouse gas (GHG) emissions in the public transport sector, especially of carbon dioxide (CO_2)
- reduce emissions of hazardous air pollutants in urban areas: carbon oxide (CO), nitrogen oxides (NO_x), particulate matter (PM) – especially $PM_{2.5}$, and sulphur dioxide (SO_2)
- increase the reliability and efficiency of public transport through modernisation of the urban transport fleet, i.e. increase the ratio of new buses (less than five-years-old) used for urban public transport
- stimulate the domestic market to produce, or at least assemble, modern buses and trolleybuses (or other types of modern buses powered using cleaner fuels).

The **environmental objectives** of the CPT Programme are expected to be accomplished by using budget support to replace the public transport fleet with modern vehicles powered by cleaner fuels or technologies. In terms of emissions reductions, the most significant improvements are expected to be less CO_2 and NO_x in absolute terms and less $PM_{2.5}$ and SO_2 in relative terms. Air pollution caused by small PM is associated with increased cardiopulmonary and lung cancer mortality. Increased air pollutants carry a risk of mortality, in particular among people more than 65-years-old. A clean public transport programme could thus be justified from a public health standpoint.

The **public service objectives** are in line with the country's transport strategies (municipal and national). They will be achieved by purchasing modern (brand new) vehicles (to increase reliability and comfort) and extending/improving service delivery outside of cities (to increase outreach).

By modernising the urban transport fleet, the CPT Programme will also contribute to the **socio-economic development** of municipalities and, ultimately, of the country. This will be achieved, for instance, through increasing the efficiency, reliability and radius of public transport networks. Improved mobility not only fosters productivity (access to jobs, markets), but also social inclusion (access to hospitals, schools), especially for low-income groups. The CPT Programme could also stimulate the domestic market to produce, or at least assemble, modern buses and trolleybuses. It could accomplish this through supporting the purchase of new buses rather than the modernisation of engines. This, in turn, could also generate new employment opportunities.

In practice, these environmental, public service and socio-economic development objectives will be accomplished by supporting investment to replace the dominant diesel-powered bus and minibus fleet used in urban, suburban or inter-city public transport.

Modern vehicles would be powered by cleaner fossil fuels, or by electricity generated by renewable energy resources or cleaner fossil fuels.

Each country case study analysed the market, identifying up to four groups of projects ("pipelines"[1]) to replace the old urban, suburban and inter-city bus fleet:

1. investment in vehicles fuelled by compressed natural gas (CNG)
2. investment in vehicles fuelled by liquefied petroleum gas (LPG)
3. investment in vehicles fuelled by diesel that meets Euro 5 and Euro 6 emissions standards
4. investment in electricity-powered vehicles (trolleybuses and battery trolleybuses).

The public transport fleet of the focus countries is ageing. Therefore, the proposed "pipelines" are intended to support the purchase of new vehicles (buses/minibuses and trolleybuses) rather than the modernisation of existing engines. Renewing the bus fleet will increase the reliability and efficiency of public transport. Meanwhile, the domestic market will be encouraged to produce, or at least assemble, modern buses and trolleybuses.[2]

The proposed investment pipelines should be accompanied by other investments in infrastructure. This could include new trolleybus lines, CNG/LPG refuelling and electricity charging stations. In addition, other supporting activities could improve the transport system in urban centres. These include the creation of bus lanes, improvement of bus stops and smart traffic control.

For instance, extending the trolleybus power-delivered network (trolleys) to cover the whole area would be too costly. In more remote areas, the trolleybus power-delivered network is not available. However, the network can be supported through battery trolleybuses. Even though these have only small batteries, they are cheaper to buy than electric buses.[3]

The public investment programme is designed to include two phases:

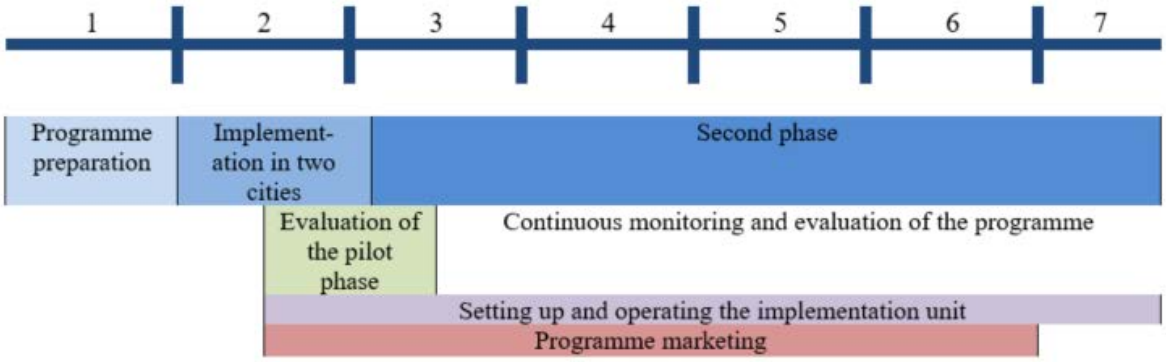
- The first (pilot) phase will be launched in selected pilot cities and focus primarily on urban transport (inner cities). The results will determine whether a second phase implementation on a larger scale is necessary/possible.
- The second (scaling-up) phase will extend the pilot phase. There are more possible scenarios for this phase: it can focus on additional cities with public transport networks (Kazakhstan), suburban areas of the pilot cities (Kyrgyzstan, Moldova), or even some indicative inter-city public transport across the country (Kyrgyzstan, Moldova).

The scaling-up phase in Kyrgyzstan is designed as a single-option case compared to Kazakhstan and Moldova, whose two-step approach included a moderate (Scenario 1) and a more ambitious (Scenario 2) alternative. In Kazakhstan, Scenario 2 includes two additional cities and a more advanced vehicle replacement in urban public transport fleets (i.e. replacing 10-year-old buses instead of the 15-year-old buses in Scenario 1). Scenario 2 in Moldova adds inter-city connections to suburban transport (in pilot cities chosen in Scenario 1). These connections serve as a substitute of a public transport network in other towns/cities in Moldova. Kyrgyzstan's arrangement is similar to Moldova. However, since inter-city connections in Phase 2 are only indicative, only one scenario was designed.

Before the first phase of the programme is launched, a preparation period will include the programme financial provisions in the state budget process. It will also identify and apply for funding from additional financing sources, including external donors.

As shown in Figure 2.1, the pilot phase was designed to last only one year (after one year of programme preparation). Scaling-up phases vary between two and five years, depending on the scenario and level. Some regional measures of the second phase might take less time (for instance, Osh in Kyrgyzstan). In all cases, the programme as such will take six years (plus one) to implement.

Figure 2.1. Proposed timeline



The second phase will require establishment of a programme implementation unit (IU) at the national level. This unit will market the programme, announce calls for proposals, collect applications, appraise and select projects, disburse funds, and monitor and evaluate the rollout and results.

The experience of other countries with similar publicly supported investment yields valuable lessons. It suggests that programmes are best carried out over the medium- to long-term and related to government targets. Thus, the CPT Programme could be carried out over five years and then reviewed in detail. At that time, it can be extended or closed based on possible new policy objectives and government goals or market developments.

In addition, annual evaluations of the CPT Programme should assess whether the selected and implemented projects are helping meet government objectives. Remedial measures could be taken if necessary. Since the programme is designed to be co-financed through the state budget, any update should be co-ordinated with the multi-year budget/requirements. On this basis, annual financial plans should be prepared for financing through the regular annual budget.

2.1.2. Approach to costing of the environmental programmes

The review of different climate-related public investment programmes identified three costing methods:

- **Bottom-up approach**: This involves collecting information from the field (prospective investors, such as local governments, utilities, etc.) and then aggregating on a higher (regional, national) level.

- **Top-down approach**: This involves imposing rules and procedures that ensure only projects within a specific (scope, costs, environmental effect) margin are implemented.
- **Average cost method**: This involves dividing the total cost of goods in inventory by the total number of items available for sale (weighted average).

Each method is used for a different type of environmental public investment programme.

The bottom-up approach is appropriate for large investments that are not replicable. An example of such a programme would be implementing the wastewater collection and treatment where each locality has different costs and solutions. Thus, separate design and before-concept documents have to be prepared at the local level. Such investments usually require separate feasibility studies for each project.

The top-down approach is used when a programme promoter decides on a relatively small margin of the project's scope and costs. The programme may contain a number of types of projects, but the promoter needs to know the details of each type (usually through research studies or pilot projects). Then the programme is comprised of many replicable and relatively small elements, mostly by buying equipment. An example of such an approach would be financing solar collector or photovoltaic (PV) on a household level, where the costs of solar collector or PV per square metre are well known.

The average unit costs method is used for costing when many replicable elements are implemented, and the programme promoter cannot decide on a relatively small scope and costs margin. This would be used, for example, in CPT Programmes that buy cleaner-fuel buses that may differ one from another. These differences could be due to procurement, but also beneficiary needs such as bus size. The average type of the bus and average unit costs are used to calculate the programme costs. To increase accuracy, the promoter can propose more than one type of bus and investigate average costs.

2.1.3. Determining the optimal subsidy level

Calculating the optimal level of public co-financing for the purchase of new, cleaner vehicles is an important element of the analysis. Estimates suggest the level of public funds should not exceed the rates provided in Table 2.11. These rates, which represent the optimal subsidy level per project pipeline, were calculated using the OPTIC model based on the net present value (NPV) of each type of investment.

The rate of financial assistance (subsidy rate) should be set to ensure that it leverages, rather than replaces, beneficiaries' spending. This calculation will ensure the subsidy encourages potential beneficiaries to participate in the CPT Programme without aiming to make a profit based on the subsidy. Therefore, the level of the subsidy should be kept to the absolute minimum, especially given the scarcity of public resources. This optimal minimum can be defined as the rate of assistance that makes environmentally and economically important projects financially viable (for further discussion, see Annex B to the country reports – "Determining the subsidy level").

The calculation of the subsidy level considers the marginal costs of new, clean buses (compared to old bus models) and the current unit price of fuel. The model checks that bus replacement does not lead to financial losses for the public transport operator. Thus, a social discount rate of 5-10% is used to determine the NPV of a typical project (e.g. bus replacement for CNG, LPG or Euro VI diesel bus). This discount rate is similar to the rate used by other public financing institutions that support similar investments.

Box 2.1. Determining the optimal subsidy level

The level of the subsidy should be sufficient to attract potential investors/beneficiaries to apply for support from the CPT Programme without making the implemented projects profitable. To evaluate a given project, the net present value (NPV) is first calculated by totalling the expected net cash flows (cash inflows/receipts minus cash outflows/expenses) over the project operating period. These net cash flows are then discounted using the rate that reflects the costs of a loan of equivalent risk on the capital market. An investment will yield a profit if the NPV is positive. All measures that yield a positive NPV using a discount rate that corresponds to the applied rate of return can be deemed beneficial.

The NPV is calculated as in the following formula:

$$\mathrm{NPV} = \sum_{i=1}^{n} \left(NCF_i \times \frac{1}{(1+r)^i} \right)$$

where:

- NCF_i is the net cash flow in the i-th year
- r is the discount rate.

Using discounting considers two factors: the investor's expectations with respect to the measure and the capacity of the NPV to be greater than zero during the operating period.

The calculation of the subsidy level should be based on economic principles. If the project is socially significant rather than profitable for the beneficiary, the subsidy should generate a small amount of profit. In simple terms, the financial NPV, including the subsidy, should be approximately at the level of zero KGS. This means the project yields an acceptable rate of return for the investor/project promoter.

The "determination of the subsidy level" module uses this principle by making a simple financial analysis of the cash inflows and outflows in each year of the analysis. Cash inflows (receipts) generated by the project include fuel savings expressed in terms of the money saved by customers (public transport providers). In terms of cash outflows (expenses), the simple financial analysis totals the difference in investment costs of a clean and traditional bus calculated in the other modules. In the subsidy module, the subsidy is included on the cash outflow side as a negative value.

It was assumed that the project will invest during its first year and that savings are averaged over the nine years of operation. Together, the period of analysis is ten years, a typical lifespan for this type of project. The subsidy is calculated so that the result of the NPV calculation is equal to zero KGS.

This approach to calculating the subsidy will enable the government to avoid over-investing. At the same time, it will provide an investment incentive for potential beneficiaries without making it too profitable for investors. Essentially, the subsidy level should provide only the necessary leverage for individual potential beneficiaries to undertake clean transport investments.

Two issues arise regarding the calculation of this optimal subsidy level. First, if a public transport operator has already modernised its fleet, buses will not likely need replacement in the near future. (A modern fleet, for example, would have already replaced ageing buses,

especially those more than 15-years-old). Thus, calculation of the subsidy level only considers the price difference between modern clean buses and traditional buses.[4] Second, some fuels will be cheaper than diesel. For example, CNG and LPG are cheaper than diesel even after considering increased consumption. Therefore, calculations of the subsidy level consider savings in fuel costs for public transport operators.

2.1.4. Financing requirements, options and sources

Analysis suggests that the total costs of the CPT Programme will be substantial. The second (scaling-up) phase of the programme would require from public financiers an estimated KZT 41 818 million (USD 121.98 million) in Kazakhstan (Scenario 2). It would require between MDL 2 394-5 542 million (USD 129.4-299.6 million) in Moldova (Scenario 2). Finally, it would require KGS 3 762 million (USD 54.63 million) in public financing in Kyrgyzstan.

It will therefore be challenging for the public financier in all three countries to cover all these costs alone. Public financial and guarantee support will be needed, including from international public financiers.

The analyses identified two possible options for funding the CPT Programme pipelines. In the first, the local banking sector would be involved, while in the second it would not. The proposed combinations of financing instruments are as follows:

- **Option 1.** Commercial loans, combined with public support in the form of loan guarantees and a relatively smaller subsidy (a grant) to help public transport operators repay a portion of the loan (Figure 2.1).
- **Option 2.** Public support in the form of a relatively larger subsidy (a grant) to motivate public transport operators to allocate more of their own financial resources to purchase cleaner vehicles. Such vehicles generally require a higher initial investment (in terms of purchase cost), but are less expensive to operate (in terms of fuel costs) (Figure 2.2).

In general, the investment programme foresees public grants, commercial and preferential loans, and public loan guarantees as the most targeted support options. Finance is available, primarily through national public authorities (grants), or international/development financial institutions (preferential loans and grants). For an immediate programme implementation, Option 1 is recommended only for Moldova (Table 2.1). In the future, however, the involvement of national commercial banks (commercial loans) together with national public authorities (loan guarantees) could broaden the scheme and its financing options in Kazakhstan and Kyrgyzstan as well.

Table 2.1. Summary of public support for the CPT Programmes

	Kazakhstan	Kyrgyzstan	Moldova	
Programme pipeline	Public co-financing	Public co-financing	Public co-financing for Option 1	Public co-financing for Option 2
Trolleybus	n.a.	80%	25% + loan guarantee	50%
Buses (minibuses*) with engines fuelled by CNG	48%	37%	25% + loan guarantee	60%
Buses (minibuses*) with engines fuelled by LPG	48%	39%	25% + loan guarantee	55%
Buses (minibuses*) with engines fuelled by modern diesel (Euro 5/V and Euro 6/VI)	81%	65%	25% + loan guarantee	75%
CNG stations	100% when the number of CNG buses is lower than 100**	Provided by the private sector	Provided by the private sector	
LPG stations	Provided by the private sector	Provided by the private sector	Provided by the private sector	
Side investments	Provided by cities	Provided by cities	Provided by cities	

Note: Percentage values denote the level of public support from the bus purchase costs; *minibuses are foreseen only for Moldova; **conversely, 100% private co-financing when the number of CNG buses exceeds 100.
Source: OECD calculations, OPTIC model.

The provision of the loan guarantee (under Option 1) is a particularly important element in the CPT Programme financing in Moldova. The overall financial support (in the form of subsidies) may not be that high. However, the Ministry of Finance (as the main guarantor of public debt) can issue guarantees on bank loans. This would overcome the lack of creditworthiness of smaller municipalities and private operators (in addition to municipal transport operators in Chisinau and Balti). Involving the Ministry of Finance in programme design is therefore of crucial importance.

It is proposed that the loan guarantee consist of two components:

- a fixed cost for issuing the guarantee (equal to 0.5% of the loan)
- cost of the guarantee in case of default by borrowers (equal to 5% of the loan provided by the bank).

These shares are based on similar international programmes. The 5% guarantee cost – although rather low – is achievable provided the government sets strict conditions on loan provision. This will result in a low default rate. In any case, should there be a need to change the rates, all major programme outputs (e.g. total programme cost, level of subsidy) will need to be recalculated.

Banks will sign an agreement with the Ministry of Agriculture, Regional Development and Environment (MARDE) to provide the loan component. The source of financing for the loans granted by the banks could include:

- the banks' own resources
- loans to banks from international financial institutions (IFIs).

Figure 2.2. Option 1 – Financing from commercial loans

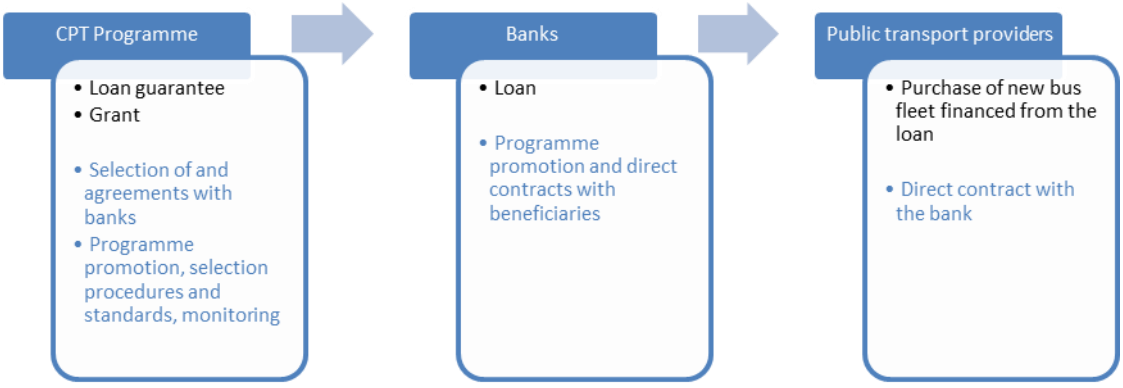
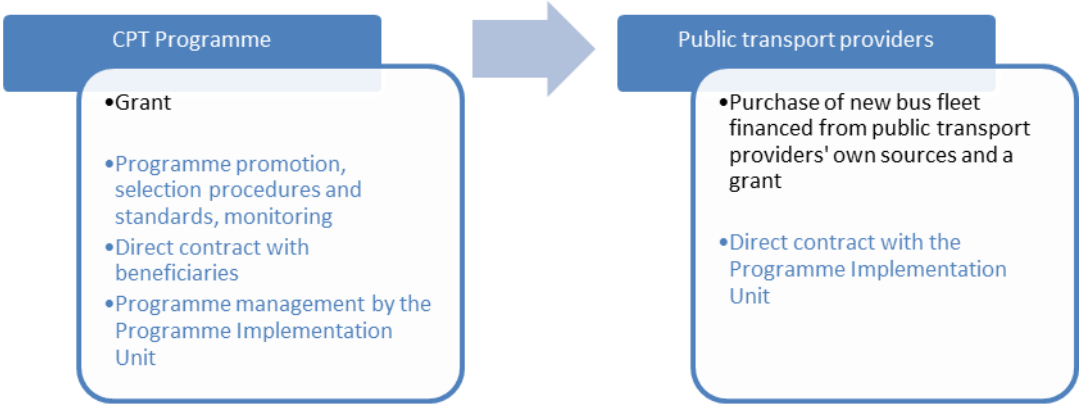


Figure 2.3. Option 2 – Financing from own sources and public grant



2.2. OPTIC model

The spreadsheet-based OPTIC model was developed to cost and calculate the environmental impact of the CPT Programme. The model supports costing of the following project pipelines:

- Replacement of the old bus fleet in urban centres with modern buses equipped with engines that run cleaner fossil fuels/power carriers, including:
  - compressed natural gas (CNG)
  - liquefied petroleum gas (LPG)
  - diesel using (or importing) of Euro 5/6 fuel
  - electricity (trolleybuses).
- Since the bus fleet in the partner countries is ageing, the proposed pipelines are intended to support the purchase of new buses, not simply the modernisation of bus engines.

- Minibuses that dominate in the public transport are not excluded, normal buses (>10 m length) are preferred.

Only investment projects (i.e. those involving capital outlays) are eligible for financing under the programme. The list of eligible projects will be reviewed annually by the programme's IU to ensure the identified project types are relevant with regard to national environmental, climate and energy policy goals.

OPTIC is a simple, easy-to-use tool to support decision making around proposed project pipelines. It is used exclusively to estimate programme costs, CO_2 emission reductions and emission reductions of other pollutants from urban public transport (CO, NO_x, PM, SO_2).

Box 2.2. The OPTIC model

The Optimising Public Transport Investment Costs (OPTIC) model was developed along with this study and is one of the main outputs of the project.

OPTIC's spreadsheet-based model is a simple, easy-to-use tool to support decisions. It was prepared exclusively to calculate and optimise total programme costs, as well as the emission reductions of CO2 and other pollutants from urban public transport (CO, NOx, PM, SO2) that might be achieved by implementing the proposed project pipelines. The model also enables calculation of the optimal level of subsidy for potential beneficiaries.

Optimisation of costs and benefits implies achieving given targets at the lowest possible cost for the public financier. Both targets and subsidy levels can be recalculated (or optimised) and adjusted accordingly if underlying economic conditions in the country change over the programme period and/or available public financing is reduced or augmented. Examples of economic factors include higher tariffs or lower interest rates on commercial loans.

The model consists of seven modules: i) assumptions; ii) emission factors; iii) transport sector overview with information on current bus fleet and age; iv) subsidy level; v) cost calculation; vi) emission reductions calculation; and vii) programme costing and environmental effects.

Similar models on the market focus on estimates of GHG emission reductions for a country or for groups of countries. These models mainly focus on GHG emissions from industry and consider different scenarios for the country's economic development. These models, however, are not particularly suitable for this investment programme, which focuses on reducing emissions only from urban public transport.

The model could be used in two ways. On the one hand, it could optimise GHG emission reductions given a specified programme budget. On the other, it could optimise the programme budget for an assumed level of reduction of GHG emissions. As such, the model acts as an analytical tool to make decisions more informed and transparent. At the same time, it allows the calculation of the optimal level of subsidy that would encourage potential beneficiaries to make necessary investments.

2.2.1. Overall structure and use of the OPTIC model

OPTIC consists of seven modules: i) assumptions; ii) emission factors; iii) transport sector overview with information on current bus fleet and age; iv) subsidy level; v) cost calculation; vi) emission reductions calculation; and vii) programme costing and environmental effects. The model has been prepared in Excel and uses macros. The user fills the cells that are highlighted in yellow in the Excel sheets.

1. Assumptions
2. Emission factors

As the model uses the average unit costs method for costing, users enter the average price of a new CNG, LPG, diesel bus equipped with a Euro 4/IV engine and trolleybus. The model supports two sizes of buses (normal and minibuses).

Users then provide the average level of fuel consumption of each bus. This information will also include old diesel buses that will be replaced. For the purpose of the model, old diesel buses were divided into several categories: new and more than 5-, 10- and 15-years-old.

Users provide information on fuel costs for each type of bus. The information on average kilometres per vehicle per day (kpvpd).

After providing basic assumptions, users input information on unit emissions from buses. The proposal is included in the model, but can be adjusted for the country specifics.

3. Transport sector overview with information on current bus fleet and age

Users provide information on the urban public transport sector by dividing the fleet by bus type.

4. Subsidy level

The model contains the module on determining the subsidy level. It considers both investment costs and savings that public service providers may achieve by replacing old buses. New buses using alternative fuels are more efficient because of technological improvements, as well as the lower price of CNG and LPG fuels compared to diesel.

5. Cost calculation

This module shows the estimated investment costs and the required subsidy by the programme. A table contains data on public transport in the country, the number of buses to be replaced, the type of new buses, total investment costs, the level of subsidy and the net costs to beneficiaries. In this module, users simply input factual information without making any decisions on the programme.

6. Emission reductions calculation

This module shows the estimated annual emission reduction by type of pollutant.

7. Programme costing and environmental effects

This module supports decision making, either for automatic calculation of programme costs or for manual adjustments.

Users may define one of the following programme targets:

- investment costs

- subsidy budget (amount of funding available for subsidies)
- CO_2 emission reduction
- CO emission reduction
- NO_x emission reduction
- $PM_{2.5}$ emission reduction
- SO_2 emission reduction.

By clicking on the "Go" button to the right of the respective target, the model calculates the programme financial envelope necessary to achieve the target (i.e. it excludes other targets).

The algorithm for the programme cost calculation is as follows:

- The model reviews the information on public transport for each city. The review is done in three iterations (urban centres, suburban centres and inter-city connections).
- The model determines whether the city has any potential for CNG buses; if so, it proposes replacement of an old bus by a CNG bus.
- The previous step is repeated until the target is reached or all old buses in a given iteration are replaced.
- If the city does not have the potential for CNG buses, the model completes the same steps with Euro VI diesel buses.
- If the city lacks the potential for either CNG or Euro VI buses, the model proceeds through the same steps with LPG buses.

The results are presented in an Excel table that contains basic information on the number of new buses, investment costs, subsidies and emission reductions per year.

Users may change the project pipelines by providing their own information on the number of new buses. Calculations are updated accordingly.

2.2.2. Potential future use of the OPTIC model

The OPTIC model is well developed, but it focuses narrowly on clean public transport programmes. It also has four predefined project pipelines (CNG, LPG, modern diesel buses and trolleybuses) and two sizes of buses (normal and minibuses). The user manual is part of the country report on specific programmes.

The model will need adjusting if the development of the future programmes goes beyond the predefined project pipelines (e.g. including electric buses). An Excel expert can make the adjustment, including using the macros. The development of the different scenarios may also require some knowledge of Excel.

The programme may be based on the similar principles described above and narrowed to the pipelines in the OPTIC model. In these cases, the model can be used for costing, estimating environmental effects and developing the different scenarios of the respective programmes.

2.2.3. Training toolkit

The training toolkit aimed to provide participants with a better understanding of issues involved in designing public investment programmes.

The toolkit consists of three main parts:

1. designing medium- to long-term public environmental expenditure programmes
2. implementing environmental expenditure programmes with a focus on project cycle management
3. implementing practical exercises.

The toolkit was partially based on the *Handbook for Appraisal of Environmental Projects Financed from Public Funds* (OECD, 2007[1]). The handbook aims to help governments design and implement public environmental expenditure (investment) programmes, as well as to supervise and evaluate the performance of agencies implementing such programmes. It was based on a study by the OECD with regard to opportunities for, and obstacles to, integrating multi-year public environmental programmes into medium-term expenditure frameworks. Several countries of Eastern Europe, Caucasus and Central Asia (EECCA) have introduced these programmes.

This analysis is summarised in a report on *Greening public budgets in Eastern Europe, Caucasus and Central Asia* (OECD, 2011[2]). The report aimed to help EECCA environmental administrations harness the potential benefits of ongoing public finance reforms in the region. The benefits are described in terms of both medium-term and performance-oriented budgeting. Thus, the toolkit was targeted at both decision makers who set rules for expenditure programmes, as well as managers who appraise, select and finance projects on a daily basis.

2.2.4. Exercises

The training toolkit contained two exercises designed to help participants learn practical skills.

First, participants designed a public environmental expenditure programme, setting objectives, specific targets and priorities. With a sample problem, they developed a problem tree, objective tree and a proposed title for the programme, as well as a draft logframe matrix. Participants then formulated targets for the specified programme, focusing on indicator, quantity, quality, time and sources of verification. In the last step, participants calculated costs of the hypothetical programme.

Second, participants focused on project appraisal using different environmental efficiency indicators. They reviewed five projects, ranking them based on the following three criteria: dynamic generation costs, emissions reduction/investment outlays, emissions reduction/annualised cost. Through this exercise, participants used Excel spreadsheet and Dynamic Generation Costs (DGC) software.

Due to time constraints, the exercises were shortened during the training sessions.

2.2.5. Software tools

An OPTIC model was prepared and then presented during the training workshops. It was also delivered to participants on USB memory drives. The user manual was part of the programme report.

DGC software, developed for previous OECD trainings, aimed to help calculate the environmental efficiency indicators, especially the DGC indicator. As the three programmes focused primarily on public transport, the DGC software tool was adjusted for this purpose.

The user manual was part of the training toolkit.

2.2.6. Participants

As the training workshop followed the presentation of the programme, usually the same group took part. The presentation of the programme and case studies interested a wider group of participants, including higher level representatives of respective ministries. The next day focused on training for programme preparation, project cycle management and selection of individual projects. This training was of chief interest to specialists of ministries, as well as representatives of cities, non-governmental organisations (NGOs) and other institutions. Additional training in the city of Balti was attended by eight persons that are directly involved in urban public transport.

The selection of participants was a challenge. Experts working in the respective ministries responsible for environment were the first choice. Representatives of ministries such as transport and economy interested in programme implementation were the second choice. However, no country where the programmes were implemented had an IU (or organisation that could play this role). Only Moldova had broad experience in operational environmental (and other) funds. However, due to changes in the ministries and a shortage of employees, the respective experts were not available. Thus, the selected participants were not optimal, especially for the part of the training related to programme implementation.

The availability of participants was also a challenge because the workshop took place over the summer holidays. As a result, in the Kyrgyz Republic in July 2018, no representative of the Ministry of Finance or Ministry of Transport and Roads attended the workshop.

If the countries prepare the programme and create or select the respective IU, it will need further support to train experts.

2.3. Examples of good practices

Establishing and managing green public investment programmes require public financiers to follow essential elements for setting minimum requirements to ensure transparency and cost-effectiveness of public spending. The essential elements of good international practices include the following:

- clearly defined objectives that are specific, measurable, realistic and time-bound, and priorities that are few and unambiguous
- clearly defined timeframe of the programme
- specified cost estimates of achieving the objectives

- specified sources of financing, specified eligible project types and eligible beneficiaries
- clearly defined terms of financing including, among others, financial instruments (eligible form of subsidy), co-financing requirements and minimum/maximum level of support
- well-documented principles, rules and operating procedures for project cycle management
- clearly defined and robust criteria for appraisal, selection and financing of investment projects.

Source: (OECD, 2007[1]).

A public investment programme consists of two main stages: analysis and design (defining essential elements) and implementation. Implementation requires that public authorities select the best institutional arrangement; ensure stable and predictable sources of finance; and hire qualified managers. While these elements may look rather obvious and logical, their practical application is often quite challenging.

In the recent past, the OECD prepared several practical tools – including expenditure guidelines or models – that support an efficient use of public resources in state-supported programmes (Box 2.2). The costing methodology developed for the CPT Programmes (OPTIC model) builds upon previous work in this area (such as good practice handbooks). As such, it complements the range of support offered by the OECD to partner countries.

Box 2.3. OECD toolbox for strengthening green public finance in EECCA countries

The OECD has assisted the countries of Eastern Europe, Caucasus and Central Asia (EECCA) to improve management of their public resources allocated for green investments. The OECD has a number of practical tools to help prepare public investment programmes:

- Good Practices for Public Environmental Expenditure Management http://www.oecd.org/env/outreach/38787377.pdf (OECD, 2006[3]).
- Handbook for Appraisal of Environmental Projects Financed from Public Funds http://www.oecd.org/env/outreach/38786197.pdf (OECD, 2007[1]).

The OECD also developed an Excel-based model called Optimising Public Transport Investment Costs (OPTIC) and a methodology to support design of green investment in the public transport sector. The methodology, developed as part of the study on Kazakhstan, calculates the main financial and environmental parameters of the programme.

Several case studies from EU countries were assembled to help participants better understand what makes a well-prepared green investment programme. The following chapters review three case studies and summarise good and bad examples.

2.3.1. Austria

In Austria, different programmes cover "green" subsidies in the transport sector at the level of the federal government, federal states (*Länder*) and/or municipalities.

At the federal level, the *klimaaktiv mobil* programme is embedded in the broader climate protection initiative *klimaaktiv*. The latter was set up by the Ministry of Environment (currently Ministry of Sustainability and Tourism) in co-operation with the Ministry of Finance. It was supported by the Austrian Climate and Energy Fund and the Ministry of Transport. The Austrian Rural Development Programme 2014-2020 co-finances some *klimaaktiv* projects through the European Agricultural Fund for Rural Development and stimulates green mobility in rural areas.

The *klimaaktiv mobil* programme provides financial support to Austrian businesses, as well as towns, cities, municipalities, regions and individuals. It promotes an environmentally friendly transition towards electric mobility, cycling, intelligent mobility management and innovative mobility services. It also includes consulting and awareness-raising programmes, partnerships, and training and certification initiatives.

The *klimaaktiv mobil* portfolio of financial supports includes the following, among others:

- action package to enhance e-mobility with renewable energy
- investment in climate-friendly vehicle fleets and electric charging stations
- climate-friendly mobility management in enterprises (industry solutions, measures regarding logistics, public transport tickets for employees, fleet management, etc.)
- climate-friendly mobility management in tourism industry (shuttle services, etc.)
- car sharing
- promotion of cycling.

The financing support is covered by a flat rate or a fund rate support.

Flat rate support is granted for specific core themes like e-vehicles, vehicles using alternative fuels or charging stations depending on size and technology used. An overview of these flat rates, valid till the end of July 2018, is provided in Table 2.2.

Table 2.2. The key parameters for public support under Austrian klimaaktiv mobil programme

Lump sums for vehicles	EUR
Purchase of cars (using 100% renewable energy)	1 500*
Adaptation of vehicles (operated with min. 50% biodiesel)	200
Adaptation of vehicles (using min. 50% biogas)	1 000 – 5 000
Adaptation or purchase of hybrid vehicles (using min. 50% biofuels)	600 – 10 000
Purchase of electric buses for up to / more than 39 passengers (using 100% renewable energy)	40 000 / 60 000

Note: * With an additional contribution of EUR 1 500 from importers.
Source: Data obtained from KPC.

Projects with a wider focus receive a standardised funding rate of 20% of the environment-related investments costs. This rate can be upgraded to a maximum of 30% with an additional funding bonus (5% each) if the project meets these conditions:

- It combines at least two different measures.
- It implements awareness-raising measures.
- It includes further companies or stakeholders.

The subsidy is, however, capped with the maximum funding according to the environmental effect:

- EUR 450/year of reduced tCO_2 + EUR 50/year of reduced tNO_x + EUR 10/year of reduced kg dust.

The financial support within the *klimaaktiv mobil* programme is managed by a private company (Kommunalkredit Public Consulting GmbH). This support ranges from the technical and financial appraisal of grant applications to submission of applications to the Ministry of Environment. It also includes fiduciary management such as disbursement of grants throughout the agreements.

The successful outcomes of the programme since 2006 are the following:

- around 12 000 supported projects
- financial support for mobility projects amounting to around EUR 100.5 million + EUR 7.6 million from EU funds
- around 2.7 million tonnes of CO_2 saved
- around 6 000 so-called green jobs secured or saved.

The following further achievements can also be attributed to the programme:

- awarded European Best Practice twice
- contributed towards reaching energy, climate and environmental targets of the European Union and Austria
- helped protect the environment and counteract climate change
- provided an important incentive for eco-friendly mobility
- improved citizens' quality of life.

Success factors included the following:

- partnerships with auto importers and two-wheeler importers, as well as sports retailers, to fund e-vehicles
- the huge number of awareness-raising campaigns promoting green transport involving different kind of media and stakeholders
- partnerships with organisations such as the Austrian Economic Chamber, the Institute for Economic Promotion, the Associations of Cities and Municipalities, etc.

2.3.2. Czech Republic

In the Czech Republic, there is no one single programme to highlight. However, good co-ordination has generated interesting results. The key actors and legislature in sustainable transport include three ministries:

- Ministry of Industry and Trade:
  - In 2005, the government adopted the Support Programme for Alternative Fuels in Transport – Natural Gas.
  - In 2015, the ministry drafted the National Action Plan for Clean Mobility. It states that by 2020, CNG should represent 10% of total energy consumption in the transport sector; alternative fuels as a group should represent 20-23%.
- Ministry of Transport:
  - It negotiated with the European Commission how to enable EU funds to support development of refuelling/recharging infrastructure in the Czech Republic.
- Ministry of Finance:
  - It regulates value-added tax, road and excise taxes, and highway tolls.
  - In 2006, the Ministry of Transport and nine gas distribution companies agreed to provide public transport operators with a CNG station if these run at least four CNG-powered buses (with a minimum consumption of 100 000 m³/year/bus). The minimum number of recharging and filling stations according to the National Action Plan for Clean Mobility (2015)[5] is provided in Table 2.3.

Table 2.3. The minimum number of recharging and filling stations according to the National Action Plan for Clean Mobility (2015)

	2015	2025	2030
Recharging stations	200	1 300	
CNG filling stations	100	200	300
LNG filling stations	0	1-2	5
Hydrogen filling stations	1		3-5
Recharging stations	200	1 300	

Source: Ministry of Industry and Trade of the Czech Republic (www.mpo.cz).

Financing is split between several public support programmes supported by both Czech and EU funds (national/operational programmes). They are focused on different aspects of introducing eco-vehicles and building up the related infrastructure:

- Operational Programme Transport II
- Integrated Regional Operational Programme
- Operational Programme Enterprise and Innovation for Competitiveness
- National Programme Environment
- Epsilon Programme
- Operational Programme Prague – Growth Pole of the Czech Republic
- Tax exemptions and other fees/waivers.

As the development of clean transport is complex, one example of the CNG-fuelled vehicles is provided below to illustrate.

Between 2006-10, the Ministry of Transport supported a programme to replace city and inter-city bus fleets. It compensated half the difference between a diesel and a CNG-powered bus (up to EUR 20 000 per vehicle). Annual (ad hoc) allocation for the programme was EUR 8-12 million. Currently, gas distribution companies provide subsidies of EUR 8 000 per CNG-powered bus.

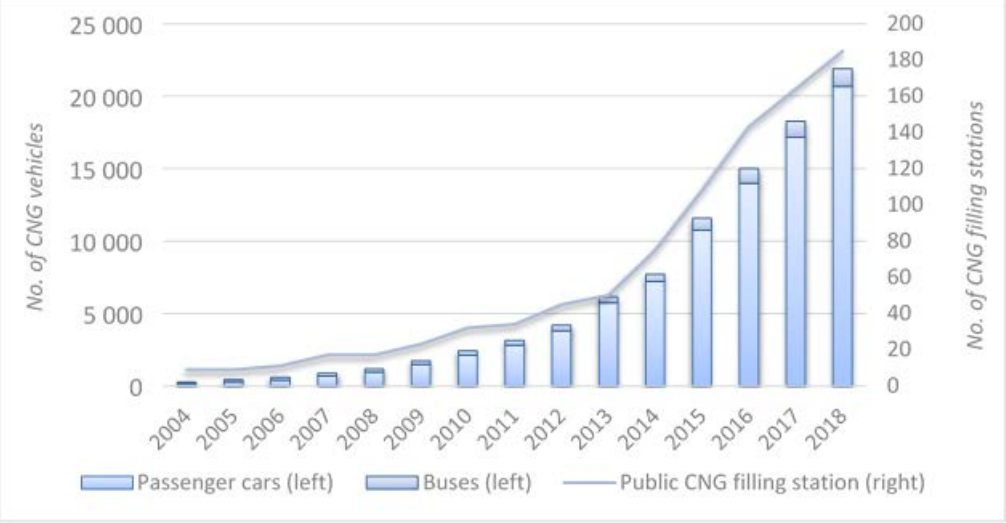
Compared to 2007-13, the 2014-20 period of Operational Programme Environment puts more emphasis on supporting sustainable forms of transport and reducing adverse impacts of this sector on the environment. It offers grants of up to 90% of total eligible expenses. Additional national public co-financing (state budget or the State Environmental Fund) is not only possible but also required.

Three criteria are used to identify inefficient buses for replacement. Vehicles need to be at least ten-years-old, to comply with Euro 1-3 emission standards, and have at least 500 000 km in mileage.

As a result, about 21 900 different CNG vehicles were in the Czech Republic at the end of 2018, as well as 185 CNG filling stations (25 in Prague). Of these vehicles, over 1 230 CNG buses were used for public transport in more than 60 cities. There was a 20% increase in the number of CNG-powered vehicles between 2017 and 2018.

The results of the implementation are also illustrated in Figure 2.4.

Figure 2.4. CNG vehicles and filling stations in the Czech Republic, 2004-17



Source: Czech Gas Association (www.cgoa.cz).

In addition to the programmes above, the city of Prague prepared a Sustainable Mobility Plan that is integrated with sustainable urban development. The plan envisages three development scenarios: Efficient Prague, Rational Prague and Liberal Prague. Together, the scenarios list priority measures required to develop sustainability in the city's transport. It contains a long list of 414 potential actions for a cost of EUR 13.6 billion. A reduced list contains 141 measures for a cost of EUR 2.5 billion. The plan was expected to be approved by the end of 2018.[6]

2.3.3. Poland

The programme "Gazelle BIS – Low-emission collective urban public transport" was prepared by the Polish National Fund for Environmental Protection and Water Management (NFEP&WM). The pilot phase was implemented, but the second phase was postponed. Still, it is a good example of preparation for a country-wide green investment programme.[7]

As its general objective, the programme seeks to reduce human exposure to the effects of air pollution in areas with significant excesses and target concentration levels of these pollutants. To that end, it will develop air protection programmes and reduce emissions of pollutants, particularly PM ($PM_{2.5}$, PM_{10}) and CO_2 emissions. The programme budget was estimated at PLN 425.5 million (~ EUR 100 million). Grants are intended to provide PLN 125 million of this amount, while soft loans provide PLN 300 million.

The programme implementation was set to take place over 2016-23. However, as it has not started yet, it is under significant review. The programme is supposed to co-finance the following vehicles:

Hybrid buses:

- Length < 13m: up to PLN 1.6 mln (< 400 thous. EUR)
- Length > 13m: up to PLN 2.1 mln (~ 500 thous. EUR)

Electric buses:

- Length < 13m: up to PLN 1.8 mln (~ 450 thous. EUR)
- Length > 13m: up to PLN 2.4 mln (~ 550 thous. EUR)

Gas-fuelled buses (like CNG):

- Length < 13m: up to PLN 1.1 mln (~ 250 thous. EUR)
- Length > 13m: up to PLN 1.5 mln (~350 thous. EUR)

Trolleybuses:

- Length < 13m with battery: up to PLN 1.9 mln (>450 thous. EUR)
- Length < 13m without battery: up to PLN 1.6 mln (<400 thous. EUR)
- Length > 13m with battery: up to PLN 2.2 mln (~500 thous. EUR)
- Length > 13m without battery: up to PLN 1.9 mln (>450 thous. EUR)

Trams:

- Length < 31m: up to PLN 8 mln (< EUR 2 mln)
- Length > 31m: up to PLN 10 mln (< EUR 2.5 mln).

In addition, the programme is supposed to co-finance this additional infrastructure:

- CNG/LNG stations
- electricity charging stations

- traffic control to ensure high priority for public transport (including area control systems and traffic light systems)
- bus lanes
- park & ride not farther than 100 m to the bus/tram stop
- passenger information system at bus stops, in the vehicles, online
- ticket sale systems
- parking fee payment stations
- bike roads
- trolleybus infrastructure.

The co-financing rate is up to 100% of the investment costs. However, new transport cannot exceed 80% of the total costs. Supporting infrastructure (automatic control, bus lanes, park & ride, CNG stations) cannot exceed 50% of total costs. The beneficiaries are local governments (cities) and municipal associations. They must ensure that at least 20 km of public transport services are available per citizen. At the same time, they should provide at least 3 parking spots per 1 000 citizens. Project selection criteria include environmental effects, project financing structure (not only new transport means, but also supporting infrastructure), project feasibility and cost efficiency.

The programme is implemented by the NFEP&WM Fund. The Fund's webpage provides information, as well as application forms, general rules for co-financing and methodology to calculate the environmental effects. Applications are submitted using a web-based software ("application generator"). It also provides information on the two stages of project appraisal.

In 2018, the government of Poland introduced an excise tax relief for CNG and LNG fuel, as well as an "emission fee" for other fuels. The emission fee will be the major source of financing of the revised programme. The fee is expected to generate at least PLN 10 billion (EUR 2.4 billion) over ten years. The government has also introduced legislation giving the cities authority to design clean transport zones.

2.4. Conclusions

As the OPTIC model calculations and experience from other countries have shown, the total cost of implementing the CPT Programme will be substantial. New technologies are more expensive before they reach market maturity. Therefore, public financial support will be necessary to help public transport operators (both municipal and private) to upgrade to a modern and environmentally friendly vehicle fleet.

The investment programme foresees public grants, commercial and preferential loans, and public loan guarantees as the most targeted support options. Finance is available, primarily through national public authorities (grants) or international/development financial institutions (preferential loans and grants). In Moldova, the involvement of national commercial banks (commercial loans) and national public authorities (loan guarantees) provides additional financing options.

When calculating the optimal level of public support (subsidies in the form of grants), the programme analysis considered several factors. Vehicles using alternative fuels incur lower

running costs as these fuels/sources of power are less expensive. They also incur lower operational and maintenance costs due to higher reliability of new vehicles and the need to replace vehicles that have been fully depreciated.

For these economic reasons (i.e. achieved savings in operational costs), the CPT Programme need not be completely financed by grants. The programme is designed to increase investment by public transport operators in the vehicle fleet without making the replacement too much of a drain on public resources (or to support purchases that would/could take place without public support).

In any case, applying a robust methodology can make the CPT Programme more credible for both national and international public financiers. Such a methodology could estimate the costs of the investment programme, set the optimal level of subsidy and forecast the expected environmental benefits.

Notes

1. As used here, a "project pipeline" is a set of projects in a given sector. These projects have been conceived and developed to achieve the objectives of the investment programme. Thus, the project pipeline is a repeatable procedure according to which priority projects are identified for their compliance with the programme's objectives.

2. There is no (clean) bus production in Moldova because there is no demand for new buses. However, the European Bank for Reconstruction and Development funded a project in Chisinau that led to a follow-up project for the licensed assembly of Belarusian trolleybuses. This has demonstrated that creating demand through the CPT Programme may help start domestic production in co-operation with a bigger producer, or at least support local assembly.

3. Battery trolleybuses can travel for a limited number of kilometres depending on battery capacity, which is proportional to the costs of the battery price. However, most of the journey uses the typical electricity-supplied wire network in the city. The batteries can be charged while the trolleybus travels in the urban centre.

4. Given that most public transport operators would rather buy used, but relatively new buses, the price of a used bus served as the basis for the calculation.

5. The document is available (in Czech) at: https://www.mpo.cz/assets/dokumenty/54377/64225/657999/priloha001.pdf.

6. For more information, see the "Tune up Prague" website: http://www.poladprahu.cz/en/sustainable-mobility-plan-for-prague-and-its-suburbs.

7. This programme is a part of a larger project on "Improvement of air quality". For more information (in Polish), see https://nfosigw.gov.pl/oferta-finansowania/srodki-krajowe/programy-priorytetowe/poprawa-jakosci-powietrza.

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3. Summary of the main findings and observations from the country-level analyses and training workshops

This chapter describes the main results of the preparation process for green public investment programmes in Kazakhstan, Kyrgyzstan and Moldova. It starts with a brief transport sector and air pollution assessment for each of the three focus countries. It then presents the main outcomes of the respective programme analysis, including costs and associated environmental benefits. The design also proposes a three-level structure for managing each country programme: 1) a programming entity; 2) an implementation unit; and 3) a technical support unit. Finally, it illustrates some key obstacles observed during implementation of the respective country projects.

3.1. Kazakhstan

3.1.1. Transport sector and air pollution assessment

Structural and technical features make vehicle transport an important contributor to the high level of air pollution in many cities in Kazakhstan. Transport vehicles generate 88% of greenhouse gas (GHG) emissions in the transport sector and contribute to the already high carbon intensity of the Kazakh economy. Most of these vehicles in Kazakhstan are more than ten-years-old. Cars and buses run mostly on diesel (about 80% of the fuel used). For their part, diesel engines barely correspond to the Euro 4/IV standard compared to Euro 6/VI used in Europe.

The basic policy and regulatory framework that can support advancement of clean public transport is in place. However, Kazakhstan still lags behind in development of modern emission norms for passenger cars, as well as heavy-duty truck and bus engines. The government has committed to develop energy-efficient local public transport. Kazakhstan presented its Intended Nationally Determined Contribution (INDC) at the Conference of the Parties (COP21) in Paris in 2015. It set the ambitious target of reducing GHG emissions by 15-25% by 2030 compared to 1990 levels (GoK, 2015[1]).

The analysis of the (urban) public transport systems in the 23 major cities of Kazakhstan further justifies the project. The State Programme for Infrastructure Development "*Nurly Zhol*" for 2015-19 set an ambitious target. It stated that 96% of settlements with a population of more than 100 people were to have regular bus routes by 2019.[1] In addition, it sought to progressively halve the share of depreciated buses on regular passenger routes by 2019 (EO PoK, 2016[2]).

As of the first half of 2016, 185 providers – of which four are utility companies – operate urban public transport systems in Kazakhstan in cities of more than 100 000 inhabitants. The total bus fleet comprises 12 314 buses, including 3 555 minibuses (about 29% of the total fleet). Of these, transport providers own 6 258 vehicles, while the remaining 6 056 are leased or rented. Nearly one-third of buses (31%) are more than ten-years-old. Within the analysed fleet, over three-quarters of the buses (76%) are diesel-powered. Compressed natural gas (CNG) and petrol-powered vehicles each constitute 10% of the fleet, while liquefied petroleum gas (LPG) is used as a fuel in only 1 out of 25 (4%) vehicles.

The analysis of air pollution in Kazakhstan's cities is based on data from the 2015 information bulletin on the environment. This bulletin is prepared by Kazakhstan's National Hydrometeorological Service – RSE Kazhydromet, which monitors air quality based on 25 pollutants (Kazhydromet & MoE, 2016[3]). Kazhydromet assesses air pollution over the year using the air quality indicators. It estimates the amount of air pollution by type by comparing the actual concentration of a pollutant with its maximum allowable concentration (MAC, in mg/m^3 or $\mu g/m^3$).[2]

The Concept for Transition of the Republic of Kazakhstan to Green Economy is the main policy justification for the investment programme. The policy provides for the development of energy-efficient transport infrastructure and increased energy efficiency of local public transport by conversion to cleaner fuels (such as gas). The conversion would take place through specific measures to modernise the transport fleet. Through the policy, Kazakhstan would also apply European emission standards, inspect vehicle fleets and transition to gas in large cities such as Almaty, Astana, Karaganda and Shymkent by 2020 (sector) (EO PoK, 2013[4]).

Changing this situation will require significant resources, both private and public. However, transport fares are low – about USD 0.2 per ride (2016). Furthermore, high interest rates (13-19%) constrain access to credit. Without state support or tariff increases, the modernisation of the public transport fleet will continue to lag.

In 2015, the OECD and Kazakhstan joined forces to analyse how a public investment programme could achieve two goals. First, the programme needed to spur development of cleaner public transport. Second, it had to reduce air pollution and GHG emissions from the public transport sector in large urban centres in the country. They agreed the programme would focus primarily on supporting the shift to modern buses powered by clean fuels, such as CNG and LPG.

3.1.2. Programme analysis

The investment programme is designed to be implemented in two stages. A pilot phase (or Phase 1) covers the cities of Kostanay[3] and Shymkent.[4] A scaling-up phase (Phase 2) would extend the programme to cover all major urban centres in Kazakhstan. Unlike the Moldova or Kyrgyzstan country case studies, inter-city transport is not part of the programme. This is mainly due to a sufficient number of cities/towns with public transport networks, as well as large distances between them.

Kostanay is an ideal pilot city because it has 421 old buses (all diesel) and only 6 relatively new ones (also diesel-fuelled). Most of the old buses are 15-20 years-old. Shymkent uses 61 very old diesel buses (over 15-years-old) out of the fleet of 1 685 vehicles (about 4%). It also has 117 relatively old (10-15 years-old) models (about 7%) in the fleet. Given a bus usually has a useful life of 12 years, up to 89% of the fleet might be already depreciated. Since both cities suffer from air pollution from transport, reducing emissions of air pollutants is an important objective for municipal authorities.

Three project pipelines were identified for analysis and evaluation. They were considered both cost-effective and realistic to implement, including through the regular budgetary process. The pipelines focus on the replacement of the old bus fleet in urban centres with modern buses fuelled by:

1. compressed natural gas (CNG), where available
2. liquefied petroleum gas (LPG)
3. diesel, but considering the import of Euro 5 and Euro 6 fuel (until respective fuel standards are implemented in Kazakhstan).

Analysis shows that use of CNG and LPG to power public transport buses will bring down operating costs and create savings. This is due to the lower prices of these fuels compared to diesel. Improved diesel fuel, however – such as Euro 5 and 6 – can also be viable alternatives where neither CNG nor LPG is available.[5] Within the analysed fleet in 23 towns/cities, over three-quarters of the buses (76%) are diesel-powered. CNG- and petrol-powered vehicles each constitute 10%, while LPG is used as a fuel in only 1 of 25 vehicles (4%).

Other potential investments include studies, construction of CNG filling stations, creation of maintenance workshops for new buses. Additional investments could also improve public transport services that accompany the replacement of buses in the three pipelines (CNG, LPG and diesel).

Replacing the outdated and depreciated domestic bus fleet would create more than environmental benefits. The analysis shows that domestic production of CNG-powered and diesel-powered buses can also be competitive and create additional jobs.[6]

Phase 1

The pilot phase, which covers the cities of Kostanay and Shymkent, is designed to run for one year. During this phase, 200 buses in Kostanay are expected to be replaced with modern models that run on LPG.[7]

The pilot phase for **Kostanay** is estimated to cost KZT 6 421 million (USD 18.72 million). Of this amount, the programme will co-finance KZT 3 079 million (USD 8.98 million). Private or municipal bus operators will invest the balance of KZT 3 342 million (USD 9.75 million).

In **Shymkent**, it is assumed that 100 buses will be replaced with modern CNG-fuelled buses.[8] The total cost will amount to KZT 3 531 million (USD 10.3 million). Of this amount, the CPT Programme can contribute KZT 1 705 million (USD 4.97 million). Private or municipal bus operators can contribute the balance of KZT 1 826 million (USD 5.32 million).

The total cost of 100 CNG-fuelled and 200 LPG-fuelled buses (not minibuses) is estimated at KZT 9 952 million (USD 29.03 million). Of this amount, public finances will cover KZT 4 784 million (USD 13.95 million) and private or municipal bus operators will contribute KZT 5 168 million (USD 15.07 million).

Phase 2

The public transport sector has more room for substantial environmental improvements. After the pilot phase, an estimated 2 458 buses that are more than ten-years-old will remain in Kazakhstan. Of these 2 458 buses, 1 471 will still be more than 15-years-old.

Therefore, two scenarios for a second phase were costed using the Excel-based model developed for this study. The second phase is designed to cover all major urban centres in Kazakhstan (19 under Scenario 1, and 21 under Scenario 2) over five years. It will aim to replace buses of more than 15-years-old (Scenario 1) or buses more than 10-years- old (Scenario 2). Some cities (four for Scenario 1 and two for Scenario 2) are not included because they have no old buses.[9]

The two scenarios have one major difference. Under Scenario 1, the programme would only finance replacement of buses that are more than 15-years-old. Under Scenario 2, the programme would also support replacement of buses older than ten years.

Scenario 1: Modernising the old bus fleet in urban centres of 19 cities/towns in Kazakhstan. This would involve replacement of 15-year-old vehicles with 286 new CNG buses and 1 241 new LPG buses.

- Under Scenario 1, investments are estimated at KZT 51 574 million (USD 150.44 million). Of this amount, public financing amounts to KZT 25 615 million (USD 74.72 million). Private or municipal bus operators would contribute KZT 25 958 (USD 75.72 million).

Scenario 2: Modernising the old bus fleet in urban centres of 21 cities/towns in Kazakhstan. This would involve replacement of ten-year-old vehicles with 853 new CNG buses and 1 630 new LPG buses.

- Under Scenario 2, total investment would rise to KZT 84 629 million (USD 246.86 million). The public financier would contribute KZT 41 818 million (USD 121.98 million). Private or municipal bus operators would contribute KZT 42 811 (USD 124.88 million).

Summary and benefits

The pilot phase will result in 300 new urban public transport vehicles in two pilot cities (100 CNG and 200 LPG buses). After the scaling-up phase (Scenario 1), there will be 1 827 new urban public transport vehicles in 19 towns/cities in Kazakhstan (386 CNG and 1 441 LPG buses). Assuming the more ambitious scaling-up phase (Scenario 2) is implemented, 21 towns/cities in Kazakhstan would have 2 783 new urban public transport vehicles (953 CNG and 1 830 LPG buses).

Together, both phases of the programme would imply the following total costs:

- Phase 1 and Scenario 1 of Phase 2: Total estimated investments amount to KZT 61 526 million (USD 179.47 million). Of this amount, public financing amounts to KZT 30 399 million (USD 88.67 million). Private or municipal bus operators would contribute 31 126 (USD 90.79 million).
- Phase 1 and Scenario 2 of Phase 2: Total investment would rise to KZT 94 581 million (USD 275.89 million). The public financier would contribute KZT 46 602 million (USD 135.94 million). Private or municipal bus operators would contribute 47 979 (USD 139.95 million).

CO_2 and NO_x promise the greatest emission reductions. Obviously, significant emission reductions start accumulating with the implementation of Phase 2 of the CPT Programme. By the end of Scenario 2, CO_2 emissions are estimated to begin decreasing by about 68 367 tonnes/year. This represents a reduction of 27.2% compared to the baseline.[10] In the case of NO_x, the decrease in emissions is estimated at 1 724 tonnes/year, which represents a reduction of 83.5% compared to the baseline. These reductions are estimated using the normative pollution factors approach.

The greatest relative improvement would be in emissions of small particulate matter – $PM_{2.5}$. After the end of Scenario 2 of the scaling-up phase, $PM_{2.5}$ emissions would be reduced by 98.2% (or 50 tonnes/year). SO_2 emissions would decrease by 39 tonnes/year (a reduction of 83.3% compared to the baseline). CO emissions reductions would amount to 315 tonnes/year (a reduction of 56.1% compared to the baseline).

3.1.3. Programme implementation and institutional map

Programme implementation will require institutional arrangements that entail transparent and cost-effective decisions. The report analyses several options; a number of institutions in Kazakhstan could potentially be selected to manage the programme. Whatever the choice, the implementing entity should have a degree of independence. Decisions should reflect rules and criteria in line with the programme objectives, and not be subject to undue political influence.

Potential financing mechanisms are available in the country that could support the transition to clean public transport. However, the programme does not need to be completely financed through grants. By its nature, the public transport sector saves operating costs through replacement of old fleet components with new models and the use of clean fuel. This means that financing should increase investment without having to

support profitable projects that would have occurred regardless of government involvement.

Inter-ministerial co-operation is vital for successful implementation of the programme. Such a programme can help increase the profile of the environment and climate on the transport policy agenda. In transition to clean public transport, the Ministry of Energy would benefit from closer co-operation with the Ministry of Investments and Development and its Transport Committee. The Ministry of Finance and the Ministry of Economy could also support the programme and contribute more effectively to achieving low-carbon mobility in the country.

To facilitate future programme implementation, the study has developed supporting materials that include the following, among others:

- A proposal for project cycle management (PCM) procedures, including eligibility criteria, project appraisal criteria, project-ranking procedures and financing rules.
- A proposal for institutional arrangements comprising three levels:
  - *Programming entity (PE):* In general, the PE designs the programme. In Kazakhstan, the Ministry of Energy (MoE) is responsible for environment (natural resources) and green economy (renewable energy). The ministry focuses on legislation and regulation, but has no capacities for managing green investment programmes.[11] Still, the MoE (Green Economy Department) is best suited to perform the role of a PE and oversee the implementation process.
  - *Implementation unit (IU):* The IU drafts the programme's operating regulations and consults their preparation and use with the technical support unit(s) (TSUs). The IU will also define the allocation of the programme budget for the given year (or programming cycle) into project types (project "baskets"). The Astana International Financial Centre (AIFC) expressed interest in helping identify potential financial sources for the programme. The AIFC, created with support from the European Bank for Reconstruction and Development (EBRD), has human resources and was trained in fundraising and programme management. However, given its existing work, it has no capacity to take on the CPT Programme.[12] The programme, however, will follow-up on its offer to identify potential financing. Programme management could also be outsourced to the "Zhasyl Damu" Environmental Defense Fund[13] and, for the pilot phase, the Social Entrepreneurship Corporations at the local level.[14] Neither, however, is prepared to implement a clean transport programme without more capacity development.
  - *Technical support unit (TSU):* The TSU provides specialised assistance, advice and expertise in the areas of energy and fuel efficiency, CNG and LGP buses, modern diesel buses, and air pollution and GHG emission reductions. The Alliance of Legal Entities "Kazakhstan Association of High-tech Energy-Efficient and Innovation Companies" (ALE-KAHTEIK) – established with support by the United Nations Development Programme – could play this role. The Association of Kazakhstan's Car Business (AKCB) could also be considered. It is a non-profit professional association of official dealers, importers, distributors and national manufacturers of the automobile market of Kazakhstan. Other TSUs may be identified, as deemed necessary and prudent.

Whatever the choice, the implementing entity should have a degree of independence. Decisions should reflect rules and criteria in line with the programme objectives, and not be subject to undue political influence. Because programming is a political process, the responsibilities for programming and PCM should be separate and distinct. The IU should manage the project cycle.

3.1.4. Main obstacles and opportunities

Obstacles to implementing a CNG support programme in Kazakhstan's public transport sector identified by this analysis include the following:

- **CNG infrastructure**. This is not evenly developed throughout the country. Natural gas pipelines are mostly concentrated in the south and southwest and do not serve the northern parts of Kazakhstan.
- **Programme focus**: CNG vs. LPG vs. diesel. Currently, 98% of cars in Kazakhstan run on petrol, 0.1% on CNG and LNG, and the rest on diesel (UNDP, 2015[5]). CNG has high initial costs, including both the purchase of new vehicles and the conversion of existing petrol and diesel vehicles. Therefore, the private sector in Kazakhstan – individuals as well as companies – favour LPG systems. The cost of conversion to LPG is between KZT 200 000 and KZT 300 000 (USD 600-900), which is roughly half the cost of conversion to CNG.
- **Air pollution monitoring:** Methodology and infrastructure for monitoring air pollution are lacking. Different government entities monitor and collect data on transport and on air pollution from the transport sector. Kazakhstan's Agency of Statistics does not have data on the transport sector, including the number of transport companies and amount of fuel consumed (UNDP, 2015[5]). Most of the information and data on the numbers, types and status of vehicles can usually be found at the Ministry of Internal Affairs website, as it conducts annual technical checks of vehicles.
- **Borrowing limits.** The upper limit of borrowing for the state is 50% of gross domestic product (GDP). This rule is defined in the Agreement on Co-ordinated Macroeconomic Policy, one of 18 sectoral agreements that serve as a legal basis for the Common Economic Space (CES). The agreement was signed in Moscow on 9 December 2010 in accordance with the Maastricht agreements. These agreements regulate the ceilings for annual public budget deficit, national debt and the rate of inflation (Secrieru, 2014[6]). The government of Kazakhstan managed to maintain its public debt at 60% of GDP, which is among the lowest levels worldwide (Lovasz and Gizitdinov, 2012[7]).

On the other hand, opportunities include the following:

- **Readiness of local actors to co-operate**. For example, the gas distribution company KazTransGaz Onimderi LLP is ready and willing to support the programme by developing the CNG infrastructure in the country.
- **Kazakhstan's commitment to innovative clean energy projects**. The country has a target to meet 3% of its energy needs from renewables by 2020 and 10% by 2030. To achieve these targets, Kazakhstan subsidises renewable energy production to encourage investment in clean energy. The programme designed as part of this study could contribute to achievement of these targets.

- **The national "green" policy framework**. The government's Astana Green Bridge Initiative promotes green economic policies (green growth and low-carbon development). It bridges Europe and Asia through knowledge sharing and green investment facilitation.[15] Within the framework of the initiative, according to the World Bank, a USD 25 million fund should be set up to support green mini-projects (with up to USD 100 000 of grants or loans per project). The fund will be managed by the Department of Green Economy at the MoE. The World Bank and Global Environment Facility will each contribute USD 10 million to the fund. The call for proposals was to be announced in 2017 (depending on the decision of the government of Kazakhstan).

3.2. Moldova

3.2.1. Transport sector and air pollution assessment

Since Moldova gained independence from the Soviet Union in 1991, the government of Moldova has committed to promoting sustainable development. National policies, programmes and action plans have been developed and approved in the main sectors affecting the economy and environment. These include energy, industry, transport, agriculture, forestry and waste.

At less than 5%, transport makes a small contribution to the country's GDP. Yet the sector is responsible for 22% of the country's GHG emissions, making it the second biggest contributor after the energy sector. The transport sector is the main source of air pollution, in particular in urban areas, accounting for 86% of total emissions (GoM, 2018[8]). According to the latest available data (2018) from the National Bureaus of Statistics of Moldova (NBS), the share could in fact be as high as high as 96%.[16]

Most transport vehicles in Moldova are more than ten-years-old. Cars and buses run mostly on diesel, while diesel engines barely correspond to the Euro 4/IV standard compared to Euro 6/VI used in Europe. For example, of 20 994 buses, 11 790 units (56% of the bus fleet) do not correspond to any Euro standard. Only about 7.7% of the total fleet comply with Euro IV-VI norms.[17] According to Art. 153 par. (9) of the Road Transport Code (No. 150 of 17 July 2014), these public transport units should be renewed or replaced by 2020.

These structural and technical features make road transport an important contributor to the high level of air pollution in Moldovan cities. While data are not readily available or reported, Moldovan cities experience air pollution typical of cities in the eastern part of Europe. Accordingly, of concern are $PM_{2.5}$ and PM_{10} from use of wood and coal for home heating, as well as diesel fuels. the air in Chisinau is polluted with one or more types of toxic gases half of the year (BCI and TUM, 2006[9]).[18]

Transport accounts for most of the increase in emissions in sulphur dioxide (SO_2). Between 2005-11, SO_2 emissions more than doubled (from 2 400 to 5 800 tonnes annually). Transport accounts for around 75% of these increased emissions (UNECE, 2014[10]). The number of deaths caused by ambient air pollution in Moldova has more than tripled since 2004 (WHO, 2009[11]).[19] Moreover, diseases of the circulatory system – to which air pollutants (especially particulates) increasingly contribute – constitute the main causes of death in Moldova.[20] The municipality of Chisinau in particular is experiencing a substantial increase in air pollution-related diseases (GoM, 2013[12]).

The Programme on Promotion of Green Economy in the Republic of Moldova for 2018-2020 and the Action Plan for its Implementation sets out targets for transport (GoM, 2018[8]). The programme emphasises effective, efficient and ecological (urban) public transport. For example, it puts greater focus on larger public transport than on passenger cars in urban centres or applies restrictions on the use of old vehicles. It also advocates for the adoption of clear environmental objectives – e.g. the use of alternative fuels and new technologies in all modes of transport – in transport policies.

As of mid-2017, 32 service providers operate urban public transport systems in Chisinau and Balti. In these cities, the total bus fleet comprises 414 trolleybuses, 208 regular buses (diesel-powered – Euro IV or lower) and 1 406 minibuses (diesel-powered). At least half of the bus fleet and nearly all of the minibus fleet need repair or replacement.

Changing this situation will require significant resources, both private and public. However, transport fares are low – about USD 0.11 (trolleybus) and USD 0.16 (bus and minibus) per ride in 2017. Access to credit is constrained by high interest rates on credit. In 2018, for example, the average interest rate on long-term (over five years) credit for businesses equalled 9.76% annually in national currency and 4.60% annually in foreign currency.[21] Without state support or tariff increases, the modernisation of the public transport fleet will continue to lag.

The programme will focus mainly on supporting the shift to modern buses powered by clean fuels, such as CNG and LPG. In addition, to the extent possible, it will help strengthen existing infrastructure to use trolleybuses.

3.2.2. Programme analysis

The investment programme is designed to be implemented in two stages. A pilot phase (or Phase 1) covers pilot investments in the cities of Chisinau[22] and Balti.[23] A scaling-up phase (Phase 2) would replace all old bus fleets in the cities of Chisinau and Balti, as well as extend the programme to the suburbs of pilot cities (Scenario 1) and inter-city connections in Moldova (Scenario 2).

In Chisinau, approximately 124 trolleybuses (36%) of the fleet of 366 vehicles have met or exceeded their operating terms, and should be replaced. In the bus fleet, at least 56 vehicles (48%) in the running fleet (i.e. that are not in need of repair) and 76 vehicles (56%) of the total fleet should be replaced. In the Balti trolleybus fleet, 11 units (about one-third) of the total of 34 are more than ten-years-old. Non-electric public transport is provided by 48 regular buses and 116 minibuses. All are diesel-powered and the vast majority are at least 15-years-old (all figures as of July 2017).

Four project pipelines, considered both cost-effective and realistic, including through the regular budgetary process, were identified for analysis and evaluation. The pipelines focus on replacement of the old bus fleet in urban centres with modern buses fuelled by the following:

1. compressed natural gas (CNG)
1. liquefied petroleum gas (LPG)
2. diesel that meets Euro 5 and Euro 6 emissions standards
3. electric power (trolleybuses and battery trolleybuses).

As Moldova's bus fleet is ageing, the proposed "pipelines" are intended to help buy new vehicles (buses/minibuses and trolleybuses) rather than modernise existing engines. Renewing the bus fleet will increase the reliability and efficiency of public transport. The domestic market will be encouraged to produce, or at least assemble, modern buses and trolleybuses.[24] Because the bus fleet in Moldova consists of too many minibuses, the CPT will give priority to replacing a part of the minibus fleet with regular buses.

Use of electricity, CNG and LPG to power public transport buses will bring down operating costs and create savings, given the lower costs of these fuels compared to diesel. The use of electrification is limited to the existing trolleybus network in Chisinau and Balti. Furthermore, the CNG is available in both cities. Improved diesel fuel, however, can also be viable alternatives where CNG and LPG are not available (for inter-city connections in Scenario 2).

The proposed investment pipelines should be accompanied by other investments in infrastructure. These include new trolleybus lines, CNG/LPG refuelling and electricity charging stations. Additional activities to improve the transport system in urban centres should also be supported, including creation of bus lanes, improvement of bus stops and smart traffic control.

The domestic assembly of trolleybuses can create additional jobs, offering further benefits in addition to replacing the outdated and depreciated domestic trolleybus fleet.

In terms of vehicle replacement, the two phases will include following:

- The first (pilot) phase will be launched in two cities (Chisinau and Balti) and will focus primarily on electric transport (trolleybuses). In total, 62 trolleybuses will be purchased: 31 will replace the old trolleybuses and the other 31 will extend the network by replacing old diesel buses. Also, a pilot replacement of a small number (15) of minibuses should be carried out during the pilot phase.[25]
- The second (scaling-up) phase would extend the pilot phase. There are two possible scenarios for this phase: Scenario 1 would extend it to the suburban areas of the pilot cities (735 new vehicles), while Scenario 2 would include inter-city public transport across the country (2 510 new vehicles).

Phase 1

The pilot phase of the programme, which covers the most urgent needs in the cities of Chisinau and Balti, is designed to run for a period of one year. In **Chisinau**, it proposes purchasing 60 new vehicles for public transport. This will include the following:

- replacing 25 old trolleybuses with the same number of new vehicles (including battery trolleybuses)
- purchasing another 25 trolleybuses (including battery trolleybuses) to strengthen the existing fleet – these will replace diesel buses that are more than 15-years-old (currently about 25)
- replacing 10 diesel-fuelled minibuses with CNG-powered models
- extending the trolleybus network to reach more remote areas where the trolleybus power-delivered network is not available (extending the trolleybus power-delivered network to cover the whole area would be too costly).

The total cost of the CPT Programme for Chisinau is estimated to be MDL 280 million (USD 15.1 million). Of this amount, MDL 141 million (USD 7.6 million) will be co-financed from the programme. Private or public bus operators are expected to invest MDL 139 million (USD 7.5 million).

In the pilot phase in **Balti**, the CPT Programme proposes purchasing 17 new vehicles for public transport. This will include the following:

- replacing six old trolleybuses with the same number of new vehicles (including battery trolleybuses)
- purchasing another six trolleybuses (including battery trolleybuses) to strengthen the existing fleet – these will replace diesel buses that are more than 15-years-old (currently about six)
- replacing five old diesel minibuses with the same number of new vehicles running on clean fuel (CNG or LPG).

In Balti, the total cost of purchasing 12 trolleybuses and 5 minibuses would amount to MDL 72 million (USD 3.9 million). Of this amount, the CPT Programme can support MDL 37 million (USD 2 million). Public and private bus operators could contribute MDL 36 million (USD 1.9 million).

Overall, the pilot phase will lead to the purchase of 62 new trolleybuses and 15 minibuses. This makes three assumptions. First, it assumes Moldova has the market capacity to supply the required quantity of modern vehicles on an annual basis. Second, it assumes that private and municipal bus operators could invest in new assets over a one-year period. Third, it assumes the government has the capacity to invest in relevant infrastructure.

This phase will, in a broader sense, build on and add to the experience of previous (EBRD-supported) trolleybus replacements that began in 2010-13. Also, both pilot cities have a large number of minibuses (usually diesel-fuelled) in their public transport fleets that urgently need replacement.

The total investment costs of the pilot phase of the CPT Programme would amount to MDL 353 million (USD 19.1 million). Of this amount, MDL 178 million (USD 9.6 million) in public support would be needed (Table 2.3).

Phase 2

Phase 2 (i.e. an extension to Phase 1) considered two institutional options with different levels of public co-financing lasting up to five years. Two scenarios for the second phase of the programme were also costed and assessed.

Scenario 1: Modernising the remaining old bus/minibus fleet in Chisinau and Balti, including those on the suburban routes. Scenario 1 would involve replacing all old buses (including minibuses), i.e. below Euro 5/V standard across the urban and suburban areas of Chisinau and Balti. This would mean purchasing 393 modern regular buses and 280 minibuses (including the 15 minibuses from the pilot phase) powered with CNG or LPG, or possibly modern diesel engines.

- Under Scenario 1, total estimated investments amount to MDL 2 427 million (USD 145 million). Of this amount, the public financing share for Option 1 amounts to MDL 607 million (USD 36 million). For Option 2, public financing amounts to MDL 1 415 million (USD 85 million).

Scenario 2: Modernising the remaining old bus/minibus fleet in Chisinau and Balti, including suburban routes. The public transport fleet operating inter-city connections in the entire country would also be modernised. The inter-city routes were chosen since there is little urban transport in other cities in Moldova. These routes act as a substitute (i.e. covering suburbs and centres of towns on the route). Scenario 2 assumes replacing all buses (including minibuses) that are below Euro 5/V standard and that provide public transport within and between cities in Moldova. This would involve purchasing 1 456 modern buses and 992 minibuses (including 15 minibuses from the pilot phase) running on cleaner fuels.

- Under Scenario 2, total investment would rise to MDL 8 871 million (USD 531 million). For Option 1, public finance would contribute MDL 2 218 million (USD 133 million). For Option 2, public finance would contribute MDL 5 365 (USD 321 million).

Summary and benefits

In total, the programme will result in 77 new urban public transport vehicles in the pilot phase (62 trolleybuses and 15 buses). The scaling-up phase (Scenario 1) would generate 735 new urban and suburban vehicles (62 trolleybuses, 393 buses and 280 minibuses). Assuming the more ambitious scaling-up phase (Scenario 2) is implemented, Moldova would have 2 510 new urban, suburban and inter-city vehicles (62 trolleybuses, 1 456 buses and 992 minibuses). They would be distributed between the pilot cities of Chisinau and Balti, and other regions of Moldova.

Analysis suggests that the total costs of the CPT Programme will be substantial. The investment cost of Phase 1 and Scenario 1 of Phase 2 is estimated at MDL 2 779 million (USD 150.2 million). Of this amount, between MDL 783-1 593 million (USD 42.3-86.1 million) in public support would be needed, depending on the financing option selected. The investment cost of Phase 1 and Scenario 2 of Phase 2 is estimated at MDL 9 223 million (USD 498.6 million). Of this amount, between MDL 2 394-5 542 million (USD 129.4-299.6 million) in public support would be needed.

The environmental cost-effectiveness of Scenario 1 is expected to be greater than Scenario 2. This is due to the higher concentration of air pollutants in urban and suburban areas than in rural ones. Urban areas of other cities would also benefit from improved inter-city connections, although to a lesser extent than pilot cities. Therefore, it is advisable to start with Scenario 1 in the scaling-up phase.

CO_2 and NO_x promise the greatest emission reductions. Obviously, significant emission reductions start accumulating with the implementation of Phase 2. By the end of Scenario 2, CO_2 emissions are estimated to begin decreasing by about 73 944 tonnes/year. This represents a reduction of 42.2% compared to the baseline.[26] In the case of NO_x, emission reductions are estimated at about 1 444 tonnes/year. This represents a reduction of 83.5% compared to the baseline. These reductions are estimated using the normative pollution factors approach.

The greatest relative improvement would be in the emissions of $PM_{2.5}$. This would be reduced by 98.8% (or 35 tonnes/year) after the end of Scenario 2 of the scaling-up phase. SO_2 emissions would decrease by 29 tonnes/year (a reduction of 88.9% compared to the baseline). CO emissions reductions would amount to 301 tonnes/year (a reduction of 76.3% compared to baseline).

3.2.3. Programme implementation and institutional map

Programme implementation will require institutional arrangements that entail transparent and cost-effective decisions. The report analyses several procedural and institutional options:

- A proposal for project cycle management (PCM) procedures, including eligibility criteria, project appraisal criteria, project-ranking procedures and financing rules
- A proposal for institutional arrangements comprising three levels:
  - *Programming entity (PE):* In general, the PE designs the programme. The Ministry of Agriculture, Regional Development and Environment (MARDE), in co-operation with the Ministry of Economy and Infrastructure, shall oversee the programme. However, the environmental section of the MARDE employs only 29 people.
  - *Implementation unit (IU):* The IU drafts the programme's operating regulations and consults on their preparation and use with the technical support unit(s). The IU markets the programme, identifies beneficiaries and appraises beneficiaries' project proposals for eligibility. It would also provide MARDE with information on the planned number of beneficiaries and programme financial needs. The IU would report to MARDE on programme expenditure. This would enable MARDE to monitor budget implementation for a given year (or programming cycle) and project type (project "baskets").
  - *Technical support unit (TSU):* The TSU would give specialised assistance, advice and expertise in the areas of energy and fuel efficiency, CNG, LPG, modern diesel buses/trolleybuses, and air pollution and GHG emission reductions. The National Agency of Road Transport (*Agenția Națională Transport Auto* – ANTA)[27] could play this role. The agency falls under the Ministry of Economy and Infrastructure (formerly, Ministry of Transport and Roads Infrastructure). Other TSUs may be defined as deemed necessary and prudent.

Several institutions in Moldova could be selected to manage the programme. The first choice would be the existing National Environmental Fund, which is part of MARDE. Most of the work could be split between regular duties of the ministry and fund. However, changes in the structure of the ministry also make different changes in the fund possible (up to merging it with the Regional Development Fund).

There are some other institutions in Moldova, like the Energy Efficiency Fund, which was created from international support. It has been implementing green investment programmes, but is not prepared to broaden its scope to cover the CPT Programme. The existing plans to create agencies that will, respectively, manage the Regional Development Fund and possibly merge with the Environmental Fund, might be a good direction to build institutional capacity.

The role of IU could be fulfilled by a local bank or banks selected through public tender, and which would sign a co-operation agreement with MARDE. The proposed Environmental Protection Agency is another potential IU.

Whatever the choice, the implementing entity should have a degree of independence to ensure that decisions reflect rules and criteria in line with the programme objectives, and not be subject to undue political influence. Because programming is a political process,

responsibilities for programming and PCM are separate and distinct, with the IU managing the project cycle.

Potential financing mechanisms are available in Moldova to help support the transition to clean public transport. As mentioned, the grant scheme already exists and is used by different funds in Moldova. Option 2 considered deployment of bus providers' own resources combined with a public grant to motivate bus operators to allocate their own financial resources. This option requires a higher share of public subsidy and a central body for implementation.

The interest of the banking sector in supporting the programme makes option 1 possible. Commercial loans would be combined with public support via loan guarantees. A relatively small grant could be given to bus operators to repay a portion of the loan. In this case, the programme implementation unit will still be needed. However, its role will be reduced to programming, setting rules and procedures and monitoring. Local banks will co-operate directly with beneficiaries.

3.2.4. Main obstacles and opportunities

Banks in Moldova do not play a significant role in the country's economic development and business activity. Moldova's high sovereign credit risk was combined with high inflation rates up until 2016. This has led to high interest rates and limited availability of affordable and long-term bank loans. This lack of long-term credit is an especially persistent problem in the country's banking system.

Therefore, although banks dominate Moldova's financial sector, their function as financial intermediaries is limited. This is due both to high interest rates and collateral requirements. Banks, on the other hand, face constraints such as lack of bankable projects and low rates of loan recovery. In the case of public transport operators, these factors might be caused by the low passenger fares mentioned above.

One factor contributing to this situation was the off-the-scale bank fraud unveiled in November 2014. More than USD 1 billion – equivalent to 15% of the country' annual GDP or half of the reserves of the BNM – had disappeared from three of Moldova's leading banks (Banca de Economii,[28] Unibank and Banca Sociala).[29] The resultant bailout of these (suddenly bankrupt) financial institutions cost national authorities almost half of Moldova's annual budget and prompted an overdue clean-up of the banking sector.

This led to a currency "collapse" (from a European perspective). It put the national economy into its third annual GDP decline within a period of only six years (after 2009 and 2012). However, this third "collapse" turned out to be not as steep as the first one.[30] Between November 2014 and November 2015, the Moldovan currency lost about 18% of its value against the Euro.[31] This decline was also due to a run on Moldovan leu caused by the "missing" billion. This resulted in a general rise in prices (e.g. household electricity, which increased by 30%[32]), whereas salaries and pensions remained frozen. The World Bank, the International Monetary Fund and the European Union suspended financial aid to the country.

Since then, trust in the country's banking sector has, to a large extent, been restored, though corruption still remains an issue.

3.3. Kyrgyzstan

3.3.1. Transport sector and air pollution assessment

Kyrgyzstan's GHG emissions are relatively low. This can be largely explained by the prevalence of hydroelectric power plants, which provide about 90% of the total electricity generation in the country. Emissions from the transport sector are included in the energy sector; with other fuel combustion, they account for approximately 71% of emissions within the energy sector (USAID, 2017[13]).[33]

The transport sector is responsible for 28% of Kyrgyzstan's GHG emissions, and in cities like Bishkek, for 75% of air pollutants. Most public transport vehicles are old and in need of replacement. Of the country's entire public transport fleet (about 6 240 vehicles in 2017), about 54% are 15 years or older. Therefore, more than half of the fleet is beyond its useful life. In the minibus fleet (5 370 vehicles), the situation is even worse – around 89% of the fleet is over ten-years-old. Buses and minibuses mostly run on diesel, while diesel engines typically meet only Euro 4/IV standards or lower. Structural and technical features also make vehicle transport an important contributor to air pollution in Kyrgyzstan. These features include the importance of road transport for the country combined with an insufficient network of technical inspection centres.

Kyrgyzstan continues to lag behind advanced countries in the development of modern emission norms for both passenger cars and heavy-duty truck and bus engines. Since 2013, post-Soviet GOST[34] standards have applied to member states of the Eurasian Economic Union. In 2014, the Eurasian Economic Commission increased standards to Euro 5. These are set to come into effect in Kyrgyzstan in 2019, but only for fuels and not for vehicle engines; vehicle emission requirements and the associated fuels do not necessarily align.[35] In transportation, fuel consumption decreased significantly between 1993 and 1997 due to changes in the country's vehicle fleet; the number of trucks and buses decreased significantly, while cars increased.[36]

These structural and technical features make vehicle transport an important contributor to the high level of air pollution in the country's two main cities. Indeed, most transport vehicles in the Kyrgyz Republic are more than ten-years-old. Cars and buses run mostly on diesel. Diesel engines barely correspond to the Euro 4/IV standard compared to the Euro 6/VI used in Europe.

The programme will primarily support the shift to modern buses powered by clean fuels, such as CNG and LPG, as well as trolleybuses. In other words, outdated buses would be placed with modern diesel-powered vehicles. At the same time, trolleybus networks would be expanded to replace diesel-powered vehicles. These shifts would help reduce pollution from particulate matter, as well as NO_x and SO_2. An effective technical inspection system for cars would also reduce harmful substances in the atmosphere.

The Agency of Hydrometeorology of the Ministry of Emergency Situations of the Kyrgyz Republic (Kyrgyzhydromet) monitors air quality. It uses 14 stationary posts in five cities of the Kyrgyz Republic that cover about 64% of the country's urban population. However, air pollution data in the Kyrgyz Republic cities are not readily available or reported. Indeed, the stationary posts of Kyrgyzhydromet have outdated laboratories. They lack emissions analysers to identify the pollution data.

The main sources of pollution of atmospheric air are power plants, mining and processing industries, construction materials industries, and the municipal and private sector. The main

cities in Kyrgyzstan suffer especially from air pollution caused by human activities. This includes vehicle emissions, and using coal to heat homes and facilities. In Bishkek, the 666-MW coal- and gas-fired combined heat and power (CHP) plant is a huge emitter. The inner-city location of the plant also contributes to the environmental impact.

The impact of motor transport on the environment in the Kyrgyz Republic is defined by the intensity of transportation and technical condition of the vehicle fleet. Two factors lead vehicles to emit harmful substances that exceed defined norms: the age of motor vehicles and inefficient technical inspection and maintenance. According to the State Agency for Environmental Protection and Forestry (SAEPF), 240 000 tonnes of pollutants are emitted into the atmosphere in Bishkek annually. Of this amount, 180 000 tonnes are from motor vehicles (Levina, M., 2018[14]).[37]

In 2018, the National Council for Sustainable Development adopted a new National Development Strategy ("*Zhany Doorgo – kyrk kadam*") 2018-2040. In the transport sector, the strategy foresees a transition to environmentally friendly modes of transport using electric vehicles and electrification of railways (GoK, 2018[15]). As one of its objectives, the Road Transport Development Strategy 2012-2015 sought to improve the technical condition of motor vehicles based on the experience of other countries. It also tried to limit the operation of vehicles whose emissions of harmful pollutants exceeded the established standards (GoK, 2012[16]).

Reaching these goals will require significant resources, both private and public. At the same time, transport fares are low – USD 0.12-0.15 in Bishkek and USD 0.09-0.15 in Osh per ride (2018). Moreover, high interest rates constrain access to credit. The average weighted interest rates of newly issued three-year loans were 15.8% in national currency and 9.2% in foreign currency.[38] These cities, which are owners of the main public transport fleets in their municipalities, have already incurred loans for public transport programmes. Such loans, mainly through the EBRD, have reduced creditworthiness. Without state support and tariff increases, the modernisation of the public transport fleet will continue to lag.

Passenger transport is now covered by more than 252 legal entities. These include 35 legal entities as taxis and involve more than 12 000 individuals. In addition, 69 enterprises (agencies) of the structural divisions of the Ministry of Transport and Roads of Kyrgyzstan are involved in the transport branch.

Automobile transport accounts for the main means of overland transport, and its share is increasing. Conversely, the number of passengers transported by trolleybus is slowly and steadily decreasing. The number of bus passengers is increasing, albeit not at the high rate of automobile transport.

3.3.2. Programme analysis

The investment programme is designed to be implemented in two stages. A pilot phase (or Phase 1) covers the pilot investments in the cities of Bishkek[39] and Osh.[40] A scaling-up (Phase 2) covers the remaining old bus/minibus fleet of Bishkek and Osh, including suburban routes, as well as some indicative inter-city connections in the entire country.

Even when considering the data discrepancies, about 2 800 minibuses (70%) of the minibus fleet in the capital are over 15-years-old. However, well over 90% of the fleet would exceed the useful life of a minibus (usually seven years). The situation for the bus fleet is similar – around 70% of vehicles are beyond their useful life (usually 12 years).[41] Trolleybuses fare somewhat better – only 5 vehicles (5%) of the total fleet of 100 fall into the oldest

category (at least 15-years-old). Conversely, over half are less than five-years-old. Trolleybuses also have a longer useful life (between 15-20 years). Therefore, at least 95% of trolleybuses are still within their useful life limits.[42]

The EBRD-financed programmes mean that Osh and Bishkek have a similar structure of trolleybus fleets. In Osh, most (about 60%) of the fleet is younger than five-years-old (23 of 40 vehicles). Only two vehicles (5%) are fully depreciated (at least 15-years-old). The age of the bus and minibus fleet is a little higher than in Bishkek. About 75% of buses in Osh have reached their useful life limits (12 years). At least 97% of minibuses are over seven-years-old (the usual useful life for minibuses, depending on mileage and service). Only 17% of minibuses (396 vehicles of 2 332) and 25% of buses (134 of 530) are less than 15-years-old (all 2016 figures).

The study analysed the market for cleaner fossil fuels and sources of power. It identified four groups of investment projects ("pipelines") to replace the old urban, suburban and inter-city bus fleet. Modern buses equipped with engines would run on one of the following:

1. CNG
2. electricity (trolleybuses and battery trolleybuses)
3. LPG
4. diesel Euro 5 and Euro 6 emissions standards.

Given Kyrgyzstan's ageing bus fleet, the proposed investment "pipelines" are intended to help buy new vehicles rather than only to modernise engines. These proposed investment pipelines should be accompanied by other investments – either from public or private sources. Areas for investment include new trolleybus lines, CNG/LPG refuelling and electricity charging stations. Other supporting activities would also be useful to improve the transport system in urban centres (e.g. the creation of bus lanes, improvement of bus stops and smart traffic control).

Because the bus fleet in Kyrgyzstan has too many minibuses, replacing part of the minibus fleet with regular buses is the priority. While buses powered using LPG are given medium priority, Bishkek and Osh have no plans to invest in LPG buses. For this reason, the results of the OPTIC model do not include LPG buses. The model can, however, be used to include LPG buses should policy makers re-evaluate this option.[43]

Modernising the bus fleet will increase reliability and efficiency of public transport. As a result, the domestic market will be encouraged to produce, or at least assemble, modern buses and trolleybuses.

In terms of vehicle replacement, the two phases will include the following:

- Phase 1 (pilot phase) covers a limited number of buses in the centres of pilot cities (Bishkek and Osh). This would involve replacement of old trolleybuses and expansion of the CNG bus fleet to displace diesel-fuelled minibuses. This would involve purchasing 115 trolleybuses and 288 new CNG buses.
- Phase 2 (scaling-up phase) would cover the remaining parts of the pilot cities (suburbs), as well as inter-city connections linking rural areas in Kyrgyzstan. Phase 2 would involve further expansion of the CNG fleet into suburban areas and on some inter-city routes. This would involve purchase of an additional 870 CNG buses and 90 modern diesel buses.

Phase 1

The CPT Programme anticipates the purchase of 216 new vehicles for public transport in the pilot phase in **Bishkek,** which will focus on the following:

- Replacing 78 old trolleybuses with the same number of modern trolleybuses. This continues a programme already begun, with the replacement of 52 buses.
- Purchasing another 20 trolleybuses to strengthen the existing fleet. The focus should be on trolleybuses equipped with electric batteries and on extending the trolleybus network in Bishkek to reach more remote areas where the trolleybus network is not available.[44]
- Replacing 78 old diesel buses with the same number of CNG buses. This builds on an ongoing programme under which 52 new CNG buses are to be purchased in 2018.
- Replacing 200 old diesel minibuses with 40 CNG buses.[45]

Bishkek has a large number of minibuses (usually diesel-fuelled) that provide public transport services to the population. The city plans gradually to replace these buses and extend services of the trolleybus and CNG-bus network in their place. Although LPG is sometimes used in the Kyrgyz Republic, the CO_2 emissions from LPG-powered engines are higher than from CNG-powered ones.

The total cost of the CPT Programme for Bishkek is estimated to be KGS 2 209 million (USD 31.81 million). Of this amount, the programme will offer co-financing of KGS 1 263 million (USD 18.18 million). Private or public bus operators and/or the city of Bishkek will invest KGS 946 million (USD 13.62 million).

Osh is the second largest city in the Kyrgyz Republic in terms of population. It is the only city beyond Bishkek with a trolleybus network and a developed public transport system.

The CPT Programme proposes to purchase 187 new vehicles for public transport in the pilot phase in Osh, which will focus on the following:

- Purchasing 17 new trolleybuses, continuing the EBRD programme that has so far replaced 23 trolleybuses.
- Replacing 50 old diesel buses with the same number of CNG buses.
- Replacing 600 old diesel minibuses with 120 CNG buses.

In Osh, the total cost of this phase would amount to KGS 1 879 million (USD 27.28 million). Of this amount, the CPT Programme could support KGS 774 million (USD 11.24 million). Public and private bus operators, and/or the city of Osh, would contribute KGS 1 104 million (USD 16.03 million).

Overall, the pilot phase would see 115 new trolleybuses and 288 new CNG buses purchased. These numbers make three assumptions. First, they assume that Kyrgyzstan has the market capacity to supply this quantity of modern vehicles. Second, they assume that private and municipal bus operators have the capacity to invest in these new assets over a one-year period. Third, they assume the government has the capacity to invest in the necessary support infrastructure.

The purchase of 98 new trolleybuses in Bishkek and 17 in Osh will, in a broader sense, add to and learn from the experience of previous (EBRD-supported) replacements. These replacements began in 2011 and 2014 in Bishkek and Osh, respectively. Also, both pilot

cities have a large number of minibuses (usually diesel-fuelled) in their public transport fleets that urgently need replacement. Therefore, 200 old diesel minibuses will be replaced in Bishkek and 600 in Osh for 40 and 120 CNG regular buses, respectively.

The investment costs of the pilot phase would amount to KGS 4 088 million (USD 59.36 million). Of this amount, KGS 2 037 million (USD 29.58 million) would need to come from the public purse.

Phase 2

For the purchase of buses in Phase 2, the CPT Programme considered the number of old diesel buses (with engines of up to Euro IV standard) and minibuses providing public passenger transport services. This estimate also considers the possibility that the number of minibuses will be reduced and that about half will be replaced with regular buses (i.e. buses that are more than 10-m long).

- Phase 2, the scaling-up phase, would last up to five years. It foresees the purchase of an additional 870 new CNG buses (730 in Bishkek, 80 in Osh and 60 for inter-city transport routes). Inter-city transport would also be strengthened by 90 new diesel buses. The total estimated investments for this phase would be KGS 9 603 million (USD 139.43 million). Of this amount, KGS 3 762 million (USD 54.63 million) in public financing would be required.

Minibuses dominate public transport in the Kyrgyz Republic; regular buses serve only a small number of urban and inter-city routes. Therefore, the second phase of the CPT Programme should replace only half of the minibuses with those powered by clean fuels; the other half would be replaced by regular buses that can provide space for up to five times more passengers.

Summary and benefits

In total, both phases of the CPT Programme would result in 1 363 urban, suburban and inter-city public transport vehicles. This represents 1 158 CNG buses, 115 trolleybuses and 90 modern diesel buses. The total investment costs for the entire programme are estimated at KGS 13 691 million (USD 198.8 million), including KGS 5 799 million (USD 84.21 million) of public support.

CO_2 and NO_x promise the greatest emission reductions. Obviously, significant emission reductions start accumulating with the implementation of Phase 2. By the end of Phase 2, CO_2 emissions are estimated to decrease by about 68 506 tonnes/year. This represents a reduction of 47.3% compared to baseline.[46] Meanwhile, in the case of NO_x, emission reductions are estimated at 1 236 tonnes/year, or a reduction of 86.4% compared to baseline. These reductions are estimated using the normative pollution factors approach.

In terms of relative improvement, reducing SO_2 emissions will provide the best results. SO_2 emissions would be reduced by 99.6% (or 27 tonnes/year) after the scaling-up phase. PM emissions would decrease by 29 tonnes/year (or by 98.7% compared to baseline). CO emissions reductions will decrease by 307 tonnes/year (or by 94.0% compared to baseline).

3.3.3. Programme implementation and institutional map

Programme implementation will require institutional arrangements that entail transparent and cost-effective decisions. The report analyses several procedural and institutional options:

- A proposal for project cycle management (PCM) procedures, including eligibility criteria, project appraisal criteria, project-ranking procedures and financing rules.
- A proposal for institutional arrangements comprising three levels:
  - *Programming entity (PE):* In general, the PE designs the programme. The Ministry of Economy (MoEcon) should perform this role. In co-operation with the State Agency for Environmental Protection and Forestry (SAEPF), the ministry should also oversee implementation. MoEcon will use its available staff and resources to undertake its programmes. In performing its duties, the PE will consult with other relevant government agencies, professional associations, local municipalities and non-governmental organisations (NGOs) as appropriate. In addition, representatives of these bodies may be invited to sit on the supervisory board of the programme and provide advice.
  - *Implementation unit (IU):* The IU drafts the programme's operating regulations and consults on their preparation and use with the technical support unit(s) (TSUs). A local bank or banks could fulfil this role. They would sign a co-operation agreement with MoEcon based on a successful public tender bid. Other potential IUs include the Investment Promotion and Protection Agency (IPPA),[47] SAEPF and the Regional Environmental Centre for Central Asia (CAREC).[48] The IU would provide MoEcon with information on the expected number of beneficiaries and their financial needs. It would also market the programme, identify beneficiaries and appraise eligibility of beneficiaries. In short, the IU would manage the project cycle. The IU would communicate to MoEcon on the loan and grant needs of beneficiaries. In this way, the ministry can monitor the CPT Programme budget for the given year (or programming cycle) and project types (project "baskets").
  - *Technical support unit (TSU):* The TSU would give specialised assistance, advice and expertise in the areas of energy and fuel efficiency, CNG, LPG, modern diesel buses/trolleybuses, and reductions of air pollution and GHG emissions. The IPPA, SAEPF or CAREC could play the TSU role, although they cannot be both IU and TSU. Other TSUs may be defined as deemed necessary and prudent.

Regardless of the final choice, the implementing entity needs independence to ensure that decisions reflect rules and criteria in line with the programme objectives, and not be subject to undue political influence. Because programming is a political process, the responsibilities for programming and PCM are separate and distinct. The IU manages the project cycle.

There are potential financing mechanisms in the Kyrgyz Republic that can support the transition to clean public transport. These include government support (grant) or on-lending to local governments based on a credit line with a development bank (such as the EBRD or the Asian Development Bank – ADB). However, the programme does not need to be completely grant-financed. By its nature, the public transport sector can save costs by replacing old fleet components with new models and using clean fuel. This means that financing should increase investment without having to support profitable projects that would have occurred regardless of government involvement.

3.3.4. Main obstacles and opportunities

Kyrgyzstan's GHG emissions are relatively low. However, emissions will increase from planned and expected economic development unless action is taken to reduce them. This, along with the review of air pollution in Kyrgyz cities, justifies the CPT Programme from the perspectives of public safety, public health and the environment. Road transport contributes the bulk of air pollution. Therefore, replacing outdated vehicles with modern diesel-powered or natural gas-powered buses, and with buses with higher capacity, would help reduce pollution by particulate matter, as well as NO_x and SO_2. It would also help keep GHG emissions in line with the country's emission-reduction objectives.

However, improved energy intensity of vehicles (megajoule/passenger-km or megajoule/tonne-km) and carbon intenstity of fuels (CO_2e/megajoule) cannot stand alone.

Reducing pollution from urban public transport, in addition to investments to replace vehicle fleets, will require a combination of measures:

- avoiding or reducing the need for travel (either through better urban planning or changing personal behaviour)
- shifting travel from private cars to non-motorised modes (walking, cycling) or public transport
- improving forms of transport through technical means (especially in energy intensity of vehicles and carbon intensity of fuels and energy carriers).

In this context, road widening would only increase traffic in cities. The combination of mass public transport with non-motorised modes of transport offers the greatest mitigation potential. The first step in this direction would be to increase the capacity and number of public transport vehicles (buses and trolleybuses). Diversifying the fleet structure, increasing energy efficiency and shifting modes from car to public transport would also improve resiliency against energy price rises (diesel, gas, electricity). Regulations on the operation of ageing vehicles, sufficient maintenance and technical inspection of vehicles are necessary prerequisites.

However, increased demand for these services is also needed. The economic and environmental viability of public transport will only be achieved through increased demand. Improving the quality of public transport to meet passenger expectations, including redesigning the urban transport network, would make it more attractive. It would also help reduce the social costs of transport, such as time lost due to congestion, air pollution, accidents, etc. Such losses can generally reduce GDP by several percent, although this has not been assessed in Kyrgyzstan.

According to information from Bicycle Kyrgyzstan, Bishkek has two bicycle lanes and about 10 000 bicycles. However, only 10% of the owners use bicycles as a mode of transport due to poor infrastructure for non-motorised commute, low traffic safety and air pollution. NGOs such as Bicycle Kyrgyzstan or MoveGreen play an irreplaceable role in conducting research and awareness campaigns on altering citizens' preferences and behaviour. Financial considerations alone – such as lower costs for public or non-motorised transport – cannot bring sustainable solutions.

3.4. Conclusions

Road transport contributes the bulk of air pollution. In urban centres, the sector produces more than three-quarters of emissions of air pollutants (although its primary energy consumption is usually much lower). Therefore, replacement of the worn-out public vehicle fleet with modern CNG, LPG or diesel Euro V/VI buses would help reduce ambient air pollution. This is especially the case for PM, NO_x and SO_2. These actions would help bring GHG emissions in line with the country's emission-reduction objectives.

As the OPTIC model calculations have shown, the total cost of implementing the CPT Programme will be substantial. New technologies are more expensive before they reach market maturity. Consequently, public financial support will be needed to help public transport operators (both municipal and private) upgrade to a modern and environmentally friendly fleet.

The calculation of the optimal level of public support (subsidies in the form of grants), considers several factors. Running costs are lower as alternative fuels are less expensive. Operational and maintenance costs are lower as well due to higher reliability of new vehicles. Finally, there is a need to replace vehicles that have been fully depreciated.

For these reasons, the CPT Programme need not be completely grant-financed. The programme is designed to increase investments by public transport operators in the vehicle fleet. These investments would not make the replacement too profitable (or support purchases that would/could take place without public support).

In any case, a robust methodology can estimate the costs of the investment programme, set the optimal level of subsidy and forecast the expected environmental benefits. As such, it can make the CPT Programme more credible for both national and international public financiers.

Several institutional set-ups for managing the programme are possible. However, the optimal set-up should be selected only after all elements of the programme are clarified and consensus reached on its priorities.

Regardless of set-up, the programme should have an institutional structure and procedures that promote environmental effectiveness, embody fiscal prudence, and use financial and human resources efficiently. Subsequently, the government needs to ensure that resources, qualified staff and instruments are sufficient to implement the programme.

The review also revealed public financing mechanisms in Kazakhstan, Kyrgyzstan and Moldova that could fund the CPT Programme. In the past, international financial institutions and donors (such as the EBRD or the ADB) have played key roles in the modernisation of the public transport fleet in post-Soviet countries. State budget financing – either directly through the budget or from special funds (transport infrastructure, environment or regional development) – has not been used. Municipal guarantees were provided to public transport operators to secure their creditworthiness. The same guarantees were not made for private operators, however.

If the reviewed domestic financing sources cannot be used directly to provide purchase subsidies (grants) for new public transport vehicles, they could perhaps finance necessary accompanying measures (e.g. infrastructure and technical assistance).

Notes

1. Some experts expressed concerns about this indicator and considered it insufficiently defined and unrealistic given the timeframe (i.e. short- to medium-term). For example, in other countries, a typical indicator related to the accessibility of bus services is the proportion of households in rural areas with access to a bus stop located at a distance of no more than 800 m and providing hourly or daily service.

2. In accordance with the air pollution index scale, there are 14 cities with low levels of pollution, 3 cities with an increased level of pollution and 5 cities with a high level of pollution. Specifically, these are Ust-Kamenogorsk, Almaty, Zhezkazgan, Shymkent, Karaganda and Temirtau. The replacement of outdated buses with modern diesel-powered or natural gas-powered buses will help reduce pollution of particulate matter, as well as NOx and SO2.

3. Kostanay is a city located on the Tobol River in northern Kazakhstan (on the border of the Russian Federation). It serves as the administrative centre of the Kostanay region. The city has a population of about 215 000, while the region has 886 000 residents (AOS, 2011[17]). The city is well-connected both by road (five Russian cities and Nur-Sultan and Almaty in Kazakhstan), as well as by rail (oil supplies from the Russian Federation and Kazakhstan).

4. Shymkent is a city in southern Kazakhstan near the border with Uzbekistan. According to the 2009 census, the city had 603 000 people (AOS, 2011[17]). With 2018 estimates of about 1 million people, it is close to Almaty and Nur-Sultan in terms of population size. In 2018, it became one of three Kazakh cities (with these other two) that have equal status equal to a region (the city of republican significance). Prior to this, the city served as an administrative centre of the South Kazakhstan Region (now, Turkistan region). This is by far the most densely populated region in Kazakhstan (21.1 vs 8.1 people/km2 of (second) Almaty Region) with a population of 2 469 000 (AOS, 2011[17]). Shymkent is a major railroad junction on the Turkestan-Siberia Railway. The city is also a regional cultural centre and home to an international airport.

5. In the future, diesel buses may have higher priority if Kazakhstan implements clean fuel standards and strict air pollution limits for diesel engines.

6. Domestic capacity needs to be expanded. Foreign suppliers, in particular from the People's Republic of China and the Russian Federation, can be competitive, and import duties are not imposed on clean technology buses. According to Daewoo Bus Kazakhstan, the additional production of 500 buses will require 130 additional jobs, excluding management costs. The reason for this quite modest job increase is the relatively simple production process, which would require more assembly work than domestic manufacturing. However, if Kazakhstan produces buses domestically, direct employment would increase by 600-800 new posts. If most of the vendor network for the bus producer is to be domestic, it could generate thousands of additional jobs. This would include employment in small and medium-sized enterprises.

7. It will be difficult to build a CNG bus pipeline in Kostanay given its location far from the gas pipelines in Kazakhstan. However, it is also close to the Russian border and not far from larger Russian cities (such as Chelyabinsk and Magnitogorsk). As a result, better quality diesel and petrol fuels may be available.

8. Shymkent is located on the route of a natural gas pipeline. It has already started to develop a modern public transport infrastructure. As of 2016, 200 CNG buses were operating in the city, which already has CNG filling stations.

9. Kazakhstan has 23 regional cities, but 4 do not have old buses (over 15 years-of-age). As a result, it would not be eligible for support under Scenario 1 of Phase 2 of the programme. Two of these cities, however, have buses older than ten years, which would make them eligible for support under Scenario 2 of Phase 2.

10. The values reflect only emissions of the vehicles to be replaced (baseline value) and the new fleet (target value), not the total emissions from all public transport in Kazakhstan.

11. This was observed by the EBRD and mentioned during one of the meetings with the OECD team in Astana.

12. See https://aifc.kz. The AIFC is positioning itself as a financial hub for Central Asia, the Caucasus, Eurasian Economic Union, Middle East, West China, Mongolia and Europe. The AIFC has identified green finance as one of its main directions of work. Other important issues relate to the development of capital markets, asset management, Islamic finance and private banking. At present, the AIFC does not consider it possible to serve as an implementing unit. AIFC could, however, provide support in mobilising concessional finance. This finance could be based on tax exemptions, whether personal income tax, corporate income tax or land and property taxes, until 2066.

13. The JSC "Zhasyl Damu" contributes to the development and implementation of state environmental policy, environmental security, and environmental regulations and standards. It also helps improve environmental protection laws and the obligations of Kazakhstan in the international conventions for the protection of the environment and the climate (www.zhasyldamu.kz).

14. The team visited the Social Entrepreneurship Corporation "Tobol" in Kostanay (www.spk-tobol.kz) as a potential implementing agency in the pilot city. This is one of 16 investor service centres set up by the government throughout the region. It manages regional budgetary resources allocated to support various business initiatives and programmes. The other potential implementing agency in the pilot city of Shymkent is SPK Shymkent: http://openspk.kz.

15. For more information on the Green Bridge Partnership Programme 2011-2020, see: https://sustainabledevelopment.un.org/partnership/?p=2237.

16. See NBS data on polluting substances emitted in atmospheric air by road transport at: http://statbank.statistica.md/pxweb/pxweb/en/10%20Mediul%20inconjurator/10%20Mediul%20inconjurator__MED030/MED030400.px/table/tableViewLayout1/?rxid=b2ff27d7-0b96-43c9-934b-42e1a2a9a774; and emission of pollutants in atmospheric air by stationary sources of economic agents at: http://statbank.statistica.md/pxweb/pxweb/en/10%20Mediul%20inconjurator/10%20Mediul%20inconjurator__MED030/MED030100.px/table/tableViewLayout1/?rxid=e30e37d0-43ff-4b5b-835f-c0252bf87a4d.

17. State Information Resource Centre "*Registru*" (www.registru.md), now located under the Public Services Agency (www.asp.gov.md/en/date-statistice).

18. This is according to measurements by the Municipal Centre of Preventive Medicine in eight points in Chisinau and the data of the State Hydrometeorological Service "Hydrometeo" (www.meteo.md).

19. Compare (WHO, 2009[11]) with the WHO Global Health Observatory data repository from July 2018 at: http://apps.who.int/gho/data/node.main.BODAMBIENTAIRDTHS?lang=en.

20. For WHO data and statistics on Moldova, see: www.euro.who.int/en/countries/republic-of-moldova/data-and-statistics.

21. See BNM's weighted average interest rates on new loans and deposits attracted and associated volumes at: www.bnm.md/bdi/pages/reports/dpmc/DPMC4.xhtml.

22. As the capital and main industrial and commercial centre of Moldova, Chisinau also serves as the main transportation hub in the country due to its geographical position. It is the largest and most populated city in Moldova – 533 000 for the city and 663 000 for the municipality according to the last 2014 Census (see http://statistica.gov.md/pageview.php?l=en&idc=479), whereas 2018 NSC estimates are around 690 000 for the city and 826 000 for the municipality (see http://statbank.statistica.md/pxweb/pxweb/en/60%20Statistica%20regionala/60%20Statistica%20regionala__02%20POP/POP010300reg.px/table/tableViewLayout1/?rxid=7959009c-1db7-4896-8a54-15c47d1c70d0). As a result, the city has the most developed public transport network. Since 2010, Chisinau has participated in a programme to renew part of the trolleybus fleet, co-financed by the EBRD.

23. Balti is the second largest city in Moldova by population – 102 000 according to the last census in 2014 (see http://statistica.gov.md/pageview.php?l=en&idc=479). NSC population estimates for 2018 are around 147 000, and 5 000 for the surrounding communes of Balti municipality (see http://statbank.statistica.md/pxweb/pxweb/en/60%20Statistica%20regionala/60%20Statistica%20regionala__02%20POP/POP010300reg.px/table/tableViewLayout1/?rxid=7959009c-1db7-4896-8a54-15c47d1c70d0). It is the only city other than Chisinau that has a trolleybus network and a well-developed public transport system. It is also located on the route of a natural gas pipeline going from the Russian Federation to the European Union via Ukraine. Similar to Chisinau, Balti has participated (since 2013) in the EBRD-supported programme to renew part of the trolleybus fleet.

24. There is no (clean) bus production in Moldova because there is no demand for the purchase of new buses. However, an EBRD project in Chisinau brought about a follow-up project for the licensed assembly of Belarusian trolleybuses. This has demonstrated that creating demand through the CPT Programme may help start domestic production in co-operation with a bigger producer, or at least local assembly.

25. It is suggested that the pilot phase should financially support the purchase of minibuses powered by CNG rather than LPG. Although LPG is often used in Moldova, the emissions of CO_2 from LPG-powered engines are higher than from CNG-powered ones. See the economic/market analysis and Annex A to the country report.

26. The values reflect only emissions of the vehicles to be replaced (baseline value) and the new fleet (target value), not the total emissions from all public transport in Moldova.

27. National Agency of Road Transport (https://anta.gov.md).

28. This was then the country's largest bank.

29. In 2010-14, an amount equivalent to one-eighth of the country's GDP was laundered – mainly through Latvia's financial system – to overseas (UK- and Hong-Kong-based firms) through a series of transactions that made no sound economic rationale (dodgy loans, asset swaps and shareholder deals). See (Whewell, 2015[23]); and (Tanas, 2017[23]).

30. For Moldova's GDP growth from World Bank national accounts data, see: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=MD.

31. See BNM's official exchange rates at: www.bnm.md/en/content/official-exchange-rates.

32. Between the first half of 2015 and the first half of 2016. See: www.statistica.md/public/files/serii_de_timp/resurse_energetice/infraanuale/Energy_prices_HH_eng.xls.

33. According to the World Resources Institute Climate Analysis Indicators Tool, (WRI CAIT), the GHG emissions of the country in 2013 excluding the land-use change and forestry (LUCF) sector, were mainly from the energy sector (61.1%), followed by emissions from agriculture (28.4%), industrial processes (5.7%), and waste (4.8%).

34. Russian: ГОСТ = state.

35. Personal communication with the Center for Renewable Energy and Energy Efficiency Development (www.creeed.net).

36. According to the National Statistical Committee of the Kyrgyz Republic, the total vehicle fleet in the country stands at about 735 000 vehicles at the end of 2016. Of this amount, there are more than 600 000 cars, 93 000 trucks, 10 000 special-purpose vehicles and more than 32 000 buses and minibuses.

37. In comparison, stationary sources release around 50 000 tonnes of harmful substances into the air annually (NSC, 2016[19]).

38. As of beginning of 2019. See National Bank of the Kyrgyz Republic (www.nbkr.kg).

39. Bishkek is the capital of Kyrgyzstan with a population of 865 000 inhabitants according to the most recent census (NSC, 2009[20]). It is the most populated city in the country. Bishkek is a separate administrative unit (independent city – *shaar*). It serves also as an administrative centre (apart from 2003-06) of the surrounding Chui *oblast* (region). This is the northernmost region in Kyrgyzstan with a population of 791 000 (NSC, 2009[20]). The capital is the financial centre of the country (home to the country's national bank, commercial banks and other financial institutions).

40. Osh is the second largest city in Kyrgyzstan in terms of population – 243 000 according to the most recent census (NSC, 2009[20]). It is the only other city with a trolleybus network and a well-developed public transport system. It is also referred to as "capital of the south", given its 3 000-year history (oldest city in Kyrgyzstan). Osh is also the only other city besides Bishkek with the administrative status of independent city (*shaar*). The city of Osh also serves (from 1939) as an administrative centre of the surrounding Osh *oblast* (region). It has a population of about 1 million (NSC, 2009[20]). The southernmost region in Kyrgyzstan, it is regarded as the country's southern hub for industry and trade. Similar to Bishkek, Osh has participated since 2014 in an EBRD programme to renew part of its bus fleet.

41. This is according to data from NSC, as the City Hall of Bishkek reports no vehicles older than 15 years in stock. These figures differ from national data for the city of Bishkek probably because national data do not deregister old vehicles.

42. In addition to outdated fleet, in the cities of Bishkek and Osh, traffic volumes on the roads have increased dramatically in recent years (JICA, 2013[18]). The current capacity of the road network cannot accommodate this increasing traffic volume. According to the general plan, the city roads are designed for 40 000 or 45 000 cars, but today about 500 000 cars use them (Mokrenko, A., 2017[21]). In the last ten years, only 14 new roads have been constructed.

43. Although LPG is used in Kyrgyzstan (mainly by private users, including public transport operators), the CO_2 emissions from LPG-powered engines are higher than from CNG-powered ones

(see the economic/market analysis and Annex A to the country report). Therefore, it is suggested that the programme should financially support buses powered by CNG rather than LPG.

44. Even though trolleybuses have only small batteries, they are cheaper to run (in terms of operational and maintenance costs) than electric buses. They can travel on the battery for a limited number of kilometres (depending on the battery capacity), but most of the route is powered by the city's electrical wire network, which allows the trolleybus batteries to be charged while driving.

45. It is proposed that the programme would support the purchase of minibuses powered by CNG rather than LPG. Although LPG is sometimes used in Kyrgyzstan, the CO_2 emissions from LPG-powered engines are higher than from CNG-powered ones.

46. The values reflect only emissions of the vehicles to be replaced (baseline value) and the new fleet (target value), not the total emissions from all public transport in Kyrgyzstan.

47. Investment Promotion and Protection Agency (http://invest.gov.kg).

48. Regional Environmental Centre for Central Asia (http://carececo.org).

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4. Key conclusions and policy recommendations

This chapter summarises the main opportunities and challenges associated with the launch and successful implementation of green investment programmes. In particular, it highlights the role of the international community and national public sectors in providing the necessary financial incentives and system support. Management of investment programmes, for example, could trigger private sector interest and participation in projects with added social value. In addition, the public sector has a crucial task in eliminating policy barriers and shortcomings in the countries' regulatory, institutional and organisational frameworks. This is needed to achieve public transport that is energy-efficient, and environment- and user-friendly. The chapter and the report conclude with possible ways to address these barriers.

4.1. Domestic and international green finance

Most of the resources needed to support the greening of the economy are expected to come from the private sector. However, the public sector still plays a role, particularly in creating incentives and supporting new technologies. The largest share of investments will go to energy efficiency, renewable energy and gas infrastructure. One way to increase availability of limited public resources is by improving the effectiveness and efficiency of managing public funds.

As the post-2012 global climate regime is evolving, donors and international finance institutions (IFIs) are already planning to invest **significant resources** to support non-Annex I countries. International carbon finance mechanisms are expected to rely to a great extent on country-based systems for programme and project identification and implementation. The Green Climate Fund (GCF), for example, was established recently under the UN Framework Convention on Climate Change.

The GCF focuses on climate mitigation and adaptation. One of its core principles is the country's **full ownership** of proposed investments, which need to be aligned with national strategic priorities. Public investment programmes with clear priorities can increase the country's chances of support from the GCF (once the institutional mechanisms to access the Fund have been set up) or other international sources.

In general, those countries that develop the **necessary skills** to prepare economically sound public expenditure programmes (designed in line with good international practices), can compete effectively for support and leverage funds from both budgetary and donor sources. Therefore, the major players in climate change policy in the respective countries need to be enabled to identify pipelines of cost-effective projects. This will allow them to become more competitive and stand a better chance of benefiting from international support. Major players comprise the Ministry of Energy of Kazakhstan; Ministry of Agriculture, Regional Development and Environment of Moldova; and the State Agency for Environmental Protection and Forestry of Kyrgyzstan.

In addition, government administrations need to be willing to apply **good practices** in public expenditure management, such as accountability, transparency and efficiency. To be successful, such programmes also need to be integrated into national development strategies and medium-term budgetary processes, such as medium-term expenditure frameworks (MTEF). Moldova, for example, has been among the first EECCA countries to introduce a medium-term perspective to its annual budget process. The Moldovan government has accumulated significant experience with the MTEF design, including in the environmental sector, but less so with its actual implementation.

4.2. Creating policy framework for green investments

Various policy barriers to implementation are listed below. Before the programme is developed and financed, the national governments should review the relevant regulations and eliminate any barriers to the extent possible.

- **Inadequate resources for programme preparation and management.** The CPT Programme requires significant work on programme preparation (including fundraising) and implementation. This will require building capacity for project selection, implementation and monitoring (project cycle management).

- **Limited creditworthiness of private operators in public transport.** Regardless of how the CPT Programme is co-financed, bus owners will need to use loans or leasing for their share. However, their creditworthiness is in many cases limited. Several options for support exist. Operators could receive direct financial support in the form of grants. The Ministry of Finance (as the main guarantor of public debt) could issue guarantees on bank loans. The CPT Programme could also provide bank guarantees. Commercial loans for the purchases of modern buses, however, are uncommon.
- **Inadequate passenger fares.** Standard fares for public transport are as low as USD 0.09 for a single ride ticket (not considering further discounts or exemptions). Some fares have not been adjusted for more than a decade. A fare increase is obviously needed (based on a sensitivity analysis to determine optimal fare levels). Otherwise, fleet operators may not be able to repay their loans.
- **Insufficient co-ordination and communication.** The municipal level is visibly trying to improve public transport service and reduce traffic congestion and air pollution in urban centres. To that end, it is primarily limiting the number of minibus operators. However, these efforts are not clearly communicated to all stakeholders. Moreover, communication is lacking about details on future routes, the transport means to be used, how many buses will be needed and who will operate them. Given the Ministry of Finance is already helping prepare the project for external financial assistance, it could play a co-ordinating role to ensure inter-ministerial co-operation.
- **Lack of proper financial products tailored to the needs of the sector**. The financial sectors in the partner countries are relatively concentrated and largely dominated by commercial banks. However, their function as financial intermediaries is limited due to high interest rates and collateral requirements. Banks also face constraints. Apart from a lack of bankable projects, banks face low rates of loan recovery. These low recovery rates, in the case of public transport operators, might be caused by the low passenger fares mentioned above.
- **Lack of interest in purchasing more fuel-efficient vehicles.** Apart from setting the right policy incentives, the government needs to reassure consumers about new technologies (e.g. their useful life) and fuels (e.g. future fuel prices). To that end, they could provide correct, sufficient and timely information – a possible role for the government implementation unit of the CPT Programme.

4.3. Key recommendations for programme implementation

4.3.1. Strengthen institutions that prepare and implement programmes

The three countries were keen to prepare the programme and, after the initial work on programme selection, were clear on its focus. However, none of them was ready for immediate implementation. The major reason for the delay was financial: there is no public money in those countries set aside for the programme. The budget procedure is relatively inflexible. It requires first general agreement of the government to spend public money on a specific programme. The government then includes this programme in the budgetary process, which means at least one year of preparation. In addition, all three countries were keen to receive external (international) sources for programme implementation. While understandable, this requires adjustment of the programme to the needs of particular donors

and preparation of the respective dossiers. The three countries had planned for programme preparation and fundraising in the first year. However, that requires an implementation unit of at least several experts to be operational. None of the three countries has such a unit in place.

Thus, lack of ownership of the CPT Programme by the respective institutions (existing or new) is a key barrier to implement environmental programmes. This situation is partially due to lack of experience of the three countries. None has ever implemented such large environmental expenditure investment programmes.

The three case studies prepared and presented (Austria, Czech Republic and Poland) show that their respective programmes were not implemented in an institutional vacuum.

In the case of the Austrian *klimaaktiv* programme, the institutional set-up was split between the Ministry of Environment (currently, Ministry of Sustainability and Tourism) and a private institution that has proven capacity to implement green investment programmes. This institution, Kommunalkredit Public Consulting, manages about 3 000 projects annually. It is also involved in management of the grant schemes for Austria's Environmental and Water Management Fund, as well as the Austrian Joint Implementation (JI)/Clean Development Mechanism (CDM) programme. The programme was furthermore set up in agreement with the Ministry of Finance and the Ministry of Transport, Innovation and Technology, and supported by the Austrian Climate and Energy Fund.

In Poland, the National Fund for Environmental Protection and Water Management (NFEP&WM) prepared and implemented the programme. It is a large institution with the capacity for this work. The Polish Environment Fund has 609 full-time jobs and is managing many green investment programmes.

In the case of the Czech Republic, the public transport programmes were prepared by relevant ministries and implemented by cities.

In short, the latter three countries are used to working within different EU-supported programmes. Neither Kazakhstan nor Moldova nor the Kyrgyz Republic has such an institution.

4.3.2. Strengthen technical regulations in transport

Many of the policy and regulatory barriers identified by this study are comparable to challenges experienced in other countries. To ensure the programme's successful implementation, the government will need to do the following:

- **Strengthen (diesel) engine emission norms and bring them closer to European standards.** Neither Kazakhstan nor Moldova nor Kyrgyzstan has developed modern emission norms for both passenger cars and heavy-duty truck and bus engines. In 2014, the European Commission adopted Euro 6/VI vehicle emission standards. However, an equivalent of the Euro 4/IV emission standard – introduced in the European Union in 2005 – has not been fully adopted in the partner countries. Moldova has only introduced requirements for buses and coaches to meet Euro I norms starting from 2020. In Kyrgyzstan, Euro 5 standards are to come into effect in 2019, but only for fuel, not engines.
- **Strengthen (diesel) fuel standards.** The latest diesel engine emission norms cannot be introduced if the available fuel does not meet certain standards. Modern engines include equipment sensitive to low-quality fuel. Moreover, SO_2 emissions

depend directly on the fuel's sulphur content. In 2016, Kazakhstan introduced Euro 4 fuel standards (Euro 5 diesel needs to be imported and is available mostly close to the Russian border). In Moldova, the diesel fuel available meets Euro 5 standards. It seems to be sufficient for a country-wide fleet upgrade. However, the legal requirements are based on post-Soviet standards that are incompatible with EU standards. It is also possible to find Euro 5 fuel in Kyrgyzstan, but available diesel fuel in the country largely meets only Euro 3 standards.

- **Strengthen technical inspection standards.** Buses and minibuses in Kazakhstan, Kyrgyzstan and Moldova must pass technical inspections (which was not always the case in the past). However, these inspections are not strict on emissions. The weak inspection (and maintenance) system means that public transport operators have no incentive to comply with emissions standards. Existing standards for technical inspection need to be better enforced, starting with responsibilities and sanctions for failing to fulfil the requirements to be included in the legislation. In this way, a more effective state regulation of the transport activities can be enforced.

4.3.3. Introduce adequate pricing signals

Although CNG and LPG fuels are cheaper than diesel or petrol fuels, CNG- and LPG-fuelled buses are more expensive (as they require installation of additional equipment). Bus operators have not been given clear incentives to shift to cleaner fuels (either from renewable resources or cleaner fossil fuels). On top of environmental and health benefits, replacement of ageing and inefficient diesel and electricity-powered vehicles provides significant efficiency gains.[1] Therefore, the investment programme (through government) should provide the necessary financial incentives to attract investment into the sector.

The experience from the EU countries shows that uptake of fossil gases in transport is highest in countries with the lowest tax rates, i.e. where CNG or LPG enjoy tax rates below the EU minimum. In some countries (such as Italy), such tax rates make CNG and LPG half the price of diesel. This support has continued despite the declining EU domestic fossil gas production and increasing dependence – similarly to Moldova or Kyrgyzstan – on energy imports from the Russian Federation or Kazakhstan[2] (T&E, 2018[1]).

The government could therefore consider introducing targeted tax exemptions (including value added tax and import duties). Such exemptions could target CNG/LPG vehicles, as well as owners of refuelling stations; the United Nations Development Programme (UNDP) clearly recommends the latter for Kazakhstan (UNDP, 2015[2]). Such fiscal measures could act as a complementary state support mechanism in addition to grants, loans or loan guarantees provided by the government until critical mass is achieved and the system becomes profitable.

For example, in 2018, Poland introduced an excise tax exemption for CNG and LNG. At the same time, it introduced a new fuel fee for other fuels, including diesel. This will give more incentive to use clean fuels.

4.3.4. Increase support to producers of clean buses

Kazakhstan has limited bus production (in Kostanay and Semey), but bus producers have no incentive to introduce clean engines. Kazakhstan is rich in natural gas and could promote local production of clean engines that would encourage use of clean fuels. This programme focuses on public transport operators, but another one could introduce incentives for

manufacturing and procuring efficient buses that run on alternative fuels (CNG, LPG) with lower CO_2 emissions.

In Moldova, there is a limited trolleybus production in Chisinau (assembly of Belarusian-made Belcommunmash). Considering limited demand for trolleybuses in Moldova (Chisinau and Balti), this production could be expanded to other types of clean transport. The analysis has shown that assembly already represents a distinct purchase cost advantage over importing completed buses. This considers both reference prices of new vehicles and also socio-economic benefits linked with in-country production/assembly.

The Kyrgyz Republic does not really have a developed domestic automobile and bus industry. However, some manufacturing projects are ongoing. For example, the manufacture of Isuzu buses and Ravon passenger cars was to begin before the end of 2018. The city of Osh already has a production area where a large-scale assembly of Ravon brands will initially be organised. Bishkek also plans to produce buses; SamAvto's products, whose partner is the Japanese company Isuzu, should be launched in the city (Trend AZ, 2017[3]).

Although Austria, Poland and the Czech Republic do not have distinct support for bus producers that run on alternative fuels, their aid programmes include research and development. The bus producers can use such programmes to co-finance their research on innovative buses, especially the so-called low-emission transport.

4.3.5. Adjust the fare system for urban public transport

Fares should be aligned with good international practices and designed to maximise the social welfare of both passengers and public transport providers (subject to budget and capacity constraints).

The benefit for public transport service providers can be defined as revenues minus costs. The benefit for the user of these services can be expressed as the generalised price citizens are willing to pay before switching to non-public transport alternatives, minus the actual generalised price of the ticket (see Box 4.1). To some extent, the producer benefit and user benefit may be negatively correlated.

Given the economic and financial situation of public transport providers in Kazakhstan, Kyrgyzstan and Moldova, the focus should be on the providers' benefit. The user benefit should be minimised as much as possible (possibly close to zero). Public transport service operators of minibuses are private, while trolleybus and bus services tend to be provided by the municipality. Private operators provide business for profit, so passenger fares need to cover capital and operating costs.

At the same time, fares on public transport are low. Current standard fares in Kazakhstan are EUR 0.18-0.20 per ride (in Kostanay and Shymkent). In Moldova, fares are EUR 0.11-0.15 per ride (in Chisinau and Balti). In Kyrgyzstan, fares are EUR 0.09-0.15 per ride (in Bishkek and Osh). In comparison, a single ticket in Poland or the Czech Republic costs about EUR 1-1.20 and EUR 1.80 in Austria. The more than tenfold (here, with an extreme case of almost twentyfold) price difference cannot be justified by difference in purchasing power of citizens.

Consequently, the quality of service provided by private operators is rather low, favouring old buses to minimise capital costs (and depreciation).

Box 4.1. Proposing a sensitivity analysis

A sensitivity analysis into how many new buses/trolleybuses could be bought by increasing fares by KZT 10.00 in Kazakhstan, or KGS 2.00 in Kyrgyzstan (both USD 0.03), or MDL 2.0 in Moldova (USD 0.11) could be informative.

Generally, the sensitivity analysis should consider that an increased price for tickets may discourage people from using public transport. It may make them switch to private cars, for instance, which can result in higher levels of air pollution. In economic language, public transport fare increases lead to an exposure-response relationship with a high price elasticity of demand. In other words, a price increase leads to less demand for a given service.

Therefore, to achieve desired environmental effects, private car transport should not substitute for public transport. Further, such an analysis depends, among others, on local circumstances, including the length of routes and the number of passengers. This type of analysis requires significant additional data collection and discussion with the government and municipal authorities. Such analysis was outside the scope of this study, but it should be carried out.

An increase in fares is clearly needed and could theoretically help co-finance the CPT Programme. The above-mentioned fares are extremely low and would be insufficient to guarantee repayment of any eventual loan by bus or trolleybus operators. Thus, if current fares are maintained, the programme and the public budget will be exposed to default by operators and will have to consume the guarantee. This implies significant actual costs for the programme.

In addition to higher single fares, subscription fares could also be considered. This option is usually favoured by passengers who do not own a car and are therefore less price-sensitive. On the other hand, in developing countries, people who do not own a car usually belong to lower income groups than those in the developed world.[3]

Regardless of the fare system, improvements in the payment system should also be implemented. Trolleybus and bus travel times are greatly increased by the "pay upon exit" system. To date, however, electronic payment systems have been tested, but not successfully implemented. Such changes in the fare system, coupled with separate bus lanes and smart traffic lights, could improve management of the public road transport sector in the three countries.

In 2016, the UNDP held discussions with some Akimats in Kazakhstan around these issues. They jointly proposed amendments in relevant legislation.

4.3.6. Improve inter-ministerial co-operation in implementation of the transport strategy

Effective inter-ministerial co-operation is required to adequately address environmental and public health issues through investments in clean technologies for urban public transport. Experience from other projects has shown that such co-operation can be challenging to implement in practice. However, the involvement in management of

multiple ministries – transport (infrastructure), economy (investments), energy and environment – can help increase the chances of success.

Environment is not a priority for transport policy. This issue could be addressed by introducing clear environmental indicators (e.g. air quality indicators) in transport-related strategic and policy documents. Better co-operation could also help improve the collection and availability of data on urban transport, which can be used in policy analysis.

Some of this information – such as disaggregated data on bus fleet age or types of fuel used – is dispersed across regions, districts and municipalities, but not yet collected at the national level. The lack of this information makes it difficult for national governments to see the full picture. As such, it presents an obstacle for policy making and progress towards clean transport. Apart from making such information available at the national level, the Ministries of Finance and of Economy could also support the programme. This would contribute to low-carbon mobility in the respective countries and help increase the profile of the environment and climate on the transport policy agenda.

In Kazakhstan, in addition to the Ministry of Energy, the Ministry of Investments and Development (in particular, its Transport Committee) plays a crucial role in this process. In the case of Moldova, the Ministry of Agriculture, Regional Development and Environment is responsible for green investment programmes. However, several other ministries are interested in the CPT Programme. These are the Ministry of Economy and Infrastructure (which absorbed the former Ministry of Economy), the Ministry of Transport and Roads Infrastructure, and the Ministry of Informational Technologies and Communications. The consolidation of ministries in July 2017 should improve co-ordination in the event they co-implement the CPT Programme. In Kyrgyzstan, the Ministry of Economy would benefit from closer co-operation with other ministries. In particular, the Ministry of Finance could help mobilise existing funds and potential external financing sources to achieve low-carbon mobility in the country.

The Czech Republic achieved interesting results in clean transport, proving the value of good co-operation. Implementation was split between the Ministry of Transport; Ministry of Environment; National Environmental Fund; Ministry of Regional Development and local institutions in the regions; and the city of Prague (see Section 2.3.2).

4.3.7. Change public tenders for providing public transport in urban centres

Using medium- to long-term contracts (at least ten years in length) would encourage operators to invest in a modern public transport fleet. This is especially the case when contracts are backed by an adjusted fare system, regulatory improvements and financial support from the state.

City-owned and private operators provide public transport in urban centres under short-term contracts. These range from one-three years in Moldova, three-five years in Kazakhstan and five years in Kyrgyzstan (for operators of passenger transport).

This approach encourages short-term planning. Operators minimise their outlays to make a quick return on their investment while they hold their licence. Moldova, for instance, often does not organise tenders; instead, it simply extends expiring contracts. As a result, private operators tend to favour cheaper and older minibuses, which are more polluting.

Projects of the UNDP and European Bank of Reconstruction and Development (EBRD) are addressing some of the main shortcomings of public tender procedures in Kazakhstan.

4.3.8. Encourage energy efficiency in public transport

Minibuses dominate public transport in most post-Soviet countries. They are usually operated by private companies or entrepreneurs. Conversely, regular buses only service a small number of urban and inter-city routes. While minibuses are needed to close the gap in public transport, they are generally less efficient than regular buses (in terms of megajoules/passenger-km). The pilot cities of the CPT Programmes intend to replace minibuses with modern, higher capacity buses (primarily trolley and CNG buses) that can carry up to five times more passengers.

Any investment in public transport will not make economic sense if streets are congested with traffic. Journey time (and related fuel) savings can be achieved by making public transport more efficient. For example, dedicated bus lanes can reduce the need to use inefficient mechanical braking. Eco-driving – i.e. a driving awareness technique that can reduce fuel consumption – can be introduced and promoted at schools for bus drivers.

A recent example is the introduction of an "autonomous" trolleybus line from the Chisinau city centre to the Chisinau International Airport in the summer of 2017. While the airport bus attracted the most fanfare, the city also introduced another wireless trolleybus route from the Vatra suburb from the city centre (Vlas, C., 2017[4]). The bus fare remains the same as for all other trolleybuses, however, at MDL 2.00 per person.

In 2013, Almaty – supported by the UNDP-Global Environment Facility (GEF) City of Almaty Sustainable Transport Project – drafted and adopted the City of Almaty Sustainable Transport Strategy 2013-2023 (Akimat of Almaty, 2013[5]). Among its sustainable transport options, the project promotes cycling, such as annual bicycle races for children and training at the cycling school. In 2014, the mayor approved projects for building a bus rapid programme transit (BRT) corridor and a new bike lane.

For its part, the Kyrgyz capital held a special campaign in March and April 2018 on trolleybus lines No. 11 and 14 to attract new passengers. Using the Balance.kg application on smartphones, passengers paid a fixed fare of KGS 1.00. This campaign was initiated by Beeline (a mobile telecom services company) and the city of Bishkek. In practice, however, the payment mechanism had several flaws and requires further development.

4.4. Conclusions

The CPT Programme seeks to modernise the bus fleet in the three countries, as well as to reduce air pollution and GHG emissions. On their own, improved regulations and financial support from the state may not be enough to achieve desired outcomes. A combination of the two has a greater chance of success.

Planning must extend beyond the short term. Using medium- to long-term contracts (at least ten years) would encourage operators to invest in a modern public transport fleet. They would have even more incentives when these contracts are backed by an adjusted fare system, regulatory improvements and financial support from the state.

Importantly, the implementers of a public investment programme – i.e. the management and the supervisory body – should be protected from political pressures. This protection should be imbedded in operating rules and procedures, such as the licensing of public transport routes. National governments should also aim to eliminate the policy and regulatory barriers that could hamper implementation of the CPT Programme. A

reflection on other countries' experience could also provide an indicative checklist of measures and approaches to tackle these problems.

The current distorted policies explain why the bus operator market is fragmented and dominated by small companies (entrepreneurs) that lack creditworthiness. This situation makes the sector unattractive to IFIs such as the EBRD. Eliminating these barriers is key for the success of the programme; however, not all of them have to be addressed at the same time and some are interchangeable. A better fare system and long-term contracts will help increase creditworthiness, for example. But this can also be achieved through loan guarantees or a higher level of public support provided by the CPT Programme.

Countries' multi-level institutional and organisational framework for the transport sector is functional. However, public authorities should adopt a unified approach to tackle the air pollution issue (also from road transport) and better co-ordinate the (priority) actions, both horizontally and vertically. With clear priorities and a co-ordinated action, public resources could be spent more efficiently.

Notes

1. Contrary to these (cleaner) fossil fuels, electricity-powered vehicles have the advantage of cheap electricity.

2. In 2016, the European Union imported 86.7% of petroleum products and 70.4% of natural gas. There, the energy dependence on natural gas is not significantly smaller than on oil. This is especially the case given the larger share of imports from the Russian Federation for natural gas (39.9%) than for oil (31.6%) (EC, 2018[6]).

3. Usually, a single or monthly ticket fare system is considered more operator-friendly, and a distance-dependent fare system seems more customer-oriented (and more technically demanding for the operator). A single or monthly ticket fare system is generally more attractive for passengers travelling longer distances, and a distance-dependent fare system more attractive for passengers travelling shorter distances. Finally, with a distance-dependent fare system, the operator can gather information both on the number of trips per route over a defined period and the average length of the route that a passenger travels in a given period. This information may be useful for making better management decisions.

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SUMMARY REPORT OF PROJECT IMPLEMENTATION 2016-2019

This report presents the objectives, methodology, procedures and main findings of the OECD project "Strengthening public finance capacity for green investments in the EECCA countries". Between 2016-19, the project aimed to help set the partner countries (Kazakhstan, Kyrgyzstan and Moldova) on a sustainable path of development by reducing the energy and carbon intensity of their economies. Working with the relevant ministry in each country, the project designed public investment programmes in line with good international practices. These programmes sought to address key objectives of the countries' environmental and climate-related policies. The Clean Public Transport Programmes focus specifically on reducing air pollution and greenhouse gas emissions from the target sector, primarily in large urban areas. They aim to demonstrate how to use scarce public funds to encourage private sector investment in projects that generate significant environmental and socio-economic benefits alike.

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